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Differential Rates of Productivity Growth:
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DIFFERENTIAL RATES OF PRODUCTIVITY GROWTH: COMMENT

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In a stimulating paper published in the Quarterly Journal of Economics, J. M. Letiche has set forth and evaluated three hypotheses designed to explain long-term international payments imbalance. 1/ The present comment deals exclusively with Letiche's data and factual conclusions with respect to the first of these hypotheses, which involves the question of comparative trends in general productivity in different countries. On this question Letiche concludes that during the inter-war period, manufacturing productivity rose about as rapidly in continental western Europe as it did in the United States. There are reasons for strongly questioning this finding. The weight of evidence seems clearly to indicate a long-run tendency for U. S. productivity growth to outstrip that of western Europe, both in the inter-war period and also prior to World War I. The purpose of the present paper is to show the weaknesses in Letiche's case.

To contend that productivity grew more rapidly in the United States than in western Europe during these periods should not, however, be construed as implying agreement with those who have held that differential productivity growth has been the main cause of "long-term" international imbalance. This question is not considered in the present paper, which is concerned only with the portion of Letiche's treatment that deals with comparative trends in general productivity.

Whatever connection may exist between productivity trends and balance-of-payments problems, the former, like the latter, are important in themselves. In most countries of western Europe, significant efforts are being made to stimulate productivity growth, and such efforts now constitute one of the major activities of the OEEC (Organization for European Economic Cooperation). Conceptions as to comparative productivity trends in Europe and in North America, especially the United States, are likely to have a bearing on the scale and intensity of European efforts to increase European productivity. If, as there is reason to believe, U. S. productivity growth has normally exceeded that of western Europe in the past, it is of some importance that that fact not be obscured.

It has been said that "for at least 40 years (and perhaps much longer) the productivity of labor has been higher in the United States than anywhere else. During most of this period the American advantage has been steadily increasing." 2/ With reference to the latter point, and so far as the inter-war period is concerned, Letiche apparently believes this is not the case. His evidence will now be summarized and examined.

1/ J. M. Letiche, "Differential Rates of Productivity Growth and International Imbalance," Quarterly Journal of Economics, LXIX (August 1955), 371-401.

2/ Francis W. Dresch, Productivity in Manufacturing in the Postwar Period in Canada, Western Europe, and the United States (Stanford Research Institute, 1953), p. 1.

Evidence presented on comparative productivity growth

In Letiche's paper, the available evidence adduced on the question at issue is a set of figures purporting to be the compound annual rates of growth in productivity per man-hour in manufacturing, in nine countries each taken separately, from 1920 to 1938, as well as in selected intervals within that period. 1/ The figures given for the period as a whole are as follows:

Country	Compound Annual Growth Rate (%)
United States	3-1/2
United Kingdom	2-1/2
France	3
Germany	2-1/2
Netherlands	3-1/2
Sweden	3-1/2
Canada	2-3/4
Japan	3
Australia	2-1/4

In a relatively brief (one-paragraph) discussion of these figures, Letiche concludes that except for Britain, which "definitely lagged behind," "the compounded annual rate of growth in productivity per man-hour in manufacturing during the period 1920-1938 appears to have been about the same in the United States and in most industrial countries of western Europe . . . The compounded rate of growth in the United States, the Netherlands, and Sweden was 3.5 per cent; in France it was around 3 per cent. The figure of 2.5 per cent for Germany and 3 per cent for Japan is probably an underestimate; it omits large-scale military expenditures."

Aside from one paragraph commenting on some of the figures given for sub-intervals within the 1920-1938 interval, the paragraph referred to summarizes the entire substantive treatment of the question at issue.

Reasons for questioning both the evidence and the conclusion drawn from it

There are at least five grounds on which the figures given, and the construction put upon them, may be questioned.

