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The 1950 Census and the Post-Enumeration Survey

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Introduction

This paper will describe the Post-Enumeration Survey of the 1950 Censuses of Population, Housing, and Agriculture. We shall be concerned mainly with what the PES has to say about the accuracy of the 1950 census percentage distributions of the population with respect to income. We shall also strive to make clear the methods and techniques of the PES, as well as its assumptions and limitations.

DEFINITIONS USED

The PES provides a basis for evaluating both the data and the statistics of the 1950 censuses. By a *datum,* we mean an edited and coded recording of an individual response to a census inquiry. By a *statistic,* we mean any result of a tabulating and computing operation carried out on data; a total, a median, or a percentage.

We use the term *gross error* to refer to errors in data; for example, the failure to list a person on the rolls of the census, the erroneous reporting, recording, or coding of income. We use the term *net error* to refer to errors in statistics, deviations from "true values."

INTERPRETATION OF RESULTS

The PES results can be viewed in two ways: first, as estimates of difference between two enumerations of the same population; second, as estimates of error in the original enumeration. In this paper, we shall in most cases take the latter position. The assumptions on which this view is based are set forth in the next section.

Tables 1 and 2 provide some results relating to the income data of the 1950 Census of Population. There were errors in obtaining in-

come data in the PES as well as in the 1950 census. Hence, with regard to the evaluation of data, we take the first position stated above. The PES furnishes estimates of gross difference between the data obtained in two enumerations of the same population, and not of gross error in the 1950 census. Yet we regard the PES as accurate enough to evaluate the net errors of the 1950 census.

QUANTITATIVE ESTIMATES OF ERROR

At present, only a start has been made by the Bureau of the Census in the development of methods for measuring accuracy. Some of this work has been documented.[1] Beginning in 1945, we have been experimenting with two methods, the record check and the re-enumerative check. The PES incorporated both. The papers in this volume that compare census data with data of the Survey Research Center, the Bureau of Old-Age and Survivors Insurance, and the Internal Revenue Service are based on information derived from the PES. This paper is concerned with the re-enumerative check of the PES.

THE NATURE OF THE CHECK

Four or five months after the start of the original census enumeration on April 1, 1950, intensive recanvasses were made of samples of small areas designed to represent the United States. The object was to find people, dwellings, and farms that were missed in the original enumeration. At the same time, and mostly in the same areas, intensive reinterviews were conducted with a sample of the population enumerated in the census in the hope of obtaining information of sufficient accuracy to evaluate that obtained in the original enumeration. The check was designed along the following lines:

1. It was as close to a "maximum intensity" procedure as could be designed. Contrast, for example, the probing-type questions used to obtain income data in the PES with the global-type questions of the census enumeration (see the appendix, Exhibits A-1 and A-2). Roughly twenty times more money was spent per case than in the original enumeration. In the census enumeration, a single individual could answer for all members of a household; in the check, the "best" respondent had to be sought out, even at the expense of repeated calls. The "best" respondent was generally regarded as the person for whom the information was required. Thus, in general, each adult was queried about his own income.

[1] A. Ross Eckler and Leon Pritzker, "Measuring the Accuracy of Enumerative Surveys," paper presented before the 27th Session of the International Statistical Institute, New Delhi, India, December 5, 1951.

2. About 250 superior interviewers were obtained, given more training, and provided with closer supervision than was possible for the 130,000 census enumerators.

3. The check provided for case-by-case comparison and, usually, reconciliation. The interviewers, for example, were provided with transcripts of the original income data obtained for 95 out of every 100 persons in the "personal income subsample." They were instructed not to examine these transcripts until they had obtained responses to their questions.

Major Assumptions Underlying the PES

We have stated our view that the PES results provide estimates of net error in the income statistics of the 1950 census. Four major assumptions are required for this position. Not one of them can be accepted unreservedly, and to the extent that they cannot, they limit the validity of the PES results.

TRUE VALUES EXIST

This is the assumption that there was a precisely defined true value for the income in 1949 of everyone in the United States. In the light of the definitions and instructions provided in the Enumerator's Reference Manual for the 1950 census, however, there was at least one case in which two income analysts, in possession of "all the facts" and employing the same definitions, would differ as to the amount of income. We do not know how common such disagreements would be, but we assume that they would not have any significant effect.

There is a deeper problem, however; the "true values" sought by the Bureau of the Census may not meet the requirements of some users of the statistics. The PES does not furnish any data on this; the census definitions were used as a basis for the PES inquiries.

"BETTER" METHODS LEAD TO GREATER ACCURACY

Largely on a priori grounds, it has been held that the addition of certain features constitutes "improvement"—features like probing interviews, insistence on the "best" respondent, intensive training and supervision of personnel, in fact all the special features employed in the PES. These improvements, it is held, show up in more accurate data and statistics. Thus, it is argued that the PES was "better" than the census, in fact sufficiently accurate to evaluate the census.

There is an obvious limitation to this assumption. Both the census

and the PES made use of interview methods and both were subject to some of the inherent limitations of such methods.

THE TIME LAG DID NOT ADVERSELY AFFECT THE PES RESULTS

In our judgment, this assumption is false, at least as far as the results relating to the number of persons missed in the original enumeration are concerned. The PES check underestimated the extent of underenumeration in the 1950 census. One reason was that the PES interviewers were unable to account for all the missed people who changed their residence during the period between the onset of the census and the onset of the check.

The validity of the assumption in regard to the reporting of income is also important. The census inquiries about income in 1949 were conducted almost entirely in April and May 1950. The PES inquiries, also directed at 1949, were conducted almost entirely in August and September 1950. Was there any significant deterioration in the respondents' memories? We do not know; we assume that there was not, especially since the PES inquires were, at least a priori, better designed to restore or refresh memory.

CERTAIN CENSUS OPERATIONS DID NOT REQUIRE CHECKING

The punching, tabulating, reviewing, and publishing operations of the census were believed sufficiently controlled. The PES results do not indicate any of the errors that may have arisen during these operations. They reflect only the errors arising from three activities of the census; enumeration, editing, and coding.

Gross Differences and Net Errors: Total Income of Persons

The starting points for study of the PES results are tables like Tables 1 and 2. They provide a first view of the sources of error in census statistics. Although we are dealing with gross differences rather than gross errors, we believe that the tables afford a fairly realistic conception of the relative contribution of each source of error. We shall not attempt any detailed description of the sources of error or of the gross differences, but we call attention to two results shown in the tables:

1. If the PES had been conducted on the entire population of the United States, about 40 per cent of the males and about 25 per cent of the females would have been assigned to different income classes from the ones they had been assigned to in the census. (These estimates exclude the contributions of nonresponse and of errors and differences in defining the population; not enumerating

TABLE 8

1949 Income of Males: Estimated PES Distribution by 1950 Census Distribution
(estimates in thousands rounded without adjustment to group totals, which are independently rounded)

Column groups: "Misclassified" and "Omitted" fall under **Not included in census income distribution**; "Total census" through "Income not reported" fall under **Income in census**.

