

WHY GROWTH RATES DIFFER—A SUMMARY AND APPRAISAL

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This review article initially summarizes some of the highlights of the volume *Why Growth Rates Differ*, including the use of income shares as weights for the various factor inputs and some of the major factual conclusions drawn from the inter-country comparisons. Some of the main factors in differences in income levels and differences in growth rates are then reviewed.

In appraising the contribution of the volume, the monumental task is emphasized. This study illustrates the adaptability of the approach which Denison developed initially in *The Sources of Economic Growth*. The volume meets many of the questions and criticisms raised of his earlier study, and should encourage a shift of the discussion from methodology towards the substance of the empirical results.

The volume introduces some shifts in emphasis on the importance of different factors in growth. The role of demand variations and the contribution of capital is considered, but the evidence in the volume gives less emphasis on the importance of these factors than earlier work by others in both the United States and Europe. The volume gives some emphasis to shifts out of agriculture and the self-employed in the high postwar growth in many individual European countries. It considers the effects of reductions in trade barriers, and follows the view of most economists in playing this down. Advances in knowledge are also considered.

Those who are interested in questions of economic growth, past and future, and economic policy in this area will find much in this volume for study and reflection.

INTRODUCTION

This is a very important volume¹ in a number of respects. In terms of method, it applies basically the same framework developed by the author in *The Sources of Economic Growth in the United States*² for the longer historical experience. In this study the approach is also extended in quite a different direction, by using it to appraise the factors contributing to the differences in income levels at a point in time (namely 1960). It also compares the factors contributing to the differences in the growth in total output and in output per employed person for the nine countries from 1950 to 1962 (with a further split between 1950 and 1955 and 1955 to 1962).

One of the important points made in the earlier work was the difficulty in raising the growth rate in the future by, say, one tenth of a point per year.

If it is as difficult as I estimated to raise the *United States* growth rate by whole percentage points, how is it that some other countries have achieved much higher growth rates than the United States in the postwar period? . . .

1. Edward F. Denison assisted by Jean-Pierre Poulhier, *Why Growth Rates Differ—Postwar Experience in Nine Western Countries* (Washington: The Brookings Institution, 1967). Dr. Denison and Mr. Poulhier have made helpful comments on earlier drafts of this review, and have made additional worksheet detail available to assist us in doing a comparable study for Canada at the Economic Council of Canada.

2. Edward F. Denison, *The Sources of Economic Growth in the United States and the Alternatives Before Us* (New York: Committee for Economic Development, January 1962), Supplementary Paper No. 13.

The study also had two quite specific purposes. One was to test how well the methodology previously used to analyze the sources of American growth and to estimate the requirements for altering the future American growth rate could explain the wide divergence of growth rates among countries and time periods. . . .

A second specific purpose was to try to establish whether or not European countries obtaining higher growth rates did so because they were doing more than the United States to obtain growth. . . .

Because my primary interest is in American economic growth and economic policy, the discussion focuses on comparisons of the European countries with the United States. But comparisons among European countries are equally possible from the tables presented, and are by no means ignored in the text discussion.³

The nine countries covered in this study include the United States, United Kingdom, France, Germany and Italy (the four largest countries in Western Europe), Belgium, Denmark, the Netherlands and Norway. These countries all have high levels of real income per person employed, and include both large and small countries. In the book, but not always in this summary, the tables include data for each country separately. The level of income in Italy is lower than in other countries, which is why Italy is excluded from the totals for Northwest Europe.

It should be recognized that such a study is a gigantic task. For example, it requires a knowledge of the statistical sources for each country (covering employment, hours worked, national income, price data, information on stock of capital, inventories, education, industrial differences, etc.), and the main policy shifts in the countries concerned (for example, the effects of the Common Market and commercial policy, measures on education, productivity improvement, differences in the pressure of demand). This is reflected in a list of books and references more than twenty pages in length.

The present note is an attempt to summarize this study, selecting key tables, major conclusions, and emphasizing the major results for Northwest Europe as a whole compared with the United States. This note may help to make the results better known, and provide some guide to those who may want to examine particular topics or chapters more fully.

ORGANIZATION OF MATERIAL

The basic methodology follows the approach developed in Denison's earlier book on the United States. Basic to his method in analyzing economic growth over time is the distinction between total inputs and output in relation to total factor input. The individual inputs follow the classical distinction between labour, capital and land, and time series are developed for each of the individual inputs. The measure of labour input takes account of changes in the age and sex composition of the labour force and hours worked. It also takes account of changes in the quality of the labour force in so far as it is influenced by the levels of formal education of those in the labour force. The measures of capital input are based on the stock of capital in the form of housing and inventories

3. Denison and Poullick, *Why Growth Rates Differ*, pp. 5-6.

in addition to non-residential structures and equipment. The input of land is based on measures of non-residential site land, agricultural land and the rental portion of mineral land.

When an over-all measure of these three major inputs (with subcategories for each of the major inputs) is to be prepared, some system of weights to combine them into a comprehensive index of inputs is necessary. For this, Denison uses the distribution of national income. This involves some assumptions about the relationships between the contribution of inputs to output and the related distribution of income, and the effects of substitution between factors. Denison uses differences in income as weights for the individual age, sex and education categories in building up the major input measures.

A comparison of the rates of growth in total factor input and total output gives a measure of output per unit of input. Denison develops measures for the main sources of growth in this area, including the effects of improved allocation of resources, the economies of scale, and advances in knowledge. Consideration has to be given to any differences in the terminal years of the period of comparison associated with irregularities in the pressure of demand on agricultural output.

