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Edward Denison's, Why Growth Rates Differ:
A Review Article

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Introduction:

In recent years, professional economists and politicians have focused attention on the comparative economic performance of the United States and Western Europe in the post World War II era. The general observation has been that Western Europe as a whole and most of the individual Western European economies have achieved higher rates of economic growth than the United States, especially higher growth in output per employee. Over the years, a number of investigations have attempted to describe and analyze this phenomenon. Interestingly, the focus of such studies has shifted rather markedly in the postwar period. Some studies prepared in earlier postwar years reflected, and were understandably influenced by, the legacy of the depression of the immediate pre-World War II years as well as by the magnitude of the pressing tasks of European reconstruction. On both these counts such studies seemed predisposed to rather gloomy views of future growth prospects, and they leaned to interpretations of Europe's growth in terms of long-run tendencies toward stagnation.^{1/} This point of view seems largely to have been abandoned in the studies of growth prompted by Europe's subsequent highly satisfactory economic performance.

^{1/} Economic Commission for Europe, Economic Survey of Europe Since the War, (Geneva), 1953; Ingvar Svernilson, Growth and Stagnation in the European Economy, (Geneva), 1954.

Several comprehensive studies dealing with the comparative economic performance in the West during the 1950's appeared several years ago,^{2/} four studies have been published within the past year,^{3/} and other investigations are currently in progress.^{4/} This review will concentrate on one of these works--Edward Denison's Why Growth Rates Differ--with passing references, where pertinent, to some of the other recent studies of growth.

Denison's book is an extension of his previous work, The Sources of Economic Growth in the United States and the Alternatives Before Us, issued in 1962 under the auspices of the Committee for Economic Development. In the present volume, Denison refines the methodology previously used in identifying and quantifying sources of economic growth, and he applies the method to eight West European economies--Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway and the United Kingdom. The product is a detailed statistical study (supported by fifteen appendices describing the derivation and use of data), enabling one

^{2/} J. W. Dewhurst et al, Europe's Needs and Resources (New York: Twentieth Century Fund), 1961; Angus Maddison, Economic Growth in the West (New York: Twentieth Century Fund), 1964; and Economic Commission for Europe, Economic Survey of Europe in 1961--Part 2--Some Factors in Economic Growth in Europe During the 1950's (Geneva), 1964.

^{3/} Edward F. Denison, Why Growth Rates Differ (Washington: The Brookings Institution), 1967; Charles P. Kindleberger, Europe's Postwar Growth (Cambridge, Mass.: Harvard University Press), 1967; Michael M. Postan, Economic History of Western Europe 1945-1964 (New York: Barnes and Noble), 1967; and Organization for Economic Cooperation and Development, Economic Growth 1960-1970 (Paris), 1966.

^{4/} The Economic Council of Canada is conducting an investigation in identifying the sources of Canadian economic growth. Preliminary results of this investigation were presented at the August 1967 meeting of the International Association for Research in Income and Wealth. In the United States, the Social Science Research Council is in the midst of a study, directed by Simon Kuznets and Moses Abramovitz, analyzing comparative economic growth of the United States, France, Germany, United Kingdom, Italy, Sweden and Japan.

to compare the sources of economic growth--both for national income and national income per person employed--of nine industrialized economies (the United States is added) for the 1950-1962 period and two sub-periods, 1950-1955 and 1955-1962. Whereas in his earlier study of U.S. growth Denison also attempted to project the likely contribution of various growth sources in the future and to assess alternative policies that might be pursued to increase the growth rate, Denison confines himself in the book under review mainly to a description and quantification of the sources of past economic growth, touching only occasionally on probable future growth trends in the nine countries. In addition, as a by-product of his data gathering and classification system, Denison presents a statistical survey and explanation of the relative ranking of the level of national income per person employed in the United States and West European economies in 1960.