TRAIT	Adjusted[a]	Not adjusted	Misclassified[b]	Omitted	Population enumerated in census and PES	Total census[d]	None	Under $500[c]	$500–$999	$1,000–$1,499	$1,500–$1,999	$2,000–$2,499	$2,500–$2,999	$3,000–$3,499	$3,500–$3,999	$4,000–$4,499	$4,500–$4,999	$5,000–$5,999	$6,000–$6,999	$7,000–$9,999	$10,000 and over	Income not reported
TOTAL CENSUS[d]	55,438	55,438	233	1,404	53,801	54,601	6,350	4,682	4,633	4,281	4,083	5,198	4,767	5,198	3,335	2,398	1,347	1,832	818	889	929	3,862
Not included in PES income distribution																						
Misclassified[b]						197	72	20	10	10	0	10	0	0	0	0	9	0	0	0	9	66
Erroneously included						603	112	19	77	76	63	63	41	29	5	0	0	10	0	11	11	86
Population enumerated in census and PES					53,801																	
Income in PES / Total PES	55,438	55,438	233	1,404	53,801	53,801	6,166	4,643	4,546	4,195	4,020	5,125	4,726	5,169	3,330	2,398	1,338	1,822	818	878	918	3,710
None	5,435	4,999	55	137	4,807	4,807	3,475	381	94	61	20	51	41	27	19	11	10	21	0	0	9	587
Under $500[c]	5,089	4,664	0	137	4,527	4,527	898	2,724	440	122	52	19	11	19	19	20	0	37	0	0	29	137
$500–999	5,038	4,608	0	133	4,475	4,475	461	498	2,476	356	173	100	64	29	31	34	11	17	35	16	11	177
$1,000–1,499	4,542	4,093	0	107	3,986	3,986	226	301	597	2,055	283	170	55	15	21	19	0	0	0	0	63	165
$1,500–1,999	4,885	4,613	16	103	4,494	4,494	258	113	306	606	2,307	468	79	73	60	22	21	5	5	0	9	162
$2,000–2,499	5,196	4,896	0	106	4,790	4,790	143	95	114	274	589	2,505	561	183	9	31	5	53	0	0	20	219
$2,500–2,999	5,410	5,188	14	105	5,069	5,069	42	23	37	50	191	985	2,831	449	103	47	19	30	21	0	0	221
$3,000–3,499	5,346	5,110	48	91	4,971	4,971	39	0	0	66	58	236	507	3,198	323	44	19	137	24	51	21	240
$3,500–3,999	3,986	3,918	5	55	3,858	3,858	34	6	29	90	48	123	143	588	2,192	206	105	34	20	0	0	236
$4,000–4,499	3,076	3,028	0	45	2,983	2,983	67	10	10	15	0	50	118	222	333	1,678	250	59	82	9	9	90
$4,500–4,999	1,375	1,292	0	15	1,277	1,277	0	9	0	0	10	37	63	26	34	102	659	260	5	0	20	35
$5,000–5,999	1,721	1,635	0	18	1,617	1,617	16	11	0	26	0	10	24	79	46	91	102	933	114	55	10	102
$6,000–6,999	695	552	0	17	535	535	0	5	9	0	5	11	0	10	27	23	45	102	214	49	9	39
$7,000–9,999	1,099	1,049	0	16	1,033	1,033	37	9	4	5	10	21	0	10	40	22	9	39	126	534	99	68
$10,000 and over	933	859	0	18	841	841	34	33	0	20	0	37	5	5	5	0	0	9	29	114	535	13
Income not reported	1,613	2,929	95	120	2,714	2,714	264	298	194	140	168	116	83	74	19	38	49	39	119	50	60	1,003
Age not reported[e]		2,006		181	1,825	1,825	172	127	236	309	104	184	139	162	49	10	34	47	24	0	14	214

Note: Figures are for persons fourteen years old and over here and in all subsequent tables unless otherwise noted.
[a] Adjusted by assigning income recorded in census to persons for whom income or age was not reported in PES.
[b] As under fourteen years old in census.
[c] Includes income classes "loss" and "even" here and in all subsequent tables.
[d] Census totals are based on a 20 per cent sample.
[e] As fourteen years old and over in census.

TABLE 2

1949 Income of Females: Estimated res Distribution by 1950 Census Distribution

(estimates in thousands rounded without adjustment to group totals, which are independently rounded)

rnax	Total res Adjusted[a]	Total res Not adjusted	Misclassified[c]	Omitted	Population enumerated in census and res	Total census[d]	None	Under $500[e]	$500–$999	$1,000–$1,499	$1,500–$1,999	$2,000–$2,499	$2,500–$2,999	$3,000–$3,499	$3,500–$3,999	$4,000–$4,499	$4,500–$4,999	$5,000–$5,999	$6,000–$6,999	$7,000–$9,999	$10,000 and over	Income not reported
TOTAL CENSUS[d]	57,932	57,932	126	1,271	56,535	57,102	30,534	6,996	4,304	3,015	2,822	2,535	1,393	825	346	213	107	148	66	29	97	3,623
Not included in res income distribution:																						
Misclassified[c]						119	58	20	0	0	0	0	10	0	0	11	0	0	0	0	0	61
Erroneously included						448	206	20	61	0	62	20	10	0	0	11	0	0	0	0	0	58
Population enumerated in census and res					56,535	56,535	30,270	5,976	4,243	3,015	2,760	2,515	1,383	823	346	202	107	148	66	79	97	3,504
Income in res — Total res					27,525																	
None	29,625	28,037	20	492	27,525	27,525	23,868	944	354	162	96	115	74	124	31	24	0	20	0	0	39	1,674
Under $500[e]	8,802	8,398	0	162	8,236	8,236	2,700	4,723	379	72	34	34	43	0	0	0	0	11	0	0	10	230
$500–999	5,134	4,908	0	132	4,776	4,776	999	595	2,716	251	21	38	10	9	9	0	0	9	10	0	10	146
$1,000–1,499	3,521	3,317	64	64	3,189	3,189	409	128	439	1,826	251	69	22	16	9	10	0	0	0	10	0	49
$1,500–1,999	3,427	3,281	0	76	3,205	3,205	315	68	68	362	1,846	241	72	0	20	10	0	0	0	0	0	133
$2,000–2,499	2,663	2,555	0	54	2,501	2,501	95	58	46	90	270	1,595	133	29	10	0	0	0	0	10	0	175
$2,500–2,999	1,476	1,417	0	29	1,388	1,388	88	58	0	19	45	238	820	76	10	0	0	10	0	10	0	72
$3,000–3,499	920	903	0	24	879	879	45	5	0	19	41	58	114	489	68	5	0	10	10	0	0	10
$3,500–3,999	345	335	0	1	334	334	19	20	10	0	0	0	10	47	160	38	0	9	10	0	0	21
$4,000–4,499	205	105	0	2	103	103	10	9	0	0	0	0	10	18	0	16	29	0	0	0	10	10
$4,500–4,999	147	147	0	4	143	143	0	5	0	0	0	0	0	0	0	9	78	23	0	5	0	0
$5,000–5,999	115	115	0	5	110	110	32	19	0	0	0	0	0	0	0	0	23	32	16	10	13	20
$6,000–6,999	149	129	0	1	128	128	19	5	0	0	0	0	0	9	0	0	0	32	10	24	0	28
$7,000–9,999	148	138	0	1	137	137	58	11	5	0	10	0	0	0	0	0	0	0	10	10	24	0
$10,000 and over	67	58	0	3	55	55	25	4	0	0	0	0	0	0	0	0	0	0	0	10	6	10
Income not reported	1,189	2,447	42	120	2,285	2,285	920	179	70	133	86	70	40	0	0	0	0	0	10	10	0	657
Age not reported		1,643		101	1,542	1,542	668	225	156	71	60	38	19	17	0	0	0	0	10	0	9	269

[a] Adjusted by assigning income recorded in census to persons for whom income or age was not reported in res.
[b] As under fourteen years old in census.
[c] Includes income classes "loss" and "even" here and in all subsequent tables.
[d] Census totals are based on a 20 per cent sample.
[e] As fourteen years old and over in census.

people, enumerating them in error, or differences in the classification of the population by age.)

2. There were more differences in which the PES income classification was higher than that of the census than vice versa. Of the 18,454,000 males who would have been classified differently, it is estimated that 11,149,000 (60 per cent) were placed in the census in lower income classes than they would have been in the PES. Of the 11,925,000 females classified differently, an estimated 7,781,000 (65 per cent) were placed in lower income classes in the census than they would have been in the PES. The major explanation for the greater difference among the females than among the males lies in the fact that the PES found that a substantial number of females classified as "persons without income" in the census received very small amounts of income in 1949.

These estimates of gross difference are made relative to the class intervals shown in Tables 1 and 2. For grosser intervals, the divergence would be less.

ACCURACY OF CENSUS STATISTICS

Table 3 contains a comparison of the marginal totals of Tables 1 and 2. Because of the fairly high levels of sampling error in the PES estimates, no single figure in the table can legitimately be used to correct the corresponding census total.[2] It is the general pattern that provides a basis for analysis. It is one of understatement of the number of income recipients in each class. There is estimated to have been a 9 per cent understatement in the total number of male income recipients and an 18 per cent understatement in the number of female recipients; about 4 million persons in each case. If the census and PES "income not reported" totals were to be proportionately distributed among the other classes, then the estimated discrepancy of 8 million recipients for males and females combined would be reduced to about 5 million. There were two major causes for this discrepancy; the underenumeration of the population and the misclassification of persons who actually acquired income in 1949 as "persons without income."

NONRESPONSE IN THE PES

The PES income distributions were derived from "adjusted PES totals." These totals were derived after substituting the census classifications, where available, for cases in which the PES was not

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[2] Because of the great effort that would have been required, estimates of sampling error have not been prepared. Some information on the extent of sampling error can be furnished, on request, by the authors.

