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DIRECTORATE OF SOCIAL AND ECONOMIC ANALYSIS

ORA RESEARCH NOTE RN9502

**THE CIVILIAN REDUCTION PROGRAM:
OVERVIEW OF SUPPORTING RESEARCH EFFORTS AND RESULTS**

by

FRANK TULUS

AUGUST, 1995

OTTAWA, CANADA

 **National Défense
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OPERATIONAL RESEARCH AND ANALYSIS

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ABSTRACT

This note provides an overview of the Civilian Reduction Program, and research efforts conducted on the program. In addition to the summary descriptions, the note also provides an analysis of early program results which can be regarded as an indicator of future CRP outcomes.

RÉSUMÉ

Cette note de recherche fournit un aperçu du Programme de Réduction du Personnel Civil, et les efforts de recherche effectués. En plus d'un récit récapitulatif, cette note fournit une analyse des résultats préliminaires du programme qui peuvent être considérés comme étant une indication des futures conséquences du PRPC.

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THE CIVILIAN REDUCTION PROGRAM:
AN OVERVIEW OF SUPPORTING RESEARCH EFFORTS AND RESULTS

I. INTRODUCTION

1. This research note describes the Government's plan for the reduction of civilian personnel in the Department of National Defence (DND), outlines the principles behind the Civilian Reduction Program (CRP), and summarizes recent studies that have been conducted on the program. Apart from the aforementioned topics, the note contains an analysis of early program results which can be regarded as an indicator of future CRP outcomes. This research note is prepared in support of the TTCP UTP-3 (The Technical Cooperation Program, Subgroup U Technical Panel 3) meeting held in Portland, Oregon, in July 1995.

II. REDUCTION PLAN FOR CIVILIAN PERSONNEL

2. The 1995 federal budget outlined the plan for further reduction of civilian personnel in the Department of National Defence (DND). Further reductions to the defence budget, the use of alternative service delivery, reductions in infrastructure, and reorganization of work units were factors that contributed to the cutbacks in civilian personnel. Initially, after the 1994 federal budget, the Government planned to downsize the complement of civilian personnel to 25,200 full-time equivalents by 1999 (see Table 1 of Annex A). The 1995 federal budget, in line with the 1994 Defence White Paper, announced an additional reduction in the order of 5,200 civilian personnel, bringing the projected total of the cutbacks to 12,500 civilians between 1994 and 1999 (see Ref. 4). By the end of 1997-98, about 20,000 civilian full-time equivalents are expected to remain in the Department (see Ref. 5).

III. THE CIVILIAN REDUCTION PROGRAM

3. Under the Work Force Adjustment Directive (WFAD), civilian DND employees affected by work force reductions, facility closures or relocations of work units are given a "reasonable job offer" in the Public Service. Beginning in 1993, however, the number of affected employees in DND was expected to be greater than could be placed under the WFAD. Consequently, DND in conjunction with Treasury Board, developed a special departure incentive program for indeterminate civilian employees called the Civilian Reduction Program (CRP). Under the CRP, a comprehensive package is offered to civilian employees who are affected by work force reduction, facility closure, or position reductions. Each offer contains the terms of individualized incentive package and a voluntary departure date. After the allotted departure date has passed, employees who have not opted for the CRP will be managed under the provisions of WFAD. Thus, the CRP was aimed at encouraging civilian DND employees to leave the Public Service rather than opting for WFAD.

4. In the 1995 federal budget, two new programs were introduced, and temporary legislative changes to the WFAD were proposed. As a result, employees affected by the cutbacks will have a choice of either taking the benefits under the CRP or, if one chooses not to take the CRP and cannot find a substitute, the benefits under the new federal programs: Early Departure Incentive (EDI) and Early Retirement Incentive (ERI) (see Ref. 3). DND's CRP will expire on March 31, 1996, at which point surplus civilian employees of DND will continue to have access to the benefits available under the new federal programs. Should the affected employees reject the incentives under the new programs and do not receive a reasonable job offer within six months, they will go on unpaid surplus status for a maximum of 12 months (after 12 months they will be laid-off).

ELIGIBILITY

5. To be eligible for the CRP, employees must fall under one of the four group categories (see Ref. 6, p.10).

- a. **Group A.** Group A consists of employees who occupy positions that will be eliminated as a result of a work force reduction or a facility closure.
- b. **Group B.** Group B contains employees who occupy similar positions, are classified at the same group or level, and work in the same location where a reduction is imminent.
- c. **Group C.** This group hold positions in a work unit which will be relocated to different geographical area.
- d. **Group D.** This category includes personnel who occupy a position in any of the previously mentioned groups, and are on leave of absence without pay.