1. Interpretation of the figures as given. Even if the figures are correct in all cases as given, they can be read to yield a quite different conclusion. Letiche's comment about the figure for France, that it is "around 3 per cent," taken in conjunction with the rest of his relatively brief discussion of his first hypothesis,

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1/ Letiche, loc. cit., p. 377.

seems to imply a belief that 3 per cent has approximately the same importance as, say, 3.5 per cent. With compound rates of growth, it is not a question of a rough order of magnitude; a seemingly small differential may be very significant. 1/ It is a striking fact that, according to Colin Clark's data, manufacturing productivity grew in the United States and in Great Britain from about 1870 to 1938 at annually-compounded rates of 2.4 and 2.0 per cent respectively -- rates that are not vastly different; yet, as a result, U. S. productivity grew from about twice that of Britain in 1870 to three times that of Britain in 1938. 2/

As to the figure of 2.5 for Germany, the meaning of the statement that it is probably an underestimate, as "it omits large-scale military expenditures," is not clear. The reference is obviously to the end year (1938) of the series used. Is it supposed to mean that military product for that year is excluded from the income-produced side of the productivity ratio, while the related labor is included on the input side? Or that both military product and related labor input are excluded, thereby introducing a downward bias because productivity in the non-military portion of industrial output is presumed to have been lower than in the military portion? While military expenditures may have been excluded in some way, the fact of their having been is not readily apparent from an examination of Letiche's sources.

It is submitted that what the table really says of significance is this: (a) the growth rate shown for the United States exceeds that shown for all other countries listed, with the exception of two countries, the Netherlands and Sweden, that are relatively small in terms of gross national product; (b) the compound rate of growth in manufacturing productivity over the period 1920-1938 was 3.5 per cent for the United States, while for the three dominant industrial powers of western Europe it was 3 per cent (France), 2.5 per cent (United Kingdom), and 2.5 per cent (Germany).

2. Applicability of the figures to the end-years indicated. There is some question as to whether certain of the figures given by Letiche for the period 1920-1938 do in fact cover that period. Letiche attributes his data to a variety of sources. In several cases, it is

1/ Any figure undergoing an annually-compounded rise of 3 per cent for twenty years will grow by 80 per cent by the end of the period, while if the rate of rise is 3.5 per cent per year, the base figure will practically double. Thus a compound rate of rise which is only one-sixth higher than another will yield, by the end of such a period, an increment in the end year which is one-fourth larger than that produced by the other. Over a forty-year period, the increase in productivity in a country in which productivity is rising by 3.5 per cent annually will be one-third larger than the increase in a country whose productivity is rising only 3 per cent annually, assuming that base-year productivity is the same in the two countries. Under the same assumption, the excess of increase in the more

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difficult to see how the data given could have been obtained from the sources indicated. If the data do not in all instances represent the entire period 1920-1938, their comparability may be significantly weakened. The following are the main instances in which the validity of the figures requires further demonstration.

(i) Letiche attributes his growth rate of 3 per cent for France to Colin Clark. 1/ It is not clear as to where in Clark one can find a relevant figure for 1920, necessary to the computation of a manufacturing productivity growth ratio for the period 1920-1938. The relevant table is found on page 271 of Clark, and it gives no data between 1865 and 1930 because, Clark says, no satisfactory employment figures are available for the intervening years. Using Clark's figures for 1930 and 1938, one computes a compound rate of growth in income produced per man-hour of manufacturing labor of 3.2 per cent; Letiche's table shows 3 per cent for 1920-1938, and as mentioned above, his text says the rate was "around 3 per cent." Did he in fact use 1930-1938 data to represent 1920-1938, or did he derive an estimate for 1920? If the latter, it would have been helpful if the basis of the estimate had been explained. In either case, there is a basis for questioning whether the compound growth rate was anything like 3 per cent for the period 1920-1938 as a whole; or, if it was, whether that rate was sufficiently normal to render international comparisons valid.

From data given by Fourastié, Clark "deduces" a productivity ratio for 1914 for France. Interpolating between this deduced figure and Clark's figure for 1930, to derive a crude estimate for 1920, and comparing the result to Clark's figure for 1938, the compound rate of growth indicated for the period 1920-1938 is 2.2 per cent. Because of disruption etc. in World War I, productivity probably declined in France during the war years, and straight-line interpolation between 1913 and 1930 may consequently overstate the real 1920 ratio. If one makes a compromise assumption that French manufacturing productivity neither rose nor fell during World War I, and takes Clark's estimate for 1913 as applicable to 1920, the compound rate of growth from 1920 to 1938 would be 2.7 per cent. If French industrial productivity was lower in 1920 than in 1914, the rate of rise from 1920 to 1938 must have been higher than 2.7 per cent; but in that case, a comparison with the United States figure is of doubtful validity. (See 3 below.) The presumably rough data and assumptions used to produce these alternative estimates may give results that are wide of the true mark; but at the very least they provide indications that can scarcely be ignored.

