

This PDF is a selection from an out-of-print volume from the National Bureau of Economic Research

Volume Title: Capital in Manufacturing and Mining: Its Formation and Financing

Volume Author/Editor: Daniel Creamer, Sergei Dobrovolsky, and Israel Borenstein, assisted by Martin Bernstein

Volume Publisher: Princeton University Press

Volume ISBN: 0-870-14104-X

Volume URL: <http://www.nber.org/books/crea60-1>

Publication Date: 1960

Chapter Title: Trends in Ratios of Fixed and Working Capital to Output

Chapter Author: Daniel Creamer, Sergei P. Dobrovolsky, Israel Borenstein, Martin Bernstein

Chapter URL: <http://www.nber.org/chapters/c1390>

Chapter pages in book: (p. 67 - 92)

## CHAPTER IV

### Trends in Ratios of Fixed and Working Capital to Output

AGGREGATE capital data can also be broken down by type of asset. For some of the benchmark years, data are separately available for fixed capital (land, buildings, and equipment) and for working capital (cash, notes and accounts receivable, inventories, and miscellaneous assets). For these years, we can relate each component in 1929 prices to output in 1929 prices.

#### *Manufacturing, 1890-1948*

The subdivision between fixed and working capital can be made for seven benchmark years (Table 20). Aside from 1904 (1904 is a year of

TABLE 20  
Ratios of Fixed and Working Capital to Output:  
All Manufacturing, Selected Years, 1890-1953  
(based on values in 1929 prices)

<i>Benchmark Years</i>	<i>Ratio to Output of—</i>	
	<i>Working Capital</i>	<i>Fixed Capital</i>
1890	.366	.364
1900	.387	.416
1904	.420	.471
1929	.452	.433
1937	.395	.346
1948	.324	.285
1953	.320	.270

Source: Based on data in Appendix Tables A-8, A-9, A-10, and A-15.

business contraction; this tends to raise capital-output ratios), for all manufacturing, the ratios of both fixed and working capital to output have risen, presumably to 1919 and most certainly not beyond 1929. This has been followed by a downward movement in both ratios that seems to have continued to 1948.

The percentage rise from 1890 to 1929 was somewhat sharper for the working capital-output ratio than for the fixed capital-output ratio (23 and 19, respectively). This may be due, in whole or in part, to reporting-errors in the earlier years when the capital data were derived from census sources. The census authorities believed that the breakdown of total capital by type of asset was reported with large errors.

# CAPITAL AND OUTPUT TRENDS

For this reason, they discontinued the inquiry after 1904. Too much may have been reported as fixed capital and too little as working capital. Even so, only the rate, not the fact, of an upward trend can be questioned.

Beginning with 1929 we are on firmer statistical ground. The downward drift of both ratios between 1929 and 1948 is unmistakable—a 34 per cent drop in the fixed capital-output ratio and a 28 per cent fall in the working capital-output ratio. This is conclusive evidence that the decline in the *total* capital-output ratio between 1929 and

TABLE 21  
Ratios of Fixed and Working Capital to Output: by Minor Manufacturing  
Industries, 1929, 1937, and 1948  
(based on values in 1929 prices)

<i>Ratio to Output of Capital as Specified:</i>	<i>1929</i>	<i>1937</i>	<i>1948</i>	<i>Per cent Change 1929-1948</i>
All manufacturing				
Working	.452	.395	.324	-28.3
Fixed	.433	.346	.285	-34.2
Food and kindred products				
Working	.337	.294	.233	-30.9
Fixed	.302	.206	.167	-44.7
Bakery and confectionery				
Working	.322	.274	.156	-51.6
Fixed	.458	.344	.212	-53.7
Canned products				
Working	.590	.450	.333	-43.6
Fixed	.377	.226	.241	-36.1
Flour mill products				
Working	.183	.249	.170	-7.1
Fixed	.144	.160	.123	-14.6
Packing house products				
Working	.158	.149	.130	-17.7
Fixed	.119	.097	.082	-31.1
Sugar refining				
Working	.567	.501	.296	-47.8
Fixed	.885	.526	.367	-58.5
Liquors and beverages				
Working	.772	.337	.303	-60.8
Fixed	.707	.275	.268	-62.1
Other food products				
Working	.305	.284	.184	-39.7
Fixed	.476	.257	.205	-56.9
Tobacco products				
Working	.861	.665	.513	-40.4
Fixed	.106	.072	.056	-47.2

(continued)

# RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

TABLE 21 (continued)

<i>Ratio to Output of Capital as Specified:</i>	<i>1929</i>	<i>1937</i>	<i>1948</i>	<i>Per cent Change</i>
<b>Textiles and their products</b>				
Working	.461	.341	.306	-33.6
Fixed	.317	.207	.162	-48.9
Basic textiles				
Working	.504	.352	.374	-25.8
Fixed	.461	.283	.221	-52.1
Carpets and floor coverings				
Working	.606	.725	.319	-47.4
Fixed	.602	.474	.292	-51.5
Knit goods				
Working	.481	.301	.220	-54.3
Fixed	.373	.206	.170	-54.4
Clothing				
Working	.395	.339	.288	-27.1
Fixed	.090	.062	.051	-43.3
<b>Leather and products</b>				
Working	.518	.416	.314	-39.4
Fixed	.176	.119	.093	-47.2
Boots and shoes				
Working	.466	.408	.330	-29.2
Fixed	.154	.112	.084	-45.5
Other leather products				
Working	.604	.436	.300	-50.3
Fixed	.213	.132	.111	-47.9
<b>Rubber products</b>				
Working	.586	.503	.343	-41.5
Fixed	.440	.246	.175	-60.2
Tires and tubes				
Working	.631	.588	.345	-45.3
Fixed	.468	.216	.147	-68.6
Other rubber products				
Working	.490	.382	.370	-24.5
Fixed	.395	.372	.266	-32.7
<b>Forest products</b>				
Working	.612	.449	.311	-49.2
Fixed	.760	.614	.394	-48.2
Sawmill and planing				
Working	.712	.500	.423	-40.6
Fixed	1.074	.949	.761	-29.1
Other wood products				
Working	.498	.401	.248	-50.2
Fixed	.404	.310	.172	-57.4
<b>Paper, pulp, and products</b>				
Working	.507	.460	.293	-42.2
Fixed	.764	.664	.471	-38.4

(continued)

## CAPITAL AND OUTPUT TRENDS

TABLE 21 (continued)

<i>Ratio to Output of Capital as Specified:</i>	<i>1929</i>	<i>1937</i>	<i>1948</i>	<i>Per cent Change 1929-1948</i>
Printing, publishing, and allied industries				
Working	.543	.572	.386	-28.9
Fixed	.334	.301	.305	-8.7
Petroleum refining				
Working	.438	.379	.317	-27.6
Fixed	.848	.678	.576	-32.1
Chemicals and allied substances				
Working	.588	.455	.351	-40.3
Fixed	.404	.352	.365	-9.7
Fertilizers				
Working	.782	.453	.259	-66.9
Fixed	.588	.385	.252	-57.1
Chemicals proper				
Working	.583	.489	.246	-57.8
Fixed	.739	.634	.453	-38.7
Allied chemical substances				
Working	.600	.468	.388	-35.3
Fixed	.321	.274	.323	+0.6
Stone, clay, and glass				
Working	.548	.455	.336	-38.7
Fixed	1.018	.763	.401	-60.6
Iron and steel products				
Working	.343	.426	.325	-5.2
Fixed	.506	.587	.372	-26.5
Blast furnaces and rolling mills				
Working	.225	.402	.290	+28.9
Fixed	.619	.738	.368	-40.5
Metal building materials and supplies				
Working	.519	.463	.432	-16.8
Fixed	.362	.354	.202	-44.2
Hardware, tools, etc.				
Working	.580	.487	.404	-30.3
Fixed	.487	.359	.309	-36.6
Nonferrous metals				
Working	.402	.397	.354	-11.9
Fixed	.382	.319	.331	-13.4
Precious metal products and processes				
Working	.605	.602	.437	-27.8
Fixed	.214	.212	.130	-39.3
Other nonferrous metal products and processes				
Working	.373	.384	.323	-13.4
Fixed	.420	.342	.311	-26.0