6. Those employees covered in Groups A, C, and D, will be given "directed offers", while the employees in Group B will be given "group offers". The employees who are given "group offers" have a choice between the CRP payments on a "first come first serve" basis, or a "wait and see" stance with the hope that a sufficient number of fellow workers accept the offer. Meanwhile, those employees who receive the "directed offers" are faced with the immediate choice of taking the CRP, finding a substitute, or when their CRP deadlines have expired, the benefits under the new federal programs (see Ref. 7, p. 4).

PROGRAM INCENTIVES

7. The existing Civilian Reduction Program offers incentives to encourage DND employees to leave the Public Service. The incentives consist of a financial component and an education/training allowance (see Ref. 2 and Ref.

3). The financial component includes the following:

- A lump sum payment of 12 months of regular pay;
- Severance pay calculated at the lay-off rate (2 weeks of pay for the first year of service plus one week of pay for every other year of service);
- A CRP supplement for those employees with five or more years of continuous employment, which takes into account an employee's age and years of service; and
- A CRP departure allowance of one week's regular pay for every year of continuous employment to a maximum of 15 weeks.
- The maximum cash settlement, including severance pay, will not exceed 104 weeks of salary.

8. The education/training component includes an allowance of up to \$7,000 for retraining of employees who seek employment outside the Federal Public Service. The education/training allowance can be spread over a period of four years; however, employees taking this option are no longer eligible for the departure allowance of one week's regular pay for every year of continuous service. Thus far, employees who have chosen the education/training option tend to be young, with few years of continuous service (see Ref. 6, p. 8). Relative to men in DND, women are more likely to be young and have fewer years of continuous service (see Table 2 of Annex A). Nonetheless, of all the women who had applied for the education/training allowance, only 46 per cent

have received approved training plans compared to 54 per cent for the men (see Ref. 6, p. 8).

IV. ANALYSIS OF EARLY PROGRAM RESULTS

9. A recently finished report, published by the Directorate of Civilian Employment Strategies (D Civ ES), reveals that the CRP was offered to 3,728 indeterminate employees between June 1994 and the end of 94-95 fiscal year. Thus far, the results of the CRP have not revealed any gross disparities in offers between men and women. As demonstrated in Table 3 of Annex A, the proportion of women who have received CRP offers is roughly equal to the men. In fact, the proportion of women who have been offered the CRP (15.9%) is slightly higher than that of the male counterparts (14.0%). A chi-square test of independence (see Appendix 1 of Annex B) failed to be significant at all probability levels, indicating that an employee's likelihood to receive a CRP offer is independent of gender.

10. Of the 3,728 employees given the CRP offers, 2,936 had accepted the offers, yielding a take-up rate of 78.8 per cent (see Table 4 of Annex A). The take-up rate, however, was slightly higher for men (79.3%) compared to women (77.9%). This gender difference in take-up rate was statistically significant ($\chi^2 = 4.345$, $df = 1$, $p < 0.05$). Nevertheless, with the calculated phi and lambda values of less than one (see Appendix 2 to Annex B), there is no strong indication of association between gender and the outcomes of a CRP offer. Although men have been more likely to accept their CRP offers than women, this gender discrepancy in take-up rates, may be explained by other intervening factors, such as age and years of continuous service.

11. Significant discrepancy can also be found when the take-up rates of employees given the directed offers¹ were divided across age categories. In particular, the take-up rate for those 60 years of age and older was 96.8 per cent, while the take-up rate for those aged 40-49 years was only 47.8 per cent (see Table 5 of Annex A). When the differences were tested for significance, the result was statistically significant ($\chi^2=474.897$, $df=4$, $p<0.001$). Furthermore, the calculated gamma value of 0.513 indicates a moderate, positive association which means older employees are more likely to accept CRP offers. The relationship remained robust when the effect of gender was removed; this is indicated by a closely matched partial gamma value of 0.564.

12. As far as years of service are concerned, the highest take-up rate (94.8%) was found among employees with over 30 years of service (see Table 6 of Annex A). In comparison, only 63.9 per cent of people with less than 5 years of continuous service accepted their CRP offers. The discrepancy, once again, was statistically significant ($\chi^2=79.584$, $df=6$, $p<0.001$). However, when gamma was calculated, its low value (0.126) clearly indicated the existence of a weak link between years of continuous service and outcomes of CRP offers. When the effects of gender were removed from years of continuous service, men with more years of continuous service were more likely to accept their CRP offers ($\gamma=0.103$); nonetheless, no such indication was found for women with more years of continuous service ($\gamma=0.085$). Undoubtedly, this phenomenon can be partly attributed to the fact that women in the Department tend to have fewer years of continuous service than men. The partial gamma value (0.099) decreased from the original gamma value of 0.126; this demonstrates the existence of an interactive (non-direct) relationship between years of continuous service and outcomes of CRP offer.

¹ Data was limited to employees that had been given "directed offers".

13. While strong discrepancies were not found in the offers and the outcomes of CRP between men and women, early program results have not revealed any disparate impact on the other employment equity groups. In particular, the relative share of CRP offers for the Aboriginals, the physically challenged, and visible minorities was approximately equal to their overall representation in DND (see Ref 6. p. 7).

