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CHAPTER 4

Trends in the Structure of Capital Formation

In the preceding chapter we dealt with capital formation as a total. Much can be learned also by studying its various components and distinguishing the domestic sector, that is, additions to capital located within the United States, from changes in claims against foreign countries; and by distinguishing not only the types of domestic capital formation—construction, producers' equipment, and inventories—but also the broad groups of eventual users—households, business firms, and governments, and even the business firms by their industrial affiliation. The present chapter is devoted to a summary of trends in the structure of capital formation, and to a discussion of factors that may have accounted for these trends.

Net Changes in Claims against Foreign Countries

Additions to the stock of buildings, plants, machinery, and inventories within the country may represent the current product of the economic activity of the members of the nation and their capital, or the product of the activity of members of other nations and their capital. The totals presented and analyzed in the preceding chapter were those of national capital formation, i.e., including additions to capital stock whether at home or abroad, so long as they belonged to the members of the community we call the United States. Such national capital formation may be smaller or larger than the total additions to capital located within the country—domestic capital formation: smaller if, on balance, the additions to claims by foreign countries

against the United States are larger than the additions to claims by the United States against foreign countries; and larger if, on balance, the additions to claims by foreign countries against the United States are smaller than additions to claims by the United States against foreign countries. In the former case, the net balance of foreign claims is negative; and part of domestic capital formation is financed by foreign capital funds or by the reduction of United States claims through the loss of gold, which represents a stock of internationally acceptable claims. In the latter case, the net balance of foreign claims is positive, and to domestic capital formation we must add those additions to claims against foreign countries—in the form of a larger stock of gold or of other types of claims (foreign securities, direct ownership of real assets abroad, and the like).

We begin with this division of total national capital formation between the domestically located part and the changes in foreign claims partly because it bears most directly upon an important point in our discussion in Chapter 3. We argued there that a major limitation upon the long-term level of capital formation in the United States lay in the supply of savings that the economy could generate; and that, by and large, this limitation may have outweighed any long-term limits on the side of demand for capital funds, i.e., on the side of domestic investment opportunities. If so, could these limits on domestic capital formation be removed by drawing upon savings abroad? To test this possibility, we examine the extent to which shortages in the supply of domestic savings were relieved by the inflow of savings from foreign countries.

There is another reason for beginning with an examination of changes in claims against foreign countries. In a review of the mechanism by which such changes are brought about, much can be glimpsed of the factors that determine the flow of savings into capital formation, and these factors are not unlike those that govern the flow of savings into various types of domestic capital formation. Hence, whatever we learn about the forces that have determined the trend in the relative share of net changes in claims against foreign countries may contribute to the hypotheses that serve as preliminary leads in the analysis of trends in the distribution of domestic capital formation among its various components.

With these comments in mind, we turn to Table 10, which summarizes the flows to and from this country from 1850 to 1955, and the resulting net changes in claims against foreign countries. An examina-

TABLE 10

BALANCE OF INTERNATIONAL PAYMENTS OF THE UNITED STATES, 1850–1955
(annual averages, millions of dollars)

	Fiscal Years				*Calendar Years*			
	1850–1873 (1)	1874–1895 (2)	1896–1914 (3)	1914[a]–1922[b] (4)	1923–1928 (5)	1929–1940 (6)	1941–1945 (7)	1946–1955 (8)
Sources of foreign claims against U.S.								
1. Imports of merchandise	339	670	1,203	3,094	4,123	2,481	4,360	8,950
2. Imports of services	43	67	238	791	840	709	1,434	2,138
3. Military expenditures	—	—	—	—	—	5	1,459	1,411
4. Income on foreign investments in U.S.	38	85	200	118	192	216	178	354
5. Total, lines 1 to 4	419	822	1,642	4,003	5,155	3,411	7,431	12,853
6. Unilateral transfers (net)	−14	20	150	386	362	225	8,327	4,769
Private	−14	20	150	346	350	208	276	528
Government	—	—	—	40	12	17	8,051	4,241
Military	—	—	—	—	—	—	8,072[c]	1,477
Other	—	—	—	40	12	17	−22	2,764
7. Total, lines 5 and 6	405	842	1,792	4,389	5,517	3,636	15,758	17,622
Sources of U.S. claims against foreign countries								
8. Exports of merchandise	277	783	1,691	5,748	4,861	3,048	11,817	13,000
9. Exports of services	27	7	5	482	456	432	2,739	2,612
10. Military transfers	—	—	—	—	—	—	n.s.s.	1,477
11. Income on U.S. investments abroad	n.a.	n.a.	40	392	921	642	546	1,656
Private	n.a.	n.a.	40	320	761	599	531	1,496
Direct	n.a.	n.a.	n.a.	n.a.	434	314	394	1,298
Other	n.a.	n.a.	n.a.	n.a.	326	285	137	198
Government	—	—	—	72	160	42	15	160
12. Total, lines 8 to 11	304	790	1,735	6,623	6,238	4,122	15,102	18,745

Balances of or net changes in claims on account of:								
13. Merchandise, line 8 minus line 1	−62	113	488	2,654	738	567	7,457	4,050
14. Services, line 9 minus line 2	−16	−60	−233	−309	−384	−277	1,305	474
15. Military, line 10 minus line 3	—	—	—	—	—	−5	−1,459	66
16. Income on investments, line 11 minus line 4	−38	−85	−160	274	729	426	368	1,302
17. Total, line 12 minus line 5	−115	−32	93	2,620	1,083	711	7,671	5,892
18. Unilateral transfers, line 6, signs reversed	14	−20	−150	−386	−362	−225	−8,327	−4,769
19. Total, lines 17 and 18	−101	−52	−57	2,234	721	486	−656	1,123
Movement in claims								
20. Gold sales (+), purchases (−)	46	5	−9	−213	−36	−1,265	392	−167
21. U.S. capital (inflow +; outflow −)	—	—	−53	−1,630	−973	163	−490	−2,232
Total private	—	—	−53	−438	−1,018	156	−96	−949
Direct	—	—	n.a.	n.a.	−310	−84	27	−642
Other long-term	—	—	n.a.	n.a.	−566	109	−108	−163
Short-term	—	—	n.a.	n.a.	−142	130	−15	−144
Government	—	—	—	−1,191	45	7	−394	−1,283
22. Foreign capital (inflow +; outflow −)	42	45	105	−269	470	297	660	785
Long-term	42	45	105	−278	222	138	−81	171
Short-term	—	—	n.a.	n.a.	248	159	740	614
23. Net capital flow, lines 21 and 22	42	45	53	−1,899	−503	460	170	−1,447
24. Errors and omissions, line 19, signs reversed, minus lines 20 and 23	14	2	13	−122	−182	320	95	490

Because of rounding, detail will not necessarily add to total.

In this and the following tables, n.a. = not available; n.s.s. = not shown separately; = nil, or negligible.

[a] July 1 of year.

[b] December 31 of year.

[c] Includes other grants.

SOURCE: *1850–1952: Balance of Payments of the United States, 1919–1953* (Supplement, *Survey of Current Business*, July 1954).

1953–1955: Survey of Current Business, June 1956.

tion of the flows is indispensable to the understanding of the net changes.

The first group of entries (lines 1–7) records the flows to this country from abroad—the sources of gross additions to claims by foreign countries against the United States. The major item here is imports of merchandise (line 1), and to this we add purchases of services rendered by foreign resources—shipping, expenditures abroad by American tourists, insurance and other financial services, and the like. We must also add income earned by foreign capital invested in the United States. A plant located in the United States, but owned by a member of a foreign nation, must be viewed as part of foreign, not United States, resources, and the earnings on such an investment constitute an addition to claims against this country. Finally, a claim against the United States can arise without any antecedent import of a commodity from abroad, without any purchase of a service rendered by foreign resources, and without foreign ownership of resources located within the United States. A member or some collective body of the United States community can make a gift to a person or group abroad—and by its nature there is no tangible or overt *quid pro quo*. Such gifts, whether private remittances or government grants, are described as unilateral transfers, and are entered on a net basis (that is, net of any gifts from abroad to the United States) in line 6.

There is conceptually no duplication or overlapping among the five categories of additions to foreign claims against the United States. Imports of merchandise cannot, in the nature of the case, be included either under the purchase of services, military expenditures abroad, or under income on foreign investments. If the value of the import includes the charges for shipping by a foreign carrier, these charges are not included under services. If income originates in a plant located within the United States, it cannot appear under imports. And since unilateral transfers are direct additions to foreign claims, they cannot overlap imports from abroad, though they may be exports from the United States. Not only are the five categories nonduplicating, they are also comprehensive in that they comprise *all* current additions to foreign claims; and their sum is the total of all current additions to foreign claims against this country.

The second group of entries (lines 8–12) deals with the counterflows, the sources of additions to United States claims against foreign countries. Here the major item is exports of merchandise, supplemented by the sales of some services of United States resources to persons abroad

and, in recent years, by military transfers. There is also, of course, income on United States investments abroad. Since, however, unilateral transfers are taken on a net basis in line 6 (such transfers to the United States have in any case been negligible), no entry for this item appears under additions to United States claims against foreign countries. Corresponding to the total of additions to foreign claims (line 7), there is the total of additions to claims by the United States against foreign countries (line 12).

It is the balances on these various accounts that are of particular interest (lines 13–19). Exports of merchandise can be balanced against imports of merchandise; exports of services against imports of services; and so on. However, such matching does not mean that claims against foreign countries derived from exports are in fact used to finance imports of merchandise but not to pay income on foreign investments. There is no reason for assuming that current additions to claims against foreign countries do not flow into a common pool in which their identity is lost, and from which drafts are made to finance any purchase from or payment abroad. Even if the sources retain their identity, it does not necessarily follow that a particular batch of claims originates as an export of a commodity rather than, say, as income on a United States investment abroad. The matching is just a simple classifying device, intended to show how each type of transaction—in commodities, in services, in income on investments, and so on—contributes to the net balance of or changes in total claims against foreign countries. This total (line 19) is of most interest to us, for it is a component of total capital formation and represents the difference between total and domestic capital formation.

This total net change in foreign claims, described in the current international balance of payments terminology as net foreign investment, can also, theoretically, be derived from movements in stocks of claims. In lines 20 to 23 these movements in stocks of claims are summarized, the claims being classified into two major categories—gold and capital assets. If the data on capital assets were complete and accurate, net changes in gold and capital assets (line 20 plus line 23) would agree with the total in line 19; but, since the estimates of capital assets are deficient, the item of errors and omissions (line 24) is introduced to provide the identity.

Two aspects of Table 10 should be noted before we comment on the findings. First, the periods distinguished were determined partly by the supply of data, partly by the desire to separate periods char-

acterized by distinctive complexes of economic and other conditions. Thus, detailed estimates are available for 1850–1873, 1874–1895, 1896–1914, and 1914–1918, but not for the years or subperiods within each; and, while we were able to derive single-year estimates of total net changes in foreign claims for the years before 1919, it would have been impossible to calculate annual estimates of all the items in Table 10. We have, therefore, used the series for the periods as given, but extended the fourth through 1922, partly because the first few years after World War I were still much affected by it, partly because complete and reliable estimates by the Department of Commerce begin with 1923. Then we distinguish 1923–1928, a period of relative prosperity; 1929–1940, a period affected by the Great Depression; the years of World War II, most distinctive from the standpoint of conditions for flow of goods, services, and claims across the country's boundaries; and, finally, the post-World War II decade.

The second point to be noted is that the estimates for the periods before the 1920's are necessarily approximate, and we took advantage of the recent and detailed work by Goldsmith which contains revisions for 1897–1914 and 1915–1922. These are summarized in Table 11, which can be regarded as an appendix to Table 10. It is important to emphasize that throughout our study we accepted Goldsmith's figures on savings, and they are, therefore, the basis for our estimates of net changes in foreign claims, and hence of national capital formation. His revisions are minor for the period 1915–1922, and not large absolutely even for 1897–1914. They show a positive balance for that period compared with a negative balance in the older estimates, although in both estimates net changes in claims are relatively small.

Among the findings suggested by Tables 10 and 11, there is, as expected, a substantial rise in the flows to and from this country. Total imports of goods and services per year rose from less than one-half billion dollars during 1850–1873 to close to $13 billion in 1946–1955 (Table 10, line 5). Total exports of goods and services per year rose from less than one-third billion dollars during the first period to almost $19 billion during the post-World War II decade (Table 10, line 12). Even the net balance rose considerably in volume, signs disregarded—from between $50 million and $100 million per year in the early periods to over $1 billion per year in the latest (Table 10, line 19); or to almost $6 billion, excluding unilateral transfers (line 17). All these volumes are in current prices and affected by price changes, but even when adjusted for price changes, both gross and net flows would

TABLE 11

REVISION OF BALANCE OF INTERNATIONAL PAYMENTS ITEMS, 1897–1922
(annual averages, millions of dollars)

	1897–1914 (1)	1915–1922 (2)
Balances of or Net Changes in Claims On Account of:		
1. Commodities	571	2,810
2. Services	−201	−414
3. Income on investments	−78	346
4. Total, lines 1 to 3	291	2,742
5. Private remittances	−147	−372
6. Total, lines 4 and 5	144	2,370
Changes in Stocks of Claims		
7. Gold stocks (increase −)	−68	−265
8. U.S. foreign assets (increase −)	−102	−1,888
Total private	−102	−622
Direct	−76	−64
Other long-term	−26	−558
Government	—	−1,266
9. Foreign assets in U.S. (increase +; decrease −)	82	−240
Long-term	57	−213
Short-term	25	−26
10. Net balance of assets, lines 8 and 9	−20	−2,128
11. Errors and omissions, line 6, signs reversed, minus lines 7 and 10	−56	23

Because of rounding, detail will not necessarily add to total.

SOURCE: Raymond W. Goldsmith, *A Study of Saving in the United States*, Vol. I (Princeton University Press, 1955), pp. 1078–1085.

still show a sharp secular rise. This is hardly surprising in view of the country's prodigious growth during the century covered by the estimates. One cannot attach much significance to these movements, unless they are compared with the movements in other countrywide totals to reveal whether the *proportional* weight and contribution of international flows, gross and net, have changed materially.

Even the absolute figures in Tables 10 and 11 clearly suggest three important, if familiar, findings. First, during periods of major wars, there is an acceleration in outflows—in exports of commodities and services to other participants in the conflict (excluding any flows representing direct participation by this country). Such marked rise in

exports sets up other movements, not only in balances and stocks of claims, but on the import side as well. Thus during World War I the huge rise in exports from the United States was offset partly by a rise in imports, but largely by an outflow of capital funds, some of which represented repatriation of foreign investments in this country, some, advances in capital loans by the United States. During World War II, the large rise in exports was offset partly by a rise in imports, but largely by unilateral transfers—government grants of various kinds to our allies.

Second, unilateral transfers have become of major importance in the whole network of international flows, to an extent unparalleled in the past. Their increase during the quinquennium of World War II was mentioned above. It continued through the post-World War II decade, and is obviously a factor that must be considered in the future. With this growing importance of unilateral transfers, net changes in claims against foreign countries can now be negative not because of greater investment of foreign capital in the United States, but because of greater grants by the United States to other countries.

Third, the balance of changes in claims against foreign countries has shifted from negative to positive. It was negative in the first two periods, covering 1850 to 1895, although even as early as 1874–1895 the net balance of merchandise and services was positive (see Table 10, lines 13 and 14). The country was exporting more commodities and services than it was importing, and capital imports were financing interest payments to foreigners, and gifts. According to the older set of estimates, that situation continued through 1896–1914, but Goldsmith's revisions for 1897–1914 suggest a small positive balance. Certainly World War I saw a sharp reversal, and since that time positive balances have been the rule with the single exception of the World War II quinquennium when huge unilateral transfers were made. With this exception, by and large since the late 1890's, there has been no period of net imports of foreign capital; and only during the first five years of the total period covered in our study—from 1869 to the mid-1870's—was capital formation located within the United States assisted by net inflow of capital funds from abroad.

The picture becomes more distinct when we relate exports, imports, and other sources of foreign claims to countrywide totals. The first comparison is presented in Table 12, where the various flows summarized in Tables 10 and 11 are expressed as percentages of gross national product in current prices.

Table 12 excludes the period 1850–1873, because we have no reliable estimates of gross national product for those years. But more important is the question whether gross national product is the proper base of reference. It might be more logical to use gross national product plus imports of goods, i.e., including imports of commodities, services, and income on foreign investments in the United States. Theoretically, net imports can exceed domestically produced output, in which case national product, gross or net, will be negative; and any reference to a negative base would be illogical. However, the total of gross national product and all imports of goods, which could be described as the total of all available resources, would be, as Table 12 clearly indicates, not much larger than gross national product, because in no period have imports constituted as much as 10 per cent of total national output. Percentages of total available resources would therefore differ only slightly from percentages of gross national product, and the trends in the two would practically parallel each other. We decided, therefore, to let the comparison stand, since gross national product is the base of reference for all other comparisons.

With this qualification, the major trends can be briefly summarized. First, the proportion of imports of all goods, including income on foreign investments, was at its highest during 1874–1895: almost 8 per cent of gross national product. It declined thereafter, and in the last period, the post-World War II decade, it was only 4.9 per cent of gross national product. This percentage is somewhat higher than that in the depressed period 1929–1940 but distinctly below the level of 5.9 per cent in 1923–1928.

Second, the share of unilateral transfers tended to increase, but it was minor—below 1 per cent of gross national product—until the World War II quinquennium, when it rose markedly. But even in the post-World War II decade, when it was somewhat less than 2 per cent of gross national product, it was distinctly higher than during any other period except that of World War II, keeping the proportional level of total additions to foreign claims higher than at any period since World War I. Despite this bolstering effect of unilateral transfers, the share of all additions to foreign claims in gross national product in 1946–1955 was lower than before the 1920's.

Third, the share of all exports in gross national product, disregarding the two world war periods, drifted downward—from 7.5 per cent in 1874–1895 to 7.2 per cent in 1946–1955. But this decline in the proportional importance of outflows is less pronounced than that in the

TABLE 12

INTERNATIONAL FLOWS AS PER CENT OF GROSS NATIONAL PRODUCT, BASED ON VOLUMES IN CURRENT PRICES, 1874–1955

	Fiscal Years			*Revised Estimates Calendar Years*		*Calendar Years*			
	1874–1895 (1)	1896–1914 (2)	1914 [a]–1922 [b] (3)	1897–1914 (2a)	1915–1922 (3a)	1923–1928 (4)	1929–1940 (5)	1941–1945 (6)	1946–1955 (7)
1. GNP, Variant I, annual averages, in current prices ($ billions)	10.56	23.81	61.24	25.01	62.96	87.27	73.70	129.06	259.97
Percentages of GNP									
Sources of Claims									
2. Imports of goods	7.0	6.1	6.3			5.7	4.3	5.6	4.8
3. Income on foreign investments	0.8	0.8	0.2			0.2	0.3	0.1	0.1
4. Unilateral transfers	0.2	0.6	0.6			0.4	0.3	6.5	1.8
5. Total sources of foreign claims	8.0	7.5	7.2			6.3	4.9	12.2	6.8
6. Exports of goods	7.5	7.1	10.2			6.1	4.7	11.3	6.6
7. Income on investments abroad	n.a.	0.2	0.6			1.1	0.9	0.4	0.6
8. Total sources of U.S. claims	7.5	7.3	10.8			7.1	5.6	11.7	7.2

Balances of or Net Changes in Claims On Account of:									
9. Goods	0.5	1.1	3.8	1.5	3.8	0.4	0.4	5.7	1.8
10. Income on investments	−0.8	−0.7	0.4	−0.3	0.5	0.8	0.6	0.3	0.5
11. Unilateral transfers	−0.2	−0.6	−0.6	−0.6	−0.6	−0.4	−0.3	−6.5	−1.8
12. Total net balance	−0.5	−0.2	3.6	0.6	3.8	0.8	0.7	−0.5	0.4
Derived Combinations									
13. Flow of goods	14.5	13.2	16.5			11.8	9.0	16.9	11.4
14. Flow of goods and investment income	15.3	14.2	17.3			13.1	10.2	17.4	12.1
15. Exports of goods minus unilateral transfers	7.3	6.5	9.6			5.7	4.4	4.8	4.8
16. Total net balance, excluding unilateral transfers	−0.3	0.4	4.2	1.2	4.4	1.2	1.0	6.0	2.2

Because of rounding, detail will not necessarily add to total.

[a] July 1 of year.

[b] December 31 of year.

SOURCE, BY LINE

1. Calculated from the annual estimates underlying Table R-25.
2. Table 10, lines 1, 2, and 3.
3. Table 10, line 4.
4. Table 10, line 6.
5. Lines 2, 3, and 4.
6. Table 10, lines 8, 9, and 10.
7. Table 10, line 11.
8. Lines 6 and 7.
9. Table 10, lines 13, 14, and 15; or Table 11, lines 1 and 2.
10. Table 10, line 16; or Table 11, line 3.
11. Line 4, signs reversed; or Table 11, line 5.
12. Lines 9, 10, and 11.
13. Lines 2 and 6.
14. Lines 3, 7, and 13.
15. Line 6 minus line 4.
16. Line 12 minus line 11.

proportional weight of inflows, and it might be safer to infer that no significant decline in the relative share of outflows has occurred. The absence of a significant decline is associated with the rise in the proportional weight of unilateral transfers, which induces a greater flow of exports. However, it is not quite legitimate to argue that without the unilateral transfers exports from the United States would have declined. Had the large government grants not been made in 1946–1955, foreign countries might still have been able to purchase some of the United States exports that were in fact financed by those grants. But if we do assume a direct connection between the two, total exports of commodities and services in 1946–1955 would have amounted to 4.8 per cent of gross national product (line 15), and the addition of income on investments abroad would have meant an outflow of goods equivalent to 5.4 per cent of gross national product, compared with percentages of about 7 per cent in 1874–1895, 1896–1914, 1923–1928, and 5.3 per cent in the depressed period 1929–1940. In other words, the proportion of total exports to gross national product may have failed to decline largely because of the increase in the relative weight of unilateral transfers, particularly during the post-World War II decade.

Fourth, the total net balance was a minute fraction of gross national product—below 1 per cent—except during the period dominated by World War I; but small as the balance was, we find a clear reversal from negative balances, indicating foreign capital imports, in the earlier periods, to positive balances, indicating United States capital exports, in the later periods. These positive balances, prevailing since the end of the nineteenth century, are particularly evident when we adjust for the effects of unilateral transfers (line 16). But even with this adjustment, they range from less than 1 to slightly over 2 per cent of gross national product, except during the world war periods.

However, our major interest here is the relation of net changes in foreign claims not to national product but to capital formation; for we are concerned with the level of and trend in this component as part of total capital formation. The relevant percentages are given in Table 13. In part A the percentages are for the periods distinguished in Tables 10 through 12; in part B they are for overlapping decades from 1869 to 1955.

Two conclusions stand out. First, except for the years associated with World War I, net changes in claims against foreign countries constituted large percentages of net capital formation alone, and only for periods in which depressed economic conditions lowered the absolute

level of net capital formation appreciably. If we were to group the years, as we should for secular analysis, to avoid the marked effects of depressions or major wars, we would find that net changes in claims against foreign countries never averaged more than 10 per cent of net capital formation, and distinctly less than that as a per cent of gross capital formation. In other words, quantitatively, net foreign additions to or drafts upon domestic capital formation, particularly gross, have not been a secularly important component of capital formation in this country.

Second, we naturally find here the reversal in sign noted above. In the earlier periods, domestic capital formation was larger than the total, the former being financed in part by a net inflow of capital from abroad. In the later periods, the opposite was true: domestic capital formation was smaller than the total, the latter being accounted for in part by net additions to capital investments abroad by the United States.

This necessarily summary account of the long-term trends in the balance of international payments of this country, and in the importance of outflows, inflows, and their net balance relative to national product and capital formation, raises three questions. (1) Why, during the second half of the nineteenth century, when this country enjoyed extraordinary growth, were not the inflows of foreign capital proportionately more substantial? (2) Why have the net changes in foreign claims shifted from negative to positive, from net capital imports to net capital exports, although the rapid growth that continued through the twentieth century could presumably have absorbed net capital imports from abroad? (3) Given the factors that make for net capital exports, which would presumably provide at least part of the answer to question (2), what limits the proportional level of capital exports? Clearly, these questions involve consideration of conditions not only in this country but in the rest of the world, and data and knowledge at our command are hardly sufficient for well founded and tested answers. Yet some attempt to deal with them must be made, if only to penetrate below the surface of the overt flows that have been summarized statistically, and to suggest the lines of direction that might lead to a tentative explanation.

1. The first question is especially puzzling when we consider that by the late 1870's the United States had recovered from the Civil War, and its capacity for growth had become an established fact. That increasing numbers of people immigrated in search of economic op-

TABLE 13

NET CHANGES IN CLAIMS AGAINST FOREIGN COUNTRIES AS PER CENT OF NATIONAL PRODUCT AND OF CAPITAL FORMATION, BASED ON VOLUMES IN CURRENT PRICES, 1869–1955
(amounts in billions of dollars)

Periods	Net National Product (Variant I) (1)	Gross Capital Formation (2)	Net Capital Formation (3)	Net Changes in Claims as Per Cent of: Gross National Product (4)	Net National Product (5)	Gross Capital Formation (6)	Net Capital Formation (7)
A. PERIODS IN TABLE 12, 1874–1955							
Fiscal Years							
1. 1874–1895	9.58	2.27	1.28		−0.5	−2.3	−4.0
2. 1896–1914	21.27	5.28	2.74		−0.3	−1.1	−2.1
3. 1914 (July 1) to 1922 (Dec. 31)	53.53	13.98	6.27		4.2	16.0	35.6
Revised Estimates, Calendar Years							
4. 1897–1914	22.33	5.49	2.81		0.6	2.6	5.1
5. 1915–1922	55.02	14.52	6.58		4.3	16.3	36.0
Calendar Years							
6. 1923–1928	77.17	19.19	9.10		0.9	3.8	7.9
7. 1929–1940	63.59	12.43	2.32		0.8	3.9	20.9
8. 1941–1945	109.40	28.66	9.00		−0.6	−2.3	−7.3
9. 1946–1955	214.18	61.29	15.50		0.5	1.8	7.2

B. OVERLAPPING DECADES, 1869–1955

Decades				
10. 1869–1878	−1.3	−1.4	−6.5	−10.7
11. 1874–1883	[a]	[a]	−0.1	−0.2
12. 1879–1888	−0.4	−0.4	−1.8	−3.1
13. 1884–1893	−0.6	−0.7	−2.8	−5.2
14. 1889–1898	0.1	0.2	0.6	1.1
15. 1894–1903	1.2	1.3	4.9	8.8
16. 1899–1908	1.0	1.1	4.3	8.0
17. 1904–1913	0.3	0.3	1.2	2.3
18. 1909–1918	2.4	2.8	11.1	23.1
19. 1914–1923	3.1	3.6	13.7	30.2
20. 1919–1928	1.6	1.8	7.2	15.7
21. 1924–1933	0.6	0.8	3.9	11.7
22. 1929–1938	0.5	0.6	3.0	22.8
23. 1934–1943	0.4	0.4	1.8	5.3
24. 1939–1948	1.0	1.2	4.7	16.8
25. 1944–1953	0.4	0.5	1.8	8.1
26. 1949–1955	−0.2	−0.3	−0.9	−3.6

[a] Less than 0.05 per cent.

