# QUANTITATIVE ASPECTS OF THE
# ECONOMIC GROWTH OF NATIONS:

## VI.    LONG-TERM TRENDS IN
## CAPITAL FORMATION PROPORTIONS

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# EXPLANATORY NOTES

The following abbreviations have been used throughout the paper:

GDCF = Gross domestic capital formation, i. e., additions to capital stock within the country gross of capital consumption, and disregarding capital exports or imports. Equals the sum of construction, producers' durable equipment, and inventory accumulation.

GDP = Gross domestic product, i. e., total output originating within the country gross of capital consumption, and before allowance for flow of factor payments across boundaries.

GNCF = Gross national capital formation. Same as GDCF, but after subtraction of capital imports or addition of capital exports.

GNP = Gross national product. Same as GDP but with addition of net balance of factor payments across boundaries.

CC = Capital consumption allowance.

NDCF = Net domestic capital formation. Same as GDCF, but net of CC.

NDP = Net domestic product. Same as GDP, but net of CC.

NNCF = Net national capital formation. Same as GNCF, but net of CC.

NNP = Net national product. Same as GNP, but net of CC.

NBFCA = Net balance on foreign current account.

GFCF = Gross fixed capital formation. Equals the sum of construction and producers' durable equipment.

NFCF = Net fixed capital formation. Same as GFCF, but net of CC.

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I.  Introduction

In Paper V  we presented evidence on capital formation in some fifty-odd countries in post-World War II years, under five heads:  (1) the level and range of capital formation proportions;  (2) the composition of capital formation by type of good and industry of use;  (3) the ratios of capital formation proportions to rates of growth in national product--the incremental capital-output ratios;  (4) the relation between industrial structure of national product and the incremental capital-output ratio;  (5) the distribution of capital formation by type of purchaser and source of financing.

In dealing with the long-term trends in capital formation proportions for a much smaller number of countries, we follow the same order of discussion, except that item (2) above is combined with item (4) and discussed after the presentation of the capital-output ratios.  We begin each section with a summary of the findings for recent years in Paper V and their implications with respect to long-term trends.  We then present the direct evidence on long-term trends in those countries for which sufficiently long series--not much less than four decades and preferably longer--are available.

The long-term evidence--for some ten to twelve countries--does not lend itself to easy interpretation.  Moreover, we cannot assign margins of error to the estimates; nor, because of our inadequate knowledge of the economic history of each country, can we evaluate the bearing upon long-term trends of the findings for various periods.  All we can do here is assemble the various estimates, many of them recently prepared and still unpublished, and try to indicate what they show.  More new questions will be raised than old ones answered; but if these new questions reflect, as we hope, the variety of experience rather than vagaries in the supply of data and in estimating procedures, they should be helpful not only in the analysis of the past but also in the diagnosis of the present.

## II.  Levels and Trends in Capital Formation Proportions

Our findings in Paper V with respect to the level and range of capital for-
mation proportions can be set down briefly. [1]

The proportions of gross domestic capital formation to gross domestic
product ranged from well over 21 percent in the high income countries in Groups
I and II to 14 percent in the low income countries in Group VII (Table 1, line 6,
p. 4).  The range of the gross national capital formation proportion, also posi-
tively associated with per capita income, was somewhat wider:  from over 21 to
about 11.5 percent (Table 1, line 10, p. 4).  For the net domestic capital forma-
tion proportion the range was from between 14 and 15.5 percent in Groups I and
II to about 10.5 percent in Groups VI and VII (Table 4, line 12, p. 14);  and for
the net national capital formation proportion the range was from between 13.5 and
16 percent in Groups I and II to between 7 and 8 percent in Groups VI and VII
(Table 4, line 18, p. 15).

If the international comparisons for post-World War II years may be used
to suggest long-term trends in capital formation proportions, the following infer-
ences can be drawn--at least for the non-Communist countries, to which the find-
ings above were limited.  First, since the recent records include countries with
per capita incomes as low as or lower than those in the long-term sample, we
should expect the long-term capital formation proportions to lie between 11.5 and
somewhat over 21 percent for the gross and between 7 and 16 for the net.  To be
sure, these ranges relate to means for groups of countries, while in the long-
term records we deal with individual countries.  But, on the other hand, here we
have averages for long periods, not for a seven-year span;  and the resulting re-
duction in variability is perhaps not unlike that involved in the use of group ave-
rages in cross-section analysis.  Second, since the per capita incomes of the
countries covered below rise, we should expect the capital formation propor-
tions--gross and net, domestic and national--to show rising trends.  Third, the
upward trend in national capital formation proportions should be more pronounced
than that in domestic proportions;  or, in other words, the countrywide savings
rate should, in the long run, rise more than the countrywide investment rate.

We have long-term records of capital formation and national product for
twelve countries.  With some exceptions--Italy, Japan, Union of South Africa,
and Argentina--these countries have relatively high per capita incomes;  and
have been classified by us for recent years in Group I or II.  The sample is thus
limited with respect to the range in per capita income.  For most of the countries
the records reach into the second half of the 19th century, and for the United
Kingdom and the United States even further back;  but for Argentina and the Union
of South Africa they are limited to the 20th century.

The appendix tables present the long-term records for each country in
overlapping decade averages, but they have been summarized here for longer
periods to provide a clearer picture of the long-term levels and trends.

In Table 1 we show averages for two long periods.  The first extends from
the mid-19th century (or a later date if the series do not reach that far back) to
World War I.  The second begins toward the end of the 19th century (or again
somewhat later, depending upon the availability of data) and extends to the years
after World War II;  but we exclude both world war quinquennia from the average

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1.      References in this and the following summaries are to tables and pages in
        "Quantitative Aspects of the Economic Growth of Nations, V. Capital For-
        mation Proportions:  International Comparisons for Recent Years," Eco-
        nomic Development and Cultural Change, Vol. VIII, No. 4, Part II, July 1960;
        and to Roman numeral groups of countries classified by per capita income
        as defined in Paper II and used in Papers II, IV, and V.

Table 1.
Capital Formation Proportions, Two Long Periods, Selected Countries (Percentages based on current price totals)

| Country | Period (1) | Duration (years) (2) | Proportions (%) GDCF/ GDP (3) | GNCF/ GNP (4) | NDCF/ NDP (5) | NNCF/ NNP (6) |
|---|---|---|---|---|---|---|
| **A. Mid-19th Century to World War I** | | | | | | |
| 1. United Kingdom | 1855-1914 | 60 | 9.0 | 12.8 | 7.3 | 11.2 |
| 2. Germany | 1851-1913 | 63 | (19.8) | (21.1) | 12.9 | 14.4 |
| 3. Italy | 1861-1915 | 55 | 12.5 | 12.2 | 6.5 | 6.3 |
| 4. Denmark | 1870-1914 | 45 | 12.6 | 10.8 | 7.7 | 5.7 |
| 5. Norway | 1865-1914 | 50 | 13.2 | 10.5 | 8.2 | 5.4 |
| 6. Sweden | 1861-1915 | 55 | 12.2 | 11.0 | (7.7) | (6.4) |
| 7. United States | 1869-1913 | 45 | 21.9 | 22.1 | 13.1 | 13.4 |
| 8. Canada | 1870-1915 | 45 | 19.7 | 12.5 | 10.8 | 2.3 |
| 9. Australia | 1861-1914/15 | 54.5 | 15.2 | 12.7 | 10.4 | 7.4 |
| 10. Japan | 1887-1916 | 30 | 10.9 | 9.7 | 6.0 | 5.4 |
| **B. End of 19th through 20th Century** | | | | | | |
| 11. United Kingdom | 1895-1914; 1921-38; 1952-58 | 45 | 10.6 | 12.4 | 6.0 | 8.0 |
| 12. Germany (unweighted) | 1891-1913; 1928-38; 1952-58 | 41 | (20.3) | (21.8) | 12.7 | 14.3 |
| 13. Italy | 1896-1915; 1921-40; 1946-55 | 50 | 18.0 | 16.5 | 10.1 | 8.7 |
| 14. Denmark | 1895-1914; 1921-39; 1952-58 | 46 | 14.7 | 15.1 | 9.4 | 9.9 |
| 15. Norway | 1895-1939; 1952-58 | 52 | 20.8 | 18.2 | 14.4 | 11.6 |
| 16. Sweden | 1901-50; 1952-58 | 57 | 18.2 | 18.2 | (11.8) | (11.5) |
| 17. United States | 1894-1913; 1919-38; 1946-55 | 50 | 20.1 | 20.8 | 8.4 | 9.2 |
| 18. Canada | 1896-1915; 1921-40; 1946-55 | 50 | 20.3 | 19.0 | 10.1 | 8.2 |
| 19. Australia | 1896-1914/15; 1920/21-1938/39; 1952/53-1958/59 | 45.5 | 19.4 | 18.6 | 14.1 | 13.1 |
| 20. Japan | 1902-40; 1952-58 | 46 | 19.8 | 19.6 | 14.1 | 13.9 |
| 21. Argentina | 1900-54 | 55 | 26.9 | 22.8 | 14.0 | 9.3 |
| 22. U. of S. Africa | 1919-55; (1919-38; 1946-55) | 37 (30) | 22.9 | (19.5) | 17.8 | (14.0) |

The entries are weighted averages in that the capital formation proportion, based on current price totals, for each subperiod (a decade or less) is multiplied by the output total in constant prices with allowance for any difference in

Table 1 (Cont.)

the duration of the subperiods. The proportions are for successive subperiods, as given in the appendix tables, and the output weights are from the sources cited in the notes to those tables.

The entries in parentheses in lines 2, 6, 12, and 16 are approximations based on the assumption that CC was 0.4 of GDCF.

The estimates for Argentina (line 21) in this and the following tables are based on constant price totals.

The entries in parentheses in line 22, columns 4 and 6, are for the shorter period in parentheses in column 1.

if the levels of capital formation proportions are distinctively different from peacetime. In general, the records cover over half a century, except that for the Union of South Africa the period is somewhat short of four decades. We excluded France because current work by Professor Jean Marczewski of the ISEA indicates that the old Pupin estimates will be substantially revised (upward) and Professor Marczewski's results are not sufficiently advanced at present to be used in detail.

The averages in Table 1 are arithmetic means of proportions for decades or shorter periods, weighted by both duration and volume--and are thus ratios of cumulated capital formation to cumulated product. For each subperiod the proportions are also derived from cumulated totals of capital formation and national product--with domestic product sometimes serving in lieu of national product (or vice versa), and with an approximate adjustment for capital consumption in order to pass from gross to net (or vice versa) for some countries or some periods. As indicated in the appendix tables and notes, we tried to make the estimates comparable in scope, including allowances for inventory accumulation where these were omitted in the original estimates and introducing other adjustments. We decided that it was preferable to allow, even if crudely, for differences in scope than to compare estimates either as reported or all short of some component of capital formation. However, the weight of these crude adjustments was never so large as to exercise major effects on the long-term levels or trends.

For the pre-World War I decades for the ten countries in Panel A of Table 1, the average of the gross capital formation proportions ranged from 9 to 22 percent--a slightly wider range than that in post-World War II years (from 11.5 to over 21 percent). For the net proportions, the range is also wider-- from less than 3 to about 14 percent, compared with the recent range of from 7 or 8 to between 13 and 16 percent.

But one can hardly attach much significance to such differences in range between the sample of ten countries in Table 1 and that for the short post-World War II period of between 40 and 50 countries. The intriguing aspect of Panel A of Table 1 is rather the grouping of countries by level of their capital formation proportions and the association between these proportions and other aspects of the countries' economies.

For the period before World War I, the countries fall into two groups with respect to the domestic capital formation proportions. In one--including Germany, the United States, Canada, and Australia--the gross domestic proportions range from about 15 to 22 percent; the net from 10 to 13. On the basis of preliminary estimates we would put France in this group, too--with gross and net domestic capital formation proportions about the same as those for Germany. In the other six countries, the gross domestic proportions range from 10 to 13 percent, and the net from 6 to 8.

The high domestic capital formation proportions in Germany, the United States, Canada, and even Australia are not puzzling since all four countries have enjoyed a high rate of growth of total income. More surprising is the fact that the group with relatively low domestic capital formation proportions includes countries with highly divergent rates of growth of total product, e.g., Japan with a high rate and the United Kingdom and Italy with low rates. This finding will be re-examined below when we deal with the incremental capital-output ratios.

The national capital formation proportions in the period before World War I, i.e., the countrywide savings rates, also fall into two groups--high and low-- but their composition is different from that of the groups of domestic proportions. The group with high national capital formation proportions--of 20 percent gross and well above 10 percent net--includes Germany and the United States (it would also include France). Seven of the other countries are marked by low national capital formation proportions or savings rates--from less than 10 to almost 13 percent gross, and from less than 3 to about 7 percent net; and these countries range from high to low per capita income units. The United Kingdom is unique in that its gross national proportion is relatively low (12.8 percent) and its net national proportion is almost as high as those for Germany and the United States (11.2 percent).

The limited association between the countrywide savings rates, gross or net (in columns 4 and 6), and per capita income is particularly to be noted. If we may use Mulhall's estimates for the mid-1890's for the purpose, which cover nine of the ten countries, and rank the missing country, Japan, at the bottom of the array; Australia, the United States, the United Kingdom, and Canada are at the top in the order given. [2] Yet the national capital formation or savings propor- tions for Canada and Australia are at the low levels of 2.3 and 7.4 percent net and about 12.5 percent gross. Norway, Italy, and Japan are at the bottom of the array by per capita income in the order given; yet their savings proportions are not significantly lower than those for Canada, Australia, and Denmark--all countries with much higher per capita income. In the classification for recent years Italy is in Group IV and Japan in Group V; and the national capital forma- tion proportions of these groups in recent years were markedly below those of Groups I and II (see Paper V, Table 1, line 10, p. 4; and Table 4, line 28, p. 16).

The averages for the more recent long period in Panel B present a less clear and reliable picture. The two world wars, the great depression of the 1930's, and the unusually high capital formation proportions in post-World War II years make it difficult to derive a meaningful secular level even for the long half-century period. Furthermore, we have data for two additional countries, Argentina and the Union of South Africa, with unusually high capital formation proportions for the former.

Nevertheless, some broad findings can be suggested. First, for the countries covered in both panels, the data indicate a convergence, a reduction of differences in capital formation proportions--the result of a greater rise of the proportions that were originally lower than others. This shift from the earlier to the later period can be shown by the unweighted arithmetic means, average deviations, and the ratios of the latter to the former, for the ten countries in both panels (Table 2).

As indicated in Table 2, the dispersion of capital formation proportions was sharply reduced. This finding is not surprising. Given a sample of coun- tries at different stages of economic growth and all growing apace, some quanti- tative and structural characteristics of their economies should become more similar. On the assumption that the process of modern economic growth has substantive unity, the longer it affects the originally different structures, the

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2.      Michael G. Mulhall, Industries and Wealth of Nations, London, 1896, Ta- ble XXXIII, p. 391, supplemented by greater detail in the country sections.

Table 2.
Means and Dispersion of Capital Formation Proportions, Ten Countries, Long
Periods (Based on Table 1)

| | Capital Formation Proportions (%) | | | |
| | GDCF/GDP (1) | GNCF/GNP (2) | NDCF/NDP (3) | NNCF/NNP (4) |
|---|---|---|---|---|
| **Arithmetic Mean** | | | | |
| 1. Panel A | 14.7 | 13.5 | 9.1 | 7.8 |
| 2. Panel B | 18.2 | 18.0 | 11.1 | 10.8 |
| **Average Deviation** | | | | |
| 3. Panel A | 3.56 | 3.22 | 2.19 | 3.13 |
| 4. Panel B | 2.28 | 2.01 | 2.31 | 2.04 |
| **Ratio, A. D. /A. M.** | | | | |
| 5. Panel A | 0.24 | 0.24 | 0.24 | 0.40 |
| 6. Panel B | 0.13 | 0.11 | 0.21 | 0.19 |

less divergent the countries should become--if the characteristics used in the comparison are held to some close upper (or lower) limit. This constraint apparently is true of capital formation proportions which, in the long run, rarely exceed twenty-odd percent gross and fifteen percent net--no matter how long growth continues and how large per capita income becomes.

    Second, there is a slight indication of association of the domestic capital formation proportions with the rate of growth of domestic or national product. Among the first ten countries (lines 11-20), Japan and Sweden show the highest rate of growth of countrywide product in the 20th century (see Paper I, Economic Development and Cultural Change, Vol. V, No. 1, 1956, Table 1, p. 10), with the United States, Norway, and Denmark close behind in that order. And the gross domestic capital formation proportion is relatively low for only one of these five countries--Denmark. The comparison cannot be pushed too far, since the periods for capital formation proportions and the rates of growth should be identical and comparable with respect to treatment of the war years. As already indicated, we shall examine this association between capital formation and rate of growth more closely when we deal with the incremental capital-output ratios.

    Third, there are major deviations from positive association between national capital formation proportions, or savings rates, and per capita income. Even if we disregard the unusually high proportions for Argentina, a country with per capita income well below that in Groups I and II, we find high net national capital formation proportions in Japan and the Union of South Africa--two countries with quite low per capita income; and lower net proportions in Canada and the United States than in Denmark and Norway. [3]

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3.     To confirm our observations on the limited association between national capital formation proportions and per capita income, we computed Kendall's coefficient of rank correlation (Tau)--using the Mulhall figures for the earlier period and the figures for 1938 in W. S. and E. S. Woytinsky, World Population and Production, New York, 1953, Table 185, p. 389, for the later period. For the earlier period the following coefficients were secured: between per capita income and gross national capital formation proportions--+0.56; between per capita

We can now turn to the more important aspect of the long-term records of capital formation proportions--their secular movements within the long periods. Have the capital formation proportions shown a marked and sustained increase with the growth of the countries and the rise in their per capita income?

We carry the record for each country as far back as possible; and distinguish periods of between twenty and thirty years--long enough to cancel the effects not only of the short-term fluctuations associated with business cycles but also of those constituting long swings (Table 3). The only exception is that for the post-World War II period we provide averages for seven to ten years.

In trying to discern the trends in capital formation proportions, we face the problems of the unusually low level in many countries for the period between the two world wars, caused by the depression of the 1930's, and the unusually high level of the post-World War II years, associated with the recovery from the war in some countries. Since it is not easy to make warranted adjustments, we rely mainly on the periods before World War I, and interpret the post-World War I experience only with some rough qualifications.

The following findings seem warranted.

First, we find a significant long-term rise in capital formation proportions in ten of the twelve countries. In Australia, one of the exceptions, the proportions (except for net domestic) are somewhat higher in the post-World War I years than earlier, but for the long period from 1861 to 1914/15 both the gross and net domestic proportions show a downward trend. In Argentina, the other exception, the record begins only in 1900, with unusually high capital formation proportions. Yet the estimates for important components of gross fixed capital formation back to 1885 indicate that the gross domestic capital formation proportions for 1885-1900 were not much lower than those for 1900-14.[4] Argentina is thus truly exceptional: its unusually high capital formation proportions, apparent as early as 1885, decline over time; and an explanation of this unique case would require a close analysis of the country's history and of the estimates implicit in such an analysis. The evidence on the whole, however, supports the expectation derived from the comparison for recent years in Paper V.

Second, in all countries that were international debtors within the period covered in Table 3, the national capital formation proportions rose more than the domestic proportions. This is true of Italy (through the interwar period), Denmark, Sweden, and Germany (if the post-World War II years are included), Canada, Australia, and Japan. It is also true of a creditor country like the United Kingdom, if we consider the record back to the early 19th century. No clear difference can be discerned in the movements of the proportions for Norway, the United States, and Argentina, except that in Argentina the decline in the net national capital formation proportion is not as great as in the net domestic. Thus the inference that national capital formation proportions would show a greater rise over time than the domestic proportions is partially confirmed by the evidence.

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income and net national capital formation proportions--+0.29. For the later period, the coefficients (for the same 10 countries) were both negative and small: -0.02 and -0.16, respectively. Only the first of these four coefficients is statistically significant and only at the 5 percent level.

4.      Manuel Balboa and Alberto Fracchia, "Fixed Reproducible Capital in Argentina, 1935-55," in Raymond Goldsmith and Christopher Saunders, eds., The Measurement of National Wealth, Income and Wealth, Series VIII, London, 1959, Table V, p. 291.

Table 3.
Capital Formation Proportions, Successive Long Periods, Selected Countries
(Percentages based on current price totals)

| | Duration (years) (1) | Proportions (%) | | | |
|---|---|---|---|---|---|
| Country and Period | | GDCF/ GDP (2) | GNCF/ GNP (3) | NDCF/ NDP (4) | NNCF/ NNP (5) |
| **United Kingdom** | | | | | |
| 1. 1700-40 (England and Wales) | 40 | | | | 5.0 |
| 2. 1740-70 ( " " " ) | 30 | | | | 5.5 |
| 3. 1770-1800 ( " " " ) | 30 | | | | 6.5 |
| 4. 1801-11 to 1821-31 | 20 | | | | 7.5 |
| 5. 1821-31 to 1851-61 | 30 | | | 7.4 | 9.0 |
| 6. 1855-74 | 20 | 8.6 | 12.2 | 7.0 | 10.6 |
| 7. 1875-94 | 20 | 8.6 | 12.2 | 6.8 | 10.6 |
| 8. 1895-1914 | 20 | 9.4 | 13.3 | 7.7 | 11.8 |
| 9. 1921-38 | 18 | 8.8 | 9.2 | 3.3 | 3.9 |
| 10. 1952-58 | 7 | 15.5 | 16.4 | 7.9 | 9.0 |
| **Germany** | | | | | |
| 11. 1851-70 (1913 boundaries) | 20 | (13.4) | (14.1) | 8.5 | 9.2 |
| 12. 1871-90 ( " " ) | 20 | (17.6) | (19.9) | 11.4 | 13.8 |
| 13. 1891-1913 (" " ) | 23 | (22.7) | (23.7) | 15.0 | 16.1 |
| 14. 1928-38 (1925 boundaries) | 11 | 13.4 | 14.5 | 5.8 | 7.0 |
| 15. 1952-58 (West Germany) | 7 | 23.9 | 27.4 | 16.6 | 20.4 |
| **Italy** | | | | | |
| 16. 1861-80 | 20 | 9.8 | 8.6 | 4.6 | 3.3 |
| 17. 1881-1900 | 20 | 10.7 | 10.8 | 5.0 | 5.0 |
| 18. 1896-1915 | 20 | 14.6 | 14.9 | 7.9 | 8.4 |
| 19. 1921-40 | 20 | 18.1 | 16.5 | 9.6 | 8.0 |
| 20. 1946-55 | 10 | 21.1 | 18.1 | 13.2 | 10.0 |
| **Denmark** | | | | | |
| 21. 1870-89 | 20 | 9.8 | 7.9 | 5.0 | 3.0 |
| 22. 1890-1909 | 20 | 13.6 | 11.4 | 8.7 | 6.3 |
| 23. 1895-1914 | 20 | 14.4 | 13.1 | 9.3 | 8.0 |
| 24. 1921-39 | 19 | 12.5 | 13.6 | 7.2 | 8.4 |
| 25. 1952-58 | 7 | 18.4 | 19.2 | 12.9 | 13.7 |
| **Norway** | | | | | |
| 26. 1865-84 | 20 | 11.3 | 11.5 | 6.9 | 7.1 |
| 27. 1885-1904 | 20 | 12.9 | 8.6 | 7.8 | 3.2 |
| 28. 1895-1914 | 20 | 14.5 | 10.0 | 9.5 | 4.7 |
| 29. 1900-19 | 20 | 16.5 | 12.9 | 11.0 | 7.2 |
| 30. 1920-39 | 20 | 17.3 | 15.7 | 11.3 | 9.4 |
| 31. 1952-58 | 7 | 30.0 | 27.6 | 22.2 | 19.5 |

Table 3 (Cont.)

|  |  | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|---|
| | **Sweden** | | | | | |
| 32. | 1861-80 | 20 | 11.0 | 10.5 | ( 6.9) | ( 6.4) |
| 33. | 1881-1900 | 20 | 11.4 | 9.9 | ( 7.1) | ( 5.6) |
| 34. | 1901-15 | 15 | 13.3 | 12.1 | ( 8.4) | ( 7.2) |
| 35. | 1911-30 | 20 | 13.5 | 14.8 | ( 8.6) | ( 9.9) |
| 36. | 1931-50 | 20 | 19.6 | 19.3 | (12.8) | (12.5) |
| 37. | 1952-58 | 7 | 21.4 | 21.3 | (14.0) | (13.9) |
| | **United States** | | | | | |
| 38. | 1869-88 | 20 | 21.1 | 20.5 | 13.9 | 13.1 |
| 39. | 1889-1913 | 25 | 22.1 | 22.6 | 12.9 | 13.5 |
| 40. | 1919-38 | 20 | 17.6 | 18.7 | 6.0 | 7.2 |
| 41. | 1946-55 | 10 | 21.5 | 21.9 | 8.5 | 9.0 |
| | **Canada** | | | | | |
| 42. | 1870-1915 | 45 | 19.7 | 12.5 | 10.8 | 2.3 |
| 43. | 1896-1915 | 20 | 22.8 | 15.3 | 13.0 | 3.8 |
| 44. | 1921-40 | 20 | 15.4 | 16.5 | 4.5 | 5.2 |
| 45. | 1946-55 | 10 | 23.3 | 23.0 | 13.6 | 13.0 |
| | **Australia** | | | | | |
| 46. | 1861-80 | 20 | 16.1 | 12.0 | 12.3 | 8.0 |
| 47. | 1881-1900 | 20 | 16.0 | 10.0 | 10.6 | 3.8 |
| 48. | 1896-1914/15 | 20 | 14.3 | 14.5 | 9.3 | 9.2 |
| 49. | 1920/21-38/39 | 19 | 16.5 | 15.3 | 10.8 | 9.2 |
| 50. | 1952/53-58/59 | 7 | 26.5 | 25.4 | 21.6 | 20.4 |
| | **Japan** | | | | | |
| 51. | 1887-1906 | 20 | 10.0 | 7.5 | 5.4 | 3.8 |
| 52. | 1897-1916 | 20 | 10.8 | 9.4 | 5.8 | 5.1 |
| 53. | 1922-40 | 19 | 17.0 | 16.2 | 11.5 | 10.6 |
| 54. | 1952-58 | 7 | 28.1 | 28.8 | 21.8 | 22.5 |
| | **Argentina** | | | | | |
| 55. | 1900-19 | 20 | 33.9 | 20.4 | 26.3 | 11.1 |
| 56. | 1920-39 | 20 | 27.4 | 24.0 | 13.0 | 8.7 |
| 57. | 1935-54 | 20 | 23.6 | 22.4 | 9.1 | 7.8 |
| | **Union of South Africa** | | | | | |
| 58. | 1919-38 | 20 | 18.3 | 17.0 | 12.5 | 11.0 |
| 59. | 1946-55 or 1944-55 | 10 or 12 | 26.6 | 21.3 | 21.9 | 16.1 |

See notes to Table 1.

The entries again are weighted averages of the proportions for about a decade or less, given in the appendix tables.

Third, the long-term rise in domestic and national capital formation pro-
portions in many countries came fairly recently. As a result, early periods of
rapid growth of total and per capita income were associated with stable, or some-
times even declining, capital formation proportions. Thus the rise in national
capital formation proportions in Norway came only with World War I, and in Swe-
den only after 1900. In Canada, for which the 19th century data are most sparse,
there is some indication that national capital formation proportions, particularly,
did not begin to rise until the first decade of the 20th century. In Australia
both domestic and national capital formation proportions rose only after the late
1890's; and in Japan a significant rise in the proportions began only after World
War I. Thus in five of the ten countries with rising trends in capital formation
proportions, the rise did not begin until after three to five decades of substantial
growth of aggregate and per capita income--at least within our records. In the
United Kingdom, Germany, Italy, Denmark, and the United States the capital
formation proportions rose significantly within the early periods of economic
growth.

Fourth, in some countries national capital formation proportions declined
within the early periods, while total and per capita income were growing. Thus
in Norway gross and net national capital formation proportions declined from
1865-84 to 1885-1904; in Sweden from 1861-80 to 1881-1900; in Australia from
1861-80 to 1881-1900. In Australia the gross domestic capital formation propor-
tion over the same periods was stable and in Norway and Sweden both gross and
net rose somewhat. We thus have the rather curious situation that while total
and per capita product grew, and domestic capital formation proportions were
either stable or rising, national capital formation proportions, or the country-
wide savings rates, declined. The more detailed decade averages in the appen-
dix tables confirm this finding. Despite the crude character of the underlying
estimates, the occurrence of this movement in several countries and over approx-
imately the same period strongly argues that the finding is not a statistical acci-
dent. Apparently during the depressed late 1880's and the 1890's, it was possible
for the national savings rates in the primary producer countries to decline while
domestic capital formation proportions were maintained or even raised slightly
(by increased capital imports).

Fifth, in two of the five countries in which the secular rise of capital for-
mation proportions began quite early--the United Kingdom and the United States--
high levels of gross and net capital formation, whether domestic or national,
were also attained quite early. As a result, much of the later period, which still
witnessed substantial growth of total and per capita product, was characterized
by constant or declining capital formation proportions. Thus the national capital
formation proportions rose only slightly from 1855-74 to World War I in the
United Kingdom; and between the 1870's and World War I in the United States.
In both countries the interwar period was marked by distinctly lower capital for-
mation proportions; and even in the post-World War II years the proportions
were no higher than before World War I. In Italy and Germany, the capital for-
mation proportions rose markedly before World War I; but the interwar period
showed no further rise, and not until the post-World War II years were the pro-
portions higher than before World War I (and the effect of recovery from World
War II must be discounted). Only in Denmark did the national capital formation
proportions rise steadily from 1870-89 to the post-World War II period. One
could, therefore, argue that just as the early periods of growth in some countries
were associated with stable (or declining) capital formation proportions (particu-
larly national), so late periods of growth in other countries were associated with
stable (or declining) capital formation proportions (if at higher levels than for
the first group of countries). This is another aspect of the lack of association
between rates of growth in total and per capita income and the trends in capital
formation proportions, domestic or national (particularly the latter).

We could suggest ad hoc explanations of these findings. The discussion
in Paper V (pp. 26-32) of the upper limits to capital formation proportions can

obviously be used to explain why in countries like the United Kingdom, United States, and Germany, the early attainment of high capital formation proportions was not followed, despite further growth in per capita income, by further rises in the proportions much above 20 percent gross or 15 percent net. Likewise, we could argue that in other countries, despite vigorous growth in early decades, national capital formation proportions failed to rise for several decades because foreign capital was available and, given the technological backlog, fair rates of growth could be attained with relatively moderate inputs of capital. But such ad hoc explanations are distressingly inadequate. Why should the national capital formation proportions in Australia and Canada have been so much lower than in the United States? What social and economic conditions prevented the savings rates in two of the Scandinavian countries and in Japan from rising significantly until after three to five decades of substantial growth of national product per capita? How can we explain the unusually high savings and capital investment proportions in Argentina? Capital formation proportions are the result of an interplay of a variety of changing economic and social conditions, within each country and in its relations with others; and, at least for the sample covered here, the differences in level and pattern of long-term trends cannot be explained by differences in level of per capita income or in rate of growth of total income. An adequate explanation would require examination of the changing distribution of income by size, of the changing savings patterns among various economic groups and institutions, of the financial mechanisms for mobilization and investment of savings, of relations within the network of foreign trade and foreign capital movements--to name but a few relevant aspects of economic development. Intensive analysis of this sort is beyond our power here.

Before we turn to the capital-output ratios, one additional item of information can be introduced. In the preceding tables the proportions were based on capital formation and countrywide product in current prices. For the bearing of these proportions on the growth of product, which must be measured in constant prices, it would be better to have capital formation also in constant prices; and deal with proportions based on constant price totals.

Unfortunately, price indexes for the numerators and denominators of these proportions are available for but a few countries; and for some only for periods shorter than those covered in the preceding tables. Moreover, the adequacy of the price indexes that are available is questionable--as will be seen from examination of the evidence.

In Table 4 we show the effects in seven countries of a shift from totals in current to totals in constant prices for one of the four capital formation proportions, viz., gross domestic capital formation to gross domestic or national product. The proportions are given in columns 1 and 2 and in column 3 we show the ratio of the prices of goods included in domestic capital formation to the prices of goods included in gross domestic or national product. In Germany the movements of the two price indexes differ little; in Italy capital goods prices decline more or rise less than those of all goods. But in the other five countries the ratios of capital goods prices to all goods prices show clear upward trends-- indicating that prices declined less or rose more for capital than for all goods. Examination of the more detailed indexes shows that it is the prices of construction, not of producers' durable equipment or inventories, that account for this difference in price movement. The implication is that efficiency has progressed more slowly in the construction industry than in other industries.

The effect of this differential price adjustment on the capital formation proportions is not insignificant. Thus in the United Kingdom for the short period available, the proportions based on current price totals show relative stability whereas those based on constant price totals show a slight decline. In Denmark, Norway, and Sweden, proportions based on current price totals show distinct upward trends; but only in Norway do those based on constant price totals retain the consistent upward movement. In the United States, the proportions based on

Table 4.
Capital Formation Proportions Based on Totals in Current and in Constant
Prices, Long Periods, Selected Countries (Proportions of GDCF to GDP or GNP
unless otherwise indicated)

| Country, Period, and Base Year of Price Index | Based on Totals in: Current prices (1) | Constant prices (2) | Ratio, Col. 1 to Col. 2 (3) |
|---|---|---|---|
| United Kingdom, 1890-99 | | | |
| 1. 1860-74 | 9.0 | 10.4 | 0.87 |
| 2. 1875-94 | 8.6 | 9.2 | 0.93 |
| 3. 1895-14 | 9.4 | 9.5 | 0.99 |
| Germany, 1913, NNCF/NNP | | | |
| 4. 1851-70 | 9.2 | 9.4 | 0.98 |
| 5. 1871-90 | 13.8 | 13.8 | 1.00 |
| 6. 1891-1913 | 16.1 | 15.9 | 1.01 |
| Italy, 1938 | | | |
| 7. 1861-80 | 9.8 | 8.3 | 1.18 |
| 8. 1881-1900 | 10.7 | 9.9 | 1.08 |
| 9. 1896-1915 | 14.6 | 13.5 | 1.08 |
| 10. 1921-40 | 18.1 | 16.9 | 1.07 |
| 11. 1946-55 | 21.1 | 20.0 | 1.06 |
| Denmark, 1929 | | | |
| 12. 1870-89 | 9.8 | 10.9 | 0.90 |
| 13. 1890-1909 | 13.6 | 13.6 | 1.00 |
| 14. 1895-1914 | 14.4 | 13.9 | 1.04 |
| 15. 1921-39 | 12.5 | 11.7 | 1.07 |
| 16. 1948-52 | 18.2 | 15.4 | 1.18 |
| Norway, 1938 | | | |
| 17. 1865-84 | 11.3 | 12.8 | 0.88 |
| 18. 1885-1904 | 12.9 | 14.3 | 0.90 |
| 19. 1900-19 | 16.5 | 17.3 | 0.95 |
| 20. 1920-39 | 17.3 | 18.0 | 0.96 |
| 21. 1947-56 | 31.3 | 25.6 | 1.22 |
| Sweden, 1913 | | | |
| 22. 1861-80 | 11.0 | 14.1 | 0.78 |
| 23. 1881-1900 | 11.4 | 12.6 | 0.90 |
| 24. 1901-15 | 13.3 | 13.6 | 0.97 |
| 25. 1911-30 | 13.5 | 12.5 | 1.08 |
| 26. 1931-50 | 19.6 | 18.5 | 1.06 |
| United States, 1929 | | | |
| 27. 1869-88 | 21.1 | 23.7 | 0.89 |
| 28. 1889-1913 | 22.1 | 23.9 | 0.92 |
| 29. 1919-38 | 17.6 | 17.1 | 1.03 |
| 30. 1946-55 | 21.5 | 18.2 | 1.18 |

Columns 1 and 2 are either taken from the appendix tables or calculated by the
methods described in the notes to Tables 1 and 3.

current price totals show fair stability or only a slight decline; those based on constant price totals show a more perceptible downward trend. In general, the price adjustment in five of the seven countries reduced the upward trend or accentuated the downward trend in the proportions based on current price totals. And the implication is that in the later decades it took higher proportions of income in current prices to secure the same capital investment proportions of product in constant prices.

But one may well hesitate to accept the results. In almost all the countries indexes of construction costs are based on prices of inputs--materials and particularly labor--with little if any allowance for change in efficiency. It is difficult to assume, as the price indexes suggest, that the prices of fixed capital investment for comparable goods have declined less or increased more than the prices of other goods entering national product, i.e., largely consumer commodities and services. If anything, one would expect that in any country sustaining economic growth and securing a larger proportion of capital goods, the effective prices of the latter would tend to decline relative to prices of consumer goods. We cannot disregard the statistical results based on the available indexes; and we shall present them as a supplement to the evidence provided by the totals in current prices. But we should not accept without question the findings they suggest.

### III.  Incremental Capital-Output Ratios

The ratios of capital formation proportions to the rates of growth of countrywide product, i.e., of additions to reproducible capital to additions to product, or the incremental capital-output ratios, were given for a number of countries for the post-World War II years in Paper V. Excluding the politically and financially dependent units and limiting the view to the non-Communist countries, we found that the incremental gross domestic capital-output ratio ranged from 7.3 in Group I to 4.4 in Groups II and III, 2.6 in Groups IV and V, and 3.0 in Groups VI and VII (Paper V, Table 10, line 15, p. 51). For the same 33 countries, the incremental gross national capital-output ratio ranged from 7.2 in Group I to 4.5 in Groups II and III, 2.5 in Groups IV and V, and 2.7 in Groups VI and VII (ibid., line 18, p. 52). Thus, by and large, the capital-output ratios were much higher for the high income countries than for the low income countries-- with a range from above 7 to between 2.5 and 3. These findings, derived for the whole period 1951-57 and with rates of growth of product calculated from single terminal year values, were confirmed when the rates of growth were derived from three-year averages of end-year values (Paper V, Table 11, p. 55), and when the total period was divided into two subperiods (Paper V, Table 12, p. 57). For the incremental net domestic capital-output ratio the range was still marked, with the ratio declining from 5.3 in Group I to 3.0 in Groups II and III, 1.9 in Groups IV and V, and 2.1 in Groups VI and VII (Paper V, Table 13, line 5, p. 58). Finally, the range of the incremental net national capital-output ratio was from 5.2 in Group I, to 3.0 in Groups II and III, and as low as 1.8 in Groups IV and V, and VI and VII (ibid., line 8, p. 58). [5]

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5.    The results of the analysis in Paper V have been confirmed in the section on investment trends and policies in United Nations, World Economic Survey, 1959, New York, 1960. In this volume, which appeared after Paper V was published, the proportions of gross fixed capital formation to gross domestic product, both in constant prices, and the rates of growth in gross domestic product, also in constant prices, are given for 36 countries for 1950-58 (Table 1-2, p. 23 and Table 2-9, p. 73). We grouped the countries by income per capita and derived arithmetic means of the proportions, rates, and ratios:

The inference that the long-term ratios would show a wide range similar to that of incremental capital-output ratios for post-World War II years is subject to two qualifications:  the post-World War II period was quite short, and the capital-output ratios for individual countries over long periods may be more stable and constrained.  But we would expect the long-term incremental capital-output ratios to lie within the range shown in Paper V--between about 2. 5 and somewhat over 7 for gross, and between 1. 8 and somewhat over 5 for net.  Second, we would expect the incremental capital-output ratios to rise in the long-run growth of a country.  Third, since during the post-World War II years the national capital-output ratios showed a somewhat wider range than the domestic ratios, we would expect the upward trend in the former over the long run to be more conspicuous than that in the latter.

In considering the direct evidence on long-term movements in the incremental capital-output ratios, we begin again with averages for the two long periods (Table 5).  Table 5 is thus parallel to Table 1 and the capital formation proportions are taken directly from Table 1.  The additional item of information in Table 5 is the rate of growth per year in countrywide product--for one or two of the four relevant concepts (gross domestic and national, net domestic and national).  The rates of growth for the four totals for the same country and period lie within narrow ranges; and the rate of growth of one total can be taken for the others when they are not available.  The rates were calculated from compound interest lines between terminal values; and those for the shorter subperiods were combined into averages for longer periods by weighting by the duration of each subperiod.  The incremental capital-output ratios for the long periods in Table 5 are then the ratios of the average capital formation proportions for each five or six decade span (from Table 1) to the average rate of growth of product over the same long span (in column 3 of Table 5).

In Panel A the range in the incremental capital-output ratios among the ten countries is quite wide:  from 2. 9 to 9. 6 for gross domestic (column 4); from 2. 6 to 9. 4 for gross national (column 5);  from 1. 6 to 5. 3 for net domestic (column 6);  and from 0. 6 to 5.4 for net national (column 7).  As with the post-World War II data, the range is wider for the national capital-output ratios than for the domestic.  But the ranges for all four ratios are distinctly wider for the ten countries over the long period than for the group averages for recent years.

The averages in Panel B, as already indicated in connection with Table 1, may be affected by the choice of subperiods, the wars, and the depression of the

| Group by Per Capita Income | Number of countries | GFCF/ GDP (%) | Arithmetic Means of: Rate of growth per year GDP (%) | Incr. C/O ratio | Incr. C/O ratio from group means |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| I | 5 | 17. 4 | 3. 1 | 5. 8 | 5. 6 |
| II and III | 9 | 19. 7 | 5. 1 | 5. 5 | 3. 9 |
| IV and V | 12 | 16. 2 | 5. 9 | 3. 2 | 2. 7 |
| VI and VII | 10 | 14. 2 | 4. 7 | 3. 1 | 3. 0 |

Like the tables cited from Paper V, this tabulation excludes the Communist countries.  Since it also omits inventories, the capital-output ratios should be somewhat lower.  The incremental fixed capital-output ratio derived directly from the group means (column 5) ranges from over 5. 5 for Group I to 3 or less for Groups IV through VII.  The range is narrower than that from over 7 to about 3 for the countries in Paper V, but still quite wide; and the association with per capita income is also positive.