14. Based on early results, CRP take-up rates tend to increase with age and the number of years of continuous service, although the analysis revealed that age was the more influential of the two factors. The trend, incidentally, is the opposite for CRP offers being turned down. Employees who have declined their CRP offers tend to be younger and have fewer years of continuous service than the CRP takers. Men are more likely to accept their CRP offers; however, this may be caused by factors other than gender itself. Finally, with regards to the CRP offers, no disparities have been found on the other employment equity groups.

V. RESEARCH EFFORTS

ATTITUDES TOWARD THE CRP

15. Focus groups and a survey were carried out by the Directorate of Internal Communication Services (DICS) to assess civilian employees' attitudes toward the CRP (see Ref. 6). In general, the results demonstrated that the CRP was well received by the employees (see Table 7 in Annex A). Fifty-one percent of civilian employees believed that the offers were "generous", while only 21 per

cent did not think the offers are generous (the other 28 per cent remained neutral). Nevertheless, only 40 per cent of employees agreed that the CRP offers were "fair" (26 per cent were neutral, 34 per cent disagreed). With respect to the CRP support services, 57 per cent of the affected employees believed the advice given from career and financial counsellors was generally useful. Moreover, affected employees found information on the CRP offers to be well-presented and readily available, thus making their decision to accept or reject much easier.

LONGITUDINAL IMPACTS OF THE CRP

16. A longitudinal study on the impacts of the CRP is to be undertaken by DND, the Union of National Defence Employees (UNDE), the Treasury Board, Human Resources Development Canada (HRDC) and the Public Service Alliance Canada (PSAC) (see Ref. 8). The goal of the project is to investigate, over a four-year period, the socio-economic and labour market impacts experienced by civilian employees subject to the personnel cutbacks. Thus, the study will be able to provide information on the impact of the CRP on quality of life while controlling for variables such as demographic and psychological characteristics. Undoubtedly, the study will provide valuable information on the labour adjustment experience of the displaced employees which can not be provided by cross-sectional research alone. Only few comparable longitudinal studies on displaced workers have been undertaken in Canada. Consequently, this particular study will contribute to the body of research dealing with labour market adjustment.

VI. JOB FAIR

17. To help affected civilian employees find job opportunities outside the Federal Government, a job fair was organized for June 6 and 7, 1995 in Ottawa. The job fair provided excellent opportunities for affected workers to meet potential employers from the following sectors: services, manufacturing, retail, scientific, high-tech, and environment/forestry. Also featured in the job fair was a guest lecture by David Chilton, a renowned financial advisor in Canada.

VII. CONCLUSION

18. The reduced defence budget has necessitated cutbacks in military and civilian personnel of the Department. To execute the reduction objectives and mitigate the social and economic repercussions of the reduction efforts, the Federal Government has created the Civilian Reduction Program. The program contains special departure incentive package for indeterminate civilian employees whose positions are affected by the cutbacks. To date, studies indicate that the program is generally well-received, and perceptions toward it have been mainly positive.

LIST OF REFERENCES

1. Department of National Defence. 1994. 1994 Defence White Paper. Ottawa: Minister of Supply and Services.
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3. Department of National Defence. February 1995. Impact on the CRP of the Government Announcement on Work Force Adjustment. CRP Bulletin, Ref. No. HRM 03/95 (DICS).
4. Department of National Defence. February 1995. 1995 Budget Impact Statement. Ottawa: Ministry of National Defence and Veteran Affairs.
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6. Department of National Defence. March 1995. Report on Employees Affected by the Civilian Reduction Program. Ottawa: Directorate of Civilian Employment Strategies.
7. Department of National Defence. January 1995. The Civilian Reduction Program at DND: Early Program Impacts and Policy Implications. Ottawa: Directorate of Internal Communication Services.
8. Department of National Defence and Union of National Defence Employees. March, 1995. Research Proposal for a Joint Study of the Longitudinal Impacts of the Civilian Reduction Program.

**ANNEX A
DSEA RESEARCH NOTE
JULY 1995**

**TABLE A-1
CIVILIAN DEFENCE PERSONNEL**

Number of Civilians	
Strength 1989	13,600
Strength 1994	32,500
1994 Budget: 1998 Target	25,200
1994 Defence White Paper: 1999 Target	20,000
TOTAL REDUCTION	
1994-1999	12,500
Percentage change	38%
1989-1999	16,600
Percentage Change	45%

Source: DND. 1994 Defence White Paper. Ottawa: Minister of Supply and Services

**TABLE A-2
DND POPULATION BY AGE GROUPS AND YEARS OF CONTINUOUS SERVICE**

Age Groups	Men		Women		Number of Years of Continuous Service	Men		Women	
	#	%	#	%		#	%	#	%
20-29	446	2.7	498	5.6	0-5	2,570	15.6	1,599	18.1
30-39	4,383	26.5	2,940	33.1	6-10	3,937	23.8	2,111	23.9
40-49	6,192	37.4	3,332	36.4	11-15	3,906	23.6	2,358	26.7
50-59	4,367	26.4	1,870	21.0	16-20	3,066	18.6	1,587	17.9
60+	1,173	7.1	345	3.9	21-25	1,840	11.1	800	9.0
Total	16,561	100.0	8,885	100.0	26-30	819	5.0	282	3.0
					30+	383	2.3	127	1.4
					Total	16,521	100.0	8,844	100.0

Source: DND. Report on Employees Affected by the CRP. Ottawa: D Civ ES. 1995.