1/ (Continued from preceding page) rapidly advancing country will alone amount to 70 per cent of the base-year productivity figure in that country. Such differences are surely not negligible.

2/ (From preceding page) Colin Clark, The Conditions of Economic Progress (2d ed.; London: MacMillan and Co. Ltd., 1951). See Table B below, which is drawn from Clark.

1/ Colin Clark, op. cit.

(ii) In the case of Letiche's figures for Germany and the Netherlands, the same type of question may be raised: whether they do in fact pertain to the period 1920-1938. The data on Germany can not be computed from the source Letiche cites, 1/ and one is led to wonder whether Letiche has actually based his figures on Clark. If so, however, the question arises as to where in Clark it is possible to find industrial productivity ratios for Germany for the entire period 1920-1938. Clark himself says that full data on employment in German industry are available only for 1929 and subsequently, 2/ and he presents ratios of net income produced per man-hour in industry for the years 1929 through 1937 only. He does give linked estimates for 1925 through 1928, and for the year 1938, and a guess for 1913. Using Clark's data, the nearest it seems possible to come to Letiche's figure of 2.5 per cent for Germany is 2.2, for the period 1925-1937. Similarly for the Netherlands, the best figure obtainable from Clark's data seems to be 3.3 per cent for the period 1925-1936. In both cases, the best figure obtainable is roughly one-fourth of one per cent lower than what Letiche shows -- a not negligible difference when dealing with compound rates of growth -- and covers a period substantially shorter than the 18-year interval from 1920 to 1938.

It should be stressed that all that is being attempted at the moment is a verification of Letiche's results. They may be perfectly valid; but if so, he has not given sufficient information to enable anyone else to retrace his steps. The matter is of sufficient importance to require a rather full indication of sources and method.

3. Comparability of conditions in the period selected. The third reason for questioning the validity of Letiche's conclusions on comparative productivity growth has to do with the appropriateness of the period 1920-1938. In 1920, many countries were still in process of recovering from the effects of World War I. For present purposes this might not matter much if all the countries in the war had been similarly affected by it, but is it reasonable to assume that they were? If, for instance, the countries of western Europe had been disrupted more than, say, the United States and Canada (by greater loss of life as well as by damage to property, and disorganization), and their productivity had increased less during the war years, or declined more, than that of the latter two countries, it seems reasonable to conclude that at least part of the subsequent growth in their productivity could be artificial, representing merely a "catching up." This factor is responsible for an important part of the growth in continental European productivity since the end of World War II. 3/ If a somewhat

1/ Statistiches Jahrbuch für das Deutsche Reich, Internationaler Teil (Survey), p. 58.

2/ Clark, op.cit., p. 272.

3/ "The period considered /1938 to 1954/ was highly abnormal; productivity dropped considerably in many Member countries during the war and the pace of its subsequent recovery has been affected by factors

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similar situation existed in 1919-1920, as it probably did, 1/ the result would have been to give an upward bias to the productivity growth ratios of European countries measured from 1920 forward, in comparison with those computed for the United States and possibly also for Canada.

For reasons set forth above, Letiche's ratios for three countries (France, Germany, and the Netherlands) may not actually cover the period 1920-1938; and if they do not, they may not be biased in the manner now being suggested. In that event, however, the question must be posed as to what the showing would be if all the countries listed in his Table I were based on the same later year. For example, it was suggested above that the figure of 3 per cent for France may actually relate only to 1930-1938. If that is the case, it is interesting to note that on the basis of Clark's data, U. S. industrial productivity rose at a compound rate of 4.2 per cent from 1930 to 1938. During the same period, the figure for the U. K. was 2.3 per cent, while German industrial productivity rose negligibly. It is not suggested, however, that the comparability of 1930-1938 conditions is necessarily any better than for those of 1920-1938. What is suggested is that in the absence of demonstrated justification for following a different procedure, one must begin with data that are comparable as to the period of time covered, with subsequent consideration being given to the question of comparability of conditions.