The organization of this volume reflects this approach in method. The first two chapters provide an introduction to the study as a whole, and Chapter 4 develops the basic weights used to combine the separate measures of input. Chapters 5 to 14 deal with separate aspects of the main factor inputs, while Chapters 16 to 20 deal with some of the main changes in output in relation to total inputs. Chapter 15 provides a summary of the major inputs and makes a transition to output per unit of input. Chapter 21 is a fascinating summary chapter.

In each chapter, all of the data for each of the nine countries are presented, dealing both with the material on the growth rates over time and the material on the 1960 differences in level (usually in that order).

In the light of the central importance of the weights used to combine the various measures of input to make a measure of total factor input, this summary will begin on this topic (Chapter 4 in the volume).

THE USE OF INCOME SHARES

A traditional distinction in economies is the three main factors of production—labour, capital and land. Denison has followed this distinction in his earlier study on the United States, and it again plays a central role in this volume. Once one makes this useful distinction, however, it is necessary to provide a basis of combining them to calculate a measure of *total factor input*. To combine the individual measures of input into an aggregate, Denison uses the individual shares of the inputs in national income as weights. This procedure permits an appraisal of the contribution of a 1 per cent increase in only one factor on the increase in real national income. This is thus a fairly crucial step, for it lays the basis for the appraisal of the importance of each individual factor in *past* growth in output, and any use of this framework for estimating future growth in potential output.

One important assumption underlying this step derives from marginal productivity analysis. This method uses the *average* earnings of the various factors of production as being proportional to the value of their *marginal* products. It should be noted that this does *not* involve the much stricter and more dubious proposition of perfect competition in both factor and product markets, but does involve some comparability over time or between countries in the extent of market imperfections.

The working hypothesis of this study is that, on the average for all producing units, the tendency toward proportionality of factor prices and marginal products under conditions of reasonably high employment is sufficiently strong in the United States and, though perhaps weaker, in Western Europe for distributive shares to provide an adequate basis for analysis of the relative contributions of the various factors to growth. The general similarity of income distributions for different time periods and for the various countries that are derived in this chapter somewhat strengthens its acceptability.⁴

The rationale for the use of income shares is more explicit here than in the U.S. study and meets some of the criticisms made of the earlier study.

A summary of the main table is presented here to illustrate the results.

PERCENTAGE DISTRIBUTION OF TOTAL NATIONAL INCOME
BY TYPE OF INCOME

| 1950-62 | United States | Northwest Europe |
|--|---------------|------------------|
| National Income | 100.0 | 100.0 |
| Labour income | 78.6 | 75.8 |
| Income from housing | 3.5 | 1.7 |
| Net property income from abroad | .6 | .6 |
| Other property income | 17.3 | 21.9 |
| Non-residential land | 2.9 | 3.9 |
| Non-residential structures and equipment | 11.2 | 14.0 |
| Inventories | 3.2 | 4.0 |

Source: *Ibid.*, Table 4-1, page 38.

FACTS ON INCOME LEVELS AND GROWTH RATES

The comparisons of real income per capita levels essentially involve three steps—the use of national income totals (the published figures are adjusted to put depreciation estimates on a replacement cost basis, and to make some adjustments for international comparability); the use of data on population, labour force and employment; and comparisons of the relative purchasing power in the different countries. The author emphasizes the weaknesses in the basic data for the level comparisons.

Remember that the main purpose of the level comparisons is to place the time series in better perspective. I believe most of the level comparisons do this sufficiently well to make the attempt rewarding, but clearly the degree of reliability is much lower.⁵

4. *Ibid.*, p. 35.

5. *Ibid.*, p. 7.

However, the main purpose of the level comparison is to place the time series in better perspective.

Probably the weakest area in the basic data is the international comparison of prices, which requires an up-dating of two earlier OEEC publications.⁶ Partly this reflects the fact that very few resources have been made available in the past to collect basic data on prices of the same (or similar) products in a number of countries. Although many countries and international agencies are interested in such data, it does not appear to be sufficiently critical to allocate an adequate amount of resources to this topic. Furthermore, even when these are brought together, the relative prices and relative quantities of the various products in the different countries are markedly different. These have a profound effect on the aggregative comparisons that result, both on differences in level and growth rates over time. This is illustrated in the accompanying table, showing the differences obtained using U.S. or national European price weights. Using U.S. weights, the level of per capita national income in Northwest Europe in 1960 was 31 per cent lower than in the United States, while with European weights, the level was 46 per cent lower! Similar large differences are apparent on a person-employed basis, and the differences are relatively even larger for individual countries.

The differences in real income between Northwest Europe and the United

INDEXES OF REAL NATIONAL INCOME, INTERNATIONAL COMPARISON, 1960
(UNITED STATES = 100)

| | Indexes based on United States price weights | | | | Indexes based on national European price weights | | | |
|------------------|--|------------|--------------------------------|---------------------|--|------------|--------------------------------|---------------------|
| | Total | Per Capita | Per Person in the Labour Force | Per Person Employed | Total | Per Capita | Per Person in the Labour Force | Per Person Employed |
| United States | 100.0 | 100 | 100 | 100 | 100.0 | 100 | 100 | 100 |
| Northwest Europe | 70.1 | 69 | 62 | 59 | 54.6 | 54 | 48 | 46 |
| Belgium | 3.1 | 61 | 63 | 61 | 2.7 | 53 | 54 | 53 |
| Denmark | 1.8 | 71 | 60 | 58 | 1.4 | 55 | 47 | 45 |
| France | 16.7 | 66 | 62 | 59 | 13.0 | 51 | 48 | 46 |
| Germany | 22.3 | 73 | 62 | 59 | 17.2 | 56 | 47 | 45 |
| Netherlands | 3.9 | 61 | 67 | 65 | 2.9 | 45 | 50 | 48 |
| Norway | 1.3 | 64 | 62 | 59 | 1.0 | 48 | 47 | 45 |
| United Kingdom | 21.0 | 72 | 61 | 59 | 16.5 | 57 | 48 | 46 |
| Italy | 11.9 | 43 | 41 | 40 | 7.1 | 26 | 25 | 24 |

Source: Denison and Poullier, *op. cit.*, Table 2-4, page 22.