**TABLE A-3
CRP OFFERS AS A PERCENTAGE OF TOTAL POPULATION, BY GENDER**

CRP Types	Male	(%)	Female	(%)
Directed Offers	1,874	11.3	1,145	12.9
Group Offers	440	2.7	269	3.0
Total	2,314	14.0	1,414	15.9
Total Population	16,561		8,885	

Source: DND. Report on Employees Affected by the CRP. Ottawa: D Civ ES. 1995.

**TABLE A-4
CRP TAKE UP RATES, BY GENDER**

CRP Types	Take Up Rates (%)		
	Male	Female	Total
Directed Offers	68.5	69.0	68.7
Group Offers	94.3	73.6	86.5
Total	79.3	77.9	78.8

Source: DND. Report on Employees Affected by the CRP. Ottawa: D Civ ES. 1995.

**TABLE A-5
COMPARISON OF CRP TAKE-UP RATES, BY AGE GROUPS (DIRECTED OFFERS ONLY)**

Age Groups	CRP Offers	CRP Accepted	Take-up Rates (%)
20-29	86	57	66.3
30-39	639	359	56.2
40-49	848	405	47.8
50-59	1,004	824	82.1
60+	442	428	96.8
Total	3,019	2,073	68.7

Source: DND. Report on Employees Affected by the CRP. Ottawa: D Civ ES. 1995.

**TABLE A-6
COMPARISON OF CRP TAKE-UP RATES, BY YEARS OF CONTINUOUS
SERVICE (DIRECTED OFFERS ONLY)**

Years of Continuous Service	CRP Offers	CRP Accepted	Take-up Rates (%)
5 year or less	380	243	63.9
6-10	582	397	68.2
11-15	780	523	67.1
16-20	581	366	63.0
21-25	322	218	67.7
26-30	181	143	79.0
Over 30 years	193	183	94.8
Total	3,019	2,073	68.7

Source: DND. Report on Employees Affected by the CRP. Ottawa: D Civ ES. 1995.

**TABLE A-7
PERCEPTION OF CRP OFFERS**

Perception of CRP Offers	Percentage who Accepts
Offer is Generous	51%
Offer is Fair	40%
Offer is Well Presented	56%
Information is Readily Available	69%
Useful Advice from Counsellors	57%
Useful Advice from Personnel	50%

Source: DND. The Civilian Program at DND: Early Program Impacts and Policy Implications. Ottawa: DICS. 1995

**APPENDIX 1
TO ANNEX B
DSEA RESEARCH NOTE
JULY 1995**

A NOTE ON TESTS OF SIGNIFICANCE AND MEASURES OF ASSOCIATION

The data used in the proceeding calculations are obtained from the frequency tables in a report published by the Division of Civilian Employment Strategies (see Ref. 3). Tests of significance and bivariate measures of association are performed on the crosstabulations of the following variables: gender, age, years of continuous service, nature of CRP offers, and outcomes of CRP offers. In multivariate analysis, gender is used as a control variable while determining the individual effect of age and years of continuous service on the outcomes of CRP offer. Finally, following the obligatory EPSEM (Equal Probability of Selection Method) principle, it is assumed here that the employees who had been given the CRP offer represent a random sample of the total DND population (all indeterminate employees).

CALCULATIONS OF CHI-SQUARE TEST OF INDEPENDENCE

When testing for significance, we usually want to reject the null hypothesis and find evidence to support the alternate hypothesis which states that the variables in question are not significantly independent of each other. However, in the proceeding tests, it is the null hypothesis we are seeking support for; that is, using the first test as an example, we wish to find a statistically insignificant result which would support the absence of gender bias in the offering of the CRP.