(continued)

# RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

TABLE 21 (concluded)

Ratio to Output of Capital as Specified:	1929	1937	1948	Per cent
				Change
				1929-1948
Machinery				
Working	.669	.565	.437	-34.7
Fixed	.361	.288	.226	-37.4
Electrical				
Working	.619	.444	.397	-35.9
Fixed	.303	.216	.186	-38.6
Agricultural				
Working	.926	.760	.405	-56.3
Fixed	.428	.303	.226	-47.2
Office and store				
Working	.862	.732	.502	-41.8
Fixed	.308	.358	.386	+25.3
Factory, household, and miscellaneous				
Working	.641	.587	.463	-27.8
Fixed	.395	.327	.220	-44.3
Transportation equipment				
Working	.305	.344	.339	+11.1
Fixed	.343	.279	.240	-30.0
Motor vehicles				
Working	.277	.308	.284	+2.5
Fixed	.298	.223	.209	-29.9
Locomotives and railroads				
Working	.572	.629	.480	-16.1
Fixed	.773	.882	.305	-60.5
Aircraft				
Working	.371	.831	.650	+75.2
Fixed	.523	.474	.167	-68.1
Miscellaneous				
Working	.654	.508	.386	-41.0
Fixed	.313	.265	.223	-28.8

Source: Based on data in Appendix Tables 1-8 to A-10.

1948 was not caused by any change in the relative importance of fixed and working capital. Moreover, any full explanation of the factors that have made capital more efficient must relate to working capital as well as to fixed capital.

How pervasive has the downward movement been in these ratios? Ratios can be computed for 39 minor industry groups for the benchmark years 1929, 1937, and 1948 (Table 21). In only 2 industries (allied chemical substances, and office and store machinery and equipment) did the fixed capital-output ratio fail to decline between 1929 and 1948. Among the other 37 industries, the decline exceeds 25 per cent in all except 4 industries. The record for the working capital-output

## CAPITAL AND OUTPUT TRENDS

ratio is similar. In only 3 industries (blast furnaces and rolling mills, motor vehicles, and aircraft) were the ratios higher in 1948 than in 1929, and in only 5 of the industries with declining ratios was the relative drop less than 20 per cent. The downward trend in the ratio of these two components of capital to output was widespread, and the results for aggregate manufacturing would not have been significantly affected by any shift in the relative importance of the various industries.

It does not necessarily follow that all components of the working capital-output ratio followed the same downward course. In fact, the deflated ratio of inventories to output (based on a sample of large corporations) seems to have risen from 1919 to 1929 and again from 1929 to 1937 (Table 22). This ratio declined only between 1937 and

TABLE 22  
Ratios of Inventories to Output, by Major Manufacturing Industries,  
Selected Years, 1919-1948  
(based on values in 1929 prices)

	Ratio of Inventories <sup>a</sup> to Output			
	1919	1929	1937	1948
All manufacturing	.184	.194	.196	.168
Food, beverages, and tobacco	.128	.143	.149	.132
Textiles and textile products	.187	.222	.241	.196
Leather and leather products	.266	.265	.286	.198
Rubber and related products	.113	.306	.279	.215
Lumber and wood products	.248	.284	.216	.103
Paper, printing, etc.	.099	.122	.130	.109
Chemicals and allied	.288	.425	.434	.376
Stone, clay, and glass	.221	.222	.214	.141
Metals and metal products	.164	.193	.207	.196
Miscellaneous	.995	.284	.287	.310

<sup>a</sup> Inventories are averages of end-of-year inventories of given year and preceding year.

Source: Inventories in 1929 prices: for 1919, 1929, and 1937, from Moses Abramovitz, *Inventories and Business Cycles*, National Bureau of Economic Research, 1950, Table 108, p. 564; for 1948, extrapolated from the 1937 estimate using the percentage change in inventories in 1947 prices, estimated by Department of Commerce and taken from unpublished worksheet.

The output figures are the ones developed for this study (see Appendix Table A-10).

1948. The ratios of most of the 10 industry groups that can be distinguished for this computation trace the same pattern as the aggregate. It follows from this that the decline in the working capital-output ratio before 1948 must have been due to the increasingly efficient use of the other components of working capital—cash, notes and accounts receivable, and other assets.

# RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

## TABLE 23

Capital<sup>a</sup>-Output Ratios in Mining: Major Industries, Selected Years, 1870-1953

<i>Ratios to Output</i>	<i>1870</i>	<i>1880</i>	<i>1890</i>	<i>1909</i>	<i>1919</i>	<i>1929</i>	<i>1940</i>	<i>1948</i>	<i>1953</i>
<b>All mining</b>									
Based on 1929 prices:									
Capital	0.72	1.16	1.36	1.80	2.30	2.14	1.59	1.34	1.26
Plant	0.61	1.02	1.19	1.52	2.00	1.57	1.10	0.92	0.84
Working capital	0.11	0.14	0.17	0.28	0.30	0.57	0.49	0.42	0.42
Based on reported values:									
Total capital	1.39	2.21	2.55	2.77	2.23	2.88	2.18	1.08	1.16
Land	0.83	1.34	1.46	1.22	0.84	0.89	0.50	0.12	0.10
Capital	0.56	0.87	1.09	1.55	1.39	1.99	1.68	0.96	1.06
Plant	0.43	0.74	0.92	1.22	1.05	1.41	1.20	0.59	0.69
Working capital	0.13	0.13	0.17	0.33	0.34	0.58	0.48	0.37	0.37
<b>Metals</b>									
Based on 1929 prices:									
Capital	1.29	2.30	2.73	2.50	2.16	1.71	1.24	1.00	1.39
Plant	1.14	2.11	2.37	1.84	1.49	1.10	0.59	0.54	0.77
Working capital	0.15	0.19	0.36	0.66	0.67	0.61	0.65	0.46	0.62
Based on reported values:									
Total capital	1.69	2.78	4.13	3.34	3.45	3.68	1.98	1.10	1.24
Land	1.20	1.98	2.90	1.63	1.78	2.09	0.87	0.20	0.18
Capital	0.49	0.80	1.23	1.71	1.67	1.59	1.11	0.90	1.06
Plant	0.40	0.71	1.03	1.12	0.84	0.99	0.55	0.42	0.56
Working capital	0.09	0.09	0.20	0.59	0.83	0.60	0.56	0.48	0.50
<b>Anthracite</b>									
Based on 1929 prices:									
Capital	0.41	0.63	0.50	0.51	0.53	0.83	0.55	0.43	0.64
Plant	0.35	0.54	0.45	0.43	0.45	0.45	0.34	0.25	0.32
Working capital	0.06	0.09	0.05	0.08	0.08	0.38	0.21	0.18	0.32
Based on reported values:									
Total capital	1.33	2.38	1.46	1.66	1.19	1.52	1.39	0.68	0.80
Land	0.70	1.21	0.66	0.91	0.68	0.75	0.76	0.30	0.23
Capital	0.63	1.17	0.80	0.75	0.51	0.77	0.63	0.38	0.57
Plant	0.50	0.98	0.71	0.60	0.37	0.40	0.40	0.19	0.27
Working capital	0.13	0.19	0.09	0.15	0.14	0.37	0.23	0.19	0.30
<b>Bituminous coal</b>									
Based on 1929 prices:									
Capital	0.91	0.70	0.69	1.06	1.25	1.06	0.88	0.88	1.17
Plant	0.66	0.52	0.59	0.90	1.07	0.72	0.53	0.48	0.72
Working capital	0.25	0.18	0.10	0.16	0.18	0.34	0.35	0.40	0.45
Based on reported values:									
Total capital	1.68	1.47	1.54	2.39	1.66	2.22	1.45	0.59	0.82
Land	1.02	0.90	0.92	1.46	0.95	1.23	0.72	0.14	0.11
Capital	0.66	0.57	0.62	0.93	0.71	0.99	0.73	0.45	0.71
Plant	0.42	0.41	0.51	0.75	0.52	0.65	0.46	0.21	0.42
Working capital	0.24	0.16	0.11	0.18	0.19	0.34	0.27	0.24	0.29

