



SOCIETY OF ACTUARIES

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## **The OASDI from a Canadian Perspective**

*Review by Bernard Dussault of the 2000 Trustees Report on the OASDI*

### **Introduction and Executive Summary**

The production of reliable long-term financial projections on social security programs (SSP) such as the OASDI rest on the availability of three main items: input valuation data, methodology and assumptions. Therefore, the results of such projections make sense to the extent that the underlying ingredients do. This review of the 2000 Trustees report puts emphasis on the actuarial evaluation assumptions, methodology and results, though a short and last section is devoted to some policy-related suggestions.

Assumptions make general sense. However, an analysis of their internal consistency reveals that they are somewhat optimistic. Internal consistency procedures are suggested and an embryonic model is offered.

The valuation methodology needs to be described in a more layman language and in more detail, and the underlying basic approach might benefit from some revamping. A simple alternative formula is presented for examination of its appropriateness.

The analysis of the main results is incomplete as it only refers to the baby boomers. The projected aging of the population results mainly from sustained lower fertility rates (baby bust) and to a lesser extent to assumed sustained mortality declines. The baby boomers are not much involved in the aging process. The temporary demographic fluctuation they represent merely adds a slight contribution, from about 2010 to 2040, with a peak in about 2025, to the permanent aging process that was launched sometime ago by declining mortality rates and more importantly about 1990 when the baby busters started joining the labor force.

The 75-year actuarial deficit is a weak template for the solution of the financing issue caused by the projected population aging. More robust measures are required to address both the financial and social equity issues that lie ahead of the current and future cohorts of contributors to the OASDI. The 1997 reform to the Canada Pension Plan is presented as a template for such robust measures.

### **1. Assumptions**

When one is asked to comment on a Trustees report, the first and easiest target area of discussion is normally assumptions because of their intrinsic nature. Indeed, no one knows the future. Fortunately, the effect of the wide range of possible ultimate assumptions is quite attenuated on the long run by:

- The fact that it is their relative rather than absolute value that really counts in the case of pension valuations (e.g. high absolute values of 20% and 24% for the inflation and investment return on assets, respectively have the same effect on the (cost) contribution rate of a pension plan as absolute values of 0% and 3.333%);
- Extreme values for a given ultimate assumption cannot be selected without also imputing a somewhat neutralizing extreme value to one or more of the other key ultimate assumptions involved in the valuation process. For example, it would not be reasonable to assume a high productivity rate of 5% without considering in parallel higher mortality declines and lower disability incidence rates, as healthier economic conditions are normally associated with healthier human beings.

Generally speaking, the process for selecting the assumptions for the Trustees reports is refined and sophisticated. And these are quite voluble in providing some rationale for the selection of the nominal value of assumptions. However, those reports would gain much in professional and scientific value if they would provide some rationale on the relationship or correlation between the various economic and demographic assumptions wherever such relationship can be proven to exist. Eventual research and development in that area might show that the effect of extreme case scenarios have a somewhat limited effect on valuation results. Moreover, in that sense, the selection of the traditional low, medium and high cost estimates could thereby possibly be done on a less arbitrary basis. Until this is done, it can only be concluded that the selection of assumptions lacks some internal consistency. The effect of such internal inconsistency is that the assumptions would tend to be somewhat optimistic for the following two main reasons:

- In reference to the second bullet above, assumed productivity levels (1.5%, 1.0% and 0.5% for the low, medium and high cost estimates, respectively) appear to be incommensurate with the assumed annual rates of decline in mortality (0.2%, 0.7% and 1.2%, respectively), as the recent 40-year experience for these two factors is 1.1% for productivity and about 1.15% for mortality declines. Besides, consistency would require that longevity improvements decrease, rather than increase, as productivity decreases.
- The report is totally silent about the critical point made in several instances by Robert Brown, e.g. in his Research Report “A Demographer’s Review of the Assumptions Underlying the Trustees Report,” published in 1995, to the effect that the projected rapid aging of the population over the next 30 years, and in particular the dramatic associated increase in age dependency ratios, is bound to increase inflation during that period, as consumption (or demand for goods, which will be reinforced by the higher retirement pension income applicable during the 21<sup>st</sup> century) will increase faster than production (or supply of goods).

