Human capital (a survey of the literature in the field) school of economics

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HUMAN CAPITAL
(A SURVEY OF THE LITERATURE IN THE FIELD)

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CHAPTER I

Capital Defined

The definition of capital has had a long and arduous evolution, one that is still incomplete. The origin of capital probably sprouted roots in the Middle Ages where it meant the "Principal of a money loan (Capitalis pars debiti) in opposition to the Interest." During the disputes over whether interest should be charged for barren money, "It had become apparent that the interest-bearing power of 'barren' money was at bottom a borrowed one—borrowed from the productive power of things that money could buy. Money only gave the exchange form...in which the interest-bearing things passed from hand to hand." Thus capital became the "goods that were got for" money.2

Who first formulated this conception is probably still doubtful. However, Bohm-Bawerk gives credit to Turgot in his Réflexions sur la Formation et la Distribution des Richesses published in 1769-70. Adam Smith in his Wealth of Nations, says Bohm-Bawerk, then divided capital into a consumptive and productive dichotomy.3 However that may be, the origin of the concept is really not as important as the substance of the concept itself. Following Turgot's Réflexions, the concept became a much debated topic. Although the road has been tortuous, it became traditional, for the most part, to include only physical capital when speaking of

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2 Ibid.
3 Ibid., p. 25.
a country's wealth. That is, it has become traditional in spite of the recurring debates on the subject.

Within six years of Turgot's *Réflexions*, Adam Smith "...included in a country's stock of fixed capital 'the acquired and useful abilities of all the inhabitants'...", and it was not long after his death that support was forthcoming. For productive labor, to J. S. Mill, led to two products: wealth and utility. Utility he broke down into three categories: 1) "...Utilities fixed and embodied in outward objects..."; 2) "...utilities fixed and embodied in human beings; the labour being in this case employed in conferring on human beings qualities which render them serviceable to themselves and others." This includes "... all labour bestowed by any persons, throughout life, in improving the knowledge or cultivating the bodily or mental faculties of themselves or others;" 3) "...utilities not fixed or embodied in any object, but consisting in a mere service rendered; ...but without leaving a permanent acquisition in the improved qualities of any person or thing..." The "musical performer, actor," etc., are included in this class. Mill equivocated somewhat here, for he then declares that "Utilities of the third class, consisting in pleasures which only exist while being enjoyed, and services which only exist while being performed, cannot be spoken of as wealth..." By implication, then, all else is wealth. In a footnote

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6 Ibid., p. 47.
(p. 47), however, he is quite clear in his contention that knowledge and skills should be included in a country's wealth.

...the skill of an artisan, ... being both a desirable possession, and one of a certain durability (not to say productive even of national wealth), there is no better reason for refusing to it the title of wealth because it is attached to a man, than to a coalpit or manufactory because they are attached to a place. Besides, if the skill itself cannot be parted with to a purchaser, the use of it may; if it cannot be sold, it can be hired; and it may be, and is, sold outright in all countries whose laws permit that the man himself should be sold along with it.

Actually, there is nothing revolutionary in Mill's exposition, only a restatement of Smith's division of capital into its consumptive and productive parts. However, Mill is very careful here not to step on anyone's philosophical toe by insisting "...that the people of a country are not to be looked upon as wealth because wealth exists only for the sake of a people" (emphasis mine). Although Mill may have equivocated somewhat in the text proper, his second thoughts as expressed by his footnote clarify his position.

Sidgwick is equally clear on this point. He states that, even though "...skill is not directly transferable, ...we can nevertheless hardly deny that, so far as it results from labour, it may be a form of investment of capital." Yet, he does not want completely to incorporate it with physical capital. He points out that material wealth owned by a lazy person can be sold and used for production; immaterial wealth in the form of skills or knowledge also possessed by a lazy person cannot be


sold and thereby put to productive use. Sidgwick is undoubtedly right here, but how would this differ from the material wealth, a waggon, say, owned by a man of sufficient means who, although he had no use for it, refused to sell it because it was the waggon that carried grandmother to the cemetery? He suggests that the label "'personal capital'" be given to immaterial wealth of this kind. This to Bohm-Bawerk was unadulterated nonsense. To him, it was "...a little out of place as elements of a 'stock,' and which, like spirits rashly conjured, banished peace for many a long day from the theory of capital." Capital to him was the "material means of production."

Along with Bohm-Bawerk one would have to place John Bates Clark, F. W. Taussig, and Irving Fisher, to name a few: With Sidgwick, one would have to place Johann Heinrich von Thünen, Friedrich List, and J. Shield Nicholson.

Of the latter, List was the most emphatic. To him "...the 'power of producing wealth is infinitely more important than wealth itself." The "mental capital of the present human race" is the greatest form of wealth.

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9 Ibid., p. 133.

10 Eugene von Bohm-Bawerk, op cit., p. 28.


of any country. Nicholson feels likewise and claims that "The principal reason why a civilized nation can so soon recover from the effects of a devastating war is to be found in the acquired skill of the inhabitants ..." However, he, like Sidgwick, feels it should not be incorporated with physical capital and, to avoid confusion, should be called "personal or immaterial" capital.

The father of modern economics, Alfred Marshall, undoubtedly exercised considerable influence in rejecting human capital (skills and knowledge) from the concept of wealth. He felt that "...only those classes of wealth that are commonly bought and sold in the market place" should be considered as capital. He maintained that "According to the older English traditions capital consists of those things which aid or support labour in production: or, as has been said more recently, it consists of those things without which production could not be carried on with equal efficiency, but which are not free gifts of nature." He then proceeds to use this definition to refute the distinction between consumptive and productive capital, claiming that the sum total of capital existing at any one time is the sum total of the existing material wealth at that time. For all of Marshall's perspicacity, he seems to have attempted to obfuscate the issue by this latter statement. For as Mill has clearly shown in his footnote above, all of Marshall's qualifications are met except the

17John Fred Bell, op. cit.
18J. Shield Nicholson, op. cit., p. 95.
19Theodore W. Schultz, op cit.
material aspect which Mill has shown to be invalid.

Despite Marshall's contention on the matter, for reasons he never satisfactorily explains, the weight of historical, theoretical thought seems to suggest that human capital in the form of knowledge and skills is part of a country's wealth. A legitimate question, then, would be to ask why the neglect of this factor until recent times. No doubt part of the answer, as Johnson maintains, to why the classical tripartite concept of land, labor, and capital remains

...embedded in the theory of distribution seems to be that economists accept the classical notion of labour as a unique original factor of production, distinct on the one hand from other original factors in the shape of natural resources, and on the other hand from produced means of production in the shape of capital goods. This acceptance is explainable by the institutional fact that democracies expressly prohibit markets in human capital (so that only the services of labour are marketed...)

and also by the liberal anthropocentricity of social science and the stereotyped concept of 'labour' employed in socialist political philosophy.21

This is manifested in our legal and political institutions. He contends that the old classical tripartite concept should all be lumped "...together as items of capital equipment, created by past investment and rendering current services to production."22 This need not destroy the income-distribution theory of the classicals, he maintains, but would help to elucidate it. The price of a factor can still theoretically be divided into two parts: "...the payment necessary to keep the factor in existence ...corresponding to the classical notion of 'wages'; and a