TABLE 3

Comparison of the 1950 Census Class Totals with the Estimated PES Class Totals: 1949 Income of Males and Females

(estimates in thousands)

INCOME CLASS	MALE				FEMALE			
			Difference				Difference	
	1950 Census [a]	Adjusted PES Totals	Number [b]	Percentage of 1950 Census	1950 Census [a]	Adjusted PES Totals	Number [b]	Percentage of 1950 Census
Total	54,601	55,438	−837	−1.5	57,102	57,932	−830	−1.5
Income reported	50,739	53,825	−3,086	−6.1	53,479	56,743	−3,264	−6.1
Income not reported	3,862	1,613			3,623	1,189		
Total reporting income	50,739	53,825	−3,086	−6.1	53,479	56,743	−3,264	−6.1
None	6,350	5,435	915	14.4	30,534	29,625	909	3.0
Some	44,389	48,390	−4,001	−9.0	22,945	27,118	−4,173	−18.2
Total reporting some income	44,389	48,390	−4,001	−9.0	22,945	27,118	−4,173	−18.2
Under $ 500	4,682	5,089	−407	−8.7	6,996	8,802	−1,806	−25.8
$ 500– 999	4,633	5,038	−405	−8.7	4,304	5,134	−830	−19.3
1,000– 1,499	4,281	4,542	−261	−6.1	3,015	3,521	−506	−16.8
1,500– 1,999	4,083	4,885	−802	−19.6	2,822	3,427	−605	−21.4
2,000– 2,499	5,198	5,196	2	0	2,535	2,663	−128	−5.0
2,500– 2,999	4,767	5,410	−643	−13.5	1,393	1,476	−83	−6.0
3,000– 3,499	5,198	5,346	−148	−2.8	825	920	−95	−11.5
3,500– 3,999	3,335	3,986	−651	−19.5	346	345	1	0.3
4,000– 4,499	2,398	3,076	−678	−28.3	213	205	8	3.8
4,500– 4,999	1,347	1,375	−28	−2.1	107	147	−40	−37.4
5,000– 5,999	1,832	1,721	111	6.1	148	115	33	22.3
6,000– 6,999	818	695	123	15.0	66	149	−83	−125.8
7,000– 9,999	889	1,099	−210	−23.6	79	148	−69	−87.3
10,000 and over	929	933	−4	−0.4	97	67	30	30.9

[a] Census totals are based on a 20 per cent sample.
[b] Census minus PES.

able to obtain responses. We recognize that this is a debatable practice. It was done on the premise that it would provide the best possible response in each case. Actually, as Tables 1 and 2 indicate, the unadjusted PES nonresponse rates were quite substantial, about 8 per cent. The major reason for this level of nonresponse was the insistence on obtaining information from the "best" respondents in the re-enumerative check. If, after repeated calls, a best respondent could not be located, the PES interviewer was instructed to record a nonresponse instead of seeking out an available respondent. Another factor, which also accounts for some of the divergence in the data of the census and the PES, is that more stringent coding rules were used for the responses in the re-enumerative check. In the PES, if one type of income was not reported, total income was coded as "not reported." On the other hand, under certain conditions, the entry for a type of income was assumed in the census to be "none" if it was not reported, thus permitting the assignment of a numerical code for total income.

Distributions of Total Income of Persons

We turn now to the results. Keeping in mind the following facts, we shall first examine Tables 4 through 8:

1. The "1950 census" medians and distributions were transcribed directly from the summary volume of the 1950 census.[3]
2. The "PES" medians and distributions were derived from "adjusted PES totals" obtained from tables like Tables 1 and 2. These totals are based on samples of approximately 10,000 persons enumerated in the 1950 census and 1,800 persons erroneously omitted from the 1950 census.
3. "Persons without income," the zero class, are not reflected in the medians.
4. All of the PES estimates are subject to fairly high sampling errors. For this reason, the medians have been rounded to the tens digit. No single figure is precise enough to be used to "correct" a census statistic; all that we can point to are general tendencies or patterns.

MEDIANS

Table 4 compares census medians with those estimated from the re-enumerative check. Results are given for males and females separately, classified by color and by residence.

Despite the levels of gross difference in the data and the levels of

[3] *1950 Census of Population,* Vol. II, *Characteristics of the Population,* Part 1. United States Summary.

net error in the class totals, not one estimated difference between medians is greater than $100. The PES medians are estimated to be higher than those of the census for the nonwhite and urban-male components of the population. For white females and rural males, the PES medians are estimated to be lower. The latter can be explained by the disproportionate addition of recipients of income to the low-income classes.

INCOME RECIPIENTS

The PES found significantly higher proportions of persons with income than did the census. The understatements in the census appear to be most pronounced for the nonwhite population (estimated at almost 8 percentage points for males and 6 percentage points for females) and for the urban-female population (estimated at almost 6 percentage points).

DISTRIBUTION

Comparison of the distributions in Tables 4 through 8, class by class, reveals no striking patterns of difference. The addition of income recipients to the low-income classes accounts, in part, for the finding that, for the female population, the relative sizes of the income classes above $2,000 tend to have been overstated in the census. By and large, however, the similarities appear to be more striking than the differences.

IDENTICAL POPULATION

The differences between the statistics of the 1950 census and the PES, summarized in Tables 4 through 8, result from more than gross differences in the reporting and coding of the amount of income. As Tables 1 and 2 indicate, "coverage" errors, errors in the reporting of age, nonresponse, and errors in the designation of

TABLE 4

Comparison of the 1950 Census Medians with the Estimated PES Medians:
1949 Income of All Males and Females, by Color and by Residence

	MALE			FEMALE		
GROUP	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]
All males or females	$2,430	$2,450	$—20	$1,030	$ 960	$ 70
White	2,570	2,600	—30	1,140	1,050	90
Nonwhite	1,340	1,350	—10	580	640	—60
Urban	2,780	2,810	—30	1,230	1,160	70
Rural nonfarm	2,070	2,040	30	720	620	100
Rural farm	1,340	1,300	40	460	450	10

[a] Census minus PES.

TABLE 5

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of All Males, by Color

INCOME CLASS	TOTAL 1950 Census	PES	Difference [a]	WHITE 1950 Census	PES	Difference [a]	NONWHITE 1950 Census	PES	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Income reported	92.9	97.1	−4.2	93.1	97.4	−4.3	91.4	94.6	−3.2
Income not reported	7.1	2.9	4.2	6.9	2.6	4.3	8.6	5.4	3.2
Total reporting income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
None	12.5	10.1	2.4	12.1	10.2	1.9	16.5	8.8	7.7
Some	87.5	89.9	−2.4	87.9	89.8	−1.9	83.5	91.2	−7.7
Total reporting some income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	10.5	10.5	0	9.6	9.3	0.3	20.2	21.6	−1.4
$ 500– 999	10.4	10.4	0	9.6	9.5	0.1	18.7	18.6	0.1
1,000– 1,499	9.6	9.4	0.2	9.0	8.9	0.1	16.2	14.1	2.1
1,500– 1,999	9.2	10.1	−0.9	8.7	9.4	−0.7	14.2	16.1	−1.9
2,000– 2,499	11.7	10.7	1.0	11.5	10.6	0.9	13.3	11.9	1.4
2,500– 2,999	10.7	11.2	−0.5	11.0	11.4	−0.4	8.0	8.8	−0.8
3,000– 3,499	11.7	11.0	0.7	12.4	11.7	0.7	5.3	4.9	0.4
3,500– 3,999	7.5	8.2	−0.7	8.1	9.0	−0.9	1.9	1.1	0.8
4,000– 4,499	5.4	6.4	−1.0	5.9	6.9	−1.0	0.9	1.0	−0.1
4,500– 4,999	3.0	2.8	0.2	3.3	3.1	0.2	0.3	0.7	−0.4
5,000 and over	10.0	9.2	0.8	11.0	10.1	0.9	0.8	1.1	−0.3

[a] Census minus PES.

TABLE 6

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of All Males, by Residence

INCOME CLASS	TOTAL 1950 Census	PES	Difference [a]	URBAN 1950 Census	PES	Difference [a]	RURAL NONFARM 1950 Census	PES	Difference [a]	RURAL FARM 1950 Census	PES	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Income reported	92.9	97.1	−4.2	93.0	97.8	−4.8	91.3	94.9	−3.6	94.6	96.9	−2.3
Income not reported	7.1	2.9	4.2	7.0	2.2	4.8	8.7	5.1	3.6	5.4	3.1	2.3
Total reporting income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
None	12.5	10.1	2.4	11.2	8.6	2.6	12.9	10.8	2.1	17.6	15.6	2.0
Some	87.5	89.9	−2.4	88.8	91.4	−2.6	87.1	89.2	−2.1	82.4	84.4	−2.0
Total reporting some income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	10.5	10.5	0	7.4	6.6	0.8	12.7	13.6	−0.9	21.8	24.2	−2.4
$ 500– 999	10.4	10.4	0	7.9	7.5	0.4	12.8	14.0	−1.2	18.4	18.7	−0.3
1,000– 1,499	9.6	9.4	0.2	7.9	8.6	−0.7	11.8	10.2	1.6	14.5	11.9	2.6
1,500– 1,999	9.2	10.1	−0.9	8.3	8.9	−0.6	10.8	11.1	−0.3	11.0	14.1	−3.1
2,000– 2,499	11.7	10.7	1.0	11.8	10.4	1.4	12.8	12.8	0	10.0	9.5	0.5
2,500– 2,999	10.7	11.2	−0.5	11.8	13.0	−1.2	10.4	8.6	1.8	6.3	6.2	0.1
3,000– 3,499	11.7	11.0	0.7	13.6	12.4	1.2	10.0	10.4	−0.4	5.6	5.5	0.1
3,500– 3,999	7.5	8.2	−0.7	8.9	9.8	−0.9	6.1	7.2	−1.1	3.0	2.4	0.6
4,000– 4,499	5.4	6.4	−1.0	6.5	7.9	−1.4	4.0	4.5	−0.5	2.5	1.7	0.8
4,500– 4,999	3.0	2.8	0.2	3.7	3.6	0.1	2.2	1.6	0.6	1.3	1.1	0.2
5,000 and over	10.0	9.2	0.8	12.2	11.1	1.1	6.3	5.9	0.4	5.7	4.8	0.9

[a] Census minus PES.

TABLE 7

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of All Females, by Color

INCOME CLASS	TOTAL			WHITE			NONWHITE		
	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Income reported	93.7	97.9	-4.2	93.7	98.0	-4.3	93.1	97.7	-4.6
Income not reported	6.3	2.1	4.2	6.3	2.0	4.3	6.9	2.3	4.6
Total reporting income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
None	57.1	52.2	4.9	57.9	53.2	4.7	49.4	43.4	6.0
Some	42.9	47.8	-4.9	42.1	46.8	-4.7	50.6	56.6	-6.0
Total reporting some income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	30.5	32.5	-2.0	28.5	31.1	-2.6	45.8	42.4	3.4
$ 500– 999	18.8	18.9	-0.1	17.9	17.7	0.2	25.1	27.8	-2.7
1,000– 1,499	13.1	13.0	0.1	13.2	13.0	0.2	12.7	12.7	0
1,500– 1,999	12.3	12.6	-0.3	12.9	13.3	-0.4	7.7	8.0	-0.3
2,000– 2,499	11.0	9.8	1.2	11.9	10.5	1.4	4.7	4.5	0.2
2,500– 2,999	6.1	5.4	0.7	6.6	5.9	0.7	2.1	2.0	0.1
3,000– 3,499	3.6	3.4	0.2	3.9	3.8	0.1	1.0	0.5	0.5
3,500– 3,999	1.5	1.3	0.2	1.7	1.4	0.3	0.3	0.3	0
4,000– 4,499	0.9	0.8	0.1	1.0	0.9	0.1	0.2	0	0.2
4,500– 4,999	0.5	0.5	0	0.5	0.6	-0.1	0.1	0.1	0
5,000 and over	1.6	1.6	0	1.9	1.8	0.1	0.4	1.9	-1.5

[a] Census minus PES

TABLE 8

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of All Females, by Residence

INCOME CLASS	TOTAL			URBAN			RURAL NONFARM			RURAL FARM		
	1950 Census	PES	Differ-ence [a]	1950 Census	PES	Differ-ence [a]	1950 Census	PES	Differ-ence [a]	1950 Census	PES	Differ-ence [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Income reported	93.7	97.9	−4.2	93.7	98.0	−4.3	93.0	97.3	−4.3	94.6	98.5	−3.9
Income not reported	6.3	2.1	4.2	6.3	2.0	4.3	7.0	2.7	4.3	5.4	1.5	3.9
Total reporting income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
None	57.1	52.2	4.9	52.7	47.0	5.7	61.1	57.7	3.4	73.6	71.2	2.4
Some	42.9	47.8	−4.9	47.3	53.0	−5.7	38.9	42.3	−3.4	26.4	28.8	−2.4
Total reporting some income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	30.5	32.5	−2.0	25.4	27.1	−1.7	41.2	45.0	−3.8	54.6	55.7	−1.1
$ 500– 999	18.8	18.9	−0.1	18.4	18.6	−0.2	20.8	21.5	−0.7	17.6	16.4	1.2
1,000– 1,499	13.1	13.0	0.1	13.7	13.7	0	12.4	10.6	1.8	9.9	11.6	−1.7
1,500– 1,999	12.3	12.6	−0.3	13.4	14.2	−0.8	9.8	8.5	1.3	7.2	7.0	0.2
2,000– 2,499	11.0	9.8	1.2	12.5	11.0	1.5	7.4	7.1	0.3	5.0	4.3	0.7
2,500– 2,999	6.1	5.4	0.7	7.1	6.5	0.6	3.6	2.2	1.4	2.2	2.2	0
3,000– 3,499	3.6	3.4	0.2	4.2	3.9	0.3	2.0	2.7	−0.7	1.3	0.5	0.8
3,500– 3,999	1.5	1.3	0.2	1.8	1.5	0.3	0.8	0.2	0.6	0.6	0.9	−0.3
4,000– 4,499	0.9	0.8	0.1	1.1	0.9	0.2	0.5	0.4	0.1	0.4	0.4	0
4,500– 4,999	0.5	0.5	0	0.5	0.7	−0.2	0.2	0.2	0	0.2	0.2	0
5,000 and over	1.6	1.6	0	1.9	1.9	0	1.2	1.5	−0.3	1.2	0.8	0.4

[a] Census minus PES.

persons as "persons with income" all contribute to the differences in Tables 4 through 8.

One major factor was the difference in the reporting and coding of income. To deal with this factor by itself, we had to define an "identical population"; the persons who were classified as "persons with income" in both the 1950 census and the PES. We exclude cases of critical difference in the reporting of age, coverage error, and nonresponse. We thus have a "population" in which there are two reports of income in 1949 for each individual. As we have noted, there is evidence of directional differences between the 1950 census and PES reports of income for this "identical population." The effect of this directional difference on the income distribution is shown in Tables 9 through 13.

TABLE 9

Comparison of the 1950 Census Medians with the Estimated PES Medians: 1949 Income of Identical Males and Females, by Color and by Residence

	MALE			FEMALE		
GROUP	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]
All males or females	$2,520	$2,580	$ —60	$1,080	$1,140	$ —60
White	2,640	2,700	—60	1,190	1,250	—60
Nonwhite	1,320	1,430	—110	620	680	—60
Urban	2,860	2,910	—50	1,280	1,340	—60
Rural nonfarm	2,150	2,200	—50	740	740	0
Rural farm	1,400	1,420	—20	450	480	—30

[a] Census minus PES.

TABLE 10

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of Identical Males, by Color

	TOTAL			WHITE			NONWHITE		
INCOME CLASS	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	9.5	8.7	0.8	8.5	7.8	0.7	20.5	18.0	2.5
$ 500– 999	10.0	9.5	0.5	9.2	8.6	0.6	18.6	19.2	—0.6
1,000– 1,499	9.1	8.9	0.2	8.4	8.4	0	16.9	14.8	2.1
1,500– 1,999	9.2	10.1	—0.9	9.0	9.7	—0.7	11.6	14.5	—2.9
2,000– 2,499	11.8	11.0	0.8	11.7	10.8	0.9	13.9	12.5	1.4
2,500– 2,999	11.1	11.9	—0.8	11.3	12.0	—0.7	8.4	11.0	—2.6
3,000– 3,499	12.2	11.6	0.6	12.8	12.2	0.6	5.8	5.7	0.1
3,500– 3,999	8.0	8.9	—0.9	8.6	9.6	—1.0	1.9	1.2	0.7
4,000– 4,499	5.8	7.0	—1.2	6.3	7.6	—1.3	1.0	1.3	—0.3
4,500– 4,999	3.1	3.1	0	3.3	3.3	0	0.4	1.0	—0.6
5,000 and over	10.1	9.2	0.9	10.9	10.0	0.9	1.0	0.9	0.1

[a] Census minus PES.

TABLE 11

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of Identical Males, by Residence

INCOME CLASS	TOTAL			URBAN			RURAL NONFARM			RURAL FARM		
	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	9.5	8.7	0.8	6.6	5.1	1.5	11.3	11.2	0.1	20.1	21.2	-1.1
$ 500- 999	10.0	9.5	0.5	7.5	6.9	0.6	12.3	11.6	0.7	18.0	18.6	-0.6
1,000- 1,499	9.1	8.9	0.2	7.4	8.1	-0.7	10.7	9.5	1.2	14.9	12.0	2.9
1,500- 1,999	9.2	10.1	-0.9	7.9	8.4	-0.5	11.8	12.0	-0.2	11.9	15.5	-3.6
2,000- 2,499	11.8	11.0	0.8	11.8	10.2	1.6	13.3	14.5	-1.2	10.2	10.1	0.1
2,500- 2,999	11.1	11.9	-0.8	12.3	13.9	-1.6	10.7	9.7	1.0	6.2	6.0	0.2
3,000- 3,499	12.2	11.6	0.6	14.3	13.2	1.1	10.0	11.0	-1.0	5.4	5.4	0
3,500- 3,999	8.0	8.9	-0.9	9.5	10.5	-1.0	6.7	8.1	-1.4	3.3	2.7	0.6
4,000- 4,499	5.8	7.0	-1.2	7.0	8.8	-1.8	4.4	5.0	-0.6	2.5	1.9	0.6
4,500- 4,999	3.1	3.1	0	3.7	3.9	-0.2	2.3	1.7	0.6	1.4	1.1	0.3
5,000 and over	10.1	9.2	0.9	12.1	11.1	1.0	6.3	5.8	0.5	6.0	5.5	0.5

[a] Census minus PES.

TABLE 12

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of Identical Females, by Color

	TOTAL			WHITE			NONWHITE		
INCOME CLASS	1950 Census	PES	Differ- ence [a]	1950 Census	PES	Differ- ence [a]	1950 Census	PES	Differ- ence [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	28.9	27.3	1.6	27.1	25.7	1.4	43.2	39.6	3.6
$ 500– 999	18.8	18.7	0.1	17.8	17.3	0.5	27.1	29.3	−2.2
1,000– 1,499	13.6	14.0	−0.4	13.6	13.9	−0.3	13.7	15.3	−1.6
1,500– 1,999	12.9	14.2	−1.3	13.7	15.2	−1.5	7.1	6.5	0.6
2,000– 2,499	11.8	11.5	0.3	12.7	12.4	0.3	4.3	4.5	−0.2
2,500– 2,999	6.4	6.3	0.1	6.9	6.8	0.1	2.6	2.7	−0.1
3,000– 3,499	3.5	4.2	−0.7	3.8	4.7	−0.9	1.2	0.7	0.5
3,500– 3,999	1.6	1.5	0.1	1.7	1.6	0.1	0.4	0.5	−0.1
4,000– 4,499	0.4	0.4	0	0.5	0.5	0	0	0	0
4,500– 4,999	0.5	0.7	−0.2	0.6	0.8	−0.2	0.1	0.1	0
5,000 and over	1.5	1.2	0.3	1.6	1.3	0.3	0.4	0.9	−0.5

[a] Census minus PES.

MEDIANS

Table 9 shows that this difference produced an error of about $60, on the average, in the census medians. This demonstrates the stability of the median as a measure of central tendency.

DISTRIBUTIONS

The gross differences in reporting produced no clear shift in any of the distributions shown in Tables 10 through 13, except that in general, both the lowest and the highest classes were reported in the census as having somewhat too high proportions of the population.

For the "identical" male population, the average absolute deviation between the 1950 census and PES percentages was about 0.7 of a percentage point for the ten income classes from $1 to $4,999. For the female population, the corresponding average absolute deviation was about 0.5 of a percentage point.

Distributions of Total Income of Families

The inquiries used in the 1950 census to obtain information on family income are reproduced in the Appendix. The method of obtaining the data was as follows:

If the head of a family was listed on a sample line on a census schedule, he (or his respondent) was asked three questions. His own total income was computed and coded from the answers. Next,

TABLE 13

Comparison of the 1950 Census Percentage Distributions with the Estimated PES Percentage Distributions: 1949 Income of Identical Females, by Residence

INCOME CLASS	TOTAL			URBAN			RURAL NONFARM			RURAL FARM		
	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]	1950 Census	PES	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	28.9	27.3	1.6	23.4	21.6	1.8	40.5	40.0	0.5	55.2	52.3	2.9
$ 500– 999	18.8	18.7	0.1	18.7	18.5	0.2	19.8	20.6	−0.8	18.1	15.9	2.2
1,000– 1,499	13.6	14.0	−0.4	13.9	14.4	−0.5	13.6	12.6	1.0	10.6	13.6	−3.0
1,500– 1,999	12.9	14.2	−1.3	14.3	15.8	−1.5	10.5	10.3	0.2	6.0	7.6	−1.6
2,000– 2,499	11.8	11.5	0.3	13.3	13.0	0.3	7.8	8.0	−0.2	6.1	4.3	1.8
2,500– 2,999	6.4	6.3	0.1	7.7	7.6	0.1	3.4	2.7	0.7	1.2	2.3	−1.1
3,000– 3,499	3.5	4.2	−0.7	4.2	4.8	−0.6	2.2	3.3	−1.1	0	0.7	−0.7
3,500– 3,999	1.6	1.5	0.1	1.9	1.8	0.1	0.7	0.3	0.4	0.7	1.3	−0.6
4,000– 4,499	0.4	0.4	0	0.4	0.4	0	0.3	0.5	−0.2	0.5	0.5	0
4,500– 4,999	0.5	0.7	−0.2	0.6	0.9	−0.3	0.3	0.3	0	0.3	0.3	0
5,000 and over	1.5	1.2	0.3	1.6	1.2	0.4	1.1	1.4	−0.3	1.4	1.1	0.3

[a] Census minus PES.

essentially the same three questions were asked concerning all the other members of his family. A single figure was recorded as the sum of each type of income for the remaining members of the family. The totals of the three types of income were then added to the total income of the family head to produce a total for family income.

In the PES, a much more elaborate procedure was employed. A complete set of income questions was asked of each member of each family.

The method of tabulation of the data for the approximately 5,500 families in the "family income subsample" precludes any direct evaluation of the family income distributions of the 1950 census. We have not been able to project the sample results to universe figures. The results are based on unadjusted totals derived from the same type of table as Tables 1 and 2. The picture of the family income data is essentially the same as that of the personal income data; a large number of disagreements in classification, of coverage errors, of errors in the definition of families, all leading to sizeable differences in the income class totals.

Again, two sets of results have been prepared, one based on all families in the sample and the other based on "identical" families. In the former case, the differences between the medians and distributions reflect all sources of error detected by the re-enumerative check. In the latter case, the differences reflect only errors arising from the reporting and coding of income. An "identical family" is one that was properly enumerated, received income in 1949, and where the PES and census agree on family type and size.

The available results are presented in Tables 14 through 16. The term "original" is used to describe the tabulation of the census data; the term "recheck" refers to the tabulation of the PES data from the same sample. Results are available only by residence.

TABLE 14

Comparison of Original and Recheck Medians:
1949 Income of Families, by Residence

GROUP	ALL FAMILIES			IDENTICAL FAMILIES		
	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
All families	$3,210	$3,480	$—270	$3,260	$3,510	$—250
Urban	3,540	3,860	—320	3,610	3,920	—310
Rural nonfarm	2,700	3,020	—320	2,710	2,990	—280
Rural farm	1,820	1,950	—130	1,850	1,900	—50

[a] Original minus recheck.

TABLE 15

Comparison of Original and Recheck Percentage Distributions: 1949 Income for All Families, by Residence

INCOME CLASS	TOTAL			URBAN			RURAL NONFARM			RURAL FARM		
	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Income reported	94.4	87.5	6.9	93.6	87.2	6.4	95.9	87.8	8.1	96.3	88.5	7.8
Income not reported	5.6	12.5	−6.9	6.4	12.8	−6.4	4.1	12.2	−8.1	3.7	11.5	−7.8
Total reporting income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
None	3.9	1.4	2.5	3.5	1.2	2.3	3.2	1.6	1.6	6.9	2.5	4.4
Some	96.1	98.6	−2.5	96.5	98.8	−2.3	96.8	98.4	−1.6	93.1	97.5	−4.4
Total reporting some income	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	4.4	3.5	0.9	2.4	1.6	0.8	4.7	3.5	1.2	14.1	13.1	1.0
$ 500– 999	6.3	5.9	0.4	3.8	3.2	0.6	9.8	9.6	0.2	13.8	14.0	−0.2
1,000– 1,499	7.1	5.9	1.2	4.5	3.9	0.6	10.7	8.3	2.4	15.1	12.4	2.7
1,500– 1,999	8.1	7.1	1.0	6.8	5.4	1.4	10.5	9.8	0.7	11.0	11.7	−0.7
2,000– 2,499	9.6	8.1	1.5	9.2	7.1	2.1	10.6	8.5	2.1	10.5	12.6	−2.1
2,500– 2,999	9.3	9.0	0.3	9.5	9.1	0.4	9.5	9.8	−0.3	8.1	7.8	0.3
3,000– 3,499	12.1	11.0	1.1	12.9	11.4	1.5	11.4	11.6	−0.2	8.7	8.4	0.3
3,500– 3,999	9.8	10.4	−0.6	11.0	11.4	−0.4	8.6	10.8	−2.2	5.0	5.1	−0.1
4,000– 4,499	6.9	7.7	−0.8	7.4	8.5	−1.1	7.9	7.0	0.9	3.1	5.0	−1.9
4,500– 4,999	4.7	6.8	−2.1	6.0	8.0	−2.0	2.7	5.6	−2.9	1.1	1.9	−0.8
5,000 and over	21.6	24.7	−3.1	26.3	30.5	−4.2	13.5	15.5	−2.0	9.3	8.1	1.2

[a] Original minus recheck.

TABLE 16

Comparison of Original and Recheck Percentage Distributions: 1949 Income for Identical Families, by Residence

INCOME CLASS	TOTAL			URBAN			RURAL NONFARM			RURAL FARM		
	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0	100.0	100.0	0
Under $ 500	3.9	3.5	0.4	2.1	1.6	0.5	4.4	2.6	1.8	12.3	14.0	−1.7
$ 500– 999	6.3	5.7	0.6	3.9	3.1	0.8	9.9	9.5	0.4	14.0	13.4	0.6
1,000– 1,499	6.4	5.8	0.6	3.6	3.7	−0.1	10.1	8.2	1.9	15.2	13.2	2.0
1,500– 1,999	8.0	6.9	1.1	6.5	5.1	1.4	10.2	10.1	0.1	12.1	11.8	0.3
2,000– 2,499	9.4	8.2	1.2	8.9	7.0	1.9	11.1	9.3	1.8	9.9	12.7	−2.8
2,500– 2,999	9.9	9.2	0.7	10.2	9.4	0.8	10.2	10.5	−0.3	7.9	6.5	1.4
3,000– 3,499	11.5	10.4	1.1	12.2	10.4	1.8	11.0	12.1	−1.1	8.8	8.3	0.5
3,500– 3,999	10.5	10.6	−0.1	11.8	11.7	0.1	9.3	10.1	−0.8	5.5	5.4	0.1
4,000– 4,499	7.1	7.6	−0.5	7.8	8.6	−0.8	7.3	5.7	1.6	2.9	4.7	−1.8
4,500– 4,999	4.8	7.0	−2.2	6.0	8.4	−2.4	2.7	6.1	−3.4	1.1	1.7	−0.6
5,000 and over	22.3	25.1	−2.8	27.0	31.0	−4.0	13.8	15.8	−2.0	10.3	8.4	1.9

[a] Original minus recheck.

MEDIANS [4]

For the urban and rural-nonfarm cases, the original medians are about $300 less than the recheck medians, with essentially the same result for identical families as for all families. For the rural-farm cases, the original and recheck medians appear to be somewhat closer together, with a difference of $130 for all families and of $50 for identical families. As in the case of personal income, some of the 1950 census medians for family income were estimated to have been too high because the additional income recipients picked up by the PES appear to have been concentrated in the low income class. We would guess (no direct evidence is available) that failing to include the income of persons other than the family head was an important factor in the understatement of the census medians.[5]

FAMILIES WITHOUT INCOME

In the census tabulations, this group is included in the class "income under $500." The results indicate that about two and one-half times as many families were included in that class in the census (about 4 per cent) as should have been (about 1.5 per cent).

DISTRIBUTIONS

Tables 15 and 16 show evidence of a small but definite directional bias in the census distributions. The proportions in the lowest income classes appear to have been overstated, in general, while the proportions in the income classes beginning with $3,500 appear to have been understated. (There are some differences depending on the residence of the families.) The fact that the results shown in Table 15 (all families) parallel those in Table 16 (identical families) indicates that the underreporting of the amount of income was the most significant source of error in the census distributions.

Distributions of Income of Persons, by Type of Income

Tables 17 through 20 present the PES results relating to income by type; wages and salaries, income from self-employment, and income from all other sources. Again we have not been able to

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[4] The medians were defined on a somewhat different basis than the published 1950 census medians for family income. The published figures *include* the "families with no income" in the computation; the figures in this report do *not*.

[5] The editing rules employed in the 1950 census probably had some impact. There were situations in which a nonresponse to a specific inquiry could be treated as a response of "none."

TABLE 17

Comparison of Original and Recheck Medians: 1949 Income of Males and Females,
by Type of Income

SOURCE OF INCOME	MALE			FEMALE		
	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
Total income [b]	$2,430	$2,450	$—20	$1,030	$ 960	$ 70
Wages and salaries	2,460	2,540	—80	1,200	1,130	70
Self-employment	1,920	1,760	160	930	760	170
All other income	470	460	10	450	420	30

[a] Original minus recheck.
[b] Based on actual 1950 census tabulations and projections of PES results to the universal level.

compare the actual census tabulations with the PES data projected
to universe levels. As in the case of family income, the comparisons
are limited to the sample itself, and thus the terms "original" and
"recheck" are used. Also the results relate only to all individuals in
the sample; no results are available for "identical" individuals.
Thus the results reflect all sources of error and difference, errors in
defining the population and nonresponse as well as differences in
the reporting of the amount of income.

TABLE 18

Comparison of Original and Recheck Percentage Distributions: 1949 Income from Wages or
Salary, Males and Females

INCOME CLASS	MALE			FEMALE		
	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0
Income reported	94.7	93.9	0.8	94.9	94.5	0.4
Income not reported	5.3	6.1	—0.8	5.1	5.5	—0.4
Total reporting income	100.0	100.0	0	100.0	100.0	0
None	31.5	31.1	0.4	69.6	67.2	2.4
Some	68.5	68.9	—0.4	30.4	32.8	—2.4
Total reporting some income	100.0	100.0	0	100.0	100.0	0
Under $ 500	11.3	11.9	—0.6	27.6	28.9	—1.3
$ 500– 999	9.0	9.0	0	16.8	17.7	—0.9
1,000– 1,499	8.4	7.7	0.7	14.0	12.6	1.4
1,500– 1,999	9.4	8.9	0.5	13.3	14.1	—0.8
2,000– 2,499	12.8	11.5	1.3	13.5	12.1	1.4
2,500– 2,999	11.2	12.4	—1.2	8.0	7.4	0.6
3,000– 3,499	13.5	12.2	1.3	3.3	3.9	—0.6
3,500– 3,999	8.6	9.5	—0.9	1.7	1.2	0.5
4,000– 4,499	4.5	5.8	—1.3	0.7	0.5	0.2
4,500– 4,999	3.1	3.1	0	0.5	0.6	—0.1
5,000 and over	8.2	8.1	0.1	0.5	0.9	—0.4

[a] Original minus recheck.

TABLE 19

Comparison of Original and Recheck Percentage Distributions: 1949 Income from Self-Employment, Males and Females

	MALE			FEMALE		
INCOME CLASS	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0
Income reported	94.4	93.4	1.0	94.6	94.1	0.5
Income not reported	5.6	6.6	—1.0	5.4	5.9	—0.5
Total reporting income	100.0	100.0	0	100.0	100.0	0
None	83.7	82.4	1.3	96.5	96.9	—0.4
Some	16.3	17.6	—1.3	3.5	3.1	0.4
Total reporting some income	100.0	100.0	0	100.0	100.0	0
Under $ 500	17.6	20.1	—2.5	37.9	40.8	—2.9
$ 500– 999	14.8	14.5	0.3	14.2	17.9	—3.7
1,000– 1,499	10.5	10.0	0.5	5.1	7.8	—2.7
1,500– 1,999	8.5	10.6	—2.1	9.4	8.0	1.4
2,000– 2,499	7.9	9.7	—1.8	6.7	6.3	0.4
2,500– 2,999	5.8	6.0	—0.2	4.2	1.6	2.6
3,000– 3,499	8.8	5.7	3.1	6.1	0.7	5.4
3,500– 3,999	6.0	6.4	—0.4	0.5	0.6	—0.1
4,000– 4,499	4.2	3.2	1.0	5.8	5.9	—0.1
4,500– 4,999	1.9	1.8	0.1	1.1	0.5	0.6
5,000 and over	13.7	11.9	1.8	9.2	10.0	—0.8

[a] Original minus recheck.

TABLE 20

Comparison of Original and Recheck Percentage Distributions: 1949 Income from Sources other than Earnings, Males and Females

	MALE			FEMALE		
INCOME CLASS	Original	Recheck	Difference [a]	Original	Recheck	Difference [a]
Total	100.0	100.0	0	100.0	100.0	0
Income reported	94.4	93.6	0.8	94.3	94.1	0.2
Income not reported	5.6	6.4	—0.8	5.7	5.9	—0.2
Total reporting income	100.0	100.0	0	100.0	100.0	0
None	78.2	68.7	9.5	87.7	81.0	6.7
Some	21.8	31.3	—9.5	12.3	19.0	—6.7
Total reporting some income	100.0	100.0	0	100.0	100.0	0
Under $ 500	53.7	55.0	—1.3	56.1	59.6	—3.5
$ 500– 999	23.2	25.8	—2.6	23.8	21.1	2.7
1,000– 1,499	10.2	9.5	0.7	7.9	9.0	—1.1
1,500– 1,999	4.6	4.2	0.4	2.6	3.5	—0.9
2,000– 2,499	2.5	2.2	0.3	2.4	2.0	0.4
2,500– 2,999	1.4	0.6	0.8	1.3	0.7	0.6
3,000– 3,499	0.3	0.5	—0.2	1.7	0.7	1.0
3,500– 3,999	0.3	0.3	0	0	0.4	—0.4
4,000– 4,499	0.5	0.1	0.4	0.3	0.3	0
4,500– 4,999	0.1	0.2	—0.1	0.3	0.3	0
5,000 and over	3.0	1.7	1.3	3.6	2.5	1.1

[a] Original minus recheck.

MEDIANS

The results of the re-enumerative check indicate that the census medians for income from self-employment may have been overstated by about $150. The census medians for income from all other sources may have been very slightly overstated. In the case of wages and salaries, there appears to have been a sex difference, with the original median for males being lower than the recheck median by about $80; while for females the original median is about $70 higher.

INCOME RECIPIENTS

Perhaps the most striking finding of the PES is that the deficiency of income recipients reported in the census was caused primarily by the failure to record income from sources other than earnings. In the case of wages and salaries and of income from self-employment, the evidence from the sample indicates that the understatement of the proportions of income recipients in the census may have been quite small.

In the case of income from sources other than earnings, however, Table 20 shows that the "original" proportion of male income recipients was understated by 9.5 percentage points, and of females by 6.7 percentage points. The additional recipients are concentrated in the low-income classes. This accounts for the PES median being lower than the census median by about $150.

DISTRIBUTIONS

Except for the consistent evidence of understatement in the census of the proportions of persons in the lowest income class ($1 to $500 or loss) for each type of income, there are no clearly discernible patterns in the results.

Discussion of Results

Despite our intentions, we have "interpreted" some of the estimates of error from the standpoint of the consumer. We have labeled some of the errors as "small." But, then, this was primarily an attempt to obtain information. Are there, for example, any essential uses of census income statistics that require the medians to be accurate within $100?

PROBING QUESTIONS

The re-enumerative check uncovered additional recipients of income from sources other than earnings. The PES also found more

recipients of wages and salaries than had been identified in the 1950 census. It is conceivable that even more intensive probing might have uncovered larger numbers of recipients of very small amounts of income. Yet, if techniques intensive enough to uncover very small amounts of income had been used in the census, would the statistics have been more useful? Median incomes were based on distributions for persons who received $1 or more of income in 1949. Would it be more desirable to base the medians on distributions beginning with $100 or $500?

SELF-EMPLOYMENT INCOME

The assumption that individual true values exist is subject to the strongest reservation in the case of income from self-employment. That the PES results are so similar to those of the census attests, however, to the statistical stability of the concept of self-employment income.

It is of interest that the "better" method produced somewhat lower medians in the case of self-employment income. The fairly general belief that the best survey procedure "gets the most income" must be discounted if we are willing to regard a procedure that precedes a question on net income with one on gross income as "better."

FUTURE CENSUSES

Our rough-and-ready evaluation of the costs and gains suggests that there would be little to be gained by including the PES types-of-income inquiry in a census. The cost would be prohibitive; the improvements in accuracy, marginal. Although the PES does not provide any substantial proof, there may, however, be some merit in obtaining family income data after first determining the income of each family member separately. This plus a single question designed to uncover small amounts of income from sources other than earnings would be the most we would recommend.

AGGREGATES AND AVERAGES

The effect on the percentage distributions of income caused by underenumeration in the 1950 census was probably trivial. The same can be said for the failure on the part of the PES to find all the people that were missed in the census.

Table 3 indicates that, according to the PES, persons fourteen years old and over were understated by 1.5 per cent in the 1950 census. There is little doubt that this estimate is too low; there is some evidence that the undercount may be 3 per cent.[6]

[6] Ansley J. Coale, "The Population of the United States in 1950 Classified by

We conjecture that it is even disproportionately lower in the low-income classes. This is based on the belief that the PES had the greatest difficulty in finding young adult migrants who were missed in the census, persons typically at the low end of the occupational scale.

The chief impact of underenumeration would arise in estimating family income where an independently determined income aggregate is applied to a census population total. This type of average, if not corrected for underenumeration, would be too high. Averages (and aggregates) based entirely on the 1950 census are, however, probably not seriously affected by underenumeration.

SHOULD ERRORS BE MEASURED?

The measurement of errors in statistics is a costly business. Suppose techniques of measurement of error were advanced to the point of unquestioned validity. Which would be preferable, measurements of error or more statistics?

Appendix: Procedures of the Re-enumerative Check

The study of income was but a small part of the re-enumerative check phase of the PES. The design of the check represented a compromise to achieve an optimum balance of effort over various subject matter areas.

Two overlapping probability samples were drawn, designed on the one hand to represent the land area of the United States and on the other hand to represent the persons, dwelling units, and farms enumerated in the 1950 censuses.

About 250 specially selected and trained enumerators were employed to canvass the sample of areas intensively in a search for persons, dwelling units, and farms which might have been missed in the original enumeration. These enumerators also conducted probing interviews designed to study the accuracy of the information obtained originally. In addition, these interviews were designed to uncover cases of overenumeration, that is, units listed on the rolls of the censuses that should not have been listed.

This work was carried out under close supervision; the questionnaires obtained were carefully edited both in the field and in Washington. Intensive searches were made of the census schedules before a unit was finally classified as erroneously omitted from or erroneously included in the census. Tabulations were made for selected characteristics of persons, dwelling units, and farms. These tabula-

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Age, Sex, and Color—A Revision of Census Figures," *Journal of the American Statistical Association,* March 1955, pp. 16–54.

tions exhibit, category by category, the estimated numbers of content differences and coverage errors that would have occurred had the PES been conducted on the entire universe rather than on a sample.

THE SAMPLE

The basic sample for the re-enumerative check was a stratified, multistage area sample of the United States. The first stage, consisting of 276 primary sampling units (counties or groups of counties), was drawn with probability proportionate to the population of the United States in 1940.

One of the major tasks of the PES was to discover households and farms which had been missed by census enumerators. To accomplish this, a segment sample was selected. This consisted of about 2,800 urban and about 1,000 rural small areas selected within the primary sample units. These small segments contained about six dwelling units in urban parts of the primary sampling units and about ten dwelling units and five farms in the rural parts.

To determine how many persons were missed in households which were enumerated, to study the extent of overenumeration in the censuses, and to study the content errors of the censuses, samples of households and farms were drawn from the census rolls. These made up what is termed the list sample of the PES. Techniques were devised to make the list sample overlap in urban areas as much as possible with the segment sample. In rural areas, the segment and list samples were drawn from the same primary sampling units but were independent of one another.

To aid the PES enumerators in canvassing the segments for missed dwelling units and farms, a special map or aerial photograph was prepared for each segment. In addition, for many segments, the PES enumerators were supplied either with photostats of the original census schedules or with lists of names and addresses of persons, dwelling units, and farms which were enumerated in or near the designated segments.

In preparing the list sample, an elaborate transcription procedure designated the specific persons, dwelling units, and farms in the list sample and provided transcriptions of the original census data for these units. To cut the cost of the program, subsamples of enumerated persons within dwelling units designated for the list sample were selected. One-half of the sample overlapped the census income sample. Transcriptions of the original census data were provided for 95 per cent of the dwelling units and persons in the sample and for 90 per cent of the farms that were sampled. A control

group was set up by not supplying transcriptions for the remainder of the cases.

The combined segment and list samples yielded 11,800 cases for the personal income subsample and 5,500 cases for the family income subsample.

DESIGN OF THE INTERVIEW

Three major considerations governed the type of interview to be conducted in the PES. The first was that in the PES the respondent be the "best" (usually the person for whom the information was being collected). The procedure in the 1950 censuses permitted the enumerator to interview any responsible member of the household or even under certain conditions to substitute other persons, such as landlords or neighbors.

The second consideration was that a series of detailed questions be supplied for a given topic. It was believed that a more accurate answer would result than that from the single question approach of the 1950 censuses.

The third guiding principle was the belief that an on-the-spot reconciliation of differences in response between the original census enumeration and the PES would produce more accurate data.

To accomplish these objectives, separate questionnaires were designed for the persons, dwelling units, and farms in the sample. In addition, a "coverage questionnaire" was designed to aid the enumerators in identifying missed dwelling units, in identifying missed persons within enumerated dwelling units, in locating farms that might have been missed, and in checking on overenumeration of dwelling units.

SUPERVISION AND TRAINING

There were fourteen PES supervisors and fourteen assistant supervisors. These people were selected from among the most highly qualified members of the supervisory staff of the census field organization. In addition to the supervisors, working observers were provided from the headquarters of the Bureau of the Census, from other government agencies, and from university groups. The observers shared responsibility with the supervisors for the technical aspects of the PES and also participated in the training of the PES interviewers. The supervisors and observers were given three weeks of training, including a full week of practice enumeration.