Another example of correlating assumptions would be the demographic and the production (or economic growth) increases, the underlying theory being that annual variations in the amounts of products and services (or more simply in the national payroll or

employment earnings) would tend in the long run to parallel those in the total population. Canadian data for 1925 to 1995 show some striking evidence in that sense. It would be interesting to see how, on average in the long run, the projected annual U.S. population increase compares with the annual increases in total covered earnings projected for OASDI purposes. The report actually fails to examine and discuss the internal consistency of the increase in total covered earnings. This parameter, which essentially corresponds to the economic growth rate for a program covering most of the national payroll, results from compounding the average wage increase with the annual increase in participation to the plan. In turn, most of the annual increase in participation in the plan corresponds to the projected annual demographic increase, as constant proportions of contributors are usually assumed for the whole projection period and as additions to the population are usually assumed to participate to the program in unchanged proportions. However, the other factors could, but only temporarily, alter the projected increase in total covered earnings, and these are the degree of compliance with participation in the program and the changes in employment rates. The matter of compliance is not covered in the Report. It should. On the other hand, some changes in employment rates are explicitly assumed for the future in terms of some relatively small gradual decreases.

Several other relationships would also exist between the various economic and demographic assumptions involved in the valuation of a SSP. In that connection, an embryonic model of what a rationale could look like for the relationship between the three key ultimate economic assumptions (inflation, wage increase and interest) is presented. For simplicity, productivity (herein defined as the difference between the nominal increase in average wages and inflation) and real return on assets are identified hereafter using as an approximation the arithmetic basis rather than the theoretically correct geometric basis.

As projections for SSPs are for the long-term, assumptions have to be determined in a manner consistent with the automatic adjustments that appear to take place in the macro-economy over the long run (e.g. 50 years or more). In that sense, the return on assets should normally be greater than the annual nominal increase in average wages, which in turn should be greater than inflation. Here is why. For the general case where the economy is projected to evolve on a wealthy basis, some productivity is presumed. For developed countries, productivity would usually be thought or hoped to be at least 1%. It would and could be higher for developing countries due to the room available for closing the gap between developed and developing economies. If inflation were assumed at 3%, then the annual nominal wage increase would be at least 4%. If the return on assets were assumed at 5%, still with inflation at 3%, real interest would be 2%, which is not inconsistent or unrealistic per se. However, in countries where income is taxed, the real interest would normally have to be at least equal to inflation grossed up for income taxes in order to account for the eroding effect of income taxes on investment income. With a marginal tax rate of 40%, this would mean that the nominal return should be assumed to be at least 5%, i.e. 3% divided by the complement of 40%. For a 50% marginal tax rate, the grossed up rate would be 6%. In other words, investment earnings are eroded by both inflation and income taxes and would normally be higher than the sum of those two factors. Under the above scenario, the absolute return on assets would accordingly have

to be higher than 6% for a presumed marginal tax rate of 50%. Return at 7%, wage increase at 4% and inflation 3% would accordingly be a sensible set of key economic assumptions. Coming back to the very starting point, which is inflation, the assumed ultimate level of inflation (3%) is irrelevant. Relevant relationships start out with productivity, and then progress on to the real return on assets and the others.

As a practical application of the above rationale, let us look at both the relevant experience data presented in the 2000 Trustees Report for 1960 to 1999 and the selected ultimate assumptions. The simple historical arithmetic average for inflation, wage increase and interest rate over that period is 4.4%, 5.5% and 7.3%, respectively. This means an average productivity rate of 1.1% and a real rate of return of 2.9%. In line with the above rationale, the real return would be associated with a marginal tax rate of 40%. Regarding the ultimate assumptions selected for the intermediate cost scenario in the Trustees Report, the starting point, ultimate inflation, is assumed at 3.3%. Then, ultimate wage increases are assumed at 4.3%, representing an underlying productivity rate of 1%. And finally, the ultimate nominal level of return on assets is assumed at 6.3%. This represents a real rate of return of 3% and an associated marginal tax rate of 48%.

There happens to be much correlation between the embryonic rationale described above, the actual 1960-1999 experience as well as the 2000 Trustees Report ultimate assumptions. There are several possible reasons for that. One could be pure coincidence. At another extreme, it would be that the above rationale is of great scientific reliability and that assumptions of the 2000 Trustees report have been selected using on a strict basis that above rationale. In any event, the main conclusions are that a rationale should be used for the selection of assumptions (which is likely actually the case) and that such rationale should be disclosed in the Report.