3/ (Continued from preceding page) which will not recur in the future." Sixth Report of the OEEC, Volume I (Paris: Organization for European Economic Cooperation, March 1955), p. 65.

1/ Whatever war-caused dislocation may still have existed in the United States in 1920, it seems most improbable that it could have equaled that existing in Europe, especially on the Continent. In the latter part of 1919, Germany was described by a British official as "broken in body and spirit." (Bowden, Karpovitch, and Usher, An Economic History of Europe since 1750; New York: American Book Company, 1937, p. 709.) For France, the material results of the war have been summarized as follows: "the devastation of land, the destruction of buildings and equipment in the regions of the north which were occupied by the enemy; the loss in population; and the enormous growth in indebtedness which was accompanied by the forfeit of most of the French investments abroad. These ravages inevitably entailed other disastrous consequences such as currency disturbances, industrial stagnation and disorganized markets." (Ogburn and Jaffé, The Economic Development of Post-war France; New York: Columbia University Press, 1929, p. 19.) "While the decrease in the total number of inhabitants amounted to only 5.4 per cent, the drop in the number of males between 15 and 50 years of age in the same territory was more than twice as great (11 per cent). It was this category of the population which made up the very backbone of industry." (Ibid., p. 21.)

4. Results obtained by using a different period. It has been suggested above that the evidence presented by Letiche can reasonably be interpreted to yield the conclusion that the growth of aggregate manufacturing productivity in the United States did exceed that of practically all other countries in his comparison, for the period 1920-1938. Calculations relating to a somewhat longer period may now be cited to show the same picture even more sharply. Table A shows compound rates of growth in industrial productivity from (in most cases) 1913 to 1938, for seven of the nine countries listed by Letiche. 1/ The calculations are based upon Clark's data, which do not permit a similar computation for the other two countries, the Netherlands and Sweden (the two countries, unfortunately, that in Letiche's table had productivity growth rates as high as that of the United States).

The most striking fact in this table is that the highest rates of growth are shown by the two North American countries, the United States and Canada. In these two cases the rates shown seem significantly higher than that of any other country. The rate for Germany appears, at first glance, impossibly low; but before concluding that it is in fact too low, the following consideration should be noted. German productivity rose very rapidly from the 1880's to the outbreak of World War I, 2/ with the result, according to Clark's estimates, that by 1913 industrial productivity in Germany was already more than 50 per cent higher than that of Great Britain. As a result of the war and the later inflation, however, German productivity did not regain the 1913 level until 1926, 3/ whereas at about the same time (1927) U. K. productivity was more than 40 per cent higher than its 1913 level. 4/ From 1913 to 1926, therefore, Germany apparently failed to benefit from a "normal" growth in productivity. Hence the figure for Germany shown in Table A may be correct, or approximately so.

1/ While the proposition being tested was whether the rate of "productivity" growth has been higher in the United States than in the other countries studied, on the proposition under review here Letiche has used data pertaining only to manufacturing productivity. This difference would not affect the conclusion; see data in Chapter III of Clark, op.cit. For this reason, and to facilitate comparison, Table A is similarly based upon manufacturing productivity ratios.

2/ "Coming on the industrial stage at a time when technological and organizational methods were far advanced, Germany was able to appropriate the best that had already been worked out in other countries. She was unhampered by the existence of obsolete industrial plants or of old habits and prejudices on the part of labor or the employing class, which were already retarding English development." E. L. Bogart, Economic History of Europe, 1760-1939 (New York: Longmans, Green and Co., 1942), p. 318.

3/ Clark, op. cit., p. 272.

4/ Ibid., p. 269.

Table A

Compound Annual Rates of Growth in Productivity per Man-Hour in Manufacturing, 1913-1938

Country	Rate of Growth (%)
United States	3 1/2
United Kingdom	2 1/4
France	2 a/
Germany	3/4 b/
Canada	3 c/
Japan	2 1/2
Australia	1 3/4 d/

a/ 1914-1938. Clark deduced his 1914 productivity ratio from comparisons made by Fourastié.
b/ Clark's productivity figure for 1913 is an estimate of the rate he thinks "probably" obtained.
c/ 1910-1938.
d/ 1913 to 1937-1939.