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22 Ibid., p. 562.
surplus above that necessary payment, arising from scarcity of the factor and corresponding to the classical notion of 'rent.'\(^23\)

One of the most prolific contemporary writers in the field of human capital, T. W. Schultz, gives three reasons why human capital has been neglected in the field of economics:\(^24\) 1) the tenacity of the classical tripartite concept helped to foist on to labor the attribute of homogeneity. Even today the most noted female economic theorist, Joan Robinson, still "...takes her labor pure and straight."\(^25\) 2) until fairly recent times, statistics on hourly earnings and prices were so inadequate that no one could tell for sure whether real wages had fluctuated or not. When it became apparent that real wages had risen, the rise was small and attributed to other factors. Consequently, labor was calculated as "manhours worked," as homogeneous units of imput. 3) Schultz claims that a more compelling reason was the "conventional restriction of the concept of capital" for which he gives Marshall the greater credit. He asserts that Fisher's definition was all-inclusive and should be used, but here he is obviously wrong. Fisher defines capital as being the "...quantity of wealth existing at an instant of time"\(^26\) and wealth as having the attributes of being "material" and "owned."\(^27\) "...there is no advantage," Fisher declares, "but much disadvantage, in including any 'immaterial' elements in wealth."\(^28\)

\(^{23}\)Ibid.
\(^{24}\)Theodore W. Schultz, op cit.
\(^{25}\)Ibid.
\(^{26}\)Irving Fisher, op. cit., p. 66.
\(^{27}\)Ibid., p. 8.
\(^{28}\)Ibid., p. 39.
Renewed Interest

The renewed interest in human capital in the last few years more than likely stems from two main sources. First, as Schultz implies, national statistics have been refined to the point where a historical analysis of the development of the American economy has become possible. The analysis reveals that some factor other than the increase in conventional labor and physical capital inputs helped to contribute to the growth of the economy to its present level. Put another way, the growth in output cannot be explained by the inputs of conventional labor and physical capital. Second, the present interest in developing the underdeveloped areas of the world has intensified the search for solutions to development problems. Quite obviously, these two reasons do not exist in isolation. A thorough knowledge of the development process as historically manifested by the American economy would also help as a guide for further development and, although not directly transportable to underdeveloped areas, would go far in solving many of their development problems.

In relation to the first source above, in the last ten years intensive work has been done on productivity trends in the United States. Such economists as Moses Abramovitz, Solomon Fabricant, Andrew Gunder Frank,


John W. Kendrick,\textsuperscript{32} Simon Kuznets,\textsuperscript{33} Daniel Creamer, and Sergei P. Dobrovolsky,\textsuperscript{34} have completed studies that strongly suggest that some little-understood factor has been lubricating the production process.

A study done quite early by Kuznets (1952) on output-labor ratios for the period 1869-78 to 1939-48 indicates that productivity in the economy as a whole has been decidedly increasing. The percentage of the labor force to total population rose from 33.1 per cent in 1869-78 to 44.2 per cent in 1939-48. The NNP per worker rose from $654 to $1,786 in 1929 prices.\textsuperscript{35} Thus, output has risen about five times as fast as has the labor force (34 per cent rise in the labor force to 173 per cent rise in product). Among the possible reasons for this increase, Kuznets mentions the increasing percentage of workers in the labor force in their more productive age, better health, more training and education.\textsuperscript{36} Those below 20 and above 50 years of age in the labor force declined from 27 to 22 per cent. He emphasizes the case for education and training. The proportion of the labor force classified under educational and other professional activities increased from 2.6 per cent in 1870 to 7.5 per cent in

\begin{itemize}
\item \textsuperscript{34} Daniel Creamer, and Sergei P. Dobrovolsky, \textit{Capital in Manufacturing and Mining} (Princeton, 1960).
\item \textsuperscript{35} Simon Kuznets, editor, \textit{Income and Wealth of the United States} (Baltimore, 1952), p. 70.
\item \textsuperscript{36} \textit{Ibid.}, p. 76.
\end{itemize}
1940; and, more important, the proportion of unskilled labor declined from 36 per cent in 1910 to 26 per cent in 1940.  

Abramovitz presents data demonstrating that the NNP per capita increased four times while population increased only three times but is unable to account for this rise by using conventional inputs of labor and capital. He presents two possibilities. First, taking the economy as a whole, economies of scale may be operating. Second, the improvement in quality of the inputs labor and capital have not been taken into account, which would understate their contributions to output.

Solomon Fabricant has computed productivity on several different bases for the period 1889 to 1953. The annual increase in productivity, so determined, ranges from 2.3 per cent to a low of 1.5 per cent. A measure of productivity for the private economy that compares output not only with labor input...but also with tangible capital, each weighted by the market value of its services, grew...about 1.7 per cent per annum. Consequently, "Each year's increase in productivity accounted, on the average, for about half of the year's increase in product." He mentions as a possible solution to the mystery the ever "greater scarcity of labor relative to capital" and the improvement that has taken place in the quality of labor.

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37Ibid., p. 77.
38Moses Abramovitz, op. cit., p. 12.
39Solomon Fabricant, op. cit., p. 3-4.
40Ibid., p. 18.
41Ibid., p. 29-30.
In the past, it was thought that as physical capital became more abundant relative to land and labor, it would be used in "greater 'depth,'" and, consequently, the capital-output ratio would grow ever larger. However, as the figures above suggest and the capital-output ratios presented by Creamer and Dobrovolsky in their "TABLE II" below show, the opposite has in fact been the case for at least the last forty years. That is, capital-output ratios have been decreasing (notes and sources not shown).

Ratios of Capital to Output and to Value Added, Selected Valuations, All Manufacturing, Selected Years, 1880-1953

<table>
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<tr>
<th>Benchmark Years</th>
<th>Capital (book value) to Output (Current prices)</th>
<th>Capital to Output (1929 prices)</th>
<th>Capital to Output (Current prices)</th>
<th>Capital to Value Added (1929 prices)</th>
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<tbody>
<tr>
<td>1880</td>
<td>0.528</td>
<td>0.547</td>
<td>0.489</td>
<td>1.506</td>
</tr>
<tr>
<td>1890</td>
<td>0.679</td>
<td>0.730</td>
<td>0.670</td>
<td>1.651</td>
</tr>
<tr>
<td>1904</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>1909</td>
<td>0.815</td>
<td>0.891</td>
<td>n.a.</td>
<td>2.093</td>
</tr>
<tr>
<td>1914</td>
<td>0.851</td>
<td>0.967</td>
<td>0.900</td>
<td>2.309</td>
</tr>
<tr>
<td>1919</td>
<td>0.894</td>
<td>1.008</td>
<td>n.a.</td>
<td>2.460</td>
</tr>
<tr>
<td>1929</td>
<td>0.688</td>
<td>1.022</td>
<td>0.873</td>
<td>2.555</td>
</tr>
<tr>
<td>1937</td>
<td>0.829</td>
<td>0.885</td>
<td>0.867</td>
<td>2.020</td>
</tr>
<tr>
<td>1948</td>
<td>0.744</td>
<td>0.741</td>
<td>0.787</td>
<td>1.809</td>
</tr>
<tr>
<td>1953</td>
<td>0.570</td>
<td>0.590</td>
<td>n.a.</td>
<td>n.a.</td>
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</table>

The trend and the variations in the trend are very similar to studies done by Kuznets. Abstracting from the economies of scale, the above table indicated a continual change has been taking place in the last 40 years either in the quality of labor or capital inputs, or both. If an improvement in the quality of capital is viewed as the culprit, the

42 Daniel Creamer and Sergei P. Dobrovolsky, op. cit., p. 40.
mystery is still left unsolved, for another question immediately arises. Is this improvement merely a free, unearned, but beneficial resultant of economic development? The derivation of this improved quality has never been satisfactorily probed except in so far as recognizing that technology is considered as somehow contributing to the brew.