SOURCE:

Part A

Col. 1. Calculated from the annual estimates underlying Table R-25.

Cols. 2 and 3. Calculated from the annual estimates underlying Table R-29.

Cols. 5–7. Entries in line 19 of Table 10, and line 6 of Table 11, as per cent of entries in columns 1–3.

Part B

The averages of the absolutes underlying the entries are given in Tables R-11 and R-14, or are calculated from Tables R-1 and R-4.

portunity is evidence enough that the economic potential of the United States was held to be one of the brightest. Why, under such circumstances, was the inflow of foreign capital, at its highest, only one-tenth of *net* capital formation and a small percentage of the national product?

Part of the answer lies in the size of the would-be lender countries compared with that of the would-be borrowers—even if we limit the latter to those countries where expectations would warrant the prognosis of favorable and vigorous economic growth. Before World War I the major creditor countries were the United Kingdom, France, and Germany, with the Netherlands, Belgium, and Switzerland providing limited additional funds. The would-be borrowers comprised not only the United States, the largest and in many ways most promising country, but also some countries in northwestern Europe (Denmark, Sweden, and Norway), Japan, several Latin American countries, Canada, and other British dominions. Even on the extreme assumption that all the savings generated in the would-be creditor countries were available for investment abroad, the supply to the would-be borrower countries, while much larger than the amount actually borrowed, would not be much larger relatively—given conditions in those countries that favored a vigorous flow of domestically originated savings. It must be remembered also that even where conditions were not very favorable to vigorous growth, as in some of the would-be borrower countries listed above, conditions for foreign investment established through special privileges encouraged some, and perhaps substantial, foreign investment. Although the economic prospects in India were, by and large, less favorable than those in the United States, the special relation of Great Britain to India warranted and required a flow of capital funds from the British Isles to India, leaving fewer British funds for investment elsewhere. In other words, the channeling of foreign capital is affected not only by the economic conditions, referred to above as the prospects of economic growth, in the would-be borrower country, but also by the noneconomic factors of political dominance and political expediency. The distribution of foreign capital investments by recipient areas, even before and especially after World War I, reveals the extent to which such investments followed not merely the economic prognosis of the long-term growth potential of the borrower country but the political factors. In fact, a substantial proportion of the foreign capital flow was a matter of political necessity, for instance, the large

volumes of capital invested in Russia (by France), in the Balkan countries, and in colonies dominated by the European powers.

But what limited the share of total savings originating in the lender countries that could be diverted to investment abroad? This question applies not only to the countries that in fact were creditors, but even to those that were not. Consider Russia as a specific illustration: it could be argued that any possessor of investment funds, even located within that country, would have concluded, upon a careful appraisal of prospects, that by the end of the nineteenth century and certainly by the twentieth it would be, in the long run, far safer to shift the funds into investment in the United States or Canada than keep them in Russia. The same argument applies even to an underdeveloped country like China. One may ask why Britain failed to invest all its current savings in foreign countries, where the prospects of economic growth were distinctly brighter than at home. One may also ask why possessors of funds in underdeveloped countries, confronted with difficult and recalcitrant economic and social problems at home, with dim prospects of successful solution and with the dangers of a breakdown fairly obvious, failed to channel their funds abroad—particularly to such promising areas as the United States.

This question, artificial and rhetorical as it may seem, points directly to one obvious but nevertheless important factor in the situation: all the savings of a country are not available for investment abroad. Assume that an English—or a Russian, or a Chinese—merchant realizes a total net income on his enterprise substantially in excess of withdrawals for use in ultimate consumption, and that he has, therefore, a net profit available for investment. Even if the net profit emerges in the form of easily disposable funds rather than larger inventory or larger stock of fixed capital, the very profitability of the enterprise makes attractive the reinvestment of the funds in the enterprise in the form of increased equity. This additional investment will then be under the control of the merchant and, combined with his continued participation and other already invested assets, will promise a substantial return. The yield on such accumulated savings invested in fixed-return foreign securities, while viewed as "safe," could hardly match the expected profits in one's own business. In addition, investment in foreign equities would either require active participation—and thus mean, in effect, migration of the investor as an active entrepreneur—or call for the exercise of judgment in the choice of equity stocks under conditions of comparative ignorance. And what is true

of the illustrative case of savings originating in a private trading firm is true of a wide variety of savings closely connected with the activities and desires of the individual saver and therefore far from free to flow abroad—savings generated by ultimate consumers in preparation for bulk outlays (such as residential housing), gross savings arising out of depreciation allowances in going enterprises, and the like.

The development of the elaborate complexes of intermediate financial institutions has, of course, facilitated the mobilization of savings and made possible diversion of at least part of such flow into foreign investment and, for that matter, into investment elsewhere within the domestic economy. Indeed, this is an important strand of modern economic growth. One major difference between developed and underdeveloped countries lies precisely in the capacity of the former to develop the financial institutions that mobilize savings, amassed at various points for various purposes, and pool them in funds in which they have much greater fluidity, permitting them to be channeled into uses that are likely to be economically more productive in the long run. All that is argued here is that in any given country a large part of the savings originates with a specific destination in the mind of the saver; that this condition may—and most likely will—restrict the savings to the uses the savers intended; and that such uses, being often indissolubly associated with the desire to combine the savings with other domestic resources, will keep them from flowing freely abroad.

To put it differently: the yield of savings or capital funds is conditioned by their combination with other resources. The potential growth of the United States means one thing to an investor who would accompany his savings to this country and add to the participation of his savings his own active participation in the process of growth. It means something different, and much less lucrative, to an investor who would limit his participation to the purchase of fixed-interest securities. And there are many gradations between the active participation of the former and the coupon clipping of the latter. The basic reason for the far from complete flow of savings, gross and net, from countries with low growth prospects to countries with high economic growth potentials has to be sought in the very factors that would explain the lack of complete mobility of people between two countries (which would equalize their current and prospective real income per capita): ignorance of foreign conditions as against familiarity with conditions at home; the large margin of error that necessarily attaches to any long-range forecast, and such a forecast is involved in the movement of

people and capital funds; and the heavy cost of dislocation and readaptation to new economic and social conditions. People migrate only when the pressures at home become exceedingly great, and savings migrate only when the supply of funds exceeds that needed for investment at home.

It is this complex of factors that explains why even in the major creditor countries, and even in the most favorable periods as, for example, from the late nineteenth century to World War I, only part of gross savings originating at home became available for investment abroad. In the United Kingdom, funds flowing into foreign investment in 1870–1913 averaged somewhat less than one-half of domestic gross capital formation.[1] It also explains why practically no capital funds flow abroad from underdeveloped countries. The reason is not so much the low rate of savings in these countries as the emergence of savings in forms not accessible to free flow. Those savings that are accessible can often be used at home, by users familiar with domestic conditions, in ways that yield exceedingly high returns—temporary though they may prove to be if the pressing weight of domestic economic and social problems causes a radical change in the country's political and social framework.

All these factors help to explain why the flow of capital funds into the United States was not greater than it was, and some of them apply not only to the distribution of savings among countries, but also to the apportionment of savings among various uses within a country. They will, therefore, bear upon the analysis of the distribution of domestic capital formation that follows. Finally, some of the points relate also to the next question: why, in the course of our development, the net changes in foreign claims have shifted from negative to positive, from net capital imports to net capital exports.

2. The reversal from net capital inflows to outflows and, eventually, from net debtor to net creditor position occurred in this country, as in many others, partly as specific historical events occasioned by transient circumstances such as wars, and partly as results of trends in economic growth. Even the war-conditioned circumstances of the shift in capital flows may be viewed as part of a wider complex of trends, and it is these that are of particular interest here.

Insofar as a greater potential for economic growth and prospects of

[1] See Simon Kuznets, "International Differences in Capital Formation and Financing," *Capital Formation and Economic Growth,* Special Conference Series, No. 6 (Princeton for NBER, 1955), Table II-4, Part B, p. 70.

higher yields in a country induce a flow of capital funds into it, that flow is likely to originate in countries that have already attained a high level of economic development and maturity where the needs for capital are less acute and the expected returns on it are lower. The differences among countries in the potential for economic growth during the last one to two centuries are to some extent a function of the time differences among them in adopting the new industrial technology and in equipping themselves with modern capital and attaining higher levels of economic productivity. Certainly the industrial revolution in Britain preceded that in the United States by one-half to three-quarters of a century. The point to be stressed, however, is that the complex of circumstances that brought about the early industrialization and modern economic growth of Great Britain also made it inevitably an active participant in World War I. That became a world war and involved large economic magnitudes precisely because by that time modern economic growth had spread to France and particularly to Germany. The complex of circumstances that delayed industrialization in the United States—its distance from the seat of the old economic civilization of Western Europe and the abundance of its land relative to population, which made agriculture the dominant economic activity for so long—also minimized its active participation as a belligerent in World War I. In that sense, the large positive change in the net balance of foreign claims in World War I in the United States was not an historical accident. It was part of the complex of trends that accounted for the difference in stage of economic growth between the United States and Great Britain through the nineteenth century, and that set earlier the conditions for net capital imports from Britain to the United States. Somewhat similar reversals in the flow of capital occurred during World War I in several Scandinavian countries and in Japan. And the following general proposition may be argued: insofar as net capital imports characterize countries with the large economic growth potentials associated with a late entry into the phase of modern industrialization, and insofar as the late entry determines their position in the "new" world, outside the area of the "older" economic units, world wars—which involve the major advanced and thus older economic units—are usually accompanied by major reversals in the flow of capital funds. Such reversals are partly a matter of repatriation by the older creditor countries, partly advances by the younger debtor countries. It may well be that such an outflow would also have occurred in the United States in World War II, except that by that time

the relevant foreign capital balances in the United States were small relative to the demands of the conflict, and the position of the United States as a world power subject to direct threat warranted the liberal use of its resources for assistance to its allies, largely in the form of unilateral transfers. It is this pattern rather than that of World War I that is likely to persist in any major war that may arise in the future.

Even if there had been no world wars, other forces would have produced a shift in this country from net capital imports to exports, although it might have occurred less precipitously. First, in the process of modern economic growth and industrialization, accompanied as it was by improvements in means of transportation and communication, reliance on imports of raw materials increased markedly. The United States used far more raw materials from abroad in the mid-twentieth century than it did in the mid-nineteenth century, even proportionately to the much greater volume of commodity production. Whereas imports of manufactured goods lead eventually to an attempt to produce them at home, imports of raw materials often lead to direct purchases of their sources and to an attempt to control their production to assure their supply in the form and at the rate most suitable for domestic needs. The well-known trends in the composition of exports and imports of a country as it becomes industrialized are away from the dominance of raw materials in exports to dominance of manufactured goods, and away from the dominance of manufactured goods to dominance of raw materials in imports. These trends induce parallel trends in direct investment abroad. Dependence upon imports of raw materials is conducive to direct investment in the production of raw materials abroad, whereas dependence upon imports of manufactured products is conducive to attempts to start their production at home. Dependence upon exports of raw materials does not lead to branch plants abroad, but dependence upon exports of manufactured products does. There was, consequently, a second group of reasons for this country to increase its direct investments abroad (and this would be true of any industrialized country)—the setting up of branch plants of manufacturing and industrial enterprises. This enhanced its creditor position except in those instances where investment abroad was disguised as a native unit with no indication of its control or ownership from the outside. Given these pressures for raw materials ownership and industrial branch plants abroad, it is significant that already by 1900 private United States assets abroad amounted to about $0.9 billion, of which over 80 per cent were in the

form of direct investment, and that even by 1946, of $17 billion of total private assets abroad, almost one-half were direct investments.[2] One need not stress the obvious fact that the economic growth of a country that provides these stimuli to *direct* investments abroad also increases its knowledge and political prestige, both of which render such foreign investments more attractive to the country's economic units.

There is a third group of factors—the growth of a system of financial institutions and practices that mobilizes savings, making them more accessible to foreign portfolio investment, if the latter is warranted. As part and parcel of modern economic growth, an increasing proportion of the country's economic community becomes involved in and habituated to the network of developed financial institutions. Clearly, large sales of foreign bonds and securities like those in the United States in the 1920's would not have been possible at the end of the nineteenth century, when the banking system and other financial institutions were far less developed, when the proportion of individual savers that dealt in securities and other financial instruments was far lower. The greater externalization of savings, which accompanies economic growth, obviously facilitates the flow of funds abroad provided the conditions are favorable, just as it facilitates the flow of funds into large-scale economic investment at home.

Finally, the role of the federal government, at least in the historical period with which we are dealing, is not to be overlooked. Much of the capital flow abroad that led to the reversal in net changes in foreign claims was due to government transactions and decisions, and not exclusively in connection with armed conflicts. The growth in the economic power of this country permitted the government, when national interests were involved, to force a flow of funds abroad in the form of loans (which, unlike unilateral transfers, affected both the net capital position and subsequent current flows) that might not have occurred merely in response to the stimulus of market conditions on private business enterprises. But even though these foreign loans stemmed from government decisions, they were still a function of the country's economic growth. Clearly their contribution to the reversal in net changes in claims against foreign countries was conditioned, or at least made possible, by the rise in the country's economic resources and power.

[2] See Raymond W. Goldsmith, *A Study of Saving in the United States*, Vol. I (Princeton University Press, 1955), Table K-7, p. 1093.

3. The preceding comments make it unnecessary to deal at length with the last question—what factors limited the net capital outflow from the United States to small proportions of national product and even of capital formation. In a way, the question is easily answered by pointing to the successive periods distinguished in Tables 10 through 13. Capital exports during World War I were substantial, amounting to over one-third of net capital formation and about one-sixth of gross capital formation. During 1923–1928, investments abroad obviously had to compete with large capital needs at home for reconstruction equipment and expansion of domestic output. During the depressed period 1929–1940, absolute volumes of net capital exports were kept down by unfavorable economic conditions, but they were large relative to total or domestic net capital formation. During World War II, the huge outflows of resources abroad did not add to claims against foreign countries only because they were gifts, not loans. And after World War II, despite the great domestic need for capital goods, capital flow abroad was substantial, particularly if we take account of unilateral transfers. If we treat the latter as negative items, net changes in claims in this recent period amount to 7 per cent of net capital formation, but if we treat them as positive items, the proportion mounts to well over one-third of net capital additions.

If we disregard political and unilateral transfers, capital exports are obviously limited by the forces that make for direct investment abroad and those that set the feasible amount of portfolio foreign investment. The former are partly technological and partly economic functions of economic growth and of the change in industrial structure accompanying such growth. Little can be said about them, except that the inducements to control foreign supplies of raw materials or facilitate exports by setting up branches of manufacturing and other plants can necessarily account for only a small fraction of national output, and of total capital formation. Portfolio foreign investment is limited by domestic competition for savings. The whole question of the demand for savings in the United States versus savings abroad is involved. This problem was touched upon in Chapter 3 and will be discussed further in Chapter 10. All that need be said here is that the long-run opportunities for further investment in this country, associated with continuous technological progress and its effects on the structure of demand and production, will probably preclude a large margin for flow of savings abroad—especially since domestic needs for capital are likely to receive a higher priority on many economic

grounds. It is, therefore, difficult to say whether, even if the political and social conditions abroad in the recent past had been as favorable as they were in the second half of the nineteenth century, net capital exports from this country would have constituted higher proportions of capital formation and national product than they actually did. For it must be remembered that while unfavorable political conditions reduced the flow of capital abroad under private auspices, they forced the flow of this country's resources abroad, either as grants or loans, under government auspices. And one would be hard put to guess whether, with favorable political conditions and without the government-sponsored flows of resources abroad, net capital exports of a purely business character would have been proportionally greater. Neither the United Kingdom nor France can be used as an example in this connection, since this country is much larger, and capital-demanding technological potentials have changed, so that the proportion of United States savings flowing abroad cannot be expected to equal the proportions that flowed from the United Kingdom and France. It must also be remembered that in the latter countries, politically motivated capital exports loomed quite large. We must, therefore, conclude—rather unsatisfactorily—that net changes in claims or net balances of flows of resources across the boundaries are a component which, if determined by purely economic forces, would not be proportionately large in a country like the United States. But that component is greatly affected by political and other noneconomic elements, and its importance in our analysis and prognosis depends largely upon the weight we wish to assign to those elements.

Structure of Capital Formation, by Type of Capital Good

Having considered that part of capital formation in this country financed from abroad or constituting net additions to claims against foreign countries, we turn to the distribution of domestic capital formation—gross and net additions to stock of commodities within the country that may be considered tools of production, and hence, capital.

One customary distribution that will be discussed in the present section distinguishes construction (buildings, roads, and other construction), producers' durables (machinery and equipment), and net changes in inventories. The basic reason for this classification lies in the span of economic life of units in the three categories. Buildings, roads, bridges, and so on continue in use for a long time, and the conversion of

their original value into current product extends over decades. Producers' equipment or machinery has a much shorter economic life span, but is also measured in years, the standard life assumed in our calculations being thirteen years. Inventories are sold or "turned-over" relatively quickly, the inventory-annual output ratio varying from 0.2 to about 0.3 in manufacturing,[3] and averaging about the same in many branches of retail trade. Presumably, such differences in the span of economic life—the period during which the value of the capital item is translated into finished product and its cost recouped—are of major importance in the problem of financing, since funds for a capital investment that will not be fully amortized for fifty years will be tied up that long, whereas funds for inventories can presumably be viewed as a short-term investment. There are also consequential differences on the demand side in the economic factors that determine the rate of long-term versus short-term capital investment.

Two aspects of this customary classification warrant stressing. First, the basis of the classification is the *economic,* not the physical, life of the capital item. A disk harrow in the hands of a firm selling agricultural machinery is part of inventory, and its economic life is assumed to be brief, since the average period during which it will remain in stock is at most a year or two, and once it is sold, the firm's funds will no longer be tied up in that item. The same disk harrow in the hands of the farmer who purchases it will last ten to fifteen years and is a producers' durable item. Its economic life is assumed to be fairly long, because the user is expected to charge its depreciation and amortization to cost of annual product for years to come. Economic life is largely a matter of the intent and practice of the economic unit that disposes of the capital item in question, rather than a matter of physical properties, although the latter naturally exercise a permissive or limiting effect. Where physical life is short, it is impossible to have long economic life—eggs *as* eggs cannot become an item of producers' durable equipment.

Second, the distinction by length of economic life is valid for each physically identifiable capital item, not for the total economic value of the complex. We think of inventory as relatively short-lived because we expect the physically identifiable items to be sold more or less promptly, their value to be converted into cash, the firm to have the option to replace them or not, and the creditor to have the opportunity

[3] See Moses Abramovitz, *Inventories and Business Cycles, with Special Reference to Manufacturers' Inventories* (New York, NBER, 1950), Table 114, p. 569.

to renew the loan or not. But when we think of inventory as a whole—its economic magnitude—we realize that a minimum volume is indispensable in the life of the firm. To operate, the firm will require x million dollars of inventory, just as it will require y million dollars of buildings and machinery, and in this sense the economic life of inventory as a whole is the same as the life of the firm.

As a consequence, one can easily envisage a situation in which long-term credit is legitimately advanced to finance additions to inventory, so long as that credit goes to a firm with a growing market and is used for additions that constitute the indispensable minimum in long-term expansion. One can also envisage short-term funds being advanced to finance a long-lived machine or building, so long as the firm makes a depreciation charge allowance that can, within the year, be used toward repayment of the loan, rather than being economically mortgaged to the financing of some indispensable replacement.

Yet these are exceptional cases. By and large, the short economic life of inventories, on the *margin*—that is, the additions to them—does permit a check upon the profitability of investment in them, a check that is impossible with the complex of capital equipment tied up in a railroad, for example, or in a house. Granted that the physical and technological characteristics of capital items act largely as permissive or limiting conditions rather than determining factors, the economic forces operating through the decisions of firms and other economic units follow patterns that reflect these underlying differences in physical and technological characteristics—if only obliquely. And we should not neglect the customary distinctions that mirror these patterns, for from them we should be able to learn what factors guided capital formation in the past and are likely to affect it in the future.

After these introductory remarks we turn to the statistical evidence in Table 14—percentage distributions of countrywide capital formation. The distribution that is of most interest to us here is that of domestic capital formation classified into construction, producers' durables, and net changes in inventories. For the sake of completeness we also present the percentage distribution of total capital formation, which includes net changes in claims against foreign countries, discussed in the preceding section; and finally, the distribution of durable capital alone (construction and producers' durables), to bring out more clearly the difference in trend movements between the two.

For guidance among the five parts of Table 14, the following notes may be useful:

First, let us indicate the scope of the items. Construction represents the value of construction work put in place, including the installed value of equipment, which is an integral part of a structure—house, plant, bridge, road, harbor installation, and the like—and including what are usually designated major repairs and alterations, but excluding ordinary repairs and maintenance. Producers' durable equipment includes machinery and similar items of considerable size, but excludes hand tools and minor types of equipment often chargeable to current expense. Inventories are stocks of commodities that are held for sale or for further fabrication, or are in process of fabrication. Construction comprises both private and public—including military construction unless specifically excluded—and that done under contract as well as that done on force account. Producers' durable equipment covers both private and public, including munitions unless military capital formation is specifically excluded. Inventories are, for conceptual reasons, limited to those in the hands of business and government agencies and exclude stocks within households; for statistical reasons they are limited to business inventories (including farm), there being no data on government inventories for the early years. However, the available series show the latter to be quite small, except for stocks of expendable (nondurable) munitions—which were enormous during the war years.[4] We excluded them because their inclusion would produce gyrations in the inventory item that would dwarf and conceal any economic movements in inventory levels.

Second, the structure by type of capital good is shown for four countrywide totals of capital formation: gross capital formation, in current and in constant prices; and net capital formation, also in current and in constant prices. In addition, since the inclusion or exclusion of military construction and munitions affects the distributions, particularly for the decades beginning with World War I, we show the

[4] At the end of 1949, public inventories in 1929 prices amounted to $2.4 billion, accounting for almost 5 per cent of the total of $50.4 billion. This high level of public inventories may be due largely to recent accretions, because before 1934 (except in the few years associated with World War I) and back to 1897, public inventories were well below $100 million, while total inventories grew from $16 billion to $38 billion. The only noticeable modification in the estimate of net changes in inventories that would be introduced by the addition of public inventories would be in 1929–1938, when the item would add $0.11 billion per year to our total. For the estimates, see R. W. Goldsmith, Dorothy S. Brady, and Horst Mendershausen, *A Study of Saving in the United States,* Vol. III (Princeton University Press, 1956), Table W-3, pp. 20–21.

TABLE 14

STRUCTURE OF CAPITAL FORMATION, BY TYPE OF CAPITAL GOOD, 1869–1955
(amounts in billions of dollars)

PERIODS	TOTAL CAPITAL FORMATION					DOMESTIC CAPITAL FORMATION				DURABLE CAPITAL FORMATION		
		Percentage Distribution of (1)					*Percentage Distribution of* (6)				*Percentage Distribution of* (10)	
	Average Volume Per Year (1)	Construction (2)	Producers' Durables (3)	Net Changes in Inventories (4)	Net Changes in Claims against Foreign Countries (5)	*Average Volume Per Year* (6)	Construction (7)	Producers' Durables (8)	Net Changes in Inventories (9)	*Average Volume Per Year* (10)	Construction (11)	Producers' Durables (12)
A. GROSS CAPITAL FORMATION, CURRENT PRICES												
Total												
1. 1869–1898	2.23	63.9	22.9	14.9	−1.8	2.27	62.8	22.5	14.7	1.93	73.6	26.4
2. 1879–1908	3.44	64.4	23.8	9.9	1.9	3.37	65.7	24.3	10.1	3.03	73.0	27.0
3. 1889–1918	5.67	57.0	27.5	8.3	7.2	5.26	61.4	29.6	9.0	4.79	67.5	32.5
4. 1899–1928	10.81	53.2	29.9	9.1	7.8	9.96	57.7	32.5	9.8	8.98	64.0	36.0
5. 1909–1938	12.89	52.9	33.8	6.5	6.9	12.00	56.8	36.3	6.9	11.17	61.0	39.0
6. 1919–1948	20.38	45.6	43.9	5.3	5.2	19.33	48.1	46.3	5.6	18.24	50.9	49.1
7. 1929–1955 [a]	37.01	47.6	47.3	4.0	1.1	36.62	48.2	47.8	4.1	35.13	50.2	49.8
8. 1946–1955	61.29	48.3	45.0	4.9	1.8	60.17	49.2	45.8	5.0	57.15	51.8	48.2
Total, Excluding Military												
3a. 1889–1918	5.48	57.6	26.3	8.6	7.5	5.07	62.3	28.4	9.3	4.60	68.7	31.3
4a. 1899–1928	10.48	53.7	28.9	9.4	8.1	9.63	58.4	31.4	10.2	8.65	65.0	35.0

5a. 1909–1938	12.44	53.7	32.5	6.7	7.1	11.56	57.8	35.0	7.2	10.72	62.3	37.7
6a. 1919–1948	17.42	50.7	37.0	6.2	6.0	16.37	54.0	39.4	6.6	15.29	57.8	42.2
7a. 1929–1955 [a]	31.91	53.1	41.0	4.7	1.2	31.52	53.7	41.6	4.7	30.03	56.4	43.6
8a. 1946–1955	55.78	51.8	40.7	5.4	2.0	54.65	52.9	41.6	5.5	51.64	56.0	44.0
B. GROSS CAPITAL FORMATION, 1929 PRICES												
Total												
9. 1869–1898	4.68	70.5	20.8	9.9	−1.2	4.74	69.6	20.6	9.8	4.28	77.2	22.8
10. 1879–1908	7.29	68.2	22.9	7.1	1.8	7.16	69.5	23.3	7.2	6.64	74.9	25.1
11. 1889–1918	10.26	62.6	25.2	6.2	6.0	9.64	66.6	26.9	6.6	9.00	71.3	28.7
12. 1899–1928	13.76	57.4	28.6	6.6	7.4	12.75	62.0	30.9	7.1	11.84	66.7	33.3
13. 1909–1938	14.42	55.0	33.2	4.8	7.0	13.42	59.2	35.7	5.1	12.73	62.3	37.7
14. 1919–1948	18.32	45.9	43.7	5.4	5.0	17.40	48.4	46.0	5.7	16.42	51.3	48.7
15. 1929–1955 [a]	23.90	43.1	50.3	5.0	1.6	23.52	43.8	51.2	5.1	22.32	46.1	53.9
16. 1946–1955	32.98	41.5	49.2	6.8	2.6	32.14	42.6	50.5	7.0	29.89	45.8	54.2
Total, Excluding Military												
11a. 1889–1918	10.04	63.0	24.5	6.3	6.2	9.42	67.2	26.1	6.7	8.79	72.0	28.0
12a. 1899–1928	13.42	57.9	27.8	6.7	7.6	12.41	62.6	30.1	7.3	11.50	67.6	32.4
13a. 1909–1938	13.95	55.9	32.0	4.9	7.2	12.95	60.2	34.5	5.3	12.26	63.6	36.4
14a. 1919–1948	15.87	50.6	37.4	6.2	5.8	14.95	53.7	39.7	6.6	13.97	57.5	42.5
15a. 1929–1955 [a]	20.27	48.4	43.8	5.9	1.9	19.88	49.4	44.6	6.0	18.69	52.5	47.5
16a. 1946–1955	29.72	45.0	44.6	7.6	2.9	28.87	46.3	45.9	7.8	26.62	50.2	49.8

Percentages, except those for 1946–1955, are based on three-decade moving totals of absolute volumes.