Source: Calculated from data given in Clark, op. cit., pp. 266, 267, 269, 271, 272, 278, 279.

Thus far we have been considering only manufacturing productivity. However, estimates of total productivity tell much the same story. Clark has assembled estimates of real national product per man-hour, by country, for as long a period as possible. 1/ A comparison of the standings of the principal countries of the world around 1880 or 1890 and in 1938 indicate a generally widening spread between the United States and the other countries; and the same is true for the period 1920-38.

5. Significance of base-period absolutes of differing orders of magnitude. There is a further weakness in the contention that differences in productivity growth in different countries have not been significant. It concerns the implications of size-differences in the base rates of productivity, from which rates of growth are calculated.

Consider Country A and Country B, with base-period productivity ratios of, respectively, 500 and 250 units of net income produced per man-hour of manufacturing labor. Assume that during a 20-year period, industrial productivity in each country grows at an annually-compounded rate of 3.5 per cent. By the end of the 20 years, industrial productivity in the two countries will have roughly doubled: income produced per man-hour will be 995 in Country A, 497 in Country B. The amount of additional product per year per worker in Country A will be approximately double that in Country B. 2/

Although this merely states an implicitly obvious fact, the fact itself is important to the issue under debate. It forces attention to a basic underlying question: what is meant when it is said that productivity growth in one country is equal to, or greater or less than, that in another country? When we say that two magnitudes grow at the same rate (e.g. 3.5 per cent per year), have we said everything that it is relevant to say quantitatively about their comparative growth? Surely the answer must be: not necessarily.

In the present context, the concept stated in Engel's law 3/ is significant. If it were not for the declining relative importance of essential consumption items in rising incomes, there might be little or no significance in a comparison of the absolute

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1/ Colin Clark, "Levels of Real National Product per Man-Hour," Review of Economic Progress, Vol. 1, No. 4 (April 1949).

2/ "Product" must here be defined to include extra leisure time resulting from a shorter work-week, if the length of the work-week has shortened in A relative to that in B.

3/ The principle that as personal income increases, the proportion of it spent on food and other necessities decreases.

amounts of increased product per worker in the example given above. 1/ In that case, real incomes in Country A would be double those in B at the outset, and would remain in that relationship throughout. But to the extent that attention is fixed upon the margin of income (M) over "subsistence" requirements, the case envisaged will appear to be one of growing inequality: for A's workers will move from M to 3M while B's workers are acquiring M. 2/ Although a "subsistence" income can never be measured very precisely, the concept of it is valid. Engel's law has been verified in innumerable studies of consumer expenditure patterns. The margin of income above subsistence is of course important not merely because it permits consumption of "luxuries"; increased income produced per-capita permits increased saving and investment, and therefore the achievement of still higher income levels.

For present purposes the point is simply this: there is a danger in excessive preoccupation with comparative rates of growth in productivity, when these are measured and compared in the usual way. Equal rates of growth in productivity can give rise to increased inequality between different countries in levels of "non-subsistence" income, if there are marked differences in the base-period levels of productivity. And there are, in fact, marked differences of this kind. As Table B suggests, U. S. productivity was much higher than that of any other leading country throughout the period 1870 to 1938. The conclusion is clear that Europe and other parts of the free world should at least aim for -- whether or not they can achieve and for a long enough time maintain -- rates of productivity growth higher than those prevailing in the United States.

1/ One qualification, relating to a point of theory, should be made. In Hicks's analysis ("An Inaugural Lecture," Oxford Economic Papers, n.s. 5, June 1953, pp. 121-135), an attempt is made to show that certain balance-of-payments effects, and possibly some real losses of income, may result from different rates of productivity growth in different countries. It can be shown that within the framework of Hicks's reasoning, such consequences could follow even if the rate of productivity growth is the same in each country. This situation, in which Engel's law is not involved, could exist in the case now under discussion: that of an identical rate of productivity growth in different countries with substantially different base-period productivity levels.