6. Milton Gilbert and Irving B. Kravis, *An International Comparison of National Products and the Purchasing Power of Currencies* (Paris: OEEC, 1954), and Milton Gilbert and Associates (Wilfred Beckerman, John Edelman, Stephen Marris, Gerhard Stuvell, Manfred Teichert), *Comparative National Products and Price Levels* (Paris: OEEC, 1958).

GROWTH RATES OF REAL NATIONAL INCOME
(Order based on 1950-62)

| | 1950-62 Rate | 1950-64 Rate |
|----------------|--------------|--------------|
| Germany | 7.3 | 7.1 |
| Italy | 6.0 | 5.6 |
| France | 4.9 | 4.9 |
| Netherlands | 4.7 | 4.9 |
| Denmark | 3.5 | 3.6 |
| Norway | 3.5 | 3.8 |
| United States | 3.3 | 3.5 |
| Belgium | 3.2 | 3.4 |
| United Kingdom | 2.3 | 2.6 |

Source: *Ibid.*, page 17.

States are considerably affected by the use of U.S. or European price weights. Essentially this difference comes about from significant differences in the relative prices of similar products in the different countries, and the related differences in quantities consumed. A simple example might illustrate this point. Automobile prices are relatively higher in Europe than other consumer prices, and the quantities purchased are a much smaller share of total consumer expenditure, compared to the same relative prices and quantities in the United States. On the other hand, prices of most foods are lower, and food expenditures are a much larger part of total expenditures than in the United States. The use of European price weights will put more emphasis on car purchases and less on food expenditures than the use of U.S. price weights. This will tend to widen the real income differences more than if measured with U.S. price weights. This example is a typical case. "The European prices of manufactured goods and mechanized services are high by comparison with their position in the U.S. price structure, while unprocessed foods and services of persons are available in the European countries at relatively low prices."⁷ Similarly, prices of machinery and equipment are relatively more expensive in Europe than in North America. (One of the effects of this is to reduce the share of machinery purchases relative to GNP if measured in U.S. rather than European relative prices.)

An important point made in the 1958 study was that the official exchange rate was a very poor indication of the difference in purchasing power between Europe and the United States. At the official exchange rates, most of the European countries were undervalued in relation to the United States. This contributed to the strong European balance-of-payments position, and increases in prices and costs could occur for years in Europe at a more rapid rate than in the United States before the very favourable European competitive position would be eroded.⁸ These results do not seem to have had much discussion in North America, in the context of the U.S. balance of payments.

7. Gilbert and Kravis, *op. cit.*, p. 57. See also pp. 51-59 and Gilbert and Associates, *op. cit.*, pp. 52-74.

8. *Ibid.*, pp. 28-31. A discussion of some of the reasons why official exchange rates are a poor measure of domestic purchasing power is given in Gilbert and Kravis, *op. cit.*, pp. 14-17.

Some of the results in the differences in total growth rates are shown in the following table. The range of growth rates is big, and the U.S. position is close to the bottom, whatever period is compared.

The growth rates on a per capita and per-employed-person basis are also shown. As the United States was undergoing a more rapid growth in both population and labour force than all the individual European countries except Germany, the differences are even more marked in this table.

It is noteworthy that because the fraction of the population employed changed so much, and so differently, among countries, there is only a remote relationship between growth rates of national income per person employed and national income per capita. The two measures are by no means interchangeable.⁹

FACTORS IN DIFFERENCES IN INCOME LEVEL

National income per person employed in Northwest Europe was 41 per cent lower than in the United States (based on U.S. price weights, data for 1960, as in Column 4, Table 2-4, reproduced earlier). The extent of this difference

GROWTH RATES OF REAL NATIONAL INCOME PER PERSON EMPLOYED AND PER CAPITA 1950-62

| | National Income Per Person Employed | National Income Per Capita |
|------------------|--|-------------------------------|
| United States | 2.1 | 1.6 |
| Northwest Europe | 3.8 | 3.9 |
| Belgium | 2.6 | 2.6 |
| Denmark | 2.6 | 2.8 |
| France | 4.8 | 3.9 |
| Germany | 5.2 | 6.1 |
| Netherlands | 3.6 | 3.4 |
| Norway | 3.3 | 2.5 |
| United Kingdom | 1.6 | 1.8 |
| Italy | 5.4 | 5.3 |

Source: *Ibid.*, Table 2-2, page 18.

had narrowed significantly from earlier post-war years. Of this difference, only about 11 percentage points were associated with differences in input per person employed; much the larger part was associated with a difference of 30 percentage points in output per unit of input.

The main factors in the differences are summarized on pages 195-200 of Chapter 15 (dealing with the summary of factor inputs) and pages 331 to 335 of Chapter 21 (summarizing all the results). The main summary of the results can be seen in Table 21-28, a portion of which is reproduced here. In 1960, only two factors were more favourable in Northwest Europe than in the United States. One was the low level of demand in the United States in that year

9. Denison and Poullier, *op. cit.*, p. 19.

that depressed the level of national income per person employed. A second was longer hours of work in Europe, associated with longer hours for full-time workers, and less prevalent part-time work of women. All of the other factors contributed to higher income levels in the United States. The sources of difference were quite diverse among those that could be separately identified. The age-sex composition was more favourable in the United States, and the average level of education was higher.