Table 5.
Incremental Capital-Output Ratios, Two Long Periods, Selected Countries (Based on current price proportions)

| Country and Output Concept | Period for rate of growth of output (1) | Duration (years) (2) | Output growth per year (%) (3) | Incremental Capital-Output Ratio Using: GDCF/GDP (4) | GNCF/GNP (5) | NDCF/NDP (6) | NNCF/NNP (7) |
|---|---|---|---|---|---|---|---|
| **A. Mid-19th Century to World War I** | | | | | | | |
| 1. United Kingdom, NNP | Avg. of 1851 and 1861 to 1905-14 | 53.5 | 2.22 | 4.1 | 5.8 | 3.3 | 5.0 |
| 2. Germany, NNP | 1851-55 to 1911-13 | 59 | 2.69 | 7.4 | 7.8 | 4.8 | 5.4 |
| 3. Italy, GDP; NDP | 1861 to 1914-16 | 54 | 1.30G; 1.23N | 9.6 | 9.4 | 5.3 | 5.1 |
| 4. Denmark, GDP; NDP | 1870 to 1914 | 44 | 3.25G; 3.27N | 3.9 | 3.3 | 2.4 | 1.7 |
| 5. Norway, GDP; NDP | 1865 to 1910-19 | 49.5 | 2.08G; 2.04N | 6.3 | 5.0 | 4.0 | 2.6 |
| 6. Sweden, GDP | 1861 to 1911-20 | 54.5 | 2.95 | 4.1 | 3.7 | 2.6 | 2.2 |
| 7. United States, GNP; NNP | 1869-78 to 1909-18 | 40 | 4.31G; 4.22N | 5.1 | 5.1 | 3.1 | 3.2 |
| 8. Canada, GNP | Avg. of 1867, 1870, and 1873 to 1911-20 | 45.5 | 3.66 | 5.4 | 3.4 | 3.0 | 0.6 |
| 9. Australia, GDP | 1861-65 to 1910/11- 1919/20 | 52 | 3.59 | 4.2 | 3.5 | 2.9 | 2.1 |
| 10. Japan, GNP; NNP | 1885-89 to 1914-18 | 29 | 3.75G; 3.71N | 2.9 | 2.6 | 1.6 | 1.5 |
| **B. End of 19th through 20th Century** | | | | | | | |
| 11. United Kingdom | 1890-99 to 1905-14; 1921-29 to 1930-38; 1952 to 1958 | 30 | 1.67 | 6.3 | 7.4 | 3.6 | 4.8 |
| 12. Germany | 1886-95 to 1911-13; 1928 to 1934-38; 1952 to 1958 | 35.5 | 3.31 | 6.1 | 6.6 | 3.8 | 4.3 |
| 13. Italy | 1891-1900 to 1914-16; 1920-22 to 1938-40; 1946 to 1956 | 47.5 | 3.17G; 3.01N | 5.7 | 5.2 | 3.4 | 2.9 |
| 14. Denmark | 1890-99 to 1914; 1921 to 1939; 1952 to 1958 | 43.5 | 3.36G; 3.34N | 4.4 | 4.5 | 2.8 | 3.0 |

(Continued on next page)

Table 5 (Cont.)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| 15. Norway | 1890-99 to 1939; 1949 to 1956 | 51.5 | 2.86G; 2.82N | 7.3 | 6.4 | 5.1 | 4.1 |
| 16. Sweden | 1896-1905 to 1948-52; 1952 to 1958 | 55.5 | 3.31 | 5.5 | 5.5 | 3.6 | 3.5 |
| 17. United States | 1889-98 to 1909-18; 1914-23 to 1934-43; 1939-48 to 1948-57 | 49 | 3.10G; 3.10N | 6.5 | 6.7 | 2.7 | 3.0 |
| 18. Canada | 1891-1900 to 1911-20; 1916-25 to 1936-45; 1946 to 1955 | 49 | 3.63 | 5.6 | 5.2 | 2.8 | 2.3 |
| 19. Australia | 1891-1900 to 1910/11- 1919/20; 1915/16- 1924/25 to 1938/39; 1952/53 to 1958/59 | 44 | 2.81 | 6.9 | 6.6 | 5.0 | 4.7 |
| 20. Japan | 1900-04 to 1938-42; 1952 to 1958 | 44 53 | 4.65G; 4.51N 3.56G; 3.31N | 4.3 7.6 | 4.2 6.4 | 3.1 4.2 | 3.1 2.8 |
| 21. Argentina, GDP; NNP 22. Union of South Africa, GNP; NNP | 1900-04 to 1955 1918-20 to 1949-58 | 34.5 | 4.68G; 4.70N | 4.9 | 4.2 | 3.8 | 3.0 |

For the sources of the output series see the notes to the appendix tables for the individual countries.

When the periods are not continuous the average rate for the total period in column 3 is the geometric mean of the rates for the subperiods weighted by their duration.

Columns 4-7 were derived by dividing the capital formation proportions in Table 1 by the rates of growth in column 3.

1930's. Although the incremental capital-output ratios converge, the range remains fairly wide. Even if we exclude Argentina and the Union of South Africa, the range for the other ten countries in Panel B is from 4.3 to 7.3 for gross domestic, 4.2 to 7.4 for gross national, 2.7 to 5.1 for net domestic, and 2.3 to 4.8 for net national. It is not significantly narrower than for the group averages in the post-World War II period.

In view of the frequent references in the literature to average and incremental capital-output ratios (presumably net domestic) of approximately 3, the evidence both for the short period after World War II in Paper V and for the long periods in Table 5 should be emphasized. It indicates that the range in incremental capital-output ratios is quite wide--over short and, significantly, even over long periods. And if the range is wide for incremental capital-output ratios over long periods, it necessarily follows that the range for the average ratios must also be wide. The average ratio is nothing but a cumulation of the incremental ratios over long periods--and will approach the latter as the period is extended. [6]

In Table 6 we measure directly the dispersion of the incremental capital-output ratios for comparison with those of rates of growth of product and of the capital formation proportions. We include only the ten countries covered in both panels of Table 5 and, in calculating the mean rates of growth, use the average value for a country if rates are given for more than one countrywide product. Two conclusions are immediately suggested. First, as with capital formation proportions, the relative dispersion of the national capital-output ratios is distinctly wider than that of the domestic. We are thus even further away from constancy of the capital-output ratios when we relate national capital formation to national product than when we associate domestic capital formation with domestic product. Second, the relative dispersion of the capital-output ratios is generally wider than that of the capital formation proportions; and, what is particularly interesting, with only one exception, no narrower than the dispersion of the rates of growth themselves. If the capital-output ratios were relatively constant, high rates of growth would be associated in simple proportional relationship with high capital formation proportions and low rates of growth with low capital formation proportions; and the dispersion of the capital-output ratios would be distinctly lower than that of the rates of growth.

Of course, the wide dispersion in the incremental capital-output ratios argues for lack of association between capital formation proportions and rate of growth of product only on the highly restrictive assumption that this association is one of strict proportionality, i.e., that the rate of growth equals the capital formation proportion multiplied by a constant. A closer association between rate of growth (as the dependent variable) and capital formation proportions (preferably domestic, as an independent variable) might be established by fitting

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6. This inference as to the wide range of average capital-output ratios is confirmed by the evidence in Raymond Goldsmith and Christopher Saunders, eds., The Measurement of National Wealth, Income and Wealth, Series VIII, Table VII, p. 32. The ratios of reproducible domestically located capital to national income at factor cost are given for 16 countries for post-World War II years. As they stand, the ratios range from a low of 1.8 for India to a high of 6.8 for Luxembourg; and if the latter is excluded, to 5.2 for Norway. Net domestic product at market prices is perhaps preferable to national income at factor cost as base, since wealth is presumably valued at prices including indirect taxes. Recalculation of the ratio with net domestic product as denominator reduces the levels but the range is still wide: from 1.8 for India (or 2.1 for Japan) to 4.6 for Norway (excluding Luxembourg with a high of 6.1). The range therefore is well over 2 to 1, not much narrower than that for the incremental ratios in Table 5, Panel B, column 6; and about the same as the range for the ratios in Panels A and B averaged for the two periods.

Table 6.
Means and Dispersion of Incremental Capital-Output Ratios, Ten Countries,
Long Periods (Based on Table 5)

| | Rates of growth of product (%) (1) | Incremental Capital-Output Ratios Using: | | | |
|---|---|---|---|---|---|
| | | GDCF/ GDP (2) | GNCF/ GNP (3) | NDCF/ NDP (4) | NNCF/ NNP (5) |
| **Arithmetic Mean** | | | | | |
| 1. Panel A | 2.97 | 5.30 | 4.96 | 3.30 | 2.94 |
| 2. Panel B | 3.17 | 5.86 | 5.83 | 3.59 | 3.57 |
| **Average Deviation** | | | | | |
| 3. Panel A | 0.73 | 1.50 | 1.66 | 0.84 | 1.39 |
| 4. Panel B | 0.47 | 0.76 | 0.91 | 0.63 | 0.72 |
| **Ratio, A. D./A. M.** | | | | | |
| **Panel A** | | | | | |
| 5. For above | 0.25 | 0.28 | 0.33 | 0.25 | 0.47 |
| 6. For capital formation proportions (Table 2) | | 0.24 | 0.24 | 0.24 | 0.40 |
| **Panel B** | | | | | |
| 7. For above | 0.15 | 0.13 | 0.16 | 0.18 | 0.20 |
| 8. For capital formation proportions (Table 2) | | 0.13 | 0.11 | 0.21 | 0.19 |

relationship functions more complicated than strict proportionality--to begin with, a straight line.[7] We forebore from pursuing elaborate correlation analysis here, because the number of cases is small and the variance in the universe far from normal.

We did calculate Kendall's coefficient of rank correlation (Tau) with the following results:

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7.     However, significant linear correlation between capital formation proportions and rates of growth may also mean large, if systematic, variations in the incremental capital-output ratio. Thus if the regression equation is $r = a + bp$, where $a$ and $b$ are constants, $r$ is the rate of growth of product, and $p$ is the capital formation proportion, then $p/r$, or the incremental capital-output ratio, equals $(1/b) - (a/br)$. Unless $a$ is zero, i.e., unless the regression line reduces to strict proportionality, a given value of $r$ will yield one capital-output ratio (i.e., the one in the expression above); but if the value of $r$ is doubled, becoming $2r$, the corresponding capital-output ratio becomes $(1/b) - (a/b2r)$, and this is not equal to $2p/2r$, or $p/r$. In general, if $b$ is a positive proper fraction, $a$ is positive, and $r$ and $p$ are positive percentages, a larger $r$ will mean a higher capital-output ratio; with $a$ negative, a larger $r$ will mean a lower capital-output ratio.

Coefficient of Rank Correlation between Rate of Growth of Product and:

|  | GDCF/ GDP | GNCF/ GNP | NDCF/ NDP | NNCF/ NNP |
|---|---|---|---|---|
| Panel A (10 countries) | 0.29 | 0.07 | 0.29 | -0.07 |
| Panel B (12 countries) | 0.33 | 0.33 | 0.27 | 0.21 |

Not one of the eight coefficients is significant. Thus formal statistical testing does not nullify the hypothesis that, at least for the ten to twelve countries in Table 5, little association exists between capital formation proportions and rates of growth.

One further test of this association can be made. In Table 7 below, we have data on the rate of growth of product in each country for several long periods. In Table 3 above we have capital formation proportions for the same countries and the same periods. If the association between capital formation proportions and the rates of growth of product were close, we would expect a rise (decline) from one period to the next in the capital formation proportions to be accompanied by a rise (decline) in the rate of growth of product. We, therefore, compared the rises and declines from period to period within each country in the gross and net domestic capital formation proportions and in the rate of growth of countrywide product. The movement of the gross domestic capital formation proportion and that of the rate of growth of product agreed in sign in 30 pairs (including one case in which no change was counted as agreement) out of 42 observed; the movements of the net domestic capital formation proportion and rate of growth of output agreed in 30 pairs out of 43. Agreement at a ratio of seven to ten is clearly compatible with the assumption that the two movements are not correlated--since with purely random sampling and the assumption of no correlation, the proportion of agreement (or disagreement) would be five to ten. [8]

We may now turn to the long-term trends in the incremental capital-output ratios. Have they shown an upward trend in most countries in the course of economic growth, as suggested by cross-section analysis for the post-World War II period? The evidence in Table 7 is not easily summarized. There is again difficulty in handling the interwar period, in which the incremental capital-output ratios may be too high, and the post-World War II years, in which they may be too low--from the standpoint of long-term secular levels. And even with all allowances, the trends in the incremental capital-output ratios differ among the countries covered. With some hesitation, the following observations may be made.

First, for the very early periods in the United Kingdom (or England and Wales) the combination of a net national capital formation proportion of 5 percent (the share now usually assumed for underdeveloped countries) with a low rate of growth of aggregate product results in an extremely high capital-output ratio,

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8.     How treacherous correlation analysis can be for data of the kind dealt with here may be seen from a check on the association for the twelve industrial countries analyzed in the United Nations, World Economic Survey, 1959, referred to in footnote 5. For these countries, the report cites a simple correlation coefficient between rate of growth of output and the investment ratio (i.e., the ratio of total fixed investment minus residential construction and general government investment to gross domestic product) of 0.70 (see note 8, p. 26); and Chart I-2, presenting the relevant scatter diagram, does suggest significant association (see p. 25). But the Kendall coefficient of rank correlation (Tau) is only 0.36, and is not significant even at the 5 percent level. Considering the exceptional cases in the array, e.g., Japan and West Germany, which dominate the correlation, the result is hardly convincing as a statistical demonstration.

Table 7.
Incremental Capital-Output Ratios, Successive Long Periods, Selected Countries
(Based on current price proportions)

| Country, Output Concept, and Period for Rate of Growth of Output | Duration (years) (1) | Output growth per year (%) (2) | Incremental Capital-Output Ratio Using: | | | |
|---|---|---|---|---|---|---|
| | | | GDCF/ GDP (3) | GNCF/ GNP (4) | NDCF/ NDP (5) | NNCF/ NNP (6) |
| **United Kingdom, NNP** | | | | | | |
| 1. 1700 to 1740 (England and Wales) | 40 | 0.3 | | | | 17 |
| 2. 1740 to 1770 (" " ") | 30 | 0.9 | | | | 6 |
| 3. 1770 to 1800 (" " ") | 30 | 1.5 | | | | 4.3 |
| 4. 1801 and 1811 to 1821 and 1831 | 20 | 2.62 | | | | 2.9 |
| 5. 1821 and 1831 to 1851 and 1861 | 30 | 2.08 | | | 3.6 | 4.3 |
| 6. 1851 and 1861 to 1870-79 | 18.5 | 2.26 | 3.8 | 5.4 | 3.1 | 4.7 |
| 7. 1870-79 to 1890-99 | 20 | 3.02 | 2.8 | 4.0 | 2.3 | 3.5 |
| 8. 1890-99 to 1905-14 | 15 | 1.13 | 8.3 | 11.8 | 6.8 | 10.4 |
| 9. 1921-29 to 1930-38 | 9 | 2.03 | 4.3 | 4.5 | 1.6 | 1.9 |
| 10. 1952 to 1958 | 6 | 2.50G | 6.2 | 6.6 | 3.2 | 3.6 |
| **Germany, NNP** | | | | | | |
| 11. 1851-55 to 1866-75 (1913 boundaries) | 17.5 | 2.73 | 4.9 | 5.2 | 3.1 | 3.4 |
| 12. 1866-75 to 1886-95 (1913 boundaries) | 20 | 2.44 | 7.2 | 8.2 | 4.7 | 5.7 |
| 13. 1886-95 to 1911-13 (1913 boundaries) | 21.5 | 2.88 | 7.9 | 8.2 | 5.2 | 5.6 |
| 14. 1928 to 1934-38 (1925 boundaries) | 8 | 1.66 | 8.1 | 8.7 | 3.5 | 4.2 |
| 15. 1952 to 1958 (West Germany) | 6 | 7.11 | 3.4 | 3.9 | 2.3 | 2.9 |
| **Italy, GDP; NDP** | | | | | | |
| 16. 1861 to 1876-85 | 19.5 | 0.92G; 0.87N | 10.7 | 9.3 | 5.3 | 3.8 |
| 17. 1876-85 to 1896-1905 | 20 | 0.97G; 0.92N | 11.0 | 11.1 | 5.4 | 5.4 |
| 18. 1891-1900 to 1914-16 | 19.5 | 2.16G; 2.06N | 6.8 | 6.9 | 3.8 | 4.1 |
| 19. 1920-22 to 1938-40 | 18 | 2.42G; 2.24N | 7.5 | 6.8 | 4.3 | 3.6 |
| 20. 1946 to 1956 | 10 | 6.58G; 6.32N | 3.2 | 2.8 | 2.1 | 1.6 |
| **Denmark, GDP; NDP** | | | | | | |
| 21. 1870 to 1885-94 | 19.5 | 2.71G; 2.75N | 3.6 | 2.9 | 1.8 | 1.1 |
| 22. 1885-94 to 1905-14 | 20 | 3.50G; 3.50N | 3.9 | 3.3 | 2.5 | 1.8 |
| 23. 1890-99 to 1914 | 19.5 | 3.68G; 3.68N | 3.9 | 3.6 | 2.5 | 2.2 |
| 24. 1921 to 1939 | 18 | 3.17G; 3.15N | 3.9 | 4.3 | 2.3 | 2.7 |
| 25. 1952 to 1958 | 6 | 2.88G; 2.79N | 6.4 | 6.7 | 4.6 | 4.9 |

Table 7 (Cont.)

|  | | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| | **Norway, GDP; NDP** | | | | | | |
| 26. | 1865 to 1880-89 | 19.5 | 1.69G; 1.64N | 6.7 | 6.8 | 4.2 | 4.3 |
| 27. | 1880-89 to 1900-09 | 20 | 2.03G; 2.01N | 6.4 | 4.2 | 3.9 | 1.6 |
| 28. | 1890-99 to 1910-19 | 20 | 2.40G; 2.36N | 6.0 | 4.2 | 4.0 | 2.0 |
| 29. | 1895-1904 to 1915-24 | 20 | 2.47G; 2.42N | 6.7 | 5.2 | 4.5 | 3.0 |
| 30. | 1915-24 to 1939 | 19.5 | 3.21G; 3.21N | 5.4 | 4.9 | 3.5 | 2.9 |
| 31. | 1949 to 1956 | 7 | 3.53G; 3.39N | 8.5 | 7.8 | 6.5 | 5.8 |
| | **Sweden, GDP** | | | | | | |
| 32. | 1861 to 1876-85 | 19.5 | 2.99 | 3.7 | 3.5 | 2.3 | 2.1 |
| 33. | 1876-85 to 1896-1905 | 20 | 2.69 | 4.2 | 3.7 | 2.6 | 2.1 |
| 34. | 1896-1905 to 1911-20 | 15 | 3.23 | 4.1 | 3.7 | 2.6 | 2.2 |
| 35. | 1906-15 to 1926-35 | 20 | 2.29 | 5.9 | 6.5 | 3.8 | 4.3 |
| 36. | 1926-35 to 1948-52 | 19.5 | 4.22 | 4.6 | 4.6 | 3.0 | 3.0 |
| 37. | 1952 to 1958 | 6 | 3.52 | 6.1 | 6.1 | 4.0 | 3.9 |
| | **United States, GNP; NNP** | | | | | | |
| 38. | 1869-78 to 1884-93 | 15 | 5.51G; 5.39N | 3.8 | 3.7 | 2.6 | 2.4 |
| 39. | 1884-93 to 1909-18 | 25 | 3.59G; 3.54N | 6.2 | 6.3 | 3.6 | 3.8 |
| 40. | 1914-23 to 1934-43 | 20 | 1.96G; 1.98N | 9.0 | 9.5 | 3.0 | 3.6 |
| 41. | 1939-48 to 1948-57 | 9 | 4.25G; 4.27N | 5.1 | 5.2 | 2.0 | 2.1 |
| | **Canada, GNP** | | | | | | |
| 42. | Avg. of 1867, 1870, and 1873 to 1911-20 | 45.5 | 3.66 | 5.4 | 3.4 | 3.0 | 0.6 |
| 43. | 1891-1900 to 1911-20 | 20 | 4.00 | 5.7 | 3.8 | 3.2 | 1.0 |
| 44. | 1916-25 to 1936-45 | 20 | 3.15 | 4.9 | 5.2 | 1.4 | 1.7 |
| 45. | 1946 to 1955 | 9 | 3.89 | 6.0 | 5.9 | 3.5 | 3.3 |
| | **Australia, GDP** | | | | | | |
| 46. | 1861-65 to 1876-85 | 17.5 | 5.66 | 2.8 | 2.1 | 2.2 | 1.4 |
| 47. | 1876-85 to 1896-1904/05 | 19.25 | 2.33 | 6.8 | 4.3 | 4.5 | 1.6 |
| 48. | 1891-1900 to 1910/11-1919/20 | 19.5 | 2.78 | 5.1 | 5.2 | 3.3 | 3.3 |
| 49. | 1915/16-1924/25 to 1938/39 | 18.5 | 2.58 | 6.4 | 5.9 | 4.2 | 3.6 |
| 50. | 1952/53 to 1958/59 | 6 | 3.61 | 7.3 | 7.0 | 6.0 | 5.7 |
| | **Japan, GNP; NNP** | | | | | | |
| 52. | 1885-89 to 1904-08 | 19 | 3.80G; 3.76N | 2.6 | 2.0 | 1.4 | 1.0 |
| 53. | 1895-99 to 1914-18 | 19 | 3.14G; 3.10N | 3.4 | 3.0 | 1.9 | 1.6 |
| 54. | 1920-24 to 1938-42 | 18 | 5.13G; 5.08N | 3.3 | 3.2 | 2.3 | 2.1 |
| 55. | 1952 to 1958 | 6 | 6.76G; 6.01N | 4.2 | 4.3 | 3.6 | 3.7 |
| | **Argentina, GDP; NDP** | | | | | | |
| 56. | 1900-04 to 1915-24 | 17.5 | 4.26G; 3.46N | 8.0 | 4.8 | 7.6 | 3.2 |
| 57. | 1915-24 to 1935-44 | 20 | 3.31G; 3.13N | 8.3 | 7.3 | 4.2 | 2.8 |
| 58. | 1930-39 to 1955 | 20.5 | 3.10G; 3.35N | 7.6 | 7.2 | 2.7 | 2.3 |

Table 7 (Cont.)

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Union of South Africa, GNP; NNP | | | | | | |
| 59. 1918-20 to 1934-43 | 19.5 | 4.59G; 4.62N | 4.0 | 3.7 | 2.7 | 2.4 |
| 60. 1944-48 to 1954-58 | 10 | 5.01G; 4.91N | 5.3 | 4.3 | 4.5 | 3.3 |

See notes to Table 5.

Columns 3-6 were derived by dividing the capital formation proportions in Table 3 by the rates of growth in column 3.

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which then declines rapidly as growth of product accelerates. Such high capital-output ratios for the pre-industrial periods are difficult to accept, since their cumulation would produce extremely high average capital-output ratios at the beginning of modern economic growth and industrialization; and whatever evidence exists suggests that average capital-output ratios are rather low in presently underdeveloped countries and were also low in others before their entry into the phase of modern growth. It may well be that the net national capital formation proportions for these early periods were well below 5 percent.

Second, incremental domestic capital-output ratios rise over the long pull in a number of countries: in the United Kingdom, particularly for gross; in Germany, if we disregard the extremely low ratios for 1952-58 (which should be discounted for effects of postwar recovery); in Denmark and Sweden; in the United States, for gross but not so clearly for net; in Canada; in Australia, with particularly high levels in post-World War II years; and in Japan. But there are several exceptions: in Italy, in which the period begins with quite low rates of growth and high incremental domestic capital-output ratios, the latter decline over the long run; in Norway, the domestic capital-output ratios are, on the whole, relatively stable and rise only in the post-World War II years; in Argentina, the domestic capital-output ratios decline, if not consistently. There is some basis for stating that the evidence in Table 7 confirms the expectation derived from international comparisons in Paper V that the long-term trend of domestic capital-output ratios would be upward. But the upward trend is not as widespread, consistent, and marked as one would infer from the wide range observed in cross-section analysis for recent years.

Third, in several countries, particularly those that were international debtors in the earlier decades, the upward trend in the incremental national capital-output ratios was more marked than in the domestic. Thus, in Italy, in which the gross and net domestic capital-output ratios declined markedly, the net national capital-output ratio was relatively stable, at least through 1921-39; in Denmark, in which the domestic capital-output ratios rose from 3.6 and 1.8 in 1870-94 to 3.9 and 2.3 in 1921-39, or 6.4 and 4.6 in 1952-58; the national capital-output ratios rose from 2.9 and 1.1 in 1870-94 to 4.3 and 2.7 in 1921-39, or 6.7 and 4.9 in 1952-58. Similarly the rises are somewhat more conspicuous in national than in domestic capital-output ratios for the United States, Canada, Australia, and Japan. But this is not true of either the United Kingdom or Germany.

Fourth, the upward trend in the incremental capital-output ratios, combined with the upward trend in capital formation proportions, means that the average rates of growth of product failed to rise; or, if they did, rose more slowly than the capital formation proportions. In five countries there has been acceleration in the rate of growth of product--Italy, Denmark, Norway, Sweden, and Japan; and in three of these--Denmark, Sweden, and Japan--we found an upward

trend in the incremental capital-output ratios.  In some countries no long-term acceleration or retardation in the rate of growth of product could be discerned: Germany (although here it is difficult to compare early and late periods) and Canada;  and in both the capital-output ratios showed some tendency to rise.  In the United Kingdom the long record describes acceleration and then retardation of the rate of growth of product;  while in the United States, Australia, and Argentina the rate of growth of product tended to decline.  In two of these four countries the trend in the incremental capital-output ratios was upward.  Thus the upward trend is found whether the rate of growth of product is constant, accelerates, or decelerates.

One perhaps should have expected incremental capital-output ratios to rise over the long run in the course of economic growth.  In the earlier periods of growth with a relative scarcity of reproducible capital and, at least in the older countries, an abundance of labor released by technological and organizational changes in the older industries (particularly agriculture), there would be pressure to economize on capital and substitute labor for it.  If at the same time it is possible, given the backwardness of some industries, to raise efficiency by non-capital-demanding innovations, the response to the pressure would be limited inputs of new capital combined with substantial growth in product, or low incremental capital-output ratios.  This tendency might be counteracted somewhat by the high prices of capital goods relative to those of consumer goods;  but even the latter factor, which makes for higher capital formation proportions and capital-output ratios in the early periods, can be offset by purchases or imports of second-hand or less advanced machinery and by the lower cost of construction within the country.  As a country grows and savings and capital become more abundant, and labor is not as plentiful, relatively, as earlier, incremental capital-output ratios may well rise--particularly the gross, and particularly during periods when the industrial structure of demand for capital goods favors the long-lived types involved in the construction of the public utility and similar networks.

The expectation of upward trends in incremental capital-output ratios in the course of economic growth is thus easy to justify.  Yet, in a last comment on Table 7, we should note that just as there were long delays in the secular rise of capital formation proportions in several countries and long-term declines in others even though aggregate and per capita product grew, so there is considerable variability over long periods in the incremental capital-output ratios and any upward trend in the ratios is qualified by such variability.  Examples of the latter abound in Table 7.  Thus for the United Kingdom, the gross domestic capital-output ratio declined from 3.8 over the two decades of 1855-74 to 2.8 for the next two decades of 1875-94;  then rose to 8.3, almost tripled, for 1891-1914.  Or to choose another example, Norway: the capital-output ratios declined markedly from the first period to the second and then rose fairly sharply to the fourth period.

The point to be stressed in this connection is that the ratios are aggregative, for large economies, and extend over long periods.  And yet their changes are quite marked--whether we deal with gross or net, domestic or national.  When a ratio can double or more, as it did in Australia and the United Kingdom, or drop to half, as it did in Canada, from one two-decade period to the next, it is not a stable statistic or coefficient in an economy;  and any trend observed in it cannot be treated as a dominant and irreversible pattern.

We conclude this section by dealing with the effects on the movements of the incremental capital-output ratios of shifting from capital formation proportions based on current price totals to those based on constant price totals (Table 8).  The comparison is limited to the gross domestic capital-output ratio for the seven countries for which the price indexes are available.

The shift to constant price totals, by reducing the upward trend in the capital formation proportions (or accentuating their decline), reduces the long-

Table 8.
Incremental Capital-Output Ratios Based on Totals in Current and Constant Prices, Long Periods, Selected Countries (Based on proportions of GDCF to GDP or GNP unless otherwise indicated)

| Country, Period for Rate of Growth of Output, and Base Year of Price Index | Ratio Based on Totals in: | |
|---|---|---|
| | Current prices (1) | Constant prices (2) |
| **United Kingdom, 1890-99** | | |
| 1. 1861 to 1870-79 | 3.7 | 4.3 |
| 2. 1870-79 to 1890-99 | 2.8 | 3.0 |
| 3. 1890-99 to 1905-14 | 8.3 | 8.4 |
| **Germany, 1913, NNCF/NNP** | | |
| 4. 1851-55 to 1866-75 | 3.4 | 3.4 |
| 5. 1866-75 to 1886-95 | 5.7 | 5.7 |
| 6. 1886-95 to 1911-13 | 5.6 | 5.5 |
| **Italy, 1938** | | |
| 7. 1861 to 1876-85 | 10.7 | 9.0 |
| 8. 1876-85 to 1896-1905 | 11.0 | 10.2 |
| 9. 1891-1900 to 1914-16 | 6.8 | 6.3 |
| 10. 1920-22 to 1938-40 | 7.5 | 7.0 |
| 11. 1946 to 1956 | 3.2 | 3.0 |
| **Denmark, 1929** | | |
| 12. 1870 to 1885-94 | 3.6 | 4.0 |
| 13. 1885-94 to 1905-14 | 3.9 | 3.9 |
| 14. 1890-99 to 1914 | 3.9 | 3.8 |
| 15. 1921 to 1939 | 3.9 | 3.7 |
| 16. 1948 to 1952 | 5.1 | 4.3 |
| **Norway, 1938** | | |
| 17. 1865 to 1880-89 | 6.7 | 7.6 |
| 18. 1880-89 to 1900-09 | 6.4 | 7.0 |
| 19. 1895-04 to 1915-24 | 6.7 | 7.0 |
| 20. 1915-24 to 1939 | 5.4 | 5.6 |
| 21. 1949 to 1956 | 8.9 | 7.3 |
| **Sweden, 1913** | | |
| 22. 1861 to 1876-85 | 3.7 | 4.7 |
| 23. 1876-85 to 1896-1905 | 4.2 | 4.7 |
| 24. 1896-1905 to 1911-20 | 4.1 | 4.2 |
| 25. 1906-15 to 1926-35 | 5.9 | 5.5 |
| 26. 1926-35 to 1948-52 | 4.6 | 4.4 |
| **United States, 1929** | | |
| 27. 1869-78 to 1884-93 | 3.8 | 4.3 |
| 28. 1884-93 to 1909-18 | 6.2 | 6.7 |
| 29. 1914-23 to 1934-43 | 9.0 | 8.7 |
| 30. 1939-48 to 1948-57 | 5.1 | 4.3 |

Based on Table 4 and rates of growth derived as described in notes to Table 5.

term rise in the incremental capital-output ratios. But in the countries in which a rise was observed in column 1 (based on current price totals), we find a rise in column 2 (based on constant price totals) except perhaps in Denmark and Sweden. There is no need to repeat our qualms concerning the validity of the relevant price indexes for most countries.

## IV.  Ratio of Capital Formation Proportions to Rate of Growth of Product per Worker

Capital can be used intensively or not, with obvious effects on the incremental capital-output ratios, even over the long run. More important, capital is only one of several factors that contribute to output; and the capital-output ratios may thus differ in space or vary over time because capital is combined in different proportions and different ways with the other productive factors. It is hardly possible to deal with these other factors here and try to secure a relation between input of capital and output of product more specific than that yielded by incremental capital-output ratios of the type discussed in the preceding section. Such analysis would require a variety of additional data that are not readily at hand or are not available at all. Nor are we sure that the familiar concept of a production function is relevant to aggregative comparisons over long periods, or that the simple equations so prevalent in the literature can be meaningful in analysis of long-term trends.

Be that as it may, it is still interesting to see whether the wide differences among countries in the incremental capital-output ratios over the long periods and the various trends in these ratios are associated with differing rates of additions to labor. Like reproducible capital and natural (irreproducible) resources, labor is a major factor of production and one for which at least some crude data can be secured. If over a long period the incremental capital-output ratio is much lower in country A than in country B, we can then ask whether the difference is associated with larger additions to labor (relative to additions to product) in the former. Is an upward (downward) trend in the incremental capital-output ratio associated with a downward (upward) trend in the input of additional labor relative to additional output?

Labor input can be estimated with varying degrees of refinement--taking account not only of different levels and trends in hours of work per member of labor force but also of changing quality of work as reflected in age, sex, education, experience, and similar characteristics. The greater the refinement, the more useful the ratios--but also the scarcer the data and more difficult the task. All we can do here is deal with the labor force, treating its members as equivalent units. We do not allow for levels of employment or hours--and should not if it is labor's potential contribution that is to be measured (as in our treatment of capital goods, where no allowance is made for differences in rate of utilization). But neither do we allow for differences in training and quality and they should be considered, even in measuring potential inputs. Yet the calculation does at least make a crude allowance for labor, a major productive factor that can obviously change greatly over time or differ widely in space--in relation to both levels and change in output.

The mechanics of the calculation are simple. For the twelve countries we have estimates of the labor force--for roughly the same periods as those for which we measured capital formation proportions and rates of growth of total product in constant prices. We computed rates of growth per year in the labor force for these periods; and dividing the rate of growth of total product (expressed as a relative) by the rate of growth of the labor force (expressed as a relative), obtained the rate of growth in product per worker (i.e., per member of labor force). We then divided the capital formation proportions by the rate of growth of product per worker to get the incremental ratios of capital per worker to output per worker.

These ratios are obviously of capital formation per worker, i.e., additions to capital stock divided by the average number of workers during the period, to additions to per worker output--just as the ratios of capital formation proportions to rate of growth of total product are those of additions to capital to additions to total output.[9] These ratios tell us how many units of additional capital per worker are associated with each unit of added product per worker. They are identical with the incremental capital-output ratios in the tables in the preceding section only if there is no change in the labor force. Clearly, the greater the rate of growth of the labor force, the larger will be the incremental capital formation per worker to output per worker ratio be than the incremental capital formation to total output ratio; the smaller the rate of growth of labor force, the closer will the two incremental ratios be.

The main point however is that the newly calculated ratios presumably eliminate the effect of differing additions to labor; and should reflect more clearly the effect of capital additions alone. In other words, if there is any constancy in the relation between additions to capital and the specific contribution which the latter make to product, such constancy should be more apparent in the ratios of capital formation per worker to additions to output per worker than in those of total capital formation to additions to total product.

This new set of ratios, based on domestic capital formation proportions alone since they are more closely related than national proportions to growth of countrywide product, is summarized for the two long periods in Table 9. The dating of the subperiods in this table is roughly the same as that in Table 1 (for capital formation proportions) and that in Table 5 (for incremental capital-output ratios). In fact, the only additional item of information provided in Table 9 is in column 3, the rates of growth per year in labor force. Having calculated these, we were able to derive rates of growth in product per worker (based also on Table 5, column 3) and the incremental per worker capital-output ratios (based also on Table 1, columns 3 and 5).

Even after the crude adjustment for changes in the labor factor in the form of additions to labor force, the incremental capital-output ratios range widely among the countries. In Panel A, the range for the gross ratios is from a low of 3.6 for Japan to 15.8 for Australia; in Panel B, from 5.4 for Japan to 30.6 for Argentina and 19.8 for Australia.

The addition to output per worker may be viewed simply as a function of additions to capital per worker and some residual factor. This residual may be due to different and changing supply of natural resources, to different and changing quality of the labor force not recorded in our simple count, and to a variety of other factors unrelated to the utilization of available productive factors in the

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9.        This can be seen from the following algebra. Designate:

$C_o$---Capital formation in period 0
$O_o$ and $O_1$---Output in periods 0 and 1
$L_o$ and $L_1$---Labor force in periods 0 and 1

Capital formation proportion = $C_o/O_o$        (1)

Rate of growth in output per worker = $\dfrac{O_1/L_1 - O_o/L_o}{O_o/L_o}$        (2)

Dividing (1) by (2), we get:

$\dfrac{C_o}{L_o}$  +  $(O_1/L_1 - O_o/L_o)$        (3)

The first term in expression (3) is the absolute increment in capital per worker and the second is the absolute increment in output per worker.

**Table 9.**
Ratios of Domestic Capital Formation Proportions to Rates of Growth of Output per Worker, Two Long Periods, Selected Countries (Based on current price proportions)

| Country and Output Concept | Period for rate of growth of labor force (1) | Duration (years) (2) | Growth per Year (%) Labor force (3) | Growth per Year (%) Output per worker (4) | Ratio to Col. 4 of: GDCF/GDP (5) | Ratio to Col. 4 of: NDCF/NDP (6) |
|---|---|---|---|---|---|---|
| **A. Mid-19th Century to World War I** | | | | | | |
| 1. United Kingdom, NNP | Avg. of 1851 and 1861 to avg. of 1911 and 1921 | 60 | 0.75 | 1.46 | 6.2 | 5.0 |
| 2. Germany, NNP | 1851-55 to 1871-75; 1871 to 1890; 1890 to 1907 | 56 | 1.25 | 1.42 | 13.9 | 9.1 |
| 3. Italy, GDP; NDP | 1861 to avg. of 1911 and 1921 | 55 | 0.23 | 1.07G; 1.00N | 11.7 | 6.5 |
| 4. Denmark, GDP; NDP | 1870 to 1914 | 44 | 0.94 | 2.29G; 2.31N | 5.5 | 3.3 |
| 5. Norway, GDP; NDP | 1865 to 1915 | 50 | 0.82 | 1.25G; 1.21N | 10.6 | 6.8 |
| 6. Sweden, GDP | 1861 to 1915 | 54 | 0.79 | 2.14 | 5.7 | 3.6 |
| 7. United States, GNP; NNP | 1874 to 1914 | 40 | 2.55 | 1.72G; 1.63N | 12.7 | 8.0 |
| 8. Canada, GNP | 1870 to avg. of 1910 and 1920 | 45 | 2.13 | 1.50 | 13.1 | 7.2 |
| 9. Australia, GDP | 1861 to 1914/15 | 53.5 | 2.61 | 0.96 | 15.8 | 10.8 |
| 10. Japan, GNP; NNP | 1883-87 to 1913-17 | 30 | 0.74 | 2.99G; 2.95N | 3.6 | 2.0 |
| **B. End of 19th through 20th Century** | | | | | | |
| 11. United Kingdom | Avg. of 1891 and 1901 to avg. of 1911 and 1921; 1921 to 1938; 1950 to 1958 | 45 | 0.76 | 0.90 | 11.8 | 6.7 |
| 12. Germany | 1886-95 to 1907; 1925 to 1939; 1950 to 1958 | 38.5 | 1.36 | 1.92 | 10.6 | 6.6 |
| 13. Italy | Avg. of 1881 and 1901 to avg. of 1911 and 1921; 1921 to 1936; 1950 to 1958 | 48 | 0.45 | 2.71G; 2.55N | 6.6 | 4.0 |
| 14. Denmark | 1894 to 1914; 1921 to 1939; 1950 to 1958 | 46 | 1.09 | 2.25G; 2.23N | 6.5 | 4.2 |

Table 9 (Cont.)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| 15. Norway | 1895 to 1940; 1950 to 1955 | 50 | 1.02 | 1.82G; 1.78N | 11.4 | 8.1 |
| 16. Sweden | 1900 to 1950; 1950 to 1958 | 58 | 0.93 | 2.36 | 7.7 | 5.0 |
| 17. United States | 1894 to 1914; 1919 to 1939; 1946 to 1956 | 50 | 1.72 | 1.36G; 1.36N | 14.8 | 6.2 |
| 18. Canada | Avg. of 1890 and 1900 to avg. of 1910 and 1920; 1920 to 1939; 1945 to 1953 | 47 | 2.04 | 1.56 | 13.0 | 6.5 |
| 19. Australia | Avg. of 1891 and 1901 to 1914/15; 1919/20 to 1938/39; 1947 to 1954 | 44.5 | 1.81 | 0.98 | 19.8 | 14.4 |
| 20. Japan | 1898-1902 to 1938-42; 1950 to 1958 | 48 | 0.95 | 3.67G; 3.53N | 5.4 | 4.0 |
| 21. Argentina, GDP; NDP | 1895 to 1955 | 60 | 2.66 | 0.88G; 0.63N | 30.6 | 22.2 |
| 22. Union of South Africa, GNP; NNP | 1919/20 to 1951/52 | 32 | 1.90 | 2.73G; 2.75N | 8.4 | 6.5 |

See notes to Table 5.

Unless otherwise indicated the underlying labor force series are from the sources cited in the appendix tables. For the United Kingdom, 1919-33 to 1934-38; Sweden except 1950 to 1958; Australia, 1871-1938/39; and the Union of South Africa, labor force is from Colin Clark, Conditions of Economic Progress (3rd ed.), London, 1957, Table X, pp. 98 ff. and Table III, pp. 510 ff. For the United Kingdom, Germany, Denmark, Sweden, and Japan, 1950 to 1958, the rate of growth of the labor force is from World Economic Survey, 1959, United Nations, New York, 1960, Table 1-4, p. 26. For Germany, 1871 to 1939, labor force is from Paul Jostock, "The Long-Term Growth of National Income in Germany," Income and Wealth, Series V, International Association for Research in Income and Wealth, London, 1955, Table VI, p. 102; and is extrapolated to 1851-55 by total population, given in W. G. Hoffmann and J. H. Muller, Das Deutsche Volkseinkommen, 1851-1957, Tübingen, 1959, Table 2, p. 14. For Italy the labor force was obtained by correspondence from A. Giannone. For Denmark, 1870 to 1939, the labor force is from Kjeld Bjerke, "The National Product of Denmark, 1870-1952," Income and Wealth, Series V, Table XIV, p. 151. For Australia, 1947 and 1954, the labor force is from the official Census, and for 1861 was extrapolated with total population as index. For Japan, 1883 to 1942, the labor force is derived from total national income and national income per gainfully occupied given in Shigeto Tsuru and Kazushi Ohkawa, "Long-Term Changes in the National Product of Japan since 1878," Income and Wealth, Series III, International Association for Research in Income and Wealth, London, 1953, Table II, p. 37 and Table IV, p. 40. For Argentina, labor force is available for only 1914 and 1947 and since it is about 40 percent of total population in both years, the latter (obtained from the United Nations Statistical Office) was used here.

Table 9 (Cont.)

Column 4 is derived from the rate of growth of output, Table 5, column 3, and the rate of growth of the labor force in column 3.

Columns 5 and 6 are derived by dividing the capital formation proportions in Table 1, columns 3 and 5, by column 4.

country; but it may and should also reflect the contribution of growing efficiency in the use of the productive resources to additions to output. The proportion of this residual to additions to output per worker depends upon the rate of yield or contribution assigned to reproducible capital. Thus if we were to assign a yield of 7 percent, standard for all countries (and it must be the same, if international comparisons of the relative share of the residual are to be made), the share of the residual (other factors including changes in efficiency) would, for the period in Panel A, be as high as 75 percent of the additions to per worker product in Japan, i.e., 100 minus (3.6 x 7); negative in Australia; and as low as 3 percent in Germany. If changes in efficiency are a major component in the residual, the wide differences among countries in Table 9 reflect a wide range in the effectiveness of increasing efficiency in using capital (and other resources) in raising output. Although the underlying production function is extremely simple and the residual factor covers more than "efficiency" in any meaningful limitation of that term, it is still true that the wide range in the ratios in Table 9 means a wide range in the share of the "unaccounted" residual in additions to output. And this finding clearly indicates that analysis must probe much further in the relation between capital and output before reasonably systematic and relatively invariant associations can be secured.