Technology to Samuelson means "better know-how, better applied science, better economic laws and customs, better management, and better work methods." Technology is made possible, he claims, partly because of "the relative abundance of capital goods—of man-made machinery, materials, and plants." Now there seems to be the possibility that Samuelson has the cart before the horse, or at least even with the horse. He explains the manifestations of technology but begs the question of the origin of technology. Could he also be talking about feed-back? "Better know-how, better applied science, better economic laws and customs, better management, and better work methods" seem to be more apt to originate from education of some type than from any place else. The sequence should be from better education to better technology to better machines and then a feed-back to better education. Better machines usually mean new and more efficient machines which require more know-how to operate.

Kuznets gives a slightly different definition to technology. Technology generally goes through several phases on its road to improving the lot of man. "While these can be seen as successive phases—from discovery to invention to innovation to improvement to spread—there is

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also a feed-back effect. The spread of innovations may favor further
inventions, and the latter may stimulate further discovery." Evidently,
the "spread" phase (diffusion throughout industry) need not necessarily
follow the "improvement" phase. It also could follow the "innovation"
phase. However that may be, Kuznets feels that there are two major
"bottlenecks" which retard or prevent the shifts from phase to phase.

First:

(a) Many major inventions, if they are to become successful
innovations, demand heavy capital investment—both in material
goods and in the training of the labor force. Material capital
is necessary to channel properly the new power in its applica-
tion to intricate ends, and an educated and skilled labor force
is indispensable in operating complex machinery and productive
processes. (b) Innovations, by definition, represent something
new and require entrepreneurial talents and skills to overcome a
series of unexpected obstacles. (c) Much depends upon the
responsiveness of the would-be users of the new products or
processes who are to be final judges of the potential technologi-
cal changes to be adopted for widespread use and hence for mass
production.

Second: Discoveries tend to become concentrated in only a few fields.
This is because there are simply not enough intellectual and material
resources available to spread the new knowledge around to all fields and
because only a few fields stand out as "most promising." Now notice that
in both types of "bottlenecks" human capital plays an all-important part
in deciding whether a "bottleneck" will in fact exist, let alone the part
it plays in the initiation of the phases.

In Adam Smith's day, the ability to conceive, construct, and operate
physical capital unquestionably came before the capital goods themselves.

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45 Simon Kuznets, *Six Lectures on Economic Growth* (Glencoe, Illinois,
1959), p. 21
Today, this is just as true. However, the necessary ability to so conceive, construct, and operate modern capital almost invariably requires a great deal more investment in some type of education than was true in Smith's day. It seems reasonable to assume, then, that the "capital" figure in capital-output ratios has been underweighted and should also include that portion of human capital that has been invested in education. When labor is being considered as an input, it seems reasonable to assume that this figure is likewise underweighted. Like physical capital, labor comes with various amounts invested in it, and this should be taken into consideration.

If capital is defined in the usual, narrow way, i.e., "construction, producers' durable equipment, inventories, and the balance of claims against foreign countries," Kuznets feels that

...the capital-output ratio can change appreciably within two or three decades on a countrywide scale, and even more rapidly for distinct industrial sectors. Such changes reveal that identical values of capital, in the narrower definition, can contribute to widely different amounts of product—even to secular levels of capacity utilization. The key is not in the physical stock of plant and equipment; it is in large part in the capital invested in human beings and the whole economic and social structure that conditions the use of plant and equipment.

Capital should be defined as all those tools used for production.

...the definition used...in most statistical measurements is too narrow: it should include...all goods in the hands of consumers and all resources (in the form of education, training, etc) that can make for a more efficient labor force...

Frank presents an interesting additional bit of evidence here. Although he uses a different figure (2 per cent) for the productivity gain in industry than Fabricant does, his figure of 1 per cent for agriculture

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is generally accepted. He then asks why this difference. He discounts differences in technological changes and economies of scale, concluding with education. Quantitatively and qualitatively, the industrial sector of the nation obtains the lion's share. Moreover, much of the education listed as agricultural is invalid because of the continual migration from rural to urban centers. On first thought, it seems reasonable to assume also that migration would be more apt to be undertaken by the better educated rural population.

Frank attempts to buttress his education thesis further. The United States made greater economic progress than did Europe in the 19th century, he claims, because of the immigration of the relatively more skilled to the United States from Europe. Also, Argentina, Brazil, Chile, and Uruguay in South American and Mexico in Latin America are advancing faster than any of the other countries in those areas. This he attributes to the higher ratio of European immigrants in the first four, while in Mexico, the highest rate of literacy growth has taken place.

48 Andrew Gunder Frank, op. cit., p. 172.

49 Ibid.
CHAPTER II

Investment in Human Capital

It seems to be a truism that a country with a high level of income also has a high level of education. The question, then, would be whether the former is a cause of the latter or depends upon the latter. In the past, the general consensus has been, more often than not, that high income comes first. This has been so because people looked upon education as a consumptive good. However, a great deal that formerly has been considered as being in the umbra of consumption should, in reality, be considered as investment—investment in human capital. That is, to the extent that education results in higher income, it should be considered as an investment. A word should probably be said here to anesthetize the anthropocentrics. The idea of education being an investment "...in no way detracts from or disparages the cultural contributions of education." Education can result in both—a higher income and a more advanced culture. Only the economic consequences of an education are being considered here.

Unquestionably, the concept of marginal analysis has at least an implicit counterpart in conventional, real-world inputs. Investment in land, labor, and capital is carried to the point where the marginal revenue of product equals the marginal cost. Why would the marginal analysis concept not be just as true for an individual considering education as an  

51 Ibid., p. 51.
investment in himself? All the above data strongly suggest that education can be looked at in this way. On purely economic grounds, the above data also suggest the returns from such human investment are considerable.

There are five major fields in which investment enhances human capital:

(1) health facilities and services...; (2) on-the-job training...; (3) formally organized education at the elementary, secondary, and higher levels; (4) study programs for adults that are not organized by firms, including extension programs notably in agriculture; (5) migration of individuals and families to adjust to changing job opportunities.

Before any quantitative figure can be given to the returns from investment of this type, some notion of costs must be known. "(3)" will be discussed first, then "(2)," "(4)," "(5)," and "(1)" in that order to indicate, if nothing else, the magnitude of these types of investment in human capital.