(continued)



# CAPITAL AND OUTPUT TRENDS

TABLE 23 (concluded)

<i>Ratios to Output</i>	1870	1880	1890	1909	1919	1929	1940	1948	1953
<b>Petroleum and natural gas</b>									
Based on 1929 prices:									
Capital	1.75	2.06	3.78	5.05	5.86	3.58	2.25	1.79	1.41
Plant	1.64	1.95	3.45	4.75	5.51	2.79	1.73	1.32	1.01
Working capital	0.11	0.11	0.33	0.30	0.35	0.79	0.53	0.47	0.40
Based on reported values:									
Total capital	0.52	1.75	2.71	3.89	2.68	3.51	2.91	1.40	1.32
Land	0.06	0.20	0.22	0.24	0.17	0.20	0.17	0.07	0.07
Capital	0.46	1.55	2.49	3.65	2.51	3.31	2.74	1.33	1.25
Plant	0.42	1.45	2.23	3.34	2.21	2.52	2.15	0.89	0.87
Working capital	0.04	0.10	0.26	0.31	0.30	0.79	0.59	0.44	0.38
Other Nonmetals									
Based on 1929 prices:									
Capital	n.c.	1.04	1.16	1.28	1.19	1.17	0.94	0.56	0.61
Plant	n.c.	0.78	0.88	1.02	0.95	0.69	0.43	0.32	0.33
Working capital	n.c.	0.26	0.28	0.26	0.24	0.48	0.51	0.24	0.28
Based on reported values:									
Total capital	0.94	1.23	1.51	1.96	1.92	2.14	1.62	0.86	0.81
Land	0.49	0.64	0.81	0.97	0.99	1.04	0.60	0.23	0.11
Capital	0.45	0.58	0.70	0.99	0.93	1.10	1.02	0.63	0.70
Plant	0.34	0.42	0.50	0.72	0.60	0.63	0.50	0.30	0.36
Working capital	0.11	0.16	0.20	0.27	0.33	0.47	0.52	0.33	0.34

n.c. = not comparable.

<sup>a</sup> For definition of terms relating to capital see Chapter 2, p. 14.

Source: see notes to Appendix Tables B-7 to B-11.

## Mining, 1870-1948

During the early decades, both the plant<sup>1</sup>-output ratio and the working capital-output ratio rose (Tables 23 and 24). In some of the industries, the increase was steeper in the plant-output ratios and, in the others, in the working capital-output ratios. These differences, however, might be due to reporting errors or to errors introduced by our estimates of the breakdown of total capital by type of asset for the years for which no breakdown was reported. For aggregate mining, the increase in the plant-output ratio appears to have been steeper than that in the working capital-output ratio. Here, the impact of errors in measurement is certainly smaller than in the case of the individual industries. On the other hand, the significance of the difference is reduced by the changes that occurred in the relative weights of the individual industries.

In the following decades, 1919-1948, the statistical data are more reliable, and the differences in the pattern of change in the ratio of plant and of working capital to output can be seen more clearly. In

<sup>1</sup> Net value of structures and equipment.

TABLE 24

Capital<sup>a</sup>-Output Ratios in Mining: Minor Industries, Selected Years, 1870-1947

<i>Ratios to Output:</i>	<i>1870</i>	<i>1880</i>	<i>1890</i>	<i>1909</i>	<i>1919</i>	<i>1940</i>	<i>1947</i>
<b>Iron</b>							
Based on 1929 prices:							
Capital	0.71	1.22	1.53	2.21	1.95	n.a.	n.a.
Plant	0.47	0.83	0.85	1.58	1.41	n.a.	n.a.
Working capital	0.24	0.39	0.68	0.63	0.54	0.25	0.37
Based on reported values:							
Total capital	1.35	1.98	2.24	2.74	2.30	1.36	1.03
Land	0.98	1.40	1.30	1.21	1.00	n.a.	n.a.
Capital	0.37	0.58	0.94	1.53	1.30	n.a.	n.a.
Plant	0.21	0.37	0.47	0.98	0.71	n.a.	n.a.
Working capital	0.16	0.21	0.47	0.55	0.59	0.22	0.44
<b>Copper</b>							
Based on 1929 prices:							
Capital	0.76	1.74	0.82	1.47	2.46	n.a.	n.a.
Plant	0.63	1.46	0.64	0.88	1.48	n.a.	n.a.
Working capital	0.13	0.28	0.18	0.59	0.98	0.72	0.49
Based on reported values:							
Total capital	1.50	3.14	3.24	2.43	4.75	2.42	1.12
Land	1.15	2.40	2.57	1.27	2.49	n.a.	n.a.
Capital	0.35	0.74	0.67	1.16	2.26	n.a.	n.a.
Plant	0.27	0.60	0.49	0.59	0.92	n.a.	n.a.
Working capital	0.08	0.14	0.18	0.57	1.34	0.78	0.57
<b>Lead and zinc</b>							
Based on 1929 prices:							
Capital	0.77	0.74	0.75	1.49	1.27	n.a.	n.a.
Plant	0.58	0.57	0.59	1.11	0.95	n.a.	n.a.
Working capital	0.19	0.17	0.16	0.38	0.32	0.51	0.39
Based on reported values:							
Total capital	1.99	1.66	1.71	2.13	2.62	1.00	0.58
Land	1.09	0.91	0.93	1.02	1.47	n.a.	n.a.
Capital	0.90	0.75	0.78	1.11	1.15	n.a.	n.a.
Plant	0.62	0.56	0.58	0.75	0.68	n.a.	n.a.
Working capital	0.28	0.19	0.20	0.36	0.47	0.44	0.30
<b>Precious metals</b>							
Based on 1929 prices:							
Capital	2.55	3.15	5.41	5.44	3.35	n.a.	n.a.
Plant	2.48	3.08	5.13	4.44	2.72	n.a.	n.a.
Working capital	0.07	0.07	0.28	1.00	0.63	0.95	0.77
Based on reported values:							
Total capital	1.89	3.05	5.22	5.71	4.80	2.26	3.09
Land	1.35	2.18	3.73	2.85	2.88	n.a.	n.a.
Capital	0.54	0.87	1.49	2.86	1.92	n.a.	n.a.
Plant	0.51	0.84	1.40	2.16	1.26	n.a.	n.a.
Working capital	0.03	0.03	0.09	0.70	0.66	0.46	0.68
<b>Other metals</b>							
Based on reported values:							
Total capital	n.c.	n.c.	n.c.	n.c.	2.51	3.01	1.99

n.a.=not available.

n.c.=not comparable.

<sup>a</sup> For definition of terms relating to capital see Chapter II, p. 14.

Source: See notes to Appendix Tables B-7 through B-11.

## CAPITAL AND OUTPUT TRENDS

most industries, the ratios of working capital to output began to decline much later than the ratios of plant to output and the decline was much smaller. Thus, for aggregate mining, the ratio of working capital to output, whether based on reported values or values in 1929 prices, increased until 1929. On the other hand, the ratio of plant to output based on values in 1929 prices began to decline in 1919, and much more markedly than did the ratio of working capital to output. In the petroleum and natural gas industry, the ratio of working capital to output, whether based on 1929 or on reported values, continued to increase until 1929, while the plant-output ratio based on 1929 prices began to decline in 1919. Very nearly the same pattern is found in the metal mining industry: the decline in the working capital-output ratio began in 1919; the plant-output ratio in reported values declined in 1909, the deflated ratio in 1890. In bituminous coal mining, the ratio of working capital to output, based on 1929 prices, continued to increase up to 1948, and that based on reported values, until 1929. However, the plant-output ratio based on 1929 prices rose only until 1919. For the other nonmetals group, the ratio of working capital to output increased until 1940, but the ratio of plant to output began to decline after 1909. Anthracite mining appears to be the only industry where the reversal of trend in the plant- and working capital-output ratios occurred at the same time and where both ratios show an equally abrupt decline.