COMPUTATION 1: BREAKDOWN OF CRP OFFERS BY GENDER, AS OF MARCH 1995

Observed Frequency Table

CRP Type	Male	Female	Total
Directed	1,874	1,145	3,019
Group	440	269	709
Σ	2,314	1,414	3,728

Expected Frequency Table

CRP Type	Male	Female	Total
Directed	1,874	1,145	3,019
Group	440	269	709
Σ	2,314	1,414	3,728

Expected frequencies are found on a cell-by-cell basis by the formula:

$$f_e = \frac{(\text{row marginal})(\text{column marginal})}{N}$$

Thus,

$$\begin{aligned} \text{for "male-directed": } f_e &= \frac{(3019)(2314)}{3728} = 1874 \\ \text{for "female-directed": } f_e &= \frac{(3019)(1414)}{3728} = 1145 \\ \text{for "male-group": } f_e &= \frac{(709)(2314)}{3728} = 440 \\ \text{for "female-group": } f_e &= \frac{(709)(1414)}{3728} = 269 \end{aligned}$$

The obtained chi-square (χ^2) formula is as follow:

$$\chi^2 (\text{obtained}) = \sum \frac{(f_o - f_e)^2}{f_e}$$

The value of χ^2 (obtained) would be:

$$\chi^2 = \frac{(1874-1874)^2}{269} + \frac{(1145-1145)^2}{1145} + \frac{(440-440)^2}{440} + \frac{(269-269)^2}{269}$$

$$= 0$$

The degrees of freedom is calculated as follow:

$$df = (r-1) (c-1) = (2-1) (2-1) = 1$$

Thus χ^2 (critical) with degrees of freedom 1, and $\alpha=0.01$ and 0.001:

$$\chi^2_{0.01} = 6.635^2$$

$$\chi^2_{0.001} = 10.827$$

Since χ^2 (critical) > χ^2 (obtained), the test result is not statistically significant (the null hypothesis fail to be rejected); the probability of an employee receiving a CRP offer (whether directed or group) is independent from that person's gender.

COMPUTATION 2: BREAKDOWN OF CRP OUTCOMES BY GENDER, AS OF DECEMBER 1994

Observed Frequency Table

CRP Outcomes	Male	Female	Total
Accepted	1,310	723	2,033
Declined	424	282	706
Σ	1,734	1,005	2,739

² From the table of chi-square distribution (any statistics reference book)

Expected Frequency Table

CRP Outcomes	Male	Female	Total
Accepted	1,287	746	2,033
Declined	447	259	706
Σ	1,734	1,005	2,739

The value of χ^2 (obtained) would be:

$$\begin{aligned} \chi^2 &= \sum \frac{(f_e - f_o)^2}{f_e} \\ &= \frac{(1310-1287)^2}{1287} + \frac{(723-746)^2}{746} + \frac{(424-447)^2}{447} + \frac{(282-259)^2}{259} \\ &= 0.4110 + 0.7091 + 1.1834 + 2.042 \\ &= 4.3455 \end{aligned}$$

$\chi^2_{0.05}$ (critical) is 3.841, hence significant at $\alpha=0.05$ with $df=1$

COMPUTATION 3: BREAKDOWN OF CRP OUTCOMES BY AGE GROUPS, AS OF DECEMBER 1994 (DIRECTED OFFERS ONLY)

Observed Frequency Table

CRP Outcomes	Age Groups					Total
	20-29	30-39	40-49	50-59	60+	
Accepted	57	359	405	824	428	2,073
Declined	29	280	443	180	14	946
Σ	86	639	848	1,004	442	3,019

Expected Frequency Table

CRP Outcomes	Age Groups					Total
	20-29	30-39	40-49	50-59	60+	
Accepted	59	439	582	670	303	2,073
Declined	27	200	266	314	139	946
Σ	86	639	848	1,004	442	946

The value of the χ^2 (obtained) would be:

$$\begin{aligned} \chi^2 &= \sum \frac{(f_o - f_e)^2}{f_e} \\ &= \frac{(57-59)^2}{59} + \frac{(359-439)^2}{439} + \frac{(405-582)^2}{582} + \frac{(824-670)^2}{670} + \frac{(428-303)^2}{303} \\ &+ \frac{(29-27)^2}{27} + \frac{(280-200)^2}{200} + \frac{(443-266)^2}{266} + \frac{(180-314)^2}{314} + \frac{(14-139)^2}{139} \\ &= 0.0678 + 32 + 117.7782 + 57.1847 + 112.41 + 14.5786 + 53.8299 \\ &+ 35.397 + 51.5766 + 0.0741 \\ &= 474.8969 \end{aligned}$$

$\chi^2_{0.001}$ (critical) is 20.517, hence significant at $\alpha=0.001$ with $df=4$

COMPUTATION 4: BREAKDOWN OF CRP OUTCOMES BY YEARS OF CONTINUOUS SERVICE, AS OF DECEMBER 1994, (DIRECTED OFFERS ONLY)

Observed Frequency Table

CRP Outcomes	Number of Years of Continuous Service							Total
	0-5	6-10	11-15	16-20	21-25	26-30	30+	
Accepted	243	397	523	366	218	143	183	2,073
Declined	137	185	257	215	104	38	10	946
Σ	380	582	780	581	322	181	193	3,019