**Formal Education.** In formal education, costs can be thought of as comprised of two main elements—opportunity costs and direct costs in the way of plant and operation expenses. Schultz has computed the total cost made in investment in education in the United States from 1900 to 1956 via these two components. 53

For elementary students, it was assumed that opportunity costs do not exist. The major reason for this assumption is simplicity and the paucity of data. It certainly was not true in 1900, as Schultz points out, because the opportunity costs of elementary students for the then agricultural nation was probably a significant figure. 54 Even today, if data were

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54 Ibid., p. 573.
available, there is the possibility of the figure being significant, particularly in the South. Abstracting from the opportunity cost, the assumption that elementary education is purely consumption also does not hold water, for the Statistical Abstract of the United States, 1959, Table 140, p. 110, shows that the median income of males who were elementary graduates was $492 to $551 more than those who had only 5 to 7 years of schooling. In arriving at an opportunity figure for those above the elementary level, it was assumed that a figure can be estimated by measuring the average income of young adults of comparable age and sex who do not attend school. Here, too, qualifications are in order. Young adults not attending school with year-around jobs probably get a higher wage. However, this tends to be offset by students who have part-time jobs while attending school. There remains the final possibility that those students attending school would average a higher wage due to superior ability if they were not attending school than would the non-students. Living costs were not taken into consideration but assumed to be the same whether attending school or not.

The earnings students forego were based upon 1949, computed in weeks, then expressed "in earnings-equivalent weeks of workers in manufacturing." On the average, high school students forego about 11 weeks and students in higher education about 25 weeks of earnings. One rather serious limitation should be noted here in using 1949 as a base year. During the period under study, the school term for ages 5 through 17 has been increased by about 60 per cent. Data, though, are not available to make possible separation of elementary from secondary instruction. Schultz feels that most of this increase has taken place at the elementary level. Yet, the weeks of

55 Ibid., pp. 574-5.
earnings foregone by secondary students are over-weighted to the extent that the increase has taken place in secondary education and must remain as a limiting factor to the validity of this assumption.

Under these assumptions, foregone earnings comprise a surprising portion of the total cost. For high school, "...they were 73 per cent in 1900 and 60 per cent in 1956; the two low years were 1930 and 1940, when they fell to 59 and 58 per cent of total costs." For higher education, the figures were as follows: "1900 and 1910, 50 per cent, 1920, 63 per cent, 1930 and 1940, 49 per cent, 1950, 60 per cent, 1956, 59 per cent. ...For all levels of education together, earnings foregone were 26 per cent of total costs in 1960 and 43 per cent in 1956." The downward trend in secondary education as contrasted with the upward trend in higher education should be noted. The downward trend in secondary education is probably the result of more rapidly rising direct costs relative to the demand for labor for young adults of high school age. Child labor laws have undoubtedly aggravated this trend. The upward trend in higher education is probably the result of a faster rising demand for labor of young adults of college age relative to direct costs.

Total resources invested in elementary education have increased at a lower rate than they have in secondary and higher education. Even so, the rate of investment in elementary education has been higher than has the rate of investment in gross physical capital formation for the nation as a whole. "In 1900 the total cost of elementary education was equal to

56 Ibid., p. 577.
57 Ibid.
about 5 per cent of gross capital formation compared to 9 per cent in 1956. Comparable figures for high-school and higher education combined are 4 per cent in 1900 and almost 25 per cent in 1956.\textsuperscript{58}

The 5 per cent to 9 per cent increase relative to gross physical capital formation from 1900 to 1956 mentioned above in regards to elementary education was partly the result of the increased number of days in the school term; the rest from an increase in enrollment. The average number of days "rose to 60 per cent" while the increase in enrollment amounted to "73 per cent between 1900 and 1956."\textsuperscript{58} For secondary education, total investment increased from 2 per cent of gross physical capital formation in 1900 to 13 per cent in 1956. Here, the increase in enrollment was the largest factor. In 1900, only 11 per cent of those in the 14 to 17 age group were enrolled in secondary schools. In 1956, "...the per cent was about 75."\textsuperscript{59} For higher education, total investment was 2 per cent of gross physical capital formation in 1900 and 12 per cent in 1956. Here, too, enrollment played the biggest part. Four per cent of those from 18 to 21 years of age were enrolled in higher education in 1900 and 32 per cent were so enrolled in 1956.\textsuperscript{60} Over the period covered, the total investment (cost) in formal education rose "from 9 to 34 per cent of the total entering into the formation of physical capital."

Total resources entering into education have increased "about three and one-half times (1) relative to consumer income in dollars and (2)
relative to the gross formation of physical capital in dollars. If education is considered as a consumptive good, this reveals a high income elasticity. And if it is viewed primarily as an investment good, it apparently has been very appealing. No doubt, one of the things that has greatly helped the increase in investment in education is the greater amount and mobility of money capital now than in the past.

Comparing investment in education to gross physical capital formation is only one way of demonstrating this growing asset. It also can be compared with national income. The table below show this comparison.

TOTAL RESOURCES ENTERING EDUCATION AS A PER CENT OF NATIONAL INCOME, 1900-1956, IN CURRENT PRICES*

<table>
<thead>
<tr>
<th>Total Resources Entering Education (Billions of Dollars)</th>
<th>Col. 1 as per cent of Col. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Years</td>
<td>(1)</td>
</tr>
<tr>
<td>1897-1901----------------------------------</td>
<td>.40</td>
</tr>
<tr>
<td>1907-1911----------------------------------</td>
<td>.81</td>
</tr>
<tr>
<td>1920----------------------------------</td>
<td>2.51</td>
</tr>
<tr>
<td>1930----------------------------------</td>
<td>4.97</td>
</tr>
<tr>
<td>1940----------------------------------</td>
<td>6.33</td>
</tr>
<tr>
<td>1950----------------------------------</td>
<td>17.00</td>
</tr>
<tr>
<td>1956----------------------------------</td>
<td>28.70</td>
</tr>
</tbody>
</table>

Sources*

Column 1: Taken from "TABLE 7" col. 4 of T. W. Schultz's "Capital Formation by Education," Journal of Political Economy, LXVIII (December, 1960), 582.

Column 2: Taken from the Historical Statistics of the United States, Colonial Times to 1957, Washington, D. C., U. S. Bureau of Census, 1960, Series F 6-9, p. 139. Lines 1 and 2 were computed in the Historical Statistics on the bases of a five year average.

The above table shows that the total resources entering into education has

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61 Ibid., pp. 577-9.
experienced an ever-increasing proportion of national income as well as an ever-increasing proportion of gross physical capital formation. The ratio of investment in education to national income increased from 2.7 per cent in 1900 to 8.2 per cent in 1956. The average increase per ten-year period is computed to be about 0.9 per cent. It appears, then, that the United States has been experiencing a "deepening" effect not only of physical capital but of human capital as well. This is demonstrated further in what follows.

Another way of looking at the increase in formal education is through the knothole on labor's side of the fence. The total number of people who service education, i.e., teachers, administrators, maintenance personnel, etc., and the total number of students who forego earnings, excluding elementary students, amounted to 5.3 per cent of the employed labor force in 1900, and to 18.8 per cent in 1956. This sounds like, and is, a rather high price for education. However, all indications are that it is worth it. If one uses a school year as a basis for comparing the stock of education in the labor force, it amounted to 216 million years in 1900 and 776 million years in 1956. If an adjustment is made to compensate for the fact that the average student, 5 to 15 years of age, attended only 99 days in 1900 and 159 days in 1956, the stock of education in the labor force amounted to 116 million years in 1900 whereas in 1956 it amounted to 740 million years.


