

PART IV .  
VARIABILITY OF EARNINGS

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## CHAPTER X

### VARIATION IN MONEY EARNINGS IN 1919

Since throughout this analysis there has been such complete reliance upon the single census average<sup>a</sup> obtained by dividing the amount paid in wages by the average number of wage earners, it was felt that it would be desirable to supplement the estimates of average earnings derived from the census average wage with data which might throw at least a little light upon the extent to which, within the separate industries and regions, individual establishments scattered above and below the regional or industry average. In view of the somewhat detailed discussion in earlier pages, and in subsequent sections also, of the characteristics of the average, particularly the census average, it seems hardly necessary to go into it any more fully here. It is enough to point out the scope and nature of the sample used for the study of variability of wages and to report the results shown upon analysis of this sample.

#### NATURE AND SCOPE OF THE SAMPLE

After some experimentation with the leading industries in two large manufacturing centers in successive census years, it was finally decided to confine the analysis to the single year 1919. In that census year, 20 of the more important of our 41 selected industries were chosen for this special inquiry. These industries are the ones listed in Table 114.<sup>1</sup> The selected industries, 20 in number, were not taken for the whole of the United States, but only the establishments, in those industries, which reported to the census from the following seven cities: Boston, Cleveland, Detroit, New York, Pittsburgh, San Francisco, and St. Louis. The city of Chicago is added, for some purposes, and some of the totals, therefore, include figures for eight cities, but the detailed analysis by industries does not include Chicago. Moreover, only 12 of the 20 industries listed in Table 114 are separately analyzed for variability.

The 20 industries in these seven cities employed in 1919 an aggregate average number of wage earners totaling 426,989, employed in 10,368 establishments. Both wage earners and establishments con-

<sup>a</sup> See initial paragraph of Ch. XIII.

<sup>1</sup> One industry—brass, bronze, and copper products—is not included in the main inquiry, but is included in the special study. It was originally intended to include this among our 41 selected industries, but the fact that it was not homogeneously reported throughout the period made it impossible to retain it on the list.

stituted about 10 per cent of the wage earners and establishments, respectively, in those industries in the whole of the United States. The wage earners in the eight cities included in the inquiry numbered slightly over half a million and constituted, as indicated in

TABLE 114.—REPRESENTATIVENESS OF SAMPLE USED FOR SPECIAL ANALYSIS OF EARNINGS IN 1919

SELECTED INDUSTRY <sup>1</sup>	INCLUDED IN VARI- ABILITY STUDY		UNITED STATES: 20 INDUSTRIES		PERCENTAGE INCLUDED	
	Estab- lish- ments <sup>2</sup>	Wage earners	Estab- lish- ments	Wage earners	Estab- lish- ments	Wage earners
Tobacco, cigars and cigarettes <sup>2</sup> .....	1,205	24,044	9,926	35,585	12	70
Slaughtering and meat packing <sup>2</sup> .....	74	1,284	1,304	160,990	6	1
Flour-mill and gristmill products.....	28	941	10,708	45,481	.....	21
Mineral and soda waters <sup>2</sup> .....	294	1,846	5,194	17,440	6	11
Clothing, women's <sup>2</sup> .....	5,340	109,251	7,711	165,649	69	63
Cotton manufactures.....	19	1,529	1,288	430,966	1	3
Boots and shoes, not including rubber boots and shoes <sup>2</sup> .....	291	29,362	1,449	211,049	20	14
Lumber and timber products.....	10	689	26,119	480,945	( <sup>3</sup> )	( <sup>3</sup> )
Furniture <sup>2</sup> .....	668	14,268	3,154	138,331	21	10
Paper and wood pulp.....	5	441	729	113,769	1	.....
Printing and publishing, newspapers and periodicals <sup>2</sup> .....	447	25,531	17,362	120,381	3	21
Glass.....	21	3,467	371	77,520	6	4
Petroleum refining.....	7	3,367	320	58,889	2	0
Iron and steel, steel works and rolling mills <sup>2</sup> .....	54	38,313	500	375,088	11	10
Foundry and machine-shop products <sup>2</sup> .....	1,477	76,177	10,934	482,767	14	16
Brass, bronze, and copper products <sup>2</sup> .....	269	16,982	1,092	75,051	25	23
Automobiles <sup>2</sup> .....	59	46,826	315	210,559	19	22
Steam-railroad repair shops <sup>2</sup> .....	48	21,521	1,744	484,437	3	4
Agricultural implements.....	2	227	521	54,368	( <sup>3</sup> )	( <sup>3</sup> )
Rubber goods.....	55	10,133	437	110,848	12	8
Total.....	10,368	426,989	101,178	3,859,109	10	11

  

CITY	INCLUDED IN VARI- ABILITY STUDY		EIGHT CITIES: ALL INDUSTRIES		PERCENTAGE INCLUDED	
	Estab- lish- ments	Wage earners	Estab- lish- ments	Wage earners	Estab- lish- ments	Wage earners
Boston.....	580	27,299	3,077	88,759	19	31
Chicago.....	1,734	96,857	10,537	403,942	16	24
Cleveland.....	550	59,234	2,946	157,730	18	37
Detroit.....	397	67,596	2,176	167,016	18	40
New York.....	7,534	185,410	32,590	638,775	23	29
Pittsburgh.....	360	46,723	1,875	83,290	19	56
San Francisco.....	427	9,630	2,360	48,550	18	20
St. Louis.....	521	31,097	3,205	107,919	16	20
Total.....	12,103	523,846	58,766	1,695,981	21	31

<sup>1</sup> The classification by industries in the upper part of the table includes all of the 8 cities, listed in the lower part, except Chicago.

<sup>2</sup> Industries separately tabulated. See Table 117, p. 235, and Table 119, p. 238.

<sup>3</sup> Less than one-half of 1 per cent.

Table 114, 31 per cent of the wage earners employed in all industries in the eight cities. The more than 12,000 establishments included in the eight cities constituted 21 per cent of all manufacturing establishments in those cities. The representativeness of the sample used is shown in detail in Table 114 for each city and industry. It is evi-

dent at once that there are several of the industries in respect to which the sample represents too small a proportion to justify presenting results for the industry separately. On this account, there was no attempt made to report results separately for 8 of the 20 industries. The remaining 12 for which the samples represent a sizable proportion of the industry are made the basis of detailed analysis. The totals for the whole group combined include, of course, all 20 industries. In respect to the cities, there is in every case a very large proportion of the wage earners of the city represented in the 20 industries included in our sample, the proportion of the wage earners in all manufacturing industries in the respective cities ranging from 20 per cent in San Francisco to 56 per cent in Pittsburgh. The proportion of all manufacturing establishments in the above cities covered by the present sample ranged from 16 per cent in St. Louis and Chicago to 23 per cent in New York.

In Table 115 the 12 separately analyzed industries and the 8 cities, 7 of which are included in the figures for the separate industries, are

TABLE 115.—MEDIAN ESTABLISHMENT AVERAGES OF ACTUAL EARNINGS: 1919

INDUSTRY	Median establishment average	CITY	Median establishment average
Slaughtering, wholesale, not including meat packing.....	\$1,541	Pittsburgh.....	\$1,433
Iron and steel, steel works and rolling mills.....	1,521	Detroit.....	1,424
Automobiles.....	1,456	Cleveland.....	1,380
Cars and general shop construction and repairs by steam railroads.....	1,433	8 cities combined.....	1,316
Printing and publishing, newspapers and periodicals.....	1,423	Chicago.....	1,243
20 industries combined.....	1,316	San Francisco.....	1,194
Foundry and machine-shop products.....	1,239	New York.....	1,184
Brass, bronze, and copper products.....	1,249	Boston.....	1,105
Furniture.....	1,244	St. Louis.....	958
Mineral and soda waters.....	1,121		
Clothing, women's.....	1,120		
Boots and shoes, not including rubber boots and shoes.....	949		
Tobacco, cigars and cigarettes.....	704		

arranged according to the median establishment average in each city and industry group.<sup>2</sup> It is to be noted that this is the median of the census averages, for all of the establishments in the industry, discounted for the time during which the plant was shut down. It represents, therefore, the median average of actual annual earnings per capita. A comparison between the median establishment averages shown in Table 115 with the estimated averages shown in Parts II and III and based upon all industries and upon the whole of the United States shows considerable differences.<sup>3</sup> First of all, it is to

<sup>2</sup> The method of arriving at these median establishment averages, as well as the whole procedure underlying the construction of the tables in this and the following chapter, is explained in detail in Ch. XX.