CONTRIBUTION TO DIFFERENCES FROM THE UNITED STATES
IN NATIONAL INCOME PER PERSON EMPLOYED, 1960
(Percentage of U.S. national income per person employed)

| | Northwest Europe |
|---|------------------|
| Total Difference | 41.0 |
| Due to: | |
| Total factor input | 11.3 |
| Labour | 1.1 |
| Hours of work | -3.9 |
| Age-sex composition | 1.2 |
| Education | 3.8 |
| Capital | 9.7 |
| Dwellings | 1.9 |
| International assets | .4 |
| Non-residential structures and equipment | 6.6 |
| Inventories | .8 |
| Land | .5 |
| Output per unit of input | 29.7 |
| Overallocation to agriculture | 2.3 |
| Overallocation to nonfarm self-employment | .3 |
| Use of shift work | .1 |
| Economies of scale: national market | 3.0 |
| Economies of scale: local markets | 1.9 |
| Irregularity in pressure of demand | -1.6 |
| Irregularity in farm output | |
| Lag in the application of knowledge, general efficiency, and errors and omissions | 23.7 |

Source: *Ibid.*, Table 21-28, page 332.

Differences in capital per worker were much more important than labour, however. Almost 10 percentage points were associated with more capital per worker in the United States, especially in non-residential structures and equipment. Denison has been able to isolate quantitatively only a relatively small part of the differences in output per unit of input. Of a difference of 30 percentage points, about 24 percentage points in total still remain unallocated, as indicated in the last line of the table.

Although Denison does not go on to draw policy implications, the inference is that a wide range of measures in a number of diverse areas would be necessary over an extended period of time to accelerate the narrowing in real income differences to any marked degree. The really big item, "lag in the application of

knowledge, general efficiency, and errors and omissions," is hard to come to grips with, but presumably partly reflects deep-seated social attitudes and practices of labour and management.

UNITED STATES:
THE SOURCES OF GROWTH OF TOTAL NATIONAL INCOME, 1929-57 AND 1950-62^(a)

| | 1929-57 | 1950-62 |
|---|---------|---------|
| National Income | 2.93 | 3.32 |
| Total factor input ^(a) | 2.00 | 1.95 |
| Labour ^(a) | 1.57 | 1.12 |
| Employment | 1.00 | .90 |
| Hours of work | -.20 | -.17 |
| Age-sex composition | .10 | -.10 |
| Education ^(a) | .67 | .49 |
| Capital | .43 | .83 |
| Dwellings | .05 | .25 |
| International assets | .02 | .05 |
| Non-residential structures and equipment | .28 | .43 |
| Inventories | .08 | .10 |
| Land | .00 | .00 |
| Output per unit of input | .93 | 1.37 |
| Advances of knowledge ^(a) | .58 | .76 |
| Improved allocation of resources by contraction of: | | |
| Inputs in agriculture | .05 | .25 |
| Nonfarm self-employment | N.A. | .04 |
| International trade barriers | .00 | .00 |
| Economies of scale associated with: | | |
| Growth of national markets measured in U.S. prices | .27 | .30 |
| Independent growth of local markets | .07 | .06 |
| Incomparability of years compared | | |
| Pressure of demand | .00 | -.04 |
| Farm output | .00 | .00 |

Source: *Sources of Economic Growth in the United States*, page 266 and *Why Growth Rates Differ*, page 298.

^(a) Denison comments on this table in a recent letter as follows:

"The table providing a comparison of the sources of U.S. growth in 1929-57 and 1950-62 encounters the difficulty that I changed some procedures in this study. The main case in point is education, where I reduced the adjustment for changes in days. Use of the 1950-62 procedure would cut the 1929-57 education figure by about one-fourth. This would make both the contributions of education and advances in knowledge (which picks up the difference) in 1929-57 about the same as in 1950-62."

FACTORS IN DIFFERENCES IN GROWTH RATES

Before considering Denison's results for the 1950 to 1962 period, it seems desirable to point out that the growth rates for these countries for the post-war period are considerably higher than the longer-term experience for these countries. This is particularly so for the European countries for which a longer period of data is available. (It might be noted that a series of complementary studies sponsored by the Social Science Research Council of the United States are under

way. These are individual country studies for the United States, United Kingdom, France, Germany, Italy, Sweden and Japan, which deal with the differences between post-war and longer-term growth experience. These studies are to be summarized by Kuznets and Abramovitz.)

For the United States, Denison's results for the 1950-62 period can be compared with his earlier results for 1929-57, as shown in the above table. The increase in total inputs for the two periods are fairly similar in total. For the individual inputs, the greatest difference is in the capital stock growth, which is larger in the post-war period in both the residential and business areas. As pointed out in the note to the table, the contribution of education is about the same in 1950-62 as in 1929-57. The increase in output per unit of input has been somewhat more rapid in the post-war period, arising primarily from a more rapid shift off the farm.

For the European countries, similar studies of the sources of economic growth for the longer period are not available. However, data on real output and employment are available for a number of countries for an extended period. The rates of growth in output per employee are shown in a longer-term context in the following table. It is apparent that for all five countries the rates of growth in output per employee are much higher for the post-war period than from 1900 to 1950. Increases were much slower in Germany and the United Kingdom from 1900 to 1950 than in the United States, so the relative differences in output per worker were smaller at the start of the century than at the start of Denison's period. Output per worker in France and Italy, on the other hand, was appreciably lower in 1900 than in the United States, United Kingdom or Germany. The more rapid increases of the post-war period for these two countries is a continuation of a tendency that had persisted for the first half of the century as well.