How can the difference in movement between the plant- and working capital-output ratios be explained? High tax liabilities might have been considered responsible for the slower decline in the working capital-output ratio, especially since 1940.<sup>2</sup> However, another factor, whose importance is difficult to assess, has had the opposite effect, at least on the working capital-output ratios based on reported values. This is the wide application of last-in, first-out (LIFO) accounting since 1940. (It was legalized in 1938.) This method has tended to understate working capital, because the inventory account is evaluated at the prices of inventory initially acquired or of inventory held when LIFO was introduced. These prices have lagged substantially behind current market values.

<sup>2</sup> A survey (taken from *Moody's*) of the balance sheets as of December 1948 of eighty large corporations engaged primarily in mining activities discloses a high share of tax liabilities. Thus, the sum of the items "accrued taxes" and "reserves for taxes" (reported under current liabilities) accounted for 7 per cent of total liabilities and 48 per cent of current liabilities. Using a 1 to 1 ratio between tax liabilities and tax funds, this sum would account for around 20 per cent of working capital. (This figure is rather exaggerated, first, because tax liabilities are presumably lower in smaller corporations than in those studied and, second, because there is no good reason to assume a 1 to 1 relationship between tax liabilities and funds available for taxes.)

# RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

At least two factors affect the behavior of the plant-output and working capital-output ratios differently in mining than in manufacturing. First, the composition of working capital in the two sectors is different. Cash is a substantially greater proportion of working capital in mining than in manufacturing. (For example, in the great majority of mining industries in 1948, cash was more than 40 per cent of total working capital, compared with less than 20 per cent in all manufacturing.) This may result in part from the relatively greater importance of leased properties in mining than in manufacturing. This, in turn, entails a greater need for cash to meet the payments for rentals and royalties.

TABLE 25  
Capital-Output Ratios in Mining: Working Capital and Components,  
Major Industries, Selected Years, 1929-1948  
(based on book values)

	1929 <sup>a</sup>	1930 <sup>b</sup>	1940	1948
<b>Metals:</b>				
Cash		.14	.26	.19
Notes and accounts receivable		.40	.13	.16
Inventories		.36	.17	.13
Total working capital <sup>c</sup>	.60	.90	.56	.48
<b>Anthracite coal:</b>				
Cash		.04	.08	.08
Notes and accounts receivable		.31	.11	.07
Inventories		.04	.04	.04
Total working capital <sup>c</sup>	.37	.39	.23	.19
<b>Bituminous coal:</b>				
Cash		.08	.08	.10
Notes and accounts receivable		.25	.15	.11
Inventories		.05	.04	.04
Total working capital <sup>c</sup>	.34	.39	.27	.24
<b>Petroleum and natural gas:</b>				
Cash		.17	.17	.19
Notes and accounts receivable		.56	.33	.16
Inventories		.16	.08	.10
Total working capital <sup>c</sup>	.79	.89	.59	.44
<b>Other nonmetals:</b>				
Cash		.11	.18	.12
Notes and accounts receivable		.23	.17	.13
Inventories		.19	.17	.08
Total working capital <sup>c</sup>	.47	.53	.52	.33

<sup>a</sup> From Table 23.

<sup>b</sup> Underlying data adjusted for consolidated returns.

<sup>c</sup> Because of rounding details may not add to total.

Source: *Statistics of Income*, Part 2, Bureau of Internal Revenue (now Internal Revenue Service) related years.

## CAPITAL AND OUTPUT TRENDS

The ratio of cash to output has not only failed to decline but has even increased in all mining industries during the last decades (Table 25).<sup>3</sup>

The second factor is the relatively higher ratio of depreciable and depletable assets to output and the relatively greater retardation in growth of output and capital in mining than in manufacturing. Other conditions being equal, a declining rate of growth of capital means a rising ratio of accumulated depreciation and depletion reserves to net capital. Thus, "self-generating" liquidity becomes relatively more important the higher the total capital-output ratio, the greater the decline in this ratio, or the greater the slackening of the rate of growth. For this reason, the range of substitutability between fixed and working capital via depreciation and depletion charges may have been particularly wide in the mining industries. The combination of these factors may have reduced the incentive for more intensive use of working capital in mining. On the other hand, the greater retardation in growth of the mining industries during the period also implies a relatively higher increase in the ratio of replacements to the net value of plant. In turn, plant efficiency should rise and, consequently, the plant-output ratio should fall.

A declining rate of growth in an industry's capital formation coincident with a rising ratio of depreciation charges to capital (gross or net) raises a different problem. Are not accounting practices responsible, at least in part, for the observed decline in the plant-output ratio? Assume that depreciation charges exceed the real functional deterioration (owing to age, obsolescence, and undermaintenance) of structures and equipment. Then, in periods of sharp retardation in the rate of growth of capital, would not the accumulated depreciation reserves increasingly overstate and, therefore, net capital value increasingly understate, the "true" operational value of the capital assets?

The premise of the preceding question is that depreciation charges exceed the real functional deterioration of the capital units. Therefore, a precise answer is not possible. Indeed, if one considers the accelerated obsolescence of equipment, in recent decades, resulting from rapid technological advances, as much ground exists for believing that the prevailing rates are too low as for assuming that they are too

<sup>3</sup> Our record begins with 1930, the first year of the Great Depression, when the cash-output ratios are certainly overstated. Nevertheless, the ratios have risen between 1930 and 1948. We have, unfortunately, no data by which to trace these ratios in earlier years.

Note that the ratios of notes and accounts receivable to output dropped sharply during 1930-1948. The decline was so substantial that, taken as a sum, the ratios of cash and receivables to output also declined. The failure of the cash-output ratios to decline could thus be partly explained by substitutions between cash and receivables.

## RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

high.<sup>4</sup> This aspect of functional deterioration is usually neglected when the length of life assumed for estimating depreciation rates is compared with the actual operational length of life of a capital asset. Newer capital units are more efficient than the relatively older ones bought for the same values in constant prices, and the newer units should be more profitable to use than the older ones. One might argue that the older equipment will be used at a rate corresponding to its obsolescence, rather than to its operational capacity. How completely this relationship is realized depends on the extent of the divisibility of capital units, the necessity of coordinating a variety of machine operations, and the interest of the owner in amortizing the capital value of the old equipment. For industry as a whole, older equipment is used in proportion to its value adjusted for obsolescence, although its operational value may be considerably higher, i.e., rapidly growing plants have newer equipment and run nearer to operational capacity than do older plants. The same is true within a single plant, although the limiting conditions mentioned above would play a much greater role.<sup>5</sup>

### *Total Capital-Output Ratios, by Industries*

The ratios of capital to output bear closely on changes in the demand for savings by the mining industries and serve to highlight technological and other changes. Such ratios, however, do not reflect the actual amount of wealth per unit of output used in the mining industries, because natural wealth, i.e., the mineral resources themselves, is not included. The discrepancy between the stock of reproducible wealth ("past labor") used in production and the actual amount of wealth used for the same purpose is unique in the mining industries.<sup>6</sup> The reason is that the nonreproducible assets—the mineral resources—constitute a large share of the value of total capital used in mining. Conversely, past labor constitutes only a small share of the total value of those assets.

This unique characteristic of mineral lands makes it difficult to analyze the movement of the land-output ratio and, hence, the total

<sup>4</sup> We are not considering here the accelerated depreciation of emergency defense facilities in the war and postwar period. This development affects a short time span only. Moreover, as stated in Appendix Table B-9, accelerated amortization is relatively unimportant in mining. At its peak in 1943, it amounted to only 5 per cent of normal depreciation.