The theoretical underpinning of Denison's work is simple. He attributes economic growth to changes in the quantity of factors in use, and to changes in output per unit of input. He divides these two broad categories into sub-classes and some of these, in turn, into smaller components. He itemizes no fewer than twenty-three "sources" of growth,^{5/} and attempts to allocate the total growth rate for

^{5/} A listing of the labels of the 23 sources of economic growth may give the reader an indication of the detail which went into the study. Within the broad category of total factor input Denison includes labor--sub-divided into (1) employment, (2) hours of work, (3) age-sex composition, and (4) education; and capital--subdivided into (5) dwellings, (6) international assets, (7) non-residential structures and equipment, (8) inventories; and (9) land. Among the factors accounting for changes in output per unit of input Denison includes allocation of resources--subdivided into (10) contraction of agricultural inputs, (11) contraction of nonagricultural self-employment, and (12) reduction of international trade barriers; and economies of scale--subdivided into (13) growth of national markets, (14) income elasticities, and (15) independent growth of local markets, (16) irregularities in pressure of demand, (17) irregularities in agricultural output, (18) balancing of capital stock, (19) deflation procedure for "government," (20) deflation procedure for "construction;" and, finally, "residuals"--subdivided into (21) advances of knowledge, (22) reduction in age of capital and (23) "other." Some of the minor sources are applicable to only one or a few countries, but for each country Denison allocates the total growth rate to most of these sources.

each of the nine countries--both for national income and national income per person employed--to their component parts.

The Denison findings

Tables 1 and 2 summarize Denison's findings for growth rates of national income and of his two broad categories, factor input and productivity. For 1950-1962 and the two sub-periods, the United States and the United Kingdom growth rates were among the lowest of the nine countries. In contrast to the European experience (with the exception of Denmark in 1950-1955), the contribution to economic growth for the United States from changes in total factor inputs outweighed the contribution to growth from changes in productivity. (See Table 2.) In 1950-1962 (with the exception of Germany), the United States derived more economic growth from factor input increases than European countries, which (with the exception of the United Kingdom) exceeded the United States in productivity gains by a very wide margin. (See Table 1.) In view of the considerable interest in the comparative growth record of output per unit of input, the following ranking of countries in descending order highlights the relative low standing of the United States and United Kingdom in this important determinant of growth.

<u>Country</u>	<u>Growth and Rates of Output Per Unit of Input, 1950-1962</u> (compound annual percentage rates)
Germany	4.48
Italy	4.29
France	2.61
Norway	2.43
Belgium	1.86
Denmark	1.81
United States	1.41
United Kingdom	1.27

Source: From Table 1.

Table 1. Economic Growth Rates: National Income, Factor Input, and Input Productivity,
Selected Periods and Countries/
(compound annual percentage rates)

Sources of Growth	United States	Germany	Italy	France	Netherlands	Norway	Denmark	Belgium	United Kingdom
<u>1950-1962</u>									
National Income ^{b/}	3.36	7.26	5.95	4.70	4.52	3.47	3.36	3.03	2.38
Total factor input	1.95	2.78	1.66	1.24	1.91	1.04	1.15	1.17	1.11
Output per unit of input	1.41	4.48	4.29	3.46	2.61	2.43	1.81	1.86	1.27
<u>1950-1955</u>									
National Income ^{b/}	3.84	9.93	6.19	4.55	5.47	3.90	2.11	3.16	2.16
Total factor input	2.30	3.19	1.92	1.17	2.33	1.55	1.38	1.33	1.05
Output per unit of input	1.54	6.74	4.27	3.38	3.14	2.35	.75	1.83	1.11
<u>1955-1962</u>									
National Income ^{b/}	3.01	5.39	5.78	4.82	3.84	3.67	4.29	2.95	2.56
Total factor input	1.70	2.51	1.48	1.28	1.62	.69	1.67	1.06	1.15
Output per unit of input	1.31	2.88	4.30	3.54	2.22	2.46	2.62	1.89	1.41

a/ European countries in column headings are listed in descending order of their growth rates in 1950-1962.

b/ The underlying data are for "adjusted national income" expressed in constant prices. To improve international comparability and eliminate random and part of cyclical influences on actual national income changes, Denison deducts four (minor) contributory sources of growth--(16), (17), (19) and (20) cited in footnote 5 in text--from the actual growth rate of measured national income. The resulting growth rate he labels "growth rate of adjusted national income."

Source: Edward F. Denison, Why Growth Rates Differ, Tables 21-1, 21-5, 21-7, 21-9, 21-11, 21-13, 21-15, 21-17 and 21-19.