2/ Assuming that in each country, "subsistence" requires 250 units of income, and that all income produced is distributed equally as wages. The qualification concerning length of work-week, and its necessary effect upon the definition of product or income, mentioned in footnote 2 on page 9, must also be noted here.

Table B

Manufacturing Output per Man-Hour

(In Colin Clark's "International Units" of product)

Country	"1870" a/	1900	1913	1920	1938
United States	.209	.343	.465	.571	1.065
United Kingdom	.110	.161 b/	.209	.226	.356
France	.057	.159 c/	.199 c/	n.a.	.319
Germany	n.a.	n.a.	.300 d/	n.a.	.369
Netherlands	n.a.	n.a.	n.a.	.228 e/	.326 f/
Sweden	n.a.	n.a.	n.a.	.268	.494
Canada	.111	.211	.341 g/	.466	.765
Japan	n.a.	n.a.	.091	.101	.173
Australia	n.a.	n.a.	.277	.307 h/	.439 i/

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a/ U. S., 1869; U. K., estimated from Clark's figures for 1856-1865 and 1870-1876; France, 1861-1865; Canada, 1870.
b/ 1894-1903.
c/ Deduced by Clark from comparisons given by Fourastié. His figure of .199 is for 1914.
d/ Estimated by Clark as "probable."
e/ 1925.
f/ 1936.
g/ 1910.
h/ 1921-1922.
i/ 1938-1939.

Source: Clark, op. cit., same page citations as in Table A.

Comparative trends since 1938

Although the question of comparative trends since 1938 is not immediately at issue, as Letiche's paper did not deal with this period, it is of interest to know whether the tendency for U. S. productivity growth to exceed that of western Europe in the inter-war period, and previously, has continued to manifest itself.

Evidence compiled by the OEEC on this question is reproduced in Table C. The last column of the table shows that U. S. manufacturing productivity increased substantially more, between pre-war years and 1954, than that of any other country for which data are given.

The basic data in Table C are indices on a 1949 base. It will therefore be seen, from the values given for 1954, that manufacturing productivity rose more in the western European countries (with the exception of the United Kingdom) from 1949 to 1954 than it did in the United States. However, as the OEEC points out, and as was noted above, part of this increase has been due merely to the regaining of productivity levels lost during the war. Therefore the relative trends since 1949 do not permit the conclusion that the characteristic pattern of the past, with respect to comparative productivity trends in western Europe and in the United States, has now been reversed. In this connection it is relevant to point out that the OEEC attributes the relatively low rates of growth since 1949 in the United Kingdom and Sweden to the fact that in those countries, pre-war productivity levels had already been exceeded by 1949. In other words, wartime losses in average industrial productivity had been regained in those countries by that time.

Conclusions

As was suggested at the outset, the evidence indicates a clear tendency for U. S. productivity growth to exceed that of all or most of western Europe. This tendency is discernible not merely for the inter-war period, but also for a period going back much further into the past, and also for the period since 1938.

It remains to be seen whether anything like the current rates of productivity growth in Europe can be maintained. To the extent that they can, it may prove possible to stop the widening of the spread in productivity between the United States and Europe that appears to have been in progress for the greater part of the last century.

Table C

Movements of Output per Employee-Hour in Industry a/

(1949=100)

	Pre-war b/	1953	1954	% increase, Pre-war to 1954
Austria c/	122	129	141	16
Belgium c/	111	114	n.a.	3 d/
France	114	110	119	4
Germany	129	131	138	7
Netherlands	118	123	129	9
Sweden	85	108	n.a.	27 d/
United Kingdom	85	107	110	29
United States	81	111	114	41

a/ "Output" represents production in the usual sense of indices of industrial production in Member countries. Cf. OEEC Statistical Bulletins: Definitions and Methods (2nd edition) Part I, Industrial Production.

b/ Pre-war=1936 for Germany, 1937 for Austria, Belgium, France and the United States, 1938 for the Netherlands, Sweden and the United Kingdom. These years were chosen by OEEC because they appear to be the pre-war years in which productivity was highest, according to OEEC data.

c/ Output per employee-year.

d/ To 1953.

Source: Sixth Report of the OEEC, Vol. I, p. 61.