<sup>5</sup> For a more extended discussion of some of these points, see Simon Kuznets' "Comment" in *Studies in Income and Wealth*, Volume 14 (National Bureau of Economic Research, 1951, pp. 62-68).

<sup>6</sup> To a lesser degree, the same situation exists in agriculture. There, however, the share of past labor in the total value of land is much higher, so that the difference between the value of past labor and the total value of land is neglected by certain authors.

## CAPITAL AND OUTPUT TRENDS

capital-output ratio, in a manner similar to that for the other capital aggregates. The ratios of land to output based on reported values are subject to the restrictions imposed by the different valuation bases of numerator and denominator. Moreover, neither for practical nor conceptual reasons is an adjustment for the different valuation bases warranted.<sup>7</sup>

The social-accounting approach is probably the most useful for the purpose of this study. We assume that the value of mineral lands is equal to the value of their reproduction costs (the input factors provided for their discovery and development). However, except for the petroleum and natural gas industry, costs of discovery and development per unit of output are low, and the estimation of such a series does not seem to warrant the time and effort required. Therefore, the ratio of total capital (which includes land) to output is given only for reported values in Tables 23 and 24. These ratios increased during the earlier decades and declined during the later in much the same way as the ratios of capital (defined as plant and working capital only) to output. However, the former ratios rose less and declined more than the ratios of capital to output. The same is true, of course, to an even larger extent, of the ratios of land to output.

In general, these findings are what we might expect. Buying of mineral land to ensure supply for a growing market, an amount beyond that necessary merely to ensure production at current rates for a reasonably long period of time, should have been more frequent before 1900, when land prices were low, than in the later years. Also, the entrepreneur's early optimism about future developments would have expressed itself, at the outset, in relatively high land evaluation. For these reasons, the land-output ratios can be expected to begin at a relatively higher level than the capital-output ratios. On the other hand, the more pessimistic outlook during the time of slackened growth should have affected land values seriously, because they were not supported by the value of input of past labor. The market value of land per unit of output and, consequently, the book value, should have declined more than the value of capital.<sup>8</sup>

<sup>7</sup> For conceptual difficulties, see Appendix B, section E.

<sup>8</sup> The last consideration is not valid for the petroleum and natural gas industry. The rate of growth of output in this industry was accelerating rather than decelerating in 1919-1929. Moreover, because the number of transfers in this industry is high, one would expect high valuations of the book value of land (see p. 82). Indeed, our figures indicate no significant decline in the ratio of book value of land to output, except for 1948. The exception is probably entirely due to the postwar inflation of prices for petroleum and natural gas. The land-output ratio for this industry (Table 24) is low because the vast majority of oil lands are held under lease and, therefore, do not appear in our land estimates. For an estimate of the market value of oil leases at different benchmarks, see note 9.

## RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

The precise validity of the above considerations, however, is obscured by several factors other than the difference in the valuation bases of the numerator and denominator. First, the land figures do not include the value of leased land. Changes in the form of land tenure may have contributed to the observed differences in the movement of the ratios. Unfortunately, after 1919, we have no data to use as a check on such a possibility. The tendencies for the period before 1919, however, may be indicated by the following percentages (based on census data) of the total number of acres operated that were held under lease:

	1890	1902	1909	1919
Anthracite coal	49.8	n.a.	33.1	25.6
Bituminous coal	25.3	n.a.	30.1	29.9
Petroleum and natural gas	81.0	n.a.	94.6	90.4
Iron	n.a.	n.a.	68.4 <sup>a</sup>	n.a.
Copper	n.a.	3.8	3.2	3.6
Lead and zinc	n.a.	n.a.	21.4	26.6
Precious metals	n.a.	5.6	15.4	20.0
All other	n.a.	n.a.	16.5	27.1

<sup>a</sup> Percentage of value of total output that was mined from leased land. The corresponding figure for 1880 was 33.0. Figures for 1880 for the other industry groups are not available.

It appears that, except in anthracite mining, for which the reverse has been true, there has been a tendency toward more extensive use of leased land. It is doubtful, however, whether this tendency has been strong enough to account for much of the change in the land-output ratios over time.<sup>9</sup>

<sup>9</sup> We are concerned with the book value of land primarily because of its importance in determining the capital dimensions of a mining enterprise, e.g., its asset structure as compared with its liability structure. No such importance can be ascribed to the value of leases. Moreover, the only way to approximate the value of leases is to capitalize royalties. The value of royalties strictly depends upon the value of output in a given year. Thus, the value of leases is directly related to the output value. However, we have calculated lease values for total mining by industries for those benchmark years prior to 1919 for which statistics could be found, and for oil and gas for the whole period. The estimates for the latter industry are of greater interest because of the magnitudes involved. In the following table, we show the estimated market value of oil and natural gas leases, exclusive of value added by drilling and equipping of wells.

	<i>Lease Value</i> (billions of dollars)	<i>Average Life</i> <i>of Reserves</i> (years)	<i>Discount</i> <i>Rate</i> (per cent)
1890	\$0.04	—	—
1909	0.3	20	4.0
1919	1.1	15	4.5
1929	1.9	14	4.0
1940	2.0	15	3.5
1948	8.0	16	3.0

The figure for 1890 is given in *Report on Mineral Industries in the United States*:



## CAPITAL AND OUTPUT TRENDS

Second, the book value of land is much affected by the extent of market turnover. As long as the mineral lands are not sold, their value may be kept on the books at levels approximating their reproducible costs, i.e., their cost of discovery and development. Thus, reported land values represent a mixture of different valuation bases, not only with respect to the time the transactions were made, but also with respect to the methods of valuation. Since the market value of land exceeds by far its development costs, the total of reported book values will depend, to a large extent, on the number of transactions made during the period preceding the year in which the reports were made. Transfers of mineral wealth were more frequent in earlier than in recent years. Hence, this factor should have worked for higher book values of land in the earlier years.

As depletion deductions received wider recognition (the tendency was strengthened by the inception of the corporation income tax in 1909), land values in book values tended to decline. However, later revenue acts counteracted this decline.

The Revenue Act of 1918 allowed depletion charges to be based on the market value as of March 1, 1913. The Act of 1921 allowed a further deduction, in determining taxable income from the operation of oil and mining properties, based on the appreciation of value resulting from the fresh discovery of minerals. As a result of the balancing of these two tendencies, book values of land in 1919 are comparable with those in 1909.<sup>10</sup>

The picture for 1929 and after is different. Relatively high depletion allowances continued, and were stepped up during the forties. However, upward revaluations of land became less frequent in 1925-1929; in the thirties, downward revaluations were predominant. The combination of these two developments is mainly responsible for the sharp decline in the land-output ratio after 1929. We hope our method of breaking down total capital into land and capital yields figures that

---

1890. For all other years, we used the current annuity value of royalties paid to the owners of oil lands, assuming that the latter remain unchanged during the lifetime of the mineral reserves. For the years 1909 and 1919, the amount paid for royalties was reported in the *Census of Mines and Quarries*. For the later years, the land-owners' share of petroleum output was assumed to be 12.5 per cent and that of natural gas to be 10 per cent. [See H. Foster Bain, "Subsoil Wealth," in *Studies in Income and Wealth*, Volume Twelve (National Bureau of Economic Research, 1950, p. 266); it was also assumed that 90 per cent of petroleum and natural gas in these years was produced from leaseholds.]

<sup>10</sup> See, for instance, data on the surplus arising from the revaluation of property assets and on depletion and depreciation reserves in *Investments and Profits of Bituminous Coal Operators*, submitted by David L. Wing and James E. Black to the U.S. Coal Commission, and published in its *Report of the U.S. Coal Commission*, Part iv (1923), p. 2541.

## RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

account fully for the shrinkage in the book value of land since 1929.<sup>11</sup> Indeed, we have good reason to think that if any bias resulted, it is in an understatement of these land values.