<sup>3</sup> Such a comparison is made in Table 15, p. 45.

be remembered that the averages, based upon the whole of manufacturing industry throughout the United States, when they are reported for the selected industries separately, are shown, not for men and women wage earners combined, as is the case in Table 115, but either for men alone or for men and women separately. It is very probable, nevertheless, even though the averages in the main part of this inquiry were in each selected industry based as they are in Table 115 upon both sexes combined, that there would still be no inconsiderable differences between these medians and the arithmetic means. In the case of such differences we can only conclude that the arithmetic means, representing as they do all manufacturing industry in the whole of the United States, must be most nearly correct. In view of these facts, it would be a serious mistake to make hasty inferences from the data in this chapter and the following, especially about the exact amounts of earnings. The figures in this and the following tables are designed not to show amounts of earnings so much as to indicate the degree of concentration of the establishments within an industry around the median establishment. Now, the figures in Table 115 are of practically no use from this point of view. They serve merely as a summary of the results obtained in the analysis and perhaps also to indicate how wide a range there seems to be among the 12 industry medians and, less strikingly, among the 8 city medians. The median earnings in the slaughtering industry were more than twice those in the median establishment of the tobacco industry. In respect to the cities there is also a wide range but it is considerably less wide than in the case of the industries. St. Louis is the city where per capita actual earnings appear to have been lowest and Pittsburgh the one where they were highest.

#### VARIATIONS IN MONEY EARNINGS, BY CITIES

When to the medians are added the establishments which occupy less central positions in respect to the per capita actual earnings received in them, it is possible to get something like a satisfactory notion of the extent to which average per capita earnings really represent the style in earnings. In other words, we get some idea of the proportion of establishments in a given city or industry whose wage earners receive annually per capita amounts of earnings more or less closely approximating the average per capita amounts received. If we take the 580 establishments included in our sample in the city of Boston, pick out the midmost establishment, which in this case (since there are an even number of establishments) can be taken as either the 290th or the 291st establishment in the array, and set down the sum of money earnings per capita estimated to have been received in that establishment we have in that sum (\$1,105 in this

case) a sample of the statistical unit on which reliance is placed in this part of the analysis.

But it is not necessary to confine the examination to the median plant. Use can be made here also of the percentile distribution. The amounts of earnings in the decil and extreme establishments are shown for each of the eight cities in Table 116. Obviously we can not take seriously either the "high" or "low" establishments indicated in the table. They represent unquestionably very abnormal conditions of some sort. In the case of the "high" item there is probably involved an establishment which consists, perhaps, of no other employees than the proprietor; or, perhaps, one or two additional employees in addition to the proprietor. In such cases, of course, per capita earnings are bound to be extraordinarily high. The minimum establishment or the establishment from which minimum per capita earnings are reported probably also represents a

TABLE 116.—VARIATION IN ACTUAL MONEY EARNINGS IN 8 CITIES FOR 20 SELECTED INDUSTRIES: 1919

	8 cities	Boston	Chicago	Cleveland	Detroit	New York	Pittsburgh	San Francisco	St. Louis
Low.....	\$14	\$70	\$12	\$54	\$107	\$14	\$98	\$52	\$24
First decil.....	728	783	861	876	1,018	634	727	722	702
Second decil.....	878	783	1,031	1,059	1,296	796	1,101	802	804
Third decil.....	1,034	879	1,151	1,228	1,359	957	1,323	972	819
Fourth decil.....	1,193	985	1,203	1,321	1,406	1,006	1,384	1,034	900
Median.....	1,316	1,105	1,243	1,389	1,424	1,184	1,433	1,194	958
Sixth decil.....	1,403	1,210	1,340	1,456	1,490	1,308	1,453	1,331	1,046
Seventh decil.....	1,468	1,276	1,411	1,521	1,525	1,425	1,576	1,424	1,179
Eighth decil.....	1,508	1,385	1,517	1,597	1,684	1,595	1,778	1,530	1,300
Ninth decil.....	1,778	1,610	1,706	1,698	1,673	1,840	2,020	1,724	1,472
High.....	5,355	3,093	5,183	2,853	2,707	5,355	2,546	3,171	3,084

very small concern or, possibly, a concern which had operated for only a very short period during the year. Discarding, then, the high and low items and giving attention to the decil items it would appear, for example, that in Boston in eight-tenths of the 580 establishments reported from that city the average actual earnings received were between \$783 and \$1,610. In four-tenths of the establishments, or nearly half of them, the average earnings are between \$879 and \$1,276. It is to be noticed that in proportion as the decils near to the median, are sums very close to the amounts of earnings entered for the median, in that measure, there is concentration about a typical wage. The tendency, then, for per capita earnings in most of the establishments to be the same as it is in the average for all establishments is measured by the closeness of the decil items to the median item.

To what degree this smaller or greater concentration of per capita earnings for establishments around the median establishment

measures a corresponding concentration of the earnings of individual wage earners around the average is a somewhat more dubious question. The most we can say is that the fact that there is a strong tendency among the establishments to show a high concentration of per capita earnings around a median per capita sum is presumptive evidence of a similarly high degree of concentration of individual workers' earnings around the average for all wage earners. Unfortunately we do not have the original raw material in the form of earnings for individual wage earners, but as intimated in Chapter I it would seem, judging by the results obtained from establishments which vary among themselves almost as widely as the earnings could possibly vary, that we may be justified in concluding that the presumptive evidence is strong.

#### INDUSTRIAL DIFFERENCES IN VARIABILITY

More important than the median and decil establishment averages for the different cities are the corresponding items for the 12 industries which have been tabulated separately. These figures are given in Table 117. There is evident here an even wider range between establishments where the per capita actual earnings are very high and those at the other extreme where they are very low than is the case with the city returns in Table 116. There is, however, a very great difference in the degree of variation of earnings in the different industries. How great these differences are will be evident after a reinspection of Figure 3 which is drawn from the data of Table 117. Good examples are the newspaper printing and publishing industry and the automobile industry, the former representing a relatively high, the latter a relatively low, degree of variation in earnings so far as we may judge from arrays in which the *establishment* per capita wage payment (or census average wage) is the unit. Expressing it in slightly different form, the figures indicate that there is a higher degree of concentration around the average earnings in the automobile industry than in most of the other industries shown in the table. Three-tenths of the wage earners in that industry were employed in establishments where the per capita earnings were between \$1,424 and \$1,499; that is to say, nearly one-third of the wage earners in this industry worked in establishments where the per capita earnings were very close to the median for the industry, which is \$1,456. The per capita earnings received by the wage earners in six-tenths of the establishments were between \$1,333 and \$1,525. In one-tenth of the establishments the per capita earnings received were between \$1,590 and \$2,240; in another one-tenth between \$1,525 and \$1,590. At the other extreme, one-tenth of the establishments had per capita earnings between \$628 and \$1,326; another one-tenth between \$1,326 and \$1,333.

In the printing and publishing industry the situation is very different. First of all, the range between the first and ninth decils is greater, being from \$973 to \$1,885, as compared with a range between \$1,326 and \$1,590 in the automobile industry. In the printing and publishing industry in six-tenths of the establishments, per

TABLE 117.—HIGH, LOW, MEDIAN, AND DECIL ESTABLISHMENTS—AVERAGES OF MONEY EARNINGS IN 1919 FOR 20 INDUSTRIES COMBINED AND SEPARATELY FOR 12 INDUSTRIES

	Total, 20 industries	Tobacco, cigars and cigarettes	Boots and shoes, not including rubber boots and shoes	Clothing, women's	Mineral and soda waters	Furniture
Number of establishments.....	10,368	1,205	291	5,340	294	663
Number of wage earners.....	426,989	24,944	29,362	109,251	1,846	14,258
Low.....	\$14	\$24	\$172	\$14	\$50	\$14
First decil.....	728	403	738	629	777	855
Second decil.....	878	557	783	773	915	947
Third decil.....	1,034	566	810	886	1,006	1,023
Fourth decil.....	1,193	636	825	1,002	1,060	1,137
Median.....	1,316	704	949	1,120	1,121	1,244
Sixth decil.....	1,403	733	1,007	1,266	1,180	1,319
Seventh decil.....	1,468	853	1,053	1,444	1,270	1,399
Eighth decil.....	1,568	963	1,209	1,643	1,369	1,521
Ninth decil.....	1,778	1,164	1,396	1,953	1,499	1,695
High.....	5,355	2,623	2,825	5,355	2,515	5,028
Per capita money earnings for all establishments reported by the Bureau of the Census <sup>1</sup> .....	1,212	504	1,149	1,137	850	1,102

  

	Brass, bronze, and copper products	Foundry and machine-shop products	Printing and publishing, newspapers and periodicals	Steam-railroad repair shops	Automobiles	Iron and steel works and rolling mills	Slaughtering and meat packing
Number of establishments.....	269	1,477	447	48	59	54	74
Number of wage earners.....	16,982	76,177	25,531	21,521	46,826	38,313	1,284
Low.....	\$181	\$70	\$94	\$715	\$628	\$229	\$50
First decil.....	795	989	973	747	1,326	962	1,061
Second decil.....	805	1,084	1,213	1,365	1,333	1,300	1,144
Third decil.....	1,005	1,189	1,338	1,366	1,424	1,384	1,323
Fourth decil.....	1,183	1,222	1,398	1,426	1,424	1,438	1,473
Median.....	1,249	1,289	1,423	1,433	1,455	1,521	1,541
Sixth decil.....	1,296	1,377	1,497	1,450	1,499	1,610	1,541
Seventh decil.....	1,335	1,465	1,573	1,472	1,523	1,778	1,570
Eighth decil.....	1,520	1,554	1,773	1,568	1,525	2,020	1,783
Ninth decil.....	1,794	1,695	1,885	1,633	1,590	2,020	2,053
High.....	3,813	4,210	4,281	2,419	2,240	2,079	3,443
Per capita money earnings for all establishments reported by the Bureau of the Census <sup>1</sup> .....	( <sup>2</sup> )	1,450	1,205	1,394	1,278	1,728	1,484

<sup>1</sup> For tobacco; mineral and soda waters; printing and publishing, newspapers and periodicals; boots and shoes; and women's clothing the figures are weighted averages of the figures given for 1919 for men and women in Table 44 (weights based on the percentages of Table G); for the other industries, the figures are taken directly from actual earnings figures in Table 38.