The effect of the allowance for the changes in labor force on the dispersion of the capital-output ratios is measured directly in Table 10. The dispersion among the incremental capital-output ratios, adjusted for additions to labor force (in lines 5 and 7) is even wider than it is among the incremental ratios of total additions to capital to total additions to product. Furthermore, the convergence from the first to the second period is not as marked as that for capital formation proportions or for the incremental total capital-total output ratios.

More important, the variability of the rates of growth of product per worker, measured in column 1, line 5, is increased appreciably when we divide the rates into the proportions of capital formation per worker to output per worker. If there were a simple positive proportional association between additions to capital per worker and additions to product per worker, the shift from column 1 to columns 2 and 3 would reduce the variability.

In short, we find neither the expected positive association between capital formation proportions and rates of growth of product per worker; nor the expected negative association between rates of growth of labor force and the incremental total capital-total output ratios. This conclusion is confirmed by the following coefficients of rank correlation (Kendall's Tau):

|  | Panel A (10 countries) | Panel B (12 countries) |
|---|---|---|
| Between Rate of Growth of Labor Force (Table 9) and Incremental Capital-Output Ratios (Table 5) | | |
| Gross domestic ratios | 0.02 | 0.24 |
| Net domestic ratios | -0.07 | 0.03 |
| Between Rate of Growth of Product per Worker (Table 9) and Capital Formation Proportions (Table 1) | | |
| Gross domestic proportions | -0.16 | -0.03 |
| Net domestic proportions | -0.16 | 0.18 |

Table 10.
Means and Dispersion of Incremental Capital-per-Worker to Product-per-Worker
Ratios, Ten Countries, Two Periods (Based on Table 9)

| | Rates of growth, product per worker (%) (1) | Incremental Ratios (Domestic) | |
| --- | --- | --- | --- |
| | | Gross (2) | Net (3) |
| **Arithmetic Mean** | | | |
| 1. Panel A | 1.67 | 9.88 | 6.23 |
| 2. Panel B | 1.94 | 10.76 | 6.57 |
| **Average Deviation** | | | |
| 3. Panel A | 0.48 | 3.70 | 2.20 |
| 4. Panel B | 0.62 | 3.40 | 1.90 |
| **Ratio, A. D. /A. M.** | | | |
| **Panel A** | | | |
| 5. For above | 0.29 | 0.37 | 0.35 |
| 6. From Table 6, line 5 | 0.25 | 0.28 | 0.25 |
| **Panel B** | | | |
| 7. For above | 0.32 | 0.32 | 0.29 |
| 8. From Table 6, line 7 | 0.15 | 0.13 | 0.18 |

All the coefficients are much below any acceptable level of significance, and six
of the eight carry a sign opposite to that expected. [10]

Another check on the association between the incremental capital-output ra-
tios for total capital and product, and the rates of growth of labor force, can be
made by comparing direction of movement in the latter for the successive periods
in Table 11 below with that in the incremental capital-output ratios in Table 7.
This test is similar to the one made above when we matched sign of change be-
tween successive long periods in capital formation proportions and rates of growth
of product. For the 42 spans or intervals in Tables 7 and 11, the incremental
gross domestic capital-output ratio (in Table 7) rises 25 times and declines 15
times, and shows no change twice. We would expect the rate of growth in labor
force to decline when this ratio rises. But we find the expected disagreement in
sign only 22 times out of the possible 42 in the comparison of the rate of growth
with the gross incremental capital-output ratios; and only 17 times in the

10.    In the United Nations survey referred to in footnote 8 the multiple correla-
       tion coefficient between the rate of growth of output on the one hand and the
       investment ratio and the rate of growth of the labor force on the other, for
       the 12 industrial countries for 1950-58, is shown to be 0.88 (see note 8,
       p. 26). But the coefficient of rank correlation (Kendall's Tau) between the
       investment ratio and the rate of growth of output per worker for the same
       12 countries, is 0.27, indicating no significant association even at the 5
       percent level; and, in fact, the coefficient is somewhat lower than that
       for the association between the investment ratio and the rate of growth of
       total output.

comparison with the net incremental capital-output ratios. Clearly, such propor-
tions of about five to ten are compatible with the assumption that there is no
significant association over time between changes in the incremental capital-
output ratio for total capital formation and total product, and changes in the rate
of growth of the labor force.

We may turn now to the set of ratios for the long periods of twenty to
thirty years (Table 11). The question is whether we can discern any significant
trends in these ratios of capital formation per worker to additional product per
worker (and complementary trends in the proportion which the "residual factors,"
including efficiency, contribute to rise in product per worker).

The incremental capital-output ratios on a per worker basis are even
more variable over time than those in Table 7. As a result, we find sustained
long-term trends in only a few countries: a rise in Germany, for the pre-World
War I period; in Denmark over the whole period through the post-World War II
years; in the United States for the gross ratio from the 1870's to World War II;
in Australia; and in Japan. In Italy, Norway, and Argentina we find a fairly sus-
tained long-term decline in the ratios. In the three remaining countries (exclud-
ing the Union of South Africa)--United Kingdom, Sweden, and Canada--no sus-
tained trend is evident. And, in general, the incremental ratios are quite vari-
able over time even in the few countries with a marked trend. To illustrate: in
Australia, the rise in per worker product observed in 1861-81 is followed by a
decline in per worker product in 1881-1901, and the incremental ratio is there-
fore infinitely large for the later period. In Japan, despite the generally upward
trend, there is a decline in the gross ratio from the second to the third period.
Thus, while on the whole there is some preponderance of rises in the long-term
movements of the ratios of capital formation per worker to additions to product
per worker, the evidence of the limited sample does not yield a firm conclusion
that an upward trend predominates. The ratios are too variable and the trends
too diverse to permit any significant substantive generalization.

Insofar as the price adjustment permits us to observe the incremental ra-
tios based on constant price totals, the impression of lack of general direction in
the incremental ratios of capital per worker to product per worker is only con-
firmed (Table 12). In fact, for Denmark the shift to totals in constant prices re-
duces the long-term rise significantly. On the other hand, for Sweden where the
current price totals yield no definite trend in the ratios, the constant price totals
suggest a long-term decline; and for Norway the downward trend in the ratios
based on the current price totals is accentuated in those based on constant price
totals. If the price indexes can be trusted at all, the long-term trends in the
incremental ratios of capital per worker to product per worker, based on con-
stant price totals, are, for our sample, even more equally divided between rises
and declines than the ratios based on current price totals; and there is even less
basis for a general finding of upward trends in these ratios.

### V.    Distribution of Capital Formation by Type
### of Good and Industry of Destination

The distribution of domestic capital formation by type of good distinguishes
additions to stocks from fixed capital formation, and within the latter, construc-
tion from producers' equipment, and various types of construction. The distribu-
tion of gross domestic capital formation in current prices for post-World War II
years yielded the following findings (Paper V, Table 6, p. 33).

First, additions to stocks accounted for between 5 and 10 percent of gross
domestic capital formation and the shares were lower in the high income countries
than in the low income countries.

Table 11.
Ratios of Domestic Capital Formation Proportions to Rates of Growth of Output per Worker, Successive Long Periods, Selected Countries (Based on current price proportions)

| Country, Output Concept, and Period for Rate of Growth of Labor Force | Duration (years) (1) | Growth per Year (%) | | Ratio to Col. 3 of: | |
|---|---|---|---|---|---|
| | | Labor force (2) | Output per worker (3) | GDCF/ GDP (4) | NDCF/ NDP (5) |
| **United Kingdom, NNP** | | | | | |
| 1. 1821 and 1831 to 1851 and 1861 | 30 | 0.93 | 1.14 | | 6.5 |
| 2. 1851 and 1861 to 1871 and 1881 | 20 | 0.71 | 1.54 | 5.6 | 4.5 |
| 3. 1871 and 1881 to 1891 and 1901 | 20 | 0.81 | 2.19 | 3.9 | 3.1 |
| 4. 1891 and 1901 to 1911 and 1921 | 20 | 0.73 | 0.40 | 23.5 | 19.2 |
| 5. 1921 to 1938 | 15 | 0.72 | 1.30 | 6.8 | 2.5 |
| 6. 1950 to 1958 | 8 | 0.9 | 1.59G | 9.7 | 5.0 |
| **Germany, NNP** | | | | | |
| 7. 1851-55 to 1871-75 (1913 boundaries) | 20 | 0.73 | 1.99 | 6.7 | 4.3 |
| 8. 1871 to 1886-95 (1913 boundaries) | 19.5 | 1.41 | 1.02 | 17.3 | 11.2 |
| 9. 1886-95 to 1907 (1913 boundaries) | 16.5 | 1.69 | 1.17 | 19.4 | 12.8 |
| 10. 1925 to 1939 (1925 boundaries) | 14 | 0.56 | 1.09 | 12.3 | 5.3 |
| 11. 1950 to 1958 (West Germany) | 8 | 2.1 | 4.91 | 4.9 | 3.4 |
| **Italy, GDP; NDP** | | | | | |
| 12. 1861 to 1881 | 20 | 0.19 | 0.73G; 0.68N | 13.4 | 6.8 |
| 13. 1881 to 1901 | 20 | 0.20 | 0.77G; 0.72N | 13.9 | 6.9 |
| 14. 1901 to 1911 and 1921 | 15 | 0.33 | 1.82G; 1.72N | 8.0 | 4.6 |
| 15. 1921 to 1936 | 15 | 0.45 | 1.96G; 1.78N | 9.2 | 5.4 |
| 16. 1950 to 1958 | 8 | 1.0 | 5.52G; 5.27N | 3.8 | 2.5 |
| **Denmark, GDP; NDP** | | | | | |
| 17. 1870 to 1889 | 19 | 0.68 | 2.02G; 2.06N | 4.9 | 2.4 |
| 18. 1889 to 1909 | 20 | 1.12 | 2.35G; 2.35N | 5.8 | 3.7 |
| 19. 1894 to 1914 | 20 | 1.19 | 2.46G; 2.46N | 5.9 | 3.8 |
| 20. 1921 to 1939 | 18 | 1.28 | 1.87G; 1.85N | 6.7 | 3.9 |
| 21. 1950 to 1958 | 8 | 0.4 | 2.47G; 2.38N | 7.4 | 5.4 |
| **Norway, GDP; NDP** | | | | | |
| 22. 1865 to 1885 | 20 | 0.85 | 0.83G; 0.78N | 13.6 | 8.8 |
| 23. 1885 to 1905 | 20 | 0.73 | 1.29G; 1.27N | 10.0 | 6.1 |
| 24. 1895 to 1915 | 20 | 0.93 | 1.46G; 1.42N | 9.9 | 6.7 |
| 25. 1900 to 1920 | 20 | 0.93 | 1.53G; 1.48N | 10.8 | 7.4 |
| 26. 1920 to 1940 | 20 | 1.10 | 2.09G; 2.09N | 8.3 | 5.4 |
| 27. 1950 to 1955 | 5 | 0.51 | 3.00G; 2.87N | 10.0 | 7.7 |

Table 11 (Cont.)

|  | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Sweden, GDP** | | | | | |
| 28. 1861 to 1880 | 19 | 0.89 | 2.08 | 5.3 | 3.3 |
| 29. 1880 to 1900 | 20 | 0.37 | 2.31 | 4.9 | 3.1 |
| 30. 1900 to 1915 | 15 | 1.22 | 1.99 | 6.7 | 4.2 |
| 31. 1910 to 1930 | 20 | 1.57 | 0.71 | 19.0 | 12.1 |
| 32. 1930 to 1950 | 20 | 0.57 | 3.63 | 5.4 | 3.5 |
| 33. 1950 to 1958 | 8 | 0.4 | 3.11 | 6.9 | 4.5 |
| **United States, GNP; NNP** | | | | | |
| 34. 1874 to 1889 | 15 | 2.77 | 2.67G; 2.55N | 7.9 | 5.5 |
| 35. 1889 to 1914 | 25 | 2.42 | 1.14G; 1.09N | 19.4 | 11.8 |
| 36. 1919 to 1939 | 20 | 1.20 | 0.75G; 0.77N | 23.5 | 7.8 |
| 37. 1946 to 1956 | 10 | 1.45 | 2.76G; 2.78N | 7.8 | 3.1 |
| **Canada, GNP** | | | | | |
| 38. 1870 to 1910 and 1920 | 45 | 2.13 | 1.50 | 13.1 | 7.2 |
| 39. 1890 and 1900 to 1910 and 1920 | 20 | 2.70 | 1.27 | 18.0 | 10.2 |
| 40. 1920 to 1939 | 19 | 1.89 | 1.24 | 12.4 | 3.6 |
| 41. 1945 to 1953 | 8 | 0.78 | 3.09 | 7.5 | 4.4 |
| **Australia, GDP** | | | | | |
| 42. 1861 to 1881 | 20 | 3.24 | 2.34 | 6.9 | 5.3 |
| 43. 1881 to 1901 | 20 | 2.86 | -0.52 | negative | |
| 44. 1891 and 1901 to 1914/15 | 18.5 | 1.43 | 1.33 | 10.8 | 7.0 |
| 45. 1919/20 to 1938/39 | 19 | 2.02 | 0.55 | 30.0 | 19.6 |
| 46. 1947 to 1954 | 7 | 2.26 | 1.32 | 20.1 | 16.4 |
| **Japan, GNP; NNP** | | | | | |
| 47. 1883-87 to 1903-07 | 20 | 0.95 | 2.82G; 2.78N | 3.5 | 1.9 |
| 48. 1893-97 to 1913-17 | 20 | 0.55 | 2.58G; 2.54N | 4.2 | 2.3 |
| 49. 1918-22 to 1938-42 | 20 | 0.86 | 4.23G; 4.18N | 4.0 | 2.8 |
| 50. 1950 to 1958 | 8 | 2.4 | 4.26G; 3.53N | 6.6 | 6.2 |
| **Argentina, GDP; NDP** | | | | | |
| 51. 1895 to 1914 | 19 | 3.70 | 0.54G; -0.23N | 62.8 | negative |
| 52. 1920 to 1940 | 20 | 2.37 | 0.92G; 0.74N | 29.8 | 17.6 |
| 53. 1935 to 1955 | 20 | 1.93 | 1.15G; 1.39N | 20.5 | 6.5 |
| **Union of South Africa, GNP; NNP** | | | | | |
| 54. 1919/20 to 1938/39 | 19 | 2.10 | 2.44G; 2.47N | 7.5 | 5.1 |
| 55. 1945/46 to 1951/52 | 6 | 1.50 | 3.46G; 3.36N | 7.7 | 6.5 |

See notes to Table 9.

Column 3 is derived from the rate of growth in output, in Table 7, column 2, and the rate of growth of the labor force, in column 2.

Columns 4 and 5 are derived by dividing the capital formation proportions, in Table 3, columns 2 and 4, by column 3.

Table 12.
Incremental Ratios of Capital to Output per Worker Based on Current and Constant Prices, Long Periods, Selected Countries (Based on proportions of GDCF to GDP or GNP unless otherwise indicated)

| Country, Period for Rate of Growth of Labor Force, and Base Year of Price Index | Based on Totals in: | |
|---|---|---|
| | Current prices (1) | Constant prices (2) |
| **United Kingdom, 1890-99** | | |
| 1. 1861 to 1881 | 5. 3 | 6. 1 |
| 2. 1871 and 1881 to 1891 and 1901 | 3. 9 | 4. 2 |
| 3. 1891 and 1901 to 1911 and 1921 | 23. 5 | 23. 8 |
| **Germany, 1913, NNCF/NNP** | | |
| 4. 1851-55 to 1871-75 | 4. 6 | 4. 7 |
| 5. 1871 to 1890 | 13. 5 | 13. 5 |
| 6. 1890 to 1907 | 13. 8 | 13. 6 |
| **Italy, 1938** | | |
| 7. 1861 to 1881 | 13. 4 | 11. 4 |
| 8. 1881 to 1901 | 13. 9 | 12. 9 |
| 9. 1901 to 1911 and 1921 | 8. 0 | 7. 4 |
| 10. 1921 to 1936 | 9. 2 | 8. 6 |
| 11. 1950 to 1958 | 3. 8 | 3. 6 |
| **Denmark, 1929** | | |
| 12. 1870 to 1889 | 4. 9 | 5. 4 |
| 13. 1889 to 1909 | 5. 8 | 5. 8 |
| 14. 1894 to 1914 | 5. 9 | 5. 7 |
| 15. 1921 to 1939 | 6. 7 | 6. 3 |
| 16. 1948 to 1952 | 6. 0 | 5. 0 |
| **Norway, 1938** | | |
| 17. 1865 to 1885 | 13. 6 | 15. 4 |
| 18. 1885 to 1905 | 10. 0 | 11. 1 |
| 19. 1900 to 1920 | 10. 8 | 11. 3 |
| 20. 1920 to 1940 | 8. 3 | 8. 6 |
| 21. 1946 to 1955 | 10. 4 | 8. 5 |
| **Sweden, 1913** | | |
| 22. 1861 to 1880 | 5. 3 | 6. 8 |
| 23. 1880 to 1900 | 4. 9 | 5. 5 |
| 24. 1900 to 1915 | 6. 7 | 6. 8 |
| 25. 1910 to 1930 | 19. 0 | 17. 6 |
| 26. 1930 to 1950 | 5. 4 | 5. 1 |
| **United States, 1929** | | |
| 27. 1874 to 1889 | 7. 9 | 8. 9 |
| 28. 1889 to 1914 | 19. 4 | 21. 0 |
| 29. 1919 to 1939 | 23. 5 | 22. 8 |
| 30. 1946 to 1956 | 7. 8 | 6. 6 |

Based on Table 4 and rates of growth derived as described in notes to Table 9.

Second, construction accounted for between 50 and 55 percent of gross domestic capital formation, and producers' equipment for between 35 and 45 percent. There was no apparent association between per capita income and the distribution of fixed capital formation between construction and equipment. But allowance for differential price levels, which would be much higher for equipment than for construction in the less developed countries, might reduce the proportions for equipment in these countries.

Third, residential construction accounted for between 16 and 22 percent of gross domestic and between 20 and 25 percent of total fixed capital formation. There was some positive association with per capita income, the shares being somewhat higher for the high income countries.

On the basis of these findings we should expect a downward trend in the share of additions to stocks in domestic capital formation and a complementary rising trend in the share of fixed capital formation over the long run. Within the latter, we might expect a rise in the shares of producers' equipment and residential construction (which would imply a decline in the share of other construction). But the latter conjectures are not too strongly indicated by the comparisons for recent years.

In considering the long-term evidence, we are impeded more than ever by the paucity and crudity of the data (Table 13). To begin with, additions to stocks for most countries are estimated on the simple assumption that they equal four-tenths of additions to national product in constant prices. For only six countries in our sample are the ratios based upon estimates in the special studies, and they too are fairly crude approximations. Yet for whatever they are worth, the shares of additions to stocks in gross domestic capital formation for these six countries (Germany, Italy, Denmark, the United States, Canada, and the Union of South Africa) show an unmistakable decline (although for Germany the estimates are for agricultural inventories alone). In general, one would expect that the very increase in the capital formation proportions as a country develops would reduce the share of inventory accumulation; and the decline in the weight of agriculture and other seasonal industries with their substantial inventories would contribute to that trend. Furthermore, inventories are a form of investment with a relatively quick turnover compared with fixed and durable capital goods--and under the conditions of capital scarcity characterizing early phases of development may therefore be a preferred type. Finally, difficulties of communication and transportation may make for a higher ratio of stocks to product in the less developed phases that is not completely offset by the expansive effect on inventories of the lengthening of the production process that may accompany economic growth.

When the additions to stocks are estimated as a constant proportion of the increase in product, their share in gross domestic capital formation is a simple function of the relevant capital-output ratio. If the gross domestic capital-output ratio rose over time, as was indicated in the earlier discussion, the share in capital formation of additions to stocks would have declined. Thus, if the gross domestic capital-output ratio rose from 4 to 6, the estimated addition to stocks (being based on an assumed incremental inventory-product ratio of 0.4), would have dropped from 10 percent to 6.7 percent. And the trends indicated in these estimated shares (entries in parentheses in column 1) are due to a combination of the assumed incremental inventory-product ratio with the actual gross domestic capital-product ratio.

This comment suggests a simple way of indicating the contribution of the trend in the share of additions to stocks in domestic capital formation to the trend in the incremental domestic capital-output ratio. If we assume that the incremental inventory-domestic product ratio is 0.4; begin with an incremental ratio of total gross domestic capital to gross domestic product of say 5.0; and furthermore assume that the initial share of additions to inventories is as high as

Table 13.
Distribution of Gross Domestic Capital Formation among Major Types of Goods,
Successive Long Periods, Selected Countries (Based on current price totals)

| Country and Period | Shares in Gross Domestic Capital Formation (%) | | | |
|---|---|---|---|---|
| | Changes in stocks (1) | Residential construction (2) | Total con- struction (3) | Producers' equipment (4) |
| **United Kingdom** | | | | |
| 1. 1855-74 | (19.4) | 14.0 | 44.9[a] | 35.7[a] |
| 2. 1875-94 | (20.3) | 15.2 | 46.0[a] | 33.6[a] |
| 3. 1895-1914 | (19.6) | 13.4 | 43.8[a] | 36.6[a] |
| 4. 1921-38 | -23.6 | | 76.6 | 47.0 |
| 5. 1952-58 | 5.7 | 19.8 | 45.7 | 48.6 |
| **Germany** | | | | |
| 6. 1851-70 | 15[b] | 28 | 65[c] | 20 |
| 7. 1871-90 | 6[b] | 32 | 70[c] | 24 |
| 8. 1891-1913 | 5[b] | 31 | 62[c] | 33 |
| 9. 1928-38 | 4 | | | |
| 10. 1952-58 | 9.9 | | 42.7 | 47.4 |
| **Italy** | | | | |
| 11. 1861-80 | 13.0 | 17.5 | 37.4[d] | 49.6[d] |
| 12. 1881-1900 | 1.7 | 22.5 | 44.0[d] | 54.3[d] |
| 13. 1896-1915 | 7.9 | 18.2 | 28.1[d] | 64.0[d] |
| 14. 1921-40 | 2.0 | 14.0 | 25.1[d] | 72.9[d] |
| 15. 1946-55 | 6.1 | 16.7 | 29.7[d] | 64.2[d] |
| **Denmark** | | | | |
| 16. 1870-89 | 11.2 | | 55.9 | 32.9 |
| 17. 1890-1909 | 10.2 | | 55.4 | 34.4 |
| 18. 1895-1914 | 10.8 | | 54.3 | 34.9 |
| 19. 1921-39 | 10.3 | | 47.3 | 42.4 |
| 20. 1952-58 | 4.3 | | 40.3 | 55.4 |
| **Norway (lines 21-23 for NDCF in 1938 prices)** | | | | |
| 21. 1865-74 to 1885-94 | (10.1) | | 74.0 | 15.9 |
| 22. 1885-94 to 1905-14 | (10.3) | | 69.0 | 20.7 |
| 23. 1905-14 to 1930-39 | (11.6) | | 67.6 | 20.8 |
| 24. 1952-58 | 2.8 | 15.7 | 44.3 | 52.9 |
| **Sweden** | | | | |
| 25. 1861-80 | (11.5) | | 66.5 | 22.0 |
| 26. 1881-1900 | ( 9.5) | | 60.5 | 30.0 |
| 27. 1891-1910 | (10.8) | | 56.1 | 33.1 |
| 28. 1911-30 | ( 5.7) | | 54.0 | 40.3 |
| 29. 1931-50 | ( 8.9) | | 49.9 | 41.2 |
| 30. 1952-58 | 5.0 | 23.9 | 60.6 | 34.4 |

Table 13 (Cont. )

|  | | (1) | (2) | (3) | (4) |
|---|---|---|---|---|---|
| | United States | | | | |
| 31. | 1869-88 | 20.8 | 20.0 | 55.4 | 23.8 |
| 32. | 1889-1913 | 8.2 | 20.9 | 67.8 | 24.1 |
| 33. | 1919-38 | 5.0 | 17.8 | 58.5 | 36.5 |
| 34. | 1946-55 | 5.5 | 18.6 | 52.9 | 41.6 |
| | Canada | | | | |
| 35. | 1870, 1890, 1900 | 13.4 | | 54.7 | 31.9 |
| 36. | 1900, 1910, 1920, 1929 | 16.7 | 24.4 | 49.1 | 34.3 |
| 37. | 1896-1915 | 14.0 | 18.2 | 57.0 | 29.0 |
| 38. | 1921-40 | 6.5 | 19.4 | 59.0 | 34.5 |
| 39. | 1946-55 | 7.8 | 19.5 | 57.8 | 34.4 |
| | Australia | | | | |
| 40. | 1861-80 | (13.8) | 23.6 | | |
| 41. | 1881-1900 | ( 5.3) | 19.4 | | |
| 42. | 1896-1914/15 | ( 7.4) | 18.7 | | |
| 43. | 1920/21-1938/39 | ( 6.0) | 19.9 | | |
| 44. | 1952/53-1958/59 | 4.2 | | | |
| | Japan (unadjusted total, excluding military) | | | | |
| 45. | 1887-1906 | (14.6) | 20.8 | 66.7 | 18.7 |
| 46. | 1897-1916 | (10.3) | 13.4 | 62.2 | 27.5 |
| 47. | 1917-36 | (11.1) | 8.6 | 58.0 | 30.9 |
| 48. | 1952-58 | 17.8 | 6.8 | | |
| | Argentina (1950 prices) | | | | |
| 49. | 1900-19 | (4) | | | |
| 50. | 1920-39 | (4) | | | |
| 51. | 1935-54 | (5) | | | |
| 52. | 1952-58 | - 0.6 | | 54.9 | 45.6 |
| | Union of South Africa | | | | |
| 53. | 1910-29 | 16.3 | | 51.2 | 32.5 |
| 54. | 1920-39 | 10.8 | | 56.8 | 32.4 |
| 55. | 1935-55 | 14.2 | | 51.0 | 34.8 |
| 56. | 1952-58 | 4.7 | | 55.6 | 39.7 |

a. The mixed category (railroads, telegraph and telephone lines, and local authorities) is included with construction.

b. Agricultural inventories only; other inventories are included with equipment.

c. Column 3 covers residential construction and capital investment in roads, canals, streets, etc., and in railroads. Col. 4 covers all other fixed capital.

d. Column 3 covers residential construction and public works. Column 4 covers all other durable capital.

Entries in parentheses in column 1 are estimates based on the assumption of a
constant ratio (0.4) of changes in stocks to additions to product in constant
prices.

The estimates are derived from the appendix tables or from the sources cited in
the notes to those tables. For periods longer than a decade the entries are arith-
metic means of the shares for successive shorter subperiods, weighted by the
duration of the subperiods.

20 percent, the implicit incremental ratio for gross fixed capital to gross domes-
tic product is 6.15, i.e., [(100 x 5) - (20 x 0.4)] ÷ 80. If then the share of
inventories is reduced to 5 percent, and the two component incremental capital-
output ratios remain the same, the over-all gross domestic capital-output ratio
will become [(5 x 0.4) + (95 x 6.15)] ÷ 100, or 5.86. Thus, on the assumptions
stated, the drop in the share of addition to stocks in gross domestic capital for-
mation raises the incremental gross capital-output ratio from 5 to 5.9. It may
well be that the downward trend in the share of additions to stocks contributed to
the upward trend in the incremental domestic capital-output ratios. But the as-
sumption may be unrealistic, and any proper measurement of this effect must
wait for more acceptable estimates of additions to stocks.

In turning now to the fixed capital formation components, we find two un-
mistakable trends. First, the share of construction in total gross domestic cap-
ital formation (and even more in total fixed) declines in most countries--the ex-
ceptions being the United Kingdom (in which, however, the apportionment is
crude), Canada, and the Union of South Africa. Second, the share of residential
construction, available for only six countries, is roughly constant in two (United
Kingdom and Italy) and declines perceptibly in the other four (United States,
Canada, Australia, and Japan). Neither of these trends is what we expected
from the cross-section analysis for post-World War II years: the latter indicated
no association between the share of construction (or producers' equipment) and
level of income, and a positive association between the movements of the share
of residential construction and per capita income (which rose in all the countries
in Table 13).

Yet both trends can be explained. In the early stages of a country's eco-
nomic growth the need for construction--the basic network of factories, roads,
public utilities, harbors, etc.--is most pressing; while in the later stages the
demand for more elaborate machinery may be greater. It may well be that tech-
nical progress itself effected a shift from heavy construction installations to the
more complex and costly machinery and thereby changed the composition of cap-
ital formation in the developed countries, which dominate our sample. Further-
more, the decline in the share of residential construction contributes to the de-
cline in the share of total construction; and the former may be due to the declin-
ing rate of growth of population in most countries (particularly marked in the
United States, Canada, Australia, and even Japan), not fully offset by the rise
in the housing demands per capita. Moreover, the volume of non-residential
construction is affected by shifts among various sectors within the economy, with
their differing demands for construction versus equipment. The explanation of
the trends in the shares would be simpler if data were available on the two types
of durable capital formation by sectors. However, the shift from construction to
equipment conforms to what we know of the shift from extensive to intensive as-
pects of economic growth; from the primary building up of the capital network to
its movement to higher technological levels typified by more complex machinery.

Before discussing the implications of these trends for the long-term move-
ments of the capital-output ratios, we consider the distribution of gross capital
formation in constant prices. In Table 14 we compare, for the five countries for
which the relevant data are available, the shares of construction in gross fixed
capital formation, based on constant and current price totals.

Table 14.
Share of Construction in Gross Fixed Capital Formation, Current and Constant
Prices, and the Ratio of the Implicit Price Index for Construction to That for
Producers' Equipment, Selected Countries

| Country and Base Year of Price Index | Share of Construction in GFCF (%) | | Ratio of price index for construction to that for equipment |
|---|---|---|---|
| | Current prices (1) | Constant prices (2) | (3) |
| **Italy, 1938** | | | |
| 1. 1861-80 | 43.2 | 44.7 | 0.94 |
| 2. 1881-1900 | 44.8 | 42.8 | 1.08 |
| 3. 1896-1915 | 30.8 | 29.6 | 1.06 |
| 4. 1921-40 | 25.6 | 25.2 | 1.02 |
| 5. 1946-55 | 31.6 | 24.1 | 1.46 |
| **Denmark, 1929** | | | |
| 6. 1870-89 | 63.0 | 75.7 | 0.55 |
| 7. 1890-1909 | 61.7 | 71.0 | 0.66 |
| 8. 1895-1914 | 60.8 | 69.4 | 0.68 |
| 9. 1921-39 | 52.7 | 54.4 | 0.93 |
| 10. 1948-52 | 41.4 | 44.3 | 0.89 |
| **Sweden, 1913** | | | |
| 11. 1864, 1873, 1882 | 71.1 | 78.9 | 0.66 |
| 12. 1882, 1889, 1897 | 67.0 | 69.5 | 0.89 |
| 13. 1889, 1897, 1906, 1913 | 65.6 | 66.3 | 0.97 |
| 14. 1913, 1926, 1938 | 60.0 | 50.3 | 1.48 |
| 15. 1938, 1948 | 54.0 | 39.7 | 1.78 |
| **United States, 1929** | | | |
| 16. 1869-88 | 69.8 | 76.1 | 0.73 |
| 17. 1889-1913 | 73.8 | 74.8 | 0.95 |
| 18. 1919-38 | 61.7 | 61.6 | 1.01 |
| 19. 1946-55 | 56.0 | 50.2 | 1.26 |
| **Canada, 1935-39** | | | |
| 20. 1870, 1890, 1900 | 63.1 | 76.9 | 0.51 |
| 21. 1900, 1910, 1920, 1929 | 59.0 | 62.8 | 0.85 |
| 22. 1929, 1939, 1951-53 | 56.2 | 54.1 | 1.09 |

The estimates are derived from the appendix tables or from the sources cited in
the notes to those tables. For periods longer than a decade the entries are arith-
metic means of the shares for successive shorter subperiods, weighted by the
duration of the subperiods.

The entries in column 3 are calculated by dividing column 1 by column 2; and
then dividing the quotient by the ratio of (100 minus column 1) to (100 minus col-
umn 2).

In all five countries the price index for construction rises more (or de-
clines less) than the index for producers' equipment.  In Sweden this disparity is
strikingly large; in Italy, on the other hand, it is moderate, becoming apparent
only in the post-World War II years.  If the underlying price indexes can be ac-
cepted, construction costs have become progressively higher relative to costs of
producers' equipment--a reflection of the much lower rate of cost-reducing tech-
nical progress in the former than in the latter.  It is also clear that the failure of
price indexes for capital formation to decline more or to rise less than the price
indexes for all goods entering national product, observed in connection with Table
4 above, is due largely to this distinctive movement of prices of construction rel-
ative to prices of other goods, producers' equipment included.

One obvious consequence of this rise in prices for construction relative to
those for producers' equipment is its effect on the distribution of fixed capital
formation in constant prices--making for a greater decline in the share of con-
struction.  In all five countries the downward trend in the share of construction in
the total in constant prices (column 2) is much more conspicuous than the down-
ward trend in the share in the current price total (column 1).  To put it differ-
ently, the part of current capital formation devoted to construction was sustained
by a relative rise in the cost of construction; and without that rise, the decline
in the share of construction might have been more marked.

Does the long-term movement in the distribution of fixed capital formation
affect the trends in the capital-output ratios?  If we could assume, as we did in
the case of addition to stocks, that new construction and flow of new producers'
equipment bear some constant ratio to increment to product, changes in the
shares of construction and equipment would automatically mean changes in the
incremental domestic capital-output ratios--provided that the assumed ratios for
construction and equipment differed.  Thus if we assumed that, for volumes in
constant prices, the initial ratio of new construction to additions to product was
5 and the initial ratio of new equipment to additions to product was 1, a shift from
70 percent to 30 percent in the share of construction in gross fixed capital forma-
tion would mean a change in the gross fixed capital-domestic product ratio from
an initial value of 6.0 to a terminal value of $[5(30/70) + 1(70/30)]$, or 4.5.  But
we have no basis for assuming that additions to product require proportionally
fixed additions to construction and to producers' durable equipment.  The use of
such an assumption to approximate additions to stocks was an estimating device
subject to error, and the assumption of some constancy in the inventory-product
relationship does not seem unreasonable.

The fact that construction units have a much longer economic life than
units of producers' equipment does not mean that the former make for a higher
capital-output ratio than the latter.  The specific net contribution of a construc-
tion unit to additions to output is no smaller or larger than the net contribution of
an equipment unit costing the same amount--assuming, as we should, that the
yield on this additional investment is the same, and no changes need occur in the
ratio of additional inputs of other factors to additions to output.  In general, if
the incremental capital-output ratio is written as $dK/dP$, the addition to product,
$dP$, consists of $dW$, the addition to input of labor properly priced, plus $Y \times dK$,
where $Y$ is the rate of yield on the additional capital.  Whether $dK$ represents
construction, equipment, or for that matter inventories, $Y$ should be the same;
and unless there is a change in $dW/dP$, the incremental capital-output ratio will
remain constant so long as $Y$ remains constant.  And there is no reason why $Y$
should be assumed to be different for construction, equipment, or inventories.[11]

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11.     This conclusion differs from the position I took in Paper V, where the dif-
        ferent lengths of life of construction and equipment were interpreted as
        directly translatable into different levels of the capital-output ratio (see
        p. 60).  Further reflection indicated that differing length of economic life
        affects the relative weight of capital consumption charges, not of current
        net contribution to addition to output.  (Continued on next page)

The difference between construction and equipment, as far as economic arguments apply, lies rather in the capital consumption charges. If dK applies to net capital formation, the same dK/dP will yield different gross incremental capital-output ratios, depending partly upon the relative shares of construction, equipment, and inventory change in the gross capital formation from which the net capital formation has been derived, and partly upon the past trends in capital formation. All other conditions being equal, the shorter the economic life of a gross capital formation component, the larger the ratio of capital consumption to gross capital formation and hence the larger the ratio of the latter to net capital formation. With net inventory additions having no capital consumption, and producers' equipment having a much shorter life than construction units, a movement toward larger shares of producers' equipment and smaller shares of inventory change and of construction, should, all other conditions being equal, yield a higher ratio of gross capital formation to net capital formation. Likewise, any deceleration in the rate of growth of gross fixed capital formation, given constant economic life of the capital components, should also raise the ratios of capital consumption and gross capital formation to net capital formation.

It follows that the trends in the distribution of capital formation in Tables 13 and 14 should have led to a rise in the ratio of gross to net capital formation. Now, in general, the ratio of gross to net capital formation is substantially larger than the ratio of gross to net domestic product. If capital consumption is 40 percent of GDCF, the ratio of the latter to NDCF is 1.67; and if NDCF is 15 percent of NDP, GDP is only 10 percent larger than NDP. But if capital consumption rises to 60 percent of GDCF, and NDCF is still 15 percent of NDP, GDP will be 22.5 percent larger than NDP. Note that in the former case the proportion of GDCF to GDP is 25 to 110, or 22.7 percent; in the latter case it is 37.5 to 122.5, or somewhat over 30 percent. The disparity between gross and net capital formation proportions will grow more markedly, with the rise of the capital consumption share, than the disparity between the rates of growth of gross and net domestic product; and consequently, the gross capital-output ratio will tend to rise, even if the net capital-output ratio remains constant. Thus, assume in the illustration above that at the initial time point, both net and gross domestic product were growing at a rate of 5 percent per year--so that the initial incremental net capital-output ratio was 3, and the initial gross was 4.54. Assume now that the second time point, at which capital consumption becomes 60 percent of GDCF, is forty years later. The rate of growth of net domestic product is then still 5 percent per year (by assumption), but that of gross domestic product is larger because it has grown to 122.5 from 110 percent of net domestic product. This would raise the rate of growth for gross domestic product to a small fraction above 5 percent per year over the 40-year period; but since the gross domestic capital formation proportion has risen from 22.7 to over 30 percent, the gross domestic capital-output ratio would have risen from 4.54 to well over 5.

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Incidentally, relating the net capital-output ratio, dK/dP, to the yield of capital, Y, among other variables, could help to explain the lower capital-output ratios in the low income countries than in the high income countries, observed for post-World War II years in Paper V. But if we assume the difference in yields to be between 7 and 14 percent (as was suggested in Paper IV), it does not go very far toward explaining the spread in the capital-output ratios for the post-World War II years. Assume net domestic capital formation proportions in the high income countries of 14 percent and in the low income countries of 10 percent, and the rate of growth of product in the former of 2.8 percent per year and in the latter of 5 percent per year (see Paper V, Table 13, p. 58). Then the direct contribution to growth of a yield of 7 percent for net capital additions in the high income countries and of 14 percent in the low income countries, would be 0.98 percent (i.e., 14 percent multiplied by 0.07) and 1.40 percent (i.e., 10 percent multiplied by 0.14), respectively. This accounts for only half of a percent difference between the two rates of growth of product, whereas the actual difference is 2.2 percentage points.

In short, the shift in the distribution of gross capital formation indicated in Tables 13 and 14 should have led to a greater rise (or lesser decline) in the gross domestic capital-output ratios than in the net. But, because of the wide variability of movements in both sets of ratios in Table 7, such a difference between the trends of the two is not readily discernible. It is found for the United Kingdom, Germany (both when the 1920-30's are taken into account), Sweden, the United States, and Australia. Obviously, the erratic aspects of some of the capital consumption estimates and the divergent movement of the rate of growth of capital formation (an acceleration in it can cancel the effects of a rise in the share of producers' equipment) prevent the effects of any upward trend in the share of producers' equipment from emerging clearly.

If the distribution of domestic capital formation by type of good contributes little to an explanation of the trends in the capital-output ratios, is the distribution of capital formation by industry or sector of use more helpful? In Paper V it was shown that the capital-output ratios (using fixed capital alone, since additions to stocks are not usually given for the separate sectors) differ widely among the major sectors. Thus, in general, the incremental capital-output ratios are usually higher for the A than for the M sector, and tend to be quite high for the T+C sector (transportation and commerce)--due largely to the capital demands of the transport component. Since shifts in weights among the sectors in the course of economic growth are substantial, the corresponding shifts in their contributions to additions to product would, given the different sectoral incremental capital-output ratios, produce trends in the countrywide ratios. The latter are weighted averages of the sectoral ratios, the weights being the shares of the various sectors in additions to total countrywide product. Hence, the decline in the share of the A sector and the rise in the share of the M sector should, all other conditions being equal, make for a downward trend in the countrywide incremental capital-output ratio. On the other hand, the rise of the transportation sector would make for a rise in the countrywide capital-output ratio; and so on.

In other words, the long-term change in the countrywide capital-output ratio may be divided into two parts. The first--the inter-sectoral shift effect--is the change due to shifting weights of the sectors in their contribution to additions to countrywide product--measured by assuming that the sectoral capital-output ratios remain constant. The other--the intra-sectoral shift effect--is the part due to changes in the sectoral capital-output ratios--measured by holding the shares of the sectors in additions to countrywide product constant. Clearly, if we could reduce the total movement in the countrywide capital-output ratio to the inter-sectoral shift effect, we would take a major step toward explaining it; for its explanation would be given by the factors, many of them familiar, that account for long-term trends in the industrial distribution of national product in the course of growth, combined with the more technical factors accounting for differences in the level of the sectoral capital-output ratios. But if most of the long-term trend in the countrywide capital-output ratio is due to intra-sectoral shifts, the task of explanation becomes more involved, requiring the elucidation of the dominance of the upward (or downward) trend among all or the majority of the sectors, despite the large differences in the level of their capital-output ratios and despite the marked trends in their relative contribution to the additions to countrywide product.

The analysis in Paper V indicated that the inter-sectoral differences among countries contributed little to the inter-country differences in the countrywide incremental capital-output ratios; that in fact there were substantial differences among the countries in the capital-output ratios for one and the same sector, and that the intra-sectoral differences were the dominant factor in international differences in capital-output ratios (see Table 15, p. 64 and discussion on p. 67). But this may have been the result of a specific historical situation: during the post-World War II years there were relatively few, surprisingly narrow, differences among groups of countries in the proportional contribution of the different sectors to additions to countrywide product. Thus, the share of the M

sector in additions to gross domestic product varied only from 46 to 54 percent; that of the services sector (excluding T+C) from 25 to 26 percent. In the long-term records we should find marked changes over time in the contribution of the different sectors to additions to total product; and therefore may expect a much greater contribution of inter-sectoral shifts to the long-term trends in the countrywide capital-output ratio.