Let us now look at how the embryonic rationale correlate with the ultimate assumptions adopted for both the low and the high cost estimate. For the low cost estimate, ultimate assumptions are 2.3%, 3.8% and 6.0% for inflation, wage increase and interest, respectively. This means a productivity rate of 1.5% and a real rate of return of 3.7%, for an underlying marginal tax rate of 62% or a return premium of 1.4% assuming a marginal tax rate of 50% ( $2.3\%/0.5 + 1.4\% = 6.0\%$ ). This is not lacking any reasonableness or common sense because in the long term productivity may well be at 1.5% (versus 1% for the intermediate cost estimate), as it has actually been on average over the last 60 to 70 years. Likewise, real return may well exceed to some extent inflation grossed up by a deemed marginal tax rate of 50%. However, this would be more easily expected for a fund invested in a diversified portfolio than for one exclusively constituted of government bonds. In that sense, it would appear that the low cost scenario is somewhat overly optimistic as long as investments will be restricted to government bonds and that life could hardly be better on average in the long run. For the high cost estimate, ultimate assumptions are 4.3%, 4.8% and 6.5% for inflation, wage increase and interest, respectively. This means a productivity rate of 0.5% and a real rate of return of 2.2%, for an underlying marginal tax rate of 34%. Again, these make sense, except that the real rate of return would appear to be unrealistically low considering the relatively low underlying marginal tax rate.

Still, one also has to investigate the correlation between productivity and real return on investments, in other words between the nominal the nominal wage increase and the nominal interest rate. If such correlation exists in the long term, then it should be documented and disclosed. The 1960-1999 experience shows a differential of about 1.75% between real return and productivity. The corresponding ultimate values assumed for the report are 2.2%, 2.0% and 1.7% for the low, intermediate and high cost scenarios, respectively. This implies a rationale whereby higher productivity would be associated with even higher returns on investments. This reflects an environment where productivity gains are shared less and less equally between workers and investors with increasing economic growth. In real life, this may well be the case. As an extreme case, wage increases could remain low or unchanged despite high real returns if most business profits would be reinvested rather than split to some extent between salary increases and investments. This might well be a driving factor in the 21st century consistent with the globalization of markets.

As a general conclusion of the above discussion of assumptions, it is fair to say that the assumptions of the 2000 Trustees Report make sense but that they tend to be somewhat optimistic. Moreover, the rationale presented for their selection, although refined and sophisticated, should go beyond a mere justification based on observed past experience. In that sense, past economic and demographic experience should be investigated further in order to deal appropriately with the correlation between various assumptions. The selection of assumptions could then be made, taking into account their internal consistency, on a more valid and explicit basis.

## **2. Methodology**

- **Basic valuation approach**

Because of the very large number of people and the long-term future involved in the valuation of SSP, macrosimulation is normally used as the projection approach.

Contrary to microsimulation, which deals with individuals, macrosimulation deals with numbers of people by age, gender, and calendar year.

Despite their lesser complexity, macrosimulation models still present material challenges of their own, typical ones being numbers of people eligible to benefits, pattern of individual earnings over the contribution period, etc. The main drawback with macrosimulation, very rarely disclosed, is that the underlying mathematical projection approach is accurate (to the extent of the selected assumptions) only in connection with some inevitable implicit assumptions underlying the approach. For Canada's SSP's, the methodology is coded in ACTUCAN. The CPP model is used for the statutory valuation of the Canada Pension Plan purposes. ACTUCAN encompasses only one simple (and luckily sensible) implicit assumption where contributors dying before retirement are implicitly deemed, in respect of each calendar year until their death, having employment earnings equal to the average earnings of the birth-cohort to whom they belong. This is disclosed, but not demonstrated in the section on methodology of the actuarial reports on the CPP. The general projection approach used for the CPP does not rely whatsoever on numbers. Indeed, proportions rather

than numbers are explicitly projected. Total covered earnings and benefits are accordingly projected at once for each age-gender-year cohort. The basic general formula for the average initial retirement benefit factor BENFAC for any given age-gender-year cohort is:

BENFAC = ratio of

- The sum, for each year over the contributory period, of the products of the proportions of contributors by the average covered (pensionable, differing from contributory) employment earnings, to
- The contributory period.

Surprisingly enough, multiplying BENFAC by the benefit replacement rate (namely 25%), and by the population at the appropriate retirement age, produces the correct answer for the annual retirement benefit of the that age-gender year cohort before further adjustments can account for some social adequacy-related provisions of the CPP. This includes its three “drop-out” provisions that disregard some years of lowest earnings for benefit calculation purposes. One of the fundamental reasons for this mathematical accuracy is that eligibility for the CPP retirement pension rests simply on having contributed at least one year to the program. However, this correct answer needs further adjustment before it can be accounted for social adequacy-related provisions of the CPP.

Due to the progressive nature of the OASDI retirement benefit formula, microsimulation is used for the projection of benefits. However, microsimulated results need to be validated using the validated results of a parallel macrosimulation projection model. SSA valuation actuaries should examine whether that “BENFAC” mechanism could not be properly applied to the OASDI valuation approach, being well understood that a new series of adjustment factors would need to be developed to account for the OASDI’s own social adequacy-related and other special provisions. That is crucial because other methods are more complex; because it is likely not possible to identify the hidden implicit assumptions they encompass; because, even worse, it is not possible to determine the extent of their inaccuracy. In any event, the Trustees reports should disclose these matters of fact.

- **Description**

The Trustees reports would gain in professional and public credibility if the description of the valuation methodology were described in a more layman language and in more detail. One structural change that could help in that respect would be to fully segregate, as done in the actuarial reports on the CPP, the description of methodology from the description of assumptions.

- **Validation**

Again, credibility would be gained if the SSA actuarial valuation team went through the exercise of backdating the actual start of the projection in order to verify that the valuation model replicates accurately results of the past. This would represent a major endeavor. Such algorithm was put in place about 10 years ago in the CPP ACTUCAN model and has so far proven to be a very helpful tool for methodology improvements and refinements purposes.

- **GDP, labor force participation rates and unemployment rates**

The Trustees report is not clear regarding how the GDP, labor force participation (LBFPR) rates and unemployment rates are projected and used. This area of methodology description is commingled with a reference to proportions of contributors (PROCON) to the program. Either, but not both, of these two series of variables needs to be used for the simulation of employment earnings. As explicit approaches have to be preferred to implicit ones, an exclusive “PROCON” approach should be adopted. A LBFPR approach is implicit in that such rates, as well as unemployment rates, are available only on an instantaneous basis, while PROCON values are the accurate average annual values explicitly required for the proper simulation of employment earnings. LBRPR instantaneous values cannot be accurately converted to an annual basis. Therefore, the reports should be clearer regarding the exact and explicit or implicit role of the GDP, labor force participation rates and unemployment rates within the valuation process. Still, these parameters are not expressly required for the valuation process. Moreover, although the GDP is a nice concept, its measurements appear distorted and inaccurate. Indeed, as nothing gets produced within the controlled economy other than through the payment of salaries, why is it that GDP values always amount to about twice the total national payroll?

### **3. Presentation of results**

The main reason given in the report for the large projected increase in the paygo rates over the next 30 years is the baby-boomers. But it must be understood that the baby-boomers merely correspond to a temporary demographic fluctuation. The projected ultimate aging of the population and the resulting ultimate paygo cost increases stem mainly, besides the less impacting projected longevity improvements, from the drop in fertility rates started in the late 1960s and their sustained low values assumed for the future. This should not come as a surprise as most populations of the world are aging, while baby boomers are strictly a North American phenomenon. The baby-boomers merely add a slight contribution, from about 2010 to 2040, with a peak around 2025, to the permanent aging process, measured using age dependency ratios, that was actually launched sometime ago by declining mortality rates and more importantly about 1990 when the baby-busters started joining the labor force. If it were not for the baby busters, the rise in age dependency ratios after 2010 would be practically negligible for these reasons listed in the following paragraph on page 80.



Fertility rates reached a peak of about 4 during the baby boomers years. Fertility rates have rapidly dropped below 2 after 1965, and are not assumed to exceed that level under intermediate assumptions. In that sense, 3 can reasonably be regarded as a standard fertility level. Boomers correspond to a temporary period of fertility at an average level of 3.5 (arithmetic mean of 3 and 4), i.e. exceeding by only 0.5 the standard level of 3. Busters correspond to a permanent fertility rate of 2 or less, i.e. a cut of at least 1 from the standard level of 3. Moreover, the effect of variations in fertility rates on age dependency ratios shrinks with increases in the fertility rates, which further reduces the effect of boomers on age dependency ratios. It would be convenient if one could eventually model historical population figures with a removal of the baby boomers (by assuming such a standard fertility rate of 3). Then one would see a very meager difference between the age dependency ratios of the “modeled without” and the “historical with” boomers populations, respectively, after 2010.

Due to legal requirements, the Trustees reports must include two rather distinct series of projections, i.e. short-range and long-range estimates. This is unduly confusing as the short-range estimates already encompassed by the long-range estimates presented in a given report for costing purposes should not be allowed to differ from a distinct set of short-range estimates presented in the same report for accounting or budgeting purposes.

In a related vein, the 75-year actuarial balance test is unduly misleading and somewhat useless except for the involved actuarial deficit calculation. Its estimate is interesting as it indicates that a level contribution rate of 14.3%, i.e. the present contribution rate of 12.4% plus the actuarial deficit of 1.9%, would prevent a depletion of the fund for the next 75 years. However, that level contribution rate would require a further material increase of about 4% at the expiration of that period, which would bring it close to 18%. The Trustees Report should accordingly disclose the projected pay-as-you-go rate that would apply for a certain number of years (one year would be minimal but valuable information) after the 75-year period. A good alternative to the 75-year actuarial balance test would consist of measuring the level contribution rate over a longer period, e.g. 100 years, that would support the payments of all expenditures over that period of time as well as the maintenance of a larger minimum contingency fund equivalent to a multiple of the current annual expenditure, such as four to six years. Any increase in the current target fund/benefit ratio of one would reduce accordingly the resulting ultimate contribution rate. That ultimate contribution rate would have the advantage of being practically good forever, except for the low and gradual effect of longevity improvements.

#### **4. Intragenerational inequities, Intergenerational equity, Funding and Reform Opportunity**

The report should build further on its good discussion of fund/benefit ratios by providing information on funding. For example, the fund/benefit ratio for a fully funded plan is about 30 times the current annual expenditure, i.e. about the arithmetic mean of the contributory and benefits periods.

Funding is an unavoidable subject matter in the financial valuation of a SSP, as the impact of the applicable financing approach, be it pure paygo or quasi paygo (partial funding), can be properly assessed and understood only in reference to the full funding approach. The least reason for referring to the full funding approach is that the readership ought to be clearly informed about the differences in terms of social rationale and financial impact between paygo financing generally applying to social pension plans and full funding imposed on private plans.

Equity and fairness issues are involved here and the public disclosure of their financial assessment in the Trustees reports should be a trivial requirement. Do actuaries have to be reminded that the rationale underlying the mathematics of actuarial funding is individual equity? Compared to private pensions plans, social pensions programs provide some legitimate social adequacy-related benefits that need not be financed on a pure intragenerational individual equity basis. But why should the transfer of any part of those legitimate intragenerational individual inequities to future generations be allowed? In other words, the unavoidable inequities induced by social adequacy measures should be allocated on an equitable basis from one generation to the next. Intergenerational inequities should be avoided. That objective cannot be met without funding.

All of this would mean that no SSP should be implemented on a basis other than full funding. This has not happened. Is it not amazing that funding easily looks inappropriate for a publicly sponsored national pension plan only until it would be privatized? Correcting the intergenerational inequities that have actually ensued would induce further but much lesser inequities. This does not mean that nothing should or could be done. There is an opportunity to attenuate the level of inequities that will anyway be carried indefinitely forward to future generations as long as those inequities are not fully corrected. Such opportunity was seized in Canada through the 1997 reform of the CPP. Benefits were reduced by about 10%. Future emerging cash flows will be invested in a diversified portfolio rather than exclusively in provincial securities. Contribution rate increases are accelerated until 2003, leading to a higher funding ratio, at which time a steady-state rate of 9.9% is envisioned for the rest of the 21st century. Without the reform, future generations were projected to contribute at a rate of about 12.5% after 2030. The CPP reform therefore represents a relative contribution rate reduction close to 20%.

In the Conclusion of their report, the Trustees “urge that the long-range deficits of the OASI and DI funds be addressed in a timely way”. However, more than the long-range deficits need to be addressed. As discussed above, in connection with the 1997 CPP reform, social equity would compel an increase in the OASDI contribution rate beyond the floor level represented by a mere addition of the actuarial deficit of 1.9% to the existing 12.4% contribution rate, for a total of 14.3%. That would no longer be a workable rate beyond year 2075. Simple arithmetic indicates that slightly higher rate of 14.7% might be workable practically for ever provided changes similar to those of the 1997 CPP reform, i.e. 10% benefit reductions and investments into a diversified portfolio, would also be introduced to the OASDI program.