63 Ibid., p. 67.
In addition, there has been a shift of the stock of education to the relatively younger generation. For example, those from age 20 to 24 had 12.8 years of school equivalent in 1956 compared to only 4.6 years in 1900; whereas those in the labor force who were in the ages 45-64 had increased from 3.8 to 7.8 years. Consequently, this shift to the relatively younger generation portends greater productivity because of the greater investment at an earlier stage in life. In dollar terms, between 1929 and 1959, "...the stock of education carried by the labor force rose by 355 billion dollars in 1956 prices." Sixty nine billion dollars of this is attributable to the increase in the labor force while the remaining 286 billion dollars is attributable to "the increase in the level of the stock of education per laborer." Long found in his study that whether or not a woman was working depended more upon her education than upon her age. This was also true for men but to a much less extent. Generally, men have to work whether they have an education or not. Only in "hard times" do the participation rates show a significant relationship between education and being in the labor force.

It is well known that agriculture is "sick," despite (because of?) the massive transfusions of subsidies. This sickness is not just endemic to agriculture, but imposes a heavy burden on the whole economy. One of

64 Ibid., p. 69.
65 Ibid., p. 78-9.
67 Ibid., p. 179.
the most refreshing ideas as to the reasons for this sickness (and a
possible solution) is presented by Schultz. Here, too, the educational
institutions play the major role. Quoting from Schultz:

...many farm people are compelled to leave farming. To do
this most of them must not only accept and learn a new
occupation but also move from the place at which they have
been living to a different location. Both of these are
difficult to do, especially where the entire farm family is
compelled to move to another community of a very different type.

There appear to be several reasons why the land grant institu-
tions (whether one looks at what is done in instruction,
research or extension serving agriculture) have not brought
their talents and resources to bear on the problem of low
earnings of those people who (want to) make their living at
farming: (1) the leaders and facilities of these institutions
have a strong technical orientation; more output from given
inputs is deemed to be desirable regardless of the economic
and social consequences of applying such improvements in techni-
cal knowledge; (2) these institutions have a large vested interest
in the natural and biological sciences and their application to
agricultural production; (3) a declining farm population is not
something to behold, much less to be encouraged, induced, and
accommodated by positive private and public measures because it
runs counter to strongly held (values) beliefs and because it
affects adversely the allocation of funds as these are now
allocated to these institutions by the federal government; (4) it
has been easy to place the blame for the maladjustments in agri-
cultural production and the accumulation of excessive farm
commodity stocks on public (price) policy and thus divert attention
from the role of new technical knowledge and its application in the
all too rapid growth of farm output; and (5) the basic problem at
hand necessarily raises social and economic issues that at the
level of public policy are inherently controversial, issues to be
avoided where one is dependent upon public funds.

No doubt there are other solutions. Viewed realistically, the policy
implied here (instruction at the agricultural schools oriented more toward
industry and the social sciences) is probably a "dead letter" because of
the time element and the resistance of custom to say nothing of the

68Theodore W. Schultz, "Agriculture and the Application of Knowledge,"
A Look to the Future (Battle Creek, Michigan, 1956), p. 66.
political reverberations. Nevertheless, a hardy effort might be warranted toward investigating this line of thought.

One of the more annoying and serious aspects of education is rising costs. Since 1940, the cost of living has increased 95 per cent while "the cost of education per student" has risen 135 per cent. Comparing the rise in real wages of teachers with the real wages of labor as a whole, the real wages of labor rose by 55 per cent between 1940 and 1956 whereas that of teachers rose only 36 per cent. However, this relatively lower rise in real wages for teachers is overshadowed by the fact that education takes more labor per unit of output.

Schultz presents six points on which he feels educational efficiency could be improved: 1) since foregone earnings of students are the most important factor in regard to costs, not enough attention has been paid to economizing student time; 2) a large part of the cost of education--well over half--is credited to non-material inputs in the form of teachers and foregone student earnings. These two factors have increased in price at a faster rate than material inputs. Therefore, material substitutes should be found and initiated wherever possible. 3) if the capabilities developed by education are as important as the above data indicate, then better systems for gauging future demand for specific capabilities should be developed and more efficient and reliable methods should be found to publish the results. As it is, it takes too long for the market demand to make itself felt. 4) since the educational "...enterprise is slow and

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cumbersome in adjusting to changes in the price level..., the lags long, and involve a large cost, the depletion of talented teachers, to take one example, can become real before the public becomes aware of the situation. Some means of rectifying this discrepancy should be found. 5) new and better techniques for dispensing knowledge should ever be pursued; 6) the presumption is "...that more could be invested in education relative to other forms of investment to the advantage of economic growth."

Becker, in an attempt to determine whether there has been under-investment in education, presents a report of a study done for the National Bureau of Economic Research not yet published. 71 Census data were used for information on income of high school and higher education graduates, "after being adjusted for other differences between high school and college graduates, such as in ability, race, unemployment, and mortality." However, he does not tell us how this was done. The returns from a college education, figured on the bases of the average of the opportunity and direct student costs, "...was about 12 1/2 per cent in 1940 and 10 per cent in 1950...," the difference being the result of the increase in the income tax during the 1940's. 72 Becker estimates that the costs as figured above came to about 2/3 of the total costs. Schultz's average figure for the opportunity costs alone came to about 60 per cent of total cost in 1950.

Becker estimates that if total cost figures and before-tax earnings for urban white males are considered, the return amounts to about 9 per cent for both 1940 and 1950. He considers this figure to be too high,

72 Ibid., p. 347.
because, as in the 12 1/2 and 10 per cent figures above, urban white males comprised only 45 per cent of all college graduates. "The rate of return to non-whites seems to be about two percentage points lower..." yet. In comparing this rate of return to that of physical capital, Becker chooses that capital "owned by business enterprise" only because it is the "easiest" with which to make comparisons. He estimates corporate capital to comprise about 60 per cent of all business capital and that it returns about 10 per cent. Non-corporate capital, the residual, he estimates to return about 5 per cent. This gives him an 8 per cent figure of return for physical business capital. Of course, doing any study on the returns from an education pitches one on the horns of perplexity. This perplexity is named external economies. How do you determine whether any exist? If there are external economies in, say, a liberal arts education, what is its value so that it can be taken into account when considering returns? In some forms of research, one can be fairly certain that they exist. Becker gives us an example in regards to "molecular physics." Assuming that knowledge gained in atomic energy has helped, and will help, mankind immensely, and will not eventually destroy him, "Einstein, Fermi, and the other pioneers received only a small fraction of the total increase...in income resulting from their work." How do you compute the returns ensuing from their education, training, and research? In considering under- or overinvestment in higher education, "It is this ignorance about external returns which prevents any firm judgment about the adequacy of expenditures on college

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73 Ibid., p. 348.
74 Ibid., p. 350.
Thus Becker's 9 per cent figure is, in the last analysis, only a guess. However, assuming that the burden of "progress in external gains" fell to graduates of the natural sciences, large gains are possible with only small additions to investment in education. Assuming, further, that only scientists engaged in "research and development" are likely to produce external economies, then a 50 per cent increase would cost very little relative to the possible gains. At present, only "about 13 per cent of all college graduates" are so engaged.

However that may be, there is little doubt that the quality of all college students could be improved. "...21 per cent of high school graduates who do not go to college have I.Q.'s of over 120." Consequently, there is the possibility that if more high school graduates with high I.Q.'s could be induced to go on to higher education, greater returns could be realized with the same amount of investment.