GROWTH RATES OF OUTPUT PER EMPLOYEE

| | 1900-50 | 1950-64 |
|----------------|---------|---------|
| United States | 1.6 | 2.4 |
| Germany | .8 | 5.4 |
| United Kingdom | .6 | 2.2 |
| France | 1.9 | 4.6 |
| Italy | 2.6 | 5.2 |

Source: Estimates by Angus Maddison published in *Long Term Economic Growth, 1860-1965* (Washington: Bureau of the Census, G.P.O., 1966), pp. 101 and 248-253.

Chapter 21 contains a very interesting and valuable summary of the differences in the sources of economic growth between the United States and Northwest Europe. For this period, 1950-62, the rate of growth in the United States was 3.32 per cent, while Northwest Europe grew 4.78 or 1.46 percentage points more. Some of the key tables for the individual countries are summarized in the accompanying table. Similar tables on a per person employed basis are contained for each country in the study.

No brief summary can do full justice to the amount of material on each

individual country, but a few major points can be made to illustrate the results obtained.

In general, the contribution to growth of output per unit of input was greater in the individual European countries (all except the United Kingdom) than in the United States. With the large increase in employment in the United States, the importance of output per unit of input on a per person employed basis is even more dramatic in most of the European countries.

Some interesting and important differences in inputs can be noted in the table. The increases in inputs in the United States over this period made a fairly important contribution to growth, especially in employment, education and housing. On the other hand, the increases in non-residential structures and equipment and inventories made a fairly small contribution, although the level of these stocks is still substantially higher on a per person employed basis than in any of the European countries. Among the European countries, Germany had the largest increase in employment and was the only country with a greater contribution from this source than the United States. The contribution of education to growth was smaller for each European country than in the United States, although the difference was not large for Belgium and Italy. The contribution of a large increase in inventories and non-residential structures and equipment was particularly important for Germany, but it was also important in Denmark, France, the Netherlands and Norway.

The increases in output per unit of input are important in all of the European countries, with the range varying from about 1.2 in the United Kingdom to 4.5 in Germany in the contribution to the growth rate of total national income. The improved allocation of resources from the shift of resources out of agriculture and non-agricultural self-employment is particularly marked, reflecting the higher incomes in alternative activities and the extent of the shift out of agriculture over this period. This is only small in the United Kingdom, where the incomes in agriculture are fairly close to incomes elsewhere and the agriculture employment was already small by 1950 in relation to total employment. The shifts out of agriculture are particularly marked in Italy, Germany, France and Norway. The growth in national markets (measured in U.S. prices) is quite important for all the European countries, except the United Kingdom.

The item "economies of scale, income elasticities" warrants special comment. This factor reflects two important considerations. One is a reflection of the index number problem. As the differences in real income per worker between Europe and North America have narrowed, the European expenditures have increased sharply on products with high relative prices in Europe as compared with the United States. For example, the increases in expenditure have been much more marked on cars and consumer durables than on food and clothing. The European expenditures show a smaller increase when U.S. weights are used than with European weights, reflecting the traditional index number problem in a more acute form than is usually experienced in comparisons over time for a single country.¹⁰ In addition to this important statistical point, there is a further economic consideration as well. With the rapid increase in consumption for

10. See the references in footnotes 7-8 for a background discussion of this point.

SOURCES OF GROWTH OF TOTAL NATIONAL INCOME 1950-1962

SELECTED COUNTRIES¹

(Contribution to growth rate in percentage points)

| Sources of growth | Belgium | Denmark | France | Germany | Nether-lands | Norway | United Kingdom | Italy | North-west Europe ² | U.S.A. |
|--|---------|---------|--------|---------|--------------|--------|----------------|-------|--------------------------------|--------|
| National income | 3.20 | 3.51 | 4.92 | 7.26 | 4.73 | 3.45 | 2.29 | 5.96 | 4.78 | 3.32 |
| Total factor input | 1.17 | 1.55 | 1.24 | 2.78 | 1.91 | 1.04 | 1.11 | 1.66 | 1.69 | 1.95 |
| Labour | .76 | .59 | .45 | 1.37 | .87 | .15 | .60 | .96 | .83 | 1.12 |
| Employment | .40 | .70 | .08 | 1.49 | .78 | .13 | .50 | .42 | .71 | .90 |
| Hours of work | -.15 | -.18 | -.02 | -.27 | -.16 | -.15 | -.15 | .05 | -.14 | -.17 |
| Age-sex composition | .08 | -.07 | .10 | .04 | .01 | -.07 | -.04 | .09 | .03 | -.10 |
| Education | .43 | .14 | .29 | .11 | .24 | .24 | .29 | .40 | .23 | .49 |
| Capital | .41 | .96 | .79 | 1.41 | 1.04 | .89 | .51 | .70 | .86 | .83 |
| Dwellings | .02 | .13 | .02 | .14 | .06 | .04 | .04 | .07 | .07 | .25 |
| International assets | -.06 | .02 | .02 | -.08 | .10 | -.07 | -.05 | -.03 | -.03 | .05 |
| Non-residential structures & equipment | .39 | .66 | .56 | 1.02 | .66 | .79 | .43 | .54 | .64 | .43 |
| Inventories | .06 | .15 | .19 | .33 | .22 | .13 | .09 | .12 | .18 | .10 |
| Land | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| Output per unit of input | 2.03 | 1.96 | 3.68 | 4.48 | 2.82 | 2.41 | 1.18 | 4.30 | 3.07 | 1.37 |