<sup>2</sup> This industry not included in the 41 selected industries reported in this monograph.



capita earnings ranged between \$1,213 and \$1,773. The highest tenth of the establishments had average earnings ranging between \$1,855 and \$4,281. The lowest tenth of the establishments had average earnings ranging between \$94 and \$973. Among the other industries rather high degrees of variation are found in women's clothing and in furniture, and rather relatively low degrees of variation (high concentration in other words) in steam-railroad repair shops, foundry and machine shops, and iron and steel.

## CLASSIFIED EARNINGS TABLES

Another way of showing the extent of variation in earnings is by means of the classified wage table, which shows, not the per capita amount of earnings in median and decil establishments, but the number of establishments having per capita earnings amounts falling within certain brackets. Such a classified arrangement of the results of the special inquiry for the year 1919 is given in Table 118. The

TABLE 118.—DISTRIBUTION OF WAGE EARNERS ACCORDING TO ESTIMATED FULL-TIME AND ACTUAL ANNUAL EARNINGS IN 1919, WITH ABSOLUTE AND CUMULATIVE PER CENT DISTRIBUTION OF WAGE EARNERS; FOR 20 INDUSTRIES COMBINED

ANNUAL EARNINGS	FULL-TIME BASIS				ACTUAL-TIME BASIS			
	Number of establishments	Wage earners			Number of establishments	Wage earners		
		Number	Per cent distribution			Number	Per cent distribution	
			Absolute	Cumulative			Absolute	Cumulative
Total.....	10,368	420,080	100.0		10,368	420,080	100.0	
Less than \$300.....	47	883	.3	100.0	435	3,297	.8	100.0
\$300-\$399.....	55	697	.1	99.7	223	1,616	.4	99.3
\$400-\$499.....	102	1,620	.4	99.0	206	4,614	1.0	98.0
\$500-\$599.....	252	7,053	1.6	99.2	448	12,272	2.9	97.9
\$600-\$699.....	447	9,794	2.3	97.6	588	13,600	3.3	95.0
\$700-\$799.....	507	23,813	5.6	95.4	710	28,013	6.8	91.7
\$800-\$899.....	680	27,482	6.5	89.3	747	27,349	6.4	84.0
\$900-\$999.....	754	24,925	5.8	83.3	702	20,157	4.7	78.5
\$1,000-\$1,099.....	886	20,341	4.8	77.5	821	30,283	7.1	72.4
\$1,100-\$1,199.....	707	20,070	4.7	70.3	702	25,356	6.0	65.3
\$1,200-\$1,299.....	838	27,505	6.4	64.2	773	34,842	8.2	59.3
\$1,300-\$1,399.....	747	42,718	10.1	56.7	643	46,288	10.8	51.2
\$1,400-\$1,499.....	678	64,218	15.0	40.6	593	59,592	14.0	40.3
\$1,500-\$1,599.....	602	46,817	10.9	33.1	545	41,613	9.7	30.3
\$1,600-\$1,699.....	538	20,897	4.9	22.0	398	17,983	4.2	16.0
\$1,700-\$1,799.....	403	16,185	3.8	15.9	320	14,081	3.3	12.4
\$1,800-\$1,899.....	405	12,757	3.0	11.9	286	10,265	2.4	9.1
\$1,900-\$1,999.....	284	7,706	1.8	8.9	202	7,015	1.6	6.7
\$2,000-\$2,099.....	280	13,335	3.1	7.1	179	11,197	2.6	5.1
\$2,100-\$2,199.....	170	5,583	1.3	4.0	124	2,571	.6	2.5
\$2,200-\$2,299.....	138	1,901	.5	2.7	82	1,352	.4	1.0
\$2,300-\$2,399.....	110	2,408	.5	2.2	78	1,677	.3	1.5
\$2,400-\$2,499.....	93	1,510	.4	1.7	65	1,134	.3	1.2
\$2,500-\$2,599.....	71	951	.2	1.3	36	554	.1	.9
\$2,600-\$2,699.....	55	1,054	.3	1.1	31	876	.2	.8
\$2,700-\$2,799.....	47	673	.1	.8	33	553	.2	.6
\$2,800-\$2,899.....	49	744	.2	.7	18	438	.1	.4
\$2,900-\$2,999.....	24	334	.1	.5	15	201	.1	.3
\$3,000 and over.....	152	1,815	.4	.4	85	1,210	.3	.3

figures report the number of establishments (and of wage earners in those establishments) in which the per capita earnings come within the designated brackets. It presents this frequency distribution on both the full-time and actual-time basis. That is to say, it shows the distribution of the establishments and the wage earners in them according to the full-time equivalent of earnings received, without any discount for short-time operation, and it shows the same distribution for actual earnings which are computed by making a discount for the proportion of the year that the establishment was not in operation. For both columns of wage earners there are inserted absolute and cumulative percentage distributions. These distributions, it should be pointed out, do not indicate the number of wage earners whose earnings amounted to designated sums during the year but the proportion of the total number of wage earners included in the sample who were employed in establishments where the per capita earnings came within the indicated earnings class.

Use is made primarily of the frequency distribution based on actual time. In this distribution in Table 118 it will be noticed that the modal or typical earnings amount was in the class \$1,400 to \$1,499. Thirty-three per cent of the wage earners were employed, it seems, in concerns in which per capita earnings ranged between \$1,200 and \$1,500. In the light of the figures given in earlier chapters this is undoubtedly too high, and here again the caution should be given that these figures can not be taken as accurately measuring *amounts* of earnings. The estimates given in Parts II and III have their margins of error, but based as they are, not upon a sample but on the whole body of manufacturing wage earners, they are far nearer the truth, it is believed, than the figures which have resulted from this special inquiry. What we may legitimately get out of this frequency distribution and of other frequency distributions following is some notion of the degree of concentration. The largest single group of wage earners in the frequency distributions of actual earnings in Table 118 is a group of more than 59,000, making up 14 per cent of all the wage earners and who worked in the 593 establishments where earnings were most highly concentrated, yet very large proportions of the wage earners worked in establishments where the per capita earnings were much higher or much lower. Thus as large a proportion as 7 per cent of the wage earners worked in establishments where the per capita earnings were in the \$700 group; 3 per cent worked in establishments in which per capita earnings were in the \$600 group.

Absolute percentage distributions corresponding to those given in Table 118 for actual earnings are presented in Table 119 for each

of the 12 industries as well as for the 20 industries combined.<sup>4</sup> The table brings out very clearly some striking differences among the 12 industries in respect to the degree of variability of earnings. The percentages definitely confirm the evidence of the medians and decils in Table 117 in respect to the degree of concentration in the different groups. The most outstanding cases of high concentration—low variability—are automobiles, steam-railroad repair shops, and slaughtering and meat packing. At the other extreme, involving extremely high variability in earnings, are the women's clothing industry, the furniture industry, and, apparently, printing and publishing.

TABLE 119.—CLASSIFIED ACTUAL EARNINGS, PER CAPITA, IN 1919, BY INDUSTRIES: PER CENT DISTRIBUTION OF WAGE EARNERS ACCORDING TO PER CAPITA EARNINGS IN ESTABLISHMENT IN WHICH THEY WERE EMPLOYED

[Based on establishment schedules from 7 cities]