Table 15 assembles all the evidence that we have on sectoral capital-output ratios for sufficiently long periods to permit observation of trends. Seven countries are covered but the data for Canada are available only since 1927-29, and hence no long-term trends can be studied in them. We could not find industrial distributions of product for Norway or of either product or capital formation for Australia in constant prices; and had to make assumptions concerning the relative movements of price indexes for sectoral product (and for sectoral capital formation). To complicate matters, the sectoral distributions are not the same in the several countries--although in practically all of them we can distinguish at least the A and the M sectors.

Limited and poor as the data in Table 15 are, they are all we have; and we present the findings that they suggest.

First, the capital-output ratios for the A sector are higher than those for the M sector, with no exceptions but with rather wide variations in relative disparity. In Norway and Australia, the two sectoral capital-output ratios are fairly close; in Sweden, Canada, and the Union of South Africa, the ratio for the A sector is double or more than double that for the M sector. In practically all cases, the sectoral ratio for the M sector is distinctly lower than the countrywide.

Second, the sectoral ratios for dwellings, when given, and for transportation and communication, or the total of public utilities when given separately, are among the highest.

Third, the decline in the share of agriculture and the rise in the share of the M sector should have made for a declining countrywide capital-output ratio in the course of economic growth. On the other hand, the rise in the shares of transport and communication and of residential construction (if observed) should have made for a long-term rise in the countrywide capital-output ratio. The net balance of effects of shifts in the industrial structure of additions to national product on the countrywide capital-output ratio would depend partly upon the inter-sectoral shifts, partly upon the inter-sectoral differences in the level of their capital-output ratios.

Fourth, the inter-sectoral shift effects on the movements of the countrywide capital-output ratios are not consistent. In Norway and Sweden, such inter-sectoral shifts account for all of the long-term movement in the countrywide capital-output ratios (see lines 9-11 and 19-21). But in the other four countries, the results are different. Thus, in the United States, Argentina, and the Union of South Africa, practically all of the contribution to the movement of the countrywide capital-output ratio is by the intra-sectoral shifts (see lines 26-28, 55-57, and 64-66). The same conclusion is suggested for Australia since the rise in the capital-output ratio is clear and marked in each of the sectors distinguished, except agriculture.

Thus, if the evidence in Table 15 is of general relevance, all we can say is that in a few countries the long-term movement of the countrywide capital-output ratios is accountable largely in terms of the shifts in industrial structure of additions to countrywide product; whereas in most countries the movement of the intra-sectoral ratios contributes much more to the trend in the countrywide capital-output ratio. Insofar as the former pattern of behavior prevails, there is a close connection between the trends in the countrywide capital-output ratios and the secular trends in industrial structure of product that usually accompany

Table 15.

Sectoral Incremental Capital-Output Ratios and Effects of Inter- and Intra-Sector Shifts on Countrywide Capital-Output Ratios, Long Periods, Selected Countries (Based on constant price totals)

| Country, Ratio Components, and Sectors | Periods | | | |
|---|---|---|---|---|
| | I (1) | II (2) | III (3) | Full span (4) |
| **Norway, NFCF and NDP** | | | | |
| 1. Dates | 1900 to 1939 | 1939 to 1953 | | Cumulated |
| Capital-Output Ratios | | | | |
| 2. Agriculture and related industries | 6.1 | 0.8 | | 2.5 |
| 3. Mining and manufacturing | 2.3 | 2.3 | | 2.3 |
| 4. Transport | 3.5 | 2.2 | | 2.9 |
| 5. Trade and services | 1.1 | 1.7 | | 1.3 |
| 6. Dwellings | 11.6 | negative | | 35.2 |
| 7. Government | 3.2 | 3.8 | | 3.4 |
| 8. Dwellings and government | 6.3 | 20.0 | | 8.0 |
| 9. Total | 3.3 | 2.7 | | 3.0 |
| 10. Inter-sector shift effect | 3.4 | 2.6 | | |
| 11. Intra-sector shift effect | 3.3 | 4.5 | | |
| **Sweden, GFCF and GDP** | | | | |
| 12. Dates | 1861 to 1890 | 1891 to 1920 | 1921 to 1950 | Average |
| Capital-Output Ratios | | | | |
| 13. Agriculture and related industries | 4.9 | 4.8 | 5.8 | 5.2 |
| 14. Mining, manufacturing, and construction | 2.5 | 2.8 | 2.4 | 2.6 |
| 15. Transport and communication | 11.0 | 9.7 | 10.7 | 10.5 |
| 16. Public administration | 5.4 | 5.6 | 6.9 | 6.0 |
| 17. Dwellings | 22.0 | 24.1 | 27.0 | 24.4 |
| 18. Other | 0.1 | 0.4 | 0.9 | 0.5 |
| 19. Total | 4.9 | 4.2 | 3.8 | 4.3 |
| 20. Inter-sector shift effect | 5.2 | 4.4 | 3.7 | |
| 21. Intra-sector shift effect | 4.1 | 4.3 | 4.7 | |
| **United States, NFCF and NNP** | | | | |
| 22. Dates | 1880 to 1900 | 1900 to 1922 | 1922 to 1948 | Cumulated |
| Capital-Output Ratios | | | | |
| 23. Agriculture | 1.1 | 7.4 | 1.3 | 2.2 |
| 24. Mining and manufacturing | 1.7 | 2.1 | 0.5 | 1.1 |
| 25. Public utilities | 5.8 | 3.5 | 0.8 | 1.9 |
| 26. Total of above | 2.4 | 2.9 | 0.7 | 1.4 |
| 27. Inter-sector shift effect | 1.5 | 1.4 | 1.4 | |
| 28. Intra-sector shift effect | 2.8 | 3.0 | 0.7 | |
| **Canada, GFCF and GDP** | | | | |
| 29. Dates | 1927-29 to 1951-55 | | | |
| Capital-Output Ratios | | | | |
| 30. Agriculture and related industries | 10.9 | | | |

(Continued on next page)

Table 15 (Cont. )

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| 31. Mining, manufacturing, electric power, and construction | 3. 3 | | | |
| 32. Transport and communication | 8. 2 | | | |
| 33. Trade and services | 2. 2 | | | |
| 34. Housing | 30. 1 | | | |
| 35. Government and social services | 9. 6 | | | |
| 36. Total` | 5. 8 | | | |

Australia, GFCF and GDP

| 37. Dates | 1861-70 to 1891-1900 | 1891-1900 to 1910-20 | 1910-20 to 1930-39 | Average |
|---|---|---|---|---|
| Capital-Output Ratios, Variant A | | | | |
| 38. Agriculture | 3. 9 | 3. 6 | 1. 8 | 3. 1 |
| 39. Mining and manufacturing | 1. 0 | 2. 3 | 3. 4 | 2. 2 |
| 40. Commerce and finance | 1. 1 | 2. 6 | 3. 3 | 2. 3 |
| 41. Housing | 8. 2 | 13. 5 | 19. 3 | 13. 7 |
| 42. Other (largely government) | 9. 2 | 14. 0 | 18. 0 | 13. 7 |
| 43. Total | 4. 0 | 6. 2 | 7. 4 | 5. 9 |
| Capital-Output Ratios, Variant B | | | | |
| 44. Agriculture | 5. 5 | 6. 6 | 5. 6 | 5. 9 |
| 45. Mining and manufacturing | 2. 6 | 5. 3 | 7. 3 | 5. 1 |
| 46. Commerce and finance | 2. 7 | 5. 6 | 7. 2 | 5. 2 |
| 47. Housing | 9. 8 | 16. 4 | 23. 2 | 16. 5 |
| 48. Other (government apportioned among sectors) | 1. 6 | 3. 0 | 3. 9 | 2. 8 |

Argentina, GFCF and GDP

| 49. Dates | 1900-09 to 1930-39 | 1920-29 to 1955 | | Cumulated |
|---|---|---|---|---|
| Capital-Output Ratios | | | | |
| 50. Agriculture | 5. 8 | 9. 5 | | 6. 4 |
| 51. Mining, manufacturing, and construction | 5. 2 | 4. 1 | | 4. 5 |
| 52. Transport, communication, and electric power | 15. 5 | 15. 0 | | 14. 9 |
| 53. Housing, trade, and services | 10. 5 | 9. 9 | | 9. 6 |
| 54. Government | 16. 4 | 10. 4 | | 12. 6 |
| 55. Total | 9. 0 | 8. 4 | | 8. 3 |
| 56. Inter-sector shift effect | 8. 4 | 8. 4 | | |
| 57. Intra-sector shift effect | 9. 3 | 8. 7 | | |

Union of South Africa, NFC and GDP

| 58. Dates | 1919 to 1928 | 1944 to 1955 | | Average |
|---|---|---|---|---|
| Capital-Output Ratios[a] | | | | |
| 59. Agriculture | 5. 4 | 3. 5 | | 4. 45 |
| 60. Mining | 2. 1 | 2. 0 | | 2. 05 |
| 61. Manufacturing | 1. 8 | 1. 6 | | 1. 7 |
| 62. Railways and utilities | 7. 5 | 4. 5 | | 6. 0 |
| 63. Other | 2. 9 | 2. 6 | | 2. 75 |
| 64. Total | 3. 5 | 2. 6 | | 3. 05 |
| 65. Inter-sector shift effect | 3. 1 | 2. 9 | | |
| 66. Intra-sector shift effect | 3. 4 | 2. 6 | | |

(Continued on next page)

a. Average capital-output ratios.

The entries are from the appendix tables or the sources cited in the notes to those tables. In column 4, the ratios are either unweighted arithmetic means of the ratios given in columns 1-3 and are headed "average"; or are derived from cumulated totals of additions to product and of capital formation for the full span and are headed "cumulated."

The underlying totals of product and capital formation are in constant prices except for Norway and Australia. For Norway, we used sector distributions of gross domestic product in current prices to represent distributions of net domestic product in constant prices. For Australia the sector distributions of both product and capital formation are in current prices, and the sectoral ratios are derived by applying to the countrywide capital-output ratio the ratios of the sector share in capital formation to the sector share in product. In Variant A capital formation under government auspices is allocated to the "other" category; in Variant B, it is distributed among all sectors in proportion to their shares in gross domestic product.

economic growth. Insofar as the latter pattern of behavior prevails, no such connection can be drawn; and the movements of the sectoral capital-output ratios must be traced to some complex of factors that affects them uniformly enough to yield a distinct long-term trend in the countrywide ratio. The wide variability over time in the countrywide incremental capital-output ratios, commented upon in connection with Table 7, may be due to the dominance of changes in the ratios within sectors; and to the possibility that these changes in sectoral ratios combine in varying fashion with changes in the relative contributions of the sectors to additions to total product.

It is particularly, and regretfully, to be noted that the evidence in Table 15 extends little support to the hope that long-term trends in countrywide capital-output ratios can be explained by secular shifts in the weights of the several sectors. Indeed, given the different levels of the sectoral capital-output ratios, and what we know about the trends in the shares of these sectors, it is difficult to see how the combination of the two would produce an upward secular trend in the countrywide capital-output ratios. For the sum of the A and M sectors, the rise in the share of the latter and decline in the share of the former should result in a decline in the countrywide ratio. Within the remaining segment of countrywide product, the later phases of development should see a decline in the shares of residential construction and of the capital-intensive public utilities, and a rise in the share of the service sector (which should have relatively low capital-output ratios). Thus the most likely conclusion would be that the inter-sectoral shifts should make for a declining trend in the countrywide capital-output ratio--particularly in the later stages of growth after the basic public utility network has been built and when the rate of population growth begins to slacken. It is the intra-sectoral capital-output ratios that, in the common sweep of their changes, are most likely to account for the upward trend in the countrywide capital-output ratios. And their community of movement may, in turn, be associated with factors of the kind that was suggested in our discussion of Table 7--greater availability of capital in later stages of development and hence less pressure to economize on capital, combined with fewer ways of increasing output without a substantial capital input.

## VI. Distribution of Capital Formation by Type of Purchaser and by Source of Financing

The distribution of domestic capital formation by type of purchaser (households, private corporations, public and government enterprises, general government--and whatever subdivisions within each category are of interest) is

inadequately reflected even in data for recent years--let alone records extending into the past. Indeed, the only aspect of the distribution upon which the long-term records shed any light is the share of the government sector in capital formation--and even here the definition of the sector varies from country to country.

One indirect way of gauging the importance of government as the purchaser of domestic capital formation in the past is to observe its share in the current stock of reproducible wealth--for this share reflects an accumulation of past net capital formation. Table 16, which summarizes the post-World War II data on this share provided in a recent volume of papers by the International Association for ·Research in Income and Wealth, shows that the share of net reproducible capital within the general government and public corporation sector, varies from 15 to over 40 percent (although the latter figure for France is exaggerated by the inclusion of art collections and land, hardly items in reproducible capital). No distinctive pattern of association between the share of government in total tangible reproducible wealth and per capita income is evident. Yet with the exception of Australia, countries in Group I do tend to have low shares of government in total capital--lower than those in Group II and at lower levels of income, with the significant exception of India, in which again the share of government is low. This negative relationship between share of government in capital and income per head was observed for the larger number of countries (excluding Communist) for post-World War II years: the share of purchases by governments including public and government corporations in gross domestic capital formation was either 39 or 41 percent in Groups VI and VII, compared with 33 percent in Group I (Paper V, Table 17, p. 69).

However, we should not therefore expect a decline over time in the share of government in gross domestic capital formation--for the conditions that determined the governments' role in post-World War II years can hardly be projected into the more distant past. At any rate, of the seven countries summarized in Table 17 not one shows a significant decline in the share of government as a purchaser of gross domestic capital formation. In Norway, Japan, Australia, Argentina, and the Union of South Africa the share remains relatively stable, and in Japan and Australia is between a third and about a half of all gross fixed capital formation. In Sweden and the United States there is a clear and substantial long-term rise in the share.

While the measures in Table 17 often understate the share of government and differ from country to country in their inclusiveness, two findings of some broad interest may be suggested. First, in countries in which initially the role of government was limited because it was possible to finance some major capital-demanding investments (e.g., in railroads and other public utility sectors) through private capital markets, the share of government was likely to rise as urbanization, increasing complexity, and wars resulted in additions to the capital-demanding functions of central and local governments. Second, in some countries--outside and at times when they never even heard of the Communist orbit--the government directly assumed responsibility for much domestic capital formation: Japan, Australia, and even the Union of South Africa. In such cases the share of government was high from relatively early periods, and did not decline significantly--for as one function receded in importance, another emerged to claim capital goods. Thus in both Australia and the Union of South Africa, a long-term decline in the share of railroads and other transport installations (which were under government auspices) in domestic capital formation was accompanied by a sufficient rise in the share of other government purchases, to prevent the total share of government from dropping significantly (see lines 8 and 8a and 14 and 14a).

In turning now to the sources of financing, we find that the only aspect of the distribution for which long-term records are available for more than one country is that which distinguishes foreign sources from domestic, and within the latter, capital consumption allowances from net domestic savings (Table 18). Even these limited data are available for only nine countries.

Table 16.
Shares of General Government and Public Enterprises in Total Reproducible
Tangible Wealth, Selected Countries, Post-World War II Years

| Country and Year | Percentage Share of: | | |
| --- | --- | --- | --- |
| | General government (1) | Public enterprises (2) | Both (3) |
| **Group I** | | | |
| 1. Belgium, 1950 | 9 | 6[a] | 15 |
| 2. Luxembourg, 1950 | 9 | 12 | 21 |
| 3. United Kingdom, 1953 | 6[b] | | |
| 4. United States, 1955 | 13 | 2[c] | 15 |
| 5. Canada, 1955 | 16[d] | 2[e] | 18 |
| 6. Australia, 1956 | | | 33 |
| **Group II** | | | |
| 7. France, 1954 | 25[f] | 23 | 48 |
| 8. West Germany, 1955 | 12[g] | | |
| 9. Netherlands, 1952 | 16[h] | 6 | 22 |
| 10. Norway, 1953 | 12[i] | 11[j] | 23 |
| **Groups III-VII** | | | |
| 11. Japan, 1955 | 20 | 8 | 28 |
| 12. Argentina, 1955 | 24 | | |
| 13. Colombia, 1953 | 18 | | |
| 14. Mexico, 1950 | 23 | | |
| 15. India, 1950 | 5 | 13 | 18 |
| 16. Union of South Africa, 1955 | | | 34 |

a. Structures and equipment only.

b. Part of government services and public-owned schools and universities included; most central government structures excluded.

c. Some public enterprises (of local authorities) included.

d. Military airports, barracks, etc., included but not munitions.

e. Rough estimates of dwellings and inventories only.

f. Museums and art collections included; also land.

g. Roads, bridges, and canals excluded.

h. Rough estimate, including land.

i. Government equipment and inventories excluded.

j. Inventories excluded.

Data are from Raymond Goldsmith and Christopher Saunders, eds., The Measurement of National Wealth, Income and Wealth, Series VIII, Table III, pp. 14-16.

Table 17.

Share of Government in Gross Fixed Capital Formation (or Total Capital), Long Periods, Selected Countries (Based on current price totals unless otherwise indicated)

| | Periods | | | | |
|---|---|---|---|---|---|
| | I (1) | II (2) | III (3) | IV (4) | V (5) |
| **Norway** | | | | | |
| 1. Dates | 1865-84 | 1885-1904 | 1920-39 | 1947-56 | |
| 2. Share of general government in GFCF (%) | 10.4 | 12.0 | 14.1 | 10.8 | |
| **Sweden** | | | | | |
| 3. Dates | 1864, 1873, 1882 | 1882, 1889, 1897 | 1889, 1897, 1906, 1913 | 1913, 1926, 1938 | 1938, 1948 |
| 4. Share of public administration in GFCF (%)[a] | 4.4 | 5.9 | 7.4 | 11.4 | 12.9 |
| **United States** | | | | | |
| 5. Dates | 1869-88 | 1889-1913 | 1919-38 | 1946-55 | |
| 6. Share of public construction in GDCF (%) | 4.0 | 5.9 | 17.4 | 13.4 | |
| **Australia** | | | | | |
| 7. Dates | 1861-80 | 1881-1900 | 1896-1914/15 | 1920/21-1938/39 | 1952/53-1958/59 |
| 8. Share of public in GFCF (%) | 36.2 | 47.9 | 51.0 | 50.9 | 33.2 |
| 8a. Of which, roads, bridges, harbors, etc. (%) | 21.9 | 28.7 | 28.0 | 17.2 | |
| **Japan** | | | | | |
| 9. Dates | 1887-1906 | 1897-1916 | 1917-36 | 1952-58 | |
| 10. Share of govt. in GFCF (%) | 38.8 | 45.5 | 44.3 | 34.8 | |
| **Argentina (1950 prices)** | | | | | |
| 11. Dates | 1900-19 | 1920-39 | 1935-54 | | |
| 12. Share of govt. in GFCF (%) | 12.4 | 10.8 | 14.8 | | |
| **Union of South Africa (1938 prices)** | | | | | |
| 13. Dates | 1909-18 | 1919-28 | 1929-38 | 1939-48 | 1944-55 |
| 14. Share of public in fixed capital (%) | 32 | 32 | 32 | 33 | 33 |
| 14a. Of which, railways and harbors (%) | 19 | 18 | 16 | 14 | 13 |

a. Arithmetic means of shares for single years.

The entries are either from the appendix tables or from the sources cited in the notes to those tables, and for long periods are arithmetic means of shares for the shorter subperiods.

Table 18.
Shares of Major Sources of Financing in Gross Domestic Capital Formation, Long
Periods, Selected Countries (Based on current price totals)

| Country and Period | Share in GDCF (%) | | |
| --- | --- | --- | --- |
| | Gross domestic savings (1) | Capital consumption allowances (2) | Net domestic savings (3) |
| **United Kingdom** | | | |
| 1. 1855-74 | 142.8 | 20.4 | 122.4 |
| 2. 1875-94 | 149.3 | 21.6 | 127.7 |
| 3. 1895-1914 | 154.8 | 19.2 | 135.6 |
| 4. 1921-38 | 114.0 | 62.8 | 51.4 |
| 5. 1952-58 | 106.9 | 53.0 | 53.9 |
| **Italy** | | | |
| 6. 1861-80 | 86.4 | 55.2 | 31.2 |
| 7. 1881-1900 | 101.1 | 56.9 | 44.2 |
| 8. 1896-1915 | 108.6 | 51.0 | 57.6 |
| 9. 1921-40 | 91.7 | 51.8 | 39.9 |
| 10. 1946-55 | 86.0 | 42.9 | 43.1 |
| **Denmark** | | | |
| 11. 1870-89 | 81.0 | 51.2 | 29.8 |
| 12. 1890-1909 | 83.0 | 39.5 | 43.5 |
| 13. 1895-1914 | 90.9 | 38.4 | 52.5 |
| 14. 1921-39 | 108.7 | 45.8 | 62.9 |
| 15. 1952-58 | 95.9 | 34.5 | 61.4 |
| **Norway** | | | |
| 16. 1865-84 | 102.6 | 42.2 | 60.4 |
| 17. 1885-1904 | 67.8 | 43.2 | 24.6 |
| 18. 1895-1914 | 66.1 | 38.6 | 27.5 |
| 19. 1920-39 | 86.0 | 40.0 | 46.0 |
| 20. 1952-58 | 91.6 | 33.5 | 58.1 |
| **United States** | | | |
| 21. 1869-88 | 96.0 | 39.5 | 56.5 |
| 22. 1889-1913 | 102.3 | 47.6 | 54.7 |
| 23. 1919-38 | 105.6 | 72.1 | 33.5 |
| 24. 1946-55 | 102.1 | 66.2 | 35.9 |
| **Canada** | | | |
| 25. 1870, 1890, 1900 | 58.0 | 59.2 | - 1.2 |
| 26. 1900, 1910, 1920, 1929 | 69.3 | 47.8 | 21.5 |
| 27. 1896-1915 | 67.6 | (50) | 17.6 |
| 28. 1921-40 | 103.0 | (71) | 32.0 |
| 29. 1946-55 | 97.2 | 48.4 | 48.8 |

(Continued on next page)

Table 18 (Cont.)

|  | (1) | (2) | (3) |
|---|---|---|---|
| **Australia** | | | |
| 30. 1861-80 | 68.6 | 26.5 | 42.1 |
| 31. 1881-1900 | 60.5 | 39.5 | 21.0 |
| 32. 1896-1914/15 | 94.3 | 39.8 | 54.5 |
| 33. 1920/21-1938/39 | 88.7 | 39.2 | 49.5 |
| 34. 1952/53-1958/59 | 94.4 | 23.5 | 70.9 |
| **Japan** | | | |
| 35. 1887-1906 | 77.6 | 48.0 | 29.6 |
| 36. 1897-1916 | 80.6 | 50.0 | 30.6 |
| 37. 1917-36 | 92.9 | 37.9 | 55.0 |
| 38. 1952-58 | 102.3 | 28.6 | 73.7 |
| **Argentina (1950 prices)** | | | |
| 39. 1900-19 | 60.1 | 31.2 | 28.9 |
| 40. 1920-39 | 87.4 | 61.2 | 26.2 |
| 41. 1935-54 | 94.7 | 69.7 | 25.0 |

The entries are from the appendix tables and for the longer periods are arithmetic means of the percentage shares for the successive subperiods included.

Germany and Sweden are omitted because for most of the period capital consumption allowances are estimates based on an assumption of a constant ratio to GDCF (as are the entries for Canada in parentheses in lines 27 and 28).

The trends in the relative importance of foreign financial sources depend upon whether the country was an international creditor or debtor at the beginning of the long span. For the one country on the list that was initially an international creditor, the United Kingdom, we find, as might have been expected, a decline in the magnitude of capital exports relative to gross domestic capital formation; and the finding would probably be the same for other early international creditor nations, such as the Netherlands, Germany, and France. By contrast, the countries that were international borrowers at the beginning of the period, quite often in amounts accounting for high proportions of gross domestic capital formation, show a reduction in the relative magnitude of capital imports or a shift to the position of an international creditor. The only novel aspect of the findings is that in some countries, e.g., Denmark, Norway, Canada, and Australia, the trends are not consistent.

The distribution of gross domestic savings between net domestic savings and capital consumption allowances is subject to a wide margin of error because the latter are estimated differently in the several countries; and short of careful and critical examination of the underlying data and methods, it is difficult to judge the reliability of the estimates. By and large one would expect the ratio of capital consumption allowances to gross domestic capital formation to show an upward trend because of the decline in the relative shares of additions to stock and of long-lived construction items. Retardation in the rates of growth of gross capital formation, in those countries in which the rise of capital formation proportions did not offset the retardation in the rate of growth of product, should also make for a rising trend in the capital consumption share. Yet we find distinct secular rises in these shares only in the United Kingdom, the United States, and Argentina. Why they did not rise in the other four countries is a question that requires a study of the estimates, in particular of the effect of using original

rather than replacement cost as the basis of valuation of capital consumption; of
the rate of growth of gross capital formation subject to consumption charges;
and so on.

As the data stand, there is a tendency for the proportion of net domestic
savings to gross domestic capital formation to decline only in the United Kingdom,
the United States, and Argentina, the countries in which the share of capital con-
sumption charges in gross domestic capital formation rose; while in the other
countries the share of net domestic savings available for financing gross domes-
tic capital formation is either roughly constant (as in Norway, but with a wide
swing) or rising. The evidence permits no statement of general import. All one
can say is that a substantial rise in the net national capital formation proportion
would ordinarily make for a rising trend in the ratio of net domestic savings to
gross domestic capital formation.

Furthermore, if analysis of the kind in Table 18 is to be of some value, be-
yond indicating the distinction between foreign and domestic savings, both the
allowance for capital consumption and net domestic savings should be given sep-
arately for business corporations, private individual firms, households, and gov-
ernments. Since the factors that determine the magnitude and disposition of
these components of savings are quite different among the saver groups, without
such a distinction we cannot interpret a movement in the share of capital con-
sumption charges as that of a "retained" component of savings available for a
firm's or other capital user's internal financing. Yet, as far as I know, no data
are available over the long period for any country except the United States, on
the distribution of gross and net savings among the major saver groups.

VII.  Concluding Comments

The long-term records for ten to twelve countries, extending back mostly to
the third quarter of the 19th century, suggest the following findings.

First, in most countries gross and net, domestic and national capital forma-
tion proportions (based on totals in current prices) rose over the long run--
although the rise was much delayed in some countries, and ended long before the
present in others. The range of the proportions was, for periods of two decades
or more, from less than 5 to over 15 percent net; from less than 10 to over 25
percent gross.

Second, the secular rise in the national capital formation proportion (the
countrywide savings rate) was, for most countries, more marked than that in the
domestic capital formation proportion (the countrywide investment rate).

Third, the adjustment for the somewhat greater rise (or lesser decline) of
prices of capital goods than of prices of all goods in countrywide product, reduced
the rise in the capital formation proportions. But the upward trend in the latter
was still evident in most countries.

Fourth, the incremental capital-output ratios, i.e., the ratios of capital
formation proportions to rate of growth of product, differed widely among coun-
tries--with average levels for the net domestic ratio ranging from less than 2 to
over 5. These ratios tended to show a secular rise, but again the rise was much
delayed in some countries, and not observed in others. The rise was less marked
but still perceptible in the capital-output ratios derived from capital formation
proportions based on totals in constant prices.

Fifth, when capital formation proportions are related to rate of growth of
product per worker, the resulting incremental per worker capital-output ratios
are quite variable; and while there was some preponderance of secular rises,

the evidence is too mixed to permit the formulation of a general statement on prevalent trends.

Sixth, the shares of additions to stocks and of construction in domestic gross capital formation tended to decline over time; the share of producers' equipment correspondingly rose. These shifts contributed little to explaining long-term trends in the countrywide incremental or average capital-output ratios.

Seventh, the sectoral capital-output ratios were usually higher for agriculture than for the M sector; and those for the transport sector and for residential housing were among the highest. In most countries, the shifts in industrial structure contributed little to an explanation of the secular movements in the countrywide capital-output ratios: it was the intra-sector changes in the capital-output ratios that were of dominant importance.

Eighth, government purchases accounted for between a seventh and four-tenths of gross fixed capital formation. In some countries the share was large in the early periods, and remained high or declined slightly. In others it rose markedly over the long period from rather low levels in the early years.

Ninth, the data on financing point up the familiar trends in the relation between capital imports and exports and domestic capital formation--the decline in the relative weight of capital exports in the early creditor countries and the decline in the share of capital imports in the countries that were initially heavy borrowers--but aside from that, are too inadequate to yield significant results.

Many of the observations just summarized are what we would expect from the widely accepted relations among per capita income, supply of capital, and growth. Thus, the rise in the national savings rates, i.e., the national capital formation proportions, is an expected response to the secular rise in per capita income, which is a constitutive characteristic of modern economic growth. The rise in the incremental capital-output ratio could be viewed as a response to increasing supply and decreasing price of capital and the increasing employment of capital in areas in which the specific capital-output ratio is high. The trends in the distribution of domestic capital formation among inventories, construction, and producers' equipment can be taken as reflections of the shifts in the impact of technological progress accompanying and underlying modern economic growth--from the seasonal and inventory-demanding agricultural industries, to the construction-demanding phases of the emergence of the transportation and public utility network, to the elaborate machinery demanded by more advanced technology.

Of more interest, because less expected, are the findings that cannot be explained in terms of economic responses to simple and presumably prevalent conditions of modern economic growth. Thus, while capital formation proportions did rise with the secular rise in per capita income; in some countries, e.g., the United Kingdom and the United States, the rise ended fairly early, while per capita income continued to grow at substantial rates; and in others, e.g., Norway, Sweden, and Japan, a significant rise in the national capital formation proportions did not begin until after several decades of vigorous growth of total and per capita product. Even more intriguing is the fact that the different levels of the national capital formation proportions were not associated with differences in per capita income: some high income countries had low proportions and some low income countries had high proportions. Nor was there any close similarity among countries either in the average level of their incremental capital-output ratios, which ranged from less than 2 to over 5 (on a net basis); or in the movement of these capital-output ratios. Even for periods as long as two decades, the incremental capital-output ratios were quite variable.

At some danger of exaggerating, one might say that the rather simple relations assumed in much economic analysis--close associations between levels

of income and the savings proportions and between capital formation proportions and the rate of growth--are not confirmed by the long-term records. The relation between capital formation and per capita income (as a determinant) and the rate of growth (as an effect) is too irregular and variable to warrant being given much weight in any realistic analysis. The association between national capital formation proportions or savings rates and levels of income is not close and is almost completely masked by a variety of other savings-determining factors. Likewise, capital, at least in the sense employed in measures of capital formation, is a factor that yields highly variable and uncertain results in terms of rates of growth--because of the great variety not only of other factors with which it was combined but also because of the conditions under which they were combined in the past. Given this past wide variety of conditioning factors, and presumably the possibility of even wider variety in the future, one may say truistically that capital formation does not matter as much as capital utilization. And utilization depends upon a host of economic and social conditions which sometimes permit attainment of high rates of growth with little capital, but at other times impede the growth-inducing effect of even large amounts of capital.

This severe limitation upon the significance of the income-savings-capital-growth relations is perhaps not unexpected. It is a result of the omission, by design, of social and technological conditions and differentials from the models of growth based on the simple relations among income, savings, and growth; and the empirical data suggest that the influence of the omitted factors is so far-reaching as to leave little of the underlying association to the purely economic variables. Capital, as defined here, would be all important in growth if there were no technological changes and no technological variety of capital-saving and capital-demanding devices; and if economic and social institutions were geared, over time and across space, to the maximization of growth under a rather uniform set of conditions of social efficiency and use of human beings. These simplifying "ifs," extremely useful in that they permit analytical clarity and completeness, could be retained provided, in the long-run past, the qualifications imposed by them were moderate and left some uniformity and stability to the empirical coefficients attached to the simple economic relations observed. Our findings, for the limited sample of ten to twelve countries, suggest that the savings-income-capital-growth relations have been far too variable--because of the wide range of technological and social conditions over time and space--to retain much usefulness as guides in either analysis or policy. While they are extremely valuable first approximations, they are so far removed from the true pattern of associations and trends as they emerge in the empirical record that they cannot be used without further elaboration. Such elaboration would require intensive analysis of the records for individual countries and is beyond the scope of the initial efforts at international comparison represented by the papers in this series.

APPENDIX TABLES

Table UK-1.
Capital Formation Proportions, United Kingdom, 1700-1958 (Percentages based on current price totals)

| Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|---|---|---|---|---|---|---|
| **England and Wales** | | | | | | |
| 1. 1700-40 | | | | | | 5.0 |
| 2. 1740-70 | | | | | | 5.5 |
| 3. 1770-1800 | | | | | | 6.5 |
| **United Kingdom** | | | | | | |
| 4. 1801 and 1811-1821 and 1831 | | | | | | 7.5 |
| 5. 1821 and 1831-1851 and 1861 | | | 7.4 | | | 9.0 |
| 6. 1855-64 | 8.1 | 21.7 | 6.4 | +31.9 | 10.5 | 8.9 |
| 7. 1860-69 | 8.9 | 20.9 | 7.2 | +33.7 | 11.6 | 10.0 |
| 8. 1865-74 | 9.1 | 19.2 | 7.5 | +53.8 | 13.6 | 12.1 |
| 9. 1870-79 | 9.9 | 19.0 | 8.2 | +40.5 | 13.4 | 11.8 |
| 10. 1875-84 | 9.7 | 19.7 | 7.9 | +33.1 | 12.3 | 10.7 |
| 11. 1880-89 | 8.0 | 22.2 | 6.4 | +63.0 | 12.4 | 10.9 |
| 12. 1885-94 | 7.8 | 23.6 | 6.0 | +65.5 | 12.1 | 10.6 |
| 13. 1890-99 | 9.1 | 21.1 | 7.3 | +36.6 | 11.7 | 10.1 |
| 14. 1895-1904 | 10.6 | 18.6 | 8.8 | +21.1 | 12.2 | 10.5 |
| 15. 1900-09 | 10.0 | 19.5 | 8.2 | +41.5 | 13.3 | 11.7 |
| 16. 1905-14 | 8.2 | 19.8 | 6.7 | +88.5 | 14.4 | 13.0 |
| 17. 1921-29 | 7.1 | 55.5 | 3.3 | +33.5 | 9.0 | 5.5 |
| 18. 1925-34 | 8.9 | 67.7 | 3.1 | + 6.9 | 9.1 | 3.5 |
| 19. 1930-38 | 10.2 | 70.2 | 3.3 | - 5.5 | 9.3 | 2.6 |
| 20. 1952-58 | 15.5 | 53.0 | 7.9 | + 6.9 | 16.4 | 9.0 |

Lines 1-5: Approximations taken from the summary discussion in Phyllis Deane and W. A. Cole, The Economic Growth of the United Kingdom (manuscript). The entry in col. 3, line 5 was derived by subtracting the ratio of overseas balance on current account (from Albert H. Imlah, Economic Elements in the Pax Brittanica, Cambridge, Mass., 1958, Table 4, pp. 70-75) to national income (from Deane and Cole, op. cit.) from the NNCF/NNP proportion in col. 5.
Lines 6-19: From Miss Deane by correspondence: GDCF; GNP except for 1855-64 and 1930-38 for which periods it was derived as the sum of CC and NNP; NDCF; and NBFCA. GDP was derived as the difference between GNP and interest and dividend payments from abroad. The latter is given in Imlah, op. cit., for 1855-1913 and assumed the same in 1914 as in 1913, and was obtained from Miss Deane for 1920, 1922-38, and interpolated for 1921 along a straight line between 1920 and 1922. CC was derived as the difference between GDCF and NDCF from 1860 on, and was extrapolated to 1855-64 by an unpublished series by Charles H. Feinstein. NDP was derived as the difference between NNP and interest and dividend payments from abroad. NNP is the difference between GNP and CC except for 1855-64 and 1930-38; and for 1855-64 it was extrapolated by Miss Deane's national income at factor cost and for 1930-38 obtained directly from Miss Deane. GNCF and NNCF are the sums of NBFCA and GDCF and NDCF, respectively.
Line 20: United Nations, Yearbook of National Accounts Statistics, 1959, New York, 1960.

Table UK-2.
Capital Formation Proportions, United Kingdom, 1860-1914 (Percentages based on constant price totals)

| Period | GDCF/ GDP (1) | NDCF/ NDP (2) | GNCF/ GNP (3) | NNCF/ NNP (4) | Implicit Price Indexes (1890-99 = 100) GDP (5) | GFCF (6) |
|---|---|---|---|---|---|---|
| 1. 1860-69 | 10.4 | 8.6 | 13.2 | 11.5 | 148 | 126 |
| 2. 1865-74 | 10.4 | 7.3 | 14.9 | 11.9 | 149 | 130 |
| 3. 1870-79 | 11.1 | 7.3 | 14.5 | 10.9 | 144 | 129 |
| 4. 1875-84 | 11.0 | 6.6 | 13.6 | 9.4 | 132 | 117 |
| 5. 1880-89 | 8.6 | 3.4 | 12.9 | 8.1 | 115 | 108 |
| 6. 1885-94 | 8.0 | 2.0 | 12.4 | 6.8 | 105 | 102 |
| 7. 1890-99 | 9.1 | 3.0 | 11.7 | 6.0 | 100 | 100 |
| 8. 1895-1904 | 10.4 | 4.8 | 12.0 | 6.7 | 104 | 106 |
| 9. 1900-09 | 10.2 | 4.1 | 13.4 | 7.8 | 113 | 111 |
| 10. 1905-14 | 8.6 | 1.2 | 14.7 | 8.0 | 122 | 117 |

Current price series for GDP, GNP, NDP, NNP, and NBFCA, described in the notes to Table UK-1, were deflated by the price index implicit in national income. The latter, given on a 1865 and 1885 base in Deane and Cole, The Long-Term Growth of the United Kingdom: A Summary of Findings, a paper presented at a conference of the International Association for Research in Income and Wealth, held at Portoroz, Yugoslavia, August-September, 1959, Table 2, was shifted to a 1890-99 base for comparability with the capital formation price index. The latter, from the Feinstein unpublished thesis, was used to deflate the GDCF current price series described in the notes to Table UK-1. GNCF is then the sum of GDCF and NBFCA; and NNCF and NDCF were obtained by subtracting CC (the difference between GNP and NNP) from GNCF and GDCF, respectively.

Table UK-3.
Rate of Growth of Product in Constant Prices and Ratios to It of Capital Forma-
tion Proportions, United Kingdom, 1700-1958

### A.  Gross Ratios

| Interval | Rate of growth per year GDP (%) (1) | Ratio to Col. 1 of GDCF/GDP | | Rate of growth per year GNP (%) (4) | Ratio to Col. 4 of GNCF/GNP | |
|---|---|---|---|---|---|---|
| | | Current prices (2) | Constant prices (3) | | Current prices (5) | Constant prices (6) |
| 1. 1860-69 to 1870-79 | 3.07 | 3.0 | 3.4 | 3.21 | 4.2 | 4.6 |
| 2. 1865-74 to 1875-84 | 2.62 | 3.8 | 4.2 | 2.74 | 4.9 | 5.3 |
| 3. 1870-79 to 1880-89 | 2.87 | 3.4 | 3.8 | 2.99 | 4.1 | 4.5 |
| 4. 1875-84 to 1885-94 | 3.11 | 2.6 | 2.8 | 3.26 | 3.8 | 4.0 |
| 5. 1880-89 to 1890-99 | 2.96 | 2.6 | 2.7 | 3.05 | 4.0 | 4.1 |
| 6. 1885-94 to 1895-1904 | 2.67 | 3.4 | 3.4 | 2.63 | 4.4 | 4.4 |
| 7. 1890-99 to 1900-09 | 1.53 | 6.9 | 6.8 | 1.53 | 8.0 | 7.8 |
| 8. 1895-1904 to 1905-14 | 0.38 | 26.3 | 26.8 | 0.53 | 25.1 | 25.3 |
| 9. 1921-29 to 1930-38 | 2.55 | 3.5 | | 2.40 | 3.8 | |
| 10. 1952 to 1958 | 2.36 | 6.6 | | 2.50 | 6.6 | |

### B.  Net Ratios

| Interval | Rate of growth per year NDP (%) | Ratio to Col. 1 of NDCF/NDP | | Rate of growth per year NNP (%) | Ratio to Col. 4 of NNCF/NNP | |
|---|---|---|---|---|---|---|
| | | Current prices | Constant prices | | Current prices | Constant prices |
| **England and Wales** | | | | | | |
| 11. 1700 to 1740 | | | | 0.3 | 16.7 | |
| 12. 1740 to 1770 | | | | 0.9 | 6.1 | |
| 13. 1770 to 1880 | | | | 1.5 | 4.3 | |
| **United Kingdom** | | | | | | |
| 14. 1801 and 1811 to 1821 and 1831 | | | | 2.62 | 2.9 | |
| 15. 1821 and 1831 to 1851 and 1861 | 2.08 | 3.6 | | 2.08 | 4.3 | |
| 16. 1851 and 1861 to 1870-79 | 2.26 | 3.1 | | 2.26 | 4.6 | |

Table UK-3 (Cont. )

|  | | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| 17. | 1860-69 to 1870-79 | 3.06 | 2.5 | 2.4 | 3.22 | 3.8 | 3.7 |
| 18. | 1865-74 to 1875-84 | 2.59 | 3.2 | 2.8 | 2.72 | 4.3 | 4.0 |
| 19. | 1870-79 to 1880-89 | 2.88 | 2.7 | 2.3 | 3.01 | 3.6 | 3.1 |
| 20. | 1875-84 to 1885-94 | 3.12 | 2.1 | 1.1 | 3.28 | 3.3 | 2.5 |
| 21. | 1880-89 to 1890-99 | 2.95 | 2.0 | 0.7 | 3.03 | 3.5 | 2.2 |
| 22. | 1885-94 to 1895-1904 | 2.66 | 2.7 | 1.1 | 2.61 | 3.9 | 2.3 |
| 23. | 1890-99 to 1900-09 | 1.53 | 5.8 | 3.1 | 1.53 | 6.9 | 4.4 |
| 24. | 1895-1904 to 1905-14 | 0.42 | 19.5 | 9.8 | 0.58 | 20.2 | 13.4 |
| 25. | 1921-29 to 1930-38 | 2.16 | 1.4 | | 2.03 | 1.7 | |

Col. 1 and 4: Lines 1-8 and 17-24 are based on the constant price series described in the notes to Table UK-2. Lines 9 and 25 are based on the current price series, described in the notes to Table UK-1, deflated by the index of purchasing power obtained by correspondence from Miss Deane. Line 10 is based upon data given in the U. N. Yearbook of National Accounts Statistics, 1959. Lines 11-16 are based on national income in constant prices, given in Deane and Cole, op. cit., Table 2. The rate of growth of NDP in lines 15-16 was assumed the same as that in NNP.