### *The Record in Manufacturing, from 1948 to 1953*

Between the postwar business cycle peak of 1948 and the succeeding peak of 1953, net fixed capital in manufacturing (measured in 1929 prices) increased by nearly one-fourth and total capital by slightly more. These represent substantial growth rates. In these circumstances, the movement of the capital-output ratios is of special interest.

As we noted at an early point, the total capital-output ratio (based on 1929 prices) for all manufacturing decreased by 3.1 per cent between 1948 and 1953. This decline occurred in 12 of the 19 groups for which we can compute the ratios to output of fixed and working capital (Table 26). In only 1 group (chemicals) did the total capital-output ratio exceed the 1937 ratio.

For all manufacturing, the fixed capital-output ratios decreased by 5 per cent between 1948 and 1953, and those for working capital decreased by 1 per cent. Perhaps of more significance is the predominant direction and magnitude of movement of the ratios for individual industry groups. In 15 of the 19 groups, the ratio of fixed capital to output declined between 1948 and 1953. In 11 groups, the decline was 10 per cent or more (Table 27). On the other hand, of the 4 industry groups with a rising ratio, the relative increase was nominal in paper and allied products and modest in textile mill products. It was substantial in iron, steel and nonferrous metals (15 per cent), and in chemicals and allied products (34 per cent),<sup>12</sup> both of which include government-owned but privately operated plants. Three of these industries (the exception is textile mill products) had a better-than-average percentage expansion of fixed capital between 1948 and 1953. On the other hand, 3 other industry groups, with an equally high relative expansion of fixed capital, continued to have declining fixed capital-output ratios.

Among the 15 industries with a declining ratio of fixed capital to output, 6 operated with less capital (in 1929 prices) in 1953 than in 1948. Leather excepted, the smaller amount of capital in 1953 produced a larger volume of output than did the larger amount of capital in 1948. In the other 9 industry groups, capital expanded, but production increased at a still more rapid rate.

In summary, nearly three-fourths of the major industry groups,

<sup>11</sup> For a description of our method, see Appendix B, note 33, and the notes to Appendix Table B-11.

<sup>12</sup> See Table 26, note a.

# CAPITAL AND OUTPUT TRENDS

TABLE 26

Major Manufacturing Industries: Ratios to Output of Selected Capital Components, 1948 and 1953  
(based on values in 1929 prices)

	Ratio to Output of:					
	Total Capital		Fixed Capital		Working Capital	
	1948	1953	1948	1953	1948	1953
All manufacturing	.609	.590	.285	.270 <sup>a</sup>	.324	.320
Beverages	.571	.413	.268	.123	.303	.290
Food and kindred products	.347	.328	.164	.134	.183	.194
Tobacco products	.569	.658	.056	.039	.513	.619
Textile-mill products	.555	.631	.237	.249	.318	.382
Apparel	.338	.342	.051	.043	.287	.299
Forest products	.705	.760	.394	.383	.311	.377
Paper and allied products	.764	.753	.471	.472	.293	.281
Printing and publishing	.690	.669	.305	.303	.385	.366
Chemicals and allied products	.716	.840	.365	.488 <sup>a</sup>	.351	.352
Petroleum and coal products	.893	.763	.576	.483	.317	.280
Rubber products	.518	.510	.175	.144	.343	.366
Leather and leather products	.407	.414	.093	.076	.314	.338
Stone, clay, and glass products	.738	.686	.401	.354	.337	.332
Iron, steel, and nonferrous metals and products	.695	.721	.363	.416 <sup>a</sup>	.332	.305
Machinery excluding electrical	.712	.657	.250	.228	.462	.429
Electrical machinery	.583	.527	.186	.139	.397	.388
Transportation equipment excluding motor vehicles	.967	.666	.382	.247 <sup>a</sup>	.585	.419
Motor vehicles and equipment	.493	.425	.209	.185	.284	.240
Miscellaneous <sup>b</sup>	.609	.577	.223	.170	.386	.407

<sup>a</sup> Except for the management fee, privately operated, government-owned facilities are excluded from the 1953 output estimates, but they are included in the capital estimates. A more realistic ratio, therefore, is obtained by excluding such facilities from fixed capital. With this exclusion from industries where this item is quantitatively important, the fixed capital-output ratios are:

All groups	.250
Chemicals and allied products	.371
Iron and steel and nonferrous metals	.367
Transportation equipment except motor vehicles	.107

Comparable absolute changes would appear in the total capital-output ratios.

<sup>b</sup> Includes instruments and miscellaneous industries; ordnance included with iron, steel, and nonferrous metals and products in both years.

Source: Based on Appendix Table A-15 and worksheets.

owning almost 60 per cent of all fixed capital (in 1929 prices) devoted to manufacturing in 1953, continue to operate with fixed capital of increasing efficiency. This suggests that the downward movement of the fixed capital-output ratio initiated after World War I had not yet spent itself, at least through 1953.

# RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

Between 1948 and 1953, the ratio of working capital to output for all manufacturing declined in 10 of the 19 industry groups. The working capital in these 10 groups also equaled 60 per cent of all working capital used in manufacturing. However, since the decline occurred only in a bare majority of the industry groups, this indicates a departure from the previous pattern of decline in the working capital.

TABLE 27  
Major Manufacturing Industries: Fixed Capital and Selected Capital-  
Output Ratios, Per Cent Change between 1948 and 1953  
(based on values in 1929 prices)

	Per Cent Change Between 1948 and 1953 in—		
	Fixed Capital	Ratio to Output of—	
		Fixed Capital	Working Capital
All manufacturing	+23.4	-5.3	-1.2
Beverages	-0.8	-54.1	-4.3
Food and kindred products	-3.5	-18.3	+6.0
Tobacco products	-23.5	-30.4	+20.7
Textile-mill products	-1.6	+5.1	+20.1
Apparel	+9.9	-15.7	+4.2
Forest Products	-0.1	-2.8	+21.2
Paper and allied products	+26.1	+0.2	-4.1
Printing and publishing	+4.0	-0.7	-4.9
Chemicals and allied products	+69.7	+33.7	+0.3
Petroleum and coal products	+8.5	-16.1	-11.7
Rubber products	-2.9	-17.7	+6.7
Leather and leather products	-18.8	-18.3	+7.6
Stone, clay, and glass products	+16.6	-11.7	-1.5
Iron, steel, and nonferrous metals and products	+38.1	+14.6	-8.1
Machinery excluding electrical	+17.6	-8.8	-6.7
Electrical machinery	+32.2	-25.3	-2.3
Transportation equipment excluding motor vehicles	+86.9	-35.3	-28.4
Motor vehicles and equipment	+37.1	-11.5	-15.5
Miscellaneous	+14.2	-23.8	+5.4

Source: See Appendix Table A-15.

output ratio that characterized most branches of manufacturing. And this deserves further exploration.

In Table 28, each major component of working capital—cash, notes and accounts receivable, and inventories—is related to output (all in 1929 prices) for 1948 and 1953. Each component of working capital is an average of year-end book values in the given and preceding year.