| Sources of Growth | Belgium | Denmark | France | Germany | Nether-lands | Norway | United Kingdom | Italy | North-west ¹ Europe | U.S.A. |
|--|---------|---------|--------|---------|--------------|--------|----------------|-------|--------------------------------|--------|
| Advances of knowledge | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 | .76 |
| Changes in the lag in the application of knowledge, general efficiency, & errors & omissions | | | | | | | | | | |
| Reduction in age of capital | .00 | .04 | .00 | .04 | .00 | .04 | .00 | .00 | .02 | — |
| Other | .08 | -.32 | .75 | .80 | .44 | .14 | .03 | .89 | .54 | — |
| Improved allocation of resources | | | | | | | | | | |
| Contraction of agricultural inputs | .20 | .41 | .65 | .77 | .21 | .54 | .06 | 1.04 | .46 | .25 |
| Contraction of non-agricultural self-employment | .15 | .18 | .23 | .14 | .26 | .23 | .04 | .22 | .14 | .04 |
| Reduction of international trade barriers | .16 | .09 | .07 | .10 | .16 | .15 | .02 | .16 | .08 | .00 |
| Balancing of the capital stock | — | — | — | .26 | — | — | — | — | .08 | — |
| Deflation procedures | .17 | — | .23 | — | — | — | — | — | .07 | — |
| Economies of scale | | | | | | | | | | |
| Growth of national market measured in U.S. prices | .33 | .35 | .44 | .63 | .48 | .38 | .22 | .55 | .41 | .30 |
| Income elasticities | .11 | .23 | .49 | .91 | .23 | .12 | .09 | .60 | .46 | — |
| Independent growth of the local markets | .07 | .07 | .07 | .07 | .07 | .07 | .05 | .07 | .06 | .06 |
| Irregularities in pressure of demand | — | .22 | — | — | .19 | — | -.09 | — | -.01 | -.04 |
| Irregularities in agricultural output | — | -.07 | -.01 | — | .02 | -.02 | — | .01 | .00 | — |

¹Dennison and Poullier, *op. cit.* Tables (21-1) — (21-19), pp. 298-316.

²The European countries — except Italy.

these items with a high income elasticity, there is increased scope for economies in production, associated with increased size of plants and firms and scope for specialization. More individual European establishments begin to approach U.S. production runs. This item contributes almost .5 percentage points of the difference, one of the most important single enumerated factors in the table.

Denison summarizes these results as follows:

My general conclusion thus far is that the ranking of countries with respect to growth rates in the 1950–62 period as a whole was determined by changes in inputs, gains from resource reallocation, some catching up of technique or other unisolated source in France and possibly Italy, and recovery from war distortions in the early post-war years in Germany and Italy.

The size of the differentials among countries in growth rates was, however, widened by economies of scale. To some extent this was simply because gains from economies of scale depend on the rate at which the size of markets increase, so that the more national income rises for other reasons the greater are gains from scale economies. . . . The reasons that European growth rates were higher in the post-war period must be sought primarily in differences in initial conditions.¹¹

Some of the factors that turn out to be quantitatively small are quite important to draw attention to. Denison suggests that there is no difference in the advance of knowledge and suggests that the productivity and management committees did little to narrow the differences with the United States, except perhaps in France (see pp. 279–289 of the relevant chapter). The reduction in international trade barriers is also regarded as of minor importance (see later discussion). Variations in demand pressure have only a minor effect from 1950 to 1962, but are more important for some of the subperiods in the United States, Denmark, the Netherlands and the United Kingdom.

The net results of separating all the individual sources of growth is a residual covering errors and omissions and changes in the lag of application of knowledge and general efficiency. One test of the procedures used is their ability to explain differences in the growth rates between countries. Eighteen growth rates were studied (nine countries for two periods), with the rates ranging from 1.58 to 9.93 per cent, with a standard deviation of 1.90 percentage points. The book notes

The sources whose contributions were independently estimated in this study accounted for nine-tenths of this amount; the standard deviation of the residuals was only 0.18. . . . Thus the general methodology followed in my American study, adopted as necessary to take account of European conditions, can successfully cope with the wide range of experience observed in these nine countries.¹²

Denison also compares the relative importance of the individual factors contributing to the differences in level with the differences in growth rate from 1955 to 1962 (see Table 21–30 and the related text from pages 335 to 342). This discussion is important as it throws light on the extent to which some of the factors contributing to a narrowing in real income over this short period

11. E. F. Denison, "Sources of Postwar Growth in Nine Western Countries," *American Economic Review*, May 1967, p. 330 and 332.

12. Denison and Poullier, *op. cit.*, p. 330.

could persist for an extended period (such as a decade or two). The shifts of resources out of low-income activities (agriculture and self-employment) over this period are out of all proportion to their importance in differences in income level, although large shifts could continue for a decade or two in some European countries. Europe as a whole, and most of the countries individually, increased its stock of business capital facilities per worker more rapidly than in the United States, and this was more important in the differences in growth rate than in differences in income levels. On the other hand, the level of education of the American labour force was higher than in Northwest Europe in 1960 and education levels were increasing more rapidly.

The difference between the education of the labor force of the United States and that of Northwest Europe is not enormous. But to close the gap in a period measured by less than generations would be extraordinarily difficult because the present tendency is for the gap to widen rather than narrow, and because the education that an individual receives in his youth usually determines his educational background for nearly half a century of labor force participation.¹³

For further discussion of the probability of a continued widening in educational levels between Europe and the United States, see pp. 107 and 108. These pages note that "in the absence of a major change in education provided young people, Germany is heading toward a position in which its labor force will have the least full-time education of any of the countries covered except Italy, and eventually little if any more than Italy."¹⁴ He also notes that:

Residual productivity—the productivity difference not due to sources separately estimated—and errors and omissions accounted for over half the 1960 difference between the United States and Northwest Europe in adjusted national income per person employed. . . .