Col. 2, 3, 5, and 6: The capital formation proportions are from Tables UK-1 and UK-2. For the interval from 1860-69 to 1870-79 those for 1865-74 were used; for 1865-74 to 1875-84, those for 1870-79 were used; and so on.

Table UK-4.
Structure of National Wealth and Its Ratio to National Income, Great Britain, Selected Years, 1800-1927 (Based on current price totals)

|  | 1798 or 1800 (1) | 1812 (2) | 1832 (3) | 1885 (4) | 1912 (5) | 1927 (6) |
|---|---|---|---|---|---|---|
| **Share in Total Wealth (%)** | | | | | | |
| 1. Land | 55.0 | 53.9 | 51.6 | 16.6 | 5.7 | 4.0 |
| 2. Reproducible wealth | 45.0 | 46.1 | 48.4 | 83.4 | 94.3 | 96.0 |
| **Share in Reproducible Wealth (%)** | | | | | | |
| 3. Buildings | 30.7 | 32.1 | 27.7 | 24.2 | 22.6 | 23.0 |
| 4. Farm capital | 19.3 | 20.1 | 18.1 | 5.7 | 2.2 | 2.4 |
| 5. Overseas balance | 0 | 1.2 | 9.7 | 19.2 | 29.1 | 7.9 |
| 6. Railways, industrial, and other private capital | 46.2 | 42.7 | 41.1 | 44.6 | 37.6 | 53.9 |
| 7. Public property | 3.8 | 3.8 | 3.3 | 6.3 | 8.5 | 12.8 |
| **Ratio to National Income** | | | | | | |
| 8. Reproducible wealth | 2.9 | 2.8 | 3.5 | 7.7 | 6.0 | 4.2 |
| 9. Reproducible wealth plus 50% of land | 4.6 | 4.4 | 5.4 | 8.5 | 6.1 | 4.3 |
| 10. Total wealth | 6.3 | 6.0 | 7.3 | 9.3 | 6.3 | 4.4 |

The underlying data are from Deane and Cole, op. cit., Ch. 8, Tables 2 and 4, except that the Imlah estimates of the accumulated foreign balance were substituted for the stock of overseas securities.

Table UK-5.
Distribution of Gross Domestic Capital Formation by Major Categories, United Kingdom, 1855-1958 (Percentages based on current price totals)

| | Period | Construction | | | Machin-ery and equip-ment (4) | Mixed FCF (5) | GFCF (6) | Change in inven-tories (7) |
|---|---|---|---|---|---|---|---|---|
| | | Resi-dential (1) | Other (2) | Total (3) | | | | |
| 1. | 1855-64 | 13.3 | 7.5 | 20.9 | 35.4 | 23.6 | 79.9 | 20.1 |
| 2. | 1860-69 | 12.6 | 7.0 | 19.5 | 36.0 | 24.5 | 80.1 | 19.9 |
| 3. | 1865-74 | 14.8 | 8.3 | 23.1 | 35.9 | 22.2 | 81.2 | 18.8 |
| 4. | 1870-79 | 16.9 | 9.6 | 26.5 | 34.8 | 21.7 | 83.1 | 16.9 |
| 5. | 1875-84 | 15.8 | 8.9 | 24.7 | 35.0 | 23.0 | 82.8 | 17.2 |
| 6. | 1880-89 | 14.6 | 7.1 | 21.8 | 34.4 | 22.5 | 78.6 | 21.4 |
| 7. | 1885-94 | 14.5 | 7.1 | 21.5 | 32.3 | 22.7 | 76.5 | 23.5 |
| 8. | 1890-99 | 15.4 | 8.2 | 23.5 | 32.2 | 23.9 | 79.6 | 20.4 |
| 9. | 1895-1904 | 15.5 | 8.7 | 24.1 | 34.0 | 25.1 | 83.2 | 16.8 |
| 10. | 1900-09 | 14.3 | 8.0 | 22.4 | 35.7 | 24.0 | 82.1 | 17.8 |
| 11. | 1905-14 | 11.3 | 7.2 | 18.5 | 39.2 | 19.8 | 77.5 | 22.5 |
| 12. | 1921-29 | | | 90.3 | 55.9 | | 146.2 | -46.2 |
| 13. | 1925-34 | | | 70.9 | 41.0 | | 111.9 | -11.9 |
| 14. | 1930-38 | | | 62.9 | 38.2 | | 101.0 | - 1.0 |
| 15. | 1952-58 | 19.8 | 25.9 | 45.7 | 48.6 | | 94.3 | 5.7 |

Lines 1-11: Col. 1-6 from Feinstein, op. cit., Tables 2.1, 2.2, 2.4, and 2.5. Mixed FCF includes expenditures of railroads, local authorities, and tele- phone and telegraph companies. Col. 7 was derived as the difference between GDCF, for which see the notes to Table UK-1, and GFCF.
Lines 12-14: From K. Maywald, "Domestic Capital Formation in the United Kingdom," The Times Review of Industry, June 1960.
Line 15: U. N. Yearbook of National Accounts Statistics, 1959. Includes mili- tary expenditures not included in other tables.

Table G-1.
Capital Formation Proportions, Germany, 1851-1913 (Percentages based on current and constant price totals)

|  | Period | NDCF/NNP Current prices (1) | NNCF/NNP Current prices (2) | NNCF/NNP Constant prices (3) | Implicit Price Indexes (1913 = 100) NNP (4) | Implicit Price Indexes (1913 = 100) NNCF (5) |
|---|---|---|---|---|---|---|
| 1. | 1851-60 | 8.4 | 8.6 | 7.9 | 93.4 | 101.8 |
| 2. | 1856-65 |  |  | 9.9 |  |  |
| 3. | 1861-70 | 8.5 | 9.7 | 10.6 | 96.1 | 87.8 |
| 4. | 1866-75 |  |  | 12.1 |  |  |
| 5. | 1871-80 | 11.6 | 13.5 | 13.0 | 97.4 | 101.5 |
| 6. | 1876-85 |  |  | 13.0 |  |  |
| 7. | 1881-90 | 11.2 | 14.0 | 14.5 | 81.6 | 78.4 |
| 8. | 1886-95 |  |  | 14.6 |  |  |
| 9. | 1891-1900 | 13.9 | 15.4 | 15.9 | 79.8 | 77.2 |
| 10. | 1896-1905 |  |  | 16.4 |  |  |
| 11. | 1901-13 | 15.6 | 16.5 | 15.9 | 92.9 | 96.2 |

The estimates refer to the territory of the German Reich in 1913, i.e., including Alsace-Lorraine.

The underlying data were obtained by correspondence with Walther G. Hoffmann except for the price index implicit in NNP. The latter is from W. G. Hoffmann and J. H. Muller, Das Deutsche Volkseinkommen, 1851-1957, Tübingen, 1959, Table 2, p. 14.


Table G-2.
Rate of Growth of Net National Product in Constant Prices and Ratios to It of Capital Formation Proportions, Germany, 1851-1913

|  | Interval | Rate of growth per year NNP (%) (1) | Ratio to Column 1 of: NDCF/NNP Current prices (2) | Ratio to Column 1 of: NNCF/NNP Current prices (3) | Ratio to Column 1 of: NNCF/NNP Constant prices (4) |
|---|---|---|---|---|---|
| 1. | 1851-60 to 1861-70 | 2.77 |  |  | 3.6 |
| 2. | 1856-65 to 1866-75 | 2.75 | 3.1 | 3.5 | 3.9 |
| 3. | 1861-70 to 1871-80 | 2.62 |  |  | 4.6 |
| 4. | 1866-75 to 1876-85 | 2.32 | 5.0 | 5.8 | 5.6 |
| 5. | 1871-80 to 1881-90 | 2.22 |  |  | 5.9 |
| 6. | 1876-85 to 1886-95 | 2.57 | 4.4 | 5.4 | 5.6 |
| 7. | 1881-90 to 1891-1900 | 3.09 |  |  | 4.7 |
| 8. | 1886-95 to 1896-1905 | 3.12 | 4.5 | 4.9 | 5.1 |
| 9. | 1891-1900 to 1901-13 | 2.73 |  |  | 6.0 |

The estimates refer to the territory of the German Reich in 1913.

See notes to Table G-1.

Col. 2-4: The capital formation proportions are from Table G-1. For the interval from 1851-60 to 1861-70 the proportion for 1856-65 was used; for 1856-65 to 1866-75 the proportions for 1861-70 were used; and so on.

Table G-3.
Distribution of Net Domestic Capital Formation, Germany, 1851-1913 (Based on current price totals)

| Period | Residential construction (1) | Other construction (2) | Canals, roads, railroads (3) | Equip- ment (4) | Change in inventories (5) |
|---|---|---|---|---|---|
| 1. 1851-60 | 24 | 16 | 19 | 18 | 22 |
| 2. 1861-70 | 33 | 17 | 21 | 21 | 8 |
| 3. 1871-80 | 34 | 19 | 27 | 14 | 6 |
| 4. 1881-90 | 31 | 18 | 12 | 34 | 5 |
| 5. 1891-1900 | 31 | 17 | 12 | 37 | 2 |
| 6. 1901-13 | 31 | 19 | 13 | 30 | 7 |

The estimates refer to the territory of the German Reich in 1913.

The underlying data were obtained by correspondence with Walther G. Hoffmann.

Inventories are given separately for agriculture alone. They are included under equipment for other sectors not shown separately.

Table G-4.
National Product and Capital Formation, Germany, 1928-1938 (Absolute values in billions of RM)

| | 1928 (1) | 1929-33 (2) | 1934-38 (3) |
|---|---|---|---|
| **Current Prices** | | | |
| 1. GNP | 89.5 | 72.1 | 84.2 |
| 2. GFCF, excluding military facilities | 13.7 | 7.8 | 11.6 |
| 3. Change in inventories | 2.6 | - 2.3 | 2.7 |
| 4. GDCF (line 2 + line 3) | 16.3 | 5.5 | 14.3 |
| 5. GDCF/GNP (%) | 18.2 | 7.6 | 17.0 |
| 6. NBFCA | - 1.3 | 1.4 | 0.7 |
| 7. GNCF (line 4 + line 6) | 15.0 | 6.9 | 15.0 |
| 8. GNCF/GNP (%) | 16.8 | 9.6 | 17.8 |
| 9. CC | 6.7 | 6.4 | 6.3 |
| 10. NNCF/NNP (%) | 10.0 | 0.8 | 11.2 |
| **1928 Prices** | | | |
| 11. GNP | 90.8 | 78.8 | 103.5 |

The estimates refer to the territory of Germany in 1925.

Lines 1 and 9: Burton H. Klein, Germany's Economic Preparations for War, Cambridge, Mass., 1959, Table 57, p. 251.
Line 2: Ibid., Table 62, p. 255, excluding military facilities shown separately in Table 5, p. 14. It was assumed that there was no investment in military facilities in 1928-34.
Lines 3 and 6: Ibid., Table 58, p. 252.
Line 11: Ibid., Table 59, p. 253.

Table G-5.
Average Capital-Output Ratio, West Germany, Selected Years, 1913-1955 (Absolute values in billions of constant 1950 DM)

| | 1913 (1) | 1929 (2) | 1939 (3) | 1955 (4) |
|---|---|---|---|---|
| 1. Net value of fixed reproducible assets | 214.5 | 245.5 | 299.0 | 306.0 |
| 2. Net value of inventories | 19.0 | 20.0 | 31.0 | 42.0 |
| 3. Total reproducible assets, excluding foreign balance (line 1 + line 2) | 233.5 | 265.5 | 330.0 | 348.0 |
| 4. GNP | 63.0 | 68.0 | 104.0 | 150.0 |
| 5. NNP | 57.3 | 61.9 | 94.6 | 136.5 |
| 6. Average net capital-output ratio (line 3 ÷ line 5) | 4.1 | 4.3 | 3.5 | 2.5 |
| 7. Share of buildings in line 3 (%) | 73.4 | 71.2 | 68.8 | 61.6 |
| 8. Share of housing and transport buildings in line 3 (%) | 48.4 | 46.1 | 44.1 | 37.6 |

The estimates refer to the territory of the Federal Republic of Germany.

Line 1: Ferdinand Grünig, "An Estimate of the National Capital Account of the Federal German Republic," in Raymond W. Goldsmith and Christopher Saunders, eds., Income and Wealth, Series VIII, p. 158.
Line 2: Ibid., p. 158.
Line 4: Ibid., p. 154.
Line 5: Line 4 reduced by 9 percent, the ratio of CC to GNP for 1952-58, as given in the U. N. Yearbook of National Accounts Statistics, 1959.
Lines 7 and 8: Grünig, op. cit., pp. 157-58.

Table G-6.
Net Capital Formation Financing, Germany, 1851-1913 (Percentages based on constant price totals)

|  | Period | Percent of NNP | | Percent of Net Savings | | |
|---|---|---|---|---|---|---|
|  |  | Private savings (1) | Public savings (2) | Private savings (3) | Undistributed profits (4) | Public savings (5) |
| 1. | 1851-60 | 6.73 | 1.21 | 85 |  | 15 |
| 2. | 1856-65 | 7.82 | 1.57 | 83 |  | 17 |
| 3. | 1861-70 | 10.15 | 0.95 | 91 |  | 9 |
| 4. | 1866-75 | 10.63 | 1.91 | 85 |  | 15 |
| 5. | 1871-80 | 11.09 | 1.92 | 85 | 4 | 15 |
| 6. | 1876-85 | 11.91 | 1.02 | 92 | 4 | 8 |
| 7. | 1881-90 | 13.06 | 1.40 | 90 | 5 | 10 |
| 8. | 1886-95 | 13.21 | 1.45 | 90 | 5 | 10 |
| 9. | 1891-1900 | 14.30 | 1.66 | 90 | 7 | 10 |
| 10. | 1896-1905 | 14.90 | 1.49 | 91 | 7 | 9 |
| 11. | 1901-13 | 14.67 | 1.27 | 92 | 8 | 8 |

The estimates refer to the territory of the German Reich in 1913.

The underlying data are from Walther G. Hoffmann, Growth and Structure of Consumption and Savings in Germany, 1851-1913, a paper presented at the Conference of the International Association for Research in Income and Wealth, held at Portoroz, Yugoslavia, August-September, 1959, Table 2.

Col. 1 and 2: Averages of percentages for successive quinquennia, weighted by NNP, the latter given in the source cited in the notes to Table G-1.  Col. 2 includes savings represented by social insurance.
Col. 3 and 5: Based on col. 1 and 2.
Col. 4: Included in col. 3 but shown separately from 1871 on.

Table G-7.
Capital Formation Proportions and Related Data, West Germany, Post-World
War II Years (Based on current price totals, except for the rate of growth of
product)

| Capital Formation Proportions, Rate of Growth, and Ratios (1952-58) | Pro-portions (1) | Rate of growth (2) | Ratios (3) |
|---|---|---|---|
| 1. GDCF and GDP | 23.9 | 6.94 | 3.4 |
| 2. NDCF and NDP | 16.6 | 7.16 | 2.3 |
| 3. GNCF and GNP | 27.4 | 6.90 | 4.0 |
| 4. NNCF and NNP | 20.4 | 7.11 | 2.9 |

| Distribution of GDCF (1952-58) | Construction | Equipment | Change in stocks |
|---|---|---|---|
| 5. Percentage shares | 42.7 | 47.4 | 9.9 |

| Shares in Financing of GDCF | 1951-57 | 1951-56 |
|---|---|---|
| 6. Foreign investment | -13.5 | -12.8 |
| 7. Capital consumption allowances | 40.0 | 40.0 |
| 8. Net savings (including adjustments) | 73.5 | 72.8 |
|     of which | | |
| 9. Net savings of general government | 34.7 | 35.0 |
| 10. Net savings of public and private corporations | | 8.0 |
| 11. Net savings of households (including adjustments) | | 29.8 |

Adjustments referred to in lines 8 and 11 are for changes in stock valuation and
statistical discrepancy.

Lines 1-5:  U. N. Yearbook of National Accounts Statistics, 1959.
Lines 6-11:  U. N. Yearbook of National Accounts Statistics, 1958, New York,
        1959.

Table I-1.
Capital Formation Proportions, Italy, 1861-1958 (Percentages based on current price totals)

| Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|--------|------|------|------|------|------|------|
| 1.  1861-70 | 10.2 | 50.8 | 5.3 | -27.7 | 7.5 | 2.4 |
| 2.  1866-75 | 10.0 | 53.9 | 4.9 | - 8.4 | 9.2 | 4.0 |
| 3.  1871-80 | 9.5 | 59.7 | 4.0 | + 0.4 | 9.6 | 4.1 |
| 4.  1876-85 | 10.6 | 54.5 | 5.1 | - 1.2 | 10.5 | 5.0 |
| 5.  1881-90 | 12.0 | 48.9 | 6.5 | -12.2 | 10.6 | 5.0 |
| 6.  1886-95 | 10.6 | 56.7 | 4.9 | - 8.2 | 9.8 | 4.0 |
| 7.  1891-1900 | 9.5 | 64.9 | 3.6 | +14.5 | 10.9 | 5.0 |
| 8.  1896-1905 | 12.2 | 54.2 | 6.0 | +21.7 | 14.5 | 8.6 |
| 9.  1901-10 | 16.5 | 44.2 | 9.9 | + 8.3 | 17.4 | 11.1 |
| 10.  1906-15 | 16.4 | 47.7 | 9.3 | - 4.5 | 15.2 | 8.3 |
| 11.  1916-20 | 8.7 | 112.5 | - 1.2 | -178.3 | - 6.7 | -18.2 |
| 12.  1921-30 | 18.3 | 49.0 | 10.3 | -12.3 | 15.9 | 7.7 |
| 13.  1926-35 | 17.6 | 53.1 | 9.1 | - 7.6 | 16.1 | 7.6 |
| 14.  1931-40 | 17.9 | 54.6 | 9.0 | - 4.3 | 17.1 | 8.2 |
| 15.  1941-45 | 4.4 | 131.4 | - 1.5 | -137.9 | - 1.7 | - 7.9 |
| 16.  1946-55 | 21.1 | 42.9 | 13.2 | -14.0 | 18.1 | 10.0 |
| 17.  1952-58 | 21.0 | 42.4 | 13.3 | - 7.7 | 19.4 | 11.5 |

Lines 1-16: Underlying data are from Indagine Statistica sullo Sviluppo del Reddito Nazionale dell'Italia dal 1861 al 1956, Annali di Statistica, Anno 86, Serie VIII, Vol. 9, Istituto Centrale di Statistica, Rome, 1957. GDCF is from Table 4, p. 191; GNP and net flow of income across boundaries are from Table 36, Part B, pp. 249-50; CC is from Table 44, pp. 264-65; NBFCA (excluding unilateral transfers) is from Table 38, pp. 253-54. Other components are derived from the above.
Line 17: U. N. Yearbook of National Accounts Statistics, 1959.

Table I-2.
Capital Formation Proportions, Italy, 1861-1955 (Percentages based on constant price totals)

| | Period | GDCF/ GDP (1) | NDCF/ NDP (2) | GNCF/ GNP (3) | NNCF/ NNP (4) | Implicit Price Indexes (1938 = 100) GDP (5) | GDCF (6) |
|---|---|---|---|---|---|---|---|
| 1. | 1861-70 | 8.4 | 4.2 | 5.8 | 1.3 | 15.9 | 19.3 |
| 2. | 1866-75 | 8.5 | 4.0 | 7.8 | 3.2 | 17.7 | 20.8 |
| 3. | 1871-80 | 8.2 | 3.5 | 8.3 | 3.6 | 18.5 | 21.4 |
| 4. | 1876-85 | 9.0 | 4.1 | 8.9 | 3.9 | 17.8 | 21.0 |
| 5. | 1881-90 | 10.8 | 5.6 | 9.4 | 4.0 | 17.4 | 19.3 |
| 6. | 1886-95 | 10.2 | 4.7 | 9.4 | 3.8 | 17.3 | 17.9 |
| 7. | 1891-1900 | 9.0 | 3.4 | 10.4 | 4.9 | 17.2 | 18.3 |
| 8. | 1896-1905 | 11.1 | 5.4 | 13.6 | 8.1 | 17.3 | 18.9 |
| 9. | 1901-10 | 14.9 | 8.8 | 15.9 | 10.1 | 18.1 | 20.0 |
| 10. | 1906-15 | 15.4 | 8.9 | 14.5 | 8.0 | 20.1 | 21.3 |
| 11. | 1916-20 | 5.1 | - 2.4 | - 6.7 | -15.0 | 57.9 | 99.3 |
| 12. | 1921-30 | 16.4 | 9.1 | 14.0 | 6.6 | 106.2 | 118.6 |
| 13. | 1926-35 | 16.5 | 8.3 | 15.0 | 6.8 | 93.7 | 100.0 |
| 14. | 1931-40 | 17.4 | 8.7 | 16.6 | 7.8 | 91.4 | 93.9 |
| 15. | 1941-45 | 11.2 | 2.6 | 9.4 | 0.6 | 474.3 | 186.3 |
| 16. | 1946-55 | 20.0 | 12.6 | 17.3 | 9.7 | 5086.4 | 5360.5 |

GDCF, NBFCA, and CC are from Indagine, Table 47, pp. 270-71; national income is from Table 37, pp. 251-52; net income flows across boundaries in current prices is from Table 38, pp. 253-54 and was adjusted to constant prices by the price index implicit in NNP given in Table 37. All other components were derived from the above.

Table I-3.
Rate of Growth of Product in Constant Prices and Ratios to It of Capital Formation Proportions, Italy, 1861-1958

## A. Gross Ratios

| Interval | Rate of growth per year GDP (%) (1) | Ratio to Col. 1 of GDCF/GDP | | Rate of growth per year GNP (%) (4) | Ratio to Col. 4 of GNCF/GNP | |
|---|---|---|---|---|---|---|
| | | Current prices (2) | Constant prices (3) | | Current prices (5) | Constant prices (6) |
| 1. 1861-70 to 1871-80 | 0.87 | 11.5 | 9.8 | 0.94 | 9.8 | 8.3 |
| 2. 1866-75 to 1876-85 | 0.74 | 12.8 | 11.1 | 0.78 | 12.3 | 10.6 |
| 3. 1871-80 to 1881-90 | 0.63 | 16.8 | 14.3 | 0.61 | 17.2 | 14.6 |
| 4. 1876-85 to 1886-95 | 0.65 | 18.5 | 16.6 | 0.65 | 16.3 | 14.5 |
| 5. 1881-90 to 1891-1900 | 0.72 | 14.7 | 14.2 | 0.84 | 11.7 | 11.2 |
| 6. 1886-95 to 1896-1905 | 1.30 | 7.3 | 6.9 | 1.55 | 7.0 | 6.7 |
| 7. 1891-1900 to 1901-10 | 2.26 | 5.4 | 4.9 | 2.51 | 5.8 | 5.4 |
| 8. 1896-1905 to 1906-15 | 2.52 | 6.5 | 5.9 | 2.56 | 6.8 | 6.2 |
| 9. 1861 to 1876-85 | 0.92 | 10.7 | 9.0 | 0.93 | 9.2 | 7.5 |
| 10. 1876-85 to 1896-1905 | 0.97 | 11.1 | 10.2 | 1.10 | 9.8 | 9.0 |
| 11. 1896-1905 to 1915 | 2.27 | 7.0 | 6.5 | 2.18 | 7.3 | 6.8 |
| 12. 1921 to 1939 | 2.42 | 7.5 | 7.0 | 2.29 | 7.2 | 6.7 |
| 13. 1946 to 1956 | 6.58 | 3.2 | 3.0 | 6.61 | 2.7 | 2.6 |
| 14. 1952 to 1958 | 5.65 | 3.7 | | 5.69 | 3.4 | |

## B. Net Ratios

| Interval | Rate of growth per year NDP (%) | Ratio to Col. 1 of NDCF/NDP | | Rate of growth per year NNP (%) | Ratio to Col. 4 of NNCF/NNP | |
|---|---|---|---|---|---|---|
| | | Current prices | Constant prices | | Current prices | Constant prices |
| 15. 1861-70 to 1871-80 | 0.83 | 5.9 | 4.8 | 0.89 | 4.4 | 3.6 |
| 16. 1866-75 to 1876-85 | 0.70 | 5.7 | 5.0 | 0.74 | 5.5 | 4.9 |
| 17. 1871-80 to 1881-90 | 0.56 | 9.1 | 7.3 | 0.53 | 9.4 | 7.4 |
| 18. 1876-85 to 1886-95 | 0.58 | 11.2 | 9.7 | 0.58 | 8.6 | 6.9 |

Table I-3 (Cont.)

|     |                        | (1)   | (2)  | (3)  | (4)   | (5)  | (6)  |
|-----|------------------------|-------|------|------|-------|------|------|
| 19. | 1881-90 to 1891-1900   | 0.70  | 7.0  | 6.7  | 0.82  | 4.9  | 4.6  |
| 20. | 1886-95 to 1896-1905   | 1.27  | 2.8  | 2.7  | 1.53  | 3.3  | 3.2  |
| 21. | 1891-1900 to 1901-10   | 2.17  | 2.8  | 2.5  | 2.44  | 3.5  | 3.3  |
| 22. | 1896-1905 to 1906-15   | 2.40  | 4.1  | 3.7  | 2.45  | 4.5  | 4.1  |
| 23. | 1861 to 1876-85        | 0.87  | 5.4  | 4.4  | 0.88  | 3.8  | 2.8  |
| 24. | 1876-85 to 1896-1905   | 0.92  | 5.5  | 4.9  | 1.06  | 4.7  | 4.2  |
| 25. | 1896-1905 to 1915      | 2.15  | 4.2  | 3.9  | 2.06  | 4.6  | 4.3  |
| 26. | 1921 to 1939           | 2.24  | 4.3  | 4.0  | 2.10  | 3.8  | 3.4  |
| 27. | 1946 to 1956           | 6.32  | 2.1  | 2.0  | 6.34  | 1.6  | 1.5  |

See the notes to Table I-2.

Col. 1 and 4: The terminal values underlying the rates of growth are single-year values for 1861, 1946, 1952, 1956, and 1958; three-year averages centered on 1915, 1921, and 1939; and decade averages for all others.

Col. 2, 3, 5, and 6: The capital formation proportions are from Tables I-1 and I-2. For the interval from 1861-70 to 1871-80, the proportions for 1866-75 were used; for 1866-75 to 1876-85, those for 1871-80 were used; and so on. For the interval from 1861 to 1876-85 the averages of the proportions for 1861-70 and 1871-80 were used; for 1876-85 to 1896-1905 the averages of those for 1881-90 and 1891-1900 were used; for 1896-1905 to 1915 the averages of those for 1901-10 and 1911-15 (the latter not shown in Tables I-1 and I-2) were used; for 1921 to 1939 the averages of those for 1921-30 and 1931-40 were used; for 1946 to 1956 the proportions for 1946-55 were used; and for 1952 to 1958 those for 1952-58 were used.

Table I-4.
Distribution of Gross Domestic Capital Formation by Major Categories, Italy, 1861-1958

| Period | Dwellings (1) | Public works (2) | Other fixed capital (3) | GFCF (4) | Additions to inventories (5) |
|---|---|---|---|---|---|
| **A.** | **Percentages Based on Current Price Totals** | | | | |
| 1. 1861-70 | 15.7 | 22.2 | 43.1 | 81.0 | 19.0 |
| 2. 1866-75 | 16.1 | 18.7 | 44.5 | 79.3 | 20.7 |
| 3. 1871-80 | 19.3 | 17.5 | 56.2 | 93.0 | 7.0 |
| 4. 1876-85 | 23.3 | 19.5 | 58.3 | 101.0 | - 1.0 |
| 5. 1881-90 | 22.6 | 24.4 | 50.5 | 97.5 | 2.5 |
| 6. 1886-95 | 21.3 | 26.6 | 51.4 | 99.3 | 0.7 |
| 7. 1891-1900 | 22.3 | 18.7 | 58.1 | 99.2 | 0.8 |
| 8. 1896-1905 | 22.1 | 9.9 | 55.3 | 87.3 | 12.7 |
| 9. 1901-10 | 17.9 | 7.8 | 64.1 | 89.8 | 10.2 |
| 10. 1906-15 | 14.2 | 10.0 | 72.7 | 96.9 | 3.1 |
| 11. 1916-20 | 8.5 | 16.3 | 110.3 | 135.2 | -35.2 |
| 12. 1921-30 | 13.1 | 10.4 | 74.5 | 98.0 | 2.0 |
| 13. 1926-35 | 16.7 | 12.2 | 71.9 | 100.8 | - 0.8 |
| 14. 1931-40 | 14.9 | 11.8 | 71.3 | 98.0 | 2.0 |
| 15. 1941-45 | 23.8 | 28.3 | 161.9 | 214.0 | -114.0 |
| 16. 1946-55 | 16.7 | 13.0 | 64.2 | 93.9 | 6.1 |
| 17. 1952-58 | 24.6 | 12.4 | 60.3 | 97.3 | 2.7 |
| **B.** | **Percentages Based on Constant Price Totals** | | | | |
| 18. 1861-70 | 16.9 | 25.3 | 41.7 | 83.9 | 16.1 |
| 19. 1866-75 | 16.2 | 19.7 | 44.8 | 80.7 | 19.3 |
| 20. 1871-80 | 18.7 | 17.8 | 56.7 | 93.2 | 6.8 |
| 21. 1876-85 | 22.8 | 21.3 | 62.6 | 106.7 | - 6.7 |
| 22. 1881-90 | 21.1 | 26.0 | 55.8 | 102.9 | - 2.9 |
| 23. 1886-95 | 18.6 | 26.5 | 54.0 | 99.2 | 0.8 |
| 24. 1891-1900 | 20.2 | 19.2 | 59.5 | 98.9 | 1.1 |
| 25. 1896-1905 | 20.7 | 10.5 | 57.0 | 88.2 | 11.8 |
| 26. 1901-10 | 16.8 | 8.2 | 64.6 | 89.6 | 10.4 |
| 27. 1906-15 | 13.0 | 9.9 | 73.0 | 95.9 | 4.1 |
| 28. 1916-20 | 10.0 | 21.1 | 127.7 | 158.8 | -58.8 |
| 29. 1921-30 | 12.3 | 10.7 | 74.5 | 97.5 | 2.5 |
| 30. 1926-35 | 15.7 | 12.3 | 72.9 | 100.9 | - 0.9 |
| 31. 1931-40 | 14.7 | 11.6 | 72.2 | 98.5 | 1.5 |
| 32. 1941-45 | 8.0 | 15.4 | 108.8 | 132.1 | -32.1 |
| 33. 1946-55 | 10.6 | 11.9 | 71.0 | 93.4 | 6.6 |
| 34. 1952-58 | 24.5 | 12.3 | 60.4 | 97.2 | 2.7 |

Lines 1-16 and 18-33: Indagine, Tables 4 and 5, pp. 191-92.
Lines 17 and 34: U. N. Yearbook of National Accounts Statistics, 1959.

Table D-1.
Capital Formation Proportions, Denmark, 1870-1958 (Percentages based on current price totals)

|     | Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GDP (5) | NNCF/ NDP (6) |
|-----|--------|---------------|--------------|---------------|-----------------|---------------|---------------|
| 1.  | 1870-79 | 12.0 | 50.9 | 5.2 | -14.1 | 8.6 | 3.7 |
| 2.  | 1875-84 | 9.8 | 52.3 | 4.9 | -18.1 | 8.0 | 3.1 |
| 3.  | 1880-89 | 9.6 | 51.4 | 4.9 | -24.0 | 7.3 | 2.5 |
| 4.  | 1885-94 | 9.2 | 51.5 | 4.7 | -21.5 | 7.2 | 2.6 |
| 5.  | 1890-99 | 12.1 | 39.9 | 7.7 | -18.9 | 9.8 | 5.2 |
| 6.  | 1895-1904 | 14.7 | 36.1 | 9.9 | -14.7 | 12.6 | 7.7 |
| 7.  | 1900-09 | 14.7 | 39.1 | 9.5 | -15.2 | 12.5 | 7.1 |
| 8.  | 1905-14 | 14.2 | 40.8 | 8.9 | - 5.1 | 13.5 | 8.2 |
| 9.  | 1921-30 | 11.8 | 48.1 | 6.5 | + 3.2 | 12.2 | 6.9 |
| 10. | 1926-34 | 12.0 | 47.0 | 6.7 | +10.1 | 13.2 | 8.0 |
| 11. | 1931-39 | 13.1 | 43.5 | 7.8 | +14.2 | 14.9 | 9.8 |
| 12. | 1948-52 | 18.2 | 27.9 | 13.8 | - 6.2 | 17.0 | 12.6 |
| 13. | 1952-58 | 18.4 | 34.5 | 12.9 | + 4.1 | 19.2 | 13.7 |

Lines 1-12:  Kjeld Bjerke and Niels Ussing, Studier over Danmarks Nationalprodukt, 1870-1950, Copenhagen, 1958, Table III, pp. 146-47 and Table V, pp. 150-51. NBFCA excludes net factor income from abroad.  Net changes in inventories are estimated to be 0.4 of net changes in GDP in constant prices. The latter were calculated from five-year averages centered on 1875, 1880, 1885, and so on, and single-year values for 1870, 1914, 1921, 1939, 1948, and 1952.  The change from 1870 to 1875 yielded the change in inventories for 1870-74; that from 1875 to 1880, the change in inventories for 1875-79; and so on.  Additions to inventories in constant prices were then converted to current prices by means of the GDP implicit price index.
Line 13:  U. N. Yearbook of National Accounts Statistics, 1959.

Table D-2.

Capital Formation Proportions, Denmark, 1870-1952 (Percentages based on constant price totals)

| Period | GDCF/ GDP (1) | NDCF/ NDP (2) | GNCF/ GDP (3) | NNCF/ NDP (4) | Implicit Price Indexes (1929 = 100) | |
|---|---|---|---|---|---|---|
| | | | | | GDP (5) | GDCF (6) |
| 1. 1870-79 | 11.1 | 5.7 | 9.8 | 4.3 | 60.2 | 54.5 |
| 2. 1875-84 | 11.3 | 5.9 | 9.6 | 4.1 | 57.8 | 50.2 |
| 3. 1880-89 | 10.8 | 5.6 | 8.6 | 3.2 | 53.6 | 47.2 |
| 4. 1885-94 | 10.0 | 5.1 | 8.1 | 3.0 | 51.4 | 47.1 |
| 5. 1890-99 | 12.5 | 8.0 | 10.2 | 5.6 | 50.5 | 49.1 |
| 6. 1895-1904 | 14.6 | 10.1 | 12.4 | 7.8 | 50.8 | 51.3 |
| 7. 1900-09 | 14.4 | 9.6 | 12.2 | 7.2 | 52.6 | 53.9 |
| 8. 1905-14 | 13.4 | 8.5 | 12.6 | 7.7 | 54.5 | 57.9 |
| 9. 1921-30 | 11.3 | 6.3 | 11.8 | 6.7 | 112.0 | 116.9 |
| 10. 1926-34 | 11.4 | 6.4 | 12.6 | 7.7 | 95.0 | 99.8 |
| 11. 1931-39 | 12.1 | 7.2 | 14.0 | 9.2 | 99.5 | 107.5 |
| 12. 1948-52 | 15.4 | 11.7 | 14.2 | 10.4 | 248.1 | 292.3 |

See notes to Table D-1.

Table D-3.
Rate of Growth of Domestic Product in Constant Prices and Ratios to It of Capital
Formation Proportions, Denmark, 1870-1958

### A.  Gross Ratios

| | Interval | Rate of growth per year GDP (%) (1) | GDCF/GDP Current prices (2) | GDCF/GDP Constant prices (3) | GNCF/GDP Current prices (4) | GNCF/GDP Constant prices (5) |
|---|---|---|---|---|---|---|
| 1. | 1870-79 to 1880-89 | 2.67 | 3.7 | 4.2 | 3.0 | 3.6 |
| 2. | 1875-84 to 1885-94 | 2.79 | 3.4 | 3.9 | 2.6 | 3.1 |
| 3. | 1880-89 to 1890-99 | 3.27 | 2.8 | 3.1 | 2.2 | 2.5 |
| 4. | 1885-94 to 1895-1904 | 3.60 | 3.3 | 3.5 | 2.7 | 2.8 |
| 5. | 1890-99 to 1900-09 | 3.38 | 4.3 | 4.3 | 3.7 | 3.7 |
| 6. | 1895-1904 to 1905-14 | 3.41 | 4.3 | 4.2 | 3.7 | 3.6 |
| 7. | 1900-09 to 1914 | 4.01 | 3.5 | 3.3 | 3.4 | 3.1 |
| 8. | 1921 to 1926-34 | 3.78 | 3.1 | 3.0 | 3.2 | 3.1 |
| 9. | 1921-30 to 1931-39 | 2.45 | 4.9 | 4.7 | 5.4 | 5.1 |
| 10. | 1926-34 to 1939 | 2.56 | 5.1 | 4.7 | 5.8 | 5.5 |
| 11. | 1948 to 1952 | 3.55 | 5.1 | 4.3 | 4.8 | 4.0 |
| 12. | 1952 to 1958 | 2.86 | 6.4 | | 6.7 | |

### B.  Net Ratios

| | Interval | Rate of growth per year NDP (%) | NDCF/NDP Current prices | NDCF/NDP Constant prices | NNCF/NDP Current prices | NNCF/NDP Constant prices |
|---|---|---|---|---|---|---|
| 13. | 1870-79 to 1880-89 | 2.69 | 1.8 | 2.2 | 1.2 | 1.5 |
| 14. | 1875-84 to 1885-94 | 2.85 | 1.7 | 2.0 | 0.9 | 1.1 |
| 15. | 1880-89 to 1890-99 | 3.33 | 1.4 | 1.5 | 0.8 | 0.9 |
| 16. | 1885-94 to 1895-1904 | 3.63 | 2.1 | 2.2 | 1.4 | 1.5 |
| 17. | 1890-99 to 1900-09 | 3.33 | 3.0 | 3.0 | 2.3 | 2.3 |
| 18. | 1895-1904 to 1905-14 | 3.38 | 2.8 | 2.8 | 2.1 | 2.1 |
| 19. | 1900-09 to 1914 | 4.04 | 2.2 | 2.1 | 2.0 | 1.9 |
| 20. | 1921 to 1926-34 | 3.75 | 1.7 | 1.7 | 1.8 | 1.8 |

Table D-3 (Cont.)

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| 21. 1921-30 to 1931-39 | 2.47 | 2.7 | 2.6 | 3.2 | 3.1 |
| 22. 1926-34 to 1939 | 2.56 | 3.0 | 2.8 | 3.8 | 3.6 |
| 23. 1948 to 1952 | 3.34 | 4.1 | 3.5 | 3.8 | 3.1 |
| 24. 1952 to 1958 | 2.79 | 4.6 | | 4.9 | |

See notes to Table D-1.

Col. 1, line 24: Rate of growth for net domestic product was calculated by applying to the gross total in constant prices the ratio of capital consumption to gross domestic product in current prices.

Col. 2-5: The capital formation proportions are from Tables D-1 and D-2. For the interval from 1870-79 to 1880-89 the proportions for 1875-84 were used; for 1875-84 to 1885-94 those for 1880-89 were used; and so on.

Table D-4.
Distribution of Gross Domestic Capital Formation by Major Categories, Denmark, 1870-1958

| Period | Construction (1) | Producers' equipment (2) | GFCF (3) | Change in inventories (4) |
|---|---|---|---|---|
| A. Percentages Based on Current Price Totals | | | | |
| 1. 1870-79 | 57.0 | 33.3 | 90.2 | 9.8 |
| 2. 1875-84 | 55.6 | 33.2 | 88.7 | 11.3 |
| 3. 1880-89 | 54.9 | 32.4 | 87.4 | 12.6 |
| 4. 1885-94 | 52.8 | 33.5 | 86.3 | 13.7 |
| 5. 1890-99 | 54.4 | 33.9 | 88.3 | 11.7 |
| 6. 1895-1904 | 57.5 | 32.6 | 90.0 | 10.0 |
| 7. 1900-09 | 56.5 | 34.9 | 91.4 | 8.6 |
| 8. 1905-14 | 51.1 | 37.2 | 88.4 | 11.6 |
| 9. 1921-30 | 46.7 | 41.0 | 87.7 | 12.3 |
| 10. 1926-34 | 50.6 | 41.7 | 92.3 | 7.7 |
| 11. 1931-39 | 48.0 | 43.9 | 91.9 | 8.1 |
| 12. 1948-52 | 38.3 | 54.2 | 92.5 | 7.5 |
| 13. 1952-58 | 40.3 | 55.4 | 95.7 | 4.3 |
| B. Percentages Based on Constant Price Totals | | | | |
| 14. 1870-79 | 70.1 | 21.0 | 91.1 | 8.9 |
| 15. 1875-84 | 67.4 | 22.7 | 90.1 | 9.9 |
| 16. 1880-89 | 66.1 | 22.7 | 88.7 | 11.3 |
| 17. 1885-94 | 63.0 | 24.4 | 87.4 | 12.6 |
| 18. 1890-99 | 63.1 | 25.6 | 88.7 | 11.3 |
| 19. 1895-1904 | 65.4 | 24.6 | 89.9 | 10.1 |
| 20. 1900-09 | 64.6 | 26.6 | 91.2 | 8.8 |
| 21. 1905-14 | 58.1 | 29.6 | 87.7 | 12.3 |
| 22. 1921-30 | 47.7 | 39.9 | 87.6 | 12.4 |
| 23. 1926-34 | 50.3 | 41.7 | 92.0 | 8.0 |
| 24. 1931-39 | 49.6 | 41.7 | 91.4 | 8.6 |
| 25. 1948-52 | 40.4 | 50.8 | 91.1 | 8.9 |

See notes to Table D-1.

Table D-5.
Shares of Major Sources of Gross Domestic Capital Formation Financing, Denmark, 1870-1958 (Percentages based on current price totals)

| | Period | Foreign investment (1) | Gross domestic savings (2) | CC (3) | Net domestic savings (4) | Ratio, net to gross domestic savings (5) |
|---|---|---|---|---|---|---|
| 1. | 1870-79 | 14.1 | 85.9 | 50.9 | 35.0 | 0.41 |
| 2. | 1875-84 | 18.1 | 81.9 | 52.3 | 29.6 | 0.36 |
| 3. | 1880-89 | 24.0 | 76.0 | 51.4 | 24.6 | 0.32 |
| 4. | 1885-94 | 21.5 | 78.5 | 51.5 | 27.0 | 0.34 |
| 5. | 1890-99 | 18.9 | 81.1 | 39.9 | 41.2 | 0.51 |
| 6. | 1895-1904 | 14.7 | 85.3 | 36.1 | 49.2 | 0.58 |
| 7. | 1900-09 | 15.2 | 84.8 | 39.1 | 45.7 | 0.54 |
| 8. | 1905-14 | 5.1 | 94.9 | 40.8 | 54.2 | 0.57 |
| 9. | 1921-30 | - 3.2 | 103.2 | 48.1 | 55.1 | 0.53 |
| 10. | 1926-34 | -10.1 | 110.1 | 47.0 | 63.1 | 0.57 |
| 11. | 1931-39 | -14.2 | 114.2 | 43.5 | 70.7 | 0.62 |
| 12. | 1948-52 | 6.2 | 93.8 | 27.9 | 65.9 | 0.70 |
| 13. | 1952-58 | - 4.1 | 104.1 | 34.5 | 69.6 | 0.67 |

See notes to Table D-1.