# CAPITAL AND OUTPUT TRENDS

In aggregate manufacturing, the ratio of cash to output declined by 13 per cent between 1948 and 1953, the inventory-output ratio increased by 3 per cent, and the ratio of notes and accounts receivable to output rose substantially (13 per cent). It was the rise in the latter

TABLE 28  
Major Manufacturing Industries: Ratios of Selected Short-Term Assets  
to Output, 1948 and 1953  
(based on values in 1929 prices)

	Ratios to Output of—					
	Cash		Notes and Accounts Receivable		Inventories	
	1948	1953	1948	1953	1948	1953
All manufacturing <sup>a</sup>	.061	.053	.085	.096	.148	.153
Beverages	.052	.047	.066	.064	.173	.165
Food and kindred products	.032	.032	.044	.051	.090	.095
Tobacco products	.031	.030	.135	.127	.461	.448
Textile-mill products	.062	.063	.072	.111	.151	.208
Apparel	.052	.045	.090	.100	.146	.145
Forest products	.058	.062	.087	.114	.146	.178
Paper and allied products	.063	.069	.078	.082	.124	.120
Printing	.082	.081	.122	.121	.083	.083
Chemical and allied products	.076	.074	.090	.101	.156	.163
Petroleum and coal	.061	.055	.106	.108	.101	.101
Rubber products	.055	.047	.111	.140	.170	.170
Leather and products	.051	.048	.093	.114	.158	.175
Stone, clay, and glass	.073	.072	.095	.098	.129	.127
Iron, steel, and nonferrous metals	.066	.060	.078	.080	.138	.150
Machinery excluding electrical	.074	.068	.109	.123	.223	.222
Electrical machinery	.073	.046	.127	.128	.220	.197
Transportation excluding motor vehicles <sup>a</sup>	.122	.047	.204	.145	.366	.208
Motor vehicles and equipment	.069	.040	.056	.072	.138	.118
Miscellaneous	.066	.055	.111	.129	.194	.195

<sup>a</sup> Shipbuilding excluded from numerator and denominator in all 1948 ratios but included in all 1953 ratios.

Source: Based on *Statistics of Income*, Part 2, Bureau of Internal Revenue (now Internal Revenue Service), for 1948 and 1953. For conversion to 1929 prices, see Appendix A, section B, part 1C.

two components that restricted the decline in the capital-output ratio to slightly more than 1 per cent. However, the inventories-output ratio rose in only 7 of the 19 industries; in 3 industries, this ratio was unchanged. On the other hand, the receivables-output ratio rose in all except 4 of the industry groups.

The inventory-output ratio in 1948 probably was unduly low owing

## RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

to the shortages of the immediate postwar years.<sup>13</sup> Probably the same set of circumstances also depressed the 1948 ratio of notes and accounts receivable to output. That is, in a strong sellers' market, manufacturers had less need to finance their customers. With the subsequent rapid expansion of capital stock and capacity, there was a gradual shift from the sellers' market to one in which the buyer was no longer at a disadvantage. To expand sales in this situation, manufacturers financed a larger proportion of their sales.<sup>14</sup>

These special circumstances of 1948 suggest that the rise in the working capital-output ratio between 1948 and 1953 may well prove to be a temporary interruption to the downward trend, rather than a trend reversal. This determination must wait upon data for years following 1953.

### *The Record in Mining, 1948-1953*

The downward trend in the capital-output ratio (in 1929 prices) for total mining has continued to 1953 (Table 29). The ratio in the latter

TABLE 29  
Selected Capital-Output Ratios, by Major Mining Industries, 1948 and 1953  
(based on values in 1929 prices)

	<i>Ratios to Output of—</i>					
	<i>Capital</i>		<i>Plant</i>		<i>Working Capital</i>	
	1948	1953	1948	1953	1948	1953
All mining	1.34	1.26	0.92	0.84	0.42	0.42
Metals	1.00	1.39	0.54	0.77	0.46	0.62
Anthracite coal	0.43	0.64	0.25	0.32	0.18	0.32
Bituminous coal	0.88	1.17	0.48	0.72	0.40	0.45
Petroleum and natural gas	1.79	1.41	1.32	1.01	0.47	0.40
Other nonmetals	0.56	0.61	0.32	0.33	0.24	0.28

Source: Based on data in Appendix Tables B-8 and B-11, and worksheets.

<sup>13</sup> The inventories-output ratio in 1948 was 14 per cent below that of 1937 (Table 22). The ratio for 1953 is 3.4 per cent higher than the 1948 ratio, making for a lower ratio in 1953 than in 1937. The ratios for 1948 differ because of differences in the method of expressing inventories in 1929 prices. The method used in preparing Table 22 is the preferred one. Data for this method were not readily at hand for 1953.

<sup>14</sup> The four industries with declining ratios of notes and accounts receivable to output serve to confirm this generalization. In two (beverages, and tobacco manufacturing) fixed capital declined; in printing and publishing, fixed capital rose a modest 4 per cent. In the fourth industry, transportation equipment except motor vehicles, military airplanes were the principal component to rise rapidly during this period of the Korean War. Since the Federal government was the buyer, the manufacturers had no pressing need to finance their sales with book credit.

## CAPITAL AND OUTPUT TRENDS

year was 6 per cent below the ratio for 1948. If the numerator of the ratio is restricted to plant (structures and equipment) the decline is even larger, nearly 9 per cent. On the other hand, the ratio of working capital to output was unchanged in 1948 and 1953. On closer inspection, it appears that the continued decline of the ratio for all mining is due to developments in the petroleum and natural gas industry which, in 1953, used 68 per cent of all capital (in 1929 prices) devoted to mining. In the other 4 major mining groups, all ratios (capital, plant, and working capital to output) were higher in 1953 than in 1948. Indeed, the 1953 ratios for metals, anthracite, and bituminous coal even exceeded the 1940 ratios; but, except in bituminous coal, the 1953 ratios were less than the 1929 ratios. The conclusion seems inescapable: the downward trend in the capital-output ratios in mining (except in the petroleum and natural gas industry), evident since 1909 or 1919, reversed in the five-year period 1948-1953. In manufacturing, the evidence of any reversal of trend, except for working capital, was much less definitive.<sup>15</sup>

### *Changes between 1953 and 1957 in Capital-Output Ratios for Manufacturing*

Since the preparation of this manuscript, preliminary estimates of capital for 1957 (another peak year in business activity) were prepared by major manufacturing industry groups for the National Industrial Conference Board.<sup>16</sup> These can be used to extend the estimates that form the core of Part I of this monograph and, thereby, to provide a view of developments in this area over the first post-World War II decade.

The fixed-capital estimates based on data from *Statistics of Income* were prepared for 1956 and extended to 1957 using a sample (the *Quarterly Financial Report, United States Manufacturing Corporations*) taken by the Federal Trade Commission and the Securities and Exchange Commission. The 1957 estimate, therefore, is probably less firmly based than are the estimates for 1948 and 1953. At best, it must be considered preliminary.

Another caution relates to the change, after 1953, in the depreciation regulations for acquisitions of depreciable assets. They introduce an

<sup>15</sup> The reversal in trend of the capital-output ratios provides an unusual opportunity to analyze the changes in technology and other factors that made first for a declining ratio of capital to output and then for a rising ratio. This would require a series of detailed industry case studies that cannot be undertaken for this monograph.

<sup>16</sup> For a description of the estimates, see Daniel Creamer, *Technical Paper*, National Industrial Conference Board (forthcoming).

## RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

element of incomparability into the balance-sheet data because the new regulations permit a faster recovery of new investment than was possible under the straight-line depreciation previously prescribed. Thus, estimates of net fixed capital derived from book values would be relatively more net of depreciation after 1953 than in 1953 and earlier years. The elimination of this element of incomparability raised the 1956 estimate of net fixed assets for all manufactures in 1929 prices by 1.6 per cent and, therefore, the fixed capital-output ratio by the same amount.<sup>17</sup> This adjustment could not be made by industry subgroups. Departure from the average adjustment of all subgroups would depend on the rate of expansion of fixed-capital assets since 1953 and on the portion subject to accelerated amortization as an emergency facility. We fall back on an arbitrary arrangement: We treat a decline in the fixed capital-output ratio of 2 per cent or less between 1953 and 1957 as equivalent to no change.<sup>18</sup>

Although fixed capital in manufacturing expanded at an average annual rate of 4.3 per cent between 1948 and 1953—perhaps the highest rate since World War I—it achieved a still higher rate, 4.7, over the 1953–1957 business cycle (Table 30). In the former period, 9 of the 21 industry groups had average or better-than-average rates of growth. With the exception of chemicals and allied products, and paper and allied products, all these industries were engaged in the manufacture of consumers' and producers' metal products. These, apparently, were the industries in which technical innovations and the long suppression of demand created the strongest pressures for expansion. These, then, were the industries that would outbid all others for the limited resources available for expansion. In the next cycle, although the urgency for expansion was less, these industries continued to grow at a relatively high rate. That is, in 6 of the 9 groups, the average annual rate of increase was less in the 1953–1957 cycle than in the preceding cycle; but, also in 6 groups, the rate equaled or exceeded the annual growth rate for all manufacturing.