In sharp contrast to the dominance of residual productivity in determining differences from the United States in income levels, [only France and Italy appear] to have gained appreciably, [or] held any important advantage over the United States, in growth from this source from 1955 to 1962. . . .

My inability to decompose residual productivity or analyze it satisfactorily is surely the greatest gap in the present study. Any projection of future European growth must be critically affected by the investigator's judgment as to whether this productivity gap will be reduced in the future and, if so, how much and how fast.¹⁵

AN APPRAISAL OF THE CONTRIBUTION

The previous pages have summarized some of the highlights of a major analytical and statistical study that took many years of work, based on long experience in the measurement and analysis of growth in the United States. At this stage, a preliminary appraisal of the contribution may be useful, primarily to put this study into perspective of previous and current work in this field.

The first point to be emphasized is the monumental magnitude of the contribution. It summarizes the major post-war developments in the United States

13. *Ibid.*, p. 338.

14. *Ibid.*, pp. 107–108.

15. *Ibid.*, pp. 339–340.

and eight Western European countries, using the available statistics and developing some important new aggregative measures in a comprehensive analytical framework. Without doubt this study has examined more growth determinants than any previous international comparison. The individual series of data are useful summaries of descriptive statistics for the individual countries. Their value is enhanced by being put in a broader analytical framework that permits the individual factors to be compared on a quantitative basis within and between countries. No matter how much criticism and controversy emerges about the analysis, conclusions and implications of individual topics, or the study as a whole, it will be a long time before another study of comparable breadth and depth emerges. Future work on post-war growth in the major industrial countries will have to study this volume carefully and take its implications and conclusions into account.

A second point to be noted is the flexibility and adaptability of the approach developed initially in *The Sources of Economic Growth*. The current volume grew out of a desire to see if the methods and results of the earlier study were consistent with European experience for the post-war period. It has not been limited, however, to comparisons over time, but has also used the same framework for comparisons between countries at a point in time. This is a useful illustration of the adaptability of the method. This lays the basis for some of the most interesting and illuminating parts of the book in Chapter 21. This covers the comparisons between the differences in growth rate and income levels, and the comparisons of the European economy of the 1960's and the U.S. economy in the late 1920's.

Thirdly, it should be noted that Denison in this volume meets many of the criticisms that were made of the earlier study *The Sources of Economic Growth*. These discussions do not intrude on the flow of the exposition, but are drawn into the text and the footnotes in the appropriate places in a restrained and reasoned way. This can be seen in the exposition of the use of income shares as weights, the question of quality change in price and volume measures, the discussion of the stock of capital concepts, the role of education and other factors in income size distribution, etc. My own view is that the discussion of this book will shift the area of controversy from the methodological area, towards the substance of the empirical results. This could be important for medium-term projections and policy analysis for individual countries and international agencies.

IMPORTANT SHIFTS IN EMPHASIS

The facts about the large differences in real income between North America and Europe and the more rapid growth on a per-worker basis in Europe than North America have been fairly widely available, and have been discussed in a number of books, articles, international meetings, and campaign speeches. However, none of the earlier studies has been as comprehensive, and many have really only treated one or two factors in the differing experience and explicitly or implicitly treated them as crucial in the explanation. A number of these factors turn out to be quantitatively unimportant, and a number of other factors

are of quite crucial importance. These results will inevitably lead to some re-examination and reappraisal, and a fair amount of discussion of these points seems inevitable over the balance of the decade. At this stage, it may be helpful to point out a number of areas that are likely to get further discussion, because the results differ appreciably from earlier work and thought.

1. *The appraisal of U.S. growth*: One important area is the appraisal of U.S. growth itself, which was quite low on a per capita basis in the late 1950's and early 1960's. Although Denison's evidence allows a depressing influence of slack demand on U.S. growth rates in that period, and the effect of a somewhat lower rate of increase in capital stock per worker in the United States, these are quantitatively small in explaining the difference in growth rate. The concluding section of Chapter 21 is "An Epilogue for American Readers" (pp. 342-345). Two paragraphs from this are worth quoting:

The conclusion, I believe, is clear. Although most of the European countries have achieved higher growth rates than the United States, this was not because they were doing more to obtain growth. They were able to secure higher growth rates only because they were operating in a different environment. Conditions were very different with respect to factor proportions; to misallocation of resources; to the existing level of technology, management, and general efficiency in the use of resources; and to economies of scale. Some have supposed that the United States could have matched the growth rates of European countries if only Americans had done as the Europeans did. I conclude that this is simply not so.

Comparisons with the post-war growth rates of European countries, therefore, do not provide grounds for dissatisfaction with the American growth record. The point needs stressing because the conditions that enabled Europe to obtain higher growth rates are not exhausted. Aside from short-term aberrations Europe should be able to report higher growth rates, at least in national income per person employed, for a long time. Americans should expect this and not be disturbed by it. Nothing in this analysis suggests that the conditions making for higher European growth would continue to operate if the European countries were to reach American levels of national income per person employed.¹⁶

2. *Role of demand variations*: The volume is primarily concerned with the amount of incomparability between the selected years with respect to the effect of demand pressure on output per unit of input, but the results raise questions about the emphasis on demand in other studies of growth. The variations in demand have been more marked in the United States than in any of the European countries over this period, but these effects do not play a marked role in the differences in growth rates. The results reflect the moderate nature of the cyclical variations in demand in the United States by historical standards, the high rate of growth in potential supply, and the small influence demand differences make when the cyclical differences in terminal years many years apart are so small. Even with the marked strengthening in demand from 1962 to 1966, the main contrasts between European and North American growth of the earlier period persist, with the differences being only marginally reduced.