About 250 enumerators were selected from among the most highly qualified personnel who worked on the 1950 censuses. No person was assigned to a sample area for which he had any responsibility in the original census enumeration. The PES enumera-

tors were specialized; approximately 160 were selected to work in urban areas and approximately 90 were selected to cover rural areas. Both urban and rural enumerators received a week's training.

In addition, there was a field edit of the questionnaires and other documents of each enumerator as soon as they were received in the area offices. This was primarily designed to return defective work to the field for correction.

PROCESSING

The processing of returns was lengthy and complex. It consisted of:

1. *An initial screening.* To detect and send back to the field defective materials which had slipped through the field-edit procedure.

2. *Editing, coding, and transcription.* To prepare material for the record checks, to identify cases of possible coverage error for which special searching of the census returns was required, and to convert the information for punching and tabulation.

3. *Searching.* Detailed criteria were established for deciding whether or not a given unit of enumeration belonged in the class of "erroneous omissions" or of "erroneous inclusions." This demanded a careful search of the census returns.

4. *Punching and tabulating.* Three punch cards were prepared for every person and three for every family in the subsamples. The basic tabulations, made on a high-speed electronic computer, in practically every case took the form of Tables 1 and 2.

In the family income results and the results for income by type, the frequencies in the basic tables represent cases in the sample adjusted to a self-weighting level. In the personal income results presented above, the frequencies in the basic tables are weighted to represent the population of the United States. To minimize the sampling error of the estimates, a final stage of "difference" estimating was employed in constructing Tables 1 and 2.

This technique is reflected in Table 1. The column totals for the census income classes are the published totals. They were substituted for the totals derived from the sample. To adjust the breakdown in a column to add to the new total, the sum of the nondiagonal elements (the weighted PES estimate of error in the column) was subtracted from the census total. This gave a new diagonal-cell entry (a "difference" estimate of the number of persons for whom no errors were made), which replaced the original sample estimate. After this adjustment, the row totals (the PES estimates) were obtained.

Exhibit A-1

Income Questions in the 1950 Census

FOR PERSONS 14 YEARS OF AGE AND OVER							
Income received by this person in 1949				If this person is a family head (see definition below)— Income received by his relatives in this household			
Last year (1949), how much money did he earn working as an employee for wages or salary? (Enter amount before deductions for taxes, etc.)	Last year, how much money did he earn working in his own business, profession-al practice, or farm? (Enter net income)	Last year, how much money did he receive from interest, divi-dends, veteran's allowances, pen-sions, rents, or other income (aside from earnings)?	LEAVE BLANK	Last year (1949), how much money did his rela-tives in this house-hold earn working for wages or salary? (Amount before deduc-tions for taxes, etc.)	Last year, how much money did his rela-tives in this house-hold earn in own business, profession-al practice, or farm? (Net income)	Last year, how much money did his relatives in this household receive from in-terest, dividends, veteran's allow-ances, pensions, rents, or other income (aside from earnings)?	LEAVE BLANK
31a	31b	31c	F	32a	32b	32c	G

29. Last year (1949) did you do any work at all, even for a week or two?

☐ Yes - Fill out the Table below

☐ No - *Skip to Item 30.*

	TABLE II	
		A
(1) Repeat the questions until job history for entire calendar year, 1949, is completed. If he held more than one job during the period, use a separate column for each period of work and each period of doing something else.	Last December (1949) what were you doing — ☐ Working or ☐ Something else?
(2) If "Working": When did you begin to work? If "Something else": When did you leave your last job or business before that?	
(3) If "Working": When did this work end? If "Something else": You were not working from........ to when? (2)	December 31, 1949
If "Something else"	(4) From.............to............., while you were not working, were you getting unemployment or workman's compensation? (2) (3)	☐ Yes } *Skip to Item (1) B* ☐ No }
If "Working"	(5) For whom were you working?	Name of employer ☐ Own farm } *Skip to Item (1) B* ☐ Own business }
If Working for Someone Else	(6) How much money did you make while working for................? (5)	$ _____ ☐ Don't know - *Skip to Item (8).*
	(7) Is this before deductions for taxes, social security, etc.?	☐ Yes ☐ No - *Correct figure in Item (6)*
	If Total in Item (6) is not known	(8) How much did you receive each week before deductions?	$ _____
		(9) How many weeks on this job did you receive this amount?	
		(10) Total amount received on this job in 1949 - (8) times (9).	$ _____
	(11) Did you receive any tips, bonuses, or commissions from this job?	☐ Yes ☐ No
	If "Yes" in Item (11)	(12) Is this included in the $........? (6) or (10)	☐ Yes ☐ No - *Correct figure in Item(6) or (10)*
	(13) Total wages and salary earned in 1949 - (6) or (10).	

	B	C	D	
(1)	Before .....(2A)....what were you doing — ☐ Working ☐ Something else?	Before .....(2B)....what were you doing — ☐ Working ☐ Something else?	Before .....(2C)....what were you doing — ☐ Working ☐ Something else?	**TOTALS**
(2)				
(3)				
(4)	☐ Yes ☐ No $\Big\}$ *Skip to Item (1) C*	☐ Yes ☐ No $\Big\}$ *Skip to Item (1) D*	☐ Yes ☐ No	
(5)	Name of employer	Name of employer	Name of employer	
	☐ Own farm ☐ Own business $\Big\}$ *Skip to Item (1) C*	☐ Own farm ☐ Own business $\Big\}$ *Skip to Item (1) D*	☐ Own farm ☐ Own business	
(6)	$ _____ ☐ Don't know – *Skip to Item (8)*	$ _____ ☐ Don't know – *Skip to Item (8)*	$ _____ ☐ Don't know – *Skip to Item (8)*	$ _____
(7)	☐ Yes ☐ No – *Correct figure in Item (6)*	☐ Yes ☐ No – *Correct figure in Item (6)*	☐ Yes ☐ No – *Correct figure in Item (6)*	
(8)	$ _____	$ _____	$ _____	
(9)				
(10)	$ _____	$ _____	$ _____	$ _____
(11)	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	
(12)	☐ Yes ☐ No – *Correct figure in Item (6) or (10)*	☐ Yes ☐ No – *Correct figure in Item (6) or (10)*	☐ Yes ☐ No – *Correct figure in Item (6) or (10)*	
(13)				$ _____

30. Did you do any (other) work during 1949, such as part-time work, odd jobs, etc.?

☐ Yes - *Enter information in Table II*

☐ No

IF SELF-EMPLOYED AT ANY TIME DURING 1949 ANSWER ITEMS 31-33

31. From .... to .... what was your gross income, that is, the total amount you took in during that period (if farm, include government loans on crops)?

$ _____

32. What was your net income after deducting business expenses? This is before deducting personal expenses, personal income taxes, and before deducting money spent for capital items such as land and buildings, equipment, machinery (tractors, trucks, etc.)?

$ _____

33. If nonfarm self-employment:

a. Did you take out a salary or make any other cash withdrawals from your business during 1949?

☐ No

◯ Yes

b. If "Yes": Does the net income figure of.........include all the money you withdrew from the business for yourself as well as any other profits which the business made?

☐ No   - *correct figure in Item 32*

☐ Yes

34. Last year, during 1949, did you receive any
money from other sources such as:

a. Unemployment or workmen's compensation (include
veterans readjustment allowances)? Verify this
by referring to Item 29-(4) in Table II.   □ No   □ Yes $ _____

b. Social Security benefits and government pensions
or assistance?   □ No   □ Yes $ _____

c. Any other pensions or allowances?   □ No   □ Yes $ _____

d. Veterans' payments, such as education and
training subsistence allowances, bonuses or
disability pensions?   □ No   □ Yes $ _____

e. Dependency allotments (from members of the Armed
Forces)?   □ No   □ Yes $ _____

f. Interest, cash dividends, and income from estates
and trusts?   □ No   □ Yes $ _____

g. Receipts from roomers and boarders (not income
after expenses)?   □ No   □ Yes $ _____

h. Rents and royalties from property
(net income after expenses)?   □ No   □ Yes $ _____

i. Money for support from persons not living in this
household (including alimony)?   □ No   □ Yes $ _____

NOTE: If amounts from any source are reported in this question or in Question 35 by more than one
member of the family, make sure these amounts are not duplicated.

35. a. Last year did you receive any money from any other source?

   1 □ No

   ○ Yes

     b. If "Yes," list the types and sources of income and show the amount

       (1) _____ $ _____

       (2) _____ $ _____

36. Compute the total "other" income for this person by adding all
amounts in Items 34 and 35.

                          $ _____