The possible returns from a formal education were recognized quite early (1826) by von Thünen. He noted that

The compensation for industrial entrepreneurs—that is, for the factory owner, the lessees, or even the mere administrators—is disproportionately high in relation to the wages of the manual laborer. Since free competition prevails, why is this disproportion not equalized by the transfer of the most skilled manual laborers to the class of the entrepreneurs? Because the worker lacks the necessary education without which, however excellent one may otherwise be, one cannot become an entrepreneur or even an administrator.77

Von Thünen's reason why the worker lacked education was poverty. This was due to marrying too early, resulting in children too many to support

76 Ibid., p. 352.
77 Johann Heinrich von Thünen, op. cit., p. 220.
and educate. The only solution was to change "the character of the people." Von Thünen's reason for poverty is quite analogous to Malthus and Ricardo's reason for the tendency toward a subsistent wage. Although his contention as to education being the major reason for the discrepancy in the entrepreneur-labor differential probably holds a great deal of truth even today, Johnson maintains that the gap between the capitalists and the masses is becoming narrower "on an increasing scale in two... ways—as owners of consumption capital, and as possessors of educated skills." 78

Various studies have been done on the relationship between income and education of which von Thünen was speaking, viz., formal education. 79 All of them tend to verify the existence of a close relationship. One of the recent studies, by Miller, concentrates on the period 1939 to 1958 during which time the proportion of college and university graduates almost doubled. One aspect which should be kept in mind is the improvement in the quality of graduates. Quality has not been taken into statistical consideration, because, as yet, no method has been developed to do so. However, it seems axiomatic that the knowledge gained in the

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78 Harry G. Johnson, op. cit., p. 564.

79 A few of the studies include D. M. Blank and G. J. Stigler, The Demand and Supply of Scientific Personnel (Princeton, 1957); H. F. Clark, Life Earnings in Selected Occupations in the United States (New York, 1937); Paul C. Glick and Herman P. Miller, "Educational Level and Potential Income," American Sociological Review, XXI (June, 1956); Dael Wolfe and Joseph G. Smith, "The Occupational Value of Education for Superior High School Graduates," Journal of Higher Education, XXVII (1956). Herman P. Miller cautions that Blank and Stigler's study is unreliable because of the canvassing of only 5 professions, the high rate of non-response, and because the survey was taken five years after the income period.
last thirty years, in all major fields of study at least, has enhanced the productive quality of graduates. Economics affords a prime example. A 1960 graduate of economics has a much greater productive potential than, say, a 1930 graduate had.

However that may be, Miller's study tends to confirm von Thünen's contention of education being the major reason for his noted income gap. Better yet, it does not disprove von Thünen's thesis.

According to von Thünen's thesis, a higher proportion of the population gaining a greater amount of education should lower the income differentials. Although the available facts do not bear this out, they should not be accepted a priori.

Miller presents figures that show a tendency for an ever-increasing income differential between elementary and high school graduates. Further, the greatest percentage gain in education had been in the number of graduates of higher education; but the data suggest a stable income differential between high school graduates and the graduates of higher education instead of a decreasing one. A larger percentage of the population being high school graduates, as has been the case, should have decreased the elementary-high school differential and, taking into consideration the much greater relative gain of college graduates, should also decrease the high school-college differential a fortiori. However, such has not been the case. If there ever were any validity in the notion, it had to be on a ceteris paribus basis. What, then, has been the disturbing factor or factors? Miller suggests demand to be the miscreant. Elementary

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graduates have experienced relatively lower rates of increase in demand. The stability of the high school-college differential, despite the relatively much greater percentage gain in graduates of higher education, he explains by presenting figures which show that the professional and managerial occupations increased relative to the total labor force. And it is precisely these two occupations which absorb the majority of the college graduates. Thus, the demand for college graduates has kept pace with the supply, explaining at least in part the stability of the differential. During "depression years," though, 1949 and 1958 in Miller's study, the high school-college differential favored the college graduate, returning to its previous relative positions in the more "normal years," 1939, 1946, and 1956. That is, the high school-college income gap was greater during 1949 and 1958 than in the more "normal years."

Comparing educational attainment with income reveals that additional years of schooling above the high school level have little immediate impact on earnings, but accumulate over time, culminating at a peak age of earning power. For male professional workers, "...the period of maximum earnings is between 45 and 54 years of age." Elementary graduates in this peak-earnings age group in 1958 earned only 18 per cent more than those below this age group. By way of contrast, high school graduates earned 28 per cent more than those below peak-earnings age group, while

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81 Ibid.
82 Ibid., p. 970.
83 Ibid., p. 969.
84 Ibid., p. 972.
college graduates earned 78 per cent more. The Serviceman's Readjustment Act of 1944 reveals that those veterans who partook of the educational and training opportunities provided thereby made greater gains than those who did not.85

Several more studies could be presented, but, as mentioned earlier, they all indicate essentially the same thing. Miller, however, is careful to warn us that his study could very well be erroneous to some extent. It could be that "...the higher incomes of those with more years of schooling are due in part to differences in intelligence, home environment, family connections, and other factors which result from individual differences in ability and opportunity."86 Houthakker makes the same point:87

Indeed we cannot even be sure that the apparent effect of education on income is not completely explicable in terms of intelligence and parents' income, so that the specific effect of education would be zero or even negative. The evidence which would settle this point is not available; off-hand I would hardly expect the extreme possibility just mentioned to be realized. On the other hand the popular figure of $100,000 for the average value of a college education can only be regarded as an upper bound....

Weak support at most is lent to Houthakker's contention by evidence presented by "Rexford Moon, of the College Entrance Examination Board."88 Moon states that 50 per cent of the students in independent colleges could afford higher tuition "without unusual sacrifices" and that only about 20 per cent got through "at great cost—much outside work, exercise of

85 Ibid., p. 977.
86 Ibid., p. 964.
unusual thrift," etc. The implication in Moon's statement is that a majority of the students in independent colleges come from families who have above average income. It could very well be, though, that families with above average income are more apt to send their children to independent colleges than are families with average or below average income. Be that as it may, one cannot escape the very close relationship between "ability" as measured by scholastic achievement" and income.

One author, Jacob Mincer, has expressed the education-income relationship in mathematical form. For his model, he let

\[ l = \text{length of working life plus length of training, for all persons = length of working life of persons without training,} \]

\[ a_n = \text{annual earnings of individuals with } n \text{ years of training,} \]

\[ V_n = \text{the present value of their life-earnings at start of training,} \]

\[ r = \text{the rate at which future earnings are discounted,} \]

\[ t = 0, 1, 2, \ldots, l \text{-time, in years,} \]

\[ d = \text{difference in the amount of training, in years, and} \]

\[ e = \text{base of natural logarithms.} \]

Then

\[ V_n = a_n \sum_{t=n+1}^{l} \left( \frac{1}{1+r} \right)^t \ldots \]

This formula is merely an expression for the value of one's life-earnings figured by the discrete process, after discounting the opportunity cost

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of "n" years of education, or training. His continuous formula is:

$$v_n = a_n \int_0^n (e^{-rt})dt = \frac{a_n}{r} (e^{-rn} - e^{-rl}).$$

A ratio can thus be determined between people differing by "d" years of training:

$$\frac{a_n}{a_{n-d}} = \frac{e^{-r(n-d)} - e^{-rl}}{e^{-rn} - e^{-rl}}$$

$$= e^{r(\ell + d - n) - 1}.$$  

From this formula, Mincer draws three observations:

... (a) people with more training command higher annual pay; 
(b) the difference between earnings of persons differing by d years of training is larger, the higher the rate at which future income is discounted, that is, the greater the sacrifice involved in the act of income postponement; (c) the difference is larger, the shorter the general span of working life, since the cost of training must be recouped over a relatively shorter period.