Table 2. Economic Growth Rates: National Income, Factor Input, and Input Productivity,
Selected Periods and Countries
(percentage shares)

<u>Sources of Growth</u>	<u>United States</u>	<u>Germany</u>	<u>Italy</u>	<u>France</u>	<u>Netherlands</u>	<u>Norway</u>	<u>Denmark</u>	<u>Belgium</u>	<u>United Kingdom</u>
<u>1950-1962</u>									
National Income	100	100	100	100	100	100	100	100	100
Total factor input	58	38	28	26	42	30	46	39	47
Output per unit of input	42	62	72	74	58	70	54	61	53
<u>1950-1955</u>									
National Income	100	100	100	100	100	100	100	100	100
Total factor input	60	32	31	26	43	40	65	42	49
Output per unit of input	40	68	69	74	57	60	35	58	51
<u>1955-1962</u>									
National Income	100	100	100	100	100	100	100	100	100
Total factor input	56	47	26	27	42	22	39	36	45
Output per unit of input	44	53	74	73	58	78	61	64	55

Source: Derived from Table 1.

Denison attributes the small share of economic growth in the United States and the United Kingdom obtained from changes in productivity, compared to the much higher benefits from this source for other European countries, to the opportunities available to the European countries in deriving growth by reallocating resources--particularly a contraction of agricultural inputs--and by exploiting possibilities for economies of scale. Denison maintains that Continental Europe's higher overall growth rates were due not to greater efforts to obtain growth but rather to the influence of a different environment. In Denison's view, Continental Europe grew more rapidly primarily because it was eliminating a misallocation of resources--primarily, an overallocation of resources in the agricultural sector--which the United States and the United Kingdom had removed previously. Denison also suggests that the conditions which enabled Continental Europe to attain higher growth rates are not yet exhausted, and he visualizes continued higher growth rates for European economies compared to the United States and the United Kingdom, though he expects the differential to narrow.^{6/} Finally, Denison offers the sound observation that the proper yardstick for evaluating economic performance is to contrast a country's achievements with its possibilities, rather than in comparing the economic performance of countries having different conditions for securing economic growth.

^{6/} Kindleberger (op.cit.), on the other hand, suggests that the growth rate achieved in recent years in Europe is really "super growth" shaped by the availability of a large supply of labor. With the exhaustion of Europe's "excess" labor supply, the high growth rates are slowing down; and he sees Europe entering a period of more "normal" growth similar to the growth the United States is likely to attain.

Denison's study suggests several observations. First, Denison's findings seem to confirm an earlier finding of the study by the Economic Commission for Europe^{7/} that, contrary to a conventional and widely held notion, the principal determinant of economic growth is not a high rate of capital formation.^{8/} Only a small part of each country's growth rate is directly attributable to increases in the capital stock. More significantly, if capital formation is a primary source of economic growth, differences in growth rates among countries should also be reflected in differences in capital formation. Denison's study rejects this hypothesis. The contribution of capital to growth for Europe and the United States, as measured by Denison's procedures, is alleged to explain only a very small part of the differences in growth rates, and for several countries which had a higher growth rate than the U.S., the direct contribution of capital to their growth is less than for the United States.

The Denison findings also fail to support the popular assumption that the formation of the European Economic Community, by reducing barriers to international trade, has resulted in higher growth rates in Common Market countries than in non-member countries, especially the United Kingdom and the United States. Denison finds that only a minute part of growth in the Common Market countries is attributable to the reduction of international trade barriers.

^{7/} Cf. footnote 2, Chapter 2. Kindleberger, op.cit., pp. 128-131, sides with this position.

^{8/} Maddison, op.cit., Chapter III. Much of the literature dealing with the growth of the less developed economies also places a heavy emphasis on the role of capital formation.

The Denison study clearly reveals the relatively poor performance of the United Kingdom, which had the lowest growth rate of the countries studied. The proportionate contribution to U.K. growth of most of Denison's sources of growth is smaller than for the Continental European economies and for the United States. The discussion suggests that a major part of the weak United Kingdom showing is due to its limited and inelastic factor supply. However, a significant share of the inferior growth record is also attributable to the failure of the U.K. to exploit its potential.

Finally, Denison makes the point that no single source explains a country's economic growth. Moreover, the various elements contributing to a nation's economic growth vary significantly from period to period and from place to place.

Evaluation of the Denison study

Although Denison's work is a meticulous empirical investigation, carefully presented and qualified at every step, it is open to criticism on a number of points. This criticism should not be taken to question the accuracy of the data, but rather Denison's methodology and the inferences drawn from it.