[a] 1949–1955 given the weight of a decade.

(continued)

TABLE 14 (continued)

PERIODS	TOTAL CAPITAL FORMATION: Average Volume Per Year (1)	TOTAL CAPITAL FORMATION: Percentage Distribution of (1): Construction (2)	Producers' Durables (3)	Net Changes in Inventories (4)	Net Changes in Claims against Foreign Countries (5)	DOMESTIC CAPITAL FORMATION: Average Volume Per Year (6)	DOMESTIC CAPITAL FORMATION: Percentage Distribution of (6): Construction (7)	Producers' Durables (8)	Net Changes in Inventories (9)	DURABLE CAPITAL FORMATION: Average Volume Per Year (10)	DURABLE CAPITAL FORMATION: Percentage Distribution of (10): Construction (11)	Producers' Durables (12)
C. NET CAPITAL FORMATION, CURRENT PRICES												
Total												
17. 1869–1898	1.26	63.9	12.8	26.4	−3.1	1.30	62.0	12.4	25.6	0.96	83.3	16.7
18. 1879–1908	1.88	64.7	13.8	18.0	3.5	1.82	67.1	14.3	18.6	1.48	82.4	17.6
19. 1889–1918	2.88	53.9	15.6	16.4	14.2	2.47	62.7	18.2	19.1	2.00	77.5	22.5
20. 1899–1928	5.16	47.3	17.4	19.0	16.3	4.32	56.5	20.8	22.7	3.34	73.1	26.9
21. 1909–1938	4.75	37.9	25.9	17.5	18.6	3.86	46.6	31.8	21.6	3.03	59.4	40.6
22. 1919–1948	6.26	25.2	40.7	17.3	16.8	5.21	30.2	48.9	20.8	4.13	38.2	61.8
23. 1929–1955 [a]	9.38	51.4	28.5	15.9	4.2	8.98	53.7	29.7	16.6	7.49	64.4	35.6
24. 1946–1955	15.50	67.1	6.2	19.5	7.2	14.38	72.3	6.7	21.0	11.36	91.5	8.5
Total, Excluding Military												
19a. 1889–1918	2.71	54.6	12.9	17.4	15.1	2.30	64.3	15.2	20.5	1.83	80.9	19.1
20a. 1899–1928	5.10	46.9	17.4	19.2	16.5	4.26	56.1	20.8	23.0	3.28	72.9	27.1
21a. 1909–1938	4.69	38.3	25.1	17.8	18.9	3.80	47.2	30.9	21.9	2.97	60.4	39.6

22a. 1919–1948	5.21	27.0	32.0	20.8	20.2	4.16	33.9	40.0	26.1	3.07	45.8	54.2
23a. 1929–1955 [a]	9.14	52.0	27.4	16.3	4.3	8.74	54.3	28.7	17.0	7.26	65.4	34.6
24a. 1946–1955	19.57	55.4	23.4	15.4	5.7	18.45	58.8	24.8	16.4	15.43	70.3	29.7
D. NET CAPITAL FORMATION, 1929 PRICES												
Total												
25. 1869–1898	2.62	73.4	11.1	17.8	−2.2	2.67	71.8	10.8	17.4	2.21	86.9	13.1
26. 1879–1908	3.96	70.6	13.1	13.1	3.3	3.83	73.0	13.5	13.5	3.31	84.4	15.6
27. 1889–1918	5.23	62.2	13.9	12.1	11.8	4.61	70.5	15.7	13.7	3.98	81.7	18.3
28. 1899–1928	6.58	54.0	16.8	13.8	15.4	5.56	63.8	19.9	16.3	4.66	76.2	23.8
29. 1909–1938	5.25	42.4	25.4	13.1	19.1	4.25	52.4	31.4	16.2	3.56	62.5	37.5
30. 1919–1948	5.63	24.5	41.6	17.5	16.3	4.71	29.3	49.8	20.9	3.72	37.1	62.9
31. 1929–1955 [a]	5.70	34.2	38.1	21.0	6.7	5.32	36.7	40.8	22.5	4.12	47.4	52.6
32. 1946–1955	7.88	55.3	5.5	28.5	10.8	7.03	62.0	6.1	31.9	4.79	91.0	9.0
Total, Excluding Military												
27a. 1889–1918	5.04	62.9	12.2	12.6	12.3	4.42	71.7	13.9	14.3	3.79	83.7	16.3
28a. 1899–1928	6.50	53.7	16.8	13.9	15.6	5.48	63.6	19.9	16.5	4.58	76.2	23.8
29a. 1909–1938	5.17	42.8	24.5	13.3	19.4	4.17	53.1	30.4	16.5	3.48	63.6	36.4
30a. 1919–1948	4.69	26.3	33.1	21.0	19.6	3.77	32.7	41.2	26.1	2.78	44.3	55.7
31a. 1929–1955 [a]	5.19	35.5	34.1	23.1	7.4	4.81	38.3	36.8	24.9	3.61	51.0	49.0
32a. 1946–1955	10.45	43.9	26.5	21.5	8.1	9.60	47.8	28.8	23.4	7.36	62.4	37.6
Da. NET CAPITAL FORMATION, 1929 PRICES, USING THE ALTERNATIVE ESTIMATE OF CAPITAL CONSUMPTION [b]												
Total												
33. 1869–1898	2.69	75.4	9.5	17.3	−2.2	2.75	73.8	9.3	16.9	2.28	88.8	11.2
34. 1879–1908	4.08	72.8	11.3	12.7	3.2	3.95	75.2	11.7	13.1	3.43	86.5	13.5
35. 1889–1918	5.40	65.0	11.8	11.7	11.5	4.78	73.4	13.3	13.3	4.15	84.7	15.3

(continued)

TABLE 14 (concluded)

PERIODS	TOTAL CAPITAL FORMATION: Average Volume Per Year (1)	TOTAL CAPITAL FORMATION: Percentage Distribution of (1): Construction (2)	Producers' Durables (3)	Net Changes in Inventories (4)	Net Changes in Claims against Foreign Countries (5)	DOMESTIC CAPITAL FORMATION: Average Volume Per Year (6)	Percentage Distribution of (6): Construction (7)	Producers' Durables (8)	Net Changes in Inventories (9)	DURABLE CAPITAL FORMATION: Average Volume Per Year (10)	Percentage Distribution of (10): Construction (11)	Producers' Durables (12)
36. 1899–1928	6.64	57.9	13.2	13.6	15.3	5.63	68.3	15.6	16.1	4.72	81.4	18.6
37. 1909–1938	4.84	53.8	11.3	14.2	20.7	3.84	67.9	14.2	17.9	3.15	82.7	17.3
38. 1919–1948	5.63	33.3	32.9	17.5	16.3	4.71	39.8	39.3	20.9	3.73	50.3	49.7
39. 1929–1955 [a]	6.88	39.6	37.4	17.4	5.5	6.50	42.0	39.6	18.4	5.30	51.4	48.6
40. 1946–1955	10.88	49.5	22.1	20.6	7.8	10.03	53.6	24.0	22.4	7.78	69.1	30.9
Total, Excluding Military												
35a. 1889–1918	5.21	65.9	10.1	12.2	11.9	4.59	74.7	11.5	13.8	3.96	86.7	13.3
36a. 1899–1928	6.56	57.6	13.1	13.8	15.5	5.55	68.2	15.5	16.3	4.64	81.5	18.5
37a. 1909–1938	4.76	54.5	10.1	14.4	21.1	3.76	69.0	12.7	18.3	3.07	84.4	15.6
38a. 1919–1948	4.69	36.8	22.6	21.0	19.6	3.77	45.8	28.1	26.1	2.79	62.0	38.0
39a. 1929–1955 [a]	6.37	41.1	34.1	18.8	6.0	5.99	43.7	36.3	20.0	4.79	54.6	45.4
40a. 1946–1955	13.45	41.7	35.2	16.7	6.3	12.60	44.6	37.6	17.8	10.35	54.2	45.8

Because of rounding, detail will not necessarily add to total.

Percentages, except those for 1946–1955, are based on three-decade moving totals of absolute volumes.

[a] 1949–1955 given the weight of a decade.

[b] For a description of the alternative estimate of capital consumption—for producers' durables (excluding military) and for "other" construction—see text.

SOURCE: Calculated from the series given in, or underlying, Tables R-6, R-7, R-29, R-30, R-32, R-33, and R-34.

percentage distribution for each of the four totals including and excluding those military items.

Third, our interest here is in the long-term trends in the structure of capital formation, not in its changes during business cycles, not even (until we reach a later stage in our analysis) in the changes during the long swings that have characterized the rate of economic growth in this country. We therefore need averages for periods of at least twenty-five to thirty years.

Those averages can be calculated in two ways. In one, the percentage shares of construction, producers' durables, etc., in the countrywide total can be calculated for each decade and then the decade shares averaged for the longer periods. In the resulting average all decades are weighted equally, although the absolute volumes of capital formation—the bases to which the percentage shares are computed—may differ markedly from decade to decade.

Such averages, when calculated, proved to be erratic, as they would be if the absolute volume of capital formation in any decade was low and if any large component was negative. That was true for net capital formation in the 1929–1938 decade, and it distorted the three-decade averages toward the end of the period. We therefore adopted the alternative procedure: the absolute volumes were averaged for successive periods of three decades each and the percentage shares were calculated from those averages. Such averages are weighted by the volume of capital formation in each decade, and they therefore assign the heaviest weights to the decades in which capital formation is largest. We used arithmetic means to preserve the additive relation of the components.

Fourth, scrutiny of the movements of percentage shares in *net* capital formation for recent decades suggested the possible value of a series based upon an alternative set of capital consumption estimates—for producers' durables (excluding munitions) and for construction other than nonfarm residential and government. For the former component, our present estimates of capital consumption for the decades since 1919 are based essentially on business depreciation shifted to a cost of replacement basis and supplemented by estimates of capital charged to current account. We link those totals with estimates for the earlier decades based upon straight-line depreciation and the assumption of a thirteen-year economic life. Comparison for the years since 1919 of consumption estimated on this basis with that based on business accounts indicates that (as mentioned in footnote 1 of Chapter 3)

the average volumes for long periods are about the same, but the estimate based on business accounts is more variable, more responsive to changing business conditions, than that based on straight-line depreciation. Thus, the business accounts measure of depreciation falls markedly short of the straight-line life total during the depressed decade 1929–1938 and exceeds it substantially in the 1940's and 1950's. To secure better continuity in our estimate of consumption of producers' durables we used as an alternative for the entire period an estimate based directly on the assumption of a thirteen-year economic life. The second modification in our standard estimate of capital consumption—for construction other than nonfarm residential and government—was to exclude the charge for depletion. As indicated in Appendix A, we consider the charge for depletion a proper deduction from current capital formation. But there may be disagreement concerning such treatment, and depletion volumes have risen rapidly in recent years. It seemed advisable, therefore, to consider an alternative that would exclude this charge. The totals of *net* capital formation based upon these alternative estimates of depreciation of producers' durables and "other" construction and the resulting percentage shares of components are shown for volumes in 1929 prices in part Da of Table 14. The modifications have only a minor effect on the trends in the aggregates, but they affect more significantly the movement in some components in the recent decades.

We now list the findings suggested by Table 14, seriatim.

1. The percentage share of net changes in claims against foreign countries in gross capital formation, whether in current or in 1929 prices, rose to a peak in the thirty-year period centered on 1909–1918, and then declined (parts A and B). The share was not large, varying from −1.8 per cent to +8.1 per cent. As already indicated, the level was held down in the recent decades by huge unilateral transfers made abroad on government account. But we can say that the proportional importance of private foreign investment in total gross capital formation has declined significantly from the peak levels in the period from 1915 to 1929.

Net changes in foreign claims loomed much larger as shares in net capital formation, ranging—even for the thirty-year periods used here—from −3.1 per cent to +21.1 per cent (parts C, D, and Da). The rise in the share of net changes in foreign claims in net capital formation continued almost to the end of the period, the peak being in the period

centered on 1919–1928 or on 1929–1938, combining the decades of the 1920's and the 1940's. We can say, in general, that relative to net capital formation, capital investment abroad continued at comparatively high levels until quite recently when world conditions and the emergence of large unilateral transfers by government—as well as a huge expansion of domestic capital formation—brought the percentage share down.

2. The share of net changes in inventories in domestic gross capital formation varied for the thirty-year periods from 4.1 per cent to about 15 per cent. The trend in the share was generally downward: a decline is observed in both parts A and B of Table 14, that is, whether based on current or constant price values, whether for totals including or excluding military capital formation. And the decline was quite marked. On the basis of the totals in current prices, the share of net changes in inventories in domestic gross capital formation shrank from 14.7 per cent to 4.1 per cent, or to less than three-tenths its original level. When the components of domestic gross capital formation are adjusted for price changes (part B), the drop in the share of net changes in inventories is reduced somewhat, but even then it is from roughly 10 per cent at the beginning to 5 per cent at the end (for totals including military), or to 6 per cent (for totals excluding military).

No such clear-cut decline is evident in the movement of the share of net changes in inventories in domestic net capital formation (parts C, D, and Da). For the totals in current prices, the share declined from almost 26 per cent and then rose again, and toward the end of the period, particularly when we exclude the military, it is no lower than at the beginning. Hence, for the totals in current prices, it is safest to conclude that there is no significant evidence of a major long-term decline in the share of net changes in inventories in net capital formation. With the adjustment for price changes, the picture is altered somewhat: the share is slightly higher in the later periods than in the earlier—well over 20 per cent as against 17 per cent, the rise being even more marked for the totals excluding military capital formation.

This effect of the adjustment for price changes is clearly due to the differential price movement. Prices of the goods constituting inventories must have risen less or declined more (obviously the former, because over the period as a whole the trend in prices has been upward) than have the prices of the sum of the other two components of do-

mestic capital formation—construction and producers' durables. This was caused largely by the construction component (although for totals including military, the high price of munitions also had some effect in recent decades), in which a lesser rise of productivity than in most other sectors of the economy made for a differentially higher price level at the end of the period than at the beginning. With prices of goods entering inventories rising less than other prices, their 1869 prices are a higher fraction and their post-1929 prices a lower fraction of 1929 levels than are the comparable prices of construction plus producers' durables. Because the multiplicand in the conversion to 1929 prices is the reciprocal of this fraction, it would be lower before 1929 and higher after 1929 than that for construction plus producers' durables. For this reason the share of net changes in inventories in constant prices (parts D and Da) is lower than that in current prices (part C) in the earlier periods and higher in the later periods.

3. The share of construction in gross durable capital formation declined, and that of producers' durable equipment rose (parts A and B). The decline in the share of construction when we include military capital formation—from about three-quarters to about one-half—is more pronounced than when we exclude it, because the addition of munitions to producers' durables is relatively greater than the addition of military construction to construction.

The same trend is observable in the distribution of net durable capital formation between net construction and net producers' durables (parts C, D, and Da). The levels of the shares and the slopes of the trends are somewhat different, however. Thus, in general, in the early periods the share of net construction in net durable capital formation tended to be higher than that of gross construction in gross durable capital formation. And the decline in the share of construction in the net totals in 1929 prices was somewhat more precipitous than the decline in its share in the gross total in constant prices. But all these differences are in the nature of details. For the present it can be stated that in current or in constant prices, including or excluding the military items, for gross or net volumes, the share of construction in durable capital formation declined, which means that the rate of growth of construction was significantly lower than that of producers' durable equipment.

Several questions suggested by these findings warrant further discussion. (a) Why did the share of net changes in inventories in *gross*

domestic capital formation decline? (b) Why did the share of net changes in inventories in *net* domestic capital formation either remain stable or rise? (c) Why did the share of construction in total durable capital formation decline? (d) Why did the share of construction in durable capital formation totals move differently from its share in the net, and did this difference have any bearing on the ratio of countrywide net capital formation to gross?

a. In dealing with the first question, we begin by assuming that net changes in inventories and net capital formation embodied in construction and producers' durables serve the same broad purpose inasmuch as they both measure additional equipment for the production of an increment of goods. This assumption is not implausible: inventories are used in the extraction, manufacture, and distribution of commodities, as well as in the provision of services. Construction and machinery are also used to produce commodities and services. The product-mix for any specific complex of structures and machinery will differ from that for any other, and it will differ from that associated with specific groups of inventories. But it can be argued that countrywide inventories and the countrywide stock of structures and equipment service the same product—the countrywide aggregate.

Let us assume also, pending further discussion, that the ratios of inventories and of net durable capital to output are constant, and so, therefore, are the marginal ratios—the ratios of net changes in inventories and of net durable capital formation to net additions to output. Under these conditions the average and the marginal ratios will be the same. It follows from this assumption that the share of net changes in inventories in net domestic capital formation is also constant.

But we are interested here in the share of net changes in inventories in gross domestic capital formation. If their share in net domestic capital formation is constant, their share in gross domestic capital formation will be constant only if the proportion of capital consumption (or of net capital formation) to gross capital formation is constant. This can be seen from the following equations:

DCF (domestic capital formation)
= DC (durable capital formation) + Inv (net changes in inventories)
DGCF (domestic gross capital formation) = DCG (durable capital formation, gross) + Inv
DNCF (domestic net capital formation) = DCN (durable capital formation, net) + Inv

If Inv/DCN is constant and equal to a, Inv = aDCN. DCG = DCN + B (capital consumption), and if B is a constant fraction of

DCN, say k, it is also a constant fraction of DCG, and the equation will read $DGCF = DCN + DCNk + Inv = Inv(k/a) + Inv = Inv(1 + k/a)$, and with k and a constant, Inv will be a constant fraction or multiple of DCG, or of DGCF.

As will be seen later, however, the proportion of capital consumption to gross durable capital formation is not constant but increases, partly because of the retardation of growth in the total of gross construction and producers' durables, partly because of the growing importance of the producers' durable component, which has an economic life span shorter than that of construction. It follows that if the ratio of net changes in inventories to net domestic capital formation is constant and the proportion of durable capital consumption to gross durable capital formation increases (or the proportion of net durable capital formation to gross declines), the ratio of net changes in inventories to *gross* domestic capital formation must decline—and this is the finding indicated in Table 14.

As noted above, this explanation is based on the assumption that the ratios of net investment in inventories and of net investment in durable capital to additions to output are constant (and that consequently the average ratios involved are also constant). But is this assumption valid? Should we expect that each dollar of new output will necessitate a constant number of dollars of net changes in inventories and a constant, although possibly different, number of dollars of net capital formation in construction and producers' durable equipment? This brings us to the second question listed above—that relating to the movement in the share of net changes in inventories in *net* domestic capital formation.

b. Changes in inventories and in durable capital can be related to changes in the aggregate product presumably made possible by the former. The relevant comparisons are provided in Table 15, and a few notes will explain the calculations involved.

Column 1 represents additions to the annual output of finished commodity product, in 1929 prices. It includes the commodity components of flow of goods to consumers (perishables, semidurables, and durables) at cost to consumers (because the distribution and transportation services involved in bringing commodities from producers to consumers require both inventories and plant and equipment). It also covers gross construction and gross producers' durables, including military items—since the latter may be and are produced in any plant serviced by the stock of construction and equipment the net changes

TABLE 15

RATIO OF NET DURABLE CAPITAL FORMATION AND OF NET CHANGES IN INVENTORIES TO NET CHANGES IN FLOW OF FINISHED COMMODITY PRODUCT, BASED ON VOLUMES IN 1929 PRICES, 1869–1955

(amounts in billions of dollars)

Periods	Net Changes in Finished Commodity Product (1)	Net Durable Capital Formation (2)	Ratio of (2) to (1) (3)	Net Durable Capital Formation, Excluding Nonfarm Residential and Government Construction (4)	Ratio of (4) to (1) (5)	Net Changes in Inventories (6)	Ratio of (6) to (1) (7)
			A. USING STANDARD DEPRECIATION ESTIMATE				
1. 1869–1898	19.6	66.2	3.38	33.5	1.71	13.9	0.71
2. 1879–1908	26.9	99.4	3.70	56.6	2.10	15.5	0.58
3. 1889–1918	26.4	116.0	4.39	67.4	2.55	19.0	0.72
4. 1899–1928	41.6	139.2	3.34	74.3	1.78	27.1	0.65
5. 1909–1938	31.7	104.8	3.31	43.3	1.37	20.6	0.65
6. 1919–1948	61.8	88.0	1.42	25.3	0.41	29.6	0.48
7. 1929–1955	68.1	87.5	1.28	23.6	0.35	30.4	0.45
8. 1946–1955	43.1	71.2	1.65	34.4	0.80	22.5	0.52
			B. USING ALTERNATIVE DEPRECIATION ESTIMATE				
9. 1869–1898		68.5	3.50	35.8	1.83		
10. 1879–1908		102.9	3.83	60.1	2.23		
11. 1889–1918		121.2	4.59	72.6	2.75		
12. 1899–1928		141.2	3.39	76.3	1.83		
13. 1909–1938		92.6	2.92	31.0	0.98		
14. 1919–1948		88.1	1.42	25.4	0.41		
15. 1929–1955		112.9	1.66	49.0	0.72		
16. 1946–1955		101.2	2.35	64.4	1.49		

SOURCE:

Part A

Col. 1. Sum of changes in flow of goods to consumers (Variant I), gross construction, and gross producers' durables. The changes are obtained from the annual series underlying Tables R-28, R-30, and R-33, at thirty-year intervals—1899 minus 1869, 1909 minus 1879, and so on, except for lines 7 and 8: 1955 minus 1929; and 1955 minus 1945.

Col. 2. Sum of net construction including military, and net producers' durables excluding military, calculated from the annual series underlying or given in Tables R-7, R-32, and R-33.

Col. 4. Column 2 minus nonfarm residential and government construction, calculated from the annual series underlying Table R-32.

Col. 6. Calculated from the decade averages in Table R-15 and the annual series in Table R-5.

Part B

For description of alternative depreciation estimate, see text.

in which we are attempting to measure.[5] From the annual series of finished commodity output we derived changes for thirty-year periods corresponding to the three-decade periods used in measuring net durable capital formation and net changes in inventories. Thus we obtained the growth in annual output of finished commodity product from 1869 to 1899, to compare with net durable capital formation and net changes in inventories for 1869–1898; from 1879 to 1909, to compare with 1879–1908; and so on.

Two variants of net durable capital formation are studied in Table 15. The first covers all net construction, including military (because the latter can be used to produce the military items in construction and producers' durables), and all net producers' durables except munitions (because munitions, by definition, cannot be used to produce other commodities). This first total, appearing in column 2, includes nonfarm residential construction which cannot be conceived directly as a tool in the production of finished commodities. It also includes government construction, some of which may be in the form of munition- and other commodity-producing plants, but most of which can be assumed to produce services not embodied in commodities. The second variant of net durable capital formation (column 4) excludes nonfarm residential and government construction, and is perhaps more directly relevant to our purposes. For both variants of net durable capital formation, we have the alternative estimate based upon the alternative series of capital consumption for producers' durables and "other" construction, discussed in connection with Table 14. Finally, net changes in inventories are shown in column 6. All the entries are in 1929 prices; and the thirty-year cumulative totals of net capital formation in columns 2, 4, and 6, are compared with the additions to the annual output of finished commodities in column 1.

The results can be stated simply. The ratio of net changes in inventories to net additions to finished commodity output, while fluctuating, remained at roughly the same level through most of the period

[5] We exclude services not embodied in finished commodities, i.e., the services component of flow of goods to consumers, although some inventories and some durable capital are used to produce these services. For example, medical practitioners use both inventories and durable capital and so do cleaning and dyeing establishments. But the construction, equipment, and inventories employed in this sector of the economy must be relatively small, and their ratio to total net output much lower than that for commodity output. It seemed to us that a much clearer picture of the ratios of changes in inventories and in durable capital to output would emerge if services not embodied in commodities were excluded from output.

covered, with a distinct decline only in the periods that include World War II and the subsequent decade. The movements of the ratios of net durable capital formation to additions to finished commodity product are quite different. These marginal capital-output ratios rose perceptibly to a peak in the thirty-year period centered on the first decade of this century, and then declined precipitously. This sharp decline is observed whether we deal with net durable capital formation including or excluding nonfarm residential and government construction, and whether we employ the standard depreciation estimate or the alternative. Even during the 1946–1955 decade, the ratio of net durable capital formation to net additions to commodity output, as shown in part A, was considerably less than one-half that reached at the peak, 1889–1918, and, as shown in part B, it was only slightly more than one-half. Clearly, greater commodity output could be produced with a smaller net addition to construction and producers' equipment.

This is a trend already observed, in somewhat different form, in Chapter 3. It is associated partly with the change in technology and in the rate of growth, and partly with the fact that a larger proportion of capital consumption and replacement to total gross durable capital formation means greater opportunity for introducing more efficient equipment, and this reduces the need for net durable capital formation. In the present connection, it is the change in technology and particularly the utilization of capital replacement to increase efficiency (a factor that is not present in the case of inventories) that may have caused the greater decline in the marginal net durable capital-output ratio than in the marginal inventory-output ratio. And as a result—at least in the calculations using the weighted averages—the share of net changes in inventories in total net domestic capital formation rose.

One cardinal qualification of this finding must be introduced at this point. The estimates of construction and the flow of producers' durable equipment, like all economic estimates, are based on imperfect data. But we do have at decennial or shorter intervals back to 1869 the basic census data that permit us to distinguish construction materials, and machinery and equipment, and a variety of subsidiary data to provide a relatively firm foundation for the estimates. No such anchorage in basic data is available for the estimates of some of the major components of inventories before the 1920's, particularly manufacturing and trade. For these we assumed that net changes were a constant ratio of changes in output or activity—the ratio prevailing in the 1920's. This assumption may have introduced a false stability into the mar-

ginal ratios of inventories to output in Table 15, which, of course, is the reason for the secular rise in the share of net changes in inventories in total domestic net capital formation.

Agricultural inventories are estimated on the basis of census data, and their secular movements are different from those of nonfarm inventories. It may therefore be of interest to distinguish farm from nonfarm and to observe the long-term trends in the structure of net changes in total inventories by groups (Table 16). Our estimates run through 1938, but for the distinction between farm and other inventories we can extend the record another decade by means of Goldsmith's estimates.

Net changes in farm inventories (which include changes in livestock) were a rapidly declining proportion of total inventory change. Regardless of the validity of the estimates of nonfarm inventories, this trend is beyond question. For one thing, agriculture constituted a diminishing fraction of the total commodity output of the economy, and it would be surprising if farm inventories did not likewise account for a declining share of the country's inventories. Second, the substitution of machinery for animals resulted in an absolute diminution of the number of horses and mules on farms, and the growth in other livestock was far slower than could have been true of inventories either in manufacturing or in trade. For the present purpose the important consequence is that, if we consider net changes in nonfarm inventories alone, they would presumably account for an even more rapidly rising proportion of net domestic capital formation than would net changes in total inventories. In part B of Table 16, where the share of changes in nonfarm inventories in both gross and net domestic capital formation is calculated, the rise of the share in net domestic capital formation is striking, more than doubling from 1869–1898 to 1919–1948. But even the share of changes in nonfarm inventories in gross domestic capital formation fails to show any significant decline, the difference in movement between the marginal ratio of nonfarm inventories to output and the marginal ratio of durable capital to output almost completely offsetting the effects of the increasing proportion of capital consumption to gross durable capital formation.

The calculation in part B of Table 16 is not quite logical, however. Changes in nonfarm inventories are compared with durable capital formation, which includes construction and equipment designed to service the farm sector. We therefore attempted to recalculate the

TABLE 16

STRUCTURE OF NET CHANGES IN INVENTORIES, 1929 PRICES, 1869–1948

A. PERCENTAGE DISTRIBUTION OF TOTAL NET CHANGES IN INVENTORIES [a]

Periods	Total Farm (1)	Livestock (2)	Total Nonfarm (3)	Mining, Manufacturing, and Construction (4)	Trade (5)	All Other (6)
			BASED ON KUZNETS ESTIMATES			
1. 1869–1898	27.3	22.0	72.7	33.1	22.9	16.6
2. 1879–1908	20.8	15.7	79.2	37.0	25.0	17.2
3. 1889–1918	12.9	9.7	87.1	37.1	33.7	16.3
4. 1899–1928	2.1	1.1	97.9	43.5	40.8	13.7
5. 1909–1938	−1.2	−1.1	101.2	35.0	46.8	19.4
			BASED ON GOLDSMITH ESTIMATES			
6. 1889–1918	18.3	12.0	81.7			
7. 1899–1928	4.4	2.2	95.6			
8. 1909–1938	2.0	−1.9	98.0			
9. 1919–1948	0.5	−4.5	99.5			

(continued)

TABLE 16 (concluded)

B. Estimated Effect of Exclusion of Farm Inventories

Periods	Net Changes in Nonfarm Inventories as % of Total (1)	Net Changes in Inventories as % of Gross Domestic Capital Formation (2)	Net Changes in Nonfarm Inventories as % of Gross Domestic Capital Formation (1) x (2) (3)	Net Changes in Inventories as % of Net Domestic Capital Formation (4)	Net Changes in Nonfarm Inventories as % of Net Domestic Capital Formation (1) x (4) (5)	Alternative Estimate of (4) (6)	Alternative Estimate of (5) (1) x (6) (7)
10. 1869–1898	72.7	9.8	7.1	17.4	12.6	16.9	12.3
11. 1879–1908	79.2	7.2	5.7	13.5	10.7	13.1	10.4
12. 1889–1918	87.1	6.7	5.8	14.3	12.5	13.8	12.0
13. 1899–1928	97.9	7.3	7.1	16.5	16.2	16.3	16.0
14. 1909–1938	101.2	5.3	5.4	16.5	16.7	18.3	18.5
15. 1919–1948	102.4	6.6	6.8	26.1	26.7	26.1	26.7

[a] Percentages are based on three-decade moving totals of absolute volumes.

Source, by Line

1–5. Absolutes calculated from Simon Kuznets, *National Product since 1869* (New York, NBER, 1946), Tables II-10 and II-11, pp. 108 and 111.

6–9. Absolutes calculated from Goldsmith, *A Study of Saving*, Vol. I, pp. 797 and 903.

10–15. Col. 1 from part A, above, line 15 being extrapolated from 1909–1938 to 1919–1948 by the movement in the Goldsmith ratio, with allowance for the difference in movement between his series and ours from 1899–1928 to 1909–1938. Cols. 2, 4, and 6 from Table 14, parts B, D, and Da, respectively.

marginal ratios of durable capital and inventories to output, excluding the farm or agricultural sector from all terms of the comparison.

Exclusion of the farm sector can be only approximate, and yet the results have sufficient validity to merit examination. In Table 17, net changes in finished commodity product are those shown in Table 15, reduced by an estimate of net income originating in agriculture. This reduction excludes the contribution of agriculture proper, without eliminating further fabrication, transportation, and distribution of the products of agriculture and without eliminating the products other industries may have contributed to agriculture. The totals in columns 2 and 4 are net durable capital formation (the former including, the latter excluding, residential and government construction, and both excluding munitions) minus the estimated construction and producers' durable equipment channeled into the agricultural sector. Finally, net changes in nonfarm inventories are derived from Table 16 and, being net of farmers' inventories, are dominated by two categories—manufacturers' and trade stocks.

The movements of the marginal ratios of durable capital and of inventories to output are not unlike those in Table 15. For net durable capital formation excluding residential and government construction, the ratio in Table 17 rises from 1.81 to 2.53 and declines to 0.36, whereas that in Table 15 (for a comparable period) moves from 1.71 to 2.55 and then to 0.41. The similarity persists for the ratio based upon values derived from the alternative estimate of depreciation. In Table 17, the marginal ratio for inventories declines from between 0.6 and 0.7 to 0.5; that in Table 15, from between 0.7 and 0.8 to below 0.5. But the decline in the marginal ratio for inventories is still far smaller than that in the marginal ratio for net durable capital; and in any calculation using as a base net domestic capital formation, excluding the agricultural sector, the share of net changes in inventories will show a secular rise, and that of net durable capital formation, a decline.

But how plausible is the basic assumption underlying this trend? Is it likely that the marginal ratio of inventories to output in manufacturing and in trade remained constant from the 1870's to the 1920's and at the level prevailing in the 1920's? Here, for lack of specific evidence, conjecture can run rampant. It can be argued that technological improvements in transportation and communication would in general make for a lower marginal ratio of inventories to output or sales, because it would not be necessary to hold as much inventory against possible shortages resulting from delays in delivery. It can be argued

TABLE 17

RATIO OF NET DURABLE CAPITAL FORMATION AND OF NET CHANGES IN INVENTORIES TO NET CHANGES IN FLOW OF FINISHED COMMODITY PRODUCT, EXCLUDING AGRICULTURE, BASED ON VOLUMES IN 1929 PRICES, 1869–1948

(amounts in billions of dollars)

Periods	Net Changes in Finished Commodity Product (1)	Net Durable Capital Formation (2)	Ratio of (2) to (1) (3)	Net Durable Capital Formation, Excluding Nonfarm Residential and Government Construction (4)	Ratio of (4) to (1) (5)	Net Changes in Inventories (6)	Ratio of (6) to (1) (7)
A. USING STANDARD DEPRECIATION ESTIMATE							
1. 1869–1898	16.28	62.2	3.82	29.5	1.81	10.1	0.62
2. 1879–1908	23.78	93.3	3.92	50.5	2.12	12.3	0.52
3. 1889–1918	23.33	107.6	4.61	59.0	2.53	16.6	0.71
4. 1899–1928	37.81	132.5	3.50	67.6	1.79	26.6	0.70
5. 1909–1938	30.75	104.0	3.38	42.4	1.38	20.8	0.68
6. 1919–1948	60.52	84.4	1.39	21.8	0.36	30.3	0.50
B. USING ALTERNATIVE DEPRECIATION ESTIMATE							
7. 1869–1898		64.5	3.96	31.8	1.95		
8. 1879–1908		96.8	4.07	54.0	2.27		
9. 1889–1918		112.8	4.83	64.2	2.75		
10. 1899–1928		134.5	3.56	69.6	1.84		
11. 1909–1938		91.8	2.99	30.2	0.98		
12. 1919–1948		84.5	1.40	21.9	0.36		

For description of estimates, see text. Agriculture is excluded from cols. 1, 2, 4, and 6.

that improvements in manufacturing processes, insofar as they reduce the time required to produce a given item, would lower the ratio of inventories constituted by stock in process to the total finished output of the plants. It can be argued that improved efficiency in trade, particularly in the form of larger units with a high stock-turnover ratio, would reduce the marginal ratio of trade inventories to sales. On the other hand, several arguments can be adduced for expecting an upward trend in the inventory-output or inventory-sales ratio: the greater detail in manufacturing production may make for a longer production process; the higher standard of living and the demand for wider selection may force trade units to hold stocks that are larger relative to sales volume; the greater dispersion of consumer markets, combined with greater concentration of producer centers, may make for large inventory holding at various focal points to bridge the gap between producer and consumer. Finally, there is the whole question of the changing product-mix. Different branches of manufacturing and trade are characterized by different inventory-output or inventory-sales ratios; and intersector shifts within manufacturing or within trade might produce trends in the aggregate ratios, even though the ratios within each sector of manufacturing or trade remained constant.

For lack of specific information, it is not easy to appraise these several conjectures. By and large, if, as we would have expected, the marginal ratio of inventories to output declined in the long run, net changes in inventories in the earlier decades are underestimated in our measures; and their share in total net domestic capital formation should show a decline rather than constancy or a rise. But this hypothesis is doubtful, if only because the marginal ratio of net durable capital to output was increasing through the thirty-year period terminating in 1918. The factors making for this rise, particularly the establishment of new large plants and units that were built for the long run and which in the early years of their use were operated at a rate below their maximum capacity, would also make for a high rate of inventories to current output. And the interindustry shift within manufacturing and the interbranch shift within trade would also militate against a decline in the inventory-output or the inventory-sales ratio. For, in this long-term change in structure, the durable goods sectors with their higher inventory-output or inventory-sales ratios were becoming more important relatively than the perishable goods sectors with their low inventory-output or -sales ratios. When we calculate the over-all ratio for manufacturing for 1899 and 1929, using Abramovitz's

inventory-sales ratios for 1919–1938, by major branches,[6] and Fabricant's estimates of value added in the same branches for 1899 and 1929,[7] we find that it rises from 22.7 per cent to 22.9 per cent. This is a small rise indeed, but a rise nevertheless; and from 1869 to 1899 there might well have been an even greater rise. In trade also, the recession in importance of wholesale trade, and particularly of products that flowed directly from producers to consumers without going through trade channels,[8] as well as the shift within retail trade in favor of the more durable types of commodities, would tend to sustain the ratio of trade inventories to total finished output in the economy.

While it is impossible, therefore, to come to firm conclusions, it is perhaps not unwarranted to infer that the marginal ratio of inventories to finished output, if it did decline from the 1870's to the 1920's, could not have declined appreciably; and that there is some validity to our finding that the share of net changes in inventories in total net domestic capital formation in constant prices has risen over the long period from the 1870's to the post-World War II decade.

c. In dealing with the trends in the structure of durable capital proper—specifically the decline in the share of construction and the rise in the share of producers' durable equipment—the first relevant observation is that construction is a much more heterogeneous total than producers' durable equipment. As measured here, construction includes nonfarm residential and related housing, and other structures above ground and underground—roads, bridges, streets, sewers, and many more. It thus includes capital items designed directly for the use of ultimate consumers (such as residences); those designed for the use of both ultimate consumers and business producers (such as roads and other common carrier installations); those designed for the exclusive use of governments and other public institutions; and finally, those intended for use as tools of commodity production in the hands of business firms (including farmers). There is considerable variety also in the type and user of producers' durable equipment: it includes equipment for farmers as well as for nonfarm enterprises, for government installations as well as for private firms. But it is narrower and more homogeneous than construction in that it excludes con-

[6] See *Inventories and Business Cycles,* Table 30, p. 133.

[7] See Solomon Fabricant, assisted by Julius Shiskin, *The Output of Manufacturing Industries, 1899–1937* (New York, NBER, 1940), p. 635.

[8] See Harold Barger, *Distribution's Place in the American Economy since 1869* (Princeton for NBER, 1955), Table 20, p. 70.

sumer durable commodities and, particularly in the variant excluding munitions, is heavily dominated by machinery and equipment destined for use by producing firms in the private business sector.

Consequently, any reasons for the slower growth in the volume of construction than in the volume of producers' durables can be more easily established if we distinguish at least the major categories of structures. The classification in Table 18 is based upon detailed estimates given in the reference tables (see Appendix C). It distinguishes nonfarm residential construction and construction on government account. "Other" construction is a residual still too mixed for our purposes. For example, it includes institutional construction, which could be separated for recent decades only. It is nevertheless a useful category, because it is predominantly construction used by producing enterprises in the business sector and, hence, much more comparable in scope with producers' durables than is total construction.

The trends in the distribution of the gross volume of construction are clear and conspicuous. The share of government construction rose, whether or not we include military construction, from considerably less than one-tenth in the first thirty-year period to about one-third in the last. The shares of nonfarm residential and "other" construction both declined—the former from about four-tenths to about three-tenths, the latter from well over one-half to somewhat above one-third. And the share of "other" construction, dominated by industrial plant and office buildings, declined more than the share of nonfarm residential. Thus the share of nonfarm residential construction in gross nongovernment construction would rise, and that of "other" construction would decline.

The trends in the distribution of the net volume of construction are affected by the estimate of depreciation for "other" construction. If we use the standard estimate, net "other" construction is negative in 1919–1948 and 1929–1955. If we use the alternative estimate of depreciation for "other" construction, the net volume of "other" construction is still negative in 1919–1948, but the decline is not so sharp, and the distorting effects on the percentage distributions, not so great.

Despite the differences between these variants of net construction, we can still come to fairly firm conclusions. First, the share of governments in net construction shows a conspicuous upward trend, whether or not we include military construction. It rises from about 6 per cent in the period 1869–1898 to 50 per cent or more in 1929–1955; and

TABLE 18

DISTRIBUTION OF GROSS AND NET CONSTRUCTION BY TYPE, 1929 PRICES, 1869–1955
(amounts in billions of dollars)

PERIODS	GROSS CONSTRUCTION				NET CONSTRUCTION				NET CONSTRUCTION, USING ALTERNATIVE ESTIMATE OF DEPRECIATION FOR "OTHER" CONSTRUCTION [a]			
		Percentage Distribution of (1)				Percentage Distribution of (5)				Percentage Distribution of (9)		
	Average Volume Per Year (1)	Nonfarm Residential (2)	"Other" (3)	Government (4)	Average Volume Per Year (5)	Nonfarm Residential (6)	"Other" (7)	Government (8)	Average Volume Per Year (9)	Nonfarm Residential (10)	"Other" (11)	Government (12)
Total												
1. 1869–1898	3.30	40.1	53.1	6.8	1.92	50.7	43.2	6.1	2.03	48.0	46.3	5.8
2. 1879–1908	4.97	35.9	56.1	7.9	2.80	43.0	48.9	8.1	2.97	40.5	51.9	7.6
3. 1889–1918	6.42	31.5	56.8	11.7	3.25	35.6	50.2	14.2	3.51	33.0	53.9	13.1
4. 1899–1928	7.90	33.0	51.4	15.6	3.55	41.7	39.0	19.3	3.85	38.5	43.7	17.8
5. 1909–1938	7.94	31.2	44.2	24.5	2.23	48.4	7.9	43.8	2.61	41.3	21.3	37.4
6. 1919–1948	8.41	30.0	37.3	32.7	1.38	67.1	−51.3	84.1	1.88	49.4	−11.3	61.9
7. 1929–1955 [b]	10.29	28.8	35.2	36.0	1.95	60.0	−33.7	73.7	2.73	42.9	4.3	52.8
8. 1946–1955	13.68	33.3	38.4	28.3	4.36	60.9	15.6	23.5	5.38	49.3	31.6	19.1
Total, Excluding Military												
3a. 1889–1918	6.33	32.0	57.5	10.5	3.17	36.6	51.5	12.0	3.43	33.8	55.2	11.0
4a. 1899–1928	7.77	33.6	52.3	14.2	3.49	42.4	39.8	17.8	3.78	39.1	44.4	16.4
5a. 1909–1938	7.80	31.8	45.0	23.2	2.21	48.6	7.9	43.5	2.59	41.5	21.4	37.1
6a. 1919–1948	8.03	31.4	39.1	29.5	1.23	75.2	−57.4	82.2	1.73	53.6	−12.3	58.6
7a. 1929–1955 [b]	9.82	30.2	36.9	32.9	1.84	63.7	−35.8	72.1	2.62	44.8	4.5	50.7
8a. 1946–1955	13.37	34.1	39.3	26.6	4.59	57.8	14.8	27.5	5.61	47.2	30.3	22.5

Because of rounding, detail will not necessarily add to total.

Percentages, except those for 1946–1955, are based on three-decade moving totals of absolute volumes.

[a] For description of the alternative estimate of depreciation used in columns 9 and 11, see text.

[b] 1949–1955 given the weight of a decade.

SOURCE: Calculated from Tables R-7, R-30, and R-32.

even in 1946–1955, when private construction was high, the share of governments was about one-fifth or more.

The share of nonfarm residential construction in net construction does not decline. It is roughly stable if we use the alternative estimate of depreciation; and rises if we use the standard estimate. This trend is different from that of the share of nonfarm residential construction in gross construction. The two trends differ because capital consumption of nonfarm residential construction grew at a lesser rate than capital consumption of "other" construction. This, in turn, is because the retardation in the rate of growth of nonfarm residential construction was less than the retardation in the rate of growth of "other" construction.

It follows that the share of "other" construction in net construction declined, whatever variant of depreciation we use and whether or not we include military construction. Indeed, the marked decline in the share of "other" construction in total construction—whether gross or net—is the major conclusion from Table 18.

We are thus led to the following inference. In the decline of the share of gross construction in gross durable capital formation, the lower rate of growth of nonfarm residential construction was a contributing factor, but the major factor was the even lower rate of growth of gross "other" construction. In the decline of the share of net construction in net durable capital formation, the lower rate of growth of nonfarm residential construction was a contributing factor but with less weight; and the major and dominant factor was again the even lower rate of growth of net "other" construction. Government construction, since it grew rapidly, did not contribute to the decline in the share of construction in total durable capital formation. In short, it is the much slower growth of "other" construction relative to that of producers' durables (with which it is most comparable in scope) that accounts for most of the shift in the distribution of durable capital in favor of producers' equipment.

"Other" construction is predominantly for the strictly business sectors—mostly nonagricultural plant, roadway (for railroads), utility, and office construction. It is a tool, therefore, for much the same commodity product that is served by producers' durable equipment, despite the minor differences in scope of the aggregate output turned out by these two complexes of capital items. The much slower rate of growth in "other" construction than in producers' durables means that the ratio of changes in the former to changes in output has declined more,

or risen less, than the ratio of changes in the latter to changes in output. The movements of these ratios can be observed directly (Table 19).

The comparisons in Table 19 are similar to those in Tables 15 and 17, except that "other" construction and producers' durables, including or excluding agriculture, are related to net changes in finished commodity output, including or excluding the contribution of agriculture. But here we have gross volumes of construction and producers' equipment as well as net volumes. The former are included in the analysis to reveal whether the trends in the marginal capital-output ratios are substantially affected by the allowance for capital consumption.

The movements in the marginal capital-output ratios are quite similar for the several variants. The ratio of "other" construction to changes in output rose to a peak in the period 1889–1918, and then declined sharply: the gross ratio dropped to less than one-third of the peak level, and the net ratio turned negative. If the middle decade can be taken as the more exact date of the secular level of a thirty-year average, the peak ratio of "other" construction to changes in output can be said to have been reached in the 1899–1908 decade; and the drop since then has been particularly sharp in the periods including the World War II and postwar years.

The ratio of producers' durables to changes in commodity output follows a different secular pattern. The gross ratio, and the net ratio based on the standard depreciation estimate, rose to a peak in the period 1909–1938, while the net ratio based on the alternative depreciation estimate reached a peak in the period 1899–1928. But despite a decline from those peak levels, the ratios in the later periods are substantially above their levels in the early periods or above their previous peak levels. Thus the ratio for gross producers' equipment is over 3.0 both in 1929–1955 and 1946–1955, compared with less than 2.0 in 1869–1898 and 1879–1908; whereas the ratio for gross "other" construction is 1.4 in 1929–1955 and 1.2 in 1946–1955, compared with 2.7 and 3.1 in the first two thirty-year periods. Likewise, the net producers' durables ratio (standard depreciation series) is well above 0.6 in the most recent periods (over 0.7 in 1919–1948), compared with less than 0.6 in the first two periods. But the recent net "other" construction ratio is either negative or a small fraction of the level that prevailed in 1869–1898.

In short, the shift in the structure of total durable capital formation away from construction toward producers' durables can be largely accounted for by the shift away from "other" construction toward pro-

TABLE 19

CAPITAL-OUTPUT RATIOS: RATIOS OF GROSS AND NET VOLUMES OF "OTHER" CONSTRUCTION AND PRODUCERS' DURABLES TO NET CHANGES IN FLOW OF FINISHED COMMODITY PRODUCT, BASED ON VOLUMES IN 1929 PRICES, 1869–1955

(amounts in billions of dollars)

Periods	*Net Changes in Finished Commodity Product* (1)	*Gross Volumes*				*Net Volumes*				*Net Volumes, Using Alternative Depreciation Estimate*			
		"Other" Construction (2)	Ratio of (2) to (1) (3)	Producers' Durables, Excluding Munitions (4)	Ratio of (4) to (1) (5)	"Other" Construction (6)	Ratio of (6) to (1) (7)	Producers' Durables, Excluding Munitions (8)	Ratio of (8) to (1) (9)	"Other" Construction (10)	Ratio of (10) to (1) (11)	Producers' Durables, Excluding Munitions (12)	Ratio of (12) to (1) (13)
Total													
1. 1869–1898	19.6	52.6	2.68	29.3	1.49	24.9	1.27	8.7	0.44	28.1	1.43	7.7	0.39
2. 1879–1908	26.9	83.7	3.11	50.0	1.86	41.0	1.52	15.5	0.58	46.2	1.72	13.9	0.52
3. 1889–1918	26.4	109.3	4.14	73.8	2.80	49.0	1.86	18.5	0.70	56.8	2.15	15.8	0.60
4. 1899–1928	41.6	121.9	2.93	111.9	2.69	41.6	1.00	32.7	0.79	50.4	1.21	25.8	0.62
5. 1909–1938	31.7	105.3	3.32	133.9	4.22	5.2	0.16	38.0	1.20	16.6	0.52	14.4	0.45
6. 1919–1948	61.8	94.1	1.52	178.1	2.88	−21.2	−0.34	46.5	0.75	−6.4	−0.10	31.8	0.51
7. 1929–1955	68.1	91.9	1.35	224.0	3.29	−22.4	−0.33	46.0	0.68	−2.5	−0.04	51.5	0.76
8. 1946–1955	43.1	52.5	1.22	132.5	3.07	6.8	0.16	27.7	0.64	17.0	0.39	47.4	1.10
Total, Excluding Agriculture													
1a. 1869–1898	16.3					21.8	1.34	7.8	0.48	25.0	1.53	6.8	0.42
2a. 1879–1908	23.8					36.3	1.53	14.1	0.59	41.5	1.74	12.5	0.53
3a. 1889–1918	23.3	n.a.	n.a.	n.a.	n.a.	42.9	1.84	16.2	0.70	50.7	2.18	13.5	0.58
4a. 1899–1928	37.8					37.0	0.98	30.6	0.81	45.8	1.21	23.7	0.63
5a. 1909–1938	30.8					5.4	0.18	37.0	1.20	16.8	0.55	13.4	0.44
6a. 1919–1948	60.5					−21.2	−0.35	42.9	0.71	−6.4	−0.11	28.2	0.47

Ratios, except those for 1946–1955, are based on three-decade moving totals of absolute volumes.

n.a. = not available.

SOURCE, BY LINE

1–8. Col. 1: Table 15, col. 1.
Cols. 2, 6, and 10: Calculated from the series given in, or underlying, Tables R-30 and R-32. For the alternative estimate of depreciation, see notes to Table 14, part Da.
Cols. 4, 8, and 12: Calculated from Table 14, parts B, D, and Da.

1a–6a. Col. 1: Table 17, col. 1.
Cols. 6, 8, 10 and 12: Calculated from the series underlying the estimates in Table 17.

ducers' durables. The latter shift, in turn, means that after roughly the first decade of this century the marginal capital-output ratio for "other" construction declined far more precipitously than did that for producers' durables. The greater decline in the ratio for "other" construction is evident even when we use gross volumes, that is, gross rather than net capital formation. In other words, during recent decades it has become increasingly possible to produce more finished commodities with absolutely and proportionately smaller gross or net additions to the stock of "other" construction than to the stock of producers' durable equipment.

The explanation of the difference between the movement in the capital-output ratio for "other" construction and that for equipment requires an examination of output and capital formation for major industry sectors, and a brief discussion along these lines is to be found in a later section of this chapter. It may be said here that the explanatory model would have to distinguish trends in the relation between construction and equipment and output within industries from trends in the weights of different industries, characterized by different ratios of construction to output and equipment to output. Thus, in a given industry, say steam railroads, the records might suggest that in the early stages of its growth the construction of track, stations, and so on formed a large part of its durable capital formation, and the ratio of construction to output was high and rising. Later, after the basic network had been completed, the need for new construction, gross or net, lessened, while technical progress stimulated the demand for new producers' equipment. If the suggestion holds, the pattern for the railroad sector may be described as an early rise in the marginal capital-output ratios, for both construction and equipment, succeeded by a marked decline in the ratio for construction, and a lesser decline, stability, or even a rise in the ratio for producers' equipment. This pattern may have typified not only railroads but also other utilities, many manufacturing industries, and so forth. However, there may also have been simultaneously interindustry shifts. We are dealing here with aggregates of "other" construction and producers' durable equipment, even if we exclude agriculture. Within the total complex of nonagricultural industries, sectors characterized by higher than average ratios of construction to output may have predominated during the early periods; and it may be that the decrease in their importance brought about the precipitous decline in the marginal ratio

of "other" construction to output—even though within each industry no significant decline occurred.

We can advance beyond such conjectures only after we consider the more detailed evidence on the industrial distribution of durable capital. The present remarks are intended merely to indicate the lines that a complete explanation would have to follow. And we now turn to the last question raised above—the effect of the changes in structure of capital formation by type of capital good on the ratio of capital consumption to gross capital formation.

d. Our estimates of capital consumption are based largely on an assumption of constant economic life and straight-line depreciation, although for some components (nonfarm residential construction, for example) and for recent decades somewhat different procedures were followed. It can be demonstrated that if constant economic life and straight-line depreciation are assumed, trends in the ratio of capital consumption to gross capital formation will depend upon three variables: first, the movement of the rate of growth in gross capital formation (retardation in the rate increases the ratio of capital consumption to gross capital formation and acceleration in the rate decreases it); second, trends in the relative weight in gross capital formation of the several categories subject to different economic life (e.g., an increase in the weight of gross producers' durables relative to construction will raise the ratio of capital consumption to gross durable capital formation); and third, trends in the weight in capital formation of items subject to depreciation relative to those, already net, that are not (net changes in inventories and in foreign claims). Clearly, a rise or decline in the share of the nondepreciable items in gross capital formation would mean, all other conditions being equal, a decline or rise in the ratio of capital consumption to gross capital formation.[9]

All three relations indicated above operated in part to raise the proportion of capital consumption to gross capital formation. We have already observed that the share of net changes in inventories in gross domestic capital formation declined. For a while, the share of net changes in foreign claims in total capital formation rose, but after reaching a peak during World War I and in the 1920's, it fell. Thus, the share of the nondepreciable components in gross capital formation declined. We have also pointed out that the rate of growth of gross

[9] For an algebraic analysis of these relations see Appendix B, in Kuznets, "International Differences in Capital Formation and Financing," in *Capital Formation and Economic Growth*, pp. 76–81.

construction was slower than that of gross producers' durables, which means that the share of the latter, with its shorter economic life span and higher depreciation ratio, increased. Now, in Table 20, we observe the movement in the rates of growth in the volumes (in constant prices) of gross construction, gross flow of producers' durables, and their total (columns 1, 2, and 3).

The period covered in Table 20 is too short for our purposes. It should extend about fifty years further back for construction, and about a decade and a half further back for producers' durables, since current capital consumption is affected by earlier rates of growth in gross capital formation. Nevertheless, it is clear even from the truncated period covered that the rate of growth in construction shows a sharp retardation, whereas retardation in the rate of growth in producers' durable equipment is not nearly so marked. The effects on the movement of the ratio of capital consumption to gross capital formation for these two categories of durable capital (columns 4 and 5, or 9 and 10) are conspicuous—particularly if we exclude the military items from both categories. For construction (column 4), the ratio of capital consumption to gross capital formation rose from less than one-half to over eight-tenths. For producers' durables (column 5) it fluctuated around seven-tenths, the only noticeable rise being in the period including World War II and later years.

The most interesting item of evidence in Table 20, however, relates to the ratio of capital consumption to gross capital formation for the more comprehensive totals. Thus, for total durable capital formation, the sum of construction and producers' durables, the ratio of capital consumption to total gross volume, rose almost as much as did the ratio for construction, even though there was no such rise in the ratio for producers' durables. But it was the increasing weight of the latter that served to sustain the rise in the proportion of capital consumption to gross durable capital formation, from almost one-half to over eight-tenths (column 6). We find similar rises in the ratio of capital consumption to domestic and total capital formation—i.e., when capital formation includes the nondepreciable components of net changes in inventories and in foreign claims (columns 7, 8, 12, and 13).

Structure of Capital Formation, by Category of User

The ultimate purpose of capital formation is that of all economic activity—to provide goods for the satisfaction of wants of the human

TABLE 20

RATE OF GROWTH IN GROSS CONSTRUCTION AND IN GROSS PRODUCERS' DURABLES, AND RATIO OF CAPITAL CONSUMPTION TO GROSS CAPITAL FORMATION, BASED ON VOLUMES IN 1929 PRICES, 1869–1955

Periods	% Rate of Growth, Per Decade			Ratios of Capital Consumption to Gross Totals					Ratios of Capital Consumption to Gross Totals, Using Alternative Estimate of Depreciation [a]				
	Gross Construction (1)	Gross Producers' Durables (2)	Gross Durable Capital Formation (3)	Construction (4)	Producers' Durables (5)	Durable Capital Formation (6)	Domestic Capital Formation (7)	Total Capital Formation (8)	Construction (9)	Producers' Durables (10)	Durable Capital Formation (11)	Domestic Capital Formation (12)	Total Capital Formation (13)
Total													
1. 1869–1898				0.42	0.70	0.48	0.44	0.44	0.39	0.74	0.47	0.42	0.43
2. 1879–1908	50.6	70.9	55.2	0.44	0.69	0.50	0.46	0.46	0.40	0.72	0.48	0.45	0.44
3. 1889–1918	29.0	55.2	35.6	0.49	0.72	0.56	0.52	0.49	0.45	0.75	0.54	0.50	0.47
4. 1899–1928	23.1	52.3	31.5	0.55	0.72	0.61	0.56	0.52	0.51	0.78	0.60	0.56	0.52
5. 1909–1938	0.5	21.6	7.5	0.72	0.72	0.72	0.68	0.64	0.67	0.89	0.75	0.71	0.66
6. 1919–1948	6.0	66.9	28.9	0.84	0.71	0.77	0.73	0.69	0.78	0.77	0.77	0.73	0.69
7. 1929–1955 [b]	22.3	50.3	36.0	0.81	0.82	0.82	0.77	0.76	0.73	0.79	0.76	0.72	0.71
8. 1919–1928 to 1946–1955, or 1946–1955	13.6	49.5	28.5	0.68	0.97	0.84	0.78	0.76	0.61	0.85	0.74	0.69	0.67
Total, Excluding Military													
3a. 1889–1918	27.3	47.5	32.4	0.50	0.75	0.57	0.53	0.50	0.46	0.79	0.55	0.51	0.48
4a. 1899–1928	22.8	51.6	30.9	0.55	0.71	0.60	0.56	0.52	0.51	0.77	0.60	0.55	0.51
5a. 1909–1938	0.3	19.7	6.6	0.72	0.72	0.72	0.68	0.63	0.67	0.89	0.75	0.71	0.66
6a. 1919–1948	3.0	33.0	13.9	0.85	0.74	0.80	0.75	0.70	0.78	0.82	0.80	0.75	0.70
7a. 1929–1955 [b]	22.3	49.4	33.8	0.81	0.80	0.81	0.76	0.74	0.73	0.75	0.74	0.70	0.69
8a. 1919–1928 to 1946–1955, or 1946–1955	13.2	41.1	24.3	0.66	0.79	0.72	0.67	0.65	0.58	0.64	0.61	0.56	0.55

Rates of growth and ratios, except those in lines 8 and 8a, are based on three-decade moving totals of absolute volumes.

[a] For "other" construction and producers' durables, excluding military.

[b] 1949–1955 given the weight of a decade.

SOURCE: Calculated from the series underlying Table 14 and those underlying Tables R-7, R-31, and R-33.

beings who comprise society, in whatever institutional and organizational framework society sets up. Viewed in that light it does not matter whether a capital item is bought directly by the ultimate consumer for his own use (a house, for instance), is purchased by a business firm to produce finished goods, or is procured by governments for needs that are the responsibility of government agencies. In all these cases, the three groups of users of capital equipment can be viewed as delegates of society for the performance of identical functions. The house owner, business firm, and government unit can all be viewed as business units, either purchasing and planning the use of a capital item in an economic calculus, or supplying the ultimate needs of society, directly or indirectly.

While the function involved in capital formation is the same no matter who the ultimate user of the capital item may be, the identity of the user does make a difference—in the institutional arrangements by which capital formation decisions are made, in the patterns of behavior with respect to these decisions, modes of financing, and the like. While for some purposes we have to apply conventions to impose uniformity, it would be misleading to let those conventions guide our analysis. Thus in estimating national income, an owner-occupant of a dwelling is treated as an entrepreneur, in the business of supplying residential services to himself; and net income originating is calculated just as for a business firm, all relevant expenses, actual or imputed, being charged against an imaginary gross rent. Likewise, in some approaches, governments are treated as huge business enterprises, whose income is from tax receipts and other charges, and whose expenses are in the form of factor payments or payments to other industries. But such conventions should not lead us to assume that decisions by individuals on house purchase or construction, or by governments on capital acquisition or construction, are similar in all major respects to decisions by business firms; that the channels of financing are the same; or that the lines of distinction between gross capital formation, capital consumption, and net capital formation have quite the same meaning.

It is of interest, therefore, to classify capital formation by the three main groups of final users of capital items—households, business firms, and government agencies. The percentage distributions in Table 21 suggest the levels of and trends in the shares of these three major groups of final users in domestic capital formation.

Unfortunately, the classification permitted by the available data suffers from many limitations, some stemming from conceptual difficulties, but most of them due to the scarcity of relevant statistics. The first set of difficulties relates to capital formation for households. Assuming that we exclude consumers' durable commodities, for reasons already discussed in Chapter 1, we should cover all residential housing, whether farm or nonfarm. But the distinction between the farm residence and the part of the farm that serves productive purposes is difficult and artificial—particularly when the estimates are extended to the early decades. We have, therefore, included farm residences with the rest of farm capital and limited residential construction to nonfarm. The omission of farm residences is not important quantitatively: Goldsmith's very rough estimates suggest an annual average gross volume, in 1929 prices, ranging from somewhat over $30 million to almost $300 million, and averaging less than $150 million for the period 1897–1949.[10] For the same period the gross totals of nonfarm residential construction averaged almost $2.5 billion, or almost sixteen times farm residential construction. A somewhat different question arises with respect to nonfarm residential construction proper: some of it is owner occupied, some is rented. Should we treat both parts as household capital formation, or only the former—classifying the latter as business because it is handled chiefly by business firms? We decided to treat all of it as household capital formation, on the grounds that the distance to the ultimate household user is quite short, and that renting part of a two-family or multifamily house by an individual owner is often little different from owner occupancy of a single family dwelling. Defined as nonfarm residential construction (excluding nonhousekeeping units), the estimate of household capital formation is fairly complete.

The difficulties in estimating the government component are somewhat different: they all lie in the scarcity of data. First, as previously indicated, changes in inventories do not include government inventories; and, to the extent that inventories in the hands of governments have increased, their total capital formation and share in the aggregate are underestimated. Second, all producer equipment except munitions is allocated to business, because we have no basis for a long-term estimate of the share going to government agencies. Here again, the flow of producers' durables to governments may have increased more than the flow to business firms; and if so, the levels of and trends in the gov-

[10] *A Study of Saving*, Vol. I, Table A-7, p. 761.

TABLE 21

STRUCTURE OF DOMESTIC CAPITAL FORMATION, BY CATEGORY OF USER, 1869–1955
(percentages)

Periods	*Gross, Current Prices*			*Gross, 1929 Prices*			*Net, Current Prices*			*Net, 1929 Prices*			*Net, 1929 Prices, Using Alternative Estimate of Depreciation*		
	Households [a] (1)	Business Firms (2)	Governments (3)	Households [a] (4)	Business Firms (5)	Governments (6)	Households [a] (7)	Business Firms (8)	Governments (9)	Households [a] (10)	Business Firms (11)	Governments (12)	Households [a] (13)	Business Firms (14)	Governments (15)
Total															
1. 1869–1898	22.6	73.2	4.3	27.9	67.4	4.7	29.0	67.2	3.8	36.4	59.2	4.4	35.4	60.3	4.3
2. 1879–1908	21.4	73.3	5.3	25.0	69.5	5.5	26.6	67.9	5.6	31.4	62.7	5.9	30.4	63.8	5.7
3. 1889–1918	17.5	72.2	10.3	21.0	69.9	9.1	20.3	64.9	14.8	25.1	62.5	12.4	24.2	63.8	11.9
4. 1899–1928	18.9	68.7	12.4	20.5	68.2	11.3	25.2	61.9	12.9	26.6	60.8	12.6	26.3	61.2	12.5
5. 1909–1938	17.3	65.2	17.5	18.5	64.5	17.0	23.7	52.2	24.2	25.4	50.1	24.5	28.1	44.8	27.1
6. 1919–1948	14.3	57.0	28.8	14.5	57.8	27.7	19.8	40.0	40.2	19.7	38.8	41.5	19.7	38.9	41.5
7. 1929–1955 [b]	15.1	57.3	27.6	12.6	58.2	29.2	30.0	44.3	25.7	22.0	43.4	34.6	18.0	53.7	28.3
8. 1946–1955	16.9	61.7	21.4	14.2	64.6	21.2	41.7	67.1	−8.8	37.7	80.9	−18.6	26.4	86.6	−13.1
Total, Excluding Military															
3a. 1889–1918	18.1	74.9	7.0	21.5	71.5	7.1	21.9	69.8	8.4	26.2	65.2	8.6	25.2	66.5	8.3
4a. 1899–1928	19.6	71.1	9.4	21.0	70.1	8.9	25.6	62.8	11.6	27.0	61.7	11.3	26.7	62.1	11.2
5a. 1909–1938	17.9	67.7	14.3	19.2	66.9	13.9	24.0	53.0	23.0	25.8	51.1	23.1	28.7	45.7	25.6
6a. 1919–1948	16.8	67.3	15.9	16.9	67.3	15.9	24.8	50.2	25.1	24.6	48.5	26.9	24.6	48.6	26.9
7a. 1929–1955 [b]	17.5	66.6	15.9	14.9	68.8	16.3	30.8	45.5	23.7	24.4	48.0	27.6	19.6	58.3	22.2
8a. 1946–1955	18.6	68.0	13.4	15.8	71.9	12.3	32.5	52.3	15.2	27.6	59.3	13.1	21.0	68.9	10.0

Because of rounding, detail will not necessarily add to total.

Percentages, except those for 1946–1955, are based on three-decade moving totals of absolute volumes.

[a] Nonfarm residential construction.

[b] 1949–1955 given the weight of a decade.

SOURCE: Calculated from the total in col. 6 of Table 14, and from the components either in or derived from Tables R-6, R-7, R-30, R-32, and R-33. Shares of business firms are derived as residuals.

ernment share in capital formation are understated. Finally, it would have been desirable to include the nonprofit public institutions with the government sector rather than with the business sector, which is necessary because of lack of detailed data for long periods back. The share of such institutions in the capital formation total has very likely increased; and if they were included in the share of the total public sector, the latter would be larger and might show greater growth. On all these counts, the share of governments in capital formation is understated. However, it appears from some alternative distributions presented below that the magnitude of the understatement may be exaggerated.

It follows that the share of the business sector in total capital formation is overstated and may have an upward trend bias. But all these qualifications are relatively unimportant, and certainly do not materially affect the clear long-term movements in the structure of capital formation by category of user.

Before summarizing the findings, it should be noted that the distribution in Table 21 is of domestic capital formation, because net changes in claims against foreign countries cannot be allocated by category of user. The users in this case in this country (rather than abroad) would presumably be the holders of the claims—households as individual owners of some claims against foreign countries, business firms as direct or portfolio investors, and governments as owners either of debt claims or of some material assets located abroad. No data indicating such a distribution are available for the years before the 1920's; and the significance of such a distribution is questionable.

The movement that dominates the picture is the rise in the share of the government sector. It is found whether we deal with gross or net capital formation, in constant or current prices, and on either basis of capital consumption. Furthermore, the rise is conspicuous. From less than 5 per cent in the early period, the share rose—even when military items are excluded—to about 16 per cent in the gross totals, and to considerably more than 20 per cent in the net totals (1929–1955, line 7a). We emphasize here 1929–1955 as the terminal period, since the distribution for 1946–1955 may be too much affected by transient elements. The broad findings would not, however, be much changed by the use of 1946–1955 as the terminal period.

As noted above, the share of governments tends to be understated in our estimates. To evaluate the effects of the understatement, alterna-

tive estimates based on Goldsmith's series on net changes in reproducible wealth (in constant prices) are presented. Inventories and producer equipment in the hands of governments are included, but all military goods are excluded. The results, for the broad periods that can be distinguished, appear in Table 22.

The table, a supplement, in a way, to Table 21, not only confirms the rise in the share of the government sector, but also indicates that the allowance for inventories and equipment produces little change in the percentages. The shift from 6 per cent in 1880–1900 to somewhat over 25 per cent in 1922–1948 (lines 8 and 10) is similar to the change from 6 per cent in 1879–1908 to almost 27 per cent in 1919–1948 (Table 21, column 12 or 15, lines 2 and 6a). In other words, the direction and

TABLE 22

STRUCTURE OF NET DOMESTIC CAPITAL FORMATION, EXCLUDING MILITARY, BY CATEGORY OF USER, BASED ON WEALTH ESTIMATES, 1929 PRICES, 1850–1948

Dates or Periods	*Percentage Shares of:* Households [a] (1)	Business Firms (2)	Governments (3)
	WEALTH, END OF YEAR		
1. 1850	21.7	75.0	3.3
2. 1880	24.9	71.5	3.6
3. 1900A [b]	29.3	65.5	5.2
4. 1900B [c]	31.8	61.1	7.2
5. 1922	29.9	60.5	9.5
6. 1948	29.6	55.5	14.9
	CHANGES IN WEALTH (NET CAPITAL FORMATION)		
7. 1850–1880	25.7	70.5	3.7
8. 1880–1900A [b]	32.1	61.7	6.2
9. 1900B–1922 [c]	28.0	60.0	12.0
10. 1922–1948	29.1	45.5	25.4

[a] Nonfarm residential construction.
[b] Entries for 1900A are comparable with entries for earlier years.
[c] Entries for 1900B are comparable with entries for later years.

SOURCE: Raymond W. Goldsmith, "The Growth of Reproducible Wealth of the United States of America from 1805 to 1950," *Income and Wealth, Series II* (International Association for Research in Income and Wealth, Cambridge, England, Bowes and Bowes, 1952), p. 307.

magnitude of the rise in the share of the government sector in capital formation would remain much the same even if our series included equipment and inventories (excluding military items) in the hands of governments.

The share of the business sector in capital formation declined in all the variants, whether gross or net, whether in constant or current prices, whether including or excluding military—with one interesting exception. For the gross totals in 1929 prices (Table 21, column 5), excluding military, the moderate rise in the share of the business sector after the turn of the century was followed by only a slight decline. On the whole, therefore, the share of the business sector in those totals shows no significant long-term decline. However, in the gross totals in current prices the share declined, and in the net totals, whether in current or in constant prices, it declined even more sharply.

The share of the household sector in total *gross* domestic capital formation, whether in constant or in current prices, declined. Its share in net totals in current prices was fairly stable, but in net totals in constant prices, the share again showed a downward trend. In other words, the share of the household sector declined in all variants except that of net totals in current prices.

Since the rise in the share of governments dominates the percentage distributions in Tables 21 and 22, we also analyze the private sector alone and observe the shares of the household and the business sectors (Table 23).

The share of the household sector (nonfarm residential construction) in gross private domestic capital formation declined—only slightly for volumes in current prices, but quite appreciably for volumes in 1929 prices. The business sector, therefore, accounted for a somewhat rising proportion of all gross private domestic capital formation. With the shift to a net basis, the share of the household sector in volumes in current prices rose, and fairly appreciably. The trend in the share in net volumes in constant prices was, on the whole, downward. In short, within private domestic capital formation proper, the business sector tended to hold its own or even to rise, except in net volumes in current prices.

The findings just summarized have already been explained in part in the discussion of the trends in the structure of capital formation by type of capital good. Nevertheless, it may be useful to deal briefly with two points: (1) the reasons for the rise in the share of the government

TABLE 23

STRUCTURE OF PRIVATE DOMESTIC CAPITAL FORMATION, BY CATEGORY OF USER, 1869–1955
(percentages)

Periods	*Gross, Current Prices*		*Gross, 1929 Prices*		*Net, Current Prices*		*Net, 1929 Prices*		*Net, 1929 Prices, Using Alternative Estimate of Depreciation*	
	Households [a] (1)	Business Firms (2)	Households [a] (3)	Business Firms (4)	Households [a] (5)	Business Firms (6)	Households [a] (7)	Business Firms (8)	Households [a] (9)	Business Firms (10)
1. 1869–1898	23.6	76.4	29.3	70.7	30.1	69.9	38.1	61.9	37.0	63.0
2. 1879–1908	22.6	77.4	26.4	73.6	28.1	71.9	33.4	66.6	32.3	67.7
3. 1889–1918	19.5	80.5	23.1	76.9	23.9	76.1	28.7	71.3	27.5	72.5
4. 1899–1928	21.6	78.4	23.1	76.9	28.9	71.1	30.4	69.6	30.0	70.0
5. 1909–1938	20.9	79.1	22.3	77.7	31.2	68.8	33.6	66.4	38.5	61.5
6. 1919–1948	20.0	80.0	20.0	80.0	33.1	66.9	33.6	66.4	33.6	66.4
7. 1929–1955 [b]	20.8	79.2	17.8	82.2	40.4	59.6	33.7	66.3	25.1	74.9
8. 1946–1955	21.5	78.5	18.0	82.0	38.3	61.7	31.8	68.2	23.4	76.6

Percentages, except those for 1946–1955, are based on three-decade moving totals of absolute volumes.

[a] Nonfarm residential construction.

[b] 1949–1955 given the weight of a decade.

SOURCE: Calculated from Table 21.

sector in total capital formation; and (2) the reasons for the rising share of the business sector in gross private domestic capital formation, and its declining share in net in current prices.

1. The rise in the share of the government sector in total capital formation is a finding beyond doubt or qualification, and would be observed even with alternative definitions of capital accumulation (for example, one including consumers' durable commodities). While it cannot be explained in full here, an effective approach would be to view it as a product of two trends: the rise in the share of governments in the total economic activity of the nation, and the relation between this rise in activity under government auspices and the accumulation of material capital needed to effect it.

The rise in the share of governments in total economic activity can be demonstrated in various ways: by measuring the share of factor payments originating in the government sector in national income; by gauging the share of employment under government auspices in the country's labor force; by estimating the share of the total finished product of the economy purchased by government agencies; by appraising the extent to which the activity of the whole economy, including the private sector, is determined by decisions, acts, and policies of the governments—whether in their regulating, inducing, or limiting capacities. Each of these approaches would yield a clear picture of the rising weight of governments in the functioning of the national economy.

These trends, and the factors underlying them, have been discussed elsewhere.[11] There is little need here to repeat the discussion, except by way of a capsule summary. One point to be stressed is that the very pattern of the country's internal economic growth—the increasing density of population in urban conglomerates, the growing scale and complexity of the forms of economic organization, the increasing importance of overhead capital that cannot be financed under private auspices—has meant an increasing need for services and functions that cannot be left to private business. The satisfactory operation of private markets and private enterprise requires that the discrepancy between returns to business and returns to society, particularly in the long run, must not be large. For if the expected returns to business exceed the

[11] Notably in the following National Bureau studies: Solomon Fabricant, *The Trend of Government Activity in the United States since 1900* (New York, 1952); George Stigler, *Trends in Employment in the Service Industries* (Princeton, 1956); and Morris A. Copeland, *Trends in Government Financing* (Princeton, 1961).

social returns by too wide a margin, some resources will be diverted to uses that are not justified by the interests of society and that, therefore, diminish the potential social product in the long run. If the prospective returns to private business are smaller than they should be from the standpoint of society, then too few resources with high social priority will be employed.

With this general formula there may be far-reaching disagreement in specific cases about what constitutes the social as against the private net returns. Yet many illustrations may be cited. For example, with the increasing density of population, and the consequently greater need to protect public health, it would clearly be quite unsatisfactory to leave epidemic control and other public health measures to private concerns. They could not be expected to provide the necessary goods and services at prices within the means of all groups in the population. It would be dangerous not to employ the compulsive powers of government agencies in fields in which a few failures to conform (milk, mosquito, water control) would endanger entire communities. If—to use another example—a private enterprise expands to such a size that the preponderance of fixed costs in its financial structure makes competition impossible, whereas the importance of its product makes monopoly socially dangerous, only the government can intervene to regulate such a potential monopoly and reduce the discrepancy between private and public costs and returns. As the structure of the economy grows in complexity and as its parts are more closely interrelated, an increasing proportion of activities in the private sector assumes dominating public importance—in the sense that failure to perform is a graver threat to the efficiency of the economy as a whole than in earlier times when the various parts of the economy were more self-sufficient. The continuous development of social and economic institutions, which has been fundamental in permitting this country's economy to tap the increasing potential of economic productivity inherent in the growing stock of useful knowledge, requires an increasing role by the government in regulating, adjusting, and complementing those institutions, whenever there is evidence that, left to themselves, they may develop bottlenecks or misallocate resources from the point of view of society as a whole.

Just as the economic growth of the country produced internal pressure for greater activity by governments, so economic growth on an international scale had similar effects within the historical period

covered by our estimates. It was the spread of the modern industrial system to an increasing number of large national units or empires that provided, at least in the permissive sense, conditions in which international discord could have economic effects and exercise economic pressures. Before the emergence of new industrial powers (Germany, Japan, and Russia), when Great Britain was the leading—in fact the only—major industrial power and could enforce *Pax Britannica* throughout a large part of the world, the threat to the United States of major international conflicts was small. Since the last quarter of the nineteenth century, however, that threat has increased steadily.

Given the growing share of governments in the country's total economic activity, their share in countrywide capital formation would increase if government activity required material capital, and if that requirement—as expressed by the capital-output ratio for the government sector—were not subject to a downward trend offsetting the upward trend in the government share in total economic activity. We have no evidence on the capital-output ratio for government activity. For some major areas of government operation such a ratio would be difficult to secure, because the activities served by the capital (streets, roads, and so on) are not those of government proper. Unlike business firms, which acquire capital goods to service their own productive operations exclusively, or households, which gear acquisition of capital to their own specific needs, many of the capital goods acquired by government agencies serve the broader purposes of society as a whole. The capital-output ratio would therefore have a clear meaning only for that part of government capital stock designed to service its own operations (office buildings, military construction, and munitions).

It is reasonable to suggest, nevertheless, that, aside from the special case of durable military material, the capital-output ratio associated with government capital formation is certainly not lower than the ratio prevailing for construction and equipment items elsewhere in the economy; and that the trend movement in the government ratio is at least not likely to show a greater decline or a lesser rise than that in the capital-output ratio for the economy at large. What might be called the utilities component of government capital formation, which bulked quite large in the nonmilitary totals of government capital, is in general characterized by a fairly high capital-output ratio. The same is true of the construction component, such as office buildings, associated directly with government operation. And as for the long-term trends in the capital-output ratio for the government sector, it

might be reasonably argued that, because of the absence of those continuous pressures to economize and raise the rates of utilization of equipment that characterize use of capital in the private business sector (and to some extent even the household sector), we should not expect the capital-output ratio for the government sector to decline more or rise less than that for the economy at large. If this conjecture is accepted, the rise in the share of governments in the country's total economic activity would necessarily be accompanied by a similar, or perhaps even greater, rise in their share in countrywide capital formation.

In connection with the rise in that share it may be useful to distinguish between capital formation of local and state governments and that occurring under the auspices of the federal government. The former would, by and large, be almost exclusively in response to internally generated needs associated with the domestic aspects of the country's economic growth. Capital formation under direct federal auspices, a mixed category, can reflect both internal and external pressures, both domestic and foreign factors.

The distributions in Table 24 are quite suggestive. If the military items are excluded, capital formation under state and local government auspices (excluding federal aid) accounted for a dominating share of government capital formation—between 80 and 90 per cent—until the period covering the decade of the 1930's. It dropped below 80 per cent only when the Great Depression necessitated increased federal government financing of state and local capital formation, and again when World War II and the postwar years led to a far greater volume of federal construction, even nonmilitary (as housing). It is war, beginning with World War I, and the increasing demands it makes that change the picture radically. One can distinguish two quite different phases in the long record of government capital formation in this country. In the early phase, urban services—road building, education, public health, and other peacetime functions of government—grew apace and required capital formation largely under the auspices of state and local governments. In the later phase, problems of war and defense became dominant and, in turn, exacerbated internal problems—of stability and depression (for clearly, the depression of the 1930's was partly a post-world-war phenomenon), of internal migration, of regional disparities—calling for multiplication of activities and capital formation under federal auspices, both military and nonmilitary. Because wars are violent phenomena, one can hardly

TABLE 24

DISTRIBUTION OF GOVERNMENT GROSS CAPITAL FORMATION, CURRENT PRICES, BETWEEN FEDERAL, AND STATE AND LOCAL, 1869–1955

Periods	*Percentage Shares in Total Nonmilitary*			Military as Percentage of Nonmilitary (4)	Percentage Share of Federal in Total, Including Military (5)
	State and Local, Including Federal Aid (1)	Federal Aid (2)	Direct Federal (3)		
1. 1869–1898 [a]	84.5	0	15.5	0	15.5
2. 1879–1908 [a]	83.9	0	16.1	0	16.1
3. 1889–1918 [a]	87.0	0.3	13.0	54.1	43.6
4. 1899–1928 [a]	92.6	3.1	7.4	36.5	32.2
5. 1909–1938 [a]	87.2	14.0	12.8	27.1	31.4
6. 1919–1948 [a]	72.2	15.4	27.8	113.7	66.2
7. 1929–1955 [a b]	72.5	11.4	27.5	101.7	64.1
8. 1946–1955	77.1	7.2	22.9	75.2	56.0
Decades (except line 17)					
9. 1869–1878	82.3	0	17.7	0	17.7
10. 1879–1888	87.0	0	13.0	0	13.0
11. 1889–1898	83.2	0	16.8	0	16.8
12. 1899–1908	83.5	0	16.5	0	16.5
13. 1909–1918	89.5	0.3	10.5	93.8	53.8
14. 1919–1928	95.2	4.6	4.8	23.2	22.7
15. 1929–1938	81.1	23.8	18.9	13.9	28.8
16. 1939–1948	53.7	14.7	46.3	234.9	84.0
17. 1949–1955	77.2	6.6	22.8	75.7	56.1
18. 1946–1955	77.1	7.2	22.9	75.2	56.0

Flow of nonmilitary producers' durables to governments is excluded.

[a] Percentages based on three-decade moving totals of absolute volumes.

[b] 1949–1955 given the weight of a decade.

SOURCE, BY COLUMN

(1) and (3) Calculated from unpublished estimates underlying Table R-30.

(2) Underlying absolutes from *Construction and Building Materials, Statistical Supplement, May 1954*, Table 5; and *Economic Report of the President*, January 1957, Table E-30.

(4) For military construction and munitions, see Table R-6.

call the movements associated with them trends. Therefore, lest the thirty-year periods give a false impression of gradual and continuous change, we provide decade distributions in the lower part of Table 24. Yet, by and large, the last four to five decades of this century may be considered "war dominated," compared with the "peaceful" decades from 1870 to 1910.

2. While it is not difficult to explain the upward trend in the share of governments in countrywide capital formation, the distribution within the private sector between households (in our measures, nonfarm residential construction) and the business sector (including farms) is more complicated. The reason lies in the fact that the determinants of household capital formation and of business capital formation are such different complexes. All we can do here is discuss further the relations between these two sectors of private capital formation, and the groups of variables to which they can be reasonably linked.

A detailed and thorough analysis of the factors that determine the demand for nonfarm residential construction, and their effect on the trends in that construction, is presented elsewhere.[12] Clearly, growth in population, change in the number of households, internal migration, the price of housing, and levels of income are all important elements in determining demand for residential housing in nonfarm areas. Of this complex of factors, we analyze here only the growth in nonfarm population, and in part A of Table 25 we relate to it the gross and net volumes of nonfarm residential construction, in constant prices. The rate of growth in household capital formation is thus interpreted as a function of two trends—additions to the nonfarm population, and the ratio of construction to population additions. The movement of the first of these two variables is portrayed in column 2; the movement of the second is shown for gross construction (with volumes for 1869–1898 related to population additions for 1870–1900, and so on) in column 5, and for net construction in column 9. Thus the trend in volume of construction is a product of columns 2 and 5, or 2 and 9, and appears in column 6 or 10.

The model for business capital formation is somewhat more elaborate. We begin again with population, on the premise that its wants are the governing determinant, as they are for the household sector. But here (columns 1 and 2 of part B) we take changes in total rather

[12] Leo Grebler, David M. Blank, and Louis Winnick, *Capital Formation in Residential Real Estate: Trends and Prospects* (Princeton for NBER, 1956), particularly pp. 76–133 and 143–155.

TABLE 25

DATA RELATING TO COMPARATIVE MOVEMENT OF HOUSEHOLD AND BUSINESS SECTORS IN PRIVATE DOMESTIC CAPITAL FORMATION, 1870–1950
(dollar amounts in 1929 prices)

A. HOUSEHOLD CAPITAL FORMATION [a]

Periods	Additions, Nonfarm Population (millions) (1)	Ratio of Successive Entries in (1) (2)	*Gross Nonfarm Residential Construction* (billions) (3)	Per Addition to Population (3) ÷ (1) (4)	Ratio of Successive Entries in (4) (5)	Ratio of Successive Entries in (3) (6)	*Net Nonfarm Residential Construction* (billions) (7)	Per Addition to Population (7) ÷ (1) (8)	Ratio of Successive Entries in (8) (9)	Ratio of Successive Entries in (7) (10)
1. 1870–1900	29.1		$3.98	$137			$2.92	$100		
2. 1880–1910	37.6	1.29	5.36	143	1.04	1.35	3.61	96	0.96	1.24
3. 1890–1920	40.6	1.08	6.07	150	1.05	1.13	3.48	86	0.90	0.96
4. 1900–1930	47.8	1.18	7.82	164	1.09	1.29	4.44	93	1.08	1.28
5. 1910–1940	41.6	0.87	7.44	179	1.09	0.95	3.23	78	0.84	0.73
6. 1920–1950	53.5	1.29	7.57	141	0.79	1.02	2.78	52	0.67	0.86

[a] Nonfarm residential construction.

SOURCE: Col. 1 for 1890–1950, from Leo Grebler, David M. Blank, and Louis Winnick, *Capital Formation in Residential Real Estate: Trends and Prospects* (Princeton for NBER, 1956), Table 23, p. 82, extrapolated to 1870 and 1880 by the movement of urban population in places up to 10,000 (Series B-156 and B-158, *Historical Statistics of the United States, 1789–1945*, p. 29).

(continued)

TABLE 25 (continued)

B. Business Capital Formation

Periods	Additions, Total Population (millions) (1)	Ratio of Successive Entries in (1) (2)	Additions, Finished Commodity Product: (billions) (3)	Additions, Finished Commodity Product: Per Addition to Population (3) ÷ (1) (4)	Ratio of Successive Entries in (4) (5)	Ratio of Successive Entries in (3) (6)	Gross Business Capital Formation: (billions) (7)	Gross Business Capital Formation: Per Addition to Finished Commodity Product (7) ÷ (3) (8)	Ratio of Successive Entries in (8) (9)	Ratio of Successive Entries in (7) (10)
7. 1870–1900	37.4		$19.6	$ 524			$ 9.6	0.49		
8. 1880–1910	41.8	1.12	26.9	644	1.23	1.37	14.9	0.55	1.12	1.56
9. 1890–1920	42.8	1.02	26.4	617	0.96	0.98	20.2	0.77	1.40	1.36
10. 1900–1930	46.8	1.09	41.6	889	1.44	1.58	26.1	0.63	0.82	1.29
11. 1910–1940	39.7	0.85	31.7	798	0.90	0.76	26.0	0.82	1.30	1.00
12. 1920–1950	45.0	1.13	61.8	1,373	1.72	1.95	30.2	0.49	0.60	1.16

Periods	Net Business Capital Formation: (billions) (11)	Net Business Capital Formation: Per Addition to Finished Commodity Product (11) ÷ (3) (12)	Ratio of Successive Entries in (12) (13)	Ratio of Successive Entries in (11) (14)
7. 1870–1900	$ 4.75	0.24		
8. 1880–1910	7.21	0.27	1.12	1.52
9. 1890–1920	8.65	0.33	1.22	1.20
10. 1900–1930	10.14	0.24	0.73	1.17
11. 1910–1940	6.38	0.20	0.83	0.63
12. 1920–1950	5.48	0.09	0.45	0.86

Source: Col. 1 from *Historical Statistics* and *Continuation to 1952*, Series B-13.

(continued)

TABLE 25 (concluded)

C. Reconciliation with Percentage Shares in Table 23

Periods	Share, Gross Nonfarm Residential Construction (1)	Share in (1) x Ratio in (6), Part A (2)	Share, Gross Business Capital Formation (3)	Share in (3) x Ratio in (10), Part B (4)	Derived Share, Gross Nonfarm Residential Construction $\frac{(2)}{(2)+(4)}$ (5)	Share, Net Nonfarm Residential Construction (6)	Share in (6) x Ratio in (10), Part A (7)	Share, Net Business Capital Formation (8)	Share in (8) x Ratio in (14), Part B (9)	Derived Share, Net Nonfarm Residential Construction $\frac{(7)}{(7)+(9)}$ (10)
13. 1870–1900	0.293		0.707			0.381		0.619		
14. 1880–1910	0.264	0.39555	0.736	1.10292	0.264	0.334	0.47244	0.666	0.94088	0.334
15. 1890–1920	0.231	0.29832	0.769	1.00096	0.230	0.287	0.32064	0.713	0.79920	0.286
16. 1900–1930	0.231	0.29799	0.769	0.99201	0.231	0.304	0.36736	0.696	0.83421	0.306
17. 1910–1940	0.223	0.21945	0.777	0.76900	0.222	0.336	0.22192	0.664	0.43848	0.336
18. 1920–1950	0.200	0.22746	0.800	0.90132	0.202	0.336	0.28896	0.664	0.57104	0.336

Source, by Column

(1) Table 23, col. 3.
(3) Table 23, col. 4.
(6) Table 23, col. 7.
(8) Table 23, col. 8.

than in nonfarm population, since it is the total increase in the number of inhabitants that has to be served by business capital. However, we cannot directly relate population numbers to business capital formation, as we do population numbers to residential construction; rather, the linkage is through finished commodity product, which business capital formation services. Hence, additions to total population are viewed as stimulating additions to finished commodity product (column 3), and we observe additions to commodity product per number added to total population (column 4). The movement in the per capita additions (column 5) multiplied by the movement in additions to total population (column 2) yields the trend in additions to finished commodity product (column 6). This trend, which characterizes the element of growth that additions to business capital service, is comparable with the trend in additions to nonfarm population, which characterizes the element of growth that new nonfarm residential construction services. It will be noted that the growth rate of this determinant of business capital formation tends to be higher than that of the immediate determinant of nonfarm residential construction. (Compare the entries in column 6 of part B with those in column 2 of part A.)

If additions to commodity product grow at a higher rate than additions to nonfarm population, business capital formation will grow at a higher rate than nonfarm residential construction if the marginal capital-output ratio for the former declines less or rises more than that for the latter. The comparison for gross marginal ratios is between column 9 of part B and column 5 of part A; and for net marginal ratios, between column 13 of part B and column 9 of part A. In the earlier periods, the ratio of business capital formation to finished commodity product additions is definitely higher than that of nonfarm residential construction to nonfarm population additions; but in the recent periods, the former declined much more drastically than the latter. On balance, however, the combination of these ratios with the movements in the basic determinants themselves yields a consistently higher rate of growth in business capital formation than in nonfarm residential construction for the gross volumes. But when we deal with the net volumes, the greater decline for business capital formation (column 12) than for nonfarm residential construction (column 8) offsets the other factors and produces a stability in the share of nonfarm residential construction in net private capital formation. Note, however, that this stability shown in Table 25 is for a period that omits

the first decade (1869–1878) and the last quinquennium (1951–1955). Over the longer period covered in Table 23, the share of nonfarm residential construction in net private domestic capital formation declines, at least for 1929 price volumes.

In part C the calculations show how differences in the rates of growth are reflected in changes in the percentage shares of the household and business sectors in total private domestic capital formation. The algebra is quite simple. If for a given period the share of the household sector is h, that of the business sector is $(1 - h)$. If capital formation in the former grows by the ratio $(1 + a)$, while that in the latter grows by the ratio $(1 + b)$, the share in the next period will be: for the household sector, $[h(1 + a)] \div [h(1 + a) + (1 - h)(1 + b)]$; and for the business sector, $[(1 - h)(1 + b)]$ divided by the same denominator. Clearly, if $(1 + a)$ is smaller than $(1 + b)$, the case more or less consistently for gross volumes, the share of the household sector in private domestic capital formation will decline, as demonstrated in part C.

This translation of changes in the relative shares of the household and business sectors in total private domestic capital formation (in 1929 prices) into differences in rates of growth, reducible to differences in rates of growth of relevant population additions and other sources of demand, is of course not an explanation. It is merely another step in the analysis toward the point at which the operating factors can be more clearly discerned. But we still would have to answer several questions: Why were additions to nonfarm population changing at the rate indicated (column 2 of part A)—at a rate higher than additions to total population (column 2 of part B)? Why did gross or net nonfarm residential construction in constant prices per addition to nonfarm population move as it did (column 5 or column 9 of part A)? Why did additions to commodity product per addition to total population grow at the high rates indicated (column 5 of part B)? On the questions relating to the determinants and factors in the movement of nonfarm residential construction, we may refer again to the discussion by Grebler, Blank, and Winnick, just cited. On the questions relating to business capital formation, reference can be made to the material in the monographs that deal with agriculture, mining and manufacturing, and the regulated industries, some of which will be summarized in the next section of this chapter. At the present juncture all we do is pass from the percentage distributions of private domestic capital formation to the next stage, where the underlying rates of growth can be linked to the most obvious determinants.

Trends in Structure of Capital Formation

If the distribution of private domestic capital formation in 1929 prices between the household and business sectors differs from the distribution in current prices, the discrepancy is assignable to differential trends in the price levels. As observed in Table 23, in the distribution of volumes in constant (1929) prices the share of the household sector (nonfarm residential construction) declined, and that of the business sector rose. If we do not observe the same trends in the distribution in current prices, it is clear that the prices of capital items in the two sectors moved differently.

This is brought out explicitly in Table 26. The price indexes in all columns were derived simply by dividing the volumes in current prices

TABLE 26

PRICE INDEXES IMPLICIT IN HOUSEHOLD AND BUSINESS SECTORS OF PRIVATE DOMESTIC CAPITAL FORMATION, AND IN CONSUMER COMMODITIES, 1869–1955
(1929 = 100)

Periods	*Gross Volumes*		*Net Volumes (standard depreciation)*		
	Households [a] (1)	Business Firms (2)	Households [a] (3)	Business Firms (4)	Consumer Commodities (5)
1. 1869–1898	38.6	51.9	38.6	55.1	56.2
2. 1879–1908	40.4	49.7	40.2	51.4	52.4
3. 1889–1918	45.4	56.3	43.4	55.7	60.8
4. 1899–1928	72.2	78.7	73.6	79.1	82.5
5. 1909–1938	83.6	90.4	84.9	94.7	88.5
6. 1919–1948	109.3	109.5	111.1	114.1	104.6
7. 1929–1955 [b]	185.9	153.4	230.1	172.2	131.4
8. 1946–1955	223.4	179.0	226.1	169.4	161.5

[a] Nonfarm residential construction.
[b] 1949–1955 given the weight of a decade.

SOURCE, BY COLUMN

(1) to (4) Calculated from Table 23.
(5) Calculated from Tables R-3, R-27, and R-28.

by those in 1929 prices. It will be observed immediately that prices implicit in the capital items in the household sector (nonfarm residential construction) rose more than those implicit in the capital items in the business sector—a total of construction, producers' equipment,

and inventories. Whereas the prices implicit in the gross volumes in the most recent long period, 1929–1955 (with the last seven years given the weight of a decade), are, for the household sector, almost five times the level in the first thirty-year period, those for the business sector are not quite three times their level in the initial period. The greater rise in prices of nonfarm residential construction may well be due to a lesser rise in productivity and efficiency of the industries closely connected with that sector and thus reflect their backwardness relative to those engaged in producing the construction, equipment, and inventories that constitute business capital formation.

Such differences in the movement of prices can easily account for the differences between the trends in the distributions of volumes in constant and in current prices. Thus, looking back at Table 23, we find that in 1869–1898 the share of the household sector in gross private domestic capital formation, in 1929 prices, was 29.3 per cent. But its share in current price volumes was only 23.6 per cent. The reduction can be explained by the differences in the implicit prices for gross volumes shown in columns 1 and 2, line 1, Table 26. If we multiply 29.3 per cent (the share of the household sector) by 38.6 (the price index for the household sector), and 70.7 per cent (the share of the business sector) by 51.9 (its implicit price index), and divide the first product by the sum of the first and second, the ratio will be 0.236 or 23.6 per cent, the share of the household sector, in current price volumes. We can do that for every entry in Tables 23 and 26, translating the movement in the shares of the household and business sectors in gross or net private domestic capital formation in current prices into a product of the movements of the shares in constant prices and of the differential changes in implicit price levels.

This naturally does not mean that the changes in the structure of private domestic capital formation in constant prices are basic, and that the differential trends in the implicit price levels are a corollary with only an additive effect on the former. On the contrary, it may well be that the difference in the price trends partly determined the distribution of capital formation in constant prices—in the sense that the greater relative rise in prices of nonfarm residential construction decreased the relative demand for it in physical volumes, causing the share of nonfarm residential construction in total private domestic capital formation, in constant prices, to decline.

In this connection, the last column in Table 26 has much suggestive value. It contains the implicit price index of finished consumer com-

modities (perishables, semidurables, and durables). Those commodities form the preponderant part of finished commodity product, changes in which appear in column 3, part B of Table 25, as one of the basic determinants of business capital formation. In fact, we know that consumer commodities account, on the average, for well over 70 per cent of total finished commodity product (the rest being gross construction and gross producers' durables, including munitions), and that their share in the latter showed no distinct trend over the period. We found in Table 25 that additions to finished commodity product (in constant prices), largely consumers' commodities, per addition to total population, rose at a higher rate than did new nonfarm residential construction (also in constant prices) per addition to nonfarm population. (Compare column 5 of part A with column 5 of part B.) In other words, the demand for additional units of consumer commodities grew at a higher rate than the demand for new nonfarm residential construction did, both expressed in constant prices. In Table 26 we find that the rise in prices of consumer commodities was far less than the rise in prices of nonfarm residential construction. We may therefore infer that the higher ratio of secular additions to finished commodity product to total population additions, compared with the ratio of new nonfarm residential construction to nonfarm population additions is due, at least in part, to the rising prices of construction relative to prices of finished consumer commodities. If this inference is correct, the price differential is another factor in the greater rise in business capital formation in constant prices, that is, the rise in the share of the business sector in total private domestic capital formation in constant prices. The differentials in price trends not only provide a statistical account of differences in movement between the shares of the household and business sectors in private domestic capital formation in constant and in current prices; they also suggest an economic argument which goes part way toward explaining why, in volumes in constant prices, the share of nonfarm residential construction tended to decline and that of business capital formation tended to rise.

Shares of Selected Industry Sectors in Net Business Durable Capital Formation

We come now to the last aspect of the structure of capital formation, the distribution of net durable business capital formation among the industries using durable capital. It would have been valuable to study

the distribution of all business capital formation—not only durable (which includes construction and equipment) but also inventories, not only net but also gross, and not for a few but for all industrial divisions that are likely to show different patterns of growth and different trends in their shares in total business capital accumulation. The available data, however, do not permit such an analysis even for recent years, let alone for decades back into the nineteenth century. We are limited to the distributions made possible by the basic monographs, in the series on capital formation and financing, dealing with agriculture, mining, manufacturing, and the regulated private industries (referred to below as public utilities).[18]

For these industrial sectors we can observe net durable capital formation, i.e., net construction and equipment, back to 1880. Table 27 presents a summary of the data, in comparable form, designed to reveal the long-term trends in the distribution of net durable business capital formation by these four major industrial sectors.

The comparison is limited to durable capital, that is, excludes inventories, because in some sectors, as the public utilities, long-term estimates of inventories cannot be secured; and in others, as manufacturing, estimates of inventories by subbranches are not possible over the long run. The estimates are limited to net volumes because, for the earlier decades, capital formation in agriculture, mining, and manufacturing, can be derived only as successive differences between estimates of stocks, and those stocks are net values. Only for the public utilities are both gross and net capital formation estimates available back to the 1870's. Finally, we deal with fairly long periods in Table 27, not only because our interest is in long-term trends, but also because the estimates for some sectors are derived as net differences between successive large totals (which are subject to marked trends), and the relative errors are likely to be smaller for long intervals than for short.

While Table 27 omits some sectors of the economy whose capital accumulation would be classified under business capital formation (e.g. contract construction, wholesale and retail trade, other business service), the missing sectors are not among the important users of

[18] See the following, published by Princeton for the National Bureau: Alvin S. Tostlebe, *Capital in Agriculture: Its Formation and Financing since 1870* (1957); Daniel Creamer, Sergei Dobrovolsky, and Israel Borenstein, *Capital in Manufacturing and Mining: Its Formation and Financing* (1960); and Melville J. Ulmer, *Capital in Transportation, Communications, and Public Utilities: Its Formation and Financing* (1960).

TABLE 27

INDUSTRIAL STRUCTURE OF APPORTIONABLE NET PRIVATE DURABLE CAPITAL FORMATION, 1929 PRICES, 1880–1948

(amounts in billions of dollars)

	Agriculture (1)	Mining (2)	Manufacturing (3)	Regulated Industries (4)	Total, (1) to (4) (5)
			A. CAPITAL STOCK AND CAPITAL FORMATION		
1. Stock, June 1, 1880	6.57	0.37	1.88	11.80	20.62
2. Net capital formation, June 1, 1880–June 1, 1900	2.20	1.20	5.76	9.18	18.34
3. Stock, June 1, 1900	8.77	1.57	7.64 [a]	20.98	38.96 [a]
			7.16 [b]		38.48 [b]
4. Net capital formation, June 1, 1900–Dec. 31, 1922	6.56	3.70	14.88	14.41	39.55
5. Stock, Dec. 31, 1922	15.33	5.27	22.04	35.39	78.03
6. Net capital formation, Dec. 31, 1922–Dec. 31, 1948	3.21	0.06	12.74	9.90	25.91
7. Stock, Dec. 31, 1948	18.54	5.33	34.78	45.29	103.94
			B. PER CENT DISTRIBUTION OF CAPITAL STOCK AND CAPITAL FORMATION		
8. Stock, June 1, 1880	31.9	1.8	9.1	57.2	100.0
9. Net capital formation, June 1, 1880–June 1, 1900	12.0	6.5	31.4	50.1	100.0
10. Stock, June 1, 1900	22.5 [a]	4.0 [a]	19.6 [a]	53.9 [a]	100.0
	22.8 [b]	4.1 [b]	18.6 [b]	54.5 [b]	100.0
11. Net capital formation, June 1, 1900–Dec. 31, 1922	16.6	9.4	37.6	36.4	100.0
12. Stock, Dec. 31, 1922	19.6	6.8	28.2	45.4	100.0
13. Net capital formation, Dec. 31, 1922–Dec. 31, 1948	12.4	0.2	49.2	38.2	100.0
14. Stock, Dec. 31, 1948	17.8	5.1	33.5	43.6	100.0
			C. VOLUME OF OUTPUT		
15. 1880	5.53	0.35	8.82	0.76	15.46
16. 1900	8.99	1.13 [c]	23.18 [a]	3.16	36.46 [a]
			21.98 [b]		35.26 [b]
17. 1922	10.55 [d]	2.56 [c]	50.57 [c]	9.60	73.28
18. 1948	18.02 [d]	5.81	128.12	27.65	179.60
			D. PER CENT DISTRIBUTION OF VOLUME OF OUTPUT		
19. 1880	35.8	2.3	57.1	4.9	100.0
20. 1900 [a]	24.7	3.1	63.6	8.7	100.0
1900 [b]	25.5	3.2	62.3	9.0	100.0
21. 1922	14.4	3.5	69.0	13.1	100.0
22. 1948	10.0	3.2	71.3	15.4	100.0

(continued)

TABLE 27 (concluded)

	Agriculture (1)	Mining (2)	Manufacturing (3)	Regulated Industries (4)	Total, (1) to (4) (5)
			E. RATIO OF CAPITAL STOCK TO OUTPUT		
23. June 1, 1880	1.19	1.06	0.21	15.53	1.33
24. June 1, 1900	0.98	1.39	0.33 [a]	6.64	1.07 [a]
			0.33 [b]		1.09 [b]
25. Dec. 31, 1922	1.45	2.06	0.44	3.69	1.06
26. Dec. 31, 1948	1.03	0.92	0.27	1.64	0.58
			F. RATIO OF NET CAPITAL FORMATION TO CHANGES IN OUTPUT		
27. 1880–1900	0.64	1.54	0.40	3.82	0.87
28. 1900–1922	4.21	2.59	0.52	2.24	1.04
29. 1922–1948	0.43	0.02	0.16	0.55	0.24
			G. APPROXIMATE NET PRODUCT		
30. 1880	3.78	0.22	2.41	0.50	6.91
31. 1900	5.82	0.71	6.07	2.09	14.69
32. 1922	6.71	1.60	13.99	6.26	28.56
33. 1948	9.16	3.62	35.50	18.08	66.36
			H. PER CENT DISTRIBUTION OF NET PRODUCT		
34. 1880	54.7	3.2	34.9	7.2	100.0
35. 1900	39.6	4.8	41.3	14.2	100.0
36. 1922	23.5	5.6	49.0	21.9	100.0
37. 1948	13.8	5.5	53.5	27.2	100.0
			I. RATIO OF CAPITAL STOCK TO NET PRODUCT		
38. June 1, 1880	1.74	1.68	0.78	23.60	2.98
39. June 1, 1900	1.51	2.21	1.26 [a]	10.04	2.65 [a]
			1.18 [b]		2.62 [b]
40. Dec. 31, 1922	2.28	3.29	1.58	5.65	2.73
41. Dec. 31, 1948	2.02	1.47	0.98	2.50	1.57
			J. RATIO OF NET CAPITAL FORMATION TO CHANGES IN NET PRODUCT		
42. 1880–1900	1.08	2.45	1.57	5.77	2.36
43. 1900–1922	7.37	4.16	1.88	3.46	2.85
44. 1922–1948	1.31	0.03	0.59	0.84	0.69

Because of rounding, detail will not necessarily add to total.

[a] Comparable with entry for 1880.

[b] Comparable with entry for later years.

[c] Extrapolated from 1902 or 1919 by NBER index (see Harold Barger and Sam H. Schurr, *The Mining Industries, 1899–1939*, New York, NBER, 1944, p. 14).

[d] Extrapolated from 1920 or 1950 by BAE index of farm production, *Statistical Abstract of the United States, 1951*, p. 507, and *Historical Statistics*, Series E-73.

[e] Extrapolated from 1919 by NBER index (see Solomon Fabricant, *The Output of Manufacturing Industries, 1899–1937*, New York, NBER, 1940, p. 44).

(Notes on following page)

(NOTES TO TABLE 27)

SOURCE, BY LINE

1, 3, 5, 7. Cols. 1–4: Data underlying the series in Table R-35.

15–18. Col. 1: Conversion of series in line 1, Table 28, to 1929 prices by correction factor (147.1) derived from Alvin S. Tostlebe, *Capital in Agriculture: Its Formation and Financing since 1870* (Princeton for NBER, 1957), Table H-3, pp. 214–216.
Col. 2: Data supplied by Israel Borenstein.
Col. 3: Data supplied by Daniel Creamer.
Col. 4: From Melville J. Ulmer, *Capital in Transportation, Communications, and Public Utilities: Its Formation and Financing* (Princeton for NBER, 1960), Table I-1, pp. 458 and 459.

30–33. Five-year averages centered on 1880, 1900, 1922, and 1948 were calculated for net national product in 1929 prices, Variant I (Table R-26). An index of these averages was computed with 1922 as the base year. The percentage shares of agriculture, mining, manufacturing, and the public utilities in net national product in 1922 were assumed to be the same as those for 1919–1928 in current prices shown in Simon Kuznets, "Long-Term Changes in the National Income of the United States of America since 1870" (*Income and Wealth, Series II,* International Association for Research in Income and Wealth, Bowes and Bowes, Cambridge, England, 1952), Table 17, p. 102.
Col. 1: Lines 15–18 multiplied by the ratio of line 12 to line 1 in Table 28. The index of the resulting product was calculated with 1922 as the base year. The ratio of this index to that for net national product was computed, and its movement used to extrapolate the share of agriculture in net national product. The latter, multiplied by this share, yielded the estimate of net income originating in agriculture in the given year.
Cols. 2–4: For each industry an index of its output (lines 15–18) was calculated with 1922 as the base year. The ratio of the industry index to that for net national product was computed and used to extrapolate the 1922 shares of the given industries in net national product. Multiplying the resulting shares by the absolute value of net national product in the given year yielded net income originating in the respective industries.

durable capital. According to the rough estimates of reproducible durable wealth, the four sectors covered in Table 27 accounted in 1880 for about 80 per cent of the total net value of construction and equipment in the business sector (i.e., excluding nonfarm residential construction, and that owned by governments and nonprofit organizations). That percentage appears to have been sustained through the recent decades.[14] We are, therefore, dealing here with the industries that account for about four-fifths of business durable capital formation.

The findings suggested by Table 27 are now listed.

1. The share of agriculture in net durable capital formation of the four industrial sectors has remained fairly steady: it amounted to 12 per cent in 1880–1900, rose to 17 per cent in 1900–1922, and then declined to about 12 per cent in 1922–1948. This more or less constant level is surprising in view of the sharp secular decline in the share of

[14] Simon Kuznets, assisted by Lillian Epstein and Elizabeth Jenks, *National Product since 1869* (New York, NBER, 1946), Tables IV-5 and IV-6, pp. 218–219.

agriculture in total output, as evidenced by the data in part D of the table.

However, even though the share of agriculture in net durable capital formation failed to decline, it was at a level lower than that which must have prevailed in the past. For in 1880, agriculture accounted for 31.9 per cent of the total stock of durable business capital, which means that in the preceding decades the share of agriculture in the comparable total of current capital formation must have averaged at that level. By 1900, however, agriculture's share in durable business capital had declined to 22.5 per cent, a reflection of the decline in its share in output. By 1922 its share in durable capital had declined to 19.6 per cent, and by 1948, to 17.8 per cent.

2. The share of mining in net durable capital formation in the four sectors was 6.5 per cent in 1880–1900 and rose to 9.4 per cent in 1900–1922. For both periods the share was much larger than it must have been before 1880, since its share in the durable capital stock of the four sectors in that year was only about 2 per cent. With the much larger share of mining in current net capital formation, its share in total durable capital (of the four sectors) climbed from less than 2 to almost 7 per cent. However, during 1922–1948, the volume of its capital formation was so small that the share of mining in total capital stock had dropped to about 5 per cent by 1948.

3. The share of manufacturing in net durable capital formation of the four sectors in 1880–1900 was close to one-third, far larger than its share in the existing stock in 1880. The share in capital formation increased continuously and, consequently, its share in the accumulated stock increased. Whereas in 1880 the share of construction and equipment used in manufacturing in the total for the four sectors was barely 9 per cent, by the end of 1948 it had risen to 33.5 per cent.

4. The share of the public utilities sector in the combined total stock in 1880 was quite large—close to six-tenths. But from then on the share in current net durable capital formation declined continuously, particularly sharply in the interval 1900–1922. In 1948, the share of the sector in the total accumulated net durable capital was about 44 per cent, a drop of almost one-quarter from its 1880 level.

How can we account for these movements, shown in parts A and B, in the distribution of net durable capital formation? Granted that the estimates are subject to error, it seems clear that the broad trends are not likely to be negated or changed much by refinements, so long as we deal with net construction and equipment, and with

these four sectors. Why, for example, should the share of manufacturing in the total for the four sectors increase, and that of public utilities decline?

The other parts of Table 27 help to resolve these trends into a combination of differential movements in the volume of output which the capital stock is to serve, and in the capital-output ratios, average and marginal.

In part C we have gross output—gross in that payments to other industries have not been deducted, although intraindustry duplication within agriculture is adjusted for. From our standpoint, it would have been preferable to use estimates of net output, specifically net income originating (or net plus capital consumption charges); and in part G we do have approximations to net output. But these approximations are quite rough, and the available data permit more accurate and detailed estimates of gross output. We should, therefore, emphasize the movement in capital, in gross output, and in the capital-gross output ratios, even though some inferences as to the movement in net output and in the capital-net output ratios are possible.

As might be expected, the share of agriculture in the total of gross output for the four sectors declined quite steadily; the shares of both the manufacturing and public utilities sectors rose quite steadily; and the share of mining rose until 1922 and then declined. On the basis of these trends in the structure of gross output, we would expect the share of manufacturing in net capital formation to rise continuously and that of mining to rise through 1922 and then decline, which is exactly what happened. We would also expect the share of agriculture in capital formation to decline, and that of public utilities to rise, but instead, the share of the former shows little change and that of the latter declined. Clearly, the capital-output ratio for agriculture must have moved quite differently from that for the public utilities sector, and both quite differently from those for mining and manufacturing.

This, an algebraic necessity, is what we find in part E. In agriculture, the ratio of capital stock (buildings, machinery, and implements) to output shows no definite trend over the period. In the public utilities sector, the capital-output ratio dropped precipitously, from a high of over 15.5 in 1880, to a low of 1.6 in 1948. The ratio in mining rose from 1.06 in 1880 to 2.06 in 1922, and then dropped sharply to 0.9 in 1948. The ratio in manufacturing more than doubled from 1880 to 1922, and then dropped markedly, but the trend over the period as a whole was upward. The weighted ratio for the four sectors combined

dropped moderately from 1880 to 1922, and then appreciably from 1922 to 1948.

Part F, which shows the marginal ratios—i.e. the ratios of net capital formation to gross output additions—emphasizes the extreme variability in these ratios, even for huge sectors like manufacturing and the public utilities, in which conflicting movements among the various branches may be expected to cancel each other, at least in part. In general, the marginal ratios during the first two intervals were high and rising for agriculture, mining, and manufacturing, but were already declining for the public utilities sector. In the last interval, 1922 to 1948, there was a general drop in the marginal ratios, and this uniformity of direction in movement for the four sectors is reflected in the sharp break in the ratio for the total.

The picture suggested by Table 27 is clear: by and large the average capital-output ratios in agriculture, mining, and manufacturing did not decline significantly or at all, over the period as a whole. It is the ratio for the public utilities sector—very high initially—that showed the most consistent and largest decline. On the other hand, the manufacturing capital-output ratio—very low at the beginning of the period—showed a sizable rise, at least to 1922. As a result, the four ratios tended to converge: in 1880, the range was from 0.21 to 15.5; in 1948, from 0.27 to 1.64. When we omit the public utilities sector, the range narrows—that in 1880 being from 0.21 to 1.19, that in 1948, from 0.27 to 1.03.

In parts G to J we repeat the analysis, this time for the movement in net output and in the capital-net output ratios in the four sectors. The estimates are based essentially upon the sector shares in net national product in 1919–1928 (in current prices), extrapolated to earlier and later decades by the movement in rates of growth of gross output compared with that of net national product (both output and product series in 1929 prices). These estimates therefore assume constancy over time in the ratio of net to gross output within each sector, and for this reason can be viewed as only rough approximations. The only exception is for agriculture from 1910 on, for which we have direct estimates of both gross and net output, in constant prices.

The general conclusions suggested by parts G to J are the same as those suggested by parts C to F. In the movement of output, there is again the marked decline in the share of agriculture, the marked rise in the shares of manufacturing and public utilities, and the rise to 1922 in the share of mining and its slight decline thereafter. The capital-net

output ratios are all significantly higher than those based on gross output, but their movement over time is similar except that the ratio for agriculture rises over the period as a whole. The marginal capital-net output ratios are even more variable than the marginal capital-gross output ratios.

Behind these movements in output and capital lie a variety of factors, many of which are discussed in the monographs from which the data are taken. It may not be amiss to consider some further detail, lest the simple story told by Table 27 leave a false impression. It is especially important to see whether the trends observed in the capital-output ratios remain the same when we vary the definition of capital and of output; and whether, by subdividing the major sectors, some light can be shed on the nature of the factors behind the trends.

We turn first to agriculture (Table 28) and consider two questions. (1) Is the movement in the ratio of net construction and equipment to net income originating the same as the movement in their ratio to gross income? (2) How does the movement of the capital-income ratio, when capital is limited to buildings and equipment, compare with the movement in the capital-income ratio when capital is defined more widely, or consists of other combinations of components?

The first question is answered simply by comparing the movement in line 7 with that in line 18. Considering only the period covered in Table 27, 1880–1950, we find that the ratio of net durable capital to gross income rose from 1.05 in 1880 to 1.27 in 1920 and then declined to 1.01 in 1950—confirming the movement already shown in Table 27. Over the period as a whole, there is no clear evidence of either an upward or downward trend in this ratio. But the ratio of net durable capital to net income originating moved from 1.22 in 1880 to 1.58 in 1920 and, after some decline, was again at 1.57 in 1950—clear evidence that the ratio over the period had, on the whole, risen. The reason, of course, lies in the fact that with increased mechanization, the use of inorganic fertilizers, and so on, the ratio of payments to other industries to gross income rose; or, in other words, the ratio of net income originating to gross income declined.

Why should the ratio of the value of buildings and equipment to net income (output) rise, and its ratio to gross income (output) remain constant in agriculture—although these ratios declined in some other sectors (as public utilities)? The answer is provided in part by the ratios for other major items of capital in agriculture, particularly land, and horses and mules (and to some extent, even other live-

TABLE 28

COMPONENTS OF CAPITAL RELATED TO GROSS AND NET FARM INCOME, AGRICULTURE, BASED ON VOLUMES IN 1910–1914 PRICES, 1870–1950
(amounts in billions of dollars)

	1870 (1)	1880 (2)	1890 (3)	1900 (4)	1910 (5)	1920 (6)	1930 (7)	1940 (8)	1950 (9)
1. Gross farm income	2.54	3.76	4.68	6.11	6.71	7.47	8.66	9.62	11.78
				RATIO OF CAPITAL TO GROSS FARM INCOME					
2. Total, including land	7.78	7.40	7.20	6.60	6.76	6.67	5.68	5.05	4.56
3. Land	5.36	5.08	4.90	4.59	4.50	4.27	3.75	3.45	2.93
4. Reproducible assets	2.41	2.31	2.30	2.01	2.26	2.40	1.93	1.60	1.63
5. Buildings	1.02	0.95	0.82	0.73	0.95	1.00	0.83	0.65	0.64
6. Equipment	0.10	0.10	0.11	0.14	0.19	0.27	0.26	0.20	0.37
7. Buildings and equipment	1.12	1.05	0.94	0.87	1.14	1.27	1.09	0.85	1.01
8. Horses and mules	0.41	0.39	0.44	0.38	0.40	0.38	0.25	0.17	0.07
9. Other livestock	0.57	0.52	0.54	0.42	0.38	0.40	0.32	0.32	0.28
10. Crops	0.31	0.35	0.39	0.34	0.33	0.34	0.27	0.26	0.27
11. Total inventories	1.29	1.27	1.36	1.14	1.12	1.12	0.84	0.74	0.62
12. Net farm income	2.23	3.22	3.90	4.98	5.33	6.02	6.74	7.27	7.61
				RATIO OF CAPITAL TO NET FARM INCOME					
13. Total, including land	8.86	8.64	8.64	8.09	8.51	8.28	7.29	6.68	7.06
14. Land	6.11	5.94	5.88	5.63	5.67	5.30	4.82	4.57	4.54
15. Reproducible assets	2.75	2.70	2.76	2.47	2.84	2.98	2.48	2.11	2.52
16. Buildings	1.17	1.11	0.99	0.90	1.20	1.24	1.07	0.86	0.99
17. Equipment	0.11	0.11	0.14	0.17	0.24	0.34	0.33	0.26	0.58
18. Buildings and equipment	1.28	1.22	1.12	1.06	1.44	1.58	1.40	1.13	1.57
19. Horses and mules	0.47	0.46	0.52	0.47	0.51	0.48	0.32	0.23	0.11
20. Other livestock	0.65	0.61	0.64	0.52	0.48	0.50	0.42	0.42	0.43
21. Crops	0.35	0.41	0.47	0.41	0.42	0.42	0.35	0.34	0.41
22. Total inventories	1.47	1.48	1.64	1.40	1.41	1.39	1.08	0.98	0.95

SOURCE, BY LINE

1. Tostlebe, *Capital in Agriculture*, Table 20. The BAE series is used through 1910 and is extrapolated to 1870 by the Strauss-Bean series.

2–11 and 13–22. *Ibid.*, Table 9, related to line 1 or line 12.

12. *Ibid.*, Table 20. For 1870–1900, the estimates are based on the gross income series. It is assumed that the difference between the gross and net series, as a percentage of the gross, rises—from 12.3 in 1870 to 14.4 in 1880, to 16.5 in 1890, and to 18.5 in 1900.

stock). The ratio of the value of land—improved land—to either gross or net farm income declined steadily, particularly sharply after 1920. The reason, of course, lies in the increasing difficulty of expanding the area of cultivated and improved land on farms. This puts a premium upon the capacity to increase output without additional land, a capacity in which the availability of equipment and many types of productive buildings is one factor. The ratio of the value of horses and mules to either gross or net income was fairly steady through 1920 and then declined sharply, clearly because of increasing substitution of mechanized equipment for power animals—another factor that tends to sustain the ratio of net durable capital to gross income or to raise its ratio to net income. Even for other livestock, there was a continuous decline in the ratio of the stock to gross or net income, apparent after 1890 and with another conspicuous falling off after 1920. Here also greater yield may have been possible through the input of products of other industries or of better capital (special types of chemically bolstered feed, new structures for milk cows, mechanical equipment for milking, and the like). In short, the estimates indirectly reflect the whole process of the industrialization of agriculture—the basis of the sustained ratio of net durable capital to gross or net income, coterminous with substantial declines in the ratios of other types of capital to gross or net income.

Another aspect of the process is revealed in Table 29. The ten regions into which the country is divided in the table are characterized by rather different types of agricultural complexes, and by differences in the time of entry upon sustained demographic and economic growth.[15] Of particular interest in the analysis of long-term trends in capital formation are two findings here regarding the relation between capital and output. One is the wide range of difference within one and the same "industry" (if agriculture can be called that) in the ratio of capital to income, whatever the variant. Thus in 1869, the ratio of total capital to gross income ranged from 3.45 to 16.87, that of reproducible capital, from 1.15 to 5.70 (and the range would presumably have been wider for ratios to net income originating); even by 1949, the range for the reproducible capital-income ratio was from 0.98 (in the Pacific region) to more than double that, 2.11 (in the Lake states). The second finding is that in the process of growth of various parts of an industry, or for a large part of the economy (as we observed

[15] For more detailed discussion see Tostlebe, *op. cit.*

TABLE 29

GROSS FARM INCOME AND CAPITAL-INCOME RATIOS, BY AGRICULTURAL REGION, BASED ON VOLUMES IN 1910–1914 PRICES, 1869–1950
(amounts in billions of dollars)

	United States (1)	North-east (2)	Appa-lach-ian (3)	South-east (4)	Lake States (5)	Corn Belt (6)	Delta States (7)	Great Plains (8)	Texas-Okla-homa (9)	Moun-tain (10)	Pacific (11)	Weighted Absolute Deviation of Capital-Income Ratios (12)	Weighted Relative Deviation, (12) as % of (1) (13)
						GROSS FARM INCOME							
1. 1869	2,254	584	323	183	178	690	153	34	45	10	54		
2. 1909	6,192	639	682	513	556	1,608	332	789	504	241	328		
3. Ratio, (2) to (1)	2.75	1.09	2.11	2.80	3.12	2.33	2.17	23.21	11.20	24.10	6.07		
4. 1909	6,598	681	726	547	593	1,713	354	841	537	257	349		
5. 1949	11,750	1,120	1,148	755	1,201	2,710	598	1,105	1,145	754	1,214		
6. Ratio, (5) to (4)	1.78	1.64	1.58	1.38	2.03	1.58	1.69	1.31	2.13	2.93	3.48		
						TOTAL CAPITAL-INCOME RATIO							
7. 1870 [a]	8.77	6.60	7.25	4.90	8.45	12.70	3.45	11.23	10.80	8.50	16.87	2.96	33.8
8. 1910 [a]	7.33	6.45	5.29	3.34	8.05	9.20	3.84	8.70	6.96	7.68	9.63	1.72	23.5
9. Ratio, (8) to (7)	0.84	0.98	0.73	0.68	0.95	0.72	1.11	0.77	0.64	0.90	0.57		
10. 1910 [a]	6.88	6.05	4.97	3.13	7.56	8.63	3.60	8.17	6.53	7.20	9.04	1.62	23.5
11. 1950 [a]	4.57	2.85	3.41	2.83	4.68	5.52	2.70	7.70	4.02	5.53	4.11	1.17	25.6
12. Ratio, (11) to (10)	0.66	0.47	0.69	0.90	0.62	0.64	0.75	0.94	0.62	0.77	0.45		
						REPRODUCIBLE CAPITAL-INCOME RATIO							
13. 1870 [a]	2.72	3.20	2.15	1.22	2.97	3.01	1.15	3.35	5.02	5.70	3.06	0.62	22.8
14. 1910 [a]	2.45	3.51	2.17	1.37	3.18	2.60	1.65	2.40	2.05	2.86	1.87	0.46	18.8
15. Ratio, (14) to (13)	0.90	1.10	1.01	1.12	1.07	0.86	1.43	0.72	0.41	0.50	0.61		
16. 1910 [a]	2.30	3.29	2.04	1.29	2.98	2.44	1.55	2.25	1.92	2.68	1.76	0.43	18.7
17. 1950 [a]	1.63	1.67	1.82	1.30	2.11	1.87	1.36	1.83	1.21	1.63	0.98	0.29	17.8
18. Ratio, (17) to (16)	0.71	0.51	0.89	1.01	0.71	0.77	0.88	0.81	0.63	0.61	0.56		

[a] Capital is for specified census year. Income is for year preceding census year.

SOURCE: Tostlebe, *Capital in Agriculture:* lines 1, 2, 4, and 5 from Table H-3, pp. 214–216; lines 7, 8, 10, and 11 from Table 22, pp. 108–109; lines 13, 14, 16, and 17 calculated as difference between Table 26, p. 117, and Table 22.

for the four sectors in Table 27), there is convergence—a reduction in the variability—in the capital-income (-output) ratios. When the ratios are initially high, the decline tends to be large or the rise small compared with the change in initially low or moderate ratios. The convergence is expressed statistically in columns 12 and 13 of Table 29. For the total capital-output ratios, the weighted absolute deviation—a proper measure of the variability of the ratios among the regions—drops from 2.96 in 1869 to 1.72 in 1909, and even as a relative of the mean, declines from 33.8 to 23.5. The average absolute deviation also declines, from 1.62 in 1909 to 1.17 in 1949, but that decline is about proportional to the drop in the countrywide mean ratio. A similar convergence, primarily during the first half of the total period, occurs in the regional ratios of reproducible capital to output.

Both the wide differences among regions in their capital-output ratios and the convergence of these differences by 1910 or 1920 were to be expected. In any major industry the various branches have different relations of capital to output, and as an industry grows the new areas tend to become more similar to the old, to the point where integration is completed and more intensive specialization and diversification begin. We shall observe the same two findings within each major sector covered.

Table 30 presents the detail we have for mining and manufacturing concerning the movement of capital-output ratios for the varying definitions of numerator and denominator. For mining we have capital excluding land, and fixed capital, that is, buildings and machinery. For each, the ratio to gross output moves in a similar pattern, rising more than threefold from 1870 to 1919 and then declining sharply. Over the period as a whole, the trend in each ratio is upward. One can only conjecture whether the results would be the same if net income originating were substituted for gross output in the denominator. There is no reason for assuming major long-term trends in the ratio of net to gross output for the branches of mining, but the internal shifts did probably tend to reduce the ratio of net income to gross output for total mining. In 1929, the ratio of total payments to individuals plus corporate savings to gross income in oil and gas was barely over 20 per cent, whereas it was over 65 per cent in anthracite coal and bituminous coal, and over 55 per cent in metals.[16] Since the share of

[16] See Kuznets, assisted by Epstein and Jenks, *National Income and Its Composition, 1919–1938* (New York, NBER, 1941), Vol. II, Tables Q1, Q7, and Q8, pp. 551 and 556.

TABLE 30

OUTPUT AND CAPITAL-OUTPUT RATIOS, MINING AND MANUFACTURING, BASED ON VOLUMES IN 1929 PRICES, 1870–1953
(amounts in billions of dollars)

CENSUS YEARS	MINING			MANUFACTURING					
						Ratio of Total Capital to:		*Ratio of Fixed Capital to:*	
	Output (1)	Ratio of Capital, Excluding Land, to Output (2)	Ratio of Plant and Equipment to Output (3)	Output (4)	Value Added Including Land (5)	Output (6)	Value Added (7)	Output (8)	Value Added (9)
1. 1870	0.18	0.72	0.61	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
2. 1880	0.35	1.16	1.02	8.82	3.20	0.55	1.51	0.27 [a]	0.75 [a]
3. 1890	0.67	1.36	1.19	15.27	6.76	0.73	1.65	0.36	0.82
4. 1900	1.13 [b]	n.a.	1.39 [b]	23.18 [c]	9.92 [c]	0.80 [c]	1.88 [c]	0.42	0.97
5. 1900	1.13 [b]	n.a.	1.39 [b]	21.98 [d]	9.28 [d]	0.79 [d]	1.88 [d]	0.41 [a]	0.97
6. 1909	1.93	1.80	1.52	32.65	13.67	0.97	2.31	n.a.	n.a.
7. 1919	2.44 [c]	2.30 [c]	2.00 [c]	45.09	18.04	1.02	2.55	n.a.	n.a.
8. 1919	2.51 [d]	2.27 [d]	1.97 [d]	45.09	18.04	1.02	2.55	n.a.	n.a.
9. 1929	3.98	2.14	1.57	71.22	31.20	0.88	2.02	0.43	0.99
10. 1937	4.21 [e]	1.59 [e]	1.10 [e]	74.69	30.58	0.74	1.81	0.35	0.85
11. 1948	5.81	1.34	0.92	128.12 [c]	50.33 [c]	0.61 [c]	1.55 [c]	0.29 [c]	0.73 [c]
12. 1948	5.81	1.34	0.92	128.60 [d]	n.a.	0.61 [d]	n.a.	0.29 [d]	n.a.
13. 1953	6.46	1.26	0.84	167.82	n.a.	0.59	n.a.	0.27	n.a.

[a] Based on the assumption of the same distribution between fixed and working capital as for 1890, or as for the preceding 1900 figure.

[b] See estimate in Table 27.

[c] Comparable with entries for preceding years.

[d] Comparable with entries for following years.

[e] Figure for 1940.

SOURCE: See Tables 31 and 32.

oil and gas in total mining output increased prodigiously—from a few percentage points in 1870 to over 60 per cent in 1953—the ratio of net to gross output in mining as a whole must have declined materially. If so, the capital-net output ratio in mining must have increased more markedly than the capital-gross output ratios shown in columns 2 and 3 of Table 30.

More information is available on the important sector of manufacturing. Both total and fixed capital can be related not only to gross output, but also to net value added—a closer approximation to net income originating than is gross output. (Net value added excludes the cost of fuel and raw materials but includes payments to other industries and capital consumption.) The striking feature of columns 6 to 9 is that the movement of the capital-output ratios over time follows the same pattern, whether the numerator is total or fixed capital, and whether the denominator is gross output or net value added. Here, there was apparently very little substitution of fixed capital (buildings and machinery) for other items in total capital (as there was in agriculture of fixed capital for livestock); and there was not much movement over time in the ratio of net value added to gross value of output. We find, therefore, that all the ratios rose to a peak in 1919, declined thereafter, and showed no significant rise or decline over the period as a whole.

Have the movements in the capital-output ratios observed for total mining and total manufacturing been the same for the branches that can be distinguished within these sectors? Table 31 answers this question for the five branches of mining for the period 1870–1953. The movements appear to follow the same pattern in all branches—a rise to a peak in 1919 and a subsequent decline—with the trend over the period as a whole being neither significantly up nor down. But there are some interesting exceptions. In anthracite, the sharp decline in output after 1919 not only kept the capital-output ratio (capital, excluding land) from dropping but actually tended to raise it. In metals, the peak capital-output ratio, whether for total or fixed capital, was reached in 1890. In oil and gas—an extremely interesting case because of its high rate of growth—the capital-output ratio, though higher in 1870 than that for any other branch of mining, rose quite rapidly and by 1919 was more than three times its 1870 level. Then it declined precipitously and by 1953 was significantly below its 1870 level, particularly so for fixed capital. But the oil and gas branch only reproduces in exaggerated form the pattern of movement observed in the

TABLE 31

OUTPUT AND CAPITAL-OUTPUT RATIOS, MAJOR BRANCHES OF MINING, BASED ON VOLUMES IN 1929 PRICES, 1870–1953
(amounts in millions of dollars)

Branches of Mining	1870 (1)	1890 (2)	1919 [a] (3)	1919 [b] (4)	1940 (5)	1953 (6)	Ratio, 1919 to 1870 (7)	Ratio, 1953 to 1919 (8)
				OUTPUT				
1. Metals	29	131	465	465	643	731	16.03	1.57
2. Anthracite coal	91	235	456	456	269	161	5.01	0.35
3. Bituminous coal	35	172	829	829	832	828	23.69	1.00
4. Petroleum and natural gas	7	65	535	535	2,051	3,939	76.43	7.36
5. Other nonmetals	n.c.	71	155	223	411	801	n.a.	3.59
6. Total	176 [c]	673	2,439	2,507	4,206	6,460	13.86	2.58
				RATIO OF CAPITAL, EXCLUDING LAND, TO OUTPUT				
7. Metals	1.29	2.73	2.16	2.16	1.24	1.39	1.67	0.64
8. Anthracite coal	0.41	0.50	0.53	0.53	0.55	0.64	1.29	1.21
9. Bituminous coal	0.91	0.69	1.25	1.25	0.88	1.17	1.37	0.94
10. Petroleum and natural gas	1.75	3.78	5.86	5.86	2.26	1.41	3.35	0.24
11. Other nonmetals	n.c.	1.16	1.19	1.23	0.94	0.61	n.a.	0.50
12. Total	0.72	1.36	2.30	2.27	1.59	1.26	3.19	0.56
				RATIO OF FIXED CAPITAL, EXCLUDING LAND, TO OUTPUT				
13. Metals	1.14	2.37	1.49	1.49	0.59	0.77	1.31	0.52
14. Anthracite coal	0.35	0.45	0.45	0.45	0.34	0.32	1.29	0.71
15. Bituminous coal	0.66	0.59	1.07	1.07	0.53	0.72	1.62	0.67
16. Petroleum and natural gas	1.64	3.45	5.51	5.51	1.73	1.01	3.36	0.18
17. Other nonmetals	n.c.	0.88	0.95	0.98	0.43	0.33	n.a.	0.34
18. Total	0.61	1.19	2.00	1.97	1.10	0.84	3.28	0.43

n.c. = no comparable data available.
[a] Comparable with entries for preceding years.
[b] Comparable with entries for following years.
[c] Including an estimate for "other" nonmetals.

SOURCE: Israel Borenstein, *Capital and Output Trends in Mining Industries, 1870–1948* (Occasional Paper 45, New York, NBER, 1954), pp. 67, 34–35, and unpublished extensions.

others. Apparently increasing mechanization and technological complexity result first in an accumulation of capital, total or fixed, which means a higher rate of growth than in output; then, with the slowing down in the growth of the industries and with the technological base set, capital saving improvements can be introduced and attempts made to raise the rate of utilization of existing capacity.

Two aspects of the movement within mining deserve note. First, the relative importance of the oil and gas industry increased rapidly, its output accounting for less than 10 per cent of the total in 1890 but for over 60 per cent in 1953. With its capital-output ratio always well above the ratio for mining as a whole, this rise in relative importance of the industry contributed to an upward trend in the capital-output ratio for mining as a whole. The changes in the sector-mix therefore tended to raise the capital-output ratio throughout the period. Second, the capital-output ratios in the several branches converged, particularly between 1919 and 1953. Weighted absolute deviations of the branch ratios from the ratio for mining as a whole confirm that impression. For the ratios of total capital to output, these deviations were 0.99 for 1890, 1.57 for 1919 (or 1.53 comparable with the figure for the earlier year), and 0.21 for 1953. The weighted relative deviations for the relevant dates—the coefficients of variation—were 0.73, 0.69 (or 0.67 comparable with the figure for 1890), and 0.17, respectively. For the ratios of fixed capital to output, the absolute deviations were 0.89 for 1890, 1.51 for 1919 (or 1.54 comparable with the figure for the earlier year), and 0.20 for 1953. The coefficients of variation were 0.75, 0.77, and 0.24, respectively. The striking decline in the capital-output ratio for the oil and gas branch between 1919 and 1953, as well as the sharp drop in the ratio for metals from its peak in 1890—another branch with a high capital-output ratio—contributed to the greater equality in the branch ratios in the later periods than in the earlier periods.

For the manufacturing sector many more branches can be distinguished than for mining. Only the major industrial branches are shown in Table 32, but a more detailed analysis can be found in the monograph dealing with this sector. The main purpose of Table 32 is to reveal the similarity between the pattern of movement of the total capital-output ratio for manufacturing as a whole and that for the twelve major branches distinguished. In all branches—with the exception of rubber and its products, and transportation equipment (both of which showed a peak in 1900), and printing and publishing (which showed a peak in 1937)—the peak capital-output ratio was reached

in 1919. In all of them (except printing and publishing) the movement in the ratio was downward after 1919. Some of the exceptions are illuminating: both rubber and its products, and transportation equipment (mainly automobiles) were going through periods of turbulent growth and mechanization somewhat later than the other branches, and their peak ratios in 1900 probably indicate that the high rates of new additions to plant and equipment reflected an expectation of growth exceeding the needs of current output.

For the other findings suggested by study of the major and minor branches of manufacturing we turn to the analysis in the relevant monograph (Creamer, Dobrovolsky, and Borenstein, *op. cit.*). Three conclusions merit emphasis here. The first concerns the effect of shifts in relative importance of various industries within total manufacturing. The finding, noted above, that the major branches display similar movements in their total capital-output ratios suggests that the shifts in weight among industries could not contribute greatly to the movement of the sector-wide ratio. And this suggestion is confirmed by direct calculations, which indicate that of the rise in the total capital-output ratio from 1880 to 1919, only one-sixth can be attributed to the altered composition of the manufacturing total. The downward movement from 1919 to 1937 occurred without any contribution from the changing industry-mix. The latter, in fact, would have made for a slight rise, rather than a decline, in the total capital-output ratio.

The second conclusion relates to the increasing convergence among the industry total capital-output ratios, similar to that observed among the ten regions in agriculture and the five divisions in mining. The coefficient of variation in the total capital-output ratios based on values in 1929 prices, in thirty-seven manufacturing industries, ranged from 63 to 70 per cent (of the mean ratio for manufacturing as a whole) from 1880 to 1900. It then dropped significantly and fairly consistently to slightly over 31 per cent in 1948. This means in essence that, in those industries for which the initial capital-output ratio was high, the decline was greater, or the rise smaller, than in those industries for which the initial capital-output ratio was low.

The third conclusion is that, while the relative changes in output and in total capital were positively correlated, the association between relative changes in output and in the total capital-output ratio was negative. For fifty or more industries distinguished in this calculation based on volumes in 1929 prices, the coefficient of correlation between relative changes in output and in capital was +0.85 for 1880 to 1919,

TABLE

OUTPUT AND CAPITAL-OUTPUT RATIOS, MAJOR BRANCHES OF
(amounts in mill

Branches of Manufacturing	1880 (1)	1900 [a] (2)	1900 [b] (3)
			OUT
1. Food and kindred products	2,452	6,794	6,513
2. Textiles and their products	1,553	3,822	3,279
3. Leather and leather products	1,013	1,569	1,435
4. Rubber products	17	37	37
5. Forest products	1,615	3,476	3,314
6. Paper, pulp, and products	90	334	332
7. Printing, publishing, and allied industries	225	965	965
8. Chemicals and allied substances	286	829	829
9. Petroleum refining	28	173	173
10. Stone, clay, and glass products	188	547	505
11. Metal and metal products	1,183	4,202	4,179
a. Iron and steel and products	459 } 619	1,434	1,452
b. Nonferrous metals and products	160 }	801	757
c. Machinery (except d)	513	1,658	1,658
d. Transportation equipment	51	309	312
12. Miscellaneous manufactures	170	434	423
13. Total	8,820	23,182	21,984
			RATIO OF TOTAL
14. Food	0.37	0.55	0.55
15. Textiles	0.64	0.82	0.88
16. Leather	0.32	0.57	0.56
17. Rubber	0.59	2.00	2.00
18. Forest products	0.52	0.82	0.68
19. Paper and allied products	1.00	1.36	1.36
20. Printing	0.64	0.83	0.83
21. Chemicals	0.72	1.05	1.05
22. Petroleum refining	1.32	1.13	1.13
23. Stone, clay, and glass	0.83	1.36	1.40
24. Metal products	0.86	1.07	1.07
a. Iron and steel	1.03 } 0.95	1.10 } 1.00	1.10 } 1.00
b. Nonferrous	0.72 }	0.81 }	0.81 }
c. Machinery	0.81	1.16	1.16
d. Transportation equipment	0.33	1.09	1.12
25. Miscellaneous	0.52	0.79	0.80
26. Total	0.55	0.80	0.79

	1890	1900 [a]	1900 b
			RATIO OF FIXED CAPITAL,
27. Food	0.21	0.25	0.24
28. Textiles	0.35	0.36	0.39
29. Leather	0.09	0.12	0.12
30. Rubber	0.90	1.27	1.19
31. Forest products	0.20	0.19	0.19
32. Paper and allied products	0.96	0.82	0.78
33. Printing	0.44	0.42	0.39
34. Chemicals }	0.42	0.47	0.44
35. Petroleum refining }			
36. Stone, clay, and glass	0.50	0.64	0.65
37. Metal products	0.44	0.50	0.47
38. Miscellaneous	0.20	0.24	0.23
39. Total	0.29	0.33	0.33

[a] Comparable with entries for preceding years.
[b] Comparable with entries for following years.
[c] Calculated after adjustment of 1880 (or 1890) by ratio of entry for 1900 in col. 3 to that in col. 2.
[d] Calculated after adjustment of 1953 by ratio of entry for 1948 in col. 6 to that in col. 7.

MANUFACTURING, BASED ON VOLUMES IN 1929 PRICES, 1880–1953
ions of dollars)

1919 (4)	1937 (5)	1948 [a] (6)	1948 [b] (7)	1953 (8)	Ratio of 1919 to 1880 [c] (9)	Ratio of 1953 to 1919 [d] (10)
PUT						
11,240	18,346	26,196	26,196	34,153	4.8	3.0
6,530	10,286	14,735	14,735	15,968	4.9	2.4
1,854	1,510	2,008	2,008	1,979	2.0	1.07
459	1,089	2,743	2,743	3,241	27.0	7.1
2,710	2,398	4,161	4,161	4,269	1.76	1.58
966	1,834	3,242	3,242	4,082	10.9	4.2
2,054	2,871	3,725	3,725	3,898	9.1	1.90
2,128	4,911	9,054	9,054	11,515	7.4	5.4
910	6,150	12,532	12,532	16,221	32.5	17.8
982	1,622	2,885	2,885	3,814	5.6	3.9
14,282	21,983	42,868	43,194	62,362	12.1	4.3
4,747 } 6,777	6,630	13,833 } 17,510	17,356	20,733	11.0	3.1
2,030 }	3,265	3,677 }				
4,732	6,194	15,615	15,615	22,998	9.2	4.9
2,773	5,894	9,743	10,223 [e]	18,631	54.4	6.4
975	1,687	3,975	4,129	6,320	5.9	6.2
45,090	74,687	128,124	128,604 [e]	167,821	5.4	3.7
CAPITAL TO OUTPUT						
0.68	0.50	0.40	0.40	0.38	1.85	0.56
1.03	0.55	0.47	0.47	0.49	1.51	0.47
0.76	0.54	0.41	0.41	0.41	2.36	0.54
1.53	0.75	0.52	0.52	0.51	2.61	0.33
1.16	1.06	0.70	0.70	0.76	2.69	0.65
1.58	1.12	0.76	0.76	0.75	1.58	0.48
0.76	0.87	0.69	0.69	0.67	1.18	0.88
1.30	0.81	0.72	0.72	0.84	1.82	0.64
1.52	1.06	0.89	0.89	0.76	1.15	0.50
1.71	1.22	0.74	0.74	0.69	1.98	0.40
1.16	0.82	0.66	0.64	0.59	1.35	0.52
1.42 } 1.26	1.01 } 0.92	0.70 } 0.70	0.66	0.67	1.32	0.56
0.89 }	0.72 }	0.68 }				
1.18	0.85	0.66	0.66	0.60	1.46	0.51
0.89	0.62	0.58	0.59 [e]	0.50	2.61	0.55
0.97	0.77	0.61	0.68	0.74	1.83	0.68
1.02	0.74	0.61	0.61 [e]	0.59	1.89	0.58

1929	1937	1948 [a]	1948 [b]	1953	Ratio of 1929 to 1890 [c]	Ratio of 1953 to 1929 [d]
EXCLUDING LAND, TO OUTPUT						
0.26	0.18	0.15	0.15	0.12	1.30	0.46
0.30	0.19	0.16	0.16	0.14	0.79	0.47
0.16	0.11	0.09	0.09	0.07	1.78	0.44
0.39	0.23	0.17	0.17	0.14	0.46	0.36
0.58	0.54	0.37	0.37	0.36	2.90	0.62
0.69	0.63	0.45	0.45	0.46	0.76	0.67
0.28	0.25	0.28	0.28	0.28	0.68	1.00
0.55	0.49	0.47	0.47	0.47	1.41	0.85
0.86	0.69	0.38	0.38	0.34	1.69	0.40
0.39	0.35	0.27	0.27 [e]	0.25	0.95	0.64
0.28	0.23	0.21	0.23	0.33	1.47	1.11
0.38	0.31	0.27	0.27 [e]	0.26	1.31	0.68

[e] Includes shipbuilding, excluded in prior years.
SOURCE: Daniel Creamer, *Capital and Output Trends in Manufacturing Industries, 1880–1948* (Occasional Paper 41, New York, NBER, 1954), Table 2, p. 18; Table A-2, pp. 86–90; and unpublished worksheets.

and +0.68 for changes from 1919 to 1948. In other words, industries in which output increased more also showed greater proportional rises in their capital stock. However, the correlation between relative changes in output and in the capital-output ratio was negative, in the order of −0.39 for 1880–1919, and −0.37 for 1919–1948 (all coefficients were statistically significant). In other words, the greater the rise in output, the less the rise, or the greater the decline, in the total capital-output ratio.

The last two conclusions are, of course, interrelated. High capital-output ratios are likely to be found among industries in the early stages of growth, when extensive expansion is at a high rate and building is in advance of current needs. It is in these industries that the relative increase in output is also likely to be at a high rate, and it is in these industries, all other conditions being equal, that the capital-output ratio is likely to decline most precipitously. Thus, one and the same complex of factors—over-expansion in terms of current needs in "new" industries—would produce, as time goes on, a convergence of the ratios, that is, a situation in which the initially higher ratios would decline most or rise least, and the initially lower ratios decline least or rise most, yielding a negative correlation between the rate of relative growth in output and the relative change in the capital-output ratio.

It is in the capital-output ratios in the public utilities sector, a field that is of great importance in the history of industrialization and capital formation in this country and many others, that we observe the most rapid declines (Table 33). The contrast between the ratios for public utilities and the others discussed so far, particularly those for manufacturing, is, of course, much exaggerated by differences in the denominators used. Even net value added in manufacturing is a gross concept relative to net income originating: in 1929 the latter was less than 30 per cent of gross value of output, whereas net value added was well over 40 per cent. The gross income or output of the public utilities sector is, in a way, a far "netter" concept: in 1929, net income originating in steam railroads (including Pullman and express) accounted for over 70 per cent of gross income; that in electric light and power and gas, for well over 60 per cent; that in communications (telephone and telegraph), for somewhat over 70 per cent.[17] Hence the

[17] See Kuznets, assisted by Epstein and Jenks, *National Income and Its Composition, 1919–1938* (New York, NBER, 1941), Vol. II, Tables P1 and P2.

TABLE 33

OUTPUT AND CAPITAL-OUTPUT RATIOS, MAJOR COMPONENTS OF THE REGULATED INDUSTRIES, BASED ON VOLUMES IN 1929 PRICES, 1880–1950
(amounts in millions of dollars)

Components of Regulated Industries	1880 (1)	1890 (2)	1900 (3)	1910 (4)	1920 (5)	1930 (6)	1940 (7)	1950 (8)	*Ratio of:* 1900 to 1880 (9)	1910 to 1890 (10)	1920 to 1900 (11)	1930 to 1910 (12)	1940 to 1920 (13)	1950 to 1930 (14)
							OUTPUT							
1. Steam railroads	610	1,377	2,352	4,157	5,959	5,570	5,752	8,451	3.9	3.0	2.5	1.3	0.97	1.5
2. Electric railways		151	295	648	900	775	473	339		4.3	3.1	1.2	0.53	0.44
3. Electric light & power		7.2	46.8	196	685	1,874	3,024	6,806		27.2	14.6	9.6	4.4	3.6
4. Telephones		15	101	414	677	1,180	1,316	2,591		27.6	6.7	2.9	1.9	2.2
5. Local bus lines					26 [a]	155	245	411					9.4 [b]	2.7
6. All other		161	372	881	1,550	2,784	4,687	10,274		5.5	4.2	3.2	3.0	3.7
7. Total	757	1,712	3,167	6,297	9,792 [c]	12,339	15,497	28,872	4.2	3.7	3.1	2.0	1.6	2.3
							CAPITAL-OUTPUT RATIOS							
8. Steam railroads	16.0	9.9	6.5	4.4	3.6	4.4	4.0	2.7	0.41	0.44	0.55	1.00	1.11	0.61
9. Electric railways		3.3	6.8	5.8	4.1	3.4	3.4	2.3		1.76	0.60	0.59	0.83	0.68
10. Electric light & power		12.1	12.3	10.5	4.8	3.7	2.4	1.3		0.87	0.39	0.35	0.50	0.35
11. Telephones		5.0	3.9	2.6	1.6	1.9	1.8	1.8		0.52	0.41	0.73	1.12	0.95
12. Local bus lines					0.2 [a]	0.7	1.0	1.7					5.00 [b]	2.43
13. All other		12.6	7.2	4.3	3.7	2.9	1.7	0.9		0.34	0.51	0.67	0.46	0.31
14. Total	15.3	9.6	6.6	4.6	3.6 [c]	3.6	2.7	1.6	0.43	0.48	0.55	0.78	0.75	0.44

All entries in cols. 1–8, except the first and last of a series, are three-year averages centered on the second year.

[a] Estimate for 1922.

[b] Ratio of 1940 to 1922.

[c] Including an estimate for 1920 (instead of 1922) for line 5 (or line 12).

SOURCE: Ulmer, *Capital in Transportation, Communications, and Public Utilities*, Appendix I.

capital-output ratios in Table 33 are more properly compared with ratios to net income originating, or lacking the latter, ratios to net value added in manufacturing or to net farm income in agriculture. Yet even with this adjustment, there is little question that the capital-output ratios in the public utilities sector, particularly in steam railroads and in electric light and power, have for a long time been far higher than the comparable ratios—for fixed capital—in manufacturing, mining, and agriculture. It is also evident that these ratios were at very high levels in the early periods of the growth of these industries; and that they declined sharply, indicating remarkable progress in the efficiency of replacement and utilization of durable capital equipment.

The three conclusions concerning manufacturing, agriculture, and mining apply here, too. We find convergence among the capital-output ratios for the several components of public utilities—the initially high ratios move downward at a rate much greater than that of the initially lower ratios. We find this occurring in each component, and following a relatively similar pattern. And we find evidence of negative correlation between the relative increase in output and the relative change in the capital-output ratio, particularly conspicuous in recent decades when the resurgence of growth in output is accompanied by a decline in the capital-output ratios to record low levels.

For the public utilities sector there are two additional findings. First, in several components, where we can observe the early record of the industry, the initial period shows a rise in the capital-output ratios. This is observed for electric railways and for electric light and power in the rise from 1890 to 1900, and more recently for local bus lines. It may well be that in some industries, in which it is technologically possible, the very early phases witnessed an attempt to produce with only a small investment in fixed capital; and only somewhat later a big durable capital investment program became feasible, which resulted in a temporary but substantial rise in the capital-output ratio. In a sense, this parallels the rise in the ratios in agriculture, mining, and manufacturing that culminated in the 1920's. Agriculture, however, saw a long period of increasing mechanization and industrialization, whereas in the public utilities there were much shorter periods of transition from a makeshift, semi-experimental scale of operation to the building up of an elaborate fixed capital network.

The second additional finding is that the capital-output ratios declined at a decreasing rate, not only on an absolute, but even on a relative, basis. In other words, as time goes on and the efficiency

in the use of capital increases, it becomes more difficult to reduce the ratio. This aspect of the long-term movement is clearly observable in lines 8 to 11 for the major components of the sector and for the sector as a whole. It is only in the recent decades that we see a break in that slowing down in the rate of utilization of capital, and it remains to be seen how transient or persistent the new and sizable reduction in the capital-output ratios will prove to be.