The above formula takes into consideration the opportunity cost only, but the conclusion, Mincer says, would vary only slightly if direct costs were also to be incorporated.

One assumption of the model is not altogether valid. It is "... that earnings are of the same size in each period of the individual's earning life." It is invalid because experience, like training, will add to one's income until age becomes the dominant force, causing an absolute deterioration in productive capacity. Correlating age with experience, the age factor has not been taken into consideration in the model.

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90 Ibid., p. 285.
91 Ibid., p. 287.
A survey of broad, rather tentative findings in this field indicates that (a) growth in productive performance is more pronounced and prolonged in jobs of higher levels of skill and complexity; (b) growth is less pronounced and decline sets in earlier in manual work than in other pursuits; and (c) the more capable and the more educated individuals tend to grow faster and longer than others in the performance of the same task.92

These "tentative findings" imply, of course, that the higher the "occupational rank" and education, the steeper the "life-path of earnings" becomes. It follows, then, that intra-occupational differences in earnings among the more highly trained or educated will be greater than among the less trained or educated. These findings can also be expressed using the Lorenz diagram. That is, if successive curves are drawn on a Lorenz diagram, with levels of education held constant and letting age vary for each level of education, the drift from the equality line becomes greater as each successive level of education is taken into consideration.

Before proceeding, mention should be made of a very intensive study of non-white to white incomes by Morton Zeman. He based his study upon the 1940 Census for the year 1939, taking into consideration sex, location differences (urban, rural, and regional), age and education. He considers age and education specifically in "Chapter IV." This part of his study was limited to urban males because of lack of data for other groups. Among his findings:93

92 Ibid.
The most important distribution differences between the two color groups was the relatively higher education levels attained by the whites. This education difference had a larger effect on the relative income of whites and nonwhite than any other distribution difference between the two groups, including the regional one. Regional location differences were the second most important cause of the low level of the nonwhite to white income ratio.

A ratio of non-South to South incomes for the same age-education group reveals a larger differential for non-whites than for whites. For whites the differential decreased with the level of education, becoming practically nil at the highest level. Besides this regional difference, the lowest ratios of non-white to white income within each region were for the age-educational class in the greatest income bracket, and the highest ratios were for the age-educational class in the lowest income bracket.

Implicitly, here, it is assumed that no differences existed in those age-educational groups in health or quality of education which is actually an unwarranted assumption as Zeman points out. Further, the rate of increase in income as the age-educational bracket increased was only 2/3 as rapid for non-whites as for whites. The ratio was close to unity for the youngest and least educated persons, but "dropped to around 40 per cent among the oldest, best educated persons." These findings are probably not as valid today as they were 20 years ago. The increased interest in civil rights should decrease the extent and severity of discrimination. This should tend to move the non-white to white ratio more toward unity.

Social and economic discrimination is not restricted to the color groups. A study done of five professions (consulting engineering, certified public accountancy, law, medicine, and dentistry) in 1945 by Kuznets and Friedman for the period from the "late twenties through 1936" also
indicates discrimination. Although earnings of these professions varied considerably depending upon such things as "location, type of practice, organization of practice, and number of years in practice," besides other factors, they averaged 85 to 180 per cent more than non-professionals in communities of the same size. The authors estimated that in order for them to be repaid for their expense in acquiring their training, they would have to receive only about 70 per cent more than the non-professionals. Obviously, then, underinvestment was present during the period covered. Two reasons were tentatively proffered as an explanation for the discrepancy. First, professionals require higher abilities. This factor alone tends to prevent investment from being "pushed to the margin." The second reason seems to carry more weight. It is that, in part, the discrepancy is the result of lack of competition caused by economic or "organizational restrictions on entry."

For example, the child of a professional man is more likely to be cognizant of opportunities in the professions and better able to seize them than the child of an unskilled laborer, even though the professional man and the unskilled laborer have the same income and capital. The child of the professional man will have a background and associations that facilitate entry into the professions and make it seem natural; he will have contacts after he finishes his professional training that will ease his path.

Over the years, there have been various attempts to explain inequalities in income. For instance, a fairly recent attempt was made by Pigou

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94Milton Friedman and Simon Kuznets, Income from Independent Professional Practice (New York, 1945).
95Ibid., p. 88.
96Ibid., p. 93.
97Ibid.
who thought a paradox was present due to the fact that although abilities were normally distributed, incomes were not.\(^{98}\) He attempted to solve this apparent paradox by considering the distribution of property. Still another attempt was made by R. Gibrat who attributed this phenomena to chance.\(^{99}\)

Although there is probably some truth in them all, the data now available suggest that if one were to toss all these reasons in the air, education (knowledge and skills) would "hurt" the worst as it hit you on the way back down. To be sure, if chance were one of the major factors, it seems reasonable to assume that one of the most economically cherished, vital and basic concepts, viz., rational maximization, would have met its nemesis long ago. For example, if consumption were not based primarily upon rational decisions, even if the firm were rationally oriented, the firm would have no predictable demand curve upon which to base production. Actually, it would be unrealistic to assume that firms were rationally oriented when consumers were not because consumers are also producers. Of course, one can go even further and say that if man were not primarily rational in all his actions there would be no civilization.

**On-The-Job Training.** Investment in formal education is just one of the several possible ways of enhancing human capital. On-the-job training can also accomplish this. In the United States, industrialization is fast approaching the stage where a "...fairly systematic education must extend through essentially the entire working life of very large fractions of the population..."\(^{100}\)

\(^{98}\) Jacob Mincer, *op. cit.*, p. 282.

\(^{99}\) Ibid.

The scantiness of information on quantity (numerically or dollar-wise) prevents any discussion in depth. There is far less known about on-the-job training than about formal and adult education. Nevertheless, some notion of its extensiveness can be gained. For skills, there is evidence to suggest that a very large amount of investment takes place every year. For instance, in New Jersey 16 per cent of the industrial concerns had some kind of employee training program. Clark claims that practically all major companies have "elaborate training programs at the technician level." A new trend is being established by Ford and General Motors. They are retraining their workers who possess obsolete skills to handle more advanced equipment. Thus, they are retraining their own employees instead of relying upon the open market. Last year, Ford "... retrained nearly 3,000 workers to handle more advanced hydraulic and electrical equipment. In addition to its apprenticeship programs, General Motors retrain 7,200 employees a year.... International Business Machines "...retrains about 100,000 workers for other companies each year to operate the computers and other equipment it sells and leases." On-the-job training is not restricted to employer supervision, for practically all skilled labor unions have voluntary training programs of some type.

The pace of technology has made skill obsolescence one of the more serious problems in the drive toward greater efficiency. A very recent

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101 Time, LXXVII (March 10, 1961), 90.
102 Harold F. Clark, op. cit., p. 261.
103 Fortune, LXIV (July, 1961), 241
104 Ibid.
attempt to solve this problem was made by Armour and Company in conjunction with the Packinghouse Workers' Union in 1959. A $500,000 fund was set up to be used to retrain workers displaced by automation, each worker to receive no more than $150 for retraining purposes. Out of 433 workers displaced in Oklahoma City, 170 applied for retraining. Out of these, all but 60 were cancelled out by aptitude tests. Some of those who were retrained had to accept substantial pay cuts. In short, the program was pretty much of a failure.105

There is evidence to suggest that the Armour experience is not symptomatic of all retraining programs. For instance, the United States Office of Vocational Rehabilitation, dealing only with the physically and mentally handicapped, has retrained over 1,200,000 workers in the last 41 years and claim a 75 per cent success record.106 Their experience signifies, however, that retraining is quite expensive, running about $2,000 per worker. In contrast to Armour, this "...agency hesitates to call any worker untrainable; officials are 'shocked at the casual approach' of the Armour experiment in declaring 65 per cent of its applicants ineligible merely on the bases of a battery of impersonal aptitude tests."107

To be sure, the great advances made in technology and the non-technical fields make further education a necessity for management as well as for the skills. Time reports that literally "...hundreds of U.S. companies, from small Texas printing firms to A.T. & T., are sending their

105 Ibid.
106 Ibid., p. 242.
107 Ibid.
employees forth to wrestle, sometimes for weeks at a stretch, with super-
sophisticated versions of Monopoly. One four-week course offered by
the American Management Association cost $850 per student. The American
Barkers' Association also has numerous courses designed on the management
level. The armed forces do a huge amount of training on both the skill and
management levels.

**Adult Education.** More on the adult education level are the many
vocational schools specializing in some skill or skills. Literally hundreds
of private and public high schools also offer courses oriented toward the
skills. The National Education Association completed a study over the
period from 1947 to 1951 on "public-school adult education" which increased
51 per cent during this time. In 1951 the estimated enrollment reached
4,750,000. Note that this 1951 figure equals the total number of stu-
dents enrolled in higher education and about half the enrollment in high
schools today (1961 figures estimated at 4,300,000 and 10,800,000 respecti-
tively). In California, "...approximately one tenth of the total population
of the state is currently participating in adult-education programs sponsor-
ed by the adult schools of the state."

"According to Toynbee, a civilization survives only so long as it
makes adequate response to the challenges of its time." Every technolo-
gical change presents new "challenges" which require solutions in which

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108 *Time*, LXXVIII (September 8, 1961), 81-2.
110 Paul H. Sheats, C. D. Jayne and R. B. Spence, *Adult Education*
non-formal (as well as formal) education plays a part. Consequently, the very rapid increase in adult education is not too surprising.

However, the point is that formal education is only a portion of the total investment in education. Without adequate data, it is hard to say how much that portion is. Clark feels that formal education is not quite one-half of the total educational investment.112

There is evidence that the type of education under discussion (on-the-job training and adult education) has been very important in Russia's abnormally high growth rate. Labor is the Soviet's biggest input by far, and consequently, a small increase in quality would have large effects upon productivity. Schultz, in a tour of Russia, was very impressed by the amount of personal study being done there. Each plant had a study program in which the Russians took great pride. Almost all the production workers were paid on the piece-work basis which undoubtedly spurs participation in plant study programs. Incentives to improve the capabilities of administrative personnel, technicians, and engineers include time off for study "...with pay and related assistance. More important still are the promotions, entailing an increase in pay, that go to those who successfully complete such study programs."113 Russia, then quite frankly views education of this type as an investment. She is strongly biased toward this type of education, in fact. Only 1/2 of those 14 to 17 years of age are in formal schools compared to 9/10 in the United States, and only

112Harold F. Clark, op. cit., p. 273.

9 per cent of the labor force have completed high school in contrast to 30 per cent in the United States. Instead of formal education, Russian planners have stressed on-the-job training and self-education through plant study programs.

Israel decided to experiment with this type of training in 1952. A training department was established with 20 people attending from 10 different establishments. "The success of the courses exceeded all expectations... Increase in productivity on the training projects ranged from 20 per cent to as high as several hundred per cent."114

Migration. Another form of investment that in the past was explained more in sociological terms than any other is migration. The trite expression was, How are you going to keep them down on the farm after seeing gay Paree? It could very well be that economic considerations played a large part in this movement off the farm and account for the movement, particularly among the young, out of the depressed areas of the country today. By migrating to areas that have better job opportunities, life-earnings are enhanced. On a purely economic level, the young are more apt to migrate because they have a longer potential working life over which to discount their expense of moving. It seems reasonable to assume that as the mobility of the American worker becomes greater still, this economic consideration will play an ever-greater role.

Health. Investment in human capital by the methods brought out above is useless unless you start with a healthy people. This would be

analogous to using inferior metal in the construction of a machine.

Health is the most obvious method of increasing efficiency, and no more will be done here than to indicate some of its peculiar economic aspects and to briefly discuss its quantitative importance.

The effect health has upon productivity is not a new discovery. For instance, we find Alfred Marshall chastising earlier economists for taking man as given.

...'earlier economists argued as though man's character and efficiency were to be regarded as a fixed quantity... (Economics) is getting to pay every year a greater attention to the pliability of human nature, and to the way in which the character of man affects and is affected by the prevalent methods of production, distribution, and consumption of wealth.'

No economists today would deny the economic importance of health. Nevertheless, due to the peculiarity of the demand for health and the external economies resulting from health, the economic aspect has not received the emphasis it should receive. The present controversy over public health seems to have become enmeshed in the moral and ethical aspect (besides, of course, the inevitable political entanglement) to the detriment of economic considerations. That is to say, the present controversy has shifted public attention from the preventive side of medicine to the cure of sickness when it appears and to whether it is or is not degrading to human dignity for a person to ask for and receive medical service he is unable to pay for. Unquestionably, this is a problem but not the problem.

Preventive health is one good for which consumer demand is not based upon rationality. The evidence: "In every income group there is a heavy

115 Selma J. Mushkin, "Toward a Definition of Health Economics," Public Health Reports, LXXIII (September, 1958), 788.
concentration of expenditures for medical care among those families who suffer illness. Only about a third of the population see their dentist in any one year, and only about a fifth of "physician services" are directed toward prevention. These data strongly suggest "... consumer outlays are undertaken primarily to cure or provide services for the sick" whereas more should be spent for preventive purposes. There appears to be no doubt that greater effort in preventive medicine would cut greatly the medical bills, and, more important, drastically reduce lost working time. In 1951, the United States was spending about $4.00 per capital per year on preventive measures.

The results of prevention has been dramatically demonstrated in the past. In New York City between 1929 and 1939, a preventive drive was conducted against diphtheria. The incidence was reduced from 14,000 to 543, while the death rate due to diphtheria was reduced from over 1,000 a year to 22 per year. "The hospital, medical, and nursing bills for the care of diphtheria in 1939 were only about $44,000. If to this figure is added the total cost of the diphtheria campaign for ten years, the figure was under $500,000, or less than half of the medical, hospital, and nursing costs for the care of diphtheria in 1920 ($1,027,000)." We need not go back 20 years, however, for an example. The recent discovery of the Salk

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116 Ibid., p. 787.
117 Ibid.
Vaccine for polