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# A STUDY OF PRIVATE PENSIONS

#### IN ONTARIO

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#### ABSTRACT

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Within the context of the private pension system in Ontario, three basic plan designs (two defined benefit plans: one based on career-average earnings and one on last five years' average earnings, and a money-purchase plan) are examined under various economic assumptions and vesting rules, for employees with different mobility characteristics and periods of participation in the labor force. The analysis is based on probabilistic models designed to characterize the ultimate benefit to be derived by a typical employee (or, ex-post, by a group of similar employees) from his or her career membership in pension plans. The ensuing pension costs are also modelled and computed by an adaptation of the projected benefitcost method to lifetime pension benefits. The results obtained constitute a detailed assessment of the basic plan types in use in Ontario, on the one hand, and of several vesting rules being suggested in different circles as more liberal alternatives to the current statutory minimum provision of "45 and 10" on the other hand.

# I. INTRODUCTION

Recent discussion of the private pension system in Ontario has centered mostly around the possible consequences of inflation indexation, portability, and more liberal vesting rules than those brought about by the Pension Benefit Act of 1965. Under this act, all pension plans are required, as a minimum, to adopt the "45 and 10" rule which calls for full vesting after 10 years of service and attained age 45. The act, which was followed by its federal and provincial counterparts in five other provinces, has served as a major impetus to the liberalization of vesting rules throughout Canada.

Evidently, further liberalization will generally increase pension benefits and costs. On the other hand, some observers maintain that moderate improvements will not substantially reduce the proportion of the retired persons with little or no pension income. It is also argued that earlier vesting might prove to be ineffective for members of contributory defined benefit plans whose own contributions may purchase most of the benefits creditable to their younger years (see [5]). Discussion of these and other issues in Ontario and elsewhere remain mainly speculative, however. Both actuarial and economic analyses of the impact of pensions on income distribution at retirement, capital accumulation, mobility of labor, and efficient allocation of labor have been mostly plan- (or firm-) oriented without an appropriate framework for integration throughout the working lives of individuals.

In this paper, we report on the applications of a methodology, recently developed by the authors, to private pensions in Ontario. The overall objective is to characterize, by way of a number of statistical measures, the ultimate benefit to be derived by a group of similar employees from their career membership in pension plans, as a function of vesting rules, termination rates, periods of employment, types of plan, and economic assumptions. A more specific objective is to provide a comprehensive

assessment of the basic plan types in use in Ontario on the one hand, and various more liberal vesting rules being suggested in different circles as replacements for the rule "45 and 10" on the other hand. For example, What are the relative virtues and limitations of career average plans, final earnings plans, and money purchase plans from the viewpoints of the three economic agents involved in the pension system (i.e., employees, employers, and governments)? What are the incremental benefits to workers and costs to employers and the economy associated with a given liberalization in vesting fules? How would these costs and benefits vary with termination rates, periods of employment, and alternative ages of retifement? What are the degrees of sensitivity of different plan types and vesting rules to rates of termination and periods of employment? What are the income distributive effects of different vesting rules -- Afe some rules more equitable than others in terms of the distribution among the retired population of the "pension wealth"? What is the impact of inflation on benefits and costs, especially in relation to different plan types?

In what follows, we provide answers to these and similar questions in the context of the private pension policy in Ontario. In Section 2, we outline the methodology. Section 3 is devoted to the scope of applications and data used. The results are presented and discussed in Section 4, followed by conclusions in Section 5.

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# II. METHODOLOGY<sup>1</sup>

Pension plans may be divided into two broad categories: 1) <u>defined</u> <u>benefit plans</u> and 2) <u>defined contribution plans</u>. A defined benefit plan may in turn be a <u>unit benefit plan</u> under which pension benefits are determined with reference to the remuneration of an employee for each year or for a selected number of years of service, or a <u>flat benefit plan</u> under which pension benefits are expressed either as a fixed amount in respect of each year of employment or a fixed periodic amount. The most common version of a defined contribution plan is the <u>money purchase</u> plan under which pension benefits are determined upon the retirement of an employee by the accumulated amount of past contributions. Defined benefit plans may be <u>contributory</u> (i.e., both employees and the employer contribute) or <u>noncontributory</u> (i.e., only the employer contributes); most money purchase plans are contributory.

In almost all defined benefit plans and in some defined contribution plans, a terminating employee is entitled to pension benefits at retirement if (1) he or she is of a prescribed minimum age at the time of termination (the <u>age requirement</u>) and/or (2) he or she has completed a prescribed minimum number of years of service with the organization (the <u>service requirement</u>). These requirements are called <u>vesting rules</u> (standards or provisions); if they are met, the pension is <u>vested</u> in the employee, contributions are "locked-in," and the employee collects benefits from it upon retirement even if he or she never again works for the organization involved. If termination occurs before vesting, the employee is entitled only to a return of his or her contributions with some interest.

<sup>1</sup>Parts of this section are technical in nature. Readers interested primarily in results could proceed to Section 3, after the first two paragraphs, without loss of continuity.

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An important proxy measure for pension benefits at retirement is the length of <u>qualifying service</u> (i.e., a length of service that qualifies or is "creditable" under the vesting rules in effect). Given the structural features of a specific pension plan and the rates of termination applicable to plan members, qualifying service in the plan can be characterized without much difficulty. Such an exercise would not be very useful, however, as a basis for the discussion of various policy issues related to lifetime pension benefits. The relevant measure is the cumulative qualifying service accruing from a career membership in pension plans. Important determinants of this measure, in turn, would be the length of the working life, periods of employment, termination rates, vesting rules, pension plan coverage, and portability (or transferability).

Since the employment termination process is a random process, qualifying service in a given plan as well as career qualifying service can be fully characterized only through probabilistic models. To illustrate the general structure of the basic model used in the following applications, let  $h^{n}(i)$  denote the length of qualifying service under a given vesting rule for an employee who terminates an employment of length i at working age n. For example, under the rule of full vesting after 10 years of service, we have

$$h^{n}(i) = \begin{cases} i & \text{if } i \ge 10 \\ 0 & \text{if } i < 10 \end{cases}$$

and, under the rule "45 and 10", we have

 $h^{n}(i) = \begin{cases} i & \text{if } i \geq 10 \text{ and } n \geq 45-a \\ 0 & \text{otherwise} \end{cases}$ 

where a is the age at entry. Next, let  $p^{n}(i)$  be the probability that an employment of duration i years at working age n will continue for at least one additional year. Note that  $p^{n}(i)$  are complements of select termination

rates. If we now denote by W<sup>n</sup>(i,j) the probability that the current employment at working age n is of i years length and that j years have been vested in previous employments, we can write

$$W^{n}(i,j) = W^{n-1}(i-1,j) p^{n-1}(i-1), \quad i=2,3,\ldots,n, \quad j=0,1,\ldots,n$$
$$W^{n}(1,j) = \sum_{i=1}^{n-1} W^{n-1}(i,j-h^{n-1}(i)) [1-p^{n-1}(i)], \quad j=0,\ldots,n.$$

These relations determine the probabilities  $W^{n}(i,j)$  recursively, which in turn can be used to compute the distribution  $Q^{N}(j)$  of career qualifying service at working (or retirement) age N by:

$$Q^{N}(j) = \sum_{i=1}^{N} W^{N}(i, j-h^{N}(i)), j=0,1,...,N$$

Under the abstraction that the pension is wage indexed (i.e., accrued at the same rate as the rate of growth of the average wage) qualifying service at retirement can be regarded as pension benefits expressed as a fraction of the wage at retirement. This assumption does not hold in practice, however, and the above model should be converted to that of pension benefits. This conversion is trivial in flat benefit plans. It can also be carried out for unit benefit and money purchase plans by appropriately modifying the function  $h^n(i)$  so as to transform the lengths of qualifying service to pension benefits, taking into account benefit formulas, benefit levels, wage profiles, and wage growth rates.

In unit benefit plans, for example, pension benefits accruing from an employment of length i years that terminates at working age n can be expressed as

$$h_{w,k}^{n}(i) = k.h^{n}(i).f(w_{n-i+1}, w_{n-i+2}, ..., w_{n})$$

where k is the benefit level (usually 1% to 2%),  $w_j$  is the wage at working age j, and f is a function that establishes the way in which career wages

are taken into account. In career-average-earnings plans

 $f(w_{n-i+1}, w_{n-i+2}, \dots, w_n) = (w_{n-i+1} + w_{n-i+2} + \dots + w_n)/i$  and in final-wage plans  $f(w_{n-i+1}, w_{n-i+2}, \dots, w_n) = w_n$ , with several other possibilities and practices existing in between these extremes. The wages involved may be taken as unindexed relative wages computed from  $w_n = (1+g)^{n-N}$ , such that  $w_N = 1$ , where g is the growth rate of the average wage and N is the age of retirement. Or, these can be computed from  $w_n = (1+g)^{n-N}(1+r)^{N-n}$ , as the value at time N of the relative wage paid at time n if it were indexed by the inflation rate r from time n to time N. Wage profiles reflecting wage differences in different ages can also be incorporated.

If we replace the function  $h^{n}(i)$  in the expressions presented above in relation to qualifying service by  $h_{w,k}^{n}(i)$ , we arrive at a framework for modelling pension benefits at retirement as a percentage of the wage in the year preceding retirement. This framework represents the theoretical basis for the benefit and cost models to be used in the applications that follow. Certain aspects of the methodology are covered in more detail in [1].

# III. DATA AND SCOPE

The study was undertaken in three interrelated phases: pensionable service, pension benefits, and pension costs. In each phase a large number of scenarios were constructed and investigated, with the results obtained in one phase being used for the design of the following phase. Scenarios were constructed through different plan types, rates of termination, periods of employment, vesting rules, and economic assumptions.

#### Plan Types

Three different plan designs were considered: a defined benefit plan based on career-average wages and 1% benefit level (abbreviated CA), a defined benefit plan based on last-five-years' average wages and 1% benefit level (5Y), and a money purchase plan with a 6% rate of contribution (MP)<sup>2</sup>.

In most cases all three plans were analyzed as contributory and noncontributory. In the former case, the employee contributions were taken as 2.5% in defined benefit plans and 3% in the MP plan. In contributory defined benefit plans, when one terminates before vesting, or dies before or after vesting, it was assumed that one gets the return of contributions plus interest at 3%, 4%, or 6%, depending on the economic assumptions being used (see economic assumptions below). In the contributory money purchase plan, it was assumed that one receives the fund rate of interest whether terminating or dying prior to retirement. In addition, in contributory plans, when one terminates after vesting, one's benefit was computed as the greater of the accrued pension or what the accumulated contributions would buy.

<sup>2</sup>Most pension plans in Ontario are defined benefit plans using a variety of benefit formulas. The CA and 5Y plans considered in this paper are common in practice and represent benchmark extremes; final earnings plans are restricted by law to last five or more years' average wages. Money purchase plans constitute about 5% of all plans in Ontario. The benefit and contribution levels used are arbitrarily selected, but the results can readily be adjusted to other levels. (For example, costs and benefits in defined benefit plans with 2% benefit level would be twice as high.)

# Periods of Employment

Four different entry-retirement age combinations were considered: 20-60, 20-65, 25-60 and 25-65. For entry ages 20 and 25, years of entry into the labor force were taken as 1980 and 1985, respectively. The last years of employment were, therefore, 2019 for retirement age 60 and 2024 for retirement age 65. In all cases, benefits were computed as fractions of the 2024 wages with actuarially reduced annuities for retirement age 60.

#### Vesting Rules

The vesting rules considered in the study were the following:

- 1) Full vesting at attained age 45 with 10 years of service (45 and 10).
- 2) Full vesting after 10 years of service (service 10).
- 3) Full vesting at attained age 40 with 5 years of service (40 and 5).
- 4) Full vesting after 5 years of service (service 5).

5) Full vesting when the combination of attained age and length of service equals 50, with at least 1 year of service (rule 50).

6) Full vesting when the combination of attained age and length of service equals 45, with at least 1 year of service (rule 45).

7) Full vesting after 1 year of service (service 1).

As mentioned earlier, the first rule is the current statutory minimum in Ontario. Others represent liberalizations of varying extent. They all were of interest to the Royal Commission as alternatives that have been suggested by or discussed in various circles. The last rule was incorporated in the study to serve as an additional basis of comparison.

# Termination Rates

Three different termination rate schedules were used in the study:<sup>3</sup> low, medium, and high (see Appendix). These schedules are fully select in that the rates of termination depend on both attained age and duration of employment. As verified by the source, these schedules are representative of the low, medium, and high mobility sectors of the covered labour force in Ontario.

For entry ages 20 and 25, expected tenure at different ages are presented in Figure 1, as computed from low, medium, and high terminationrate schedules. It is seen that the expected tenure increases linearly with age in all cases. Expected numbers of job changes and expected lengths of completed service, as implied by the termination rate schedules used, are given in Table 1.

Periods of Employment

				•					
		20-	-60	20-	-65	25-	-60	25-	-65
tes	Low	3.0	(13.5)	3.1	(14.7)	2.8	(12.7)	2.9	(14.0)
Ra	Med.	6.6	(6.0)	7.0	(6.5)	· 5.9	(6.0)	6.2	(6.4)
erm	High	12.3	(3.3)	13.1	(3.4)	10.6	(3.3)	11.4	(3.5)
Н	TAB	LE 1.	Expect	ted Nu	mber of	Job C	Changes	(Expec	ted

Length of Employment) under Different Rates of Termination)

<sup>3</sup>Two additional rate schedules, representing the actual experience of the Ontario Public Service Superannuation fund in the period 1974-76, were also used throughout most of the study. Results obtained under these schedules were included in the reports submitted to the Royal Commission but will not be discussed in this paper. All termination rate schedules were constructed and made available to us by Towers, Perrin, Forster and Crosby of Toronto.







## Mortality Rates

Mortality rates used in the study were based on the 1971 GAM Table developed by the Society of Actuaries, adjusted for the actual experience of pension plan members.<sup>4</sup> As computed from these rates, number of survivors at different ages per 1000 at age 20, and life expectancy at different ages are given in Figure 2. 'Note, in particular, that the life expectancies at ages 60 and 65 are 19.23 and 15.57, respectively. Mortality rates used in the study are also given in the Appendix.<sup>5</sup>

## Economic Assumptions

Economic assumptions used in the study regarding the rates of inflation, return on investment, and wage growth are given in Table 2.<sup>6</sup> The rate of return estimates are based on a long-term government bond index (10 years and

	Ra	te of Infl	ation	Tota	l Rate of Re	eturn	Real
<u>.</u>	Low	Most Probable	High	Low	Most Probable	High	Wage Growth
1980-84	4.5	5.5	7.5	6.9	7.9	9.9	1.8
1985-89	4.0	5.0	7.0	6.6	7.6	9.6	2.0
1990-	3.0	4.0	6.0	5.4	6.4	8.4	2.1

#### TABLE 2. Economic Assumptions

over) adjusted to Government of Canada bonds with terms of 20 years or more. Additional scenarios were subsequently investigated using 0.6 higher rates of return than those in Table 2.

"The loading was removed from the GAM Table and a projection for mortality improvement was incorporated by Towers, Perrin, Forster and Crosby of Toronto.

<sup>5</sup>Computations were also carried out using somewhat higher rates of mortality taken from Male Life Table, Canada, 1970-1972. These rates are also given in the Appendix and the annuity cost differences implied by the two different tables will be noted later in this section.

These projections were made and provided to us by the Royal Commission on the Status of Pensions in Ontario.

Based on recent studies in Canada [4] and the United States [3], the wage profile was taken as

Age	20	25	30	35	40-65
Wage Index	.40	.65	.85	.93	1.00

As implied by these assumptions, some wage functions relevant to career average and money purchase plans are presented in Figure 3. Essential to money purchase plans is the projection of wages at different ages invested until age 65, expressed as a fraction of the wage at 65. Evidently, the rate of inflation has no impact on the wage function so expressed. In contrast, wage profiles depicted in Figure 3 (which are significant in computing pension benefits and costs in career-average plans) are affected by the rate of inflation.<sup>7</sup>

Finally, costs at different ages of a unit annuity starting at age 60 or 65 (given survival until 60 or 65) are given in Figure 4 as a function of the rate of inflation. The input data summarized in this figure are similar to those used in establishing benefits and costs in money purchase plans. Annuity costs relevant to defined benefit plans are given in Table 3 for alternative ages of retirement under different economic assumptions, including 0.6 higher rates of return<sup>8</sup> than those shown in Table 2. All the annuity costs were computed using the adjusted GAM Table mortality rates. Costs using Male Life Table Canada rates are also included in Table 3 under the most probable economic scenario for purposes of comparison.

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<sup>&</sup>lt;sup>7</sup>Similar wage functions relevant to last-five-years' average plans can also be constructed but are not shown in Figure 3. It should be noted, however, that since benefits related to a creditable year of service depend on the wage at termination in final earnings plans, there will be a wide disparity relative to career-average plans.

<sup>&</sup>lt;sup>8</sup>As noted before, rates of return are based on the long term government bond index. It was subsequently decided to recompute some of the results using somewhat higher rates of return to account for the private sector and as an additional dimension in sensitivity analysis.

![](_page_15_Figure_0.jpeg)

![](_page_15_Figure_1.jpeg)

→ age

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			Age of Retirem	ent	
	· · ·	55	60	65	70
цл	Low	12.87	11.56	10.11	8.62
etu:	Med.	11.82 (11.39)	10.72 (10.30)	9.47 (9.14)	8.16 (7.95)
ц К	High	10.14	9.35	8.40	7.36
e o	Low +.6	12.22	11.05	9.72	8.34
Rat	Med.+.6	11.26	10.27	9.12	7.90
	High+.6	9.72	9.00	8.12	7.15

TABLE 3. Cost of a \$1 Annuity Purchased at Alternative Ages of Retirement under Different Economic Assumptions. (Entries in parentheses are computed using Male Life Table Canada mortality rates)

Using the above data, more than 1,000 scenarios were investigated using the methodology outlined in Section 2. The output of the models include various statistical measures related to qualifying service, pension benefits, and pension costs. The balance of the paper is devoted to the presentation and analysis of the results. IV. RESULTS

The first phase of the study was limited to career qualifying service. The objective was to investigate the impacts of vesting rules, termination rates, and periods of employment on the distribution of qualifying service. Results obtained in this phase were then used in designing the second- and third-phase scenarios on pension benefits and pension costs. This section is devoted to the presentation and discussion of the findings in the last two phases of the study. It begins with a comparative analysis of the expectation, variability, and distribution of pension benefits at retirement under different plans, vesting rules, termination rates, and periods of employment. The impacts of inflation and source of contributions are examined next. Finally, the expected total costs and costs to the employers of projected benefits are analyzed under different scenarios, with particular reference to the effects of plan types, vesting rules, termination rates, inflation, and source of contributions.

#### IV.1 Pension Benefits

Output of the benefit models included expectations, variances, Gini coefficients, distributions, and Lorenz curves, as measures characterizing pension benefits at retirement for a typical employee (or, ex-post, for a group of similar employees). As already noted, benefits are expressed as a fraction of the wage in the year 2024 (hereafter referred to as the base wage).

## Expected Benefits

Expected pension benefits at retirement are presented in Table 4 for some of the scenarios investigated. The northwest corner entry of 8.34, for example, means that in CA plans under the vesting rule "45 and 10," a typical worker of low mobility, who starts his or her working life at

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			20-60			20-65				25-60	•		25-65	·
		CA	5Y	MP	CA	5¥	MP		CA	5 <b>Y</b>	MP	CA	. 5Y	MP
	45 + 10	8.34	16.70	11.99	13.61	29.00	21.64	. •	8.10	14.91	11.11	13.34	26.32	20.27
	Service 10	8.69	17.26	13.20	14.01	29.63	23.51		8.37	15.31	11.94	13.66	26.76	21.54
	40 + 5	8.96	17.48	12.95	14.44	30.01	23.13		8.76	15.71	12.10	14.22	27.34	21.79
LOW	Service 5	9.25	17.89	14.18	14.77	30.48	25.03		9.01	16.01	12.97	14.50	27.68	23.14
TERM.	Rule 50	9.24	17.83	13.45	14.84	30.48	23.93		9.02	15.99	12.44	14.59	27.74	22.34
	Rule 45	9.36	17.97	13.81	14.97	30.64	24.49		9.14	16.12	12.77	14.72	27.89	22.85
	Service 1	9.57	18.21	14.83	15.21	30.92	26.07		9.37	16.37	13.68	14.99	28.18	24.25
														·
	45 + 10	6.20	10.91	8.38	10.52	19.36	15.66		5,98	9.93	7.79	10.26	17.92	14.74
	Service 10	6.61	11.54	9.73	10.99	20.06	17.75		6.29	10.35	8,68	10.60	18.39	16.11
	40 + 5	7.53	12.47	10.21	12.43	21.54	18.64		7.36	11.50	9.63	12.22	20.13	17.75
MED.	Service 5	7.94	13.00	11.84	12.90	22.15	21.16		7.68	11.88	10.75	12.59	20.56	19.47
TERM.	Rule 50	8.28	13.27	11.08	13.60	22.77	20.17		8.08	12.24	10.34	13.37	21.29	19.02
	Rule 45	8.56	13.58	11.80	13.91	23.13	21.28		8.37	12.55	11.03	13.69	21.64	20.08
	Service 1	9.06	14.12	13.87	14.48	23.74	24.48		8.85	13.06	12.76	14.25	22.22	22.74
	•													
	45 + 10	3.86	6.15	4.96	6.87	11.29	9.67		3.72	5.71	4.66	6.70	10.66	9,19
	Service 10	4.15	6.58	5.88	7.20	11.77	11.09		3.93	6.00	5.25	6.94	10.98	10.11
	40 + 5	5.56	8.07	7.12	9.47	14.18	13.38		5.44	7.63	6.81	9.33	13.56	12.89
HIGH	Service 5	5.92	8.50	8.47	9.88	14.68	15.47		5.71	7.94	7.72	9.63	13.91	14.29
TERM.	Ru1e 50	6.92	9.46	8.43	11.74	16.48	15.86		6.80	8.99	8.01	11.59	15.83	15.21
	Rule 45	7.35	9.91	9.38	12.22	17.00	17.32		7.22	9.44	8.93	12.07	16.33	16.62
	Service 1	8.06	10.65	12.07	13.04	17.85	21.48		7.88	10.11	11.13	12.83	17.10	20.01

TABLE 4. Expected Pension Benefits under Different Entry-Retirement Age Combinations, Plan Types, Termination Rates and Vesting Rules

C,

age 20 and plans to retire at age 60, may expect as private pension income at retirement 8.34% of his or her projected 2024 wage. (If the benefit level used were 2%, rather than 1%, the expectation in question would have been 16.68% of the base wage.) Comparatively, all other things being equal, 5Y plans imply benefits twice as high (16.70% of the base wage), the retirement age of 65 increases pension benefits by 50% (13.61% of the base wage), while, under the same circumstances, a worker of high mobility could expect less than half (3.86% of the base wage) the benefits due to his or her low-mobility counterpart. Such comparisons will now be expanded through vesting rules, termination rates, plan types, and periods of employment. Because of the somewhat arbitrarily selected benefit levels and contribution rates, expectations under defined benefit plans are not directly comparable, however, with those under the MP plan.

Let us first look at the impact of vesting rules. An examination of Table 4 indicates that for all age groups and termination rates, and for both of the defined benefit plans, the rank of the vesting rules under consideration, from the most stringent to the most liberal, is, "45 and 10," "service 10," "40 and 5," "service 5," "rule 50," "rule 45," and "service 1." This ordering is preserved with a few marginal exceptions. In addition, performances of the first, second, and third pairs of rules are similar in general, but differences between pairs increase with rates of termination. Pairwise comparisons of the results under the rules "45 and 10" versus "service 10," and "40 and 5" versus "service 5" in defined benefit plans suggest that the age requirement, as an addition to the service requirement, would have a minor impact on expected benefits. This reflects lower salary scales and higher rates of termination in younger years. It can also be seen from Table 4 that the vesting rule has a

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marginal effect on expected benefits and that little is lost due to vesting requirements in the low termination sector. As termination rates increase, however, the vesting rule becomes a critical factor, especially in CA plans. The relative insensitivity to vesting rules in 5Y plans is evidently due to the fact that the pension benefits accumulated at different ages in these plans depend heavily on the age at termination. Thus, liberalization brings in a smaller percentage increase in benefits (as compared with CA plans) associated with creditable service at different ages.

The ordering and pairing of the vesting rules in defined benefit plans are not preserved under the MP plan. The most notable development here is the relative improvement in expectations when the age requirements are dropped from the vesting rules "45 and 10" and "40 and 5." This can be explained by noting that in MP plans benefits creditable to different years of service are independent of the age at termination (as in CA but not in 5Y plans), in addition to being comparable in value (as opposed to both defined benefit plans). Accordingly, removing the age requirement results in comparable additional benefits, making the rule "service 5" the most liberal vesting provision in the low-termination sector (with the exception of the rule "service 1"). In the medium-termination sector also, the rule "service 5" is either the most liberal vesting rule or a close second to "rule 45." Significant improvements in the relative performance in MP plans of the rule "service 10" are also evident in Table 4. With this exception - that the age requirement in vesting rules is a more substantial deterrent in MP plans than in defined benefit plans - the effect of vesting rules in MP plans is similar, in general, to that in CA plans.

Next, regarding the impact of mobility, higher rates of termination would have two interrelated effects on vested benefits: reducing the length

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of a creditable service, and dividing a long period of creditable service in one employment into shorter periods of such service in several employments. The former effect is operational in all plans, but the latter is relevant only with respect to 5Y plans, where benefits vested for a given year of service are determined by wages earned in later years in the same employment. Thus, 5Y plans are doubly affected by termination rates. In addition, since reductions in creditable service are more pronounced during younger years when termination rates are higher, MP plans would be more sensitive to mobility than CA plans. These expectations are well reflected in Table 4, where the impact of termination rates is comparatively higher in 5Y plans than in MP plans, and in MP plans than in CA plans. Note also that the relative advantages in 5Y plans increase from high to low rates of termination and from early to normal ages of retirement. The results also show that the previously noted ranking (and pairing in defined benefit plans) of the vesting rules is also valid in relation to the influences of termination rates and plan types. In other words, more stringent provisions are comparatively more sensitive to plan designs and high rates of termination magnify this sensitivity. Consequently, liberalization of vesting rules would have an overall equalizing effect on expected benefits.

For the same age of retirement (60 or 65) the entry age 20 implies a marginal increase in expected benefits as compared with the entry age 25, due the fact that either the years of service from age 20 to age 25 will not be creditable (due to higher mobility during younger years) or, even if they are, relative value of the associated benefits will be small in defined benefit (especially CA) plans. On the other hand, for the same entry age (20 or 25) expected benefits related to the normal retirement age of 65 are much larger than those associated with the early retirement age of 60. For

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in all plans, more benefits will accrue over a longer working life, and an actuarial increase in benefits will be realized due to shorter expected postretirement life span. In addition, if not terminated, benefits related to the last employment will be larger in 5Y plans; and, the fund will accrue returns over five additional years in MP plans. It can also be seen from Table 4 that the relative increases in expected benefits resulting from a liberalization of vesting rules would be nearly the same for all age groups. Similarly, higher rates of termination do not appear to have an aggravating effect on the relative benefits of different age groups.

# Variability of Benefits

In Table 5, coefficients of variation are presented under the same scenarios as in Table 4. Coefficient of variation, defined as the ratio of standard deviation to mean, is a summary measure of the dispersion of benefits across the population of recipients. The measure is independent of the benefit level in defined benefit plans; that is, same numerical values would have resulted if higher or lower levels of benefit (than 1%) were used in computations. Similarly, the measure does not depend on the particular contribution level used in the money purchase plan. Consequently, as opposed to the means, coefficients of variation under defined benefit plans are directly comparable with those under the money purchase plan.

Analysis of the entries in Table 5 in much the same way as before reveals that the ranking and pairing of the vesting rules, in relation to defined benefit and money purchase plans according to <u>increasing</u> means, also turn out to be the order of these rules in <u>decreasing</u> coefficients of variation. It is evident that the vesting rules have a substantial impact on the variability of benefits for all age groups, plan types, and termination

-20-

		•	20-60	•		. 2	0-65			•			2560				25-65	
		CA	5Y	MP	C	Ă	5Y .	MP			•	CA	5Y	MP		CA	5Y	MP
	45 + 10	.26	. 38	.31	•	.22	.35	.27			•	.27	.37	.31		.23	.34	.26
	Service 10	.22	.33	.20	•	19	.32	.18				.24	.33	.23		.21	.32	.20
	40 + 5	.13	.30	.20	•	11	.29	.17				.13	.27	.19		.11	.27	.16
LOW	Service 5	.10	.27	.10	•	.09	.27	.09				.11	.25	.11.		.10	.26	.10
TERM.	Rule 50	.08	.27	.16	•	.06	.27	.14				.08	.24	.16		.06	.25	.14
•	Rule 45	.06	.25	.12	•	.04	.26	.11				.06	.23	.12		.05	.24	.11
	Service 1	.03	.24	.03	•	.03	.25	.03	•			.03	.22	.03		.03	.23	.03
•	÷			•														۰.
		F./							•									
	45 + 10	• 54	.00	• 58	•	40	.61	.50				• 56	.66	.59		.48	.60	.50
	Service tu	-40 20	.00	.45	•	.43	.5/	.40				.51	.61	.49		.45	.57	.43
MED	40 7 5	.20	.47	. 34	•	24	.45	.30				.28	.44	.33		1 -25	.42	.29
TED.	Dula 50	.23	43	.23	•	. 2.2	.42	.21				.26	.41	.25		.23	.41	.23
TRUL	Rule JU	.15	• 30	. 27	•	.11	.3/	.23			•	.15	.35	.26		.11	.35	.22
	Kule 45	.14		. 21	•	.09 .	. 30	.18				.12	.32	.20		-09	.33	.17
	Service 1	-00	• 52	.07	. •	.07	• 34	.07 .				.08	.29	.08		.07	.31	.07
								•				•••				•		
			•		•											, ·		•
	45 + 10	.93	1.06	.97	· · .	81	.95	.84			•	.95	1.05	. 97		82	0/	0/
	Service 10	.85	.97	.81		.77	.90	.73			• •	-89	.99	.86	,	.02	01	04
	40 + 5	.50	.68	. 55		.44	.63	.48				. 50	.65	.53			61	•/0
HIGH	Service 5	.46	.63	. 44		41	.60	.39				.47	.62	.46		.44	50	•47
TERM.	Rule 50	.24	.47	.38		.19	.44	.32				.24	. 44	37		•44	•	•41 20
	Rule 45	.19	.42	.30	-	16	.42	.25				.19	30	28		16	•42	.30
	Service 1	.14	.37	.14		13	.38	.13				.14	.34	.14		.13	•36	.24

TABLE 5. Coefficients of Variation under Different Entry-Retirement Age Plan Types, Termination Rates, and Vesting Rules

rates. Also, both standard deviations and coefficients of variation are highest in the 5Y plan, followed by MP and CA plans. High dispersion of benefits in 5Y plans can again be explained by the fact that in these plans benefits associated with a creditable year of service may vary substantially as a function of the age at termination. Also, since the benefits creditable to earlier ages are comparatively more significant in MP plans than in CA plans, pension benefits are relatively more dispersed in the former plans.

In view of these observations, tentative conclusions reached through expected benefits regarding the "immunity" of the low-termination sector to vesting rules, and the extent of superiority of 5Y plans over CA plans must be qualified. In addition, reductions in the variability of benefits in moving to more liberal vesting rules are not as significant in 5Y plans as in CA and MP plans. It is interesting to note that the age requirement in vesting rules is again more critical in MP plans than in defined benefit plans.

#### Distribution of Benefits

Due to the random nature of the employment termination process, pension benefit at retirement is a random variable. Therefore, the measures considered so far provide only a partial characterization. To arrive at the complete picture, especially in relation to policy issues, distribution of benefits must be identified.

As computed through the underlying methodology, cumulative distributions of pension benefits at retirement for age group 25-65 are presented in Figures 5 to 13, under different vesting rules, plan types, and termination rates. For every benefit level on the horizontal axes, the proportion of recipients whose benefits will be below this level can readily be determined

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<sup>9</sup> Standard deviations can easily be computed by multiplying the entries of Table 5 with the corresponding entries of Table 4.

![](_page_25_Figure_0.jpeg)

![](_page_25_Figure_1.jpeg)

→ Fraction of Recipients

![](_page_26_Figure_0.jpeg)

→ Percentage of Wage in 2024

![](_page_26_Figure_2.jpeg)

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FIGURE 6.

Distribution of Pension Benefits and d

![](_page_27_Figure_0.jpeg)

![](_page_27_Figure_1.jpeg)

![](_page_27_Figure_2.jpeg)

FIGURE 8. Distribution of Pension Benefits and Lorenz Curves under Different Vesting Rules in 5Y Plans with Low Termination Rates

![](_page_28_Figure_1.jpeg)

![](_page_28_Figure_2.jpeg)

![](_page_29_Figure_0.jpeg)

![](_page_29_Figure_1.jpeg)

![](_page_29_Figure_2.jpeg)

![](_page_30_Figure_0.jpeg)

![](_page_30_Figure_1.jpeg)

FIGURE 10. Distribution of Pension Benefits and

![](_page_31_Figure_0.jpeg)

![](_page_31_Figure_1.jpeg)

→ Percentage of Wage in 2024

![](_page_31_Figure_3.jpeg)

![](_page_32_Figure_0.jpeg)

![](_page_32_Figure_1.jpeg)

FIGURE 13. Distribution of Pension Benefits and Lorenz Curves under Different Vesting Rules in MP Plans with High Termination Rates

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![](_page_33_Figure_1.jpeg)

![](_page_33_Figure_2.jpeg)

from these graphs. For example, we can see from Figure 10 that nearly 68% of the high-mobility sector will receive less than 15 (15% of the base wage) in a 5Y plan under the rule "service 10." This proportion reduces to about 10% for the low-mobility group (Figure 8). By implication, 32% and 90%, respectively, of the high- and low-mobility workers will receive more than 15. Conversely, by first identifying the percentages, one can determine the percentiles of the distributions. Again, from Figures 10 and 8, the first quartiles under "service 10" with high and low rates of termination are 3.5 and 15, respectively, medians are 10 and 20, third quartiles are 17.5 and 35, and interquartile ranges are 14 and 20. These numbers have obvious interpretations. Evidently, benefits of the middle 50% will vary from 3.5 to 17.5--a range of 14--if termination rates are high, but from 15 to 35--a range of 20--if termination rates are low. Note that the maximum possible benefit is 36, and 25% of the low-termination group will receive more than 35 under any vesting rule.

The above observations are related to the distribution of career pension benefits, ex post, for a group of similar employees under a given scenario. The obvious equitable result for them would be to obtain equal pensions. Any departures from this equality would have to be a consequence of the interaction of termination rates with vesting rules and other scenario elements. An instrument for the measurement of such departures is the <u>Lorenz curve</u>. The Lorenz curve of a pension benefit distribution is a plot of the fraction of employees receiving less than a given level of benefit versus the relative share of this group of the total pension income (or pension wealth). Figures 5 to 13 also include the corresponding Lorenz curves. According to Figure 10, for example, in 5Y plans under the rule "service 10," the bottom 40% of the high-termination sector will share only 3% of the pension income due to this sector. In the low-termination sector, the share of the bottom 40% of the recipients would be 25% (Figure 8).

If the correspondence between the fractions of recipients and their shares of the pension wealth were to be one-to-one, the Lorenz curve would have been the straight-line diagonal shown in the Figures. This corresponds to an ideal (perfectly egalitarian) distribution. Departures from this ideal are measured by the Lorenz curve on a point-by-point basis, and by a summary measure called the <u>Gini coefficient</u> on a global basis. The latter index is defined, conventionally, as twice the area formed by the straight-line diagonal and the Lorenz curve (i.e., the ratio of this area to the total area of 0.5 below the diagonal). Consequently, as the Lorenz curve approaches the diagonal, the Gini coefficient decreases (tends to 0), signifying an egalitarian distribution. Conversely, as the Lorenz curves moves away from the diagonal, the Gini coefficient increases (approaches to 1), characterizing an inequitable distribution in the sense of the disproportionately high accumulations of the pension wealth in the high pension income groups. Gini coefficients under different scenarios are presented in Table 6.

We now turn to a brief comparative discussion of the distributions, Lorenz curves, and Gini coefficients through the impacts of vesting rules, termination rates, plan types, and periods of employment.

Figures 5 and 8 show that the impact of vesting rules in defined benefit plans is in fact marginal when termination rates are low; only the rules "45 and 10" and "service 10" perform noticeably worse than others. This impact becomes substantial in medium and high termination sectors, where the previously noted groupings are remarkably distinct (Figures 6, 7, 9, and 10). In general, distributions shift to the right as the vesting rule becomes more liberal, thus placing smaller fractions of recipients below a given level of benefit. These shifts are not always uniform, however. In Figure 5,

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			20-60		1	20-65				25-60			25-65	
		CA	5 <b>Y</b>	MP	CA	5X	MP		CA	5Y	MP	CA	.5Y	MP
	45 + 10	.12	.21	.16	.10	. 20	.14		.13	.20	.16	.10	.19	.14
	Service 10	.09	.18	.10	.08	.18	.09		.11	.18	.11	.09	.17	.10
	40 + 5	.06	.17	.11	.05	.16	.09		.06	.15	.10	.05	.15	.09
OW	Service 5	.04	.15	.05	.04	.15	.04		.05	.14	.05	.04	.14	.05
ERM.	Rule 50	.04	.15	.08	.03	.15	.07		.04	.14	.08	.03	.14	.07
	Rule 45	.03	.14	.06	.02	.15	.06		.03	.13	.06	.02	.13	.06
	Service 1	.01	.13	.01	.01	.14	.01		.02	.12	.02	.01	.13	.02
	45 + 10	.30	. 38	.33	.25	.35	.29		.31	.38	.33	.26	.34	.28
	Service 10	.26	. 34	.25	.23	.33	.22		.28	.35	.27	.24	.33	.24
	40 + 5	.15	.27	.20	.13	.26	.17		.15	.25	.19	.13	.24	.16
ED.	Service 5	.13	.24	.13	.11	.24	.12		.14	.23	.14	.12	.23	.12
ERM.	Rule 50	.08	.22	.16	.06	.21	.13		.08	.20	.15	.06	.20	.13
	Rule 45	.06	.20	.12	.05	.20	.10		.06	.18	.11	-05	.19	.10
	Service 1	.04	.18	.04	.04	.19	.04	ेत्र ४	.04	.16	.04	.04	.17	.04
				,										
	45 + 10	.52	.57	.54	.46	.52	.47		.53	.57	.54	.47	.52	-47
	Service 10	.48	.54	.46	.44	.50	.41		.50	.55	.49	.45	.51	.43
	40 + 5	.28	.38	.31	.25	.35	.27		.29	.37	.31	.25	.34	.27
IGH	Service 5	.26	.35	.25	.23	.33	.22		.27	.35	.26	.24	.33	.23
ERM.	Rule 50	.14	.25	.22	.11	.24	.18		.13	.24	.21	.10	.22	.17
	Rule 45	.11	.23	.17	.09	.22	.15		.11	.21	.16	.09	.21	.14
	Service 1	.08	.20	.08	.07	.20	.07		.08	.18	.08	.07	.19	.07
											+	••••		

TABLE 6. Gini Coefficients under Different Entry-Retirement Ages, Plan Types, Termination Rates and Vesting Rules

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s;

for example, distributions under the rules "service 10" and "40 and 5" cross at about the benefit level 14. Thus, under both rules, approximately 28% will receive less than 14. However, below this benefit level, relatively higher proportions of recipients would receive smaller benefits (and above this benefit level, relatively lower proportions of recipients would receive higher benefits) under the rule "service 10." Similar crossings can be observed in Figure 5 also with respect to the vesting rule "service 5." Therefore, distributions of benefits in defined benefit plans under the service-requirement rules are relatively more concentrated at both extremes of the range, while under the age-service rules relatively more of the frequency lies in the mid-ranges. These tendencies, however, are not reflected by Lorenz curves and Gini coefficients strongly enough to contradict the previously suggested ranking of the vesting rules. Lorenz curves and Gini coefficients for medium and high rates of termination are in strict agreement with this ranking. When termination rates are low, Lorenz curves are hardly distinguishable under more liberal vesting rules.

The vesting rule is much more influential in the money purchase plan (Figures 11, 12 and 13), even when the rates of termination are low. Groupings observed in relation to defined benefit plans are no longer evident. Thus, even modest changes in vesting rules would create significant overall changes and shifts in distributions. This is a direct consequence of the periods of service for which benefits are forfeited due to termination before the vesting requirements are met. As pointed out before, in terms of their value at retirement, such benefits are comparable for comparable lengths of service in money purchase plans, irrespective of the specific time periods of accrual in one's working life. Their forfeiture would, therefore, induce a corresponding decrease in pension benefits due at

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retirement. (In defined benefit plans, on the other hand, benefits forfeited at younger years would have a relatively minor impact on the purchasing power of the pension income at retirement.)

The impact of termination rates is substantial in all cases, as reflected by a shift to the left in distributions and a shift to the right in Lorenz curves, from low to high rates. The former is due to the fact that as termination rates increase, the proportion of recipients below a given level of pension income would also increase. Shifts in Lorenz curves, especially under more stringent vesting rules, are consequences of the relatively larger fractions of recipients with little or no pension income in higher termination sectors. Both Lorenz curves and distributions indicate that in the high termination sector (age group 25-65), 32.5% of the covered population would have no vested pension under the rule "45 and 10." This proportion drops to 27.5% under the rule "service 10," and to below 5% under the rule "40 and 5." For the age group 20-65, (distributions are not shown) the respective proportions are 25.5%, 18% and 2%. In the medium termination sector for age group 25-65 (20-65) the same proportions are 9.5% (7%) under the rule "45 and 10," 7% (3%) under the rule "service 10," and negligible or zero under other rules. Consequently, as a measure of the risk of terminating employees, probability of no vested pension is highly sensitive to vesting rules, termination rates, and periods of employment. These findings, which refer to the covered population only, should be reflected in view of the currently large proportion of the retired population in Ontario (and elsewhere) receiving no private pension income.

Regarding the impact of the plan type, it is seen from the distributions that the maximum possible benefit is 16 in CA plans, 36 in 5Y plans and 25 in MP plans. Narrowness of the benefit range in CA plans is coupled with the concentration of most of the frequercy near the upper range. Thus,

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although one cannot expect too much from a CA plan, most are likely to receive near-maximum benefits (or, expressed in the negative, all should fare equally badly). In contrast, the range of the distributions in 5Y plans is very wide and dispersions are high. The fact remains, however, that 5Y plans are superior to CA plans in terms of implied benefits. According to Figure 8, for example, 88% of the low termination sector will receive more than 16 in the 5Y plan under the rule "service 10," while everyone will receive at most 16 in a CA plan even under full and immediate vesting.

Numerous other observations and comparisons can be made through the distributions and Lorenz curves. The above has been a demonstrative account of the effects of some of the more important variables on the distribution of benefits and related measures. The impacts of inflation and source of contributions will be outlined next.

# Inflation and Source of Contributions

Results discussed so far are based on the most probable economic scenario and essentially noncontributory plans. To isolate the effects of inflation and source of contributions, expected lifetime pension benefits under different vesting rules were recomputed for age groups 25-60 and 25-65, using the low, most probable (medium), and high estimates for the rate of inflation, and contributory and noncontributory plans. (For details on economic assumptions and rates of contribution, see Section 3.) The results are presented in Table 7.

The contributory-noncontributory distinction is irrelevant in MP plans. In defined benefit plans, increases in expected benefits from noncontributory to contributory modes are due to the computation of benefits in contributory plans as the greater of the accrued pension implied by the benefit formula or what the accumulated contributions would buy. The greatest increase is 17% (excluding the rule "service 1"), and increases are larger for higher rates of

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					25	-60				•		25	-65		
			NONC	ONTRIBUT	ORY	co	NTRIBUTO	RY		NONC	ONTRIBUT	ORY	CO	NTRIBUTO	RY
			CA	5Y	MP	CA	5 Y	MP		CA	5Y	MP	CA	5Y	MP
		45 + 10	9.28	15.86	10.80	9.28	15.86	10.80		14.89	27.02	19.00	14.89	27.02	19.00
		Service 10	9.65	16.35	11.60	9.66	16.35	11.60		15.30	27.58	20.19	15.43	27.61	20.19
	LOW	. 40 + 5	10.06	16.76	11.76	10.06	16.76	11.76		15.88	28.17	20.42	15.93	28.17	20.42
	TERM.	Service 5	10.38	17.16	12.61	10.44	17.19	12.61		16.25	28.62	21.69	16.55	28.79	21.69
		Rule 50	10.35	17.08	12.09	10.35	17.08	12.09		16.28	28.60	20.94	16.37	28.61	20.94
		Rule 45	10.50	17.25	12.41	10.51	17.25	12.41		16.45	28.80	21.42	16.61	28.85	21.42
		Service 1	10.82	17.59	13.30	10.96	17.70	13.30		16.82	29.18	22.74	17.34	29.57	22.74
		45 + 10	6.82	10.62	7.58	6.82	10.62	7.58		11.39	18.53	13.82	11.39	18.53	13.82
		Service 10	. 7.22	11.15	8.43	7.23	11.15	8.43		11.84	19.13	15.09	11.97	19.16	15.09
LOW	MED.	40 + 5	8.40	12.39	9.36	8.40	12.39	9.36		13.58	20.96	16.63	13.65	20.97	16.63
INF.	TERM.	Service 5	8.83	12.89	10.45	8.90	12.93	10.45		14.07	21.54	18.25	14.45	21.77	18.25
		Rule 50	9.19	13.20	10.06	9.19	13.20	10.06		14.80	22.21	17.82	14.90	22.22	17.82
		Rule 45	9.55	13.59	10.72	9.56	13.59	10.72		15.21	22.65	18.81	15.41	22.74	18.81
		Service 1	10.21	14.27	12.41	10.45	14,48	12.41		15.96	23.43	21.31	16.84	24.17	21.31
		45 + 10	4.23	6.14	4.53	4.23	6.14	4.53		7.41	11.08	8.61	7.41	11.08	8.61
		Service 10	4.51	6.50	5.10	4.51	6.50	5.10		7.72	11.49	9.47	7.80	11.51	9.47
	HIGH	40 + 5	6.19	8.28	6.62	6.19	8.28	6.62		10.31	14.25	12.08	10.37	14.27	12.08
	TERM.	Service 5	6.55	8.69	7.51	6.60	8.72	7.51		10.72	14.72	13.39	11.03	14.92	13.39
		Rule 50	7.66	9.76	7.80	7.66	9.76	7.80		12.71	.16.66	14.24	12.77	16.67	14.24
		Rule 45	8.19	10.32	8.69	8.19	10.32	8.69		13.31	17.29	15.56	13.50	17.39	15.56
	•	Service 1	9.07	11.21	10.83	9.36	11.48	10.83		14.32	18.32	18.74	15.37	19.26	18.74
		45 + 10	8.10	14.92	11.10	8.10	14.92	1/1, 10		13.33	26.32	20.27	13.41	.26.32	20.27
		Service 10	8.37	15.31	11.93	8.44	15.32	11.93		13.65	26.77	21.55	13.98	26,90	21.55
	TOW	40 + 5	8.76	15 71	12.09	8 79	15.71	12:09		14.21	27.35	21.79	14.44	27.41	21.79
	TEDM	Service 5	9.01	16.01	12.96	9.18	16.11	12.96		14.49	27.69	23.14	15.10	28.07	23.14
		Rule 50	9.02	15.99	12.43	39.07	15.99	12:43	•	14.58	27.74	22.35	14.87	27.85	22.35
		Rule 45	9.14	16:12	12.76	9.22	-16.15	12.76		14.71	27.90	.22.86	15.13	28.10	22.86
		Service 1	9.37	16.37	13.67	9.68	16.61	13.67		14.,98	28.18	24.26	15.90	28.87	24.26
		45 + 10	5.98	9.94	7.79	5.98	9.94	7.79		10.25	17.92	14.75	10.33	17.92	14.75
		Service 10	6.29	10.36	8.67	6.35	10.37	8,67		10.60	18.40	16.11	10.95	18.54	16.11
MED.	MED.	40 + 5	7.36	11.50	9.63	7.39	11.50	9.63		12.21	20.13	17.74	12.53	20.25	17.74
INF.	TERM.	Service 5	7.68	11.88	10.75	7.90	12.01	10.75		12.58	20.56	19.47	13.38	21.10	19.47
		Rule 50	8.08	12.24	10.34	8.13	12.25	10.34		13.35	21.29	19.01	13.71	21.43	19.01
		Rule 45	8.37	12.55	11.03	8.47	12.58	11.03		13.68	21.64	20.07	14.27	21.98	20.07
		Service 1	. 8.86	13.06	12.76	9.38	13.50	12.76		14.23	22.21	22.74	15.79	23.51	22.74
		45 + 10	3.73	5.72	4.66	3.73	5.72	4.66		6.70	10.66	9.19	6.76	10.66	9.19
		Service 10	3.94	6.00	5.25	. 3.98	6.01	5.25		6.94	10.98	10,11	7.17	11.08	10.11
·	HICH	40 + 5	5.45	7.63	6.81	5.47	7.63	6:81		9.32	13.56	12.89	<b>19.60</b>	13.68	12.89
	TERM.	Service 5	5.72	7.94	7.72	5.89	8.05	7.72		9.63	13.91	14.29	10.30	14.39	14.29
		Rule 50	6.80	8.99	8.02	6.83	8.99	8.02		11.57	15.81	15.20	11.86	15.94	15.20
		Rule 45	7.22	9.43	8,93	7.30	9.46	8:93		12.05	16.32	16.60	12.62	16.71	16.60
		Service 1	7.89	10.11	11.13	8.49	10.66	11.13		12.80.	17.08	20.00	14.62	18.71	20,00

TABLE 7. Expected Pension Benefits (Inflation and Source of Contributions) under Different Entry-Retirement Ages, Plan Types, Termination RAtes and Vesting Rules

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					25	5-60			•	25-65	5			
			NONC	CONTRIBUT	ORY	CON	TRIBUTO	RY	NONCO	NTRIBUTO	RY	CO	NTRIBUTO	RY
			CA	5¥	MP	CA	5Y	MP	CA	5Y .	MP	CA	5Y	MP
		45 + 10	6.27	13.21	11.59	6.31	13.21	11.59	10.96	25.07	22.84	11.24	25.13	22.84
		Service 10	6.43	13.45	12.45	6.65	13.55	12.45	11.14	25.35	24.27	11.86	25.75	24.27
	LOW	40 + 5	6.78	13.83	12.62	6.93	13.87	12.62	11.67	25.92	24.55	12.26	26.21	24.55
	TERM.	Service 5	6.92	14.00	13.53	7.32	14.27	13.53	11.82	26.11	26.07	12.98	26.93	26.07
		Rule 50	6.99	14.05	12.98	7.18	14.12	12.98	11.98	26.25	25.18	12.69	26.64	25.18
		Rule 45	7.06	14.13	13.32	7.33	14.27	13.32	12.06	26.35	25,75	12.96	26.92	25.75
		Service 1	7.19	14.27	14.27	7.80	14.75	. 14.27	12.20	26.50	27.33	13.82	27.77	27.33
		45 + 10	4.67	8.71	8.13	4.71	8.71	8.13	8.48	16.85	16.61	8.84	16.95	16.61
		Service 10	4.85	8.98	9.05	5.08	9.08	9.05	8.69	17.15	18.14	9.50	17.61	18.14
HIGH	MED.	40 + 5	5.74	9.96	10.05	5.94	10.04	10.05	10.10	18,71	19.99	10.96	19.21	19.99
INF.	TERM.	Service 5	5.92	10.18	11.22	6.46	10.55	11.22	10.31	18.96	21.93	11.89	20.14	21.93
		Rule 50	6.35	10.58	10.80	6.58	10.67	10.80	11.11	19.73	21.42	12.09	20.34	21.42
		Rule 45	6.53	10.78	11.51	6.91	11.01	11.51	11.31	19.95	22.61	12.69	20.94	22.61
		Service 1	6.80	11.06	13.32	7.85	11.94	13.32	11.62	20.27	25.61	14.38	22.63	25.61
		45 + 10	2.92	4.97	4.86	2.96	4.97	4.86	5.58	9.92	10.36	5.85	10.01	10.36
		Service 10	3.05	5.15	5.48	3.20	5.22	5.48	5.72	10.13	11.38	6.29	10.45	11.38
	HIGH	40 + 5	4.28	6.51	7.11	4.46	6.60	7.11	7.77	12.39	14.52	8.56	12.90	14.52
	TERM.	Service 5	4.44	6.69	8.06	4.88	7.02	8,06	7.94	12.60	16.10	9.32	13.67	16.10
		Rule 50	5.42	7.66	8.37	5.61	7.74	8.37	9.76	14.39	17.12	10.69	15.03	17.12
		Rule 45	5.70	7.95	9.33	6.07	8.21	9.33	10.07	14.72	18.71	11.53	15.88	18.71
		Service 1	6.08	8.34	11.62	7.30	9.44	11.62	10.50	15.15	22.52	13.75	18.10	22.52

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TABLE 7 (continued). Expected Pension Benefits (Inflation and Source of Contributions)

termination and inflation, larger in CA plans than in 5Y plans, and larger for the retirement age 65 than for 60. Also, in all cases, the increases are more pronounced under the vesting rule "service 5". This last result is in support of the widely held belief that the contributions of the members of defined beneift plans may buy a large portion of the benefits they are entitled to during their younger years. Thus, in the absence of an age requirement for vesting, benefits creditable to earlier ages under the rule "service 5" appear to have fallen short of what the contributions would buy (more so under this rule than others).

Table 7 also indicates decreases in expected benefits of 21 to 23% and 29 to 33% from, respectively, low to medium and from low to high rates of inflation in noncontributory CA plans for age group 25-60. Decreases in benefits are slightly smaller in contributory plans and for the retirement age 65. More stringent vesting rules and higher rates of termination do not appear to aggravate the impact of inflation. As expected, reductions in benefits due to inflation are considerably less in 5Y plans than in CA plans (6 to 10% from low to medium and 18 to 26% from low to high inflation for age group 25-60). And, in contrast to the defined benefit plans, expected benefits increase in MP plans together with the rate of inflation, due, evidently, to the relatively cheaper annuities purchased at retirement (see Table 3). The increases are 3% for age group 25-60 and 7% for age group 25-65, from low to medium inflation; and, 7% for age group 25-60 and 20% for age group 25-65, from low to high inflation.

#### IV.2 Pension Costs

Pension costs were modelled through an adaptation to lifetime pension benefits of the "projected benefit cost method"; the version of this method

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that develops a normal cost that remains constant as a percentage of salary was used (cf. [6]). For every scenario, the model output included the total cost and the employer's cost, both expressed as a fraction of the present value of the payroll over the working life.

In Table 8, we present the total costs (employer cost plus employee cost in contributory plans) for age groups 25-60 and 25-65. As expected, costs are higher under lower rates of termination, more liberal vesting rules, contributory plans, 5Y plans (relative to CA plans), and the retirement age 60. It is also seen that the total costs in defined benefit plans decrease as the rate of inflation increases. As noted previously, although wages increase with inflation, vested benefits related to terminated employments do not in defined benefit plans. On the other hand, it is cheaper to maintain a constant level of benefit during post-retirement years when the interest rates are high.

Table 8 reveals that the relative incremental cost of liberalization would be larger in CA plans than in 5Y plans, in noncontributory than in contributory defined benefit plans, and for the retirement age 60 than for 65; these costs would also be larger in the higher termination sectors. In many if not most of the cases, however, increases in total costs are remarkably small.<sup>10</sup>

Employer costs are presented in Table 9. Very low entries under CA plans, especially for higher rates of inflation, should be noted. Comparative examinations of the entries in Tables 8 and 9 would also reveal the effects of other scenario variables. Such observations would be substantially

<sup>10</sup> Recall that the defined benefit plans are based on a 1% benefit level and that the level of contribution in the MP plan is 6%. If these levels are increased, cost differences in question would also increase proportionately. Recall also that neither absolute nor incremental costs under MP plans are directly comparable with those under defined benefit plans.

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LOWLOWLOWLOWLOWCA57FRCA57FRCA57FRCA57FRCA57FRCA57FRCA57FRCA57FRCA57FRFRCA57FRFRCA57FRFRFRCA57FRF						25-	-60						25-	65		
LOW         LOW         CA         SY         PP         C				NONCO	ONTR 1 BUT	ORY	CON	TRIBUTO	<u>x</u>		NONCO	)NTRI BUT(	ORY	CON	TRIBUTOR	Y
Low         45 + 10         3, 64         6, 22         4, 23         6, 83         5, 08         3, 22         5, 84         4, 11         3, 83         6, 43         5, 33           Low         A0 + 5         3, 94         6, 38         4, 61         4, 43         7, 04         5, 23         3, 31         5, 56         4, 33         6, 60         5, 11           Low         Service 1         3, 76         6, 70         4, 74         7, 11         5, 23         3, 31         5, 56         4, 33         6, 60         5, 12           Rule 50         4, 66         6, 70         4, 74         7, 11         5, 22         3, 52         6, 61         4, 12         4, 00         6, 65         5, 22           Low         A1         10         2, 68         4, 17         2, 71         3, 52         3, 66         6, 31         4, 32         4, 00         6, 65         5, 23           Low         A1         2, 88         4, 18         3, 11         3, 68         5, 71         4, 43         3, 26         4, 33         4, 00         6, 32         4, 68         5, 33         4, 01         6, 66         5, 23           Low         A5         5, 50         3, 61				CA	5Y	MP	CA	5 <u>y</u>	MP		СЛ	5Y	MP	CA	5Y	MP
LOW         Dervice 1D         3,78         6,42         4,55         4,28         6,91         5,23         3,31         5,96         4,37         3,87         6,50         5,17           TERM,         Service 5         4,07         6,73         4,95         4,44         7,04         5,26         3,31         6,19         4,49         3,98         6,62         5,27           Rule 50         4,06         6,70         4,47         7,11         5,32         3,31         4,53         4,00         6,65         5,22           Service 10         4,24         6,90         5,22         4,50         7,15         5,41         2,26         4,43         4,46         7,12         5,27         3,56         6,23         4,65         3,56         5,22         4,50         5,66         4,31         4,26         5,38         4,32         5,46         4,41         5,47         4,41         5,47         4,41         5,46         4,30         3,46         6,39         5,37         4,45           IMF.         TERM,         Service 10         2,68         4,41         4,46         5,70         4,41         3,20         4,33         3,60         3,79         5,32         4,43 </th <th></th> <td></td> <td>45 + 10</td> <td>3.64</td> <td>6.22</td> <td>4.24</td> <td>4.25</td> <td>6.83</td> <td>5,08</td> <td></td> <td>3.22</td> <td>5.84</td> <td>4.11</td> <td>3.85</td> <td>6.47</td> <td>5.02</td>			45 + 10	3.64	6.22	4.24	4.25	6.83	5,08		3.22	5.84	4.11	3.85	6.47	5.02
LOW         10 + 5         1, 94         6, 58         4, 41         7, 04         5, 26         3, 43         6, 09         4, 42         3, 95         6, 60         5, 17           TERN.         Service 1         4, 06         6, 70         4, 74         7, 07         5, 541         3, 51         6, 19         4, 69         5, 22         3, 52         6, 18         4, 53         4, 00         6, 53         52           LOW         K10         5, 412         6, 77         4, 77         1, 15         5, 52         3, 64         6, 31         4, 00         6, 53         4, 66         5, 22         4, 50         7, 15         5, 52         3, 64         6, 63         1, 12         4, 53         5, 77         3, 64         6, 31         5, 32         4, 65         5, 32         4, 65         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59         5, 12         4, 59 <th></th> <td></td> <td>Service 10</td> <td>3.78</td> <td>6.42</td> <td>4.55</td> <td>4.28</td> <td>6.91</td> <td>5.23</td> <td></td> <td>3.31</td> <td>5.96</td> <td>4.37</td> <td>3.87</td> <td>6.50</td> <td>5.14</td>			Service 10	3.78	6.42	4.55	4.28	6.91	5.23		3.31	5.96	4.37	3.87	6.50	5.14
HTRM.         Service 5         4.07         6.73         4.43         7.07         5.41         3.15         6.19         4.69         3.98         6.62         5.29           Rule 45         4.12         6.77         4.87         4.44         7.11         5.32         3.52         6.61         4.63         4.01         6.66         5.20           LOW         Service 1         4.24         6.90         5.22         4.45         7.12         5.37         3.66         6.23         4.63         4.01         6.66         5.30           Service 1         2.68         4.17         2.97         3.80         5.27         4.45         2.46         4.01         2.99         3.54         5.06         4.45           Service 5         3.46         5.06         4.10         4.14         5.74         4.98         3.04         4.66         3.95         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24         4.93         3.24		1.04	40 + 5	3.94	6.58	4.61	4.41	7.04	5.26		3.43	6.09	4.42	3.95	6.60	5.17
Law.         Rule 50         4.06         6.70         4.74         7.11         5.12         3.52         6.18         4.53         4.00         6.65         5.22           Bule 65         4.12         6.70         4.87         4.87         5.22         5.37         3.56         6.63         4.43         4.00         6.65         5.25           LOW         Service 10         2.68         4.17         2.97         3.80         5.29         4.45         2.46         4.01         2.99         3.54         5.08         4.46           MED.         Service 10         2.68         4.17         2.97         3.80         5.29         4.45         2.46         4.14         3.26         3.56         3.52         4.44           NW         Service 5         3.46         3.06         1.01         4.14         5.70         4.78         2.94         4.53         3.60         3.28         4.03         3.66         3.66         3.66         3.66         3.65         3.66         3.65         3.66         3.65         3.66         3.65         3.66         3.65         3.66         3.65         3.66         3.65         3.66         3.65         3.66         3.65		TEDM	Service 5	4.07	6.73	4.95	4.43	7.07	5.41		3.51	6.19	4.69	3.98	6,62	5.29
HED.         HED.         A.12         G.77         A.86         7.12         5.52         3.56         G.23         4.63         4.01         G.666         5.26           LOW         HED.         A.24         G.90         S.22         4.50         7.15         S.52         3.66         G.31         4.92         4.04         6.66         5.26           LOW         HED.         Service 10         2.68         4.13         3.31         3.83         S.37         4.61         2.56         4.14         3.26         3.55         5.12         4.59           JDW         Service 5         3.46         5.06         4.10         4.14         5.70         4.78         2.94         4.53         3.60         3.79         5.22         4.85         3.73         5.24         4.55           Bule 45         3.73         3.33         4.21         4.35         5.93         3.01         3.29         4.90         3.90         5.29         3.45         5.93         3.01         3.29         4.40         3.83         3.94         4.03         3.96         1.66         2.40         1.93         3.97         4.45         3.06         3.16         4.03         3.96 <td< th=""><th></th><td>I GNI •</td><td>Rule 50</td><td>4 06</td><td>6 70</td><td>4.74</td><td>4.47</td><td>7.11</td><td>5.32</td><td></td><td>3,52</td><td>6.18</td><td>4.53</td><td>4.00</td><td>6.65</td><td>5.22</td></td<>		I GNI •	Rule 50	4 06	6 70	4.74	4.47	7.11	5.32		3,52	6.18	4.53	4.00	6.65	5.22
LOW         HED.         A:24         6:90         5:22         4:50         7:15         5:52         3:64         6:31         4:92         4:04         6:66         5:39           LOW         HED.         Service 10         2:68         4:17         2:97         3:80         5:29         4:45         2:46         4:10         2:26         3:54         5:38         4:54         3:64         5:65         5:12         4:59           INF.         Service 10         3:24         4:86         3:67         4:14         5:70         4:78         2:94         4:53         3:60         3:79         5:37         4:75           NEW.         Service 1         4:00         5:60         4:16         5:74         4:98         3:04         4:66         3:53         3:94         5:22         4:85         5:01         3:29         4:60         3:53         3:94         5:23         4:85         5:01         3:29         4:61         4:01         3:60         3:15         3:95         5:29         3:45         5:07         4:61         4:01         3:60         3:15         3:69         5:01         3:29         3:64         5:01         3:20         4:03         3:67			Rule 45	4.12	6.77	4.87	4.48	7.12	5.37		3.56	6.23	4.63	4.01	6.66	5.26
LOW INF.         HED. Service 10         2.66 2.83         4.17 3.29         2.97 3.80         3.80 5.37         4.45 4.45         2.46 2.56         4.14 4.33         3.26 3.56         5.12 4.75           LOW INF.         HED. TERH.         40 + 5 8 ervice 5         3.46 3.46         5.06 5.06         4.10 4.16         5.77 4.43         4.51 5.98         3.60 3.60         3.75 3.82         5.40 4.75         4.75 3.82         5.40 5.40         4.75 3.82         5.40 4.60         4.77 3.80         3.64 3.60         3.75 3.82         5.40 4.75         4.75 3.82         5.40 4.60         4.77 3.80         5.28         4.46         3.85 3.44         5.52 4.65         4.60         3.85 3.44         5.52         4.80 3.85         3.84 3.53         4.75 3.82         4.80 3.85         3.84 3.60         4.60 3.15         3.85 3.44         4.55 3.17         4.61 3.17         3.75 3.17         5.33 3.41         4.09 3.17         3.77 3.61         3.10 3.10         4.10 3.17         3.77 3.53         4.10 3.17         3.97 3.17         3.91 3.17         3.91 3.17 <th></th> <td></td> <td>Service 1</td> <td>4.24</td> <td>6.90</td> <td>5.22</td> <td>4.50</td> <td>7.15</td> <td>5.52</td> <td></td> <td>3.64</td> <td>6.31</td> <td>4.92</td> <td>4.04</td> <td>6,68</td> <td>5.39</td>			Service 1	4.24	6.90	5.22	4.50	7.15	5.52		3.64	6.31	4.92	4.04	6,68	5.39
LOW         HED.         Service 10         2.68         4.11         2.97         3.69         3.29         4.63         2.46         4.01         2.72         3.69         4.61         2.75         3.64         5.70         5.77         4.63         2.66         4.11         3.20         3.20         3.27         4.77         2.96         4.13         3.20         3.27         4.77         2.96         4.13         3.20         3.20         3.28         3.37         4.75           IMP.         TERN.         Services 1         4.00         5.00         4.12         5.93         5.01         3.20         4.80         3.66         5.07         4.61         4.00         5.60         5.18           Service 1         4.00         5.60         4.87         4.40         5.98         5.07         4.61         4.01         5.60         5.18           Service 1         4.00         5.60         4.87         4.40         5.98         5.97         3.41         4.01         5.60         5.18           Service 1         3.06         4.07         4.25         2.23         3.08         2.61         3.17         3.97         4.01         2.28         3.08         3.12 </th <th></th> <td></td> <td></td> <td>o /o</td> <td></td> <td></td> <td>2.00</td> <td>r 00</td> <td>, ,<del>,</del></td> <td></td> <td>2 16</td> <td>4 01</td> <td>2 00</td> <td>2 54</td> <td>5 09</td> <td>1 16</td>				o /o			2.00	r 00	, , <del>,</del>		2 16	4 01	2 00	2 54	5 09	1 16
LOW         HED.         Service 10         2.39         4.38         3.31         3.83         5.37         4.74         2.30         3.12         3.73         3.12         3.73         3.12         3.73         3.73         3.74         3.76         3.76         3.76         3.75         3.75         4.73           IMF.         TERM.         Service 5         3.66         3.61         5.18         3.95         4.78         2.75         4.73         3.60         4.66         3.53         3.62         5.40         4.85           Rule 50         3.61         5.18         3.95         5.98         5.09         3.29         4.00         3.66         5.62         4.85         5.79         3.65         5.07         4.61         4.01         5.60         5.18           Service 10         1.66         2.41         1.78         3.28         4.03         3.86         1.60         2.40         1.86         3.17         3.97         4.00         5.60         4.33         2.23         3.08         2.61         3.49         4.33         4.26           TERM.         Service 5         3.22         4.03         3.66         4.07         4.90         4.43         2.75 <th></th> <td></td> <td>45 + 10</td> <td>2.68</td> <td>4.1/</td> <td>2.97</td> <td>3.80</td> <td>2.29</td> <td>4.45</td> <td></td> <td>2.40</td> <td>4.01</td> <td>2.99</td> <td>2.54</td> <td>5 12</td> <td>4.40</td>			45 + 10	2.68	4.1/	2.97	3.80	2.29	4.45		2.40	4.01	2.99	2.54	5 12	4.40
LOW         HED.         40 + 5         3.29         4.36         3.10         4.14         5.70         4.78         2.494         4.33         3.00         3.73         4.73           INF.         TERH.         Service 1         3.66         5.16         4.10         4.16         5.74         4.98         3.04         4.66         3.85         3.94         5.50         4.80         3.85         3.94         5.50         4.80         3.85         3.94         5.50         4.80         3.85         3.94         5.50         4.80         3.20         4.80         3.85         3.94         5.50         4.85           Service 1         1.66         2.41         1.78         3.28         4.03         3.86         1.60         2.40         1.86         3.15         3.95         3.91           HICH         40 + 5         2.43         3.25         2.60         3.72         4.45         4.22         2.23         3.08         2.61         3.49         4.33         4.26           Rule 50         3.00         3.83         3.06         4.07         4.90         4.43         2.75         3.60         3.08         3.72         4.45         3.14         4.35			Service 10	2.83	4.38	3.31	3.83	5.3/	4.61		2.56	4.14	3.20	3.30	5.12	4.35
INT.       TERH.       Service 5       3.46       5.104       4.10       4.10       4.10       4.95       3.04       4.06       3.05       3.02       3.02       3.03       3.02       3.04       3.09       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       3.02       4.00       3.04       4.01       5.04       4.35       5.01       3.29       4.40       3.04       4.01       5.04       4.35       5.01       3.29       4.00       4.01       5.06       5.14       4.35       5.01       3.29       4.00       4.01       5.06       5.18         BIGH       45 + 10       1.66       2.41       1.78       3.28       4.03       3.86       1.66       2.40       1.86       3.15       3.97       3.91         BIGH       46 + 5       2.43       3.22       2.00       3.14       4.57       4.41       2.32       3.18       2.80       3.14       3.43       4.20         Rule 50       3.00       3.41       4.12       4.65       4.42       3.70       4.41       2.32       3.10       3.96       4.33       3.8	LOW	MED.	40 + 5	3.29	4.86	3.67	4-14	5.70	4.78		2.94	4.55	3.60	3.79	5.31	·4.75
Rule 50         3.61         5.18         3.95         4.32         5.89         5.01         3.20         4.80         3.85         3.94         5.54         4.95           Service 1         4.00         5.60         4.87         A.40         5.98         5.29         3.45         5.07         4.61         4.01         5.60         5.14         4.95           Mice 45         3.75         5.25         2.00         3.31         4.09         3.97         1.60         2.40         3.15         3.95         3.95         3.91         4.00         4.00         4.00         4.00         4.00         4.00         4.00         5.60         4.01         4.00         4.00         4.01         5.60         4.11         3.28         4.03         3.86         1.60         2.40         3.13         3.95         3.91         4.00         4.00         4.00         4.00         4.00         4.00         4.03         2.161         3.40         4.33         4.25         2.23         3.08         3.78         4.62         4.43         3.78         4.62         4.43         3.78         4.62         4.43         3.78         4.63         4.33         3.78         4.61         4.99	INF.	TERM.	Service 5	3.46	5.06	4.10	4.16	5.74	4.98		3.04	4.00	3.93	3.02	5.40	4.71
Rule 45         3.75         5.33         4.21         4.35         5.93         5.01         3.29         4.90         4.07         5.96         5.38         4.90           Service 1         4.00         5.60         4.87         4.40         5.98         5.92         3.45         5.07         4.61         4.00         5.60         5.38           MIGH         40.0         5.60         3.72         2.00         3.31         4.09         3.45         5.03         3.45         5.03         3.45         5.03         3.45         5.01         3.45         5.02         3.17         3.97         4.00           Service 5         2.57         3.41         2.94         3.74         4.57         4.41         2.32         3.08         2.61         3.49         4.33         4.26           Rule 45         3.21         4.05         3.41         4.12         4.96         4.59         2.88         3.74         3.36         3.81         4.62         4.45           Rule 45         3.21         4.05         3.41         4.12         4.96         4.59         2.88         3.74         3.36         3.81         4.62         4.45           Service 1			Rule 50	3.61	5.18	3.95	4.32	5.89	4.90		3.20	4.80	3.85	3.94	5.54	4.03
Service 1         4.00         5.60         4.87         A.40         5.99         3.65         5.00         4.61         4.01         5.00         3.01         4.00         5.00         5.01         4.00         5.00         3.01         4.00         4.01         5.00         5.01         4.03         2.05         3.17         3.05         4.03         4.03         4.03         2.05         3.16         4.05         3.01         4.02         3.00         3.83         3.06         4.05         3.01         4.02         3.00         3.08         4.02         4.04         4.01         4.02         4.04         4.01         4.02         4.01         4.01         4.00         4.01         4.02			Rule 45	3.75	5.33	4.21	4.35	5.93	5.01		3.29	4.90	4.07	3.96	5.54	4.95
HIGH         45 + 10         1.66         2.41         1.78         3.28         4.03         3.86         1.60         2.40         1.86         3.15         3.95         3.91           HIGH         40 + 5         2.43         3.25         2.60         3.72         4.54         4.25         2.23         3.08         2.61         3.49         4.33         4.26           Service 5         2.57         3.61         2.94         3.74         4.57         4.41         2.32         3.18         2.90         3.51         4.36         4.42           Nie 45         3.21         4.05         3.41         4.12         4.90         4.43         2.78         3.64         4.05         3.88         4.62         4.45           Rule 45         3.21         4.05         3.44         4.12         4.96         4.92         3.10         3.96         3.88         3.74         3.36         3.88         4.62         4.45           Service 10         3.09         5.69         4.24         3.70         6.30         5.08         2.70         5.33         4.11         3.35         5.96         5.12           Service 10         3.20         5.96         4.44			Service 1	4.00	5.60	4.87	4.40	5,98	5,29		3,45	5.07	4.61	4.01	5.60	2.10
Service 10         1.77         2.55         2.00         3.31         4.09         3.97         1.67         2.49         2.05         3.17         3.97         4.00           TERM.         Service 5         2.57         3.41         2.94         3.74         4.57         4.41         2.32         3.18         2.90         3.51         4.33         4.62         4.45           Rule 45         3.21         4.05         3.41         4.12         4.96         4.59         2.88         3.74         3.36         3.81         4.65         4.57           Service 1         3.56         4.40         4.25         4.18         5.01         4.92         3.10         3.96         4.05         3.88         4.72         4.85           LOW         45 + 10         3.09         5.69         4.24         3.70         6.30         5.08         2.70         5.33         4.11         3.35         5.96         5.02           Service 10         3.20         5.84         4.55         3.71         6.34         5.23         2.77         5.42         4.33         3.77         5.96         5.02           RUW         40 + 5         3.34         5.99         4.61			45 + 10	1.66	2.41	1.78	3.28	4,03	3,86		1,60	2.40	1.86	3.15	3.95	3.91
HIGH         40 + 5         2.43         3.25         2.60         3.72         4.54         4.25         2.23         3.08         2.61         3.49         4.33         4.26           TERM.         Service 5         2.57         3.41         2.94         3.74         4.57         4.41         2.32         3.18         2.90         3.51         4.36         4.32         4.38           Rule 50         3.00         3.83         3.06         4.07         4.90         4.43         2.75         3.60         3.08         3.78         4.62         4.45           Service 1         3.56         4.40         4.25         4.18         5.01         4.92         3.10         3.96         4.05         3.88         4.72         4.85           LOW         45 + 10         3.09         5.69         4.24         3.70         6.30         5.08         2.70         5.33         4.11         3.35         5.96         5.02           LOW         A0 + 5         3.34         6.31         3.20         5.84         4.54         3.40         6.13         5.23         2.77         5.42         4.37         3.37         5.96         5.02           LOW <th< th=""><th></th><td></td><td>Service 10</td><td>1.77</td><td>2.55</td><td>2.00</td><td>3.31</td><td>4.09</td><td>3.97</td><td></td><td>1.67</td><td>2.49</td><td>2.05</td><td>3.17</td><td>3.97</td><td>4.00</td></th<>			Service 10	1.77	2.55	2.00	3.31	4.09	3.97		1.67	2.49	2.05	3.17	3.97	4.00
TERM.       Service 5       2.57       3.41       2.94       3.74       4.57       4.41       2.32       3.18       2.90       3.51       4.36       4.36       4.36         Rule 50       3.00       3.63       3.06       4.05       3.41       4.12       4.96       4.59       2.88       3.74       3.36       3.81       4.65       4.57         Service 1       3.56       4.40       4.25       4.18       5.01       4.92       3.10       3.96       4.05       3.88       4.72       4.85         Low       Service 10       3.20       5.84       4.55       3.71       6.34       5.23       2.77       5.42       4.37       3.37       5.98       5.14         Low       40 + 5       3.34       5.99       4.61       3.82       6.46       5.26       2.88       5.54       4.42       3.44       6.06       5.12         Rule 50       3.44       6.10       4.74       3.87       6.52       3.20       2.94       5.61       4.69       3.46       6.10       5.22         Rule 45       3.49       6.15       4.87       3.88       6.52       5.37       2.98       5.62       4.63		HIGH	40 + 5	2.43	3.25	2.60	3.72	A.54	4.25		2.23	3.08	2.61	3.49	4.33	4.26
Rule 50       3.00       3.83       3.06       4.07       4.90       4.43       2.75       3.60       3.08       3.78       4.62       4.45         Service 1       3.56       3.40       4.25       4.18       5.01       4.92       3.10       3.96       3.00       3.81       4.65       4.57         Service 1       3.56       4.40       4.25       4.18       5.01       4.92       3.10       3.96       4.05       3.88       4.72       4.85         LOW       5.94       4.55       3.71       6.34       5.23       2.77       5.42       4.37       3.37       5.98       5.14         M0 + 5       3.34       5.99       4.61       3.62       6.46       5.26       2.88       5.54       4.42       3.44       6.06       5.17         Service 5       3.44       6.11       4.95       3.88       6.52       5.37       2.98       5.62       4.63       3.44       6.10       5.28         Rule 45       3.49       6.15       4.87       3.88       6.52       5.37       2.98       5.62       4.63       3.44       6.11       5.26         Rule 45       3.49       6.15       <		TERM.	Service 5	2.57	3.41	2.94	3.74	4.57	4.41		2.32	3.18	2.90	3.51	4.36	4.39
Rule 45       3.21       4.05       3.41       4.12       4.36       4.59       2.88       3.74       3.36       3.81       4.65       4.57         Service 1       3.56       4.40       4.25       4.18       5.01       4.92       3.10       3.96       4.05       3.88       4.72       4.85         LOW       5ervice 10       3.20       5.69       4.24       3.70       6.30       5.08       2.70       5.33       4.11       3.35       5.96       5.02         Service 5       3.44       6.11       4.95       3.81       4.66       5.22       2.88       5.54       4.42       3.44       6.00       5.22         Rule 50       3.44       6.10       4.74       3.87       6.51       5.32       2.95       5.62       4.53       3.47       6.10       5.22         Rule 45       3.44       6.10       4.74       3.87       6.51       5.32       2.95       5.62       4.53       3.47       6.11       5.22         Rule 45       3.44       6.10       4.74       3.87       6.51       5.23       3.03       5.71       4.92       3.51       6.11       5.22       3.03       5.71			Rule 50	3.00	3.83	3.06	4.07	4.90	4.43		2.75	3.60	3.08	3.78	4.62	4.45
Service 1         3.56         4.40         4.25         4.18         5.01         4.92         3.10         3.96         4.05         3.88         4.72         4.85           LOW         Service 10         3.09         5.69         4.24         3.70         6.30         5.08         2.70         5.33         4.11         3.35         5.96         5.02           Service 10         3.20         5.84         4.55         3.71         6.34         5.23         2.77         5.42         4.37         3.37         5.98         5.14           MOW         TERN.         Service 5         3.44         6.11         4.95         3.83         6.46         5.26         2.88         5.54         4.42         3.47         6.10         5.29           Rule 50         3.44         6.10         4.77         3.88         6.52         5.37         2.98         5.65         4.63         3.46         6.10         5.26           Service 1         3.58         6.25         5.22         3.03         5.71         4.92         3.51         6.14         5.39           MED.         HED.         HED.         2.08         3.63         2.99         3.17         4.71			Rule 45	3.21	4.05	3.41	4.12	4 96	4.59		2.88	3.74	3.36	3.81	4.65	4.57
HED.         HED.         45 + 10         3.09         5.69         4.24         3.70         6.30         5.08         2.70         5.33         4.11         3.35         5.96         5.14           LOW         Service 10         3.20         5.84         4.55         3.71         6.34         5.23         2.77         5.42         4.37         3.37         5.98         5.14           LOW         TERM.         Service 5         3.44         6.11         4.95         3.83         6.48         5.41         2.94         5.61         4.69         3.44         6.05         5.29           Rule 50         3.44         6.10         4.74         3.87         3.83         6.48         5.41         2.94         5.61         4.69         3.46         6.09         5.29           Rule 45         3.49         6.15         4.87         3.88         6.52         5.37         2.98         5.65         4.63         3.48         6.11         5.26           Service 10         2.28         3.79         2.97         3.40         4.91         4.45         2.08         3.63         2.99         3.17         4.71         4.46           Service 10         2.40 <th></th> <td></td> <td>Service 1</td> <td>3.56</td> <td>4.40</td> <td>4.25</td> <td>4.18</td> <td>5,01</td> <td>4.92</td> <td></td> <td>3.10</td> <td>3.96</td> <td>4.05</td> <td>3.88</td> <td>4.72</td> <td>4.85</td>			Service 1	3.56	4.40	4.25	4.18	5,01	4.92		3.10	3.96	4.05	3.88	4.72	4.85
HED.         HED.         45 + 10         2.09         5.69         4.24         3.70         6.30         5.08         2.70         5.33         4.11         3.35         5.96         5.02           LOW         Service 10         3.20         5.84         4.55         3.71         6.34         5.23         2.77         5.42         4.37         3.37         5.98         5.14           LOW         Service 5         3.34         5.99         4.61         3.82         6.46         5.26         2.88         5.54         4.42         3.44         6.06         5.27           Rule 50         3.44         6.10         4.74         3.87         6.51         5.32         2.95         5.62         4.53         3.47         6.10         5.22           Service 1         3.58         6.25         5.22         3.90         6.54         5.52         3.03         5.71         4.92         3.51         6.14         5.39           HED.         HED.         MED.         2.28         3.79         2.97         3.40         4.91         4.45         2.08         3.63         2.99         3.17         4.71         4.46           Service 10         2.40														•		
NED.         MED.         MED.         2.28         3.79         2.97         3.42         4.37         3.37         5.98         5.14           HED.         MED.         40 + 5         3.34         5.99         4.61         3.82         6.46         5.26         2.88         5.54         4.42         3.44         6.06         5.17           Rule 50         3.44         6.11         4.75         3.87         6.51         5.32         2.95         5.62         4.53         3.44         6.10         5.22           Service 1         3.58         6.25         5.22         3.90         6.54         5.52         3.05         5.67         4.63         3.48         6.11         5.22           Service 1         3.58         6.25         5.22         3.90         6.54         5.52         3.05         5.71         4.92         3.51         6.14         5.39           MED.         45 + 10         2.28         3.79         2.97         3.40         4.91         4.45         2.08         3.63         2.99         3.17         4.71         4.46           Service 10         2.40         3.95         3.81         3.66         5.23         4.78			45 + 10	3.09	5.69	4.24	3.70	6.30	5.08		2.70	5.33	4.11	3.35	5.96	5.02
LOW         40 + 5         3.34         5.99         4.61         3.82         6.46         5.26         2.88         5.54         4.42         3.44         6.06         5.17           TERM.         Service 5         3.44         6.10         4.74         3.87         6.51         5.32         2.94         5.61         4.69         3.46         6.09         5.29           Rule 50         3.44         6.10         4.74         3.87         6.51         5.32         2.95         5.62         4.63         3.47         6.10         5.29           Rule 45         3.49         6.15         4.87         3.88         6.52         5.37         2.98         5.65         4.63         3.48         6.11         5.26           Service 1         3.58         6.25         5.22         3.90         6.54         5.52         3.03         5.71         4.92         3.51         6.14         5.39           HED.         HED.         2.28         3.79         2.97         3.40         4.91         4.455         2.08         3.63         2.99         3.17         4.71         4.46           Service 10         2.28         3.79         3.61         3.66			Service 10	3.20	5.84	4.55	3.71	6.34	5.23		2.77	5.42	4.37	3.37	5.98	5.14
HED.         HED.         HED.         40 + 5         2.81         4.99         3.82         6.48         5.41         2.94         5.61         4.69         3.46         6.09         5.29           NED.         Rule 50         3.44         6.10         4.74         3.87         6.51         5.32         2.95         5.62         4.53         3.47         6.10         5.22           Rule 45         3.49         6.15         4.87         3.88         6.52         5.37         2.98         5.65         4.63         3.48         6.11         5.26           Service 1         3.58         6.25         5.22         3.90         6.54         5.52         3.03         5.71         4.92         3.51         6.14         5.39           MED.         HED.         2.28         3.79         2.97         3.40         4.91         4.45         2.08         3.63         2.99         3.17         4.71         4.46           Service 10         2.60         3.95         3.82         5.39         4.90         2.71         4.31         3.85         3.66         3.29         3.41         4.97         4.91           MED.         HED.         40 + 5		1.04	40 + 5	3 34	5 99	4.61	3.82	6.46	5.26		2.88	5.54	4.42	3.44	6.06	5.17
HER.       Bettle 50       3.44       6.11       4.74       3.87       6.51       5.32       2.95       5.62       4.53       3.47       6.10       5.22         Rule 45       3.49       6.15       4.87       3.88       6.52       5.37       2.98       5.65       4.63       3.48       6.11       5.22         Service 1       3.58       6.25       5.22       3.90       6.54       5.52       3.03       5.71       4.92       3.51       6.14       5.39         MED.       45 + 10       2.28       3.79       2.97       3.40       4.91       4.45       2.08       3.63       2.99       3.17       4.71       4.46         Service 10       2.40       3.95       3.31       3.42       4.95       4.61       2.15       3.73       3.26       3.20       4.73       4.59         INF.       TERM.       Service 5       2.93       4.54       4.10       3.68       5.22       4.98       2.55       4.17       3.95       3.41       4.97       4.91         Rule 50       3.08       4.67       3.95       3.82       5.39       4.90       2.77       4.38       4.07       3.55       5.06		TYPM	Service 5	3.44	6.11	4.95	3,83	6.48	5.41	•	2.94	5.61	4.69	3.46	6.09	5.29
MED.		I DRI .	$R_{\rm H}$ 10 50	3 44	6 10	4.74	3.87	6.51	5.32		2.95	5.62	4.53	3.47	6.10	5.22
MED.       HED.       MED.       MIGH       MIGH       MIGH			Rule 45	3 49	6 15	4 87	3 88	6 52	5.37		2,98	5.65	4.63	3.48	6.11	5.26
MED.       MED.       45 + 10       2.28       3.79       2.97       3.40       4.91       4.45       2.08       3.63       2.99       3.17       4.71       4.46         Service 10       2.40       3.95       3.31       3.42       4.95       4.61       2.15       3.73       3.26       3.20       4.73       4.59         INF.       TERM.       Service 5       2.93       4.54       4.10       3.68       5.25       4.98       2.55       4.17       3.95       3.41       4.97       4.91         Rule 50       3.08       4.67       3.95       3.82       5.39       4.90       2.71       4.31       3.85       3.50       5.06       4.95         Rule 45       3.19       4.79       4.21       3.83       5.41       5.01       2.77       4.38       4.07       3.52       5.08       4.95         Service 1       3.38       4.98       4.87       3.87       5.45       5.29       2.88       4.50       4.61       3.57       5.14       5.18         HIGH       40 + 5       2.08       2.19       2.60       3.83       3.97       1.41       2.23       2.05       2.93       3.73			Service 1	3.58	6.25	5.22	3.90	6.54	5.52		3.03	5.71	4.92	3.51	6.14	5.39
MED.       MED.       10       1.02       10       1.03       1.04       1.05       1.04       1.04       1.05 <td< th=""><th></th><td></td><td><i>4</i>5 ± 10</td><td>2 28</td><td>3 79</td><td>2.97</td><td>3.40</td><td>4.91</td><td>4.45</td><td></td><td>2.08</td><td>3.63</td><td>2,99</td><td>3.17</td><td>4.71</td><td>4.46</td></td<>			<i>4</i> 5 ± 10	2 28	3 79	2.97	3.40	4.91	4.45		2.08	3.63	2,99	3.17	4.71	4.46
MED.         MED.         40 + 5         2.81         4.39         3.67         3.66         5.23         4.78         2.48         4.08         3.60         3.38         4.94         4.75           INF.         TERM.         Service 5         2.93         4.54         4.10         3.68         5.25         4.78         2.48         4.08         3.60         3.38         4.94         4.75           INF.         TERM.         Service 5         2.93         4.54         4.10         3.68         5.25         4.78         2.48         4.08         3.60         3.38         4.94         4.75           INF.         TERM.         Service 5         2.93         4.54         4.10         3.68         5.25         4.98         2.55         4.17         3.95         3.41         4.97         4.91           Rule 50         3.08         4.67         3.95         3.82         5.90         2.71         4.31         3.85         3.50         5.06         4.95           Service 1         3.38         4.98         4.87         3.87         5.45         5.29         2.88         4.007         3.52         5.08         4.95           Service 10         1.50			Service 10	2.20	3,95	3, 31	3.42	4.95	4.61		2.15	3.73	3.26	3.20	4.73	4.59
IMD:       Hor:       TERM.       Service 5       2.93       4.154       4.10       3.68       5.25       4.19       2.55       4.17       3.95       3.41       4.97       4.91         INF:       TERM.       Service 5       3.08       4.67       3.95       3.82       5.39       4.90       2.71       4.31       3.85       3.50       5.06       4.85         Rule 50       3.08       4.67       3.95       3.82       5.39       4.90       2.71       4.31       3.85       3.50       5.06       4.85         Rule 45       3.19       4.79       4.21       3.83       5.41       5.01       2.77       4.38       4.07       3.52       5.08       4.95         Service 1       3.38       4.98       4.87       3.87       5.45       5.29       2.88       4.50       4.61       3.57       5.14       5.18         HIGH       40 + 5       2.08       2.91       2.60       3.81       3.86       1.36       2.16       1.86       2.92       3.71       3.91         HIGH       40 + 5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61	MED	MED	40 + 5	2.81	4.39	3.67	3.66	5.23	4.78		2.48	4.08	3,60	3.38	4.94	4.75
HIT       Hith       Borvice 1       3.08       4.67       3.95       3.82       5.39       4.90       2.71       4.31       3.85       3.50       5.06       4.85         Rule 50       3.19       4.79       4.21       3.83       5.41       5.01       2.77       4.38       4.07       3.52       5.08       4.95         Service 1       3.38       4.98       4.87       3.87       5.45       5.29       2.88       4.50       4.61       3.57       5.14       5.18         45 + 10       1.42       2.18       1.78       3.05       3.81       3.86       1.36       2.16       1.86       2.92       3.71       4.91         Service 10       1.50       2.29       2.00       3.06       3.83       3.97       1.41       2.23       2.05       2.93       3.73       4.00         HIGH       40 + 5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61       3.19       4.02       4.26         TERM.       Service 5       2.18       3.03       2.94       3.40       4.22       4.41       1.95       2.82       2.90       3.22       4.04	TNP	TEPM	Service 5	2.93	4.54	4.10	3.68	5.25	4.98		2.55	4.17	3.95	3.41	4.97	4.91
Rule 45       3.19       4.79       4.21       3.83       5.41       5.01       2.77       4.38       4.07       3.52       5.08       4.95         Service 1       3.38       4.98       4.87       3.87       5.41       5.01       2.77       4.38       4.07       3.52       5.08       4.95         Service 1       3.38       4.98       4.87       3.87       5.45       5.29       2.88       4.50       4.61       3.57       5.14       5.18         45 + 10       1.42       2.18       1.78       3.05       3.81       3.86       1.36       2.16       1.86       2.92       3.71       3.91         Service 10       1.50       2.29       2.00       3.06       3.83       3.97       1.41       2.23       2.05       2.93       3.73       4.00         HIGH       40 + 5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61       3.19       4.02       4.26         TERM.       Service 5       2.18       3.03       2.94       3.40       4.22       4.41       1.95       2.82       2.90       3.22       4.04       4.39	THE .	I LIVIT.	Rule 50	3.08	4.67	3.95	3.82	5.39	4.90		2.71	4.31	3.85	3.50	5.06	4.85
Number       Service 1       3.38       4.98       4.87       3.87       5.45       5.29       2.88       4.50       4.61       3.57       5.14       5.18         K12       1       1.42       2.18       1.78       3.05       3.81       3.86       1.36       2.16       1.86       2.92       3.71       3.91         Service 10       1.50       2.29       2.00       3.06       3.83       3.97       1.41       2.23       2.05       2.93       3.73       4.00         HIGH       40       +5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61       3.19       4.02       4.26         TERM.       Service 5       2.18       3.03       2.94       3.40       4.22       4.41       1.95       2.82       2.90       3.22       4.04       4.39         Rule 50       2.59       3.43       3.06       3.67       4.50       4.44       2.34       3.20       3.08       3.42       4.25       4.45         Rule 50       2.76       3.60       3.41       3.70       4.52       4.99       2.44       3.31       3.36       3.45       4.28			Rule 45	3,19	4.79	4.21	3,83	5.41	5.01		2.77	4.38	4.07	3.52	5.08	4.95
45 + 10       1.42       2.18       1.78       3.05       3.81       3.86       1.36       2.16       1.86       2.92       3.71       3.91         Service 10       1.50       2.29       2.00       3.06       3.83       3.97       1.41       2.23       2.05       2.93       3.73       4.00         HIGH       40 + 5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61       3.19       4.02       4.26         TERM.       Service 5       2.18       3.03       2.94       3.40       4.22       4.41       1.95       2.82       2.90       3.22       4.04       4.39         Rule 50       2.59       3.43       3.06       3.67       4.50       4.44       2.34       3.20       3.08       3.42       4.25       4.45         Rule 50       2.76       3.60       3.41       3.70       4.52       4.59       2.44       3.31       3.36       3.42       4.25       4.45         Service 1       3.01       3.86       4.25       3.75       4.58       4.92       2.59       3.46       4.05       3.52       4.35       4.85 </th <th></th> <td></td> <td>Service 1</td> <td>3.38</td> <td>4.98</td> <td>4.87</td> <td>3.87</td> <td>5.45</td> <td>5.29</td> <td></td> <td>2.88</td> <td>4.50</td> <td>4.61</td> <td>3.57</td> <td>5.14</td> <td>5.18</td>			Service 1	3.38	4.98	4.87	3.87	5.45	5.29		2.88	4.50	4.61	3.57	5.14	5.18
Service 10       1.50       2.29       2.00       3.06       3.83       3.97       1.41       2.23       2.05       2.93       3.73       4.00         HIGH       40 + 5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61       3.19       4.02       4.26         TERM.       Service 5       2.18       3.03       2.94       3.40       4.22       4.41       1.95       2.82       2.90       3.22       4.04       4.39         Rule 50       2.59       3.43       3.06       3.67       4.50       4.44       2.34       3.20       3.08       3.42       4.25       4.45         Rule 50       2.57       3.60       3.41       3.70       4.52       4.59       2.44       3.31       3.36       3.42       4.25       4.45         Service 1       3.01       3.86       4.25       3.75       4.58       4.92       2.59       3.46       4.05       3.52       4.35       4.85			45 + 10	1.42	2.18	1.78	3.05	3.81	3.86		1.36	2.16	1.86	2,92	3.71	3.91
HIGH       40 + 5       2.08       2.91       2.60       3.38       4.20       4.25       1.89       2.75       2.61       3.19       4.02       4.26         TERM.       Service 5       2.18       3.03       2.94       3.40       4.22       4.41       1.95       2.82       2.90       3.22       4.04       4.39         Rule 50       2.59       3.43       3.06       3.67       4.50       4.44       2.34       3.20       3.08       3.42       4.25       4.45         Rule 45       2.76       3.60       3.41       3.70       4.52       4.59       2.44       3.31       3.36       3.45       4.28       4.57         Service 1       3.01       3.86       4.25       3.75       4.58       4.92       2.59       3.46       4.05       3.52       4.35       4.85			Service 10	1,50	2.29	2.00	3.06	3.83	3.97		1.41	2.23	2.05	2.93	3.73	4.00
TERM.         Service 5         2.18         3.03         2.94         3.40         4.22         4.41         1.95         2.82         2.90         3.22         4.04         4.39           Rule 50         2.59         3.43         3.06         3.67         4.50         4.44         2.34         3.20         3.08         3.42         4.25         4.45           Rule 50         2.59         3.43         3.06         3.67         4.50         4.44         2.34         3.20         3.08         3.42         4.25         4.45           Rule 45         2.76         3.60         3.41         3.70         4.52         4.39         2.44         3.31         3.36         3.45         4.28         4.57           Service 1         3.01         3.86         4.25         3.75         4.58         4.92         2.59         3.46         4.05         3.52         4.35         4.85		HICH	40 + 5	2.08	2.91	2.60	3.38	4.20	4,25		1.89	2.75	2.61	3,19	4.02	4.26
Rule 50         2.59         3.43         3.06         3.67         4.50         4.44         2.34         3.20         3.08         3.42         4.25         4.45           Rule 45         2.76         3.60         3.41         3.70         4.52         4.39         2.44         3.31         3.36         3.45         4.28         4.57           Service 1         3.01         3.86         4.25         3.75         4.58         4.92         2.59         3.46         4.05         3.52         4.35         4.85		TERM.	Service 5	2.18	3.03	2.94	3.40	4.22	4.41		1,95	2.82	2.90	3.22	4.04	4.39
Rule 45         2.76         3.60         3.41         3.70         4.52         4.39         2.44         3.31         3.36         3.45         4.28         4.57           Service 1         3.01         3.86         4.25         3.75         4.58         4.92         2.59         3.46         4.05         3.52         4.35         4.85			Rule 50	2.59	3.43	3.06	3.67	4.50	4.44		2.34	3.20	3.08	3.42	4.25	4.45
Service 1 3.01 3.86 4.25 3.75 4.58 4.92 2.59 3.46 4.05 3.52 4.35 4.85			Rule 45	2.76	3.60	3.41	3.70	4.52	4.59		2,44	3.31	3.36	3.45	4.28	4.57
			Service 1	3.01	3.86	4.25	3.75	4.58	4.92		2.59	3.46	4.05	3.52	4.35	4.85

TABLE 8. Total Pension Costs (Inflation and Source of Contribution) under Different Entry-Retirement Ages, Plan Types, Termination Rates and Vesting Rules.

			NONCO	NTRIBUTO	RY	CON	TRIBUTOR	Y	•	NONCO	NTRIBUTO	RY	CON	TRIBUTOR	Y
			CA	5Y	MP	CA	5Y	MP		ĊA	5Y	MP	CA	5Y	MP
		45 + 10	2.29	4.83	4.24	2.89	5.41	5.08		1.97	4.51	4.11	2.61	5.11	5.02
		Service 10	2.35	4.92	4.55	2.90	5.42	5.23		2.00	4.56	4.37	2.63	5.13	5.14
	LOW	40 + 5	2.48	5.06	4.61	2.97	5.51	5.26		2.10	4.66	4.42	2.68	5.19	5.17
	TERM.	Service 5	2.53	5.12	4.95	2.99	5.53	5.41		2.13	4.70	4.69	2,70	5.21	5.29
		Rule 50	2.55	5.14	4.74	.3.01	5.55	5.32	-	2.16	4.72	4.53	2.71	5.22	5.22
		Rule 45	2.58	5.17	4.87	3.02	5.56	5.37		2.17	4.74	4.63	2.72	5.23	5.26
		Service 1	2.63	5.22	5.22	3.04	5.58	5.52		2.20	4.77	4.92	2.75	5.26	5.39
		45 + 10	1.71	3.18	2.97	2.81	4.27	4.45		1.53	3.03	2,99	2.62	4.08	4.46
		Service 10	1.77	3.28	3.31	2.82	4.28	4.61		1.56	3.09	3.26	2.65	4.10	4.59
HIGH	MED.	40 + 5	2.10	3.64	3.67	2.99	4.48	4.78		1.82	3.37	3.60	2.77	4.26	4.75
INF.	TERM.	Service 5	2.17	3.72	4.10	3.01	4.51	4.98		1.85	3.41	3.95	2.80	4.29	4.91
		Rule 50	2.32	3.87	3.95	3.10	4.59	4.90		2.00	3.55	3.85	2.86	4.34	4.86
		Rule 45	2.39	3.94	4.21	3.11	4.61	5.01		2.04	3.59	4.07	· 2.88	4.36	4.95
		Service 1	2.49	4.04	4.87	3.15	4.65	5.29		2.09	3.65	4.61	2.93	4.42	5.18
		45 + 10	1.07	1.82	1.78	2.67	3.40	3.86		1.00	1.79	1.86	2.55	3,30	3.91
		Service 10	1.12	1.88	2.00	2.68	3.41	3.97		1.03	1.82	2.05	2.57	3, 32	4.00
	HIGH	40 + 5	1.57	2.38	2.60	2.90	3.68	4.25		1.40	2.23	2.61	2.75	3,53	4.26
	TERM.	Service 5	1.62	2.45	2.94	2.91	3.69	4.41		1.43	2.27	2.90	2.77	3,55	4.39
		Rule 50	1.98	2.80	3.06	3.09	3.87	4.44		1.76	2.59	3.08	2.91	3.69	4.45
		Rule 45	2.08	2.91	3.41	3.11	3.89	4.59		1.81	2.65	3.37	2.93	3.72	4.57
		Service 1	2.22	3.05	4.25	3.16	3.94	4.92		1.89	2.73	4.05	3.01	3.79	4.85

25-65

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25-60

TABLE 8 (continued). Total Pension Costs (Inflation and Source of Contribution)

10 a 10 a 2

					2	5-60					2	5-65		
			NONG	NONCONTRELIGIOUS			NTRENUT	HKY	NON	ONTRI BUT	YOK Y	CON	TRI BUTOR	Y
			UA	5Y	MP	CA	5 Y	MP	CA	7 C	мр	СЛ	5 Y	мр
		45 + 10	3.64	6.22	4.24	1.75	4.33	2.08	3.22	5.84	4.11	1.35	3.97	2.02
•		Service 10	3.78	6.42	4.55	1.78	4,41	2.23	3.31	5.96	4.37	1.37	4.00.	2.14
	LOW	40 + 5	3.94	6.58	4.61	1.91	4.54	2.26	3.43	6.09	4.42	1.45	4.10	2.17
	TERM.	Service 5	4.07	6.73	4.95	1.93	4.57	2.41	3.51	6.19	4.69	1.48	4.12	2.29
		Rule 50	4.06	6.70	4.74	1.97	4.61	2.32	3,52	6.18	4.53	1.50	4.15	2.22
		Rule 45	4.12	6.77	4.87	1.98	4.62	2.37	3.56	6.23	4.63	1.51	4.16	2.26
		Service 1	4.24	6.90	5.22	2.00	4.65	2.52	3.64	6.31	4.92	1.54	4.18	2.39
		45 + 10	2.68	4.17	2.97	1.30	2.79	1.45	2.46	4.01	2.99	1.04	2.58	1.46
		Service 10	2.83	4.38	3.31	1.33	2.87	1.61	2.56	4.14	3.26	1.06	2.62	1,59
LOW	MED.	40 + 5	3.29	4.86	3.67	1.64	3.20	1.78	2.94	4.53	3.60	1.29	2.87	1.75
INF.	TERM.	Service 5	3.46	5.06	4.10	1.66	3.24	1.98	3.04	4.66	3.95	1.32	2,90	1.91
		Rule 50	3.61	5.18	3.95	1.82	3.39	1.90	3.20	4.80	3.85	1.44	3.02	1.85
		Rule 45	3.75	5.33	4.21	1.85	3.43	2.01	3,29	4.90	4.07	1.46	3.04	1.95
		Service 1	4.00	5.60	4.87	1.90	3.48	2.29	3.45	5.07	4.61	1.51	3.10	2.18
		$45 + 10^{\circ}$	1.66	2.41	1.78	. 78	1.53	.86	1.60	2.40	1.86	.65	1.45	.91
		Service 10	1.77	2.55	2.00	.81	1.59	.97	1.67	2.49	2.05	.67	1.47	1.00
	нтсн	40 + 5	2.43	3.25	2.60	1.22	2.04	1.25	2.23	3.08	2.61	.99	1.83	1.26
	TERM	Service 5	2.57	3.41	2.94	1.24	2.07	1.41	2.32	3.18	2.90	1.01	1.86	1.39
	251411	Rule 50	3.00	3.83	3.06	1.57	2.40	1.43	2.75	3.60	3.08	1.28	2.12	1.45
		Rule 45	3.21	4.05	3.41	1.62	2.46	1.59	2.88	3.74	3.36	1.31	2.15	1.57
		Service 1	3.56	4.40	4.25	1.68	2.51	1.92	3.10	3.96	4.05	1.38	2.22	1.85
		45 + 10	3.09	5.69	4.24	1.20	3.80	2.08	2,70	5.33	4.11	.85	3,46	2.02
		Service 10	3.20	5.84	4.55	1.21	3.84	2.23	2.77	5.42	4.37	.87	3.48	2.14
	LOW	40 + 5	3.34	5.99	4.61	1.32	3.96	2.26	2.88	5.54	4.42	.94	3.56	2.17
	TERM.	Service 5	3.44	6.11	4.95	1.33	3.98	2.41	2.94	5.61	4.69	<b>' .</b> 96	3.59	2.29
		Rule 50	3.44	6.10	4.74	1.37	4.01	2.32	2.95	5.62	4.53	.97	3.60	2.22
		Rule 45	3.49	6.15	4.87	1.38	4.02	2.37	2.98	5.65	4.63	.98	3.61	2.26
		Service 1	3.58	6.25	5.22	1.40	4.04	2.52	3.03	5.71	4.92	1.01	3.64	2.39
		45 + 10	2.28	3.79	2.97	.90	2.41	1.45	2.08	3.63	2.99	.67	2.21	1.46
		Service 10	2.40	3.95	3.31	.92	2.45	1.61	2.15	3.73	3.26	.70	2.23	1.59
MED.	MED.	40 + 5	2.81	4.39	3.67	1.16	2.73	1.78	2.48	4.08	3.60	.88	2.44	1.75
INF.	TERM.	Service 5	2.93	4.54	4.10	1.18	2.75	1.98	2.55	4.17	3.95	.91	2.47	1.91
		Rule 50	3.08	4.6/	3.95	1.32	2.89	1.90	2./1	4.31	3.85	1.00	2,56	1.85
		Rule 45	3.19	4.79	4.21	1.33	2.91	2.01	2.77	4.38	4.07	1.02	2.58	1.95
		Service 1	3.38	4.98	4.8/	1.37	2.95	2.29	2.88	450	4.61	1.07	2.64	2.18
		45 + 10	1.42	2.18	1.78	.55	1.31	.86	1.36	2.16	1.86	.42	1.21	.91
		Service 10	1.50	2.29	2.00	.56	1.33	.97	1.41	2.23	2.05	.43	1.23	1.00
	HIGH	40 + 5	2.08	2.91	2.60	.88	1.70	1.25	1.89	2.75	2.61	.69	1.52	1.26
	TERM.	Service 5	2.18	3.03	2.94	.90	1.72	1.41	1.95	2.82	2.90	.72	1.54	1.39
		Rule 50	2.59	3.43	3.06	1.17	2.00	1.44	2.34	3.20	3.08	.92	1.75	1.45
-		Rule 45	2.76	3.60	3.41	1.20	2.02	1.59	2.44	3.31	3.36	.95	1.78	1.57
		Service 1	3.01	3.86	4.25	1.25	2.08	1.92	2.59	3.46	4.05	1.02	1.85	1.85

TABLE 9. Employer Costs (Inflation and Source of Contribution) under Different Entry-Retirement Ages, Plan Types, Termination Rates and Vesting Rules

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				25-60						25-65					
			NONG	NONCONTRIBUTORY		C	CONTRIBUT	TORY		NONCONTRIBUTORY			CONTRIBUTORY		
			CA	5¥	MP	CA	5Y	MP	•	CA	5Y	MP	CA	5Y	MP
		45 + 10	2.29	4.83	4.24	. 39	2,91	2.08		1 97	4 51	6 7 1		<b>.</b>	
		Service 10	2.35	4.92	4.55	.40	2.92	2.23		2 00	4.54	4.11	11.	2.61	2.02
	LOW	40 + 5	2.48	5.06	4.61	.47	3.01	2.26		2 10	4.50	4.37	.13	2.63	2.14
	TERM.	Service 5	2.53	5.12	4.95	.49	3.03	2.41		2 13	4.00	4.42	.18	2.69	2.17
		Rule 50	2.55	5.14	4.74	.51	3.05	2.32		2.15	4.70	4.09	.20	2.71	2.29
		Rule 45	2.58	5.17	4.87	.52	3.00	2.37		2.10	4.72	4.33	• 21	2.72	2.22
		Service 1	2.63	5.22	5.22	.54	3.08	2.52		2.20	4.77	4.92	.22	2.73	2.26 2.39
		45 + 10	1.71	3.18	2.97	.31	1.77	1.45		1.53	3 03	2 00	. 10		
		Service 10	1.77	3.28	3.31	.32	1.78	1.61		1 56	3.00	2.33	•12	1.58	1.46
HIGH	MED.	40 + 5	2.10	3.64	3.67	.49	1.98	1.78		1.82	3 37	3.20	.15	1.60	1.59
INF.	TERM.	Service 5	2.17	3.72	4.10	.51	2.01	1.98		1.85	3 41	3.00	•27	1./6	1.75
		Rule 50	2.32	3.87	3.95	.60	2.09	1,90		2.00	3 55	3.95	. 50	1.79	1.91
		Rule 45	2.39	3.94	4.21	.61	2.11	2.01		2.04	3 59	4 07	. 30	1.84	1.86
		Service 1	2.49	4.04	4.87	.65	2.15	2.29		2.09	3.65	4.61	.30	1.86	2.18
		45 + 10	1.07	1.82	1.78	.17	. 90	86		1 00	1 70	7.07	<u> </u>		
		Service 10	1,12	1.88	2.00	.18	.91	97		1.00	1./9	1.80	.05	.80	.91
	HIGH	40 + 5	1.57	2.38	2.60	_40	1.18	1 25		1.05	1.02	2.05	.07	.82	1.00
	TERM.	Service 5	1.62	2.45	2.94	.41	1.19	1 41		1.40	2.23	2.61	.25	1.03	1.26
		Rule 50	1.98	2.80	3.06	. 59	1 37	1 44		1.43	2.2/	2.90	.27	1.05	1.39
		Rule 45	2.08	2.91	3.41	.61	1 30	1 50		1 01	2.39	3.08	.41	1.19	1.45
•		Service 1	2.22	3.05	4.25	66	1 44	1 02		1.01	2.65	3.37	.43	1.22	1.57
				0.05		00	T*44	1.74		1.89	2.73	4.05	.51	1.29	1 85

TABLE 9 (continued). Employer Costs (Inflation and Source of Contribution)

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similar to those already noted in relation to pension benefits. Employer costs are also presented in Table 10 using 0.6 higher rates of return than before. Evidently, higher rates of return on investment would decrease employer costs marginally in MP plans but substantially in defined benefit plans. In fact, some of the entries in Table 10 are negative, implying that the employee contributions alone (2.5% of the payroll) would be more than sufficient to subsidize the projected benefits under certain circumstances.

					25-	-60					25-	-65		
	•		NONC	CONTRIBUT	TORY	со	NTRIBUTO	DRY	NONC	ONTRIBUT	ORY	co	NTRIBUTO	RY
			CA	5y	MP	CA	5Y	мр	CA	5Y	MP	CA	5 Y	MP
		45 + 10	3.18	5.43	4.19	1.28	3.54	2.06	2.76	5.02	4.05	.89	3.13	1.99
		Service 10	3.30	5.60	4.52	1.30	3.59	2.22	2.84	5.12	4.33	.91	3.16	2.12
	LOW	40 + 5	3.44	5.74	4.57	1.41	3.70	2.23	2.95	5.23	4.36	.98	3.24	2.14
	TERM.	Service 5	3.56	5.87	4.92	1.43	-3.73	2.40	3.02	5.31	4.66	1.00	3.26	2.28
		Rule 50	3.54	5.85	4.70	1.46	3.76	2.29	3.02	5.31	4.48	1.02	3.28	2.19
		Rule 45	3.59	5.91	4.83	1.47	3.77	2.35	3.05	5.35	4.59	1.03	3.29	2.24
		Service 1	3.70	6.02	5.20	1.49	3.79	2.52	3.12	5.42	4.89	1.06	3.32	2.37
		45 + 10	2.34	3.64	2.92	.95	2,25	1.43	2.11	3.44	2.93	.69	2.01	1.43
		Service 10	2.47	3.82	3.27	· .97	2.31	1.60	2.20	3.55	3.22	- 71	2.03	1.57
LOW	MED.	40 + 5	2.88	4.24	3.61	1.22	2.59	1.75	2.52	3.89	3.53	.89	2.24	1.71
INF.	TERM.	Service 5 .	3.02	4.41	4.07	1.25	2,62	1.96	 2.61	4.00	3,90	.93	2.27	1.89
		Rule 50	3.15	4.52	3.87	1.38	2.75	1.86	2.75	4.12	3.77	1 01	2 36	1 82
		Rule 45	3.27	4.65	4.14	1.40	2.77	1.98	2.82	4.20	4.00	1 03	2.30	1 02
		Service 1	3.49	4.88	4.85	1.45	2.81	2.28	2.96	4.35	4.58	1.10	2.44	2.16
		45 + 10	1.45	2.10	1.74	.56	1.22	. 84	1.37	2.06	1.81	.41	1.09	.88
		Service 10	1.54	2.22	1.97	.58	1.25	.96	1.43	2.13	2.01	.43	1.11	.98
	HIGH	40 + 5	2.12	2.84	2.54	.91	1.63	1.22	1.91	2.65	2.54	.69	1.40	1.23
	TERM.	Service 5	2.24	2.98	2.91	.93	1.65	1.39	1.99	2.73	2.85	.72	1.43	1.37
		Rule 50	2.62	3.34	2.97	1.21	1.93	1.40	2.36	3.09	2.98	.93	1.64	1.40
		Rule 45	2.80	3.53	3.33	1,25	1.96	1.55	2.47	3.21	3.28	.95	1.66	1.53
		Service 1	. 3.10	3.84	4.22	1.30	2.02	1.91	2.66	3.40	4.02	1.03	1.74	1.83
				÷									· .	
		45 + 10	2.70	4.98	4.19	.81	3.09	2.06	2.33	4.59	4.06	.47	2.72	1.99
	·.	Service 10	2.80	5.11	4.52	.83	3.11	2.22	2.38	4.67	4.33	. 49	2.74	2 13
	LOW	40 + 5	2.93	5.25	4.57	.91	3.21	2.23	2.48	4.77	4.36	. 55	2.80	2.14
	TERM.	Service 5	3.01	5.35	4.92	.93	3.23	2.40	2.53	4.83	4.66	.57	2 83	2 28
	•	Rule 50	3.01	5.34	4.70	.96	3.26	2.29	2.54	4.84	4.48	58	2.84	2 10
		Rule 45	3.05	5.39	4.83	.96	3.27	2.35	2.57	4.87	4.59	59	2.04	2 2/
		Service 1	3.13	5.47	5.20	.98	3.29	2.52	2.61	4.92	4.90	.62	2.88	2.37
		45 + 10	2.00	3.32	2.92	.62	1.94	1.43	1.79	3.13	2.93	. 39	1.70	1.43
	•	Service 10	2.10	3.46	3.27	.63	1.96	1.60	1.85	3.21	3.22	.41	1.72	1.57
MED.	MED.	40 + 5	2.46	3.84	3.61	.83	2.19	1.75	2.13	3.51	3.53	.56	1.89	1.71
INF.	TERM.	Service 5	2.57	3.97	4.07	.85	2.22	1.96	2.20	3.59	3.90	.59	1.93	1.89
		Rule 50	2.70	4.09	3.87	.96	2.32	1.86	2.33	3.72	3.77	.66	1.99	1.82
		Rule 45	2.80	4.19	4.14	.98	2.34	1.98	2.39	3.78	4.00	.68	2.01	1.92
		Service 1	2.96	4.36	4.85	1.02	2.38	2.28	2.48	3.88	4.58	.74	2.07	2.16
		45 + 10	1.24	1.91	1.74	.36	1.02	.84	1.17	1.86	1.81	.23	.90	-88
		Service 10	1.31	2.01	1.97	.37	1.04	.96	1.21	1.92	2.01	.24	.91	.98
	HIGH	40 + 5	1.82	2.55	2.54	.64	1.35	1.22	1.63	2.37	2.54	.45	1.16	1.23
	TERM.	Service 5	1.91	2.65	2.91	.66	1.37	1.39	1.68	2.43	2.85	.48	1.18	1.37
		Rule 50	2.27	3.00	2.98	.88	1.59	1.40	2.02	2.76	2.99	.64	1.35	1.40
	• •	Rule 45	2.41	3.15	3.33	.90	1.61	1.55	2.10	2.85	3.28	.67	1.37	1.53
		Service 1	2.63	3.38	4.22	.96.	1.67	1.91	2.23	2.98	4.02	.75	1.45	1.83

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TABLE 10. Employer Costs with 0.6 Higher Rates of Return (Inflation and Source of Contribution) under Different Entry-Retirement Ages, Plan Types, Termination Rates and Vesting Rules.

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			NONC	NONCONTRIBUTORY			NTRIBUTC	RY	NON	NONCONTRIBUTORY			CONTRIBUTORY		
			CA	5Y	MP	CA	5Y	MP	CA	5Y	MP	CA	5Y	MP	
		45 + 10	2.02	4.25	4.19	.12	2.33	2.06	1.71	3.91	4.06	15	2.01	1.99	
		Service 10	2.07	4.33	4.52	.13	2.34	2.22	1.74	3.95	4.33	13	2.03	2.13	
	LOW	40 + 5	2.18	4.45	4.57	.19	2.42	2.24	1.82	4.04	4.37	09	2.08	2.14	
	TERM.	Service 5	2.23	4.51	4.92	.21	2.44	2.40	1.84	4.07	4.66	06	2.10	2.28	
		Rule 50	2.25	4.52	4.70	.22	2.45	2.29	1.87	4.09	4.48	06	2.11	2.19	
		Rule 45	2.27	4.55	4.83	.23	2.46	2.36	1.88	4.11	4.59	05	2.11	2.24	
		Service 1	2.31	4.59	5.20	.25	2.48	2.52	1.90	4.13	4.90 <sub>1</sub>	02	2.15	2.37	
		45 + 10	1.50	2.80	2.92	.11	1.39	1.43	1.32	2.63	2.93	08	1.18	1.43	
		Service 10	1.56	2.89	3.27	.12	1.40	1.60	1.35	2.67	3.22	05	1.20	1.57	
l'Gh	MED.	40 + 5	1.85	3.21	3.61		1.57	1.75	1.58	2,92	3.53	.05	1.33	1.72	
Ni .	TERM.	Service 5	1.91	3.28	4.07	.28	1.59	1,97	1.61	2.96	3.90	.08	1.36	1.89	
		Rule 50	2.04	3.41	3.88	.35	1.66	1.86	1.73	3.08	3.78	.12	1.40	1.82	
		Rule 45	2,10	3.47	4.15	.37	1.68	1.98	1.76	3.11	4.00	.14	1.42	1.92	
		Service 1	2.19	3.56	4.85	.41	1.72	2.28	1.81	3.16	4.58	.20	1.48	2.16	
		45 + 10	.94	1.60	1.74	.04	.68	-85	.87	1.55	1.81	08	- 56	.88	
		Service 10	.98	1.66	1.97	.05	.69	.96	.89	1.58	2.01	07	-57	.98	
	HIGH	40 + 5	1.38	2.10	2.54	.23	.91	1.22	1.21	1.93	2.55	.08	.75	1.23	
	TERM.	Service 5	1.43	2.15	2.91	.25	.93	1.39	1.24	1.96	2.85	.11	.78	1.37	
		Rule 50	1.75	2.47	2.98	.40	1.08	1.40	1.52	2,24	2.99	.22	.89	1.40	
		Rule 45	1.84	2.56	3.33	.41	1.09	1.55	1.57	2.29	3.28	.24	.91	1.53	
		Service 1	1.96	2.69	4.22	.47	1.15	1.91	1.64	2.36	4.02	.32	.99	1.83	

TABLE 10 (continued). Employer Costs with 0.6 Higher Rates of Return (Inflation and Source of Contribution)

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# V. CONCLUSIONS

In the foregoing, three basic plans were examined under various economic assumptions and vesting rules, for employees with different mobility characteristics and periods of participation in the labor force. The analysis was based on probabilistic models designed to characterize the ultimate benefit to be derived by a typical employee (or, ex-post, by a group of similar employees) from his or her career membership in pension plans. The ensuing pension costs were also modelled and computed by an adaptation of the projected benefit-cost method to lifetime pension benefits. The results presented and discussed in the paper have important implications regarding the current status of the private pension system in Ontario, and the expected consequences of more liberal vesting rules.

A discussion of the virtues and limitations of alternative vesting rules must be preceded by an assessment of the plan types examined in the paper in terms of employee beneifts, employer costs, and the social objectives of the government which supports these plans through tax expenditures. While the employers are primarily concerned with the magnitude and unpredictability of pension costs as a function of the payroll, issues of main importance for the employees have been the existence and value of private pension benefits. On the other hand, in addition to the questions of distributional equity, the government is concerned with the overall well-being of the private pension system as a regulator (at the provincial level) and as a subsidizer (at the federal and provincial levels).

From the employees' perspective, defined benefit plans have a number of important drawbacks. First, pension benefits under CA plans deteriorate rapidly with inflation, as the accrual of pension is based on past wages.

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The prospects are somewhat better in 5Y plans where, although benefits related to previous employments would also erode rapidly with inflation, current job benefits would exhibit a good follow-up. Accrued pension benefits are fully protected from inflation only in MP plans in which both past and current benefits increase with inferest rates reflecting inflation (Table 7). Second, and for substantially the same reasons, defined benefit plans (especially CA plans) are not "age neutral" because benefits for younger workers are lower in value than for older workers. Although there have been some proposals to eliminate age-related pension benefit differentials, it appears impossible to construct age-neutral defined benefit plans.<sup>11</sup> In contrast, money purchase plans, in which the employer contributes a fixed percentage of employee earnings, are clearly age-neutral. It should be noted, however, that benefit differentials due to age would prevail even in MP plans, except under full and immediate vesting, so long as termination rates decrease with age.

In addition to being very sensitive to inflation and age, pension benefits under CA plans are not well related to current economic status of the worker, for wages grow but past benefits do not (see Figure 3). This relationship is improved in MP and 5Y plans. (In the latter, current job benefits are based on final earnings.) Also, in relation to other forms of saving, comparative value of benefits in CA plans is difficult to ascertain for the average worker; such a comparison should necessarily involve annuities. This difficulty is compounded in 5Y plans because of wage growth in the

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<sup>&</sup>lt;sup>11</sup>See [2] for a comprehensive analysis and discussion of this issue as it relates to cost-neutrality to firms in hiring workers of different ages.

current job. In MP plans, on the other hand, accrued pension benefits are readily comparable with other assets.

As for the relative advantages to the workers of defined benefit plans, it might be noted that such schemes promise a fixed benefit rate, not a fixed contribution rate as in MP plans. Evidently, the latter would increase the uncertainties about future benefits. It is also true that the accrued benefit is easily comparable with current wage in defined benefit plans, but not in MP plans where it is necessary to go back through annuities. Such advantages, however, fall short of explaining the relative popularity of defined benefit plans in Ontario and elsewhere in North America.

MP plans offer notable advantages for employers also. For one thing, cost of a defined benefit plan fluctuates with economic conditions (Tables 9 and 10), as the cost of annuity depends on the prevailing rate of return on investment, while the cost of a MP plan has a known upper bound implied by the rate of contribution. In addition, defined benefit plans are very difficult to cost for the firm because of uncertainties involved in the projection of economic conditions, termination rates, and wages.<sup>12</sup> Costing of a MP plan, on the other hand, is almost immediate.

In defined benefit plans, there may be incentives for the firms to formulate hiring and retention policies that are discriminatory to older workers, because such plans are not age-neutral and pension costs are relatively higher for older workers; such incentives would be more pronounced in final earnings plans under which the employers may expect the largest

<sup>12</sup> In CA plans, costing would be relatively easy if the firm used the "plan termination cost method," but harder under other actuarial cost methods.

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relative reductions in mobility.<sup>13</sup> As pointed out in section 4.1, 5Y plans are highly sensitive to rates of termination, followed by MP and CA plans.

From the viewpoint of the government, distribution of pension income across the retired workers of comparable preretirement economic status would be most equitable and uniform under CA plans. At the other extreme are the 5Y plans with highest distributional dispersions, with MP plans falling somewhere in between (see Tables 5 and 6 for coefficients of variation and Gini coefficients). The same relative ranking of the three plan types (i.e., CA, MP, and 5Y) also prevails in relation to the efficient allocation of labor, as CA plans place the lowest restriction on mobility and 5Y plans the highest. In terms of preserving the purchasing power of the pension income relative to the earnings of comparable nonretired workers, however, CA plans are inferior to both 5Y and MP plans. In this regard, a comparison between the last two types of plan would depend very much on when changes in economic conditions (i.e., wage growth, interest rate) take place and on the timing of annuity purchases. Finally, in relation to the impact of regulation through statutory vesting rules, it has been established that CA and MP plans are highly sensitive but 5Y plans are relatively neutral to vesting provisions.

These observations are summarized in Table 11, which also includes ordinal rankings of the three plans through various criteria of importance to workers, employers, and the government. Two conclusions emerge: (1) overall,

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<sup>&</sup>lt;sup>13</sup>Unfortunately, such influences are not well-reflected in the results because of the assumed independence in the foregoing policy simulations of termination rates, wages, and plan characteristics. This assumption avoids the estimation problems related to the extent to which varying plan parameters would affect labor turnover (the individual response) or cause compensating variations in wages (the market response). Such considerations do not limit the usefulness of the results, however, so long as they are interpreted with due regard to elements that are not incorporated in the models.

ECONOMIC AGENT	FACTOR/ CRITERION	ASSES CA	SMENT (ORDINAL RANK) C 5Y	F PLAN
WORKER	1) Inflation	Fast deterioration of previous and current benefits (3)	Fast deterioration of previous, good follow-up by current-job benefits (2)	Increase of past and current benefits with interest rate reflecting inflation (1)
	2) Age-Related Benefit Differ- entials	Very high age- related pension differentials (3)	High differentials with partial smooth- ing by current job benefits (2)	Differentials due only to vesting rules and termination rates (1)
	3) Comparability with Current Economic Status	Very weak follow-up (3)	Comparability of 5Y on the timing of cha growth, interest rat it may go either way (1-2)	with NP depends heavily nges in terms of wage e, and annuity purchase;
	4) Comparability with Current Wage	Easy (2)	Easy (1)	Difficult, must be backtracked through annuities (3)
	5) Comparability with Other Assets	Difficult, should be based on annuities	Difficult, should be based on annuities and wage growth in current	Immediate
		(2)	јоб (3)	(1)
FIRM	6) Cost	Variable, depending on inflation	Very variable, depending on inflation and	Known upper bound - rate of contribution
		(2) *	(3)	(1)
	7) Costing of Plan	Difficult except under PTCM - hard projection of economic conditions	Difficult - very hard projection of economic conditions, termination rates, and wage growth	Almost immediate
		(2)	(3)	(1)
	8) Labor Mobility	Small relative reduction	Large relative reduction as past years in current job are upped	Small relative reduction
		(3)	(1)	(2)
	9) Cost Differentials Related to Hiring Age	High Differentials	Very high differ- ential due to wage at termination	Small differentials due only to inter- action of vesting rules and termina-
		(2)	(3)	(1)
GOVERNMENT	10) Equitable Distribution of Pension Wealth	Lowest Gini and Coefficient of Variation	Highest Gini and Coefficient of Variation	Moderate distribution- al indexes
	11) Comparability of Retired to Non- retired	Inferior to 5Y	Comparability of 5Y w heavily on the timing terms of wage growth, and annuity purchase; way	with MP depends g of changes in interest rate, it may go either
		(3)	(1-2)	)
	12) Efficient Allocation of Labor	Less restriction on mobility is probably best	High restriction on mobility	Medium restriction on mobility
		(1)	(3)	(4)

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TABLE 11. Assessment and Ordinal Rank of Plan Types in Terms of Various Factors/Criteria.

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MP plans best serve the interests of all three economic agents, (2) the impact of vesting rules cannot be isolated from--and thus should not be assessed independent of--plan types. In turn, the latter issue must be addressed from two different directions: (1) incremental changes in pension-related measures induced by alternative forms of more liberal vesting provisions in different plans, (2) comparative effects in different plans of delayed vesting characterized by these alternatives relative to full and immediate vesting.

Some of the results reported in Section 4 are reproduced in Tables 12 and 13 as multiples of the corresponding values under the rule "45 and 10" in defined benefit plans.<sup>14</sup> It is apparent that liberalization of vesting rules would have a larger impact on CA plans and in higher termination sectors. It is also apparent that removing the age requirement from the current statutory vesting rule "45 and 10" would result in marginal increases in costs and benefits and equally modest improvements in the distribution of benefits in defined benefit plans. Rule "40 and 5" or "service 5" would result in comparable moderate increases in costs and benefits, and a more substantial liberalization can be achieved through "rule 50" or "rule 45."

The rational in arriving at better regulatory alternatives should not be based, however, largely on considerations relative to current vesting standards. More important are the relativities with respect to ultimate benefits and costs under full and immediate vesting which has been characterized in this study by the rule "service 1." Performances of different vesting rules relative to this form of vesting are also given in Tables 12 and 13 in terms of cost, benefit, and Gini ratios in defined benefit plans. It is interesting to observe that the effects of the rules

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<sup>&</sup>lt;sup>14</sup>Ratios in Tables 12, 13, and 14 are for age group 25-65 under the most probable economic scenario. Ratios for different age groups and economic assumptions are similar.

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Termin. Rate	Vesting Rule	Expected Benefit (Total Cost) in Noncontributory Plans	Gini Index in Non- Contributory Plans	Expected Contributo Total	Cost in ory Plans Employer
Low	45 and 10 Service 10 40 and 5 Service 5 Rule 50 Rule 45 Service 1	1.00 ( .89) 1.02 ( .91) 1.07 ( .95) 1.09 ( .97) 1.09 ( .97) 1.10 ( .98) 1.12 (1.00)	$\begin{array}{ccccccc} 1.00 & (10.00) \\ .86 & (9.00) \\ .49 & (5.00) \\ .39 & (4.00) \\ .29 & (3.00) \\ .23 & (2.00) \\ .10 & (1.00) \end{array}$	1.00 ( .95) 1.01 ( .96) 1.03 ( .98) 1.03 ( .99) 1.04 ( .99) 1.04 ( .99) 1.05 (1.00)	1.00 ( .86) 1.02 ( .86) 1.11 ( .93) 1.13 ( .95) 1.15 ( .96) 1.16 ( .97) 1.19 (1.00)
Med.	45 and 10 Service 10 40 and 5 Service 5 Rule 50 Rule 45 Service 1	1.00 ( .72) 1.03 ( .74) 1.19 ( .86) 1.23 ( .88) 1.30 ( .94) 1.33 ( .96) 1.39 (1.00)	$\begin{array}{c} 1.00 & ( \ 6.50 ) \\ .94 & ( \ 6.00 ) \\ .50 & ( \ 3.25 ) \\ .46 & ( \ 3.00 ) \\ .25 & ( \ 1.50 ) \\ .20 & ( \ 1.25 ) \\ .15 & ( \ 1.00 ) \end{array}$	1.00 ( .89) 1.01 ( .90) 1.06 ( .95) 1.07 ( .96) 1.10 ( .98) 1.11 ( .99) 1.13 (1.00)	1.00 ( .63) 1.03 ( .65) 1.30 ( .82) 1.35 ( .85) 1.48 ( .93) 1.51 ( .95) 1.60 (1.00)
High	45 and 10 Service 10 40 and 5 Service 5 Rule 50 Rule 45 Service 1	1.00 ( .52) 1.04 ( .54) 1.39 ( .73) 1.44 ( .75) 1.73 ( .90) 1.80 ( .94) 1.91 (1.00)	1.00 ( 6.71) .97 ( 6.43) .54 ( 3.57) .51 ( 3.43) .22 ( 1.43) .19 ( 1.29) .15 ( 1.00)	1.00 ( .83) 1.01 ( .83) 1.09 ( .91) 1.10 ( .91) 1.17 ( .97) 1.18 ( .98) 1.21 (1.00)	1.00 ( .41) 1.04 ( .42) 1.65 ( .68) 1.71 ( .71) 2.20 ( .90) 2.26 ( .93) 2.43 (1.00)

TABLE 12.

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. Selected Measures for Career Average Plans Indexed on the Corresponding Values under the Rules "45 and 10" and ("Service 1").

Termin. Rate	Vesting Rule	Expected Benefit (Total Cost) in Noncontributory Plans	Gini Index in Non- Contributory Plans	Expected Cost in Contributory Plans Total Employer			
Low	45 and 10	1.00 ( .93)	1.00 (1.46)	1.00 ( .97)	1.00 ( .95)		
	Service 10	1.02 ( .95)	.93 (1.31)	1.00 ( .97)	1.01 ( .96)		
	40 and 5	1.04 ( .97)	.81 (1.15)	1.02 ( .99)	1.03 ( .98)		
	Service 5	1.05 ( .98)	.77 (1.08)	1.02 ( .99)	1.04 ( .99)		
	Rule 50	1.05 ( .98)	.74 (1.08)	1.02 ( .99)	1.04 ( .99)		
	Rule 45	1.06 ( .99)	.72 (1.00)	1.03 (1.00)	1.04 ( .99)		
	Service 1	1.07 (1.00)	.68 (1.00)	1.03 (1.00)	1.05 (1.00)		
Med.	45 and 10 Service 10 40 and 5 Service 5 Rule 50 Rule 45 Service 1	1.00 ( .81) 1.03 ( .83) 1.12 ( .91) 1.15 ( .93) 1.19 ( .96) 1.21 ( .97) 1.24 (1.00)	1.00 (2.00) .95 (1.94) .71 (1.41) .68 (1.35) .57 (1.18) .54 (1.12) .50 (1.00)	$\begin{array}{cccc} 1.00 & ( .92) \\ 1.00 & ( .92) \\ 1.05 & ( .96) \\ 1.06 & ( .97) \\ 1.07 & ( .98) \\ 1.08 & ( .99) \\ 1.09 & (1.00) \end{array}$	1.00 ( .84) 1.01 ( .84) 1.10 ( .92) 1.12 ( .94) 1.16 ( .97) 1.17 ( .98) 1.19 (1.00)		
High	45 and 10	1.00 ( .62)	1.00 (2.74)	1.00 ( .85)	1.00 ( .65)		
	Service 10	1.03 ( .64)	.97 (2.68)	1.00 ( .86)	1.01 ( .66)		
	40 and 5	1.27 ( .79)	.65 (1.79)	1.08 ( .92)	1.25 ( .82)		
	Service 5	1.30 ( .81)	.63 (1.74)	1.09 ( .93)	1.28 ( .83)		
	Rule 50	1.48 ( .93)	.43 (1.16)	1.15 ( .98)	1.45 ( .95)		
	Rule 45	1.53 ( .95)	.40 (1.11)	1.15 ( .98)	1.47 ( .96)		
	Service 1	1.60 (1.00)	.37 (1.00)	1.17 (1.00)	1.53 (1.00)		

TABLE 13. Selected Measures for Last Five Years' Average Plans Indexed on the Corresponding Values under the Rules "45 and 10" and ("Service 1").

"service 5" and "40 and 5" in CA plans are comparable to the effects of "service 10" and "45 and 10" in 5Y plans. A comparative examination of the Gini ratios reveals, also, that the previously noted high distributional inequities in 5Y plans are primarily due to the plan type, while in CA plans the main negative factor is the vesting rule. Therefore, if the new regulatory guidelines in relation to delayed vesting are to balance the impacts of different plan types, statutory vesting rules applicable to CA plans ought to be more liberal than those applicable to final earnings plans.

It is also clear from these results that both "rule 50" and "rule 45" approximate, in effect, full and immediate vesting in defined benefit plans, except in relation to distributional equity. These rules, however, would create additional complications for workers and firms in their valuation of the defined benefit pension scheme. More importantly, they would further the negative effects of age-dependent pension differentials by providing additional incentives for the firms to formulate hiring policies that are discriminatory to older workers.

Table 14 shows that the impact of alternative forms of liberalization on MP plans would be comparable, in general, to that observed in CA plans with an important qualification that the age requirement is much more influential in MP plans than in defined benefit plans. On the other hand, more is lost due to vesting in MP plans. In fact, it is seen through measures relative to "service 1" that the performance of "service 5" in MP plans is remarkably similar to the performance of "40 and 5" in CA plans.

In conclusion, growth of defined contribution (money purchase) plans should be encouraged as the most important means of reforming the private pension system in Ontario. In terms of the alternatives examined in this

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Termin. Rate	Vesting Rule	Expected Benefit (Total Cost) in Noncontributory Plans	Gini Index in Non- Contributory Plans	Expected Contributo Total	Cost in ry Plans Employer
Low	45 and 10 Service 10 40 and 5 Service 5 Rule 50 Rule 45 Service 1	1.00 ( .84) 1.06 ( .89) 1.08 ( .90) 1.14 ( .95) 1.10 ( .92) 1.13 ( .94) 1.20 (1.00)	$\begin{array}{cccc} 1.00 & (7.00) \\ .71 & (5.00) \\ .62 & (4.50) \\ .35 & (2.50) \\ .52 & (3.50) \\ .40 & (3.00) \\ .14 & (1.00) \end{array}$	1.00 ( .93) 1.02 ( .95) 1.03 ( .96) 1.05 ( .98) 1.04 ( .97) 1.05 ( .98) 1.07 (1.00)	1.00 ( .85) 1.06 ( .90) 1.07 ( .91) 1.14 ( .96) 1.10 ( .93) 1.12 ( .95) 1.18 (1.00)
Med.	45 and 10	1.00 ( .65)	1.00 (7.00)	1.00 ( .86)	1.00 ( .67)
	Service 10	1.09 ( .71)	.85 (6.00)	1.03 ( .87)	1.09 ( .73)
	40 and 5	1.20 ( .78)	.57 (4.00)	1.06 ( .92)	1.20 ( .80)
	Service 5	1.32 ( .86)	.44 (3.00)	1.10 ( .95)	1.31 ( .87)
	Rule 50	1.29 ( .84)	.45 (3.25)	1.09 ( .94)	1.27 ( .85)
	Rule 45	1.36 ( .88)	.35 (2.50)	1.11 ( .96)	1.33 ( .89)
	Service 1	1.54 (1.00)	.14 (1.00)	1.16 (1.00)	1.49 (1.00)
High	45 and 10	1.00 ( .46)	1.00 (6.71)	1.00 ( .81)	1.00 ( .49)
	Service 10	1.10 ( .51)	.92 (6.14)	1.02 ( .82)	1.10 ( .54)
	40 and 5	1.40 ( .64)	.57 (3.86)	1.09 ( .88)	1.39 ( .68)
	Service 5	1.55 ( .71)	.49 (3.29)	1.12 ( .91)	1.53 ( .75)
	Rule 50	1.65 ( .76)	.37 (2.43)	1.14 ( .92)	1.59 ( .78)
	Rule 45	1.81 ( .83)	.29 (2.00)	1.17 ( .94)	1.73 ( .85)
	Service 5	2.18 (1.00)	.15 (1.00)	1.24 (1.00)	2.03 (1.00)

TABLE 14. Selected Measures for Money Purchase Plans Indexed on the Corresponding Values under the Rules "45 and 10" and ("Service 1"). paper, <u>vesting rules should not be more restrictive than "service 5" in</u> <u>defined contribution plans and "40 and 5" in defined benefit, career average</u> <u>plans;</u> a more stringent benchmark may be considered for defined benefit final earnings plans. Since defined benefit plans are not restricted to "career average" and "last five years' average" modes (in fact, these are extreme forms) the latter differentiation leads to the perhaps undesirable prospect of prescribing a different vesting rule for every benefit formula. The rule "40 and 5" could, therefore, be adopted for all defined benefit plans and the rule "service 5" for all defined contribution plans. <u>If a</u> <u>single statutory minimum provision is to replace the rule "45 and 10" in all</u> plans, then the most appropriate choice appears to be the rule "service 5."

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# APPENDIX

			•				Durat	ion of	Emplo	yment	(years	)		
U <sup>1</sup>		Attained Age	Mobility	0	1	2	3	4	. 7	12	17	22	27	32
4			High	.412	.604	.700	.757	.796	.862					
		22	Med.	.618	.736	.800	.838	.864	.908					
			Low	.809	.868	.900	.919	.932	.954					•
			High	.440	.624	.715	.769	.806	.866	.910				
		27	Med.	.627 <sup>·</sup>	.749	.810	.846	.871	.911	.940				
		• • • • • • • • • • • • • • • • • • •	Low	.814	.874	.905	.923	.936	.956	.970		۰.		
			High	.468	.642	.728	.781	.816	.872	.914	.934		· .	· · .
	• 	32	Med.	.645	.761	.819	.854	.877	.915	.943	.956	· .		
		•	Low	.822	.880	.910	.927	.938	.958	.972	.978	•		
		•	High	.493	.658	.742	.792	.824	.880	.918	.937	.948		
		37	Med.	.662	.772	.828	.861	.883	.920	.946	.958	.965		
			Low	.831	.886	.914	.930	.942	.960	.973	.979	.982		
			High	.518	.676	.754	.802	.834	.884	.922	.940	.950	.956	-
		42	Med.	.679	.784	.836	.868	.889	.923	.948	.960	.967	.971	
			Low	.840	.892	.918	.934	.944	.962	.974	.980	.983	.986	
			High	.541	.691	.766	.811	.841	.890	.925	.943	.952	.958	.964
		47	Med.	.69.4	.794	.844	.874	.894	.927	.950	.962	.968	.972	.976
			Low	.847	.897	.922	.937	.947	<b>.</b> 964 <sup>.</sup>	.975	.981	.984	.986	.988
			High	.564	.706	.778	.820	.848	.896	.929	.946	.954	.960	.967
		52	Med.	.709	.804	.852	.880	.899	.931	.953	.964	.970	974	.978
		•	Low	.854	.902	.926	.940	.950	.966	.976	.982	.985	.987	.989
		N	High	.584	.721	.788	.829	.856	.901	.932	.949	.956	.962	.968
		57	Med.	.723	.814	.859	.886	.904	.934	.955	.966	.971	.975	.979
			Low	.862	.907	.930	.943	.952	.967	.978	.983	.986	.988	.990

TABLE A1.

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Probabilities of Remaining in the Same Employment for an Additional Year as a Function of Attained Age and Tenure for High, Medium, and Low Mobility Sectors.

	Mortali	ty Rate		Mortali	ty Rate		Mortality Rate		
Age	GAM	MLT	Age	GAM	MLT	Age	GAM	MLT	
20	.000524	.0017810	47	.003907	.0056127	74	.051474	.0606918	
21	.000543	.0018411	48	.004400	.0062159	75	.055566	.0655171	
22	.000566	.0018657	49	.004933	.0068820	76	.060364	.0707965	
23	.000589	.0018340	50	.005501	.0076117	77	.066249	.0766410	
24	.000615	.0017500	51	.006106	.0084061	78	.072953	.0829766	
25	.000644	.0016447	52	.006744	.0092659	79	.080085	.0897294	
26	.000676	.0015492	53	.007418	.0101672	80	.087862	.0970103	
27	.000712	.0014944	54	.008124	.0111092	81	.095916	.1049301	
28	.000751	.0014816	55	.008866	.0121282	82	.104202	.1125998	
29	.000794	.0014901	56	.009577	.0132603	83	.112857	.1229454	
30	.000842	.0015181	57	.010313	.0145417	84	.121713	.1328930	
31	.000895	.0015636	58	.011113	.0159649	85	.130743	.1435535	
32	.000953	.0016246	59	.012091	.0175060	86	.140002	.1550377	
33	.001018	.0016949	60	.013216	.0191759	87	.149447	.1674566	
34	.001089	.0017758	61	.014452	.0209856	88	.159267	.1807363	
35	.001168	.0018766	62	.015773	.0229460	89	.169541	.1948027	
36	.001253	.0020070	63	.017202	.0250341	90	.180337	.2097668	
37	.001348	.0021764	64	.018935	.0272425	91	.191428	.2257396	
38	.001454	.0223866	65	.020982	.0296059	92	.202675	.2428318	
39	.001571	.0026315	66	.023475	.0321591	93	.215006	.2609695	
40	.001700	.0029081	67	.026287	.0349367	94	.229719	.2800788	
41	.001862	.0032136	68	.029332	.0378967	95	.245661	.3002707	
42	.002082	.0035452	69	.032595	.0410161	96	.262162	.3216559	
43	.002352	.0038886	70	.036284	.0443578	97	.280078	.3443454	
44	.002674	.0042458	71	.040205	.0479848	98	.299603	.3682653	
45	.003041	.0046380	72	.044043	.0519601	99	.320625	.3933416	
46	.003453	.0050865	73	.047723	.0562097	100	.343642	.4196852	

TABLE A2. Mortality Rates at any Given Age for Canadian Males, Adjusted for Experience of Pension Plan Members (GAM) and for all Canadian Males (MLT)