3. *The contribution of investment and capital*: A number of earlier studies have used the data on the growing share of investment to GNP in Europe and the

16. *Ibid.*, p. 344.

higher investment share in the late 1950's and early 1960's as evidence of the greater importance of capital as a growth factor. Denison throws much new light on this question. For one thing, he criticizes the use of investment data and incremental capital to output measures, pointing out the differences that can emerge from such indirect measures and the more appropriate measures of capital stock. He also points out that the line of causation might more appropriately go from final demand to investment (via a capital stock adjustment model) than from investment to the supply side. Furthermore, the European prices of capital goods are so much more expensive than in the United States (relative to the general price level) that the investment shares in European prices are overstated, compared to the use of U.S. prices. The growth in capital stock per worker has been more rapid in Northwest Europe than in the United States, but this contributes only about .21 percentage points to the differences in growth of national income from 1950 to 1962.

4. *Inter-industry shifts*: In earlier work, Kendrick and Denison found the influence of inter-industry shifts on longer-term growth rates in the United States to be small. Subsequent work on Europe by the United Nations and for Canada by Harvey Lithwick and the Economic Council indicated greater scope for such shifts in these countries, especially shifts out of agriculture. This study by Denison also finds this factor of greater importance in a number of European countries, and contributes appreciably to the higher post-war growth there.

5. *Reduction in international trade barriers*: Denison suggests a relatively small influence of tariffs on national income per person, drawing on earlier discussion by Scitovsky, Balassa, Harry Johnson and E. A. G. Robinson. He also uses European work on average tariff rates, based on nominal tariffs. Although this is an area in which new work is under way, it might be noted that later work on effective tariff rates suggests that the effects of tariffs on resource allocation might be much larger than suggested by earlier work. Furthermore, the more moderate price increases in export and import price indexes and the striking increase in intra-European trade may arise from increased specialization within individual manufacturing establishments within Europe, accelerated by the reduction of tariff barriers, especially within the Common Market. It is, of course, difficult to isolate this change from other influences such as the increase in business capital and the growth of markets, but it seems likely to this writer that tariff barriers and their reduction play a larger role than is allowed for in Denison's estimates.

6. *Advances in knowledge*: This includes technological knowledge (knowledge concerning the physical properties of things, and of how to make, or combine, or use them in a physical sense) and managerial knowledge (techniques of management and business organization). Such advances in knowledge spread quickly to all advanced countries, although important differences between the best practice and the average practice are present. Although Denison recognizes the difficulty in appraising this area, he ends up stating that "the contribution made by advances in knowledge to growth is assumed to have been the same in the European countries as it was in the United States".¹⁷ This assumption will

17. *Ibid.*, p. 286.

probably create some discussion, but it will be difficult to obtain evidence with which to modify this working assumption one way or the other.

7. *Comparability of data*: In using the data on national product in constant prices, the volume draws attention to two areas. Belgium and France use rather different assumptions about productivity change in government and construction respectively, and an allowance for these differences in deflation procedures is made.¹⁸ In Chapter 17, a further feature is introduced dealing with the effects of measuring European growth with U.S. price weights.¹⁹ As the table included earlier indicates, this amounts to .46 for Northwest Europe, and is .49 for France, .60 for Italy and .91 for Germany. These are very significant differences, and this suggests that more attention should be given to this point in inter-country comparisons of growth.

It might be noted that Denison has limited his study in several directions. For one thing, he has not tried to develop the policy implications of his study to any extent, although there are incidental remarks about individual countries or groups of countries scattered through the book. Policy discussions of growth would inevitably be clarified and strengthened by careful study of this book.

Cet article résume d'abord quelques-uns des points saillants de l'ouvrage *Why Growth Rates Differ*, y compris l'emploi des parts respectives du revenu national comme coefficients de pondération des divers facteurs de production ainsi que certaines des principales conclusions concrètes tirées des comparaisons entre pays. L'article passe ensuite en revue quelques-uns des principaux facteurs en cause dans les écarts de revenu et de taux de croissance.

Dans son appréciation de l'importance pratique de cet ouvrage, l'auteur de l'article insiste sur l'immensité de la tâche accomplie. L'étude signale le degré d'adaptabilité de la méthode, originellement mise au point par Denison dans son ouvrage *The Sources of Economic Growth*. Le volume fournit la réponse à diverses questions et critiques formulées à l'égard de l'étude précédente de Denison et devrait contribuer à faire évoluer les discussions, de façon à les concentrer moins sur la méthode et davantage sur la substance des résultats empiriques.

Le volume déplace quelque peu l'accent quant à l'importance des divers facteurs de croissance. Denison tient compte du rôle des variations de la demande et de l'apport des capitaux, mais, dans les preuves présentées, l'importance de ces facteurs est moins accentuée que dans certains ouvrages antérieurs d'autres économistes américains ou européens. L'auteur accorde une certaine attention aux déplacements de la main-d'œuvre hors de l'agriculture et des entreprises autonomes dans plusieurs pays européens au cours de la forte croissance d'après-guerre. Il tient compte des répercussions de la réduction des entraves douanières et, comme la plupart des économistes, tend à leur accorder une importance assez négligeable. Il tient compte également des progrès des connaissances.

Ceux qu'intéressent les questions de croissance économique, tant passée que future, et la politique économique dans ce domaine trouveront dans le volume de Denison ample matière à étude et à réflexion.

18. *Ibid.*, p. 27.

19. *Ibid.*, pp. 235-251. The reasoning is based on the differences in weights between U.S. and the individual European countries, the differing rates of growth between them, and the high demand elasticities for certain products in the European countries.