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**1981 Census of Canada
Public Use Sample Tapes
Income Data**

NOTE:

Please find enclosed, a paper, prepared by Mr. A. Rashid of our Consumer Income and Expenditure Division, describing the special treatment of the income variables on the 1981 Public Use sample Tapes.

This paper explains both the procedures taken to ensure confidentiality and their impact on the income data.

Questions concerning this paper should be directed to Mr. Rashid or one of his staff at (613) 990-9730.

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1981 Census of Canada

PUBLIC USE SAMPLE TAPES
INCOME DATA

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August 1984

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I. INTRODUCTION

From the 1981 Census data base, two smaller micro-data files, known as Public Use Sample Tapes (PUST), have been created. One file contains individual records and the other covers households and families. The various methodological, technical and content aspects of these tapes are documented elsewhere and will be available to users. This paper describes the special treatment of one variable - income. In planning these tapes, it was deemed essential to devise procedures to guard against the possibility of associating a particular income record with an identifiable individual. These procedures and their impact on income data are described below. Also included is an overall evaluation of the income data from the two tapes.

II. PUST (INDIVIDUAL)

1. Rounding and Adjustment of High Incomes and Losses

The records on the individual file were subjected to two separate operations. Initially, all amounts beyond certain pre-specified limits were rounded to the limits. Further adjustments were then made to clean these records.

(a) Rounding to Limits

The individual file consists of 372,130 records, of which 316,539 are income recipients from one or more sources of income. For confidentiality considerations, it was decided to set upper and lower limits for amounts in wages and salaries, self-employment income, investment income, miscellaneous (retirement and other money) income, and total income. Government transfer payments were to remain unchanged. All amounts beyond the specified limits, i.e. below the negative or above the positive limits, were to be rounded to the limits as prescribed in the rules in Appendix A.

Based on these criteria, 315,656 records, or 99.7% of the total sample with income, were accepted without a change. The remaining 883 records, or less than 3 in 1,000, had either a source or total income or both outside the limits imposed by confidentiality consideration. Table 1 provides a distribution of these cases by sources outside limits. In about one-third of these, the source amounts were within limits but the total income exceeded the limit. Only 28 individuals reported incomes in excess of the limits in

more than one source. For the remaining cases (a single source in excess), wages and self-employment each accounted for two-fifths and investment income for one-fifth. There was a small number of cases (26) where total income was within limits but one or more income sources were not. These involved individuals who reported both positive and negative amounts in their sources. In all other cases, when a source was outside the limits, so was the total income. As a first step, amounts in excess of limits were rounded to the limits.

(b) Adjustments for Consistency

The above procedure resulted in certain inconsistencies in most of the records subjected to rounding. The reasons were as follows:

- (i) If only the total income was rounded, the sources will add up to the original total.
- (ii) If only the sources were rounded and not the total (which might happen in the case of large negative amounts), the sum of sources will be larger than the total income.
- (iii) If more than one source as well as the total were rounded, the sum of sources will be larger than the total.
- (iv) In all cases involving rounding, the sum of sources will exceed the total if an amount was present for government transfer payments.

Therefore, in order to ensure consistency within each of the 883 records subject to the rounding procedure, further adjustments to the four sources and the total income were undertaken as specified in Appendix B. Of the 883 records subject to rounding, 77 did not require any change and 752 required adjustment of the sources. After these adjustments, the existing total income was replaced by the true sum of income sources including government transfer payments. In one case, where the final positive and negative sources added to zero, the total income was changed to one dollar in order to identify the universe with income.

2. Impact of Changes

As already stated, the proportion of records changed is very small. In a large majority of the cases, where a source was rounded, further changes were required due to the second round of adjustment described above. As Table 2 shows, whenever the second round of adjustment was necessary, it was applied to

each of the income sources other than transfer payments. This was done in order to avoid changing the interrelationship between these sources. On the whole, records of about one-fourth of 1% of all income recipients were changed.

As far as total income is concerned, almost the entire change is due to rounding. Within the sources, most of the change is due to rounding except in the case of miscellaneous (retirement pensions and other) income. There were only four cases where both rounding and adjustment were applied for this source. In the remaining 90 cases, only the downward adjustment was applied in the second round. Thus, for this source, the major part of the change comes from the secondary adjustment.