Table N-1.
Capital Formation Proportions, Norway, 1865-1958 (Percentages based on current price totals)

|     | Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|-----|--------|------|------|------|-------|------|------|
| 1.  | 1865-74   | 11.2 | 41.9 | 6.8  | +11.3 | 12.5 | 8.1  |
| 2.  | 1870-79   | 12.2 | 39.5 | 7.8  | - 2.5 | 12.0 | 7.5  |
| 3.  | 1875-84   | 11.4 | 42.5 | 6.9  | - 6.2 | 10.7 | 6.2  |
| 4.  | 1880-89   | 10.6 | 47.2 | 5.9  | + 4.2 | 11.1 | 6.4  |
| 5.  | 1885-94   | 12.4 | 46.6 | 7.0  | -18.2 | 10.2 | 4.7  |
| 6.  | 1890-99   | 14.1 | 40.5 | 8.9  | -39.7 | 8.6  | 3.0  |
| 7.  | 1895-1904 | 13.4 | 39.8 | 8.5  | -46.1 | 7.3  | 2.0  |
| 8.  | 1900-09   | 13.2 | 44.1 | 7.9  | -40.7 | 8.0  | 2.2  |
| 9.  | 1905-14   | 15.4 | 37.3 | 10.3 | -21.7 | 12.2 | 6.8  |
| 10. | 1910-19   | 19.0 | 34.9 | 13.3 | -12.3 | 16.7 | 10.8 |
| 11. | 1915-24   | 18.9 | 39.0 | 12.4 | -29.7 | 13.3 | 6.4  |
| 12. | 1920-29   | 16.3 | 42.5 | 10.1 | -31.3 | 11.3 | 4.6  |
| 13. | 1925-34   | 14.3 | 43.3 | 8.6  | - 4.7 | 13.8 | 8.0  |
| 14. | 1930-39   | 18.0 | 37.4 | 12.1 | + 3.3 | 18.9 | 12.9 |
| 15. | 1947-56   | 31.3 | 28.8 | 24.5 | -11.9 | 27.7 | 20.5 |
| 16. | 1952-58   | 30.0 | 33.5 | 22.2 | - 8.4 | 27.6 | 19.5 |

Lines 1-15: GDCF is the sum of NFCF, CC, and change in inventories. NFCF is from Juul Bjerke, Some Aspects of Long-Term Economic Growth of Norway since 1865, a paper presented at the Conference of the International Association for Research in Income and Wealth, held at Portoroz, Yugoslavia, August-September, 1959, Table VI-2. CC is derived as 50 percent of the difference between GDP, unadjusted, and NDP. GDP, unadjusted, is the product of GDP in constant prices, given in ibid., Table IV-3 and the GDP price index, given in ibid., Table V-3. NDP is from ibid., Table VI-3. GDP, adjusted, is the sum of NDP and CC so derived. Change in inventories is estimated at 0.4 of the increase in GDP in constant prices and the latter is derived from decade averages centered on terminal years of the periods shown, except that single-year values are used for 1865, 1939, 1949 (1947 is not available), and 1956. The estimated inventory change is then converted to current prices by the GDP implicit price index. NBFCA is from ibid., Table V-7. GNP is the sum of GDP and net factor income from abroad, given in ibid., Table V-7. All other components are derived from those described above.
Line 16: U. N. Yearbook of National Accounts Statistics, 1959.

Table N-2.
Capital Formation Proportions, Norway, 1865-1956 (Percentages based on constant price totals)

| Period | GDCF/ GDP (1) | NDCF/ NDP (2) | GNCF/ GNP (3) | NNCF/ NNP (4) | Implicit Price Indexes (1938 = 100) | |
|---|---|---|---|---|---|---|
| | | | | | GDP (5) | GDCF (6) |
| 1. 1865-74 | 12.1 | 7.5 | 13.2 | 8.6 | 51 | 47 |
| 2. 1870-79 | 13.3 | 8.7 | 12.1 | 7.3 | 54 | 50 |
| 3. 1875-84 | 13.4 | 8.5 | 10.7 | 5.6 | 53 | 45 |
| 4. 1880-89 | 12.6 | 7.3 | 10.2 | 4.7 | 49 | 41 |
| 5. 1885-94 | 13.4 | 7.9 | 9.8 | 4.1 | 47 | 44 |
| 6. 1890-99 | 15.3 | 10.0 | 8.0 | 2.2 | 48 | 44 |
| 7. 1895-1904 | 15.0 | 9.7 | 6.6 | 0.6 | 50 | 45 |
| 8. 1900-09 | 14.4 | 8.8 | 7.9 | 1.7 | 53 | 49 |
| 9. 1905-14 | 17.2 | 11.6 | 12.0 | 6.0 | 58 | 52 |
| 10. 1910-19 | 19.5 | 13.9 | 11.9 | 5.8 | 104 | 101 |
| 11. 1915-24 | 18.2 | 12.3 | 9.9 | 3.3 | 152 | 158 |
| 12. 1920-29 | 17.0 | 10.8 | 12.9 | 6.2 | 137 | 131 |
| 13. 1925-34 | 16.2 | 9.8 | 16.3 | 9.8 | 100 | 88 |
| 14. 1930-39 | 18.7 | 12.6 | 20.5 | 14.4 | 91 | 88 |
| 15. 1947-56 | 25.6 | 20.1 | 24.1 | 18.5 | 236 | 289 |

See notes to Table N-1. NFCF is the difference between NDP, given in Bjerke, op. cit., Table IV-3, and consumption expenditures, given in ibid., Table VI-6, and the net balance of exports and imports of goods and services, given in ibid., Table V-1. Change in inventories is described in the notes to Table N-1. CC is the difference between GDP and NDP, both given in ibid., Table IV-3, reduced by 50 percent. NBFCA is the sum of the net balance of exports and imports of goods and services and net transfers from abroad, the latter given in current prices in ibid., Table V-7 and adjusted to constant prices by the GDP implicit price index. For 1947-56 the transfer item is exclusive of war damage compensation and ERP grants. All other components are derived from those described above.

Table N-3.
Rate of Growth of Product in Constant Prices and Ratios to It of Capital Formation Proportions, Norway, 1865-1958

### A.  Gross Ratios

| Interval | Rate of growth per year GDP (%) (1) | Ratio to Col. 1 of GDCF/GDP | | Rate of growth per year GNP (%) (4) | Ratio to Col. 4 of GNCF/GNP | |
|---|---|---|---|---|---|---|
| | | Current prices (2) | Constant prices (3) | | Current prices (5) | Constant prices (6) |
| 1.  1865-74 to 1875-84 | 1.97 | 6.2 | 6.8 | 1.94 | 6.2 | 6.2 |
| 2.  1870-79 to 1880-89 | 1.17 | 9.7 | 11.5 | 1.15 | 9.3 | 9.3 |
| 3.  1875-84 to 1885-94 | 1.34 | 7.9 | 9.4 | 1.33 | 8.3 | 7.7 |
| 4.  1880-89 to 1890-99 | 2.23 | 5.6 | 6.0 | 2.22 | 4.6 | 4.4 |
| 5.  1885-94 to 1895-1904 | 2.33 | 6.1 | 6.6 | 2.30 | 3.7 | 3.5 |
| 6.  1890-99 to 1900-09 | 1.83 | 7.3 | 8.2 | 1.76 | 4.1 | 3.8 |
| 7.  1895-1904 to 1905-14 | 2.15 | 6.1 | 6.7 | 2.14 | 3.7 | 3.7 |
| 8.  1900-09 to 1910-19 | 2.96 | 5.2 | 5.8 | 3.08 | 4.0 | 3.9 |
| 9.  1905-14 to 1915-24 | 2.79 | 6.8 | 7.0 | 2.86 | 5.8 | 4.2 |
| 10.  1910-19 to 1920-29 | 2.46 | 7.7 | 7.4 | 2.40 | 5.5 | 4.1 |
| 11.  1915-24 to 1925-34 | 2.71 | 6.0 | 6.3 | 2.61 | 4.3 | 4.9 |
| 12.  1920-29 to 1930-39 | 3.26 | 4.4 | 5.0 | 3.20 | 4.3 | 5.1 |
| 13.  1947 to 1956 | 3.53 | 8.9 | 7.3 | | | |
| 14.  1952 to 1958 | 3.11 | 9.6 | | 3.00 | 9.2 | |

### B.  Net Ratios

| Interval | Rate of growth per year NDP (%) | Ratio to Col. 1 of NDCF/NDP | | Rate of growth per year NNP (%) | Ratio to Col. 4 of NNCF/NNP | |
|---|---|---|---|---|---|---|
| | | Current prices | Constant prices | | Current prices | Constant prices |
| 15.  1865-74 to 1875-84 | 1.93 | 4.0 | 4.5 | 1.90 | 3.9 | 3.8 |
| 16.  1870-79 to 1880-89 | 1.10 | 6.3 | 7.7 | 1.08 | 5.7 | 5.2 |
| 17.  1875-84 to 1885-94 | 1.29 | 4.6 | 5.7 | 1.27 | 5.0 | 3.7 |

Table N-3 (Cont.)

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| 18. 1880-89 to 1890-99 | 2.22 | 3.2 | 3.6 | 2.20 | 2.1 | 1.9 |
| 19. 1885-94 to 1895-1904 | 2.32 | 3.8 | 4.3 | 2.30 | 1.3 | 1.0 |
| 20. 1890-99 to 1900-09 | 1.79 | 4.7 | 5.4 | 1.72 | 1.2 | 0.3 |
| 21. 1895-1904 to 1905-14 | 2.11 | 3.7 | 4.2 | 2.10 | 1.0 | 0.8 |
| 22. 1900-09 to 1910-19 | 2.93 | 3.5 | 4.0 | 3.06 | 2.2 | 2.0 |
| 23. 1905-14 to 1915-24 | 2.73 | 4.9 | 5.1 | 2.82 | 3.8 | 2.1 |
| 24. 1910-19 to 1920-29 | 2.40 | 5.2 | 5.1 | 2.34 | 2.7 | 1.4 |
| 25. 1915-24 to 1925-34 | 2.67 | 3.8 | 4.0 | 2.56 | 1.8 | 2.4 |
| 26. 1920-29 to 1930-39 | 3.26 | 2.6 | 3.0 | 3.20 | 2.5 | 3.1 |
| 27. 1947 to 1956 | 3.39 | 7.2 | 5.9 | | | |

Col. 1 and 4: See notes to Table N-2. For lines 13 and 27 the interval is 1949 to 1956 since the estimate for 1947 is not available.

Col. 2, 3, 5, and 6: The capital formation proportions are from Tables N-1 and N-2. For the interval from 1865-74 to 1875-84 the proportions for 1870-79 were used; for 1870-79 to 1880-89, those for 1875-84 were used; and so on.

Table N-4.
Distribution of Additions to Net Reproducible Fixed Capital, Norway, 1865-1956
(Percentages based on constant price totals)

| | | Share in Total Additions (%) | | | | |
|---|---|---|---|---|---|---|
| Interval | Building and construction (1) | Machinery and transport equipment, including ships and boats (2) | Dwellings (3) | Business construction and buildings (4) | Government construction and buildings (5) | Ships and boats (6) |
| **Decade Estimates (Bjerke)** | | | | | | |
| 1. 1865-74 to 1885-94 | 82.3 | 17.7 | | | | |
| 2. 1885-94 to 1905-14 | 76.9 | 23.1 | | | | |
| 3. 1905-14 to 1930-39 | 76.5 | 23.5 | | | | |
| 4. 1930-39 to 1947-56 | 66.8 | 33.2 | | | | |
| **Single-Year Estimates (Bjerke)** | | | | | | |
| 5. 1865 to 1899 | 80.4 | 19.6 | 41.3 | 27.9 | 11.2 | |
| 6. 1899 to 1939 | 74.8 | 25.2 | 27.2 | 35.1 | 12.5 | |
| 7. 1939 to 1953 | 65.2 | 34.8 | 16.6 | 36.2 | 12.4 | |
| **Single-Year Estimates (Aukrust-Bjerke)** | | | | | | |
| 8. 1899 to 1914 | 71.5 | 28.5 | | 62.7 | 8.8 | 9.3 |
| 9. 1914 to 1929 | 80.6 | 19.4 | | 65.9 | 14.7 | 8.7 |
| 10. 1929 to 1939 | 69.6 | 30.4 | | 57.0 | 12.6 | 10.7 |
| 11. 1945 to 1955 | 62.2 | 37.8 | | 51.2 | 11.0 | 12.1 |

Lines 1-7: From Bjerke, op. cit., Tables III-3 and III-4.
Lines 8-11: From Odd Aukrust and Juul Bjerke, "Real Capital and Economic
    Growth in Norway 1900-56," in Raymond Goldsmith and Christopher Saunders,
    eds., Income and Wealth, Series VIII, pp. 80-118, in particular Table I, p.
    114.

Table N-5.
Industrial Distribution of Gross Domestic Product, Current Prices, 1865-1956,
and of Fixed Capital, Constant Prices, and Derived Sectoral Incremental Capital-
Output Ratios, 1900-1953, Norway

| Year | Agriculture and related industries (1) | Mining, manufacturing, and related industries (2) | Transport and communications (3) | Trade, banking, and insurance (4) | Dwellings (5) | Other public and private services (6) | Total (7) |
|---|---|---|---|---|---|---|---|
| **A. Share in Gross Domestic Product, Current Prices (%)** | | | | | | | |
| 1. 1865 | 33.9 | 20.9 | 10.9 | 14.3 | 11.6 | 8.5 | 100.0 |
| 2. 1875 | 32.9 | 21.2 | 12.1 | 14.6 | 11.3 | 7.9 | 100.0 |
| 3. 1890 | 27.6 | 22.4 | 14.7 | 15.8 | 9.6 | 9.9 | 100.0 |
| 4. 1900 | 22.5 | 24.3 | 13.5 | 17.0 | 10.1 | 12.6 | 100.0 |
| 5. 1910 | 23.7 | 26.2 | 11.3 | 17.8 | 9.2 | 11.8 | 100.0 |
| 6. 1930 | 16.6 | 30.1 | 12.7 | 16.9 | 10.2 | 13.5 | 100.0 |
| 7. 1939 | 11.4 | 33.5 | 15.4 | 18.4 | 8.5 | 12.8 | 100.0 |
| 8. 1950 and 1956 | 13.1 | 37.0 | 17.4 | 16.7 | 3.9 | 12.0 | 100.0 |
| **B. Share in Fixed Capital, Constant Prices (%)** | | | | | | | |
| 9. 1900 | 16.9 | 8.0 | 10.8 | 7.5 | 42.3 | 14.5 | 100.0 |
| 10. 1939 | 13.0 | 19.3 | 14.9 | 6.7 | 32.8 | 13.3 | 100.0 |
| 11. 1953 | 10.9 | 24.2 | 15.6 | 7.1 | 28.7 | 13.5 | 100.0 |
| **C. Derived Ratio, Net Fixed Capital Formation to Additions to Net Domestic Product, Constant Prices** | | | | | | | |
| 12. 1900-39 | 6.1 | 2.3 | 3.5 | 1.1 | | 6.3 | 3.3 |
| 13. 1939-53 | 0.8 | 2.3 | 2.2 | 1.7 | | 20.0 | 2.7 |
| 14. 1900-53 | 2.5 | 2.3 | 2.9 | 1.3 | | 8.0 | 3.0 |
| **D. Over-all Ratio, Holding Sectoral Ratios Constant: Inter-sector Changes** | | | | | | | |
| 15. 1900-39 | | | | | | | 3.4 |
| 16. 1939-53 | | | | | | | 2.6 |
| **E. Over-all Ratio, Holding Sector Shares Constant: Intra-sector Changes** | | | | | | | |
| 17. 1900-39 | | | | | | | 3.3 |
| 18. 1939-53 | | | | | | | 4.5 |

Lines 1-8: From Bjerke, op. cit., Tables IV-10 and IV-12. The breakdown of
gross domestic product is provided back to 1910. For years before 1910 the
shares were extrapolated by those in final output (also provided by Bjerke); and
the share of dwellings was assumed to be the same proportion of the residual
private and public services (i.e., the sum of columns 5 and 6) as in 1910.
Lines 9-11: From Aukrust-Bjerke, op. cit., Table III, p. 95.
Lines 12-14: Increase in fixed capital is from ibid. Additions to net domestic
product are derived by first distributing NDP in constant prices for 1900, 1939,
1953, given in ibid., App. Table I, p. 114, by lines 6-8 above and then calcu-
lating the changes.

(Continued on next page)

Table N-5 (Cont.)

Lines 15-16:  The sectoral shares in additions to net domestic product, described
     in the notes to lines 12-14, multiplied by line 14 and divided by 100.
Lines 17-18:  The sectoral ratios in lines 12 and 13 multiplied by the sectoral
     shares in additions to NDP over the entire period, 1900-53 (see notes to lines
     12-14) and divided by 100.


Table N-6.
Shares of Major Sources in Gross Domestic Capital Formation Financing and
Shares of Government in Net Domestic Savings and in Gross Fixed Capital Forma-
tion, Norway, 1865-1958 (Percentages based on current price totals)

| | Period | Share in GDCF (%) | | | Share of government in net domestic savings (%) | Share of government in GFCF (%) |
|---|---|---|---|---|---|---|
| | | Gross domestic savings (1) | CC (2) | Net domestic savings invested at home (3) | (4) | (5) |
| 1. | 1865-74 | 111.3 | 41.9 | 58.1 | 15.6 | 10.5 |
| 2. | 1870-79 | 97.5 | 39.5 | 58.0 | 11.6 | 9.2 |
| 3. | 1875-84 | 93.8 | 42.5 | 51.3 | 10.5 | 10.4 |
| 4. | 1880-89 | 104.2 | 47.2 | 52.8 | 11.1 | 11.8 |
| 5. | 1885-94 | 81.8 | 46.6 | 35.2 | 20.8 | 12.3 |
| 6. | 1890-99 | 60.3 | 40.5 | 19.8 | 21.4 | 11.1 |
| 7. | 1895-1904 | 53.9 | 39.8 | 14.1 | 27.3 | 11.6 |
| 8. | 1900-09 | 59.3 | 44.1 | 15.2 | 76.9 | 10.4 |
| 9. | 1905-14 | 78.3 | 37.3 | 41.0 | 22.2 | 9.2 |
| 10. | 1910-19 | 87.7 | 34.9 | 52.8 | 8.2 | 8.2 |
| 11. | 1915-24 | 70.3 | 39.0 | 31.3 | - 1.2 | 11.7 |
| 12. | 1920-29 | 68.7 | 42.5 | 26.2 | 11.6 | 15.1 |
| 13. | 1925-34 | 95.3 | 43.3 | 52.0 | 26.4 | 15.1 |
| 14. | 1930-39 | 103.3 | 37.4 | 62.6 | 21.6 | 13.1 |
| 15. | 1947-56 | 88.1 | 28.8 | 59.3 | 42.5 | 10.8 |
| 16. | 1952-58 | 91.6 | 33.5 | 58.1 | | 10.2 |

See notes to Table N-1.

Lines 1-15:  Col. 4 is from Bjerke, op. cit., Table VI-4.  In line 15 savings in-
     cludes war damage compensation and ERP grants excluded from other tables.
     Government capital formation is from ibid., Table VII-3 and to the extent that
     it includes minor repairs and maintenance whereas the total does not, the
     share in col. 5 is overestimated.

Table S-1.
Capital Formation Proportions, Sweden, 1861-1958 (Percentages)

| Period | GDCF/ GDP | NBFCA/ GDCF | GNCF/ GDP | GDCF/ GDP Constant prices | Implicit Price Indexes (1913 = 100) | |
|---|---|---|---|---|---|---|
| | | Current Prices | | | GDP | GDCF |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| 1. 1861-70 | 9.3 | - 0.9 | 9.2 | 13.4 | 85.4 | 59.3 |
| 2. 1866-75 | 11.5 | - 1.4 | 11.4 | 14.9 | 89.8 | 69.4 |
| 3. 1871-80 | 12.1 | - 6.6 | 11.3 | 14.6 | 92.5 | 76.2 |
| 4. 1876-85 | 11.0 | -16.6 | 9.2 | 13.0 | 89.8 | 76.0 |
| 5. 1881-90 | 10.6 | -23.2 | 8.1 | 12.3 | 83.2 | 71.9 |
| 6. 1886-95 | 10.3 | -10.7 | 9.2 | 11.8 | 80.0 | 69.5 |
| 7. 1891-1900 | 12.0 | - 6.8 | 11.2 | 12.8 | 82.2 | 77.2 |
| 8. 1896-1905 | 13.8 | -16.3 | 11.6 | 14.1 | 85.3 | 83.4 |
| 9. 1901-10 | 13.5 | -17.9 | 11.1 | 13.9 | 91.0 | 88.5 |
| 10. 1906-15 | 13.1 | + 5.6 | 13.8 | 13.1 | 98.9 | 99.0 |
| 11. 1916-20 | 12.6 | + 6.4 | 13.4 | 9.6 | 211.4 | 277.0 |
| 12. 1911-20 | 12.7 | +11.3 | 14.2 | 11.1 | 160.2 | 184.0 |
| 13. 1916-25 | 13.1 | + 4.6 | 13.7 | 11.5 | 199.1 | 227.6 |
| 14. 1921-30 | 14.2 | + 7.9 | 15.3 | 13.7 | 176.7 | 182.6 |
| 15. 1926-35 | 15.1 | + 9.2 | 16.5 | 14.7 | 161.0 | 165.3 |
| 16. 1931-40 | 17.6 | - 0.2 | 17.5 | 16.4 | 162.3 | 173.5 |
| 17. 1941-45 | 20.2 | + 0.7 | 20.4 | 19.6 | 230.5 | 238.6 |
| 18. 1936-45 | 19.8 | - 1.1 | 19.5 | 18.5 | 201.3 | 215.0 |
| 19. 1941-50 | 21.0 | - 2.2 | 20.5 | 19.9 | 241.3 | 254.8 |
| 20. 1952-58 | 21.4 | - 0.6 | 21.3 | | | |

Lines 1-19: GDP in current and constant prices is from Osten Johannson, Economic Structure and Growth in Sweden, 1861-1953, a paper presented at the Conference of the International Association for Research in Income and Wealth, held at Portoroz, Yugoslavia, August-September, 1959, Tables 17 and 18. GFCF in current and constant prices was obtained by correspondence with Mr. Johannson. Change in inventories was estimated at 0.4 of the increase in GDP in constant prices. The latter was calculated from the single-year value for 1861 and five-year averages centered on 1866, 1871, 1876, and so on through 1951. Thus the increase in GDP from 1861 to 1866 yielded the change in inventories for 1861-65; that from 1866 to 1871, the change in inventories for 1866-70; and so on. The change in inventories in constant prices was converted to current prices by means of the GDP implicit price index. NBFCA (excluding net factor income from abroad) is from Olof Lindahl, "Some Results of an Investigation of the Gross Domestic Product of Sweden for the Period 1861-1951," 25 Economic Essays in Honour of Erik Lindahl, Stockholm, 1956, Table I, pp. 206-14. All other components were derived from those described above.
Line 20: U. N. Yearbook of National Accounts Statistics, 1959.

Table S-2.
Rate of Growth of Gross Domestic Product in Constant Prices and Ratios to It of
Capital Formation Proportions, Sweden, 1861-1958

| | | Rate of growth per year GDP (%) (1) | Ratio to Column 1 of: | | GNCF/ GDP Current prices (4) |
|---|---|---|---|---|---|
| | | | GDCF/GDP | | |
| | Interval | | Current prices (2) | Constant prices (3) | |
| 1. | 1861-70 to 1871-80 | 4.12 | 2.8 | 3.6 | 2.8 |
| 2. | 1866-75 to 1876-85 | 2.90 | 4.2 | 5.0 | 3.9 |
| 3. | 1871-80 to 1881-90 | 1.80 | 6.1 | 7.2 | 5.1 |
| 4. | 1876-85 to 1886-95 | 2.00 | 5.3 | 6.2 | 4.0 |
| 5. | 1881-90 to 1891-1900 | 2.81 | 3.7 | 4.2 | 3.3 |
| 6. | 1886-95 to 1896-1905 | 3.38 | 3.6 | 3.8 | 3.3 |
| 7. | 1891-1900 to 1901-10 | 3.32 | 4.2 | 4.2 | 3.5 |
| 8. | 1896-1905 to 1906-15 | 3.45 | 3.9 | 4.0 | 3.2 |
| 9. | 1901-10 to 1911-20 | 3.20 | 4.1 | 4.1 | 4.3 |
| 10. | 1906-15 to 1916-25 | 2.15 | 5.9 | 5.2 | 6.6 |
| 11. | 1911-20 to 1921-30 | 2.07 | 6.3 | 5.6 | 6.6 |
| 12. | 1916-25 to 1926-35 | 2.43 | 5.8 | 5.7 | 6.3 |
| 13. | 1921-30 to 1931-40 | 2.58 | 5.9 | 5.7 | 6.4 |
| 14. | 1926-35 to 1936-45 | 3.26 | 5.4 | 5.0 | 5.4 |
| 15. | 1931-40 to 1941-50 | 4.24 | 4.7 | 4.4 | 4.6 |
| 16. | 1952 to 1958 | 3.52 | 6.1 | | 6.1 |

See notes to Table S-1.

Col. 2-4: The capital formation proportions for 1866-75 were related to the rate
of growth from 1861-70 to 1871-80; those for 1871-80 to the rate of growth
from 1866-75 to 1876-85; and so on.

Table S-3.
Distribution of Gross Domestic Capital Formation by Major Categories, Sweden,
1861-1958 (Percentages based on current price totals)

|  | Period | Construction (1) | Machinery and equipment (2) | GFCF (3) | Change in inventories (4) |
|---|---|---|---|---|---|
| 1. | 1861-70 | 65.3 | 19.8 | 85.1 | 14.9 |
| 2. | 1866-75 | 59.5 | 25.4 | 84.9 | 15.1 |
| 3. | 1871-80 | 67.8 | 24.1 | 91.9 | 8.1 |
| 4. | 1876-85 | 70.2 | 23.8 | 94.0 | 6.0 |
| 5. | 1881-90 | 64.3 | 27.8 | 92.1 | 7.9 |
| 6. | 1886-95 | 58.9 | 29.1 | 88.0 | 12.0 |
| 7. | 1891-1900 | 56.7 | 32.1 | 88.8 | 11.2 |
| 8. | 1896-1905 | 58.3 | 32.1 | 90.4 | 9.6 |
| 9. | 1901-10 | 55.6 | 34.1 | 89.7 | 10.3 |
| 10. | 1906-15 | 54.9 | 35.2 | 90.1 | 9.9 |
| 11. | 1916-20 | 52.4 | 46.3 | 98.7 | 1.3 |
| 12. | 1911-20 | 53.6 | 42.5 | 96.1 | 3.9 |
| 13. | 1916-25 | 53.1 | 40.9 | 94.0 | 6.0 |
| 14. | 1921-30 | 54.5 | 38.0 | 92.5 | 7.5 |
| 15. | 1926-35 | 56.6 | 36.2 | 92.8 | 7.2 |
| 16. | 1931-40 | 54.3 | 38.4 | 92.7 | 7.3 |
| 17. | 1941-45 | 44.0 | 44.6 | 88.6 | 11.4 |
| 18. | 1936-45 | 47.0 | 43.6 | 90.6 | 9.4 |
| 19. | 1941-50 | 45.5 | 44.1 | 89.6 | 10.4 |
| 20. | 1952-58 | 60.6 | 34.4 | 95.0 | 5.0 |

Lines 1-19: By correspondence with Osten Johannson.
Line 20: U. N. Yearbook of National Accounts Statistics, 1959.

Table S-4.
Distribution of Gross Fixed Capital Formation by Sector of Destination, Sweden,
1861-1950 (Percentages based on constant price totals)

|  | Period | Agri-culture and forestry (1) | Manufac-turing, mining, and con-struction (2) | Transpor-tation and commu-nications (3) | Dwellings (4) | Other (5) |
|---|---|---|---|---|---|---|
| 1. | 1861-70 | 33.2 | 10.0 | 20.2 | 31.5 | 5.1 |
| 2. | 1866-75 | 30.1 | 12.0 | 23.7 | 28.7 | 5.4 |
| 3. | 1871-80 | 24.6 | 13.3 | 23.4 | 33.2 | 5.5 |
| 4. | 1876-85 | 22.3 | 17.8 | 18.4 | 35.4 | 6.1 |
| 5. | 1881-90 | 23.4 | 21.8 | 15.6 | 32.8 | 6.4 |
| 6. | 1886-95 | 22.4 | 22.0 | 20.8 | 27.8 | 7.0 |
| 7. | 1891-1900 | 15.4 | 23.0 | 22.6 | 31.5 | 7.6 |
| 8. | 1896-1905 | 10.9 | 23.2 | 23.4 | 32.4 | 10.0 |
| 9. | 1901-10 | 11.4 | 26.6 | 24.2 | 25.9 | 11.9 |
| 10. | 1906-15 | 10.7 | 29.6 | 22.6 | 24.8 | 12.3 |
| 11. | 1916-20 | 10.9 | 37.8 | 19.3 | 19.6 | 12.5 |
| 12. | 1911-20 | 10.0 | 33.5 | 20.9 | 23.1 | 12.4 |
| 13. | 1916-25 | 11.7 | 31.9 | 22.6 | 18.6 | 15.2 |
| 14. | 1921-30 | 12.0 | 28.8 | 24.5 | 19.1 | 15.5 |
| 15. | 1926-35 | 9.4 | 31.2 | 23.1 | 19.8 | 16.5 |
| 16. | 1931-40 | 7.7 | 32.7 | 20.4 | 19.3 | 19.9 |
| 17. | 1941-45 | 7.8 | 31.4 | 18.9 | 15.8 | 26.0 |
| 18. | 1936-45 | 8.0 | 32.0 | 19.1 | 17.3 | 23.6 |
| 19. | 1941-50 | 8.2 | 35.1 | 19.6 | 16.1 | 21.1 |

Underlying data were obtained by correspondence with Osten Johannson.

Table S-5.
Sectoral Fixed Capital-Output Ratios and the Effects of Changes in Them and in Sectoral Weights on the Countrywide Fixed Capital-Output Ratio, Sweden, 1861-1950 (Based on constant price totals)

| | Period | Agriculture and forestry (1) | Manufacturing, mining, and construction (2) | Transportation and communications (3) | Public administration (4) | Dwellings (5) | Other (6) | Total (7) |
|---|---|---|---|---|---|---|---|---|
| | | Share in Addition to Gross Domestic Product (%) | | | | | | |
| 1. | 1861-90 | 25.9 | 30.9 | 8.8 | 4.7 | 7.2 | 22.5 | 100.0 |
| 2. | 1891-1920 | 10.4 | 44.0 | 9.9 | 6.5 | 4.6 | 24.6 | 100.0 |
| 3. | 1921-50 | 5.8 | 53.1 | 7.4 | 7.8 | 2.5 | 23.4 | 100.0 |
| 4. | Average, lines 1-3 | 14.0 | 42.7 | 8.7 | 6.3 | 4.8 | 23.5 | 100.0 |
| | | Ratio, Gross Fixed Capital Formation to Addition to Gross Domestic Product | | | | | | |
| 5. | 1861-90 | 4.9 | 2.5 | 11.0 | 5.4 | 22.0 | 0.1 | 4.9 |
| 6. | 1891-1920 | 4.8 | 2.8 | 9.7 | 5.6 | 24.1 | 0.4 | 4.2 |
| 7. | 1921-50 | 5.8 | 2.4 | 10.7 | 6.9 | 27.0 | 0.9 | 3.8 |
| 8. | Average, lines 5-7 | 5.2 | 2.6 | 10.5 | 6.0 | 24.4 | 0.5 | 4.3 |
| | | Derived Ratio, Gross Fixed Capital Formation to Additions to Gross Domestic Product, Based on Fixed Weights in Line 4 | | | | | | |
| 9. | 1861-90 | | | | | | | 4.1 |
| 10. | 1891-1920 | | | | | | | 4.3 |
| 11. | 1921-50 | | | | | | | 4.7 |
| | | Derived Ratio, Gross Fixed Capital Formation to Addition to Gross Domestic Product, Based on Fixed Ratios in Line 8 | | | | | | |
| 12. | 1861-90 | | | | | | | 5.2 |
| 13. | 1891-1920 | | | | | | | 4.4 |
| 14. | 1921-50 | | | | | | | 3.7 |

Underlying data were obtained by correspondence with Osten Johannson.

Lines 1-3: For each sector and for total GDP the change from beginning to end of each period is derived from the single-year figure for 1861 and quinquennial averages centered on 1891, 1921, and 1951, respectively. The entries are percentage shares of the additions to the sectoral gross products in the addition to GDP.

Lines 5-7: The ratio, for each sector and for the entire country, of gross fixed capital formation to the addition to GDP.

Lines 9-11: The sector ratios in lines 5-7 weighted by the fixed shares in line 4.

Lines 12-14: The sector shares in lines 1-3 weighted by the fixed ratios in line 8.

Table US-1.
Capital Formation Proportions, United States, 1869-1955 (Percentages based on current price totals)

|     | Period | GDCF/ GNP (1) | CC/ GDCF (2) | NDCF/ NNP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|-----|--------|------|------|------|------|------|------|
| 1.  | 1869-78   | 21.6 | 37.2 | 14.8 | - 6.1 | 20.3 | 13.4 |
| 2.  | 1874-83   | 20.8 | 38.6 | 13.9 | - 0.1 | 20.7 | 13.8 |
| 3.  | 1879-88   | 20.9 | 41.7 | 13.4 | - 1.8 | 20.6 | 13.0 |
| 4.  | 1884-93   | 22.8 | 43.7 | 14.3 | - 2.8 | 22.2 | 13.6 |
| 5.  | 1889-98   | 23.0 | 46.5 | 13.8 | + 0.6 | 23.1 | 13.9 |
| 6.  | 1894-1903 | 22.8 | 46.6 | 13.6 | + 5.1 | 23.9 | 14.9 |
| 7.  | 1899-1908 | 21.9 | 47.9 | 12.7 | + 4.5 | 22.8 | 13.8 |
| 8.  | 1904-13   | 21.6 | 49.1 | 12.3 | + 1.2 | 21.8 | 12.6 |
| 9.  | 1909-18   | 18.5 | 62.3 | 7.9 | +13.4 | 20.9 | 10.7 |
| 10. | 1914-23   | 18.4 | 64.4 | 7.4 | +17.2 | 21.6 | 11.0 |
| 11. | 1919-28   | 20.4 | 55.2 | 10.3 | + 7.9 | 22.0 | 12.1 |
| 12. | 1924-33   | 17.7 | 66.9 | 6.7 | + 4.1 | 18.4 | 7.5 |
| 13. | 1929-38   | 15.0 | 89.1 | 1.9 | + 3.2 | 15.5 (12.7) | 2.5 |
| 14. | 1934-43   | 16.6 | 81.3 | 3.6 | + 2.4 | 17.0 (12.1) | 4.0 |
| 15. | 1939-48   | 16.0 | 82.4 | 3.3 | + 6.8 | 17.1 (12.6) | 4.5 |
| 16. | 1944-53   | 19.8 | 71.0 | 6.7 | + 2.2 | 20.2 (16.1) | 7.2 |
| 17. | 1946-55   | 21.5 | 66.2 | 8.5 | + 2.1 | 21.9 (18.2) | 9.0 |

Underlying data for all except figures in parentheses in column 5, lines 13-17, are from Simon Kuznets, Capital in the American Economy: Its Formation and Financing, National Bureau of Economic Research (in press). For figures in parentheses in column 5, lines 13-17, they are from U. S. Income and Output, Washington, 1958, and National Income, 1954 Edition, Washington, 1954; and the entries are the proportions of the sum of gross private capital formation, net exports, government construction (excluding military) to GNP, all as defined by the Department of Commerce.

Table US-2.
Capital Formation Proportions, United States, 1869-1955 (Percentages based on constant price totals)

| | Period | GDCF/ GNP (1) | NDCF/ NNP (2) | GNCF/ GNP (3) | NNCF/ NNP (4) | Implicit Price Indexes (1929 = 100) | |
| | | | | | | GNP (5) | GDCF (6) |
|---|---|---|---|---|---|---|---|
| 1. | 1869-78 | 24.7 | 16.9 | 23.4 | 15.4 | 68.1 | 59.5 |
| 2. | 1874-83 | 23.3 | 15.4 | 23.3 | 15.4 | 60.1 | 53.6 |
| 3. | 1879-88 | 23.2 | 14.9 | 22.9 | 14.5 | 54.9 | 49.6 |
| 4. | 1884-93 | 25.6 | 16.3 | 24.9 | 15.6 | 51.4 | 45.8 |
| 5. | 1889-98 | 25.9 | 15.7 | 26.0 | 15.9 | 47.6 | 42.3 |
| 6. | 1894-1903 | 24.5 | 14.6 | 25.7 | 15.9 | 47.8 | 44.3 |
| 7. | 1899-1908 | 23.2 | 13.5 | 24.2 | 14.6 | 52.5 | 49.4 |
| 8. | 1904-13 | 23.0 | 13.0 | 23.2 | 13.3 | 57.8 | 54.3 |
| 9. | 1909-18 | 20.1 | 8.9 | 22.6 | 11.7 | 70.3 | 64.6 |
| 10. | 1914-23 | 18.4 | 6.9 | 21.6 | 10.5 | 95.1 | 95.2 |
| 11. | 1919-28 | 20.3 | 10.0 | 21.9 | 11.8 | 103.9 | 104.2 |
| 12. | 1924-33 | 17.3 | 6.0 | 18.0 | 6.8 | 95.5 | 98.0 |
| 13. | 1929-38 | 14.0 | 1.6 | 14.4 | 2.1 | 86.2 | 92.8 |
| 14. | 1934-43 | 15.3 | 3.7 | 15.8 | 4.2 | 89.1 | 96.7 |
| 15. | 1939-48 | 14.9 | 3.1 | 15.9 | 4.3 | 116.2 | 125.3 |
| 16. | 1944-53 | 16.8 | 5.0 | 17.2 | 5.5 | 151.1 | 178.0 |
| 17. | 1946-55 | 18.2 | 6.9 | 18.8 | 7.5 | 160.6 | 189.3 |

See notes to Table US-1.

Table US-3.
Approximation to Share of Gross Fixed Capital Formation in Gross National
Product, United States, 1844-1894 (Based on constant price totals)

| Year | Share of fixed capital output in gross commodity output (%) (1) | Three-year average of column 1 (%) (2) | Ratio, gross commodity output to GNP (3) | Share of fixed capital output in GNP (%) (4) | GFCF/ GNP (%) (5) |
|------|------|------|------|------|------|
| 1. 1839 | 18.2 | | | | |
| 2. 1844 | 17.1 | 18.1 | (0.79) | 14.3 | |
| 3. 1849 | 19.0 | 20.1 | (0.78) | 15.7 | |
| 4. 1854 | 24.3 | 21.7 | (0.77) | 16.7 | |
| 5. 1859 | 21.9 | | | | |
| 6. 1869 | 27.2 | | | | |
| 7. 1874 | 27.6 | 26.7 | 0.72 | 19.2 | 19.9 |
| 8. 1879 | 25.4 | 27.1 | 0.68 | 18.4 | 19.4 |
| 9. 1884 | 28.3 | 26.5 | 0.67 | 17.8 | 19.9 |
| 10. 1889 | 25.8 | 27.9 | 0.71 | 19.8 | 22.4 |
| 11. 1894 | 29.5 | 26.4 | 0.69 | 18.2 | 22.1 |
| 12. 1899 | 23.8 | | | | |

Col. 1: From Robert E. Gallman, "Commodity Output, 1839-1899," in William
   N. Parker, ed., Trends in the American Economy in the Nineteenth Century,
   Studies in Income and Wealth, Vol. 24, Princeton, 1960, Table A-1, p. 43,
   Table A-2, pp. 46-48, Table A-10, p. 63, and Table A-12, p. 65. Fixed
   capital goods includes construction, output of fixed durable goods by manufac-
   turing industries, and land improvements by farm labor. Here we used Var-
   iant A for construction reduced by one-quarter to allow for repairs and main-
   tenance. The other two items, reported by Prof. Gallman for 1839, 1849,
   1859, and so on, were interpolated by the movement of construction.
       Gross commodity output is the sum of the gross product of agriculture,
   mining, manufacturing, and construction.
Col. 3: From 1869 on the underlying GNP series is from Kuznets, op. cit. We
   took the ratios of gross commodity output in 1879 prices to GNP in 1929
   prices; averaged the ratios for each group of three years; and raised these
   average ratios by the fraction of the price level in 1929 to that in 1879, de-
   rived from the price index implicit in GNP.
       The ratio was then extrapolated back by the ratio of workers engaged in the
   same sectors to total labor force, the latter derived from Historical Statistics
   of the United States, Series D47-61.
Col. 5: Averages of ratios for the years used in deriving the ratios in col. 4.
   The underlying data are from annual tables supplementing Kuznets, op. cit.

Table US-4.
Rate of Growth of National Product in Constant Prices and Ratios to It of Capital
Formation Proportions, United States, 1869-1957

### A. Gross Ratios

| | Interval | Rate of growth per year GNP (%) (1) | Ratio to Column 1 of: | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | GDCF/GNP | | GNCF/GNP | |
| | | | Current prices (2) | Constant prices (3) | Current prices (4) | Constant prices (5) |
| 1. | 1869-78 to 1879-88 | 6.52 | 3.2 | 3.6 | 3.2 | 3.6 |
| 2. | 1874-83 to 1884-93 | 4.47 | 4.7 | 5.2 | 4.6 | 5.1 |
| 3. | 1879-88 to 1889-98 | 3.30 | 6.9 | 7.8 | 6.7 | 7.5 |
| 4. | 1884-93 to 1894-1903 | 3.79 | 6.1 | 6.8 | 6.1 | 6.9 |
| 5. | 1889-98 to 1899-1908 | 4.52 | 5.0 | 5.4 | 5.3 | 5.7 |
| 6. | 1894-1903 to 1904-13 | 4.11 | 5.3 | 5.6 | 5.6 | 5.9 |
| 7. | 1899-1908 to 1909-18 | 2.93 | 7.4 | 7.8 | 7.4 | 7.9 |
| 8. | 1904-13 to 1914-23 | 2.36 | 7.8 | 8.5 | 8.9 | 9.6 |
| 9. | 1909-18 to 1919-28 | 3.35 | 5.5 | 5.5 | 6.4 | 6.4 |
| 10. | 1914-23 to 1924-33 | 2.69 | 7.6 | 7.6 | 8.2 | 8.1 |
| 11. | 1919-28 to 1929-38 | 0.43 | 41.2 | 40.2 | 42.8 | 41.9 |
| 12. | 1924-33 to 1934-43 | 1.24 | 12.1 | 11.3 | 12.5 | 11.6 |
| 13. | 1929-38 to 1939-48 | 3.61 | 4.6 | 4.2 | 4.7 | 4.4 |
| 14. | 1934-43 to 1944-53 | 4.29 | 3.7 | 3.5 | 4.0 | 3.7 |
| 15. | 1939-48 to 1948-57 | 4.25 | 4.7 | 4.0 | 4.8 | 4.0 |

### B. Net Ratios

| | Interval | Rate of growth per year NNP (%) | Ratio to Column 1 of: | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | NDCF/NNP | | NNCF/NNP | |
| | | | Current prices | Constant prices | Current prices | Constant prices |
| 16. | 1869-78 to 1879-88 | 6.48 | 2.2 | 2.4 | 2.1 | 2.4 |
| 17. | 1874-83 to 1884-93 | 4.27 | 3.1 | 3.5 | 3.0 | 3.4 |
| 18. | 1879-88 to 1889-98 | 3.03 | 4.7 | 5.4 | 4.5 | 5.2 |
| 19. | 1884-93 to 1894-1903 | 3.72 | 3.7 | 4.2 | 3.7 | 4.3 |
| 20. | 1889-98 to 1899-1908 | 4.62 | 2.9 | 3.2 | 3.2 | 3.4 |
| 21. | 1894-1903 to 1904-13 | 4.14 | 3.1 | 3.3 | 3.3 | 3.5 |
| 22. | 1899-1908 to 1909-18 | 2.81 | 4.4 | 4.6 | 4.5 | 4.7 |
| 23. | 1904-13 to 1914-23 | 2.26 | 3.5 | 3.9 | 4.7 | 5.2 |
| 24. | 1909-18 to 1919-28 | 3.44 | 2.2 | 2.0 | 3.2 | 3.1 |
| 25. | 1914-23 to 1924-33 | 2.74 | 3.8 | 3.6 | 4.4 | 4.3 |
| 26. | 1919-28 to 1929-38 | 0.30 | 22.3 | 20.0 | 25.0 | 22.7 |
| 27. | 1924-33 to 1934-43 | 1.23 | 1.5 | 1.3 | 2.0 | 1.7 |
| 28. | 1929-38 to 1939-48 | 3.67 | 1.0 | 1.0 | 1.1 | 1.1 |
| 29. | 1934-43 to 1944-53 | 4.25 | 0.8 | 0.7 | 1.1 | 1.0 |
| 30. | 1939-48 to 1948-57 | 4.27 | 1.6 | 1.2 | 1.7 | 1.3 |

See notes to Table US-1.

Col. 1: GNP in 1948-57 was estimated by extrapolating the average for 1946-55
by the ratio of the 1948-57 average to the 1946-55 average of the Department

(Continued on next page)

Table US-4 (Cont.)

of Commerce series. NNP was then derived by applying the ratio to GNP for
1946-55 to the 1948-57 GNP figure.

Col. 2-5: The capital formation proportions are from Tables US-1 and US-2.
For the interval from 1869-78 to 1879-88 the proportions for 1874-83 were
used; for 1874-83 to 1884-93 those for 1879-88 were used; and so on.

Table US-5.
Approximations to Ratios of Gross Fixed Capital Proportion to Output, United
States, 1839-1899 (Based on constant price totals)

| Interval | Rate of growth per year, commodity product (%) (1) | Ratio to col. 1 of GFCF proportion to commodity product (2) | Ratio, GFCF/GNP to rate of growth, GNP (3) | Ratio, GDCF/GNP to rate of growth, GNP (4) |
|---|---|---|---|---|
| 1. 1839 to 1849 | 4.75 | 3.8 | | |
| 2. 1844 to 1854 | 4.85 | 4.1 | | |
| 3. 1849 to 1859 | 4.43 | 4.9 | | |
| 4. 1869 to 1879 | 5.33 | 5.0 | 3.1 | |
| 5. 1874 to 1884 | 5.14 | 5.3 | 3.3 | 3.6 |
| 6. 1879 to 1889 | 4.64 | 5.7 | 4.8 | 5.2 |
| 7. 1884 to 1894 | 3.86 | 7.2 | 6.8 | 7.8 |
| 8. 1889 to 1899 | 3.10 | 8.5 | 5.8 | 6.8 |

Col. 1: From Gallman, op. cit., Table 1, p. 16. Single-year values were used
for 1839, 1859, 1869, and 1899. For other terminal values geometric means
of values at five-year intervals were used, e.g., for 1844 the values for 1839,
1844, and 1849 were averaged.

Col. 2: The proportions in Table US-3, col. 2 were used.

Col. 3: From Kuznets, op. cit., and the supplementary annual tables. The
rates of growth were calculated in exactly the same way as those in col. 1.
The capital formation proportions were calculated from decennial averages.

Col. 4: From Table US-4, col. 3.

Table US-6.
Distribution of Domestic Capital Formation by Major Categories, United States, 1869-1955

| | | Construction | | | | Pro- | | Additions to |
|---|---|---|---|---|---|---|---|---|
| | Period | Resi-dential (1) | Govern-ment (2) | Other (3) | Total (4) | ducers' durable (5) | GFCF (6) | inven-tories (7) |
| | **A. Share in Gross Domestic Capital Formation, Current Prices (%)** | | | | | | | |
| 1. | 1869-78 | 16.3 | 4.0 | 31.6 | 51.9 | 23.5 | 75.4 | 24.6 |
| 2. | 1874-83 | 16.7 | 3.8 | 30.7 | 51.2 | 24.3 | 75.5 | 24.5 |
| 3. | 1879-88 | 23.7 | 4.0 | 31.1 | 58.8 | 24.2 | 83.0 | 17.0 |
| 4. | 1884-93 | 27.7 | 4.2 | 37.1 | 69.0 | 21.3 | 90.3 | 9.7 |
| 5. | 1889-98 | 25.0 | 4.6 | 41.9 | 71.5 | 20.7 | 92.2 | 7.8 |
| 6. | 1894-1903 | 18.1 | 5.0 | 41.0 | 64.1 | 22.8 | 86.9 | 13.1 |
| 7. | 1899-1908 | 18.1 | 6.4 | 41.0 | 65.5 | 26.4 | 91.9 | 8.2 |
| 8. | 1904-13 | 18.5 | 7.4 | 38.9 | 64.8 | 26.2 | 91.0 | 9.0 |
| 9. | 1909-18 | 15.4 | 8.3 | 32.7 | 56.4 | 32.9 | 89.3 | 10.7 |
| 10. | 1914-23 | 15.2 | 9.1 | 24.3 | 48.6 | 35.2 | 83.8 | 16.2 |
| 11. | 1919-28 | 21.8 | 10.7 | 24.7 | 57.2 | 32.2 | 89.4 | 10.5 |
| 12. | 1924-33 | 22.8 | 15.8 | 27.2 | 65.8 | 35.1 | 100.9 | - 0.9 |
| 13. | 1929-38 | 13.7 | 24.1 | 21.9 | 59.7 | 40.8 | 100.5 | - 0.5 |
| 14. | 1934-43 | 13.0 | 24.7 | 14.5 | 52.2 | 39.3 | 91.5 | 8.5 |
| 15. | 1939-48 | 14.6 | 15.8 | 18.3 | 48.7 | 44.2 | 92.9 | 7.1 |
| 16. | 1944-53 | 17.2 | 12.8 | 20.3 | 50.3 | 43.7 | 94.0 | 5.9 |
| 17. | 1946-55 | 18.6 | 13.4 | 20.9 | 52.9 | 41.6 | 94.5 | 5.5 |
| | **B. Share in Net Domestic Capital Formation, Current Prices (%)** | | | | | | | |
| 18. | 1869-78 | 19.0 | 2.9 | 24.8 | 46.7 | 14.1 | 60.8 | 39.2 |
| 19. | 1874-83 | 20.0 | 3.1 | 21.3 | 44.4 | 15.8 | 60.2 | 39.8 |
| 20. | 1879-88 | 31.6 | 3.5 | 19.8 | 54.9 | 16.0 | 70.9 | 29.1 |
| 21. | 1884-93 | 38.3 | 3.9 | 30.0 | 72.2 | 10.7 | 82.9 | 17.2 |
| 22. | 1889-98 | 33.0 | 4.6 | 39.6 | 77.2 | 8.3 | 85.5 | 14.5 |
| 23. | 1894-1903 | 19.6 | 5.1 | 39.2 | 63.9 | 11.5 | 75.4 | 24.5 |
| 24. | 1899-1908 | 19.7 | 7.2 | 40.4 | 67.3 | 17.0 | 84.3 | 15.6 |
| 25. | 1904-13 | 20.8 | 8.9 | 38.3 | 68.0 | 14.3 | 82.3 | 17.7 |
| 26. | 1909-18 | 17.3 | 11.6 | 25.4 | 54.3 | 17.3 | 71.6 | 28.4 |
| 27. | 1914-23 | 18.3 | 12.0 | 1.4 | 31.7 | 22.9 | 54.6 | 45.4 |
| 28. | 1919-28 | 30.6 | 13.1 | 9.4 | 53.1 | 23.4 | 76.5 | 23.5 |
| 29. | 1924-33 | 36.8 | 27.3 | 5.6 | 69.7 | 33.2 | 102.9 | - 3.0 |
| 30. | 1929-38 | - 1.9 | 113.4 | -119.6 | - 8.1 | 112.0 | 103.9 | - 3.9 |
| 31. | 1934-43 | 6.2 | 64.1 | -74.3 | - 4.0 | 58.5 | 54.5 | 45.6 |
| 32. | 1939-48 | 21.5 | 21.6 | -33.8 | 9.3 | 50.6 | 59.9 | 40.1 |
| 33. | 1944-53 | 30.6 | 13.1 | 5.3 | 49.0 | 30.4 | 79.4 | 20.5 |
| 34. | 1946-55 | 32.5 | 15.2 | 11.1 | 58.8 | 24.8 | 83.6 | 16.4 |
| | **C. Share in Gross Domestic Capital Formation, Constant Prices (%)** | | | | | | | |
| 35. | 1869-78 | 22.7 | 4.9 | 36.8 | 64.4 | 18.5 | 82.9 | 17.1 |
| 36. | 1874-83 | 22.4 | 4.6 | 34.2 | 61.2 | 21.3 | 82.5 | 17.5 |
| 37. | 1879-88 | 29.5 | 4.5 | 31.3 | 65.3 | 22.4 | 87.7 | 12.3 |
| 38. | 1884-93 | 32.7 | 4.4 | 35.7 | 72.8 | 20.6 | 93.4 | 6.6 |
| 39. | 1889-98 | 28.9 | 4.8 | 40.7 | 74.3 | 20.2 | 94.5 | 5.5 |

(Continued on next page)

Table US-6 (Cont.)

|     |           | (1)   | (2)   | (3)    | (4)   | (5)   | (6)   | (7)    |
|-----|-----------|-------|-------|--------|-------|-------|-------|--------|
| 40. | 1894-1903 | 21.4  | 5.2   | 41.4   | 68.0  | 21.9  | 89.9  | 10.1   |
| 41. | 1899-1908 | 20.0  | 6.5   | 41.5   | 68.0  | 25.9  | 93.9  | 6.1    |
| 42. | 1904-13   | 20.1  | 7.7   | 39.2   | 67.0  | 26.2  | 93.2  | 6.8    |
| 43. | 1909-18   | 18.1  | 8.9   | 35.0   | 62.0  | 29.9  | 92.0  | 8.0    |
| 44. | 1914-23   | 18.2  | 9.4   | 26.7   | 54.3  | 34.4  | 88.7  | 11.3   |
| 45. | 1919-28   | 23.7  | 10.3  | 25.8   | 59.8  | 32.7  | 92.5  | 7.5    |
| 46. | 1924-33   | 23.4  | 16.3  | 27.4   | 67.1  | 35.8  | 102.8 | - 2.8  |
| 47. | 1929-38   | 13.9  | 24.0  | 21.1   | 59.0  | 41.5  | 100.5 | - 0.5  |
| 48. | 1934-43   | 12.6  | 22.4  | 14.1   | 49.2  | 39.4  | 88.6  | 11.4   |
| 49. | 1939-48   | 12.6  | 15.6  | 16.4   | 44.6  | 45.0  | 89.6  | 10.4   |
| 50. | 1944-53   | 14.4  | 11.9  | 18.1   | 44.4  | 48.2  | 92.7  | 7.3    |
| 51. | 1946-55   | 15.8  | 12.3  | 18.2   | 46.3  | 45.9  | 92.2  | 7.8    |

### D.  Share in Net Domestic Capital Formation, Constant Prices (%)

|     |           | (1)   | (2)    | (3)     | (4)    | (5)    | (6)    | (7)    |
|-----|-----------|-------|--------|---------|--------|--------|--------|--------|
| 52. | 1869-78   | 27.1  | 3.8    | 30.3    | 61.2   | 11.0   | 72.2   | 27.8   |
| 53. | 1874-83   | 27.4  | 3.9    | 25.2    | 56.4   | 14.5   | 70.9   | 29.1   |
| 54. | 1879-88   | 39.7  | 4.0    | 20.5    | 64.3   | 14.5   | 78.8   | 21.2   |
| 55. | 1884-93   | 44.7  | 4.2    | 29.3    | 78.1   | 10.3   | 88.4   | 11.6   |
| 56. | 1889-98   | 38.0  | 4.9    | 38.7    | 81.6   | 8.1    | 89.7   | 10.3   |
| 57. | 1894-1903 | 23.8  | 5.5    | 40.3    | 69.6   | 11.1   | 80.7   | 19.3   |
| 58. | 1899-1908 | 22.0  | 7.6    | 41.6    | 71.2   | 17.0   | 88.2   | 11.8   |
| 59. | 1904-13   | 23.0  | 9.6    | 39.1    | 71.7   | 14.7   | 86.4   | 13.6   |
| 60. | 1909-18   | 21.0  | 12.8   | 30.1    | 63.9   | 15.4   | 79.3   | 20.7   |
| 61. | 1914-23   | 24.1  | 14.1   | 3.4     | 41.6   | 23.8   | 65.4   | 34.6   |
| 62. | 1919-28   | 34.4  | 13.1   | 10.5    | 58.0   | 24.8   | 82.8   | 17.3   |
| 63. | 1924-33   | 39.4  | 30.1   | 4.4     | 73.9   | 35.3   | 109.2  | - 9.2  |
| 64. | 1929-38   | - 8.1 | 125.9  | -137.6  | -19.8  | 124.8  | 105.0  | - 5.0  |
| 65. | 1934-43   | 5.0   | 50.9   | -64.6   | - 8.7  | 54.7   | 46.0   | 53.9   |
| 66. | 1939-48   | 14.8  | 22.4   | -40.9   | - 3.6  | 47.5   | 43.9   | 56.1   |
| 67. | 1944-53   | 26.5  | 10.7   | - 0.9   | 36.3   | 35.5   | 71.8   | 28.1   |
| 68. | 1946-55   | 27.6  | 13.1   | 7.1     | 47.8   | 28.8   | 76.6   | 23.4   |

See notes to Table US-1.

Table US-7.
Ratio of Net Fixed Capital Formation to Addition to Net Product, by Major Sectors, United States, 1880-1948 (Based on constant price totals)

|  | 1880 to 1900 (1) | 1900 to 1922 (2) | 1922 to 1948 (3) | 1880 to 1948 (4) |
|---|---|---|---|---|
| **Ratio of NFCF to Addition to Net Product** | | | | |
| 1. Agriculture | 1.08 | 7.37 | 1.31 | 2.22 |
| 2. Mining and manufacturing | 1.68 | 2.11 | 0.54 | 1.05 |
| 3. Public utilities | 5.77 | 3.46 | 0.84 | 1.91 |
| 4. Total of above | 2.36 | 2.85 | 0.69 | 1.41 |
| **Sectoral Shares in Addition to Net Product (%)** | | | | |
| 5. Agriculture | 26.2 | 6.4 | 6.5 | 9.0 |
| 6. Mining and manufacturing | 53.3 | 63.5 | 62.2 | 61.4 |
| 7. Public utilities | 20.4 | 30.1 | 31.3 | 29.6 |
| 8. Total of above | 100.0 | 100.0 | 100.0 | 100.0 |
| **Over-all Ratios** | | | | |
| 9. Holding sectoral ratios constant (col. 4, lines 1-3) | 1.53 | 1.38 | 1.40 | 1.41 |
| 10. Holding sectoral shares constant (col. 4, lines 5-7) | 2.84 | 2.98 | 0.70 | 1.41 |

| Over-all Ratios, 1880-1938 | 1880 to 1900 | 1900 to 1922 | 1922 to 1938 | 1880 to 1938 |
|---|---|---|---|---|
| 11. Holding sectoral ratios constant | 2.7 | 3.0 | 2.7 | 2.8 |
| 12. Holding sectoral shares constant | 3.8 | 3.2 | 1.9 | 2.8 |
| 13. Actual ratio | 3.4 | 3.4 | 1.9 | 2.8 |

Lines 1-10: From Kuznets, op. cit., Table 27. Here the net product and net fixed capital formation for the three sectors only are distributed.
Lines 11-13: From Simon Kuznets and Raymond W. Goldsmith, Income and Wealth of the United States: Trends and Structure, Income and Wealth, Series II, London, 1952, particularly Table 1, p. 30, Table 17, p. 102 (with the share for transportation and public utilities in 1874-83 assumed to be 3.6 percent), Table 21, p. 118, and Table 25, p. 127. Here total NNP and total NFCF are distributed among four sectors: agriculture, mining and manufacturing, transportation and public utilities, and all other.

Table US-8.
Ratio of Gross Retention to Financing of Total Uses and to Gross National Capital
Formation, United States, 1900-1955 (Based on current price totals)

|  | | Corporate (1) | Business (2) | Private (3) | Total (4) |
|---|---|---|---|---|---|
| | Ratio of Gross Retention to Total Sources of Funds | | | | |
| 1. | 1900-09 or 1901-10 | 0.55 | 0.59 | 0.61 | 0.60 |
| 2. | 1910-19 or 1911-20 | 0.60 | 0.59 | 0.58 | 0.41 |
| 3. | 1920-29 or 1921-30 | 0.55 | 0.59 | 0.53 | 0.58 |
| 4. | 1930-39 or 1931-40 | 1.14 | 1.16 | 0.96 | 0.52 |
| 5. | 1940-44 or 1941-45 | 0.80 | 0.90 | 0.80 | -0.22 |
| 6. | 1945-55 or 1946-56 | 0.61 | 0.64 | 0.57 | 0.56 |
| 7. | 1900-19 or 1901-20 | 0.58 | 0.59 | 0.59 | 0.47 |
| 8. | 1920-39 or 1921-40 | 0.67 | 0.72 | 0.63 | 0.56 |
| | Ratio of Gross Retention to Gross National Capital Formation | | | | |
| 9. | 1900-09 or 1901-10 | 0.84 | 0.82 | 0.78 | 0.78 |
| 10. | 1910-19 or 1911-20 | 0.92 | 0.89 | 0.83 | 0.60 |
| 11. | 1920-29 or 1921-30 | 0.92 | 0.85 | 0.69 | 0.76 |
| 12. | 1930-39 or 1931-40 | 1.03 | 1.02 | 0.87 | 0.63 |
| 13. | 1940-44 or 1941-45 | 1.48 | 1.86 | 1.65 | -0.52 |
| 14. | 1945-55 or 1946-56 | 0.91 | 0.90 | 0.75 | 0.77 |
| 15. | 1900-19 or 1901-20 | 0.90 | 0.87 | 0.81 | 0.67 |
| 16. | 1920-39 or 1921-40 | 0.95 | 0.91 | 0.74 | 0.71 |

See notes to Table US-1. The underlying data are from Tables 45 and 46.

Table US-9.
Sources of Financing Net Uses and Net Domestic Capital Formation, United
States, 1900-1955 (Based on current price totals)

|  | 1900-19 or 1901-20 (1) | 1920-39 or 1921-40 (2) | 1945-55 or 1946-56 (3) |
|---|---|---|---|
| **Sources of Financing Total Uses** | | | |
| 1. Ratio, gross retention to gross uses | 0.47 | 0.56 | 0.56 |
| 2. Ratio, CC to gross uses | 0.36 | 0.54 | 0.48 |
| 3. Ratio, net retention to net uses | 0.17 | 0.04 | 0.15 |
| **Sources of Financing Capital Formation** | | | |
| 4. Ratio, gross retention to GDCF | 0.67 | 0.71 | 0.77 |
| 5. Ratio, CC to GDCF | 0.52 | 0.68 | 0.66 |
| 6. Ratio, net retention to NDCF | 0.31 | 0.09 | 0.32 |
| 7. Ratio, external financing to NDCF | 0.69 | 0.91 | 0.68 |
| 8. Ratio, financing by financial intermediaries to external financing | 0.41 | 0.63 | 0.70 |
| 9. Ratio, direct financing by individuals to NDCF | 0.41 | 0.34 | 0.20 |

Line 1: From Table US-8, col. 4, lines 6-8.
Line 2: Line 5 + line 4 x line 1.
Line 3: (Line 1 - line 2) + (1.00 - line 2).
Line 4: From Table US-8, col. 4, lines 14-16.
Line 5: From annual tables supplementing Kuznets, op. cit.
Line 6: (Line 4 - line 5) + (1.00 - line 5).
Line 7: 1.00 - line 6.
Line 8: Kuznets, op. cit., Table 57.  The entry in col. 3 is based on the esti-
    mate for 1946-50.
Line 9: Line 7 x (1.00 - line 8).

Table C-1.
Capital Formation Proportions, Canada, 1870-1958 (Percentages based on current price totals)

|  | Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|---|---|---|---|---|---|---|---|
| | **O. J. Firestone's Estimates** | | | | | | |
| 1. | 1870 | 14.4 | 52.9 | 7.3 | -51.5 | 7.2 | - 0.7 |
| 2. | 1890 | 15.0 | 55.6 | 7.3 | -44.4 | 8.6 | 0 |
| 3. | 1900 | 13.1 | 69.1 | 4.4 | -30.2 | 9.4 | 0.1 |
| 4. | 1910 | 25.5 | 39.3 | 17.2 | -49.0 | 13.5 | 3.5 |
| 5. | 1920 | 22.6 | 31.8 | 16.6 | -21.0 | 18.4 | 11.9 |
| 6. | 1929 | 21.6 | 51.0 | 11.9 | -22.5 | 17.5 | 6.8 |
| | **Kenneth Buckley's Estimates** | | | | | | |
| 7. | 1896-1900 | 13.1 | (50) | 7.0 | -23.4 | 10.3 | 3.8 |
| 8. | 1896-1905 | 18.3 | (50) | 10.1 | -23.5 | 14.4 | 5.5 |
| 9. | 1901-10 | 24.4 | (50) | 13.9 | -30.4 | 17.6 | 5.7 |
| 10. | 1906-15 | 25.7 | (50) | 14.8 | -41.3 | 15.8 | 2.7 |
| 11. | 1916-20 | 18.5 | (50) | 10.2 | - 6.5 | 18.0 | 9.3 |
| 12. | 1911-20 | 21.1 | (50) | 11.8 | -24.3 | 16.7 | 6.4 |
| 13. | 1916-25 | 16.9 | (50) | 9.2 | - 2.5 | 17.2 | 9.2 |
| 14. | 1921-30 | 17.7 | (55) | 8.8 | - 5.2 | 17.5 | 8.2 |
| 15. | 1926-30 | 19.5 | (58) | 9.2 | - 9.7 | 18.3 | 7.4 |
| | **Official Estimates** | | | | | | |
| 16. | 1926-30 | 20.5 | 58.2 | 9.7 | - 9.3 | 19.4 | 7.9 |
| 17. | 1926-35 | 16.3 | 78.9 | 3.9 | - 7.8 | 15.8 | 2.6 |
| 18. | 1931-40 | 13.3 | 96.4 | 0.5 | +11.2 | 15.5 | 2.4 |
| 19. | 1941-45 | 12.2 | 80.6 | 2.6 | +26.3 | 15.7 | 6.3 |
| 20. | 1936-45 | 13.3 | 79.0 | 3.1 | +23.2 | 16.9 | 6.8 |
| 21. | 1941-50 | 17.5 | 58.1 | 8.2 | +10.4 | 19.7 | 10.4 |
| 22. | 1946-55 | 23.3 | 48.4 | 13.6 | - 2.8 | 23.0 | 13.0 |
| 23. | 1952-58 | 24.7 | 46.0 | 15.1 | -10.3 | 22.5 | 12.4 |

Lines 1-6: All underlying series except net interest and dividend payments
  across boundaries are from O. J. Firestone, Canada's Economic Develop-
  ment, 1876-1956, Income and Wealth, Series VII, International Association
  for Research in Income and Wealth, London, 1958, Table 10, p. 66, Table
  35, p. 112, Table 36, p. 114, and Table 46, p. 142. Net interest and divi-
  dend payments across boundaries is from John A. Stovel, Canada in the World
  Economy, Cambridge, Mass., 1959, Table 27, pp. 338-45 for 1900-55 and
  for years before 1900 is assumed to be 3 percent of GNP, the level in 1900.
Lines 7-15: For 1901-30 GNP, GDCF, and NBFCA are from Kenneth Buckley,
  Capital Formation in Canada, 1896-1930, Toronto, 1955, Table V, p. 11.
  The net balance of interest and dividend payments across boundaries is from
  Stovel, op. cit. CC for quinquennia before 1926-30 is assumed to be 50 per-
  cent of GDCF; and for 1926-30 is 58 percent (see line 16).
    For 1896-1900 GDCF is from Buckley, op. cit., Appendix Table B, p. 129,
  Appendix Table D, p. 132, and Appendix Table E, p. 133; NBFCA is from
  Penelope Hartland, "Canadian Balance of Payments since 1868," in William

Table C-1 (Cont.)

N. Parker, ed., Studies in Income and Wealth, Vol. 24, Table 1, p. 718; and GNP is extrapolated from 1901-05 by Firestone's series. The latter, given annually in constant prices in Firestone, op. cit., Table 87, p. 276, was converted to current prices by Firestone's implicit price index for 1900 extrapolated to 1896-1900 and 1901-05 by the U. S. annual price index implicit in GNP. The movement of the latter for 1890, 1900, and 1910 conformed with that of the Canadian price index.

Lines 16-22: GDCF, NBFCA, and GNP are from National Accounts: Income and Expenditures, 1926-56 and 1955, Dominion Bureau of Statistics, Table 2. CC is the sum of private capital consumption, given in ibid., Table 51 and public, estimated at 8.5 percent of private, the proportion for 1951-57 derived from the U. N. Yearbook of National Accounts Statistics, 1958. The net balance of interest and dividend payments across boundaries is from Stovel, op. cit.

Line 23: U. N. Yearbook of National Accounts Statistics, 1959.


Table C-2.
Rate of Growth of Gross National Product in Constant Prices and Ratios to It of Capital Formation Proportions, Canada, 1870-1958

|  | Interval | Rate of growth per year GNP (%) (1) | Ratio to Column 1 of: | | | |
|---|---|---|---|---|---|---|
|  |  |  | GDCF/ GDP (2) | GNCF/ GNP (3) | NDCF/ NDP (4) | NNCF/ NNP (5) |
| 1. | 1870 to 1898-1902 | 3.36 | 4.2 | 2.5 | 1.9 | -0.1 |
| 2. | 1898-1902 to 1928-30 | 3.51 | 5.9 | 4.2 | 3.6 | 1.6 |
| 3. | 1894-98 to 1904-08 | 4.21 | 4.3 | 3.4 | 2.4 | 1.3 |
| 4. | 1899-1903 to 1909-13 | 5.13 | 4.8 | 3.4 | 2.7 | 1.1 |
| 5. | 1904-08 to 1914-18 | 3.86 | 6.7 | 4.1 | 3.8 | 0.7 |
| 6. | 1909-13 to 1919-23 | 1.45 | 14.6 | 11.5 | 8.1 | 4.4 |
| 7. | 1914-18 to 1924-28 | 2.19 | 7.7 | 7.9 | 4.2 | 4.2 |
| 8. | 1919-23 to 1929-33 | 1.75 | 10.1 | 10.0 | 5.0 | 4.7 |
| 9. | 1926 to 1934-38 | 0.68 | 24.0 | 23.2 | 5.7 | 3.8 |
| 10. | 1929-33 to 1939-43 | 5.08 | 2.6 | 3.1 | 0.1 | 4.7 |
| 11. | 1934-38 to 1944-48 | 6.76 | 2.0 | 2.5 | 0.5 | 1.0 |
| 12. | 1939-43 to 1949-53 | 3.98 | 4.4 | 4.9 | 2.1 | 2.6 |
| 13. | 1944-48 to 1954-58 | 3.84 | 6.1 | 6.0 | 3.5 | 3.4 |
| 14. | 1952 to 1958 | 2.86 | 8.6 | 7.9 | 5.3 | 4.3 |

Col. 1: Lines 1-8 are from Firestone, op. cit., Table 87, p. 276. For 1870 the average of 1867, 1870, and 1873 was used. Lines 9-13 are from National Accounts: Income and Expenditure, 1926-1956 and 1959, Table 5. For 1926 the single-year value was used. Line 14 is from U. N. Yearbook of National Accounts Statistics, 1959 and single-year values were used.

Col. 2-5: The capital formation proportions are from Table C-1. For the interval from 1870 to 1898-1902 the averages of proportions for 1870, 1890, and 1900 were used; for 1898-1902 to 1928-30 the averages of proportions for 1900, 1910, 1920, and 1929 were used; for 1894-98 to 1904-08 the proportions for 1896-1905 were used; for 1899-1903 to 1909-13, those for 1901-10 were used; and so on.

Table C-3.
Distribution of Gross Domestic Capital Formation by Major Categories, Canada,
1870-1958 (Percentages based on current price totals)

| | Period | Construction | | | Machinery and equipment | GFCF | Additions to inventories |
| | | Residential (1) | Other (2) | Total (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| | O. J. Firestone's Estimates | | | | | | |
| 1. | 1870 | | | 48.5 | 30.9 | 79.4 | 20.6 |
| 2. | 1890 | | | 58.7 | 31.0 | 89.7 | 10.3 |
| 3. | 1900 | 36.7 | 20.1 | 56.8 | 33.8 | 90.6 | 9.4 |
| 4. | 1910 | 24.8 | 17.9 | 42.7 | 26.2 | 68.8 | 31.2 |
| 5. | 1920 | 18.3 | 25.8 | 44.1 | 34.2 | 78.3 | 21.7 |
| 6. | 1929 | 17.8 | 34.9 | 52.7 | 42.9 | 95.6 | 4.4 |
| | Kenneth Buckley's Estimates | | | | | | |
| 7. | 1896-1900 | 19.2 | 30.4 | 49.6 | 34.5 | 84.1 | 15.9 |
| 8. | 1896-1905 | 17.9 | 34.2 | 52.1 | 31.1 | 83.1 | 16.9 |
| 9. | 1901-10 | 19.3 | 40.1 | 59.4 | 27.1 | 86.4 | 13.6 |
| 10. | 1906-15 | 18.6 | 43.3 | 61.9 | 26.9 | 88.8 | 11.2 |
| 11. | 1916-20 | 15.9 | 36.7 | 52.6 | 32.8 | 85.4 | 14.6 |
| 12. | 1911-20 | 16.5 | 39.9 | 56.5 | 30.6 | 87.0 | 13.0 |
| 13. | 1916-25 | 18.0 | 39.2 | 57.2 | 33.0 | 90.3 | 9.7 |
| 14. | 1921-30 | 19.0 | 37.8 | 56.8 | 34.9 | 91.7 | 8.3 |
| 15. | 1926-30 | 18.2 | 35.1 | 53.3 | 36.0 | 89.3 | 10.7 |
| | Official Estimates | | | | | | |
| 16. | 1926-30 | 17.1 | 41.4 | 58.5 | 30.4 | 88.9 | 11.1 |
| 17. | 1926-35 | 18.7 | 44.8 | 63.5 | 31.0 | 94.5 | 5.5 |
| 18. | 1931-40 | 19.8 | 41.5 | 61.2 | 34.0 | 95.3 | 4.7 |
| 19. | 1941-45 | 20.3 | 41.7 | 62.0 | 44.2 | 106.2 | - 6.2 |
| 20. | 1936-45 | 19.4 | 39.1 | 58.5 | 40.4 | 98.9 | 1.1 |
| 21. | 1941-50 | 20.5 | 36.6 | 57.1 | 38.3 | 95.5 | 4.5 |
| 22. | 1946-55 | 19.5 | 38.3 | 57.8 | 34.4 | 92.2 | 7.8 |
| 23. | 1952-58 | 19.1 | 43.8 | 62.9 | 33.3 | 96.2 | 3.8 |

Lines 1-6: From Firestone, op. cit., Table 29, p. 100 and Table 36, p. 114.
Lines 7-15: From Buckley, op. cit., Appendix Tables B, p. 129, D, p. 132, E,
   p. 133, and N, p. 139.
Lines 16-22: From National Accounts: Income and Expenditure, 1926-1956 and
   1959, Tables 2 and 54.
Line 23: From U. N. Yearbook of National Accounts Statistics, 1959.

Table C-4.
Ratio of Gross Fixed Capital Formation to Addition to Gross Domestic Product by Sectors, Canada, 1927-29 to 1951-55 (Based on constant price totals)

| Sector and Subdivision | Ratio, GFCF to Addition to GDP | | | Share in Addition to GDP (%) | | |
| | 1927-29 to 1946-50 (1) | 1946-50 to 1951-55 (2) | 1927-29 to 1951-55 (3) | 1927-29 to 1946-50 (4) | 1946-50 to 1951-55 (5) | 1927-29 to 1951-55 (6) |
|---|---|---|---|---|---|---|
| 1. Agriculture | neg. | 5.7 | 15.6 | - 1.1 | 10.4 | 3.4 |
| 2. Resource industries | 5.7 | 5.5 | 5.6 | 9.1 | 14.1 | 11.0 |
| 3. Forestry and fishing | 3.7 | 3.6 | 3.7 | 2.2 | 2.2 | 2.2 |
| 4. Mining | 4.0 | 2.4 | 3.1 | 4.2 | 8.6 | 5.9 |
| 5. Electric light and power | 11.2 | 16.2 | 13.4 | 2.5 | 3.1 | 2.7 |
| 6. Manufacturing | 2.6 | 3.5 | 2.9 | 40.5 | 25.6 | 34.7 |
| 7. Primary | 3.2 | 5.3 | 3.8 | 9.9 | 6.2 | 8.5 |
| 8. Secondary | 2.4 | 3.0 | 2.5 | 30.6 | 19.4 | 26.2 |
| 9. Transportation, storage, and communications | 8.4 | 8.0 | 8.2 | 7.4 | 7.0 | 7.3 |
| 10. Construction, trade, finance, and services | 1.9 | 2.3 | 2.1 | 26.3 | 26.6 | 26.4 |
| 11. Construction | 2.2 | 1.1 | 1.6 | 4.6 | 8.3 | 6.0 |
| 12. Trade | 1.2 | 2.7 | 1.6 | 16.6 | 10.5 | 14.3 |
| 13. Finance and real estate | 4.9 | 3.4 | 4.0 | 1.0 | 2.0 | 1.4 |
| 14. All other | 3.9 | 3.0 | 3.4 | 4.0 | 5.8 | 4.7 |
| 15. Government and social services | 9.9 | 8.9 | 9.6 | 14.1 | 11.3 | 13.0 |
| 16. Residential housing | 37.5 | 21.4 | 30.1 | 3.7 | 4.9 | 4.2 |
| 17. Total industry (lines 1, 2, 6, 9, and 10) | 3.9 | 4.1 | 4.0 | 82.2 | 83.7 | 82.8 |
| 18. Total social (lines 15 and 16) | 15.7 | 12.7 | 14.6 | 17.8 | 16.3 | 17.2 |
| 19. Total | 6.0 | 5.5 | 5.8 | 100.0 | 100.0 | 100.0 |

Underlying data are from William C. Hoad and Anthony Scott, Output, Labour and Capital in the Canadian Economy, Royal Commission on Canada's Economic Prospects, Ottawa, February 1957, Chapter 5, App. F, inset between pp. 398 and 399 and Chapter 6, App. B, Tables 6 B. 1, pp. 409-24 and 6 B.4, pp. 445-46.

Col. 1: Capital formation figures are for 1928-48 with terminal years weighted by half.
Col. 2: Capital formation figures are for 1948-53 with terminal years weighted by half.
Col. 3: Capital formation figures are the sum of those used for col. 1 and 2.

Table A-1.
Capital Formation Proportions, Australia, 1861-1958/59 (Percentages based on current price totals)

| Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|---|---|---|---|---|---|---|
| 1. 1861-70 | 14.3 | 27.3 | 10.8 | -41.6 | 8.6 | 4.8 |
| 2. 1866-75 | 15.0 | 27.1 | 11.4 | -23.5 | 11.8 | 8.0 |
| 3. 1871-80 | 17.0 | 25.7 | 13.2 | -21.3 | 13.8 | 9.7 |
| 4. 1876-85 | 19.3 | 26.3 | 15.0 | -36.2 | 12.8 | 8.0 |
| 5. 1881-90 | 19.6 | 28.0 | 14.9 | -51.5 | 10.0 | 4.5 |
| 6. 1886-95 | 16.4 | 36.6 | 11.1 | -51.4 | 8.5 | 2.2 |
| 7. 1891-1900 | 12.8 | 51.0 | 6.7 | -27.4 | 10.0 | 3.2 |
| 8. 1896-1904/05 | 13.7 | 44.9 | 8.0 | -10.8 | 13.1 | 6.9 |
| 9. 1900/01-1909/10 | 13.9 | 38.6 | 9.0 | + 3.0 | 15.2 | 10.1 |
| 10. 1905/06-1914/15 | 14.7 | 34.6 | 10.1 | - 0.6 | 15.3 | 10.5 |
| 11. 1910/11-1919/20 | 14.1 | 36.6 | 9.4 | -27.9 | 10.6 | 5.5 |
| 12. 1915/16-1924/25 | 16.8 | 32.9 | 11.9 | -20.5 | 13.9 | 8.6 |
| 13. 1920/21-1929/30 | 18.6 | 33.6 | 13.2 | -15.4 | 16.4 | 10.6 |
| 14. 1925/26-1934/35 | 15.3 | 43.8 | 9.2 | -15.7 | 13.6 | 7.0 |
| 15. 1930/31-1938/39 | 14.4 | 45.5 | 8.4 | - 6.8 | 14.2 | 7.8 |
| 16. 1952/53-1958/59 | 26.5 | 23.5 | 21.6 | - 5.6 | 25.4 | 20.4 |

Lines 1-15: GFCF is from Noel G. Butlin, "Some Structural Features of Austra-
lian Capital Formation, 1861 to 1938/39," The Economic Record, Vol. XXXV,
No. 73, 1959, pp. 389-415.
    Additions to inventories were assumed to be 0.4 of net additions to GDP in
constant prices. GDP in current prices was provided by Mr. Butlin. It was
adjusted for price changes by an index derived from the following sources:
(a) for 1861-1900 from Noel G. Butlin, "The Shape of the Australian Economy,
1861-1900," The Economic Record, Vol. XXXIV, No. 67, 1958, pp. 26-29, the price
index implicit in GDP; (b) for 1915/16 to 1938/39 from Colin Clark, Conditions
of Economic Progress, 3rd ed., London, 1957, pp. 90-91, the index derived
from national income in current prices and in I. U's; (c) interpolated from
1900 to 1915/16 by means of the wholesale price index provided by Mr. Butlin.
From GDP in constant prices thus obtained, we calculated the differences be-
tween decade averages, centered on the terminal years of the periods except
that for 1861 and 1938/39 single-year values were used; multiplied these addi-
tions to GDP by 0.4; and multiplied the change in inventories in constant
prices thus obtained by the price index implicit in GDP.
    CC and GNP were provided by Mr. Butlin.
    NBFCA for 1861-95 was provided by Mr. Butlin; for 1896-1929/30 it is the
Roland Wilson series in Carl Iversen, Aspects of the Theory of International
Capital Movements, London, 1935, p. 402; for 1930/31-1938/39 it is from
The Australian Balance of Payments 1928/29 to 1951/52, Commonwealth Bu-
reau of the Census and Statistics, Canberra, 1953.
Line 16: U. N. Yearbook of National Accounts Statistics, 1959.

Table A-2.
Rate of Growth of Product in Constant Prices and Ratios to It of Capital Formation Proportions, Australia, 1861-1958/59

| | Rate of Growth per Year (%) | | | | Ratio to Rate of Growth of: | | | |
| Interval | GDP (1) | NDP (2) | GNP (3) | NNP (4) | GDCF/GDP (5) | NDCF/NDP (6) | GNCF/GNP (7) | NNCF/NNP (8) |
|---|---|---|---|---|---|---|---|---|
| 1. 1861-70 to 1871-80 | 6.39 | 6.33 | 6.35 | 6.28 | 2.3 | 1.8 | 1.9 | 1.3 |
| 2. 1866-75 to 1876-85 | 4.62 | 4.50 | 4.52 | 4.40 | 3.7 | 2.9 | 3.1 | 2.2 |
| 3. 1871-80 to 1881-90 | 3.94 | 3.82 | 3.76 | 3.63 | 4.9 | 3.9 | 3.4 | 2.2 |
| 4. 1876-85 to 1886-95 | 2.98 | 2.88 | 2.75 | 2.63 | 6.6 | 5.2 | 3.6 | 1.7 |
| 5. 1881-90 to 1891-1900 | 1.29 | 1.17 | 1.09 | 0.96 | 12.7 | 9.5 | 7.8 | 2.3 |
| 6. 1886-95 to 1896-1904/05 | 1.55 | 1.54 | 1.49 | 1.47 | 8.3 | 4.4 | 6.7 | 2.2 |
| 7. 1891-1900 to 1900/01-1909/10 | 3.04 | 3.18 | 3.14 | 3.28 | 4.5 | 2.5 | 4.2 | 2.1 |
| 8. 1896-1904/05 to 1905/06-1914/15 | 4.26 | 4.38 | 4.49 | 4.62 | 3.3 | 2.1 | 3.4 | 2.2 |
| 9. 1900/01-1909/10 to 1910/11-1919/20 | 2.46 | 2.48 | 2.65 | 2.69 | 6.0 | 4.1 | 5.8 | 3.9 |
| 10. 1905/06-1914/15 to 1915/16-1924/25 | 0.44 | 0.40 | 0.51 | 0.47 | 32.0 | 23.5 | 20.8 | 11.7 |
| 11. 1910/11-1919/20 to 1920/21-1929/30 | 2.48 | 2.36 | 2.47 | 2.35 | 6.8 | 5.0 | 5.6 | 3.7 |
| 12. 1915/16-1924/25 to 1925/26-1934/35 | 2.70 | 2.57 | 2.55 | 2.41 | 6.9 | 5.1 | 6.4 | 4.4 |
| 13. 1920/21-1929/30 to 1930/31-1938/39 | 1.12 | 1.08 | 0.97 | 0.92 | 13.7 | 8.5 | 14.0 | 7.6 |
| 14. 1952/53 to 1958/59 | 3.61 | 3.01 | 3.59 | 2.98 | 7.3 | 7.2 | 7.1 | 6.8 |

See notes to Table A-1.

Col. 1-4: Lines 1-13: The price index used to convert GDP to constant prices, described in the notes to Table A-1, was also used for the other three countrywide product totals.
Line 14: Single-year values were used. Current price totals, given in the U. N. Yearbook of National Accounts Statistics, 1959, were converted to constant price totals by the cost of living index, given in the U. N. Statistical Yearbook, 1959 and various issues of the U. N. Monthly Bulletin of Statistics.
Col. 5-8: The capital formation proportions are from Table A-1. For the interval from 1861-70 to 1871-80 the proportions are for 1866-75; for 1866-75 to 1876-85, the proportions are for 1871-80; and so on.

Table A-3.
Distribution of Gross Fixed Capital Formation by User Categories, Australia,

| | Period | Local authorities (1) | Common-wealth and states (2) | Private (3) | Agricultural and pastoral (4) | Private Industry and mining (5) |
|---|---|---|---|---|---|---|
| 1. | 1861-70 | 7.9 | 30.3 | 61.8 | 15.6 | 9.5 |
| 2. | 1866-75 | 7.7 | 26.5 | 65.8 | 21.6 | 10.0 |
| 3. | 1871-80 | 6.1 | 28.1 | 65.8 | 32.0 | 7.4 |
| 4. | 1876-85 | 5.9 | 33.3 | 60.8 | 26.2 | 6.6 |
| 5. | 1881-90 | 6.9 | 34.2 | 58.9 | 22.4 | 5.7 |
| 6. | 1886-95 | 9.8 | 34.6 | 55.5 | 23.4 | 5.2 |
| 7. | 1891-1900 | 13.2 | 41.5 | 45.3 | 18.1 | 6.9 |
| 8. | 1896-1904/05 | 10.3 | 40.8 | 48.9 | 9.8 | 12.7 |
| 9. | 1900/01-1909/10 | 9.7 | 35.9 | 54.4 | 7.3 | 14.8 |
| 10. | 1905/06-1914/15 | 10.1 | 40.7 | 49.2 | 6.3 | 12.1 |
| 11. | 1910/11-1919/20 | 10.2 | 43.2 | 46.6 | 6.5 | 12.2 |
| 12. | 1915/16-1924/25 | 10.4 | 41.1 | 48.5 | 6.2 | 12.9 |
| 13. | 1920/21-1929/30 | 13.4 | 39.5 | 47.1 | 4.7 | 10.9 |
| 14. | 1925/26-1934/35 | 18.8 | 36.5 | 44.7 | 4.9 | 9.9 |
| 15. | 1930/31-1938/39 | 22.1 | 29.3 | 48.6 | 6.2 | 13.9 |
| 16. | 1952/53-1958/59 | 33.2 | | 66.8 | | |

Lines 1-15: From Noel G. Butlin, "Some Structural Features of Australian Capital Formation, 1861 to 1938/39," op. cit., Table I, pp. 391-92, Table II, pp. 397-98, and Table IV, pp. 403-04.
Line 16: U. N. Yearbook of National Accounts Statistics, 1959.

1861-1958/59 (Percentages based on current price totals)

| vate | | Commonwealth and States (excluding Defense) | | | | |
|---|---|---|---|---|---|---|
| Commercial and shipping (6) | Residential (7) | Railways (8) | Roads, bridges, and harbors (9) | Public and education (10) | Water and sewerage (11) | Other (12) |
| 5.1 | 31.6 | 15.0 | 7.7 | 4.6 | 1.7 | 1.3 |
| 5.5 | 28.7 | 13.0 | 6.2 | 3.9 | 1.9 | 1.5 |
| 4.1 | 22.3 | 14.9 | 6.2 | 4.3 | 1.3 | 1.3 |
| 4.0 | 24.0 | 19.8 | 6.0 | 4.1 | 2.1 | 1.3 |
| 5.9 | 24.9 | 21.4 | 5.2 | 3.2 | 2.9 | 1.5 |
| 5.2 | 21.7 | 21.1 | 5.7 | 2.9 | 3.3 | 1.7 |
| 4.2 | 16.1 | 22.5 | 8.3 | 3.5 | 4.5 | 2.8 |
| 7.9 | 18.5 | 20.7 | 8.9 | 3.2 | 5.0 | 3.0 |
| 9.5 | 22.8 | 19.0 | 5.9 | 2.7 | 4.5 | 3.9 |
| 9.1 | 21.7 | 23.2 | 3.2 | 2.9 | 4.8 | 6.5 |
| 8.5 | 19.3 | 22.1 | 3.4 | 2.6 | 5.1 | 10.0 |
| 10.2 | 19.2 | 15.2 | 3.5 | 2.1 | 5.3 | 15.0 |
| 9.6 | 21.9 | 15.0 | 4.4 | 2.2 | 4.8 | 13.1 |
| 8.4 | 21.4 | 14.7 | 5.6 | 2.2 | 5.1 | 8.9 |
| 8.4 | 20.2 | 9.9 | 5.0 | 2.3 | 5.9 | 6.2 |

Table A-4.
Distribution of Gross Domestic Product by Major Sectors, Australia, 1861-
1938/39 (Percentages based on current price totals)

| | Period | A sector (1) | M sector (2) | Shipping, commerce, and finance (3) | Residential (4) | Government and other services (5) |
|---|---|---|---|---|---|---|
| 1. | 1861-70 | 23.7 | 28.9 | 19.0 | 11.9 | 16.6 |
| 2. | 1866-75 | 25.8 | 28.1 | 18.2 | 11.6 | 16.3 |
| 3. | 1871-80 | 26.4 | 28.6 | 18.0 | 11.4 | 15.6 |
| 4. | 1876-85 | 24.3 | 30.0 | 17.8 | 12.3 | 15.6 |
| 5. | 1881-90 | 22.4 | 30.5 | 17.5 | 13.2 | 16.4 |
| 6. | 1886-95 | 22.8 | 29.4 | 16.0 | 12.7 | 19.2 |
| 7. | 1891-1900 | 22.6 | 28.8 | 14.8 | 11.1 | 22.7 |
| 8. | 1896-1904/05 | 21.8 | 28.3 | 16.7 | 9.6 | 23.6 |
| 9. | 1900/01-1909/10 | 25.6 | 25.4 | 18.2 | 8.1 | 22.7 |
| 10. | 1905/06-1914/15 | 25.0 | 25.5 | 19.6 | 7.6 | 22.3 |
| 11. | 1910/11-1919/20 | 25.2 | 24.9 | 21.1 | 7.2 | 21.7 |
| 12. | 1915/16-1924/25 | 26.3 | 24.6 | 21.6 | 7.0 | 20.5 |
| 13. | 1920/21-1929/30 | 23.1 | 25.9 | 22.2 | 7.9 | 20.9 |
| 14. | 1925/26-1934/35 | 21.7 | 25.3 | 21.2 | 9.6 | 22.2 |
| 15. | 1930/31-1938/39 | 23.0 | 25.3 | 19.5 | 10.0 | 22.2 |

Absolute totals were provided by Mr. Butlin.

Table A-5.
Shares of Subdivisions of the A and M Sectors in Gross Domestic Product, Australia, 1861-1938/39 (Percentages based on current price totals)

| | | A Sector | | | M Sector | |
| | Period | Pastoral (1) | Agriculture (2) | Dairying, forestry, and fisheries (3) | Mining (4) | Manufacturing (5) | Construction (6) |
|---|---|---|---|---|---|---|---|
| 1. | 1861-70 | 10.3 | 9.6 | 3.8 | 12.9 | 6.8 | 9.2 |
| 2. | 1866-75 | 13.7 | 8.4 | 3.7 | 9.8 | 8.8 | 9.5 |
| 3. | 1871-80 | 14.4 | 8.3 | 3.7 | 6.9 | 10.4 | 11.3 |
| 4. | 1876-85 | 12.1 | 8.3 | 3.8 | 4.9 | 12.3 | 12.9 |
| 5. | 1881-90 | 11.3 | 7.5 | 3.7 | 4.4 | 12.6 | 13.5 |
| 6. | 1886-95 | 12.3 | 6.1 | 4.4 | 5.4 | 12.3 | 11.7 |
| 7. | 1891-1900 | 11.5 | 5.9 | 5.2 | 7.8 | 12.8 | 8.2 |
| 8. | 1896-1904/05 | 10.9 | 6.1 | 4.9 | 8.8 | 12.0 | 7.5 |
| 9. | 1900/01-1909/10 | 15.3 | 6.1 | 4.3 | 7.6 | 11.5 | 6.2 |
| 10. | 1905/06-1914/15 | 14.3 | 6.4 | 4.2 | 5.7 | 13.0 | 6.8 |
| 11. | 1910/11-1919/20 | 13.6 | 7.2 | 4.4 | 4.1 | 13.3 | 7.5 |
| 12. | 1915/16-1924/25 | 13.1 | 8.1 | 5.0 | 2.7 | 13.8 | 8.1 |
| 13. | 1920/21-1929/30 | 10.8 | 7.1 | 5.3 | 2.0 | 15.4 | 8.4 |
| 14. | 1925/26-1934/35 | 9.9 | 6.3 | 5.4 | 1.9 | 16.2 | 7.1 |
| 15. | 1930/31-1938/39 | 10.2 | 7.0 | 5.8 | 2.4 | 16.9 | 5.9 |

Absolute totals were provided by Mr. Butlin.

Table A-6.
Approximation to Incremental Sectoral Gross Fixed Capital-Output Ratios, Australia, 1861-1938/39

|  | 1861-70 to 1891-1900 (1) | 1881-90 to 1910/11- 1919/20 (2) | 1900/01- 1909/10 to 1930/31- 1938/39 (3) |
|---|---|---|---|
| 1. Ratio, GFCF proportion to rate of growth, GDP | 4.0 | 6.2 | 7.4 |

### A.   Sectoral Ratios, Variant A

Ratio, Share in GFCF to Share in GDP

|  | (1) | (2) | (3) |
|---|---|---|---|
| 2. A sector | 0.98 | 0.58 | 0.24 |
| 3. M sector | 0.25 | 0.37 | 0.46 |
| 4. Commerce and finance | 0.28 | 0.42 | 0.44 |
| 5. Residential real estate | 2.04 | 2.17 | 2.61 |
| 6. All other | 2.31 | 2.25 | 2.43 |

Derived Ratio, GFCF to Growth in Product

|  | (1) | (2) | (3) |
|---|---|---|---|
| 7. A sector (line 1 x line 2) | 3.9 | 3.6 | 1.8 |
| 8. M sector (line 1 x line 3) | 1.0 | 2.3 | 3.4 |
| 9. Commerce and finance (line 1 x line 4) | 1.1 | 2.6 | 3.3 |
| 10. Residential real estate (line 1 x line 5) | 8.2 | 13.5 | 19.3 |
| 11. All other (line 1 x line 6) | 9.2 | 14.0 | 18.0 |

### B.   Sectoral Ratios, Variant B

Ratio, Share in GFCF to Share in GDP

|  | (1) | (2) | (3) |
|---|---|---|---|
| 12. A sector | 1.37 | 1.06 | 0.76 |
| 13. M sector | 0.64 | 0.85 | 0.99 |
| 14. Commerce and finance | 0.68 | 0.91 | 0.97 |
| 15. Residential real estate | 2.44 | 2.65 | 3.14 |
| 16. All other | 0.39 | 0.49 | 0.53 |

Derived Ratio, GFCF to Growth in Product

|  | (1) | (2) | (3) |
|---|---|---|---|
| 17. A sector (line 1 x line 12) | 5.5 | 6.6 | 5.6 |
| 18. M sector (line 1 x line 13) | 2.6 | 5.3 | 7.3 |
| 19. Commerce and finance (line 1 x line 14) | 2.7 | 5.6 | 7.2 |
| 20. Residential real estate (line 1 x line 15) | 9.8 | 16.4 | 23.2 |
| 21. All other (line 1 x line 16) | 1.6 | 3.0 | 3.9 |

Line 1:  The GFCF proportion for successive decades (for col. 1: 1866-75, 1876-85, and 1886-95; and so on) is based on data underlying Table A-1.  The rate of growth of GDP for successive intervals (for col. 1: 1861-70 to 1871-80, 1871-80 to 1881-90, 1881-90 to 1891-1900; and so on) is from Table A-2, col. 1.  Averages of the proportion and the rate of growth were derived for the periods in col. 1-3 and the ratios of the averages then derived.

Table A-6 (Cont.)

Lines 2-6: Ratios of percentage shares, calculated for each sector for succes-
sive decades (1866-75, 1876-85, and 1886-95; and so on), were averaged
for the periods shown.  Line 2 is based on Table A-3, col. 4 and Table A-4,
col. 1; line 3 on Table A-3, col. 5 and Table A-4, col. 2; line 4 on Table
A-3, col. 6 and Table A-4, col. 3; line 5 on Table A-3, col. 7 and Table
A-4, col. 4; line 6 on Table A-3, col. 1 and 2 and Table A-4, col. 5.

Lines 12-16: The method of calculation is that described in the notes to lines
2-6 but the distribution of GFCF is different.  Here government capital forma-
tion (Table A-3, col. 1 and 2) was apportioned among the five sectors in ac-
cordance with the distribution of GDP shown in Table A-4.  The share of each
sector in government capital formation was then added to its share in private
capital formation to yield the shares of the five sectors in GFCF.

Table J-1.
Gross Domestic Capital Formation, Excluding Military:  Relation of Adjusted to
Unadjusted Totals, Japan, 1887-1940 (Percentages based on current price totals)

| | | | Share in Adjusted GDCF (%) | | |
| | Period | Unad-justed GFCF (1) | Adjustment for agriculture (2) | Adjusted GFCF (3) | Additions to inventories (4) | Adjusted GDCF (5) |
|---|---|---|---|---|---|---|
| 1. | 1887-96 | 71.9 | 10.8 | 82.7 | 17.3 | 100.0 |
| 2. | 1892-1901 | 79.6 | 4.9 | 84.5 | 15.6 | 100.0 |
| 3. | 1897-1906 | 87.4 | 3.0 | 90.4 | 9.6 | 100.0 |
| 4. | 1902-11 | 85.4 | 3.4 | 88.8 | 11.2 | 100.0 |
| 5. | 1907-16 | 87.8 | 1.7 | 89.5 | 10.5 | 100.0 |
| 6. | 1912-21 | 88.3 | 1.7 | 90.0 | 10.0 | 100.0 |
| 7. | 1917-26 | 85.9 | 2.6 | 88.5 | 11.5 | 100.0 |
| 8. | 1922-31 | 86.0 | 1.5 | 87.5 | 12.5 | 100.0 |
| 9. | 1927-36 | 88.5 | 1.1 | 89.6 | 10.4 | 100.0 |
| 10. | 1931-40 | 89.6 | 1.9 | 91.5 | 8.5 | 100.0 |

Henry Rosovsky, Capital Formation in Japan, 1868-1940 (in press), Tables 1
and 5.

Table J-2.
Capital Formation Proportions, Including and Excluding Military, Japan, 1887–
1958 (percentages based on current price totals)

| Period | GDCF/ GNP (1) | CC/ GDCF (2) | NDCF/ NNP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|---|---|---|---|---|---|---|
| | A. Including Military | | | | | |
| 1. 1887-96 | 12.3 | 38.1 | 8.0 | - 2.2 | 12.0 | 7.7 |
| 2. 1892-1901 | 12.4 | 39.4 | 8.0 | -14.9 | 10.6 | 6.0 |
| 3. 1897-1906 | 11.9 | 42.7 | 7.2 | -19.7 | 9.5 | 4.7 |
| 4. 1902-11 | 13.6 | 38.9 | 8.8 | -11.0 | 12.1 | 7.2 |
| 5. 1907-16 | 13.8 | 39.6 | 8.8 | + 3.4 | 14.3 | 9.3 |
| 6. 1912-21 | 16.7 | 34.3 | 11.6 | + 3.0 | 17.2 | 12.2 |
| 7. 1917-26 | 18.5 | 31.8 | 13.4 | - 8.9 | 16.8 | 11.7 |
| 8. 1922-31 | 18.4 | 33.0 | 13.1 | -11.0 | 16.4 | 11.0 |
| 9. 1927-36 | 18.1 | 34.6 | 12.6 | - 3.4 | 17.5 | 12.0 |
| 10. 1931-40 | 25.0 | 25.9 | 19.8 | - 0.1 | 24.9 | 19.7 |
| | B. Excluding Military | | | | | |
| 11. 1887-96 | 11.0 | 41.9 | 6.7 | - 1.8 | 10.8 | 6.4 |
| 12. 1892-1901 | 10.0 | 47.6 | 5.5 | -18.0 | 8.2 | 3.5 |
| 13. 1897-1906 | 9.3 | 54.1 | 4.5 | -43.0 | 5.3 | 2.0 |
| 14. 1902-11 | 11.4 | 46.0 | 6.5 | -13.2 | 9.9 | 4.9 |
| 15. 1907-16 | 11.9 | 46.0 | 6.8 | + 4.2 | 12.4 | 7.3 |
| 16. 1912-21 | 14.2 | 40.2 | 9.0 | + 3.5 | 14.7 | 9.5 |
| 17. 1917-26 | 16.3 | 36.6 | 11.0 | -10.4 | 14.6 | 9.3 |
| 18. 1922-31 | 16.8 | 36.3 | 11.4 | -11.9 | 14.8 | 9.3 |
| 19. 1927-36 | 15.9 | 39.2 | 10.3 | - 3.8 | 15.3 | 9.7 |
| 20. 1931-40 | 17.2 | 37.4 | 11.5 | 0 | 17.2 | 11.5 |
| 21. 1952-58 | 28.1 | 28.6 | 21.8 | + 2.3 | 28.8 | 22.5 |

Lines 1-20: Rosovsky, op. cit., Tables 2 and 4. Lines 11-20, col. 2 and 4 were
derived from col. 1 and 3, and col. 1 and 4, respectively, since all the abso-
lutes required were not available.
Line 21: U. N. Yearbook of National Accounts Statistics, 1959. Data are for
fiscal years starting April 1.

Table J-3.
Rate of Growth of National Product in Constant Prices and Ratios to It of Capital
Formation Proportions, Excluding Military Investment, Japan, 1887-1958

| Interval | Rate of growth per year GNP (%) (1) | Ratio to Col. 1 of: GDCF/ GNP (2) | Ratio to Col. 1 of: GNCF/ GNP (3) | Rate of growth per year NNP (%) (4) | Ratio to Col. 4 of: NDCF/ NNP (5) | Ratio to Col. 4 of: NNCF/ NNP (6) |
|---|---|---|---|---|---|---|
| 1. 1885-89 to 1895-99 | 4.92 | 2.2 | 2.2 | 4.88 | 1.4 | 1.3 |
| 2. 1890-94 to 1900-04 | 4.41 | 2.3 | 1.9 | 4.37 | 1.3 | 0.8 |
| 3. 1895-99 to 1905-09 | 2.67 | 3.5 | 2.0 | 2.62 | 1.7 | 0.8 |
| 4. 1900-04 to 1910-14 | 3.49 | 3.3 | 2.8 | 3.44 | 1.9 | 1.4 |
| 5. 1905-09 to 1915-19 | 4.07 | 2.9 | 3.0 | 4.03 | 1.7 | 1.8 |
| 6. 1910-14 to 1920-24 | 3.71 | 3.8 | 4.0 | 3.68 | 2.4 | 2.6 |
| 7. 1915-19 to 1925-29 | 5.20 | 3.1 | 2.8 | 5.16 | 2.1 | 1.8 |
| 8. 1920-24 to 1930-34 | 5.97 | 2.8 | 2.5 | 5.92 | 1.9 | 1.6 |
| 9. 1925-29 to 1935-39 | 5.10 | 3.1 | 3.0 | 5.06 | 2.0 | 1.9 |
| 10. 1930-34 to 1941 | 4.18 | 4.1 | 4.1 | 4.13 | 2.8 | 2.8 |
| 11. 1952 to 1958 | 6.76 | 4.2 | 4.3 | 6.01 | 3.6 | 3.7 |

Col. 1 and 4: Lines 1-10: NNP in constant prices is given annually in Kazushi
Ohkawa and others, The Growth Rate of the Japanese Economy since 1878,
Tokyo, 1957, Table 4, p. 248. GNP in constant prices was derived by ap-
plying the ratio of GNP to NNP in current prices (calculated from Rosovsky,
op. cit., Table 2) to NNP in constant prices. The single-year values were
used for 1941.
    Line 11: Single-year values were used for 1952 and 1958. Current price
totals, given in the U. N. Yearbook of National Accounts Statistics, 1959,
were converted to constant price totals by the cost of living index, given in
the U. N. Statistical Yearbook, 1959 and various issues of the U. N. Monthly
Bulletin of Statistics.
Col. 2, 3, 5, and 6: The capital formation proportions are from Table J-2. For
the interval from 1885-89 to 1895-99 the proportions for 1887-96 were used;
for 1890-94 to 1900-04 those for 1892-1901 were used; and so on.

Table J-4.
Distribution of Unadjusted Gross Fixed Capital Formation, Excluding Military,
by Major Categories, Japan, 1887-1958 (Percentages based on current price
totals)

| | Period | Construction | | | | Durable Equipment | | |
|---|---|---|---|---|---|---|---|---|
| | | Resi-dential (1) | Private nonresi-dential (2) | Public (3) | Total (4) | Private (5) | Public (6) | Total (7) |
| 1. | 1887-96 | 31.9 | 23.5 | 28.3 | 83.7 | 11.2 | 5.2 | 16.4 |
| 2. | 1892-1901 | 24.8 | 24.5 | 33.8 | 83.1 | 8.0 | 8.9 | 16.9 |
| 3. | 1897-1906 | 17.8 | 22.8 | 32.5 | 73.1 | 15.4 | 11.5 | 26.9 |
| 4. | 1902-11 | 10.7 | 21.9 | 35.2 | 67.8 | 19.7 | 12.4 | 32.2 |
| 5. | 1907-16 | 12.0 | 20.1 | 33.4 | 65.5 | 20.9 | 13.7 | 34.5 |
| 6. | 1912-21 | 13.2 | 24.2 | 24.7 | 62.1 | 26.2 | 11.7 | 37.9 |
| 7. | 1917-26 | 11.8 | 25.7 | 30.0 | 67.5 | 20.6 | 11.9 | 32.5 |
| 8. | 1922-31 | 9.3 | 25.7 | 35.5 | 70.5 | 16.0 | 13.5 | 29.5 |
| 9. | 1927-36 | 7.6 | 22.6 | 32.8 | 63.0 | 23.0 | 14.0 | 37.0 |
| 10. | 1931-40 | 5.5 | 19.7 | 17.4 | 42.6 | 46.7 | 10.7 | 57.4 |
| 11. | 1952-58 | 8.3 | | | | | | |

See notes to Tables J-1 and J-2.

Table J-5.
Share of Government in Unadjusted Gross Fixed Capital Formation, Japan, 1887-1958 (Percentages based on current price totals)

| | Period | Share, Excluding Military, in: | | | Share, Including Military, in: | | |
|---|---|---|---|---|---|---|---|
| | | GFCF (1) | Con-struction (2) | Durable equip-ment (3) | GFCF (4) | Con-struction (5) | Durable equip-ment (6) |
| 1. | 1887-96 | 33.5 | 33.8 | 31.7 | 42.5 | 35.9 | 61.9 |
| 2. | 1892-1901 | 42.7 | 40.7 | 52.8 | 55.9 | 44.7 | 80.5 |
| 3. | 1897-1906 | 44.0 | 47.6 | 42.7 | 57.3 | 47.7 | 71.2 |
| 4. | 1902-11 | 47.7 | 51.9 | 38.6 | 57.3 | 54.4 | 61.2 |
| 5. | 1907-16 | 47.0 | 51.0 | 39.5 | 53.2 | 53.3 | 58.1 |
| 6. | 1912-21 | 36.4 | 39.8 | 30.9 | 47.0 | 41.5 | 53.3 |
| 7. | 1917-26 | 41.9 | 44.5 | 36.6 | 49.9 | 45.4 | 56.4 |
| 8. | 1922-31 | 49.0 | 50.3 | 45.8 | 54.1 | 50.8 | 60.0 |
| 9. | 1927-36 | 46.8 | 52.0 | 37.8 | 53.9 | 52.8 | 55.2 |
| 10. | 1931-40 | 28.0 | 40.9 | 18.5 | 52.0 | 44.3 | 55.4 |
| 11. | 1952-58 | 34.8 | | | | | |

See notes to Tables J-1 and J-2.

Table Ar-1.
Capital Formation Proportions, Argentina, 1900-1958 (Percentages based on con-
stant price totals)

| Period | GDCF/ GDP (1) | CC/ GDCF (2) | NDCF/ NDP (3) | NBFCA/ GDCF (4) | GNCF/ GDP (5) | NNCF/ NDP (6) |
|---|---|---|---|---|---|---|
| 1. 1900-09 | 41.6 | 13.3 | 38.2 | -37.2 | 26.1 | 21.8 |
| 2. 1905-14 | 46.3 | 22.1 | 40.1 | -42.3 | 26.7 | 18.4 |
| 3. 1910-19 | 28.8 | 49.1 | 17.1 | -42.6 | 16.6 | 2.8 |
| 4. 1915-19 | 14.2 | 113.8 | - 2.3 | -23.9 | 10.8 | - 6.4 |
| 5. 1915-24 | 22.4 | 65.2 | 9.1 | -15.7 | 18.9 | 5.0 |
| 6. 1920-29 | 31.8 | 46.2 | 20.1 | -13.5 | 27.5 | 15.0 |
| 7. 1925-34 | 28.6 | 59.7 | 13.9 | -14.0 | 24.6 | 9.1 |
| 8. 1930-39 | 24.0 | 76.3 | 7.0 | -11.8 | 21.2 | 3.5 |
| 9. 1935-44 | 22.1 | 79.3 | 5.6 | - 8.9 | 20.1 | 3.2 |
| 10. 1940-44 | 19.7 | 85.9 | 3.3 | - 7.6 | 18.2 | 1.5 |
| 11. 1940-49 | 22.9 | 67.6 | 8.8 | - 3.2 | 22.2 | 7.9 |
| 12. 1945-54 | 24.6 | 60.1 | 11.5 | - 1.7 | 24.1 | 11.0 |
| 13. 1952-58 | 21.8 | 51.8[a] | 10.6[a] | - 4.5 | 20.8 | 8.5[a] |

a. Based on current price totals.

Lines 1-12:  Except for changes in inventories, all data are from Alexander
Ganz, "Problems and Uses of National Wealth Estimates in Latin America,"
in Raymond W. Goldsmith and Christopher Saunders, eds., Income and
Wealth, Series VIII, Table XI, p. 243, Table XII, p. 243, Table XX, p. 248,
and Table XXI, p. 249.
    Change in inventories was estimated on the assumption that it constituted
0.4 of additions to GDP in constant prices.  These additions were calculated
from quinquennial averages except for 1900-04, when inventory change was
assumed to be 10 percent of GFCF.
Line 13:  U. N. Yearbook of National Accounts Statistics, 1959.

Table Ar-2.
Rate of Growth of Domestic Product in Constant Prices and Ratios to It of Capital Formation Proportions, Argentina, 1900-1958

| | Interval | Rate of growth per year GDP (%) (1) | Ratio to Col. 1 of: GDCF/ GDP (2) | Ratio to Col. 1 of: GNCF/ GDP (3) | Rate of growth per year NDP (%) (4) | Ratio to Col. 4 of: NDCF/ NDP (5) | Ratio to Col. 4 of: NNCF/ NDP (6) |
|---|---|---|---|---|---|---|---|
| 1. | 1900-09 to 1910-19 | 3.89 | 11.9 | 6.9 | 2.90 | 13.8· | 6.3 |
| 2. | 1905-14 to 1915-24 | 2.23 | 12.9 | 7.4 | 1.72 | 9.9 | 1.6 |
| 3. | 1910-19 to 1920-29 | 4.16 | 5.4 | 4.5 | 4.10 | 2.2 | 1.2 |
| 4. | 1915-24 to 1925-34 | 4.15 | 7.7 | 6.6 | 3.85 | 5.2 | 3.9 |
| 5. | 1920-29 to 1930-39 | 2.29 | 12.5 | 10.7 | 1.85 | 7.5 | 4.9 |
| 6. | 1925-34 to 1935-44 | 2.48 | 9.7 | 8.5 | 2.42 | 2.9 | 1.4 |
| 7. | 1930-39 to 1940-49 | 3.41 | 6.5 | 5.9 | 3.76 | 1.5 | 0.9 |
| 8. | 1935-44 to 1945-54 | 3.44 | 6.7 | 6.5 | 3.78 | 2.3 | 2.1 |
| 9. | 1940-49 to 1955 | 2.80 | 8.8 | 8.6 | 2.96 | 3.9 | 3.7 |
| 10. | 1952 to 1958 | 3.13 | 7.0 | 6.6 | 3.02 | 3.5 | 2.8 |

See notes to Table Ar-1.

Col. 2, 3, 5, and 6: The capital formation proportions are from Table Ar-1. For the interval from 1900-09 to 1910-19, proportions for 1905-14 were used; for 1905-14 to 1915-24, those for 1910-19 were used; and so on.

Col. 4, line 10: NDP, given in current price totals only, was converted to constant prices by the price index implicit in GDP.

Table Ar-3.
Sector Incremental Gross Fixed Capital-Output Ratios, Argentina, 1900-1955
(Based on constant price totals)

| Interval | A sector (1) | M sector (2) | Transportation, communication, and electricity (3) | Housing, commerce, finance, service (4) | Government (5) | Total (6) |
|---|---|---|---|---|---|---|
| **Ratio, Gross Fixed Capital Formation Proportion to Rate of Growth of Gross Domestic Product** | | | | | | |
| 1. 1900-09 to 1910-19 | 5.4 | 7.6 | 20.6 | 12.5 | 21.6 | 11.5 |
| 2. 1910-19 to 1920-29 | 3.9 | 3.3 | 6.7 | 6.0 | 7.4 | 5.0 |
| 3. 1920-29 to 1930-39 | 11.1 | 5.4 | 18.5 | 16.2 | 17.5 | 12.1 |
| 4. 1930-39 to 1940-49 | 5.4 | 2.6 | 16.3 | 6.8 | 7.0 | 6.1 |
| 5. 1940-49 to 1955 | 16.2 | 5.0 | 10.4 | 9.0 | 9.2 | 8.4 |
| 6. 1900-09 to 1930-39 | 6.8(5.8) | 5.4(5.2) | 15.3(15.5) | 11.6(10.5) | 15.5(16.4) | 9.5(9.0) |
| 7. 1920-29 to 1955 | 10.9(9.5) | 4.3(4.1) | 15.1(15.0) | 10.7(9.9) | 11.2(10.4) | 8.9(8.4) |
| 8. 1900-09 to 1955 | 8.4(6.4) | 4.8(4.5) | 14.5(14.9) | 10.1(9.6) | 12.5(12.6) | 8.6(8.3) |
| **Share of Sector in Addition to Gross Domestic Product (%)** | | | | | | |
| 9. 1900-09 to 1910-19 | 23.8 | 18.9 | 11.8 | 37.7 | 7.8 | 100.0 |
| 10. 1910-19 to 1920-29 | 24.3 | 25.7 | 10.5 | 34.4 | 5.1 | 100.0 |
| 11. 1920-29 to 1930-39 | 16.6 | 35.1 | 13.1 | 26.3 | 8.9 | 100.0 |
| 12. 1930-39 to 1940-49 | 12.6 | 37.8 | 11.6 | 26.9 | 11.0 | 100.0 |
| 13. 1940-49 to 1955 | 5.3 | 34.3 | 14.7 | 31.0 | 14.7 | 100.0 |
| 14. 1900-09 to 1930-39 | 21.6 | 26.6 | 11.8 | 32.8 | 7.3 | 100.0 |
| 15. 1920-29 to 1955 | 11.5 | 35.7 | 13.1 | 28.1 | 11.5 | 100.0 |
| 16. 1900-09 to 1955 | 16.5 | 30.4 | 12.3 | 31.3 | 9.5 | 100.0 |

(Continued on next page)

Table Ar-3 (Cont.)

<div align="right">(6)</div>

Effects of Inter- and Intra-Sector Shifts

| | | |
|---|---|---|
| 17. | 1900-09 to 1930-39, holding ratios in line 8 constant | 8.4 |
| 18. | 1920-29 to 1955, holding ratios in line 8 constant | 8.4 |
| 19. | Inter-sector shifts | 0.0 |
| 20. | 1900-09 to 1930-39, holding shares in line 16 constant | 9.3 |
| 21. | 1920-29 to 1955, holding shares in line 16 constant | 8.7 |
| 22. | Intra-sector shifts | 0.6 |

See notes to Table Ar-1.

Lines 1-5: GDP originating in each sector, given on the basis of factor cost was adjusted to market prices by the ratio of GDP at market prices to GDP at factor cost.

For the interval from 1900-09 to 1910-19 the capital formation proportions for 1905-14 were used; for 1910-19 to 1920-29 the proportions for 1915-24 were used; and so on.

Lines 6-8: The entries without parentheses are arithmetic averages of entries in lines 1-5; those within parentheses are ratios of the averages of decadal proportions for the longer periods to the averages of the decadal rates of growth for the same period.

Line 17: Based on lines 8 and 14, entries within parentheses.

Line 18: Based on lines 8 and 15, entries within parentheses.

Line 20: Based on lines 6 and 16, entries within parentheses.

Line 21: Based on lines 7 and 16, entries within parentheses.

Table SAF-1.
Capital Formation Proportions, Union of South Africa, 1919-1958 (Percentages based on current price totals)

| Period | GDCF/ GNP (1) | CC/ GDCF (2) | NDCF/ NNP (3) | NBFCA/ GDCF (4) | GNCF/ GNP (5) | NNCF/ NNP (6) |
|---|---|---|---|---|---|---|
| 1. 1919-28 | 18.8 | 34.4 | 13.3 | -15.8 | 15.9 | 10.1 |
| 2. 1924-33 | 15.1 | 46.4 | 8.7 | - 6.8 | 14.1 | 7.6 |
| 3. 1929-38 | 18.0 | 38.5 | 11.9 | - 1.2 | 17.7 | 11.6 |
| 4. 1934-43 | 17.6 | 35.0 | 12.2 | | | |
| 5. 1939-48 | 19.7 | 27.3 | 15.2 | | | |
| 6. 1944-55 | 26.6 | 22.9 | 21.9 | -24.2[a] | 21.3[a] | 16.1[a] |
| 7. 1952-58 | 24.7 | 34.6 | 17.7 | - 9.9 | 22.3 | 15.0 |

a. 1946-55.

Lines 1-6: From D. G. Franzsen and J. J. D. Willers, "Capital Accumulation and Economic Growth in South Africa," in Raymond Goldsmith and Christopher Saunders, eds., Income and Wealth, Series VIII, Table XII, p. 310, Table XIII, p. 311, Appendix Table V, p. 316, and Appendix Table VI, p. 317.
Line 7: U. N. Yearbook of National Accounts Statistics, 1959.

Table SAF-2.
Domestic Capital Formation Proportions, Union of South Africa, 1919-1955 (Percentages based on constant price totals)

| Period | GDCF/GNP (1) | NDCF/NNP (2) | Ratio, implicit price index in GDCF to that in GNP (3) |
|---|---|---|---|
| 1. 1919-28 | 18.7 | 12.1 | 1.01 |
| 2. 1924-33 | 17.4 | 10.8 | 0.87 |
| 3. 1929-38 | 19.1 | 12.7 | 0.94 |
| 4. 1934-43 | 15.1 | 8.9 | 1.17 |
| 5. 1939-48 | 13.7 | 8.0 | 1.44 |
| 6. 1944-55 | 17.7 | 12.2 | 1.50 |

Col. 1 and 2: See notes to Table SAF-1 for source.
Col. 3: Table SAF-1, col. 1 divided by col. 1 of this table.

Table SAF-3.
Rate of Growth of National Product in Constant Prices and Ratios to It of Capital Formation Proportions, Union of South Africa, 1919-1958

### A.  Gross Ratios

| Interval | Rate of growth per year GNP (%) (1) | GDCF/GNP Current prices (2) | GDCF/GNP Constant prices (3) | GNCF/GNP Current prices (4) |
|---|---|---|---|---|
| 1. 1918-20 to 1927-31 | 3.69 | 5.1 | 5.1 | 4.3 |
| 2. 1919-28 to 1929-38 | 4.07 | 3.7 | 4.3 | 3.5 |
| 3. 1924-33 to 1934-43 | 5.46 | 3.3 | 3.5 | 3.2 |
| 4. 1929-38 to 1939-48 | 5.36 | 3.3 | 2.8 | |
| 5. 1934-43 to 1944-53 | 4.73 | 4.2 | 2.9 | |
| 6. 1939-48 to 1949-58 | 4.92 | 5.4 | 3.6 | 4.3 |
| 7. 1952 to 1958 | 4.24 | 5.8 | | 5.3 |

### B.  Net Ratios

| Interval | Rate of growth per year NNP (%) | NDCF/NNP Current prices | NDCF/NNP Constant prices | NNCF/NNP Current prices |
|---|---|---|---|---|
| 8. 1918-20 to 1927-31 | 3.64 | 3.7 | 3.3 | 2.8 |
| 9. 1919-28 to 1929-38 | 4.07 | 2.1 | 2.7 | 1.9 |
| 10. 1924-33 to 1934-43 | 5.55 | 2.1 | 2.3 | 2.1 |
| 11. 1929-38 to 1939-48 | 5.49 | 2.2 | 1.6 | |
| 12. 1934-43 to 1944-53 | 4.80 | 3.2 | 1.7 | |
| 13. 1939-48 to 1949-58 | 4.87 | 4.5 | 2.5 | 3.3 |
| 14. 1952 to 1958 | 4.12 | 4.3 | | 3.6 |

Col. 1:  Derived from annual series, 1918-1958, obtained from D. G. Franzsen by correspondence.
Col. 2-4:  The capital formation proportions are from Tables SAF-1 and SAF-2. For the interval from 1918-20 to 1927-31 the proportions for 1919-28 were used;  for 1919-28 to 1929-38 those for 1924-33 were used;  and so on.

Table SAF-4.
Distributions of Gross Domestic Capital Formation by Major Categories and by
Users, Union of South Africa, 1910-1958 (Percentages based on current price
totals)

| | Period | Building and construction (1) | Machinery, plant, and equipment (2) | Change in inventories (3) | Private (4) | Public corps. (5) | Public authorities (6) |
|---|---|---|---|---|---|---|---|
| 1. | 1910-19 | 49.0 | 32.6 | 18.4 | 74.7 | 0.3 | 25.0 |
| 2. | 1915-24 | 48.5 | 33.6 | 17.9 | 72.8 | 0.5 | 26.7 |
| 3. | 1920-29 | 53.5 | 32.4 | 14.1 | 67.9 | 1.3 | 30.8 |
| 4. | 1925-34 | 62.2 | 33.1 | 4.7 | 62.5 | 3.4 | 34.1 |
| 5. | 1930-39 | 60.2 | 32.4 | 7.4 | 63.2 | 4.0 | 32.8 |
| 6. | 1935-44 | 55.1 | 31.2 | 13.7 | 64.5 | 4.1 | 31.4 |
| 7. | 1940-49 | 46.2 | 33.0 | 20.8 | 68.4 | 4.0 | 27.6 |
| 8. | 1945-55 | 47.2 | 38.1 | 14.7 | 68.9 | 6.4 | 24.7 |
| 9. | 1952-58 | 55.6 | 39.7 | 4.7 | 61.9 | 7.2 | 30.9 |

See notes to Table SAF-1. For lines 1-8 the data are from Franzsen and Willers,
op. cit., App. Table IV, p. 315 and App. Table V, p. 316.

Table SAF-5.
Average Capital-Output Ratios by Sectors, Union of South Africa, 1919-1955
(Based on constant price totals)

|  | Agri-culture (1) | Mining (2) | Manu-fac-turing (3) | Railways and harbors (4) | All other (5) | Total (6) |
|---|---|---|---|---|---|---|
| **1919-28** | | | | | | |
| 1. Capital-output ratio | 5.4 | 2.1 | 1.8 | 7.5 | 2.9 | 3.5 |
| 2. Share of repro-ducible stock (%) | 29 | 11 | 6 | 18 | 36 | 100 |
| 3. Derived share of output (%) | 18.8 | 18.3 | 11.7 | 8.4 | 42.8 | 100 |
| **1944-55** | | | | | | |
| 4. Capital-output ratio | 3.5 | 2.0 | 1.6 | 4.5 | 2.6 | 2.6 |
| 5. Share of repro-ducible stock (%) | 19 | 10 | 13 | 13 | 45 | 100 |
| 6. Derived share of output (%) | 14.1 | 13.0 | 21.1 | 7.5 | 44.3 | 100 |
| 7. Average share of output (%) | 16.5 | 15.6 | 16.4 | 8.0 | 43.5 | 100 |
| 8. Average capital-output ratio | 4.45 | 2.05 | 1.70 | 6.00 | 2.75 | 3.05 |

Over-all Ratio, Holding Sectoral Ratios (line 8) Constant: Inter-sector Changes

|  |  |  |
|---|---|---|
| 9. | 1919-28 | 3.09 |
| 10. | 1944-55 | 2.92 |
| 11. | Change | -0.17 |

Over-all Ratio, Holding Sectoral Shares (line 7) Constant: Intra-sector Changes

|  |  |  |
|---|---|---|
| 12. | 1919-28 | 3.38 |
| 13. | 1944-55 | 2.64 |
| 14. | Change | -0.74 |

Franzsen and Willers, op. cit., Table IX, p. 308, and Table X, p. 309.

Lines 3 and 6:  Line 2 (or line 5) divided by line 1 (or line 4), summated and re-
    duced to percentage shares.
Line 7:  Average of lines 3 and 6.
Line 8:  Average of lines 1 and 4.