ANNUAL PER CAPITA EARNINGS	20 industries combined	Automobiles	Boots and shoes, not including rubber boots and shoes	Brass, bronze, and copper products	Cars and general shop construction and repairs by steam-railroad companies	Clothing, women's
Total number of establishments.....	10,268	59	291	269	48	5,340
Total number of wage earners.....	426,989	46,826	20,362	16,982	21,521	109,251
Total.....	100.0	100.0	100.0	100.0	100.0	100.0
Less than \$300.....	.8		.3	2.5		1.1
\$300-\$399.....	.4		.1			1.1
\$400-\$499.....	1.0		.2			1.9
\$500-\$599.....	2.9		1.2	.1		4.2
\$600-\$699.....	3.3	.4	5.0	1.4		6.4
\$700-\$799.....	6.8		18.8	15.7	10.1	8.0
\$800-\$899.....	6.4	1.8	16.7	7.5		8.5
\$900-\$999.....	6.1		15.7	2.5		8.7
\$1,000-\$1,099.....	7.1	1.4	14.8	6.9		8.2
\$1,100-\$1,199.....	6.0	1.3	5.5	6.1	.6	7.3
\$1,200-\$1,299.....	8.2	2.3	4.4	18.9	5.1	5.9
\$1,300-\$1,399.....	10.8	18.3	7.5	11.5	17.9	5.2
\$1,400-\$1,499.....	14.0	43.4	2.0	5.0	30.4	5.8
\$1,500-\$1,599.....	9.7	27.1	1.0	6.4	18.8	5.6
\$1,600-\$1,699.....	4.2	2.5	2.5	4.1	7.6	3.6
\$1,700-\$1,799.....	3.3	.8	2.1	6.8	.9	3.0
\$1,800-\$1,899.....	2.4		.3	.9	.2	2.8
\$1,900-\$1,999.....	1.8	.4	.5	3.2	1.8	2.5
\$2,000-\$2,099.....	2.6	.3	.6		.4	1.9
\$2,100-\$2,199.....	.6		.4			1.8
\$2,200-\$2,299.....	.4		.1	.2		.8
\$2,300-\$2,399.....	.3		.2			1.2
\$2,400-\$2,499.....	.3				.2	.8
\$2,500-\$2,599.....	.1			.3		.3
\$2,600-\$2,699.....	.2					.8
\$2,700-\$2,799.....	.2					.3
\$2,800-\$2,899.....	.1		.1			.3
\$2,900-\$2,999.....						.1
\$3,000 and over.....	.3					.8

<sup>4</sup> The complete classified tables for each of the 12 industries, including numbers of establishments and wage earners and cumulative percentages, are given in Table H in Pt. VI.

TABLE 119.—CLASSIFIED ACTUAL EARNINGS, PER CAPITA, IN 1919, BY INDUSTRIES: PER CENT DISTRIBUTION OF WAGE EARNERS ACCORDING TO PER CAPITA EARNINGS IN ESTABLISHMENT IN WHICH THEY WERE EMPLOYED—CON.

[Based on establishment schedules from 7 cities]

ANNUAL PER CAPITA EARNINGS	Foundry and machine-shop products	Furniture	Iron and steel, steel works and rolling mills	Mineral and soda waters	Printing and publishing, newspapers and periodicals	Slaughtering and meat packing	Tobacco, cigars and cigarettes
Total number of establishments.....	1,477	663	54	204	447	74	1,205
Total number of wage earners.....	76,177	14,258	38,318	1,840	2,531	1,284	24,044
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than \$300.....	.2	.5	2.4	.5	.1	.1	2.0
\$300-\$399.....	.1	.6	.1	.1	.2	.1	.6
\$400-\$499.....	.1	.3	.1	1.6	.1	.1	8.9
\$500-\$599.....	.6	.2	1.7	1.2	.4		24.0
\$600-\$699.....	.6	2.1	2.1	2.1	1.0		14.2
\$700-\$799.....	.7	2.1	4.7	4.0	4.0	.9	15.2
\$800-\$899.....	2.7	10.0	.2	8.2	1.9	4.0	12.8
\$900-\$999.....	7.7	9.0	1.4	10.1	2.7	.5	5.0
\$1,000-\$1,099.....	10.4	11.7	2.0	10.1	5.6	11.0	5.3
\$1,100-\$1,199.....	9.7	8.2	4.7	21.1	3.7	6.8	3.7
\$1,200-\$1,299.....	10.7	13.3	2.7	7.9	5.8	5.2	1.8
\$1,300-\$1,399.....	9.2	11.5	12.8	8.9	15.1	0.0	1.2
\$1,400-\$1,499.....	12.9	8.3	13.5	7.4	20.4	7.6	3.7
\$1,500-\$1,599.....	9.0	8.2	10.4	2.3	11.1	28.5	.3
\$1,600-\$1,699.....	0.3	3.4	0.0	.5	3.7	6.0	.5
\$1,700-\$1,799.....	5.0	3.0	4.8	1.0	0.1	8.1	.2
\$1,800-\$1,899.....	1.6	2.1	8.0	1.6	8.2	2.0	.5
\$1,900-\$1,999.....	1.5	.8	1.2	.3	5.3	1.1	.1
\$2,000-\$2,099.....	.5	1.2	20.5	.6	.8	4.3	
\$2,100-\$2,199.....	.1	.9		1.3	1.2		
\$2,200-\$2,299.....	.3	.2		1.4	.3	.9	
\$2,300-\$2,399.....	.2	.3		.4	.2	.6	
\$2,400-\$2,499.....	.1	.2		.3	.6		
\$2,500-\$2,599.....		.2		.2	.3	.1	
\$2,600-\$2,699.....	.1				.1		
\$2,700-\$2,799.....	.1	.1				4.3	
\$2,800-\$2,899.....					.2		
\$2,900-\$2,999.....		.3				1.0	
\$3,000 and over.....	.1	.4			.9	.9	

The eight cities covered in the 1919 inquiry are separately reported as to the percentage distribution of their establishments in respect to per capita earnings in Table 120.<sup>5</sup> There is naturally less difference between the cities in respect to variation than between the different industries, inasmuch as the figures for each city represent the consolidation of the widely variant industries shown in Table 119. Moreover, such differences as are visible between the cities are probably in part attributable to the prominence of certain industries in those cities. For example, it would appear that there is a greater degree of uniformity of earnings in Detroit than is true of the eight cities combined or, than is true of, say, San Francisco. This is probably due to the great prominence of the automobile industry in Detroit. Similarly, no doubt, the relatively greater variability of earnings in New York may be accounted for by the importance of the women's clothing trade in that city.

<sup>5</sup> The complete frequency tables for each of the 8 cities, including numbers of establishments and wage earners and cumulative percentages, are given in Table I in Pt. VI.

TABLE 120.—CLASSIFIED ACTUAL EARNINGS, PER CAPITA, IN 1919, BY CITIES

[Based on census schedules for 20 industries in these cities]

ANNUAL PER CAPITA EARNINGS	Eight cities combined	Boston	Chicago	Cleveland	Detroit	New York	Pittsburgh	San Francisco	St. Louis
Total number of establishments.....	12, 103	590	1, 734	550	397	7, 524	360	427	521
Total number of wage earners.....	523, 846	27, 299	96, 857	59, 234	67, 596	185, 410	46, 723	9, 030	31, 097
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than \$300.....	.8	.1	.1	.1	.6	1.2	2.0	.5	.1
\$300-\$399.....	.4	.2	.1	.1	.7	.7	.2	.0	.3
\$400-\$499.....	1.0	.4	.5	.1	.1	1.8	.9	2.0	.7
\$500-\$599.....	2.9	1.3	1.7	2.0	.2	5.0	.7	4.3	1.4
\$600-\$699.....	3.3	2.1	2.0	1.6	1.9	4.3	1.3	1.9	7.5
\$700-\$799.....	0.7	13.8	2.6	3.1	2.5	7.4	5.4	8.1	9.2
\$800-\$899.....	6.4	9.6	5.2	4.9	3.9	5.9	3.0	7.2	20.1
\$900-\$999.....	0.1	7.7	5.5	6.5	.8	6.7	2.5	14.2	15.2
\$1,000-\$1,099.....	7.1	7.2	7.1	3.6	1.9	11.2	.9	5.7	9.0
\$1,100-\$1,199.....	5.9	9.0	10.5	5.1	2.3	7.1	4.3	5.6	8.2
\$1,200-\$1,299.....	8.2	13.5	22.6	9.5	7.5	8.2	4.8	8.1	6.9
\$1,300-\$1,399.....	10.8	11.0	11.8	14.4	17.2	7.5	15.2	10.8	3.5
\$1,400-\$1,499.....	14.0	4.9	8.1	17.3	26.6	8.7	22.6	5.1	8.9
\$1,500-\$1,599.....	9.7	3.2	7.2	11.9	22.2	6.6	9.0	12.3	4.0
\$1,600-\$1,699.....	4.3	2.8	3.5	11.1	3.6	3.1	3.1	3.0	2.2
\$1,700-\$1,799.....	3.3	1.9	2.1	1.8	3.9	3.5	6.2	2.5	1.0
\$1,800-\$1,899.....	2.4	1.7	1.6	4.2	1.5	2.6	2.4	2.5	.3
\$1,900-\$1,999.....	1.8	2.9	0.4	1.0	2.5	2.1	.1	.1	.6
\$2,000-\$2,099.....	2.6	.5	.5	1.7	.3	1.4	15.3	.4	.1
\$2,100-\$2,199.....	.6	.1	.3	.1	.1	1.2	.3	.1	.1
\$2,200-\$2,299.....	.4	.3	.1	.1	.1	.6	.2	.2	.1
\$2,300-\$2,399.....	.3	.2	.1	.1	.8	.1	.3	.1	.1
\$2,400-\$2,499.....	.3	.1	.1	.3	.5	.2	.2	.1	.1
\$2,500-\$2,599.....	.1	.3	.1	.1	.3	.3	.3	.1	.1
\$2,600-\$2,699.....	.2	.1	.1	.1	.4	.4	.4	.1	.1
\$2,700-\$2,799.....	.2	.3	.1	.1	.3	.2	.2	.2	.1
\$2,800-\$2,899.....	.1	.1	.1	.1	.1	.1	.1	.1	.1
\$2,900-\$2,999.....	.1	.1	.1	.1	.1	.1	.1	.1	.1
\$3,000 and over.....	.3	.1	.1	.1	.6	.6	.6	.6	.1

## VARIABILITY IN TERMS OF STANDARD DEVIATION

The facts about variability of earnings which have appeared in the preceding tables of this chapter in more or less discursive form can be set out much more briefly by calculating for the different city and industry groups the standard or typical deviation and the corresponding coefficient of variation for each group. The standard deviation, which is the square root of the mean square of the deviations of the individual (establishment per capita) rates of wages from the average (establishment) rate, has been worked out here on the basis of the following formulae:<sup>6</sup>

$$\sigma = \sqrt{\frac{\sum fd^2}{n} - c^2}$$

$$c = \frac{\sum fd}{n}$$

<sup>6</sup> An example of the way in which these formulae are applied to our data, in order to get the results shown in Tables 121 and 122, is given in Table 170, p. 372, which uses as its basic material the frequency distribution of wage earners (actual time) in Table 118.