Half of the 12 industry groups with less than the average rate of growth between 1948 and 1953 actually sustained a contraction in fixed capital measured in constant prices. In each case, however, the contraction was either nominal or of modest proportions. In the next period, 9 of the 12 had a higher rate of expansion (or a lower rate of contraction), and 5 groups actually expanded at a higher annual rate than all manufacturing. Once the chemical and metal working

<sup>17</sup> This adjustment will be described in Creamer, *op. cit.*

<sup>18</sup> Estimates for both 1957 and 1953 include fixed capital owned by government but operated by private industry. The output estimate is the annual rate of output of the peak quarterly output in 1957, as indicated by the Federal Reserve Board's index of manufacturing production.



# CAPITAL AND OUTPUT TRENDS

TABLE 30

Change in Fixed Capital and in Its Ratio to Output, by Major Manufacturing Industries, 1948-1953 and 1953-1957  
(based on values in 1929 prices)

	Rate of Change per year in Fixed Capital		Per Cent Change in Fixed Capital-Output Ratio	
	1948-1953	1953-1957	1948-1953	1953-1957
All manufacturing	+4.3	+4.7	-5.3	+8.1
Miscellaneous including ordnance	+18.5	+0.3	+71.5	-11.8
Transportation equipment ex- cluding autos	+13.3	+5.9	-35.3	+13.4
Chemicals and allied products	+11.2	+7.9	+33.7	+5.3
Instruments and professional apparatus	+10.4	+7.6	-17.8	+12.1
Motor vehicles	+6.5	+8.6	-11.5	+48.1
Electrical machinery	+5.8	+3.7	-25.3	+18.7
Paper and allied products	+4.8	+6.6	+0.2	+5.9
Fabricated metal products	+4.3	+3.6	-7.7	+5.4
Primary metals	+4.3	+4.7	+10.4	+19.6
Machinery other than electrical	+3.3	+5.5	-8.8	+12.3
Stone, clay, and glass products	+3.1	+8.7	-11.7	+26.0
Apparel	+1.9	0.0	-15.7	-7.0
Petroleum and coal products	+1.7	+7.0	-16.1	+2.3
Printing and publishing	+0.8	+3.7	-0.7	-5.0
Lumber and products	+0.6	+6.9	-4.0	+16.0
Textile-mill products	-0.3	-1.8	+5.1	-16.1
Rubber products	-0.6	+3.7	-17.7	+5.6
Food and kindred products <sup>a</sup>	-0.6	-0.8	-27.2	-6.9
Furniture and fixtures	-2.4	+2.7	-10.7	-6.7
Leather and leather products	-4.1	-1.5	-18.3	-21.1
Tobacco products	-5.2	+7.2	-30.4	+35.9

<sup>a</sup> Includes beverages.

Note: The industry groups are arranged by order of the rate of change between 1948 and 1953, starting with the highest.

Source: Daniel Creamer, *Technical Paper*, National Industrial Conference Board (forthcoming).

industries had satisfied their more pressing needs for capital, other branches of manufacturing were able to grow at a faster rate.

We have already noted that in most branches (16 out of 21), the fixed capital-output ratio declined between 1948 and 1953, thus continuing the general pattern that had persisted since about 1919. Over the course of the 1953-1957 cycle, the continuance of the relatively high rates of expansion caused the stock of fixed capital to grow more rapidly than output, resulting in a significant rise in the fixed capital-output ratio. This occurred in two-thirds of the 21 industry groups.

## RATIOS OF FIXED AND WORKING CAPITAL TO OUTPUT

With one exception, the rise in the ratio amounted to 5 per cent or more and to 10 per cent or more in 9 industries. Thus, for the first time in about four decades, manufacturing industries typically used more fixed capital in constant prices, *not less*, to produce a unit of output. This was the predominant trend from 1880 to 1919. Perhaps it is no coincidence that the condition reappeared in 1957, when the annual rate of capital expansion was approaching that of some of these earlier decades. The latter supposition is consistent with the low rates of growth of the 7 industries with declining fixed capital-output ratios between 1953 and 1957. Five of these industries had either stood still or declined, and the remaining 2 rose less than 4 per cent.

The ratio of working capital to output in 1956 (the last year for which the computation can be made) was 5 per cent above the ratio for 1953 and 3.7 per cent above the 1948 ratio. The reversal in the direction of the trend initiated in half of the industry groups in the 1948-1953 period became more pervasive, having occurred in all but 5 of the 22 subgroups. Once again, to judge by a limited examination of the evidence, the need to hold an ever larger volume of accounts and notes receivable per unit of output has been mainly responsible for the rising ratio of working capital to output. Thus, to utilize the rapidly expanded capacity, producers have been obliged to finance an increasing proportion of their sales.

### *Summary of Findings*

1. For manufacturing, the subdivision between fixed and working capital can be made for seven benchmark years beginning 1890. The ratios of both fixed and working capital to output, have risen up to 1919 or, at the latest, 1929. Both ratios declined thereafter up to 1948. The rise from 1890 to 1929 was somewhat sharper for the working capital-output ratio than for the fixed capital-output ratio (23 and 19 per cent, respectively). The decline from 1929 to 1948 was greater for the fixed capital-output ratio than for the working capital-output ratio (34 and 29 per cent, respectively). This is conclusive evidence that the changes in the total capital-output ratio were not caused by any change in the relative importance of fixed and working capital.

2. In mining industries, also, during the earlier decades, the ratios of plant (net value of structures and equipment) to output and of working capital to output rose. The increase in the former was steeper. Between 1919 and 1948, in most mining industries, the ratios of working capital to output began to decline later (1929 rather than 1919) than the ratios of plant to output, and the decline was much smaller.

3. The discrepancy between the stock of reproducible wealth ("past labor") used in production and the actual amount of wealth used for

## CAPITAL AND OUTPUT TRENDS

the same purpose is unique for mining industries in that nonreproducible assets—the mineral resources—constitute a large share of the value of total capital used in mining. Conversely, past labor constitutes only a small share of the total value of these assets. Because of conceptual difficulties, the ratio of total capital (which includes land) to output is given only for reported values. These ratios increased during the earlier decades and declined during the later ones in much the same way as the ratios of capital (defined as plant and working capital only) to output. The rise in the former ratios, however, was less pronounced and the decline more marked than in the ratios of capital to output. The same is true, of course, to an even larger extent, of the ratios of land to output.

4. After 1948, nearly three-fourths of the major industry groups, owning almost 60 per cent of all fixed capital (in 1929 prices) devoted to manufacturing in 1953, continued to operate with fixed capital of increasing efficiency. That is, the fixed capital-output ratio continued to decline despite the relatively rapid rate of annual expansion in fixed capital between 1948 and 1953. The working capital-output ratio also declined for all manufacturing and for about half of the 19 industry groups. This nonconformity of nearly half of the industry groups represents a departure from the pattern that had persisted since about the end of World War I.

5. The downward trend in the capital-output ratio in mining, evident since 1919, was reversed in 1948–1953, except in the petroleum and natural gas industries. This was true for mining industries that expanded their capital (in 1929 prices), such as metals and other non-metals, as well as for those that contracted their capital stock, such as anthracite, or maintained a constant stock, such as bituminous coal.

6. The continuance in the 1953–1957 cycle of the relatively high growth rates initiated in the 1948–1953 business cycle caused the stock of fixed capital to increase more rapidly than output, resulting in a significant rise in the fixed capital-output ratio. This occurred in two-thirds of the 21 industry groups. Thus, for the first time in about four decades, manufacturing industries typically used more fixed capital in constant prices, *not less*, to produce a unit of output. The working capital-output ratio also increased in this period (by 5 per cent) and this increase occurred in all except 5 of the industry groups.