Expected Frequency Table

CRP Outcomes	Number of Years of Continuous Service							Total
	0-5	6-10	11-15	16-20	21-25	26-30	30+	
Accepted	261	400	536	399	221	124	132	2,073
Declined	119	182	244	182	101	57	61	946
Σ	380	582	780	581	322	181	193	3,019

The value of χ^2 (observed) would be:

$$\begin{aligned}\chi^2 &= \sum \frac{(f_e - f_o)^2}{f_e} \\ &= \frac{(243-261)^2}{261} + \frac{(397-400)^2}{400} + \frac{(523-536)^2}{536} + \frac{(366-399)^2}{399} + \frac{(218-221)^2}{221} \\ &+ \frac{(143-124)^2}{124} + \frac{(183-132)^2}{132} + \frac{(137-119)^2}{119} + \frac{(185-182)^2}{182} + \frac{(257-244)^2}{244} \\ &+ \frac{(215-182)^2}{182} + \frac{(38-57)^2}{57} + \frac{(10-61)^2}{61} + \frac{(104-101)^2}{101} \\ &= 1.2414 + 0.0225 + 0.3153 + 2.7293 + 0.0407 + 2.9113 + 19.7045 \\ &+ 2.7227 + 0.0494 + 0.6926 + 0.1813 + 6.3333 + 42.6393 \\ &= 79.5836\end{aligned}$$

$\chi^2_{0.001}$ (critical) is 22.457, hence significant at $\alpha=0.001$ with $df=6$.

**APPENDIX 2
TO ANNEX B
DSEA RESEARCH NOTE
JULY 1995**

BIVARIATE MEASURES OF ASSOCIATIONS

COMPUTATION 1: BREAKDOWN OF CRP OUTCOMES BY GENDER

CRP Takers/Decliners	Male	Female	Total
Accepted	1,310	723	2,033
Declined	424	282	706
Σ	1,734	1,005	2,739

The chi-square value for the above crosstabulation was significant ($\chi^2 = 10.827$, $df = 1$, $p < 0.05$) which indicated that a person's gender has some influence with respect to his/her decision to accept or decline a CRP offer. However, the chi-square value, by itself, did not indicate the strength nor the direction of association. Since both gender and outcomes of CRP offers are considered nominal and discrete variables, phi and lambda will be used to assess the strength of their relationship.

The value of phi (Φ) are calculated as follow:

$$\begin{aligned}\Phi &= \sqrt{\frac{\chi^2}{N}} \\ &= \sqrt{\frac{4.3455}{2739}} \\ &= 0.0398\end{aligned}$$

The result indicates a very weak association - almost none, in fact - between gender and outcomes of CRP offers.

In order to get a PRE (Proportional Reduction of Error) interpretation, lambda must be calculated:

$$\begin{aligned} \lambda &= \frac{E_1 - E_2}{E_1} \\ &= \frac{(2739 - 2033) - [(1734 - 1310) + (1005 - 723)]}{706} \\ &= 0 \end{aligned}$$

The lambda value of "0" clearly indicates that an employee's gender will not improve predictions on future outcomes of CRP offers.

COMPUTATION 2: BREAKDOWN OF CRP OUTCOMES BY AGE GROUPS, AS OF DECEMBER 1994 (DIRECTED OFFERS ONLY)

CRP Outcomes	Age Groups					Total
	20-29	30-39	40-49	50-59	60+	
Accepted	57	359	405	824	428	2,073
Declined	29	280	443	180	14	946
Σ	86	639	848	1,004	442	3,019

The above crosstabulation yielded a statistically significant result ($\chi^2 = 474.89$, $df = 4$, $p < 0.001$). Since "age" is considered a collapsed ordinal variable, it is possible to calculate the gamma (γ) for the purpose of assessing the strength and direction of association.

The formula for gamma (γ) is as follow:

$$\gamma = \frac{N_s - N_d}{N_s + N_d}$$

where,

N_s = number of pairs of cases that are ranked the same on both variables.

N_d = number of pairs of cases ranked differently on the variables.

The value of gamma (γ) would be:

		N_s
20(359 + 405 + 824 + 428)	=	58,464
280(405 + 824 + 428)	=	463,960
443(824 + 428)	=	554,636
180(428)	=	77,040
Σ		1,154,103

		N_d
14(824 + 405 + 359 + 57)	=	23,030
180(405 + 359 + 57)	=	147,780
443(359 + 57)	=	184,288
280(57)	=	77,040
Σ		371,058

$$\begin{aligned}
 \gamma &= \frac{N_s - N_d}{N_s + N_d} \\
 &= \frac{1154103 - 371058}{1154103 + 371058} \\
 &= 0.513
 \end{aligned}$$

The gamma value of 0.513 indicates a moderate, positive association between age and the outcomes of CRP offers. Specifically, the older the employee, the more likely that person will accept a CRP offer. Thus, by taking age into consideration, 51 per cent fewer errors will be made in predicting an employee's action with respect to taking/declining a CRP offer.