Where

$\sigma$  = Standard deviation.

$d$  = Deviation from assumed average.

$f$  = Class frequencies (numbers of wage earners).

$n$  = Total number of wage earners.

$c$  = Correction for error in assumed average.<sup>7</sup>

The standard deviation is, of course, an absolute sum, not a percentage. Consequently, for purposes of comparison, coefficients of variation have been computed. The coefficient of variation is the standard deviation expressed as a percentage of the arithmetic mean. The formula is:

$$V = \frac{\sigma}{M} \times 100$$

in which  $V$  = Coefficient of variation

and  $M$  = Weighted arithmetic mean (of establishment per capita earnings items).

The standard deviation, as already stated, is a sum in dollars representing the typical deviation in earnings from the average earnings. Since it would be meaningless to compare this deviation in an industry where the average earnings are high with the deviation in an industry where the average earnings are very much lower, it is put in a form which makes it more possible to compare one industry with another by expressing it as a percentage of the average. In other words, coefficients of variations are derived from the standard deviations by dividing the latter by the average. The coefficient of variation, then, is the quotient of the standard deviation divided by the average, multiplied by 100. To illustrate, the standard deviation worked out by application of the above formula for all 20 industries combined was \$426. This is the deviation from the average of \$1,272, the average being a weighted arithmetic mean calculated from the same classified data which were used for the calculation of the standard deviation. This standard deviation of \$426, divided by the average wage of \$1,272, gives a coefficient of variation of 33.5 per cent.

Standard deviations and their corresponding coefficients of variations for each of the eight cities and for all of them combined (without Chicago) are shown in Table 121. Alongside the standard deviations are listed the average money earnings from which the deviations are measured. Again, illustrating by use of the figures for the seven cities combined, which is the same thing, of course, as to say for the 20 industries combined, we have a standard deviation of \$426 from an average of \$1,272. This means that, in 1919 in the

<sup>7</sup> Since it has been necessary to calculate the standard deviation from classified earnings tables, we are under the necessity of using an assumed average for our point of departure in the calculation.

establishments included in the sample, the typical variation from the average was \$426, the typical variation being an amount almost exactly one-third of the average; that is to say, its coefficient of variation was 33.5 per cent.

TABLE 121.—STANDARD DEVIATIONS AND COEFFICIENTS OF VARIATION BASED ON CLASSIFIED WAGE TABLES FOR EACH OF 8 CITIES, FOR 20 INDUSTRIES: 1919

CITY	Median establish- ment average	Average actual money earnings (based on 7 cities for 20 in- dustries)	Standard devia- tion from average in pre- ceding column	Coeffi- cient of variation
Seven cities.....	\$1,316	\$1,272	\$426	33.5
Boston.....	1,105	1,120	350	31.6
Chicago.....	1,243	1,415	344	24.3
Cleveland.....	1,389	1,343	325	24.2
Detroit.....	1,424	1,390	283	20.3
New York.....	1,184	1,225	490	40.1
Pittsburgh.....	1,433	1,423	410	28.8
San Francisco.....	1,194	1,215	453	37.8
St. Louis.....	958	1,042	300	29.4

<sup>1</sup> Including Chicago, 8 cities.

<sup>2</sup> Chicago excluded.

Corresponding standard deviation figures and variation coefficients for each of the 12 industries and for the consolidated group of 20 industries combined are given with the corresponding averages in Table 122. For purposes of comparison the averages calculated

TABLE 122.—STANDARD DEVIATIONS AND COEFFICIENTS OF VARIATION BASED ON CLASSIFIED WAGE TABLES FOR EACH OF 12 INDUSTRIES IN 7 CITIES: 1919

INDUSTRY	AVERAGE ACTUAL MONEY EARNINGS		Standard deviation from average in pre- ceding column	Coeffi- cient of variation (per cent)
	Based on all manu- facturing indus- tries reported by Census Bureau	Based on special study of 20 industries in 7 cities		
Twenty industries (in 7 cities) <sup>1</sup> .....	\$1,212	\$1,272	\$427	33.6
Automobiles.....	Men 1,278 Women 859	1,456	170	11.7
Boots and shoes, not including rubber boots and shoes.....	1,342	1,016	312	30.7
Brass, bronze, and copper products.....	838	1,202	379	31.5
Clothing, women's.....	1,586	1,227	539	44.0
Foundry and machine-shop products.....	1,450	1,322	300	22.7
Furniture.....	1,192	1,253	380	30.3
Iron and steel, steel works and rolling mills.....	1,728	1,626	422	27.6
Mineral and soda waters.....	866	1,160	347	26.9
Printing and publishing, newspapers and peri- odicals.....	1,330	1,406	1,311	82.7
Railroad repair shops, steam.....	1,394	1,392	255	18.3
Slaughtering, wholesale, not including meat packing.....	1,484	1,544	447	28.9
Tobacco, cigars and cigarettes.....	907	758	285	37.6

<sup>1</sup> Boston, Cleveland, Detroit, New York, Pittsburgh, San Francisco, and St. Louis.  
<sup>2</sup> Calculated from frequency distribution in Table 118.

from the whole of manufacturing industry, as presented in detail in earlier chapters of this book, are also included. The results shown in this table, of course, indicate a wide variation between the different industries as to the degree of uniformity of earnings therein. On the whole they confirm what has already been brought out in a more general way. In this form the figures have the advantage of telling the story in a nutshell. Again, it appears that the automobile industry, foundry and machine-shop products, and steam-railroad repair shops are industries having a relatively high degree of uniformity in earnings, whereas women's clothing, and tobacco, cigars and cigarettes and, possibly, printing seem to have a relatively low degree of uniformity in earnings.



## CHAPTER XI

### CHANGES IN VARIABILITY BETWEEN 1899 AND 1919

The classified wage tables in the Dewey report, covering the census years 1890 and 1899 (1900), and similar classified wage tables reported in Census Bulletin 93 for the manufactures census year 1904, furnish the necessary data for making a comparison with the results reached in the special analysis here made for the year 1919. The details of the method of effecting what is the equivalent to the deflation of the nominal earnings of the different periods are given in Chapter XX. A comparison between classified wage distributions in 1890, 1900, 1904, and 1919 is made in Table 123. In the left-hand part of the table the distribution of wage earners is in accordance with nominal wage sums. On the right-hand side of the table two comparisons are made: One between the distribution in 1900 and 1919; the other between the distribution of 1904 and 1919. In these two distributions the numbers of wage earners are distributed according to amounts of their real wages on the basis of the two earlier periods. In the case of the first comparison, that is to say, on the 1900 basis; in the case of the second comparison on the 1904 basis. In both cases percentage distribution figures are given.

#### COMPARISON OF FREQUENCY DISTRIBUTIONS: 1890 TO 1919

The more general term "wages" has been used in the preceding paragraph instead of the term "earnings." This has been done deliberately because of the (for us) unfortunate fact that the classified tables for 1890, 1900, and 1904 are not built upon exactly the same kind of wage data as are our tables for 1919. In Table 123 the frequency tables for 1890 and 1900 are based upon rates per week. Those for 1904 are based upon earnings per week. The frequency tables for 1919 are based upon earnings per week; and these earnings are not earnings of individual wage earners but, as has been explained, upon the per capita earnings received by the employees of individual establishments. The classifications of the weekly rates of the two earliest years and the weekly earnings of the year 1904 have been compressed at certain points, in order to put them in a form comparable with the later classifications. The weekly brackets multiplied by 50 (here assuming the earnings of the full year's work to be equivalent to 50 times the earnings received in the one week reported) are shown on the right-hand side of the stub. Of course,

it is not assumed that this rather free translation of weekly brackets into equivalent annual brackets is free from error, possibly serious error, but it is believed that, for purposes of showing large outstanding contrasts in the distribution of earnings, the results are not without some value. It is also obvious that the significant comparisons are to be made between the two pairs of percentage

TABLE 123.—COMPARISON BETWEEN CLASSIFIED WAGE DISTRIBUTIONS IN 1890, 1899, 1904, AND 1919

WAGES		NUMBER OF WAGE EARNERS							
		Comparison based on current prices				Comparison based on purchasing power of 1900 dollar		Comparison based on purchasing power of 1904 dollar	
		1890 <sup>1</sup> A	1900 <sup>1</sup> B	1904 C	1919 D	1900	1919 <sup>2</sup>	1904	1919 <sup>3</sup>
Weekly amounts	Equivalent yearly amounts								
	Total.....	104,923	160,055	3,297,819	420,989	100,055	420,980	3,297,819	420,989
Less than \$3..	Less than \$150..	444	591	132,064	210	591	1,708	132,064	1,708
\$3-\$4.....	\$150-\$199.....	2,329	2,640	150,403	83	2,640	2,988	150,403	1,281
\$4-\$5.....	\$200-\$249.....	3,723	4,331	194,301	132	4,331	11,099	194,301	5,550
\$5-\$6.....	\$250-\$299.....	2,735	3,880	205,163	453	3,880	20,408	200,163	13,234
\$6-\$7.....	\$300-\$349.....	6,435	7,026	262,531	401	7,026	35,006	262,531	28,602
\$7-\$8.....	\$350-\$399.....	9,529	15,727	266,012	296	15,727	36,713	266,012	31,164
\$8-\$9.....	\$400-\$449.....	8,184	13,233	255,458	701	13,233	34,162	255,458	33,725
\$9-\$10.....	\$450-\$499.....	12,372	23,686	378,009	829	23,686	37,994	378,009	30,737
\$10-\$12.....	\$500-\$599.....	18,750	25,375	439,208	7,053	25,375	130,181	439,208	80,257
\$12-\$15.....	\$600-\$749.....	18,244	31,403	404,875	23,402	31,403	67,460	404,875	142,157
\$15-\$20.....	\$750-\$999.....	15,422	23,384	390,367	62,231	23,384	28,602	390,367	50,374
\$20-\$25.....	\$1,000-\$1,249.....	3,913	4,427	106,700	70,950	4,427	3,415	106,700	5,977
\$25 and over..	\$1,250 and over..	2,843	3,446	51,728	200,063	3,446	854	51,728	2,134
PER CENT DISTRIBUTION									
	Total.....	100.00	100.00	100.0	100.0	100.0	100.0	100.0	100.0
Less than \$3..	Less than \$150..	.42	.37	4.0	.1	.4	.4	4.0	.4
\$3-\$4.....	\$150-\$199.....	2.22	1.66	4.6	—	1.7	.7	4.6	.3
\$4-\$5.....	\$200-\$249.....	3.55	2.71	5.9	—	2.7	2.6	5.9	1.3
\$5-\$6.....	\$250-\$299.....	2.61	2.43	6.2	.2	2.4	6.2	6.2	3.1
\$6-\$7.....	\$300-\$349.....	6.13	4.95	8.0	.2	5.0	8.2	8.0	6.7
\$7-\$8.....	\$350-\$399.....	9.10	9.83	8.1	.1	9.8	8.6	8.1	7.3
\$8-\$9.....	\$400-\$449.....	7.80	8.27	7.7	.2	8.3	8.0	7.7	7.9
\$9-\$10.....	\$450-\$499.....	11.79	14.86	11.5	.2	14.8	8.9	11.5	7.2
\$10-\$12.....	\$500-\$549.....	17.87	15.83	13.3	1.6	15.8	31.9	13.3	18.8
\$12-\$15.....	\$600-\$749.....	17.38	19.62	14.1	5.5	19.6	15.8	14.1	33.3
\$15-\$20.....	\$750-\$999.....	14.70	14.61	11.8	14.6	14.6	6.7	11.8	11.8
\$20-\$25.....	\$1,000-\$1,249.....	3.73	2.78	3.2	10.7	2.8	.8	3.2	1.4
\$25 and over..	\$1,250 and over..	2.70	2.14	1.6	60.8	2.1	.2	1.6	.5

<sup>1</sup> Data from H. L. Moore, "The variability of wages," 22 Political Science Quarterly, 67. This article is a summary of the Census data in the Dewey report on "Employees and wages."

<sup>2</sup> Each establishment average wage on tally sheet divided by 2.63 (cost of living index) before making frequency table.

<sup>3</sup> Tally sheet figures divided by 2.35 before making frequency table.

distribution columns in the lower right-hand corner of the table. These percentage distributions represent a comparison between 1919 and 1900 or 1904, as the case may be, in respect to the distribution of real earnings for all industries combined. Thus the first pair of percentage columns representing 1900 and 1919 indicates that in the latter year 32 per cent of the 427,000 wage earners covered

by the figures were employed in establishments paying per capita earnings which had a 1900 purchasing power value of between \$500 and \$550. In 1900, 16 per cent of the 160,000 employees in the 30 industries covered by the Dewey report received earnings also having a purchasing power in that year between \$500 and \$550. The 1900-1919 comparison does not bring out any very marked difference in variability of wages between the two periods. It is true that there is a greater concentration around the mode in 1919 but this seems to be compensated for, to a degree, by the fact of larger proportions in that year in the lower wage brackets; that is, the brackets higher up in the column. No very different result appears from the comparison between 1904 and 1919. In making the frequency distributions in Table 123, where comparisons are made on the basis of uniform purchasing power, the establishment per capita earnings items on the tally sheets for 1919 were divided by cost of living factors—2.63 for the 1900 comparison and 2.35 for the 1904 comparison—before making the frequency table.<sup>1</sup>

Each of the 12 industries shown in Table 122 is reported separately in Table 126 in a form similar to that of the percentage distributions in the lower right-hand corner of Table 123. There is, however, this difference between the two tables: For each of the 12 industries in Table 126 two percentage distributions are given for 1919—one the percentage distribution on the basis of nominal earnings in 1919, the other the distribution on the deflated basis used in the percentage distributions in Table 123; that is to say, on the basis of the purchasing power of 1919 money wages in the earlier year of the comparison. The heavy bunching of the percentages in the case of the nominal distribution for 1919 shows how very misleading it would be to try to compare frequency distributions of money wages in 1904 with similar distributions of money wages in 1919. The two comparable columns are, of course, the first two of the three columns shown for each industry. In some cases the percentages for the earlier year are for male wage earners only, and in the later year for male and female workers combined; in other cases the reverse is true. This condition, no doubt, diminishes the comparability of the data. It is important to note, on the other hand, that where 1899 (1900) is the earlier year in the comparison, the figures used are taken from Mr. Dewey's tables of earnings and not from his tables of rates.

#### CHANGES IN VARIABILITY DURING 30 YEARS

In Table 124 a comparison is made between the coefficients of variation for actual yearly earnings in 1919, full-time yearly earnings

<sup>1</sup> The data for the years 1890 and 1900 are not taken directly from the census volume on Employees and Wages, which embodies the Dewey report, but from a summary of that report made by H. L. Moore in an article entitled "The variability of wages" (22 Political Science Quarterly, 87).

in 1919, average weekly earnings in 1904, and average weekly rates in 1899 (1900) and 1890. The table also presents in the second column the standard deviations, which, in the case of the 1919 data, are worked out both on the basis of full-time and actual earnings and, for the three earlier years, on the basis of the yearly amounts estimated to be roughly equivalent to the standard deviations calculated upon the basis of the weekly rates or earnings for those years, respectively. More precisely, the deviation for yearly rates is assumed to be 51 times the deviation calculated on the basis of weekly rates; so also the deviations for earnings for 1904 are assumed to be 51 times those for weekly earnings. This latter estimate especially is probably widely in error, yet it is reassuring that the separate calculations of standard deviations for 1919 on the actual and full-time earnings bases produced very little difference in the resulting figures for standard deviation.

TABLE 124.—STANDARD DEVIATIONS AND COEFFICIENTS OF VARIATION, ALL INDUSTRIES COMBINED: 1890, 1899, 1904, AND 1919<sup>1</sup>

YEAR	STANDARD DEVIATION		Coefficient of variation <sup>2</sup>
	Based on weekly wages	Based on yearly wages <sup>3</sup>	
1890 <sup>4</sup>	\$5.31	\$271	45.9
1899 <sup>4</sup>	5.02	250	43.5
1904 <sup>5</sup>	3.08	157	30.0
1919 <sup>6</sup>		425	31.0
1919 <sup>7</sup>		420	33.5

<sup>1</sup> Figures for 1890 and 1900 (1899) taken from H. L. Moore "Variability of wages" 22 Political Science Quarterly 66. Figures for 1904 computed from classified wage table in Census Bull. 93, p. 11.

<sup>2</sup> Estimated for 1890, 1899, and 1904 by multiplying the deviation figures in the first column by 51.

<sup>3</sup> Standard deviation divided by average wages, multiplied by 100.

<sup>4</sup> Based on average weekly rates for 30 selected industries.

<sup>5</sup> Based on average weekly earnings for 333 industries.

<sup>6</sup> Based on average annual full-time earnings for 20 selected industries.

<sup>7</sup> Based on average annual actual earnings for 20 selected industries.

Even with the standard deviations thus quite crudely put on an annual basis, they are not in a form in which they can be compared one with another. The only form in which they can be compared is that of the coefficient of variation obtained by dividing each one of them by the average. These coefficients seem to indicate a very large drop in the variability of wages between 1899 and 1904, followed during a longer period to 1919 by a slight rise, this rise being more pronounced if the coefficient based on actual earnings be taken rather than the one based upon full-time earnings. It may be said that the decline between 1899 and 1904 is apparent only and is the result of the fact that the 1899 data are based on rates, whereas those of 1904 are based on earnings. There would be more to be said for such a supposition if the rates and earnings in the two periods were *annual* rates and earnings. Certainly, there would seem to be a wide difference between variation in annual rates and variation in annual

earnings, but it does not seem likely that there would be so great a difference between full-time weekly earnings (that is to say, weekly rates) and actual weekly earnings. That this difference is very slight seems to be indicated by the results of our separate calculations of the standard deviation from the 1919 data. The standard deviation, computed from full-time earnings (annual rates) is \$425; the corresponding standard deviation, computed from actual yearly earnings, is \$426; the two coefficients of variation corresponding to these standard deviations are 31.6 and 33.5. Now, if there is no more difference than this between a standard deviation based, respectively, on full-time and actual yearly earnings, it would seem likely that the difference could hardly be greater when the standard deviations are calculated from full-time and actual earnings data reported on a weekly basis.

## INDUSTRY CHANGES IN VARIABILITY

The coefficients of variation for each of the industries separately reported in the special inquiry for 1919 are compared in Table 125 with corresponding coefficients for the same industries in the three earlier periods. The coefficients for 1904 were calculated from the data in Census Bulletin 93. The coefficients for 1890 and 1899 (1900) are taken from Mr. Moore's calculations which in turn are based upon the Dewey report. The figures by industries bear out in a very general way the consolidated coefficients shown in the preceding table. They indicate on the whole diminishing variation in wages;

TABLE 125.—COEFFICIENTS OF VARIATION, BY INDUSTRIES: 1890, 1899, 1904, AND 1919<sup>1</sup>

INDUSTRY	1890	1899	1904	1919
All industries <sup>2</sup> .....	45.9	43.5	30.6	33.5
Automobiles.....			15.3	11.7
Boots and shoes, not including rubber boots and shoes.....	44.2	41.1	23.7	30.7
Brass, bronze, and copper products.....			18.8	31.5
Clothing, women's <sup>3</sup> .....	53.2	50.3	18.8	44.0
Foundry and machine-shop products <sup>4</sup> .....	41.7	40.0	21.6	22.7
Furniture.....	42.8	43.8	25.6	30.3
Iron and steel, steel works and rolling mills <sup>5</sup> .....	53.1	52.1	10.8	27.6
Mineral and soda waters.....			27.5	29.0
Printing and publishing, newspapers <sup>6</sup> .....	45.7	47.3	25.3	32.7
Railroad repair shops, steam <sup>7</sup> .....	30.9	36.6	18.0	18.3
Slaughtering, wholesale, not including meat packing <sup>8</sup> .....	30.7	20.5	13.6	28.0
Tobacco, cigars and cigarettes <sup>9</sup> .....	49.0	54.8	26.4	37.6
Cigars.....	48.6	44.4		

<sup>1</sup> Coefficients for 1890 and 1899 (1900) from H. L. Moore, op. cit., p. 72-73; for 1904 for the separate industries from Bull. 93 (based on earnings of men only).

<sup>2</sup> For 1890 and 1899 the "all industries" figure includes 30 industries covered in the Dewey report; for 1904, it covers all industries; for 1919, the 20 industries, in seven cities, included in variability study.

<sup>3</sup> Figures for 1890 and 1899 are for "Clothing."

<sup>4</sup> Figures for 1890 and 1899 are for "Foundries."

<sup>5</sup> Figures for 1890 and 1899 are for "Iron and steel."

<sup>6</sup> Figures for 1890 and 1899 are for "Printing."

<sup>7</sup> Figures for 1890 and 1899 are for "Car and railroad shops."

<sup>8</sup> Figures for 1890 and 1899 are for "Slaughtering."

<sup>9</sup> Figures for 1890 and 1899 are for "Tobacco."

that is to say, they seem to indicate that there is a tendency toward greater uniformity in earnings, but this tendency is made somewhat doubtful by the fact that during the 15 years from 1904 to 1919 there has been an apparent increase in variability. In some industries this increase has been very large. It appears that between 1899 and 1904 every industry listed experienced a fall in the variability of the earnings received by its employees. At least this is true

TABLE 126.—COMPARISON OF PURCHASING POWER OF WAGES BETWEEN 1904 AND 1919, AND BETWEEN 1899 AND 1919, BY MEANS OF DEFLATED PERCENTAGE DISTRIBUTIONS OF NUMBER OF WAGE EARNERS RECEIVING CLASSIFIED AMOUNTS

WAGE CLASS <sup>1</sup>		MINERAL AND SODA WATERS			FURNITURE		
Weekly basis	Annual basis	1904	1919 (deflated to 1904 prices)	1919 (money wages)	1904	1919 (deflated to 1904 prices)	1919 (money wages)
Number of wage earners.....		<i>M. and F.</i> 9,059	<i>M. and F.</i> 1,846	<i>M. and F.</i> 1,846	<i>M. and F.</i> 53,715	<i>M.</i> 14,253	<i>M.</i> 14,253
Total.....		100.0	100.0	100.0	100.0	100.0	100.0
Less than \$3.....	Less than \$150.....	1.4	—	—	1.7	—	—
\$3-\$4.....	\$150-\$199.....	3.4	.2	—	2.3	.2	—
\$4-\$5.....	\$200-\$249.....	4.6	.0	—	3.9	.1	.1
\$5-\$6.....	\$250-\$299.....	5.2	2.4	—	4.5	1.6	—
\$6-\$7.....	\$300-\$349.....	8.1	4.6	—	7.4	2.4	—
\$7-\$8.....	\$350-\$399.....	7.0	12.5	—	10.5	11.5	.2
\$8-\$9.....	\$400-\$449.....	6.2	12.7	—	9.8	16.6	—
\$9-\$10.....	\$450-\$499.....	12.8	21.6	.2	13.7	7.8	—
\$10-\$12.....	\$500-\$599.....	17.8	20.5	.7	15.2	25.8	.1
\$12-\$15.....	\$600-\$749.....	10.4	11.8	2.8	17.4	24.1	2.1
\$15-\$20.....	\$750-\$999.....	10.9	6.5	20.2	11.1	8.3	20.0
\$20-\$25.....	\$1,000-\$1,249.....	1.6	.6	41.6	2.0	1.0	21.4
\$25 and over.....	\$1,250 and over.....	.6	—	34.5	.5	.5	56.1

  

WAGE CLASS <sup>1</sup>		PRINTING AND PUBLISHING, NEWSPAPERS			IRON AND STEEL, STEEL WORKS AND ROLLING MILLS		
Weekly basis	Annual basis	1904	1919 (deflated to 1904 prices)	1919 (money wages)	1904	1919 (deflated to 1904 prices)	1919 (money wages)
Number of wage earners.....		<i>M.</i> 49,042	<i>M. and F.</i> 25,531	<i>M. and F.</i> 25,531	<i>M.</i> 117,374	<i>M.</i> 38,313	<i>M.</i> 38,313
Total.....		100.0	100.0	100.0	100.0	100.0	100.0
Less than \$3.....	Less than \$150.....	3.4	—	—	1.1	—	—
\$3-\$4.....	\$150-\$199.....	3.5	—	—	1.2	—	—
\$4-\$5.....	\$200-\$249.....	3.8	—	—	1.4	2.4	—
\$5-\$6.....	\$250-\$299.....	4.3	1.3	—	2.1	1.7	—
\$6-\$7.....	\$300-\$349.....	6.1	4.1	—	3.8	2.0	—
\$7-\$8.....	\$350-\$399.....	4.9	2.8	.2	7.9	—	—
\$8-\$9.....	\$400-\$449.....	4.8	2.4	—	12.5	2.3	—
\$9-\$10.....	\$450-\$499.....	6.8	6.2	.1	13.3	2.0	—
\$10-\$12.....	\$500-\$599.....	12.0	22.9	.4	17.9	13.0	.6
\$12-\$15.....	\$600-\$749.....	15.0	37.6	4.3	15.9	33.0	1.4
\$15-\$20.....	\$750-\$999.....	16.5	20.2	5.2	12.7	43.9	3.5
\$20-\$25.....	\$1,000-\$1,249.....	9.2	1.4	10.3	4.6	—	5.3
\$25 and over.....	\$1,250 and over.....	9.7	.0	79.5	5.6	—	39.2

<sup>1</sup> Classified wage distributions for 1899 and 1900 based on "earnings in a week"; for 1904, for earnings in "busiest week"; for 1919, on "establishment-per capita-averages" of "full-time" earnings.