On the whole, the above changes led to a reduction of about \$39 million, or less than 1% of the original aggregate income. About 51% of this total reduction occurred in wages and salaries, 19% in self-employment, 28% in investment income and less than 2% in miscellaneous income. Calculated for the records changed, the reduction is significant, averaging about \$44,500 per record. However, when spread over all income recipients, the average reduction in total income amounts to \$124, about 1%. By source, wages were reduced by 0.6% as were retirement pensions and other money income. Self-employment income was reduced by 2.9% and investment income by 3.8%. The initial rounding contributed about two-thirds of the total reduction in the various sources. The secondary adjustments had no significant impact on the already rounded total income. As the last two rows in Table 2 show, these changes did not change the composition of income in any significant manner.

III. PUST (HOUSEHOLD/FAMILY)

1. Partial Replacement of the Sample

The household/family file consists of 82,808 household records. When the original sample was examined in the light of the criteria set in Appendix A, it was found that the income of an individual or a family or a household will be subject to rounding in 470 of these households.

The confidentiality and consistency problems became much more complex when the application of the rounding procedure was considered for the

household file. Unlike the individual file, no simple procedure could be found to make adjustments to bring about internal consistency in the 470 household records in question. It was also considered inappropriate to drop these records from the sample as this would introduce a significant downward bias in incomes.

The problem was resolved by replacing the 470 records by households which did not violate any of the conditions in Appendix A. To minimize changes to income from the original sample, three further conditions were laid down for replacement:

- (a) A rejected record was replaced by another from the same province/census metropolitan area.
- (b) The rejected households were classified by household type: households with two or more persons, one-person (male) households and one-person (female) households. Each rejected household was replaced by matching the type of the household.
- (c) Depending on the province of residence and the type of household, the replacement records were to have a total household income between \$60,000 and \$150,000.

2. Impact of Changes

As stated above, only 470 or about one-half of 1% of the original sampled households were replaced. The changes in household incomes as a result of this resampling are shown in Table 3. The overall impact of this change was a reduction of about \$21 million or about 1% in the aggregate income. A major part of the reduction, about 46%, occurred in aggregate wages and salaries and another 34% occurred in aggregate investment income. The former aggregate was reduced by 0.6% and the latter by 5.1%. The average income of the originally sampled 470 households was \$152,867. These were replaced by households with an average income of \$107,181. Thus, the average total income in these households was reduced by \$45,686. However, when this reduction is spread over all households, the average effect is a reduction of \$259. The procedure had no significant impact on the composition of household income.

IV. EVALUATION

1. Aggregate Income

A detailed evaluation of 1981 Census income data was undertaken and the results are included in a paper "1981 Census of Canada, Evaluation of 1980 Income Data" dated August 1983. That paper compares and reconciles census income aggregates from various sources of income with similar aggregates in the national accounts. Table 4 extracts the aggregates of the main components of income from that paper and incorporates the relevant weighted aggregates derived from the PUST (individuals). As expected, the difference between the national accounts and PUST aggregates of total income from comparable sources is slightly larger than in the case of aggregates from the main census base. Most of the change is due to the rounding process. However, even if no rounding of high incomes was undertaken, the differences in sampling variance between census and PUST estimates would result in minor differences in reconciliation of the two estimates with the national accounts estimates.

Table 5 distributes the weighted aggregate income from the main census base and the PUST by province. The aggregate from the PUST is smaller by about \$1,481 million. This is not unexpected in the light of the rounding of high incomes described earlier. The rounding limit for negative incomes reduced the aggregate loss by about \$194 million while the upper limit reduced the positive aggregate by about \$2,158 million. The net result was a reduction of aggregate income by about \$1,964 million on the PUST.

2. Average Income

Table 6 compares average incomes of individuals, census families, non-family persons and households from the two Public Use Sample Tapes and the main census data base. At the national level, the differences in the average income of individuals, families and households are around 1%, as may be expected from the rounding/resampling procedures described earlier. Most of the provincial differences are close to the national difference. In the case of the smaller provinces, the differences may be somewhat larger due to relatively larger sampling variability.

3. Income Size Distributions

In Tables 7-10, percentage distributions of individuals, census families, non-family persons and households by income size groups from the two Public Use Sample Tapes are compared with those published in 1981 Census reports derived from the main census data base. As can be seen, the differences between the four sets of distributions are insignificant.

V. CONCLUSION

The income data in the Public Use Sample Tapes from the 1981 Census have been manipulated to safeguard the anonymity of individuals, families and households. The overall impact of the various procedures is very small on average incomes, income size distributions, composition of income and other summary income statistics. However, the changes are not insignificant in the case of high incomes which have been restricted within certain limits. Accordingly, the Public Use Sample Tapes are not an appropriate basis for analyzing the two extremes of the distribution or focussing on detailed inequality issues. Researchers interested in these topics should obtain, by special request, data for their purposes from the total census data base that are not affected by the adjustments described in this paper.

TABLES

Table 1. Distribution of Individuals with Incomes Outside Positive and Negative Limits (1) in 1980, PUST (Individual), 1981 Census

Source outside limits	Number	Per cent
<u>One source</u>		
Wages and salaries	220	24.9
Self-employment income	221	25.0
Investment income	113	12.8
Other money income	3	0.3
<u>Two sources</u>		
Wages and self-employment	4	0.5
Wages and investment	18	2.0
Self-employment and investment	4	0.5
Investment and other money income	1	0.1
<u>Three sources</u>		
Wages, self-employment and investment	<u>1</u>	<u>0.1</u>
	585	66.3
<u>Total income only</u>	<u>298</u>	<u>33.7</u>
TOTAL	883	100.0

(1) See Appendix A for limits.

Table 2. Number of Individuals, Their Original and Changed Aggregate and Average Incomes, by Source, and Composition of Income in 1980, PUST (Individual), 1981 Census

Number, aggregate income average income and composition of income	Wages and salaries	Self-employment income	Investment income	Retirement pensions and other money income	Government transfer payments	Total income
1. <u>Number of records</u>						
(a) Total	372,130	372,130	372,130	372,130	372,130	372,130
(b) With income	235,428	22,551	101,032	24,533	155,008	316,539
(c) Changed	530	381	614	94	-	879
- rounded only	42	63	39	-	-	88
- adjusted only	287	151	477	90	-	22
- rounded and adjusted	201	167	98	4	-	769
(d) Per cent changed (c/b)	% 0.23	1.69	0.61	0.38	-	0.28
2. <u>Aggregate income</u>						
				<u>Dollars ('000)</u>		
(a) Original	3,121,773	258,734	287,887	104,100	345,450	4,117,945
(b) Change	-20,082	-7,527	-11,051	-624	-	-39,284
- due to rounding	-14,914	-5,153	-6,844	-183	-	-39,321
- due to adjustment	-5,167	-2,374	-4,208	-441	-	37
(c) Final	3,101,691	251,207	276,836	103,475	345,450	4,078,660
(d) Per cent change (b/a)	% -0.64	-2.91	-3.84	-0.60	-	0.95

Table 2. Number of Individuals, Their Original and Changed Aggregate and Average Incomes, by Source, and Composition of Income in 1980, PUST (Individual), 1981 Census - Concluded

Number, aggregate income average income and composition of income	Wages and salaries	Self- employment income	Investment income	Retirement pensions and other money income	Government transfer payments	Total income
<hr/>						
3. <u>Average income</u>	<u>Dollars</u>					
(a) Original per recipient	13,260	11,473	2,849	4,243	2,229	13,009
(b) Change per record changed	-37,890	-19,756	-17,999	-6,643	-	-44,692
- due to rounding	-61,376	-22,404	-49,954	-45,783	-	-45,883
- due to adjustment	-10,589	-7,466	-7,318	-4,695	-	47
(c) Change per recipient	-85	-334	-109	-25	-	-124
(d) Final per recipient	13,175	11,140	2,740	4,218	2,229	12,885
<hr/>						
4. <u>Composition of income</u>						
(a) Original	75.81	6.28	6.99	2.53	8.39	100.00
(b) Final	76.05	6.16	6.79	2.54	8.47	100.00

Table 3. Number of Households, Their Original and Changed Aggregate and Average Incomes, by Source, and Composition of Income in 1980, PUST (Household/Family), 1981 Census

Number, aggregate income average income and composition of income	Wages and salaries	Self-employment income	Investment income	Retirement pensions and other money income	Government transfer payments	Total income
1. <u>Number of records</u>	82,808	82,808	82,808	82,808	82,808	82,808
2. <u>Aggregate income</u>	<u>Dollars ('000)</u>					
(a) Original, total	1,545,681	121,890	141,759	51,115	168,465	2,028,910
(b) Changes (470 records)	-9,954	-3,634	-7,279	-792	186	-21,472
- original	37,289	14,014	18,148	1,813	584	71,848
- replacement	27,335	10,381	10,869	1,021	770	50,375
(c) Final	1,535,727	118,256	134,480	50,323	168,651	2,007,437
(d) Per cent change (b/a)	% -0.64	2.98	-5.13	-1.55	0.11	1.06
3. <u>Average income per household</u>	<u>Dollars</u>					
(a) Original	18,666	1,472	1,712	617	2,034	24,501
(b) Changed (470 records)	-21,178	-7,732	-15,487	-1,686	396	-45,686
- original	79,338	29,818	38,612	3,858	1,242	152,867
- replacement	58,160	22,086	23,125	2,172	1,638	107,181
(c) Overall change	-120	-44	-88	-9	3	-259
(d) Final	18,546	1,428	1,624	608	2,037	24,242
4. <u>Composition of income</u>						
(a) Original	76.18	6.01	6.99	2.52	8.30	100.00
(b) Final	76.30	5.89	6.70	2.51	8.40	100.00

Table 4. Comparison Between Census, PUST and Adjusted(1) Personal Income Estimates, by Source of Income, 1980

Source of income	Census income estimates(2)	PUST income estimates(3)	Adjusted personal income estimates(2)	Difference	
				Census/ personal income	PUST/ persona income
		\$ '000,000			%
Wages and salaries	155,931.2	155,084.6	153,532.0	1.6	1.0
Self-employment income	12,687.2	12,560.4	13,811.6	-8.1	-9.1
Investment income	14,353.8	13,841.8	19,553.0	-26.6	-29.2
Government transfer payments	17,275.7	17,272.5	21,772.8	-20.7	-20.7
TOTAL(4)	200,248.1	198,759.3	208,669.4	-4.0	-4.7

(1) Adjustments to the Personal Income Estimates in the National Accounts were to compensate for differences of concepts and coverage.

(2) From Table 32 in "1981 Census of Canada, Evaluation of 1980 Income Data", August 1983.

(3) 1981 Census Public Use Sample Tape for individuals.

(4) Total of comparable sources only; excludes retirement pensions and other money income.

Table 5. Distribution of Aggregate Income of Individuals in 1980, by Province - Census and PUST (Individual) Estimates

Province	Dollars		Per cent		Difference PUST/Census
	Census(1)	PUST	Census	PUST	
	\$'000,000		%		
Newfoundland	3,204.9	3,197.2	1.56	1.57	-0.2
Nova Scotia	5,706.3	5,657.8	2.78	2.77	-0.8
New Brunswick	4,383.1	4,349.3	2.13	2.13	-0.8
Quebec	50,363.2	50,292.5	24.52	24.66	-0.1
Ontario	76,880.2	76,179.9	37.43	37.36	-0.9
Manitoba	7,886.7	7,739.3	3.84	3.80	-1.9
Saskatchewan	7,647.6	7,618.8	3.72	3.74	-0.4
Alberta	21,551.1	21,374.9	10.49	10.48	-0.8
British Columbia	26,488.9	26,233.0	12.90	12.86	-1.0
CANADA(2)	205,413.7	203,933.0	100.00	100.00	-0.7

(1) Main 1981 Census data base without random rounding.

(2) Includes residual areas: Prince Edward Island, Yukon and Northwest Territories.

Table 6. Average Income of Individuals, Census Families, Non-family Persons and Private Households in 1980 - Census and PUST

		Canada(1)	Newfound- land	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskat- chewan	Alberta	British Columbia
1. <u>Individuals with income</u>											
Census(2)	\$	12,993	10,464	10,785	10,423	12,457	13,315	11,674	12,421	14,691	14,239
PUST (Individual)	\$	12,885	10,552	10,638	10,311	12,420	13,182	11,426	12,318	14,553	14,108
Difference	%	-0.8	0.8	-1.4	-1.1	-0.3	-1.0	-2.1	-0.8	-0.9	-0.9
2. <u>Census Families</u>											
Census(3)	\$	26,748	20,971	21,872	21,155	25,105	28,002	24,455	25,438	30,390	29,132
PUST (Household/Family)	\$	26,471	20,882	21,626	20,653	25,080	27,594	24,220	26,042	29,450	28,866
Difference	%	-1.0	-0.4	-1.1	-2.4	-0.1	-1.5	-1.0	2.4	-3.1	-0.9
3. <u>Non-family Persons</u>											
Census(4)	\$	10,984	7,767	8,804	8,238	9,988	11,488	9,969	10,347	12,590	12,221
PUST (Household/Family)	\$	10,990	8,196	9,144	8,315	10,045	11,374	9,678	10,438	12,694	12,211
Difference	%	0.1	5.5	3.9	0.9	0.6	-1.0	-2.9	0.9	0.8	-0.1
4. <u>Private households</u>											
Census(5)	\$	24,460	21,198	20,476	20,112	22,869	25,577	21,721	22,637	27,969	26,171
PUST (Household/Family)	\$	24,242	21,197	20,399	19,690	22,822	25,227	21,447	23,096	27,394	25,959
Difference	%	-0.9	0.0	-0.4	-2.1	-0.2	-1.4	-1.3	-2.0	-2.1	-0.8

(1) Includes residual areas: Prince Edward Island, Yukon, and Northwest Territories.

(2) 1981 Census of Canada, Population, Total Income, Catalogue No. 92-928.

(3) 1981 Census of Canada, Census Families in Private Households, Income, Catalogue No. 92-936.

(4) 1981 Census of Canada, Population, Private Households, Census Families in Private Households, Income, Catalogue Nos. 93-949 to 93-960.

(5) 1981 Census of Canada, Private Households, Income, Catalogue No. 92-934.

Table 7. Percentage Distribution of Individuals 15 Years and Over, With Income, by 1980 Income Size Groups, Canada - Census and PUST (Individual)

Income size	Census(1)	PUST
	Per cent	
Under \$2,000	11.8	11.7
\$ 2,000 - 3,999	9.9	9.9
4,000 - 5,999	12.6	12.6
6,000 - 7,999	8.1	8.0
8,000 - 9,999	7.0	7.0
10,000 - 11,999	6.9	6.9
12,000 - 14,999	9.5	9.5
15,000 - 19,999	12.5	12.5
20,000 - 24,999	9.2	9.2
25,000 - 29,999	5.2	5.2
30,000 and over	7.2	7.2
Total	100.0	100.0
Average income	\$ 12,993	12,885
Median income(2)	\$ 10,179	10,209

(1) 1981 Census of Canada, Population, Total Income, Catalogue No. 92-928.

(2) Calculated from the distribution in this table.

Table 8. Percentage Distribution of Census Families in Private Households by 1980 Family Income Size Groups, Canada - Census and PUST (Household/Family)

Family income size	Census(1)	PUST
	Per cent	
Under \$5,000	4.8	4.7
\$ 5,000 - 7,999	4.7	4.5
8,000 - 9,999	5.2	5.2
10,000 - 11,999	4.8	4.7
12,000 - 14,999	6.9	6.9
15,000 - 16,999	4.9	4.9
17,000 - 19,999	7.8	7.8
20,000 - 21,999	5.8	5.9
22,000 - 24,999	8.3	8.1
25,000 - 29,999	12.7	13.0
30,000 - 34,999	10.4	10.4
35,000 - 44,999	12.6	12.4
45,000 and over	11.3	11.4
Total	100.0	100.0
Average income	\$ 26,748	26,471
Median income(2)	\$ 23,900	23,966

(1) 1981 Census of Canada, Census Families in Private Households, Income, Catalogue No. 92-936.

(2) Calculated from the distribution in this table.

Table 9. Percentage Distribution of Non-family Persons, 15 Years and Over, by 1980 Income Size Groups, Canada - Census and PUST (Household/Family)

Income size	Census(1)	PUST
	Per cent	
Under \$1,000	7.6	7.4
\$ 1,000 - 1,999	2.9	2.8
2,000 - 2,999	3.4	3.3
3,000 - 3,999	4.8	4.8
4,000 - 4,999	9.6	9.6
5,000 - 5,999	11.7	11.7
6,000 - 7,999	9.4	9.5
8,000 - 9,999	7.4	7.4
10,000 - 11,999	7.1	6.9
12,000 - 14,999	9.7	9.7
15,000 - 19,999	11.5	12.2
20,000 - 24,999	7.1	7.1
25,000 and over	7.7	7.7
Total	100.0	100.0
Average income	\$ 10,984	10,990
Median income(2)	\$ 8,138	8,243

(1) 1981 Census of Canada, Census Families in Private Households, Income, Catalogue No. 92-936.

(2) Calculated from the distribution in this table.

Table 10. Percentage Distribution of Private Households by 1980 Household Income Size Groups, Canada - Census and PUST (Household/Family)

Household income size	Census(1)	PUST
	Per cent	
Under \$5,000	7.6	7.6
\$ 5,000 - 9,999	13.5	13.4
10,000 - 14,999	12.7	12.6
15,000 - 19,999	12.6	12.7
20,000 - 24,999	12.8	12.7
25,000 - 29,999	11.0	11.2
30,000 - 34,999	8.9	8.9
35,000 - 44,999	10.8	10.6
45,000 and over	10.2	10.3
Total	100.0	100.0
Average income	\$ 24,460	24,242
Median income(2)	\$ 21,423	21,459

(1) 1981 Census of Canada, Private Households, Income, Catalogue No. 92-934.

(2) Calculated from the distribution in this table.

APPENDICES

APPENDIX A

1981 Census PUST - Income Limits

(1) Income Limits - On the Individual PUST as specified below in (2), the amounts below the negative or above the positive limits are rounded to the limits for wages and salaries, self-employment income, investment income, retirement and other money income, and total income:

	<u>Below</u>	<u>Above</u>
Limit 1 (L1)	-30,000	75,000
Limit 2 (L2)	-50,000	100,000
Limit 3 (L3)	-50,000	150,000

<u>(2) Application of Limits</u>	<u>Atlantic Region</u>	<u>Other Areas</u>
<u>Individual Income</u>		
Males	L1	L2
Females	L1	L1
<u>Family Income</u>		
Husband-wife and lone-(male) parent families		
(a) 1 income recipient (male)	L1	L2
(b) 1 income recipient (female)	L1	L1
(c) Other	L3	L3
Lone-(female) parent families:		
(a) 1 income recipient	L1	L1
(b) Other	L3	L3
<u>Household Income</u>		
(a) 1 income recipient (male)	L1	L2
(b) 1 income recipient (female)	L1	L1
(c) Other	L3	L3

(3) Household/Family PUST

The sample for the Household/Family PUST was chosen in a manner that the records do not violate the above limits and, therefore, no rounding was necessary.

APPENDIX B

Adjustments Made on the PUST (Individual) to Remove Inconsistencies Introduced by Rounding

I. Adjustment of Sources

(1) If $A > 0$ and $B > 0$ and $A < B$
then $S_f = (S_i)(C/D)$

(2) If $A < 0$ and $B < 0$ and $A > B$
then $SE_f = SE + A - B$

(3) No adjustment in all other cases

II. Adjustment of Total Income

(1) $Y =$ Sum of sources (after adjustments in I above) including transfer payments

(2) $Y = 1$, if sum of sources including transfer payments = 0

A = Total income after rounding

B = Sum of sources after rounding

C = A less transfer payments

D = B less transfer payments

S_i = Rounded wages, self-employment, investment and miscellaneous

S_f = Final wages, self-employment, investment and miscellaneous

SE = Rounded self-employment income

SE_f = Final self-employment income

Y = Final total income on PUST

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