1. Denison's procedure of attributing growth to changes in resource use and changes in productivity does not really answer the question which the title of the book raises. Denison allocates bits of the total growth rate to over twenty sources, but he does not explain why the various sources changed as they did. He appears to be aware of this problem by stating that his classification scheme "leaves no room

for . . . [identifying the] more ultimate influences on growth." (P. 315, emphasis added.) In his introductory chapter, Denison states that his "study does not seek to decide whether indicative planning in France or its absence in Germany was more conducive to growth, to establish the effect on the growth rate of maintaining a stronger or weaker pressure of demand or of one exchange rate rather than another, to study the consequences of changes in the tax structure, or to examine the effects of the British 'stop-go' cycle that originates in balance of payments crises." He argues that if such events affect growth rates they "must do so by influencing the quantity or quality of one or more of the inputs, their allocation, or the efficiency with which they are used." (Pp. 10-11.)

This is somewhat circular reasoning, and evades the problem of identifying the ultimate determinants of economic growth. Denison's method bypasses the more interesting questions concerning growth and does not really analyze the process of economic growth nor the initiating forces leading to growth. The role of economic policy in affecting a particular growth rate does not receive attention. Denison is of course correct in his view that physical factors place a limit on a country's growth potential. But economic policies presumably have significant effects on the pace of changes in factor inputs and increases in productivity. To explain growth partly in terms of specific policies is a difficult and complex task. But to ignore the influences of policy on the growth process is to omit a major element affecting growth.

2. Most of the European economies are more "open" than the United States. The international influences affecting their economic growth--balance of payments conditions, exchange rates, terms of trade, liquidity position, etc.--need emphasis in any discussion of the determinants of growth. The recurrent balance of payments crises in the United Kingdom, for example, have affected its growth performance by necessitating periodic stringent restrictions on domestic economic activity. These conditions and policies in the United Kingdom have almost certainly been reflected in smaller increases in inputs and smaller increases in output per unit of input compared with the increases that would have taken place if the balance of payments had not been a constraint (and compared with increases in other countries). However, to assert that slower factor input changes and productivity changes caused the slow growth in the United Kingdom--as is implied in the Denison study--is to look at the growth process entirely too mechanistically, and to fail to analyze adequately the originating and ultimate causes of growth.

3. Denison's approach also leads to some questionable inferences. For example, Denison considers "reduction of international trade barriers" to be a source of economic growth. His data yield a very small numerical value to this source of growth for all of the European economies. He concludes that the formation of the European Economic Community, which reduced barriers to international trade, therefore did not contribute very significantly to economic growth in the Common Market countries. This conclusion probably understates the contribution of the formation

of the Common Market to economic growth. The formation of the EEC contributed to the overall growth rate not only through the "reduction of international trade barriers," but also through many other influences stemming from its creation. Part of the growth contribution of the increased labor input should be assigned to the freer flow of labor made possible by the Common Market. Similarly, part of the contribution to economic growth from economies of scale is attributable to the Common Market's existence. The same critical point can be made with respect to Denison's analysis of some of the other sources of growth. It is a complicated assignment to allocate small parts of each growth source to an event such as the establishment of a Common Market, but solely allocating the most directly related source and ignoring the others will not yield an accurate assessment of the facts.

Denison's finding that a high rate of capital formation is not a primary source of economic growth is another illustration of the difficulty of applying his approach of allocating part of the total growth rate to a specific source. If technical progress is embodied in new capital stock, then a high rate of capital formation might be a necessary, although not sufficient condition for a high rate of productivity increase. Denison's implied assumption that one is able to separate the effects of productivity increases from the effects of capital formation is questionable.

4. Any attempt to identify causes of an event always raises the possibility of confusing cause and effect. It is thus possible that some factors which Denison regards as sources of growth are in reality

the effects of growth. For example, Denison considers that labor movements from agriculture to industry have been a major contributor to growth. It may be, however, that economic growth--originating from some other sources--induces such factor movements, so that growth itself turns out to be a source of growth. It may, therefore, be somewhat misleading to say that factor reallocation was the source of growth. Similar problems of identifying causality exist in regard to the other factors analyzed by Denison.