TABLE 126.—COMPARISON OF PURCHASING POWER OF WAGES BETWEEN 1904 AND 1919, AND BETWEEN 1899 AND 1919, BY MEANS OF DEFLATED PERCENTAGE DISTRIBUTIONS OF NUMBER OF WAGE EARNERS RECEIVING CLASSIFIED AMOUNTS—Continued

WAGE CLASS <sup>1</sup>		FOUNDRY AND MACHINE-SHOP PRODUCTS			AUTOMOBILES		
Weekly basis	Annual basis	1904	1919 (deflated to 1904 prices)	1919 (money wages)	1904	1919 (deflated to 1904 prices)	1919 (money wages)
Number of wage earners.....		M. 242,845	M. 76,177	M. 76,177	M. 10,805	M. 46,826	M. 46,826
Total.....		100.0	100.0	100.0	100.0	100.0	100.0
Less than \$3.....	Less than \$150.....	1.4	.....	.....	.6	.....	.....
\$3-\$4.....	\$150-\$199.....	1.9	.2	.....	.5	.....	.....
\$4-\$5.....	\$200-\$249.....	2.6	.2	.....	1.0	.....	.....
\$5-\$6.....	\$250-\$299.....	2.8	.7	.1	1.7	.....	.....
\$6-\$7.....	\$300-\$349.....	4.3	.9	.1	2.0	1.4	.....
\$7-\$8.....	\$350-\$399.....	6.1	2.8	.....	3.3	.4	.....
\$8-\$9.....	\$400-\$449.....	7.6	10.5	.....	4.0	.6	.....
\$9-\$10.....	\$450-\$499.....	12.7	8.9	.....	12.2	1.1	.....
\$10-\$12.....	\$500-\$599.....	15.0	20.5	.2	20.8	15.6	.....
\$12-\$15.....	\$600-\$749.....	18.7	30.4	1.1	24.1	79.7	.....
\$15-\$20.....	\$750-\$999.....	21.1	6.3	6.1	24.0	1.2	1.8
\$20-\$25.....	\$1,000-\$1,249.....	4.5	.4	27.3	4.4	.....	2.6
\$25 and over.....	\$1,250 and over.....	1.3	.2	65.1	1.4	.....	95.6

  

WAGE CLASS <sup>1</sup>		TOBACCO, CIGARS AND CIGARETTES <sup>2</sup>				CLOTHING, WOMEN'S <sup>3</sup>		
Weekly basis	Annual basis	1900 (earnings)		1919 (deflated to 1904 prices)	1919 (money wages)	1900	1919 (deflated to 1904 prices)	1919 (money wages)
Number of wage earners.....		M. 1,762	F. 1,490	M. and F. 24,944	M. and F. 24,944	F. 1,240	M. and F. 109,251	M. and F. 109,251
Total.....		100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than \$3.....	Less than \$150.....	1.6	5.9	.1	.....	7.5	.6	.....
\$3-\$4.....	\$150-\$199.....	1.9	10.0	2.9	.....	11.9	1.7	.1
\$4-\$5.....	\$200-\$249.....	2.5	17.1	15.3	.1	16.1	4.4	.....
\$5-\$6.....	\$250-\$299.....	1.9	20.2	20.4	.....	19.3	8.4	.....
\$6-\$7.....	\$300-\$349.....	3.7	15.2	18.6	.....	16.8	9.8	.4
\$7-\$8.....	\$350-\$399.....	5.7	10.2	9.8	.....	11.6	11.0	.2
\$8-\$9.....	\$400-\$449.....	6.3	7.5	10.6	1.2	7.3	11.6	.4
\$9-\$10.....	\$450-\$499.....	7.6	4.9	6.7	.7	4.6	8.5	.5
\$10-\$12.....	\$500-\$599.....	12.2	6.1	7.3	12.0	3.1	14.7	2.4
\$12-\$15.....	\$600-\$749.....	19.6	2.6	2.2	23.3	1.7	15.0	8.1
\$15-\$20.....	\$750-\$999.....	27.0	.3	.1	32.5	.....	11.0	10.4
\$20-\$25.....	\$1,000-\$1,249.....	6.4	.....	.....	18.7	.1	2.7	20.8
\$25 and over.....	\$1,250 and over.....	4.2	.....	.....	11.5	.....	.6	47.7

<sup>1</sup> Classified wage distributions for 1899 and 1900 based on "earnings in a week"; for 1904, for earnings in "busiest week"; for 1919, on "establishment-per capita-averages" of "full-time" earnings.

<sup>2</sup> 1900, "cigars."

<sup>3</sup> 1900, "clothing."

TABLE 126.—COMPARISON OF PURCHASING POWER OF WAGES BETWEEN 1904 AND 1919, AND BETWEEN 1899 AND 1919, BY MEANS OF DEFLATED PERCENTAGE DISTRIBUTIONS OF NUMBER OF WAGE EARNERS RECEIVING CLASSIFIED AMOUNTS—Continued

WAGE CLASS <sup>1</sup>		BOOTS AND SHOES			
Weekly basis	Annual basis	1900		1919 (deflated to 1904 prices)	1919 (money wages)
Number of wage earners.....		M. 2,092	F. 1,334	M. and F. 29,362	M. and F. 29,362
Total.....		100.0	100.0	100.0	100.0
Less than \$3.....	Less than \$150.....	.2	1.1	.....	.....
\$3-\$4.....	\$150-\$199.....	.6	3.9	.3	.....
\$4-\$5.....	\$200-\$249.....	.9	5.9	.5	.....
\$5-\$6.....	\$250-\$299.....	2.1	8.7	9.4	.....
\$6-\$7.....	\$300-\$349.....	2.5	10.1	31.4	.....
\$7-\$8.....	\$350-\$399.....	3.9	10.6	20.2	.....
\$8-\$9.....	\$400-\$449.....	3.7	11.0	8.1	.1
\$9-\$10.....	\$450-\$499.....	7.0	12.7	8.0	.1
\$10-\$12.....	\$500-\$599.....	13.9	18.8	13.3	.6
\$12-\$15.....	\$600-\$749.....	23.2	12.4	6.7	8.2
\$15-\$20.....	\$750-\$999.....	24.3	4.0	1.8	42.8
\$20-\$25.....	\$1,000-\$1,249.....	8.9	.2	.3	22.2
\$25 and over.....	\$1,250 and over.....	5.8	.....	.....	20.0

  

WAGE CLASS <sup>1</sup>		SLAUGHTERING, WHOLESALE, NOT INCLUDING MEAT PACKING			STEAM-RAILROAD REPAIR SHOPS <sup>4</sup>		
Weekly basis	Annual basis	1904	1919 (deflated to 1904 prices)	1919 (money wages)	1900 (earn- ings)	1919 (deflated to 1904 prices)	1919 (money wages)
Number of wage earners.....		M. 2,815	M. 1,284	M. 1,284	M. 710	M. 21,521	M. 21,521
Total.....		100.0	100.0	100.0	100.0	100.0	100.0
Less than \$3.....	Less than \$150.....	.0	.1	.....	.6	.....	.....
\$3-\$4.....	\$150-\$199.....	.5	.1	.....	.8	.....	.....
\$4-\$5.....	\$200-\$249.....	.6	.....	.....	.2	.....	.....
\$5-\$6.....	\$250-\$299.....	1.1	.8	.....	.5	.....	.....
\$6-\$7.....	\$300-\$349.....	1.6	.....	.....	.0	10.1	.....
\$7-\$8.....	\$350-\$399.....	2.5	10.1	.....	.7	.....	.....
\$8-\$9.....	\$400-\$449.....	2.2	7.7	.....	.8	.6	.....
\$9-\$10.....	\$450-\$499.....	5.8	12.3	.2	4.5	4.8	.....
\$10-\$12.....	\$500-\$599.....	17.8	46.4	.....	11.2	69.0	.....
\$12-\$15.....	\$600-\$749.....	29.1	15.6	.7	33.0	14.5	.....
\$15-\$20.....	\$750-\$999.....	25.4	6.0	1.6	33.3	1.0	9.1
\$20-\$25.....	\$1,000-\$1,249.....	7.8	.9	24.1	7.5	.....	1.0
\$25 and over.....	\$1,250 and over.....	4.7	.....	73.4	.1	.....	89.9

<sup>1</sup> Classified wage distributions for 1899 and 1900 based on "earnings in a week"; for 1904, for earnings in "busiest week"; for 1919, on "establishment-per capita-averages" of "full-time" earnings.

<sup>4</sup> 1900, "car and railroad repair shops."

if the whole comparison is not invalidated because of the fact that one set of coefficients is based upon weekly earnings whereas the other is based upon weekly rates. Subject to the same reservation, it seems that between 1904 and 1919 nearly all of the industries showed an increase in variability. This increase, however, was not shared by the automobile industry. It was shared only slightly in the case of steam-railroad repair shops, where the change was from 18 to 18.3 per cent. In 1919, then, there seems to have been a much greater difference between industries in respect to variability of wages than at any earlier period.