COMPUTATION 3: BREAKDOWN OF CRP OUTCOMES BY YEARS OF CONTINUOUS SERVICE, AS OF DECEMBER 1994 (DIRECTED OFFERS ONLY)

CRP Outcomes	Number of Years of Continuous Service							Total
	0-5	6-10	11-15	16-20	21-25	26-30	30+	
Accepted	243	397	523	366	218	143	183	2,073
Declined	137	185	257	215	104	38	10	946
Σ	380	582	780	581	322	181	193	3,019

The above crosstabulation was statistically significant ($\chi^2 = 79.584$, $df = 6$, $p < 0.001$). The level of measurement for the variables are ordinal; consequently, gamma will be the appropriate measure of association here. The gamma (γ) value will be:

	N_e
137(397 + 523 + 366 + 218 + 143 + 183)	= 250,710
185(523 + 366 + 218 + 143 + 183)	= 265,105
257(366 + 218 + 143 + 183)	= 233,870
215(218 + 143 + 183)	= 116,960
104(143 + 183)	= 33,904
38(183)	= 6,954
Σ	<u>907,503</u>

	N_d
10(143 + 218 + 366 + 523 + 397 + 243)	= 18,900
38(218 + 366 + 523 + 397 + 243)	= 66,386
104(366 + 523 + 397 + 243)	= 159,016
215(523 + 397 + 243)	= 250,045
257(397 + 243)	= 164,480
185(243)	= 44,955
Σ	<u>703,782</u>

$$\begin{aligned}\gamma &= \frac{N_s - N_d}{N_s + N_d} \\ &= \frac{907503 - 703782}{907503 + 703782} \\ &= 0.126\end{aligned}$$

The gamma value indicates a positive, weak to moderate association between years of continuous service and outcomes of CRP offers (as number of years of continuous service increase, the likelihood of accepting a CRP offer increases as well). Nonetheless, by taking the number of years of continuous service into account, only 13 per cent fewer errors will be made when predicting the future outcomes of CRP offers.

**APPENDIX 3
TO ANNEX B
DSEA RESEARCH NOTE
JULY 1995**

MULTIVARIATE ANALYSIS

To determine whether the relationships between the independent variables (gender, age and years of continuous service) and the dependent variables (CRP outcomes) are direct or spurious, it is necessary to assess the effect of each independent variable while controlling for the effect of other independent variables. Unfortunately, due to incomplete data set, it is only possible to control for gender effects. To conduct the aforementioned analysis, a statistical technique known as partial gamma will be applied.

CALCULATION 1: BREAKDOWN OF CRP OUTCOMES BY AGE GROUPS, CONTROLLING FOR GENDER, AS OF DECEMBER 1994 (DIRECTED OFFERS ONLY)

Partial Table 1: Male

CRP Outcomes	Age Groups					Total
	20-29	30-39	40-49	50-59	60+	
Accepted	17	129	160	360	237	903
Declined	4	123	234	112	8	481
Σ	21	252	394	472	245	1,384

Partial Table 2: Female

CRP Outcomes	Age Groups					Total
	20-29	30-39	40-49	50-59	60+	
Accepted	27	112	105	211	69	524
Declined	15	87	112	55	9	278
Σ	42	199	217	266	78	802

The gamma (γ_1) value for crosstabulation of CRP outcomes and age groups (male only) will be:

		N_{s1}
4(129 + 160 + 360 + 237)	=	3,544
123(160 + 360 + 237)	=	93,111
234(360 + 237)	=	139,698
112(237)	=	26,544
Σ		262,897
		N_{d1}
8(360 + 160 + 129 + 17)	=	5,328
112(160 + 129 + 17)	=	34,272
234(129 + 17)	=	34,164
123(17)	=	2,091
Σ		75,855

$$\begin{aligned}
 \gamma_1 &= \frac{N_s - N_d}{N_s + N_d} \\
 &= \frac{262897 - 75855}{262897 + 75855} \\
 &= 0.552
 \end{aligned}$$

The gamma (γ_2) value for crosstabulation of CRP outcomes and age groups (female only) will be:

		N_{s2}
15(112 + 105 + 211 + 69)	=	7,455
87(105 + 211 + 69)	=	33,495
112(211 + 69)	=	31,360
55(69)	=	3,795
Σ		76,105
		N_{d2}
9(211 + 105 + 112 + 27)	=	4,095
55(105 + 112 + 27)	=	13,420
112(112 + 27)	=	15,568
87(27)	=	2,349
Σ		35,432

$$\begin{aligned}
\gamma_2 &= \frac{N_B - N_d}{N_B + N_d} \\
&= \frac{76105 - 35432}{76105 + 35432} \\
&= 0.365
\end{aligned}$$

The partial gamma (γ_p) value will be calculated as follow:

$$\begin{aligned}
\gamma_p &= \frac{\sum N_B \sum N_d}{\sum N_B + \sum N_d} \\
&= \frac{(76105 + 262897) - (35432 + 75855)}{(76105 + 262897) + (35432 + 75855)} \\
&= \frac{287715}{510289} \\
&= 0.564
\end{aligned}$$

The first gamma value of 0.552 for the male only group indicates a moderate, positive relationship between age groups and CRP outcomes. In particular, older male employees are more likely to accept their CRP offers. The second gamma value of 0.365 for the female only group demonstrates the same relationship as the male counterpart; however, the relationship is weaker. The partial gamma value of 0.564 is roughly the same as the original gamma value of 0.513 for the crosstabulation of age groups and CRP outcomes, without controlling for gender (see Appendix 2 to Annex B). This means removing the effect of gender does not change the relationship between age groups and outcomes of CRP offers; age is more likely to affect the outcomes of CRP offers directly.

CALCULATION 2: BREAKDOWN OF YEARS OF CONTINUOUS SERVICE ON CRP OUTCOMES, CONTROLLING FOR GENDER, AS OF DECEMBER 1994 (DIRECTED OFFERS ONLY)

Partial Table 1: Male

CRP Outcomes	Number of Years of Continuous Service							Total
	0-5	6-10	11-15	16-20	21-25	26-30	30+	
Accepted	99	156	225	159	99	74	91	903
Declined	63	83	124	115	59	23	14	481
Σ	162	239	349	274	158	97	105	1,384

Partial Table 2: Female

CRP Outcomes	Number of Years of Continuous Service							Total
	0-5	6-10	11-15	16-20	21-25	26-30	30+	
Accepted	78	103	141	91	48	28	34	523
Declined	46	56	79	58	29	10	0	278
Σ	124	159	220	149	77	38	34	801

The gamma (γ_1) value for the crosstabulation between years of continuous service and outcomes of CRP offers (male only) will be:

	$N_{.1}$
63(156 + 225 + 159 + 99 + 74 + 91)	= 50,652
83(225 + 159 + 99 + 74 + 91)	= 53,784
124(159 + 99 + 74 + 91)	= 51,584
115(99 + 74 + 91)	= 30,360
59(74 + 91)	= 9,735
23(91)	= 2,093
Σ	<u>198,208</u>

		<u>N_{d1}</u>
14(74 + 99 + 159 + 225 + 156 + 99)	=	11,368
23(99 + 159 + 225 + 156 + 99)	=	16,974
59(159 + 225 + 156 + 99)	=	37,701
115(225 + 156 + 99)	=	55,200
124(156 + 99)	=	31,620
83(99)	=	8,217
Σ		<u>161,080</u>

$$\begin{aligned}
 \gamma_1 &= \frac{N_B - N_d}{N_B + N_d} \\
 &= \frac{198208 - 161080}{198208 + 161080} \\
 &= 0.103
 \end{aligned}$$

The gamma (γ_2) value for the crosstabulation between years of continuous service and outcomes of CRP offers (female only) will be:

		<u>N_{s2}</u>
46(103 + 141 + 91 + 48 + 28 + 34)	=	20,470
56(141 + 91 + 48 + 28 + 34)	=	19,152
79(91 + 48 + 28 + 34)	=	15,897
58(48 + 28 + 34)	=	6,380
29(28 + 34)	=	1,798
10(34)	=	340
Σ		<u>64,019</u>

		<u>N_{d2}</u>
0(28 + 48 + 91 + 141 + 103 + 78)	=	0
10(48 + 91 + 141 + 103 + 78)	=	4,610
29(91 + 141 + 103 + 78)	=	11,977
58(141 + 103 + 78)	=	18,676
79(103 + 78)	=	14,299
56(78)	=	4,368
Σ		<u>53,930</u>

$$\begin{aligned}
 \gamma_2 &= \frac{N_s - N_d}{N_s + N_d} \\
 &= \frac{64019 - 53930}{64019 + 53930} \\
 &= 0.085
 \end{aligned}$$

The partial gamma (γ_p) value will be:

$$\begin{aligned}
 \gamma_p &= \frac{\sum N_s - \sum N_d}{\sum N_s + \sum N_d} \\
 &= \frac{(64019 + 198208) - (53930 + 161080)}{(64019 + 198208) + (53930 + 161080)} \\
 &= \frac{47217}{477237} \\
 &= 0.099
 \end{aligned}$$

Looking at the results of the gammas and the partial gamma, it is clear that the number of years of continuous service actually only has a effect on the outcomes of CRP offers, once the effects of gender is removed. This is shown by the smaller partial gamma value of 0.099 in contrast to the original gamma value of 0.126. Therefore, the relationship between years of continuous service and CRP outcomes may be spurious and interactive, since there is still a weak indication of association for the male group ($\gamma_1 = 0.103$) while none for the female group ($\gamma_2 = 0.085$).

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CRP Analysis
Personnel Cutbacks
Work Force Adjustment Directive

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