5. Denison's study concentrates on the supply determinants of growth and does not deal with the contribution of demand to growth. Without strong and stable sources of demand, either foreign or domestic, the availability of factor supplies or increases in productivity by themselves will not yield economic growth. What role did demand play in the postwar growth of Europe and the United States? Do the relative export performances of the various countries parallel their growth rate performances, and if so, does one cause the other? Denison's study neglects this aspect completely.^{9/} In reality, supply and demand factors interact and must be taken into account in formulating a theory which explains international differences in economic growth performance.

^{9/} Kindleberger, op.cit., who also concludes that supply factors are primary in explaining the economic growth record of Europe, does devote a chapter to the demand side. Maddison's study, op.cit., attributes a significant share of the growth rate to demand factors.

6. Denison gives great weight to that part of growth which is derived from increases in labor input, and from the reallocation of agricultural and self-employed nonagricultural labor to the industrial sector. Surprisingly, Denison's book contains hardly any discussion of the role of foreign labor (and refugee flows in West Germany) in Europe. Yet the contribution of foreign labor to Europe's growth record differs significantly in a number of respects from the contribution to growth from changes in the domestic labor supply. International labor migration affects the labor receiving and labor supplying countries differently. Also, the ability to utilize foreign labor partly as a cyclical safety valve makes this labor a separate group in its economic effect. Finally, the educational, skill and motivational aspects of foreign labor makes this group a distinct labor supply; foreign labor may therefore affect a country's growth rate differently from domestic labor. Some quantification and evaluation of foreign labor's contribution to the growth rate of various countries would have been useful.^{10/}

7. Finally, Denison's method of allocating the total growth rate to a number of elements is not entirely satisfactory. For many of the components Denison is able to arrive at a numerical value of its contribution to an economy's growth. For some of the sources of growth which are difficult to quantify precisely, Denison makes a number of simplifying assumptions and uses rule-of-thumb reasoning to arrive at

^{10/} Kindleberger, op.cit., devotes three chapters--Chapters VIII-X--to many of these issues.

what seem to be plausible estimates.^{11/} However, after adding all the sources for which he makes estimates, Denison is left with part of the total growth rate unaccounted for. He labels this segment of the growth rate the "residual," and considers that this "residual" picks up "the net error in the other estimates, as well as the net contribution of other sources for which no estimate was attempted." (P. 281.) In practice, however, Denison assigns most of the residual to a source of growth for which no estimate was attempted--"advances of knowledge"--and thereby minimizes the importance of the residual as a receptacle for error in his other estimates. The following tabulation shows that the "residual" as a percentage of the total growth rate for the 1950-1962 period is fairly high--for most of the countries, over 25 per cent of the total growth rate. Part of the residual certainly is attributable to "advances of knowledge." The remainder, however, needs to be allocated either to

<u>Country</u>	<u>"Residual" as a Percentage of the Total Growth Rate</u>
United Kingdom	33%
France	32
Belgium	28
Italy	28
Netherlands	27
Norway	27
United States	23
Germany	22
Denmark	13

^{11/} Denison is fully aware of the flimsiness of some of the data and the roughness of some of the estimates, and offers repeated warnings to the reader. Nevertheless, when the final quantified results appear in the statistical tables--attributing little bits of the total growth rate to one of the twenty-three sources--many readers will have forgotten the qualifications raised by Denison and will be left with an erroneous feeling of precision.

the other sources of growth or perhaps to a source of growth not identified in Denison's classification. The fact that the "residual" is so large leads one to suspect that Denison has not completely identified the growth variables.

Conclusions

Although the Denison study does not fully accomplish what one would expect from its suggestive title, one should not minimize the usefulness of the volume. Denison has compiled an illuminating set of statistics dealing with detailed aspects of nine industrialized countries' economies, and he has presented his data in a systematic and coherent form. Denison's valuable store of data could be the basis for further studies dealing with international comparisons of economic performance. But his method is statistical rather than analytic or econometric.^{12/} Many of the criticisms raised in this review deal with more analytic issues, and they deserve the attention of researchers in this field of study.

The published comparative economic growth studies merit the attention and thought of economists and policymakers. Collectively, these investigations offer a clearer view of the determinants of the growth process. Any future theory of growth for industrial economies will draw heavily on the findings of most of these studies. Denison's study is a valuable addition to the literature of this important area of economics.

^{12/} Surprisingly, Denison does not make use of advanced statistical methods. He does not "confirm" any of his conclusions by correlation or regression analysis. The Economic Commission for Europe study cited in footnote 2 makes extensive use of correlation analysis to "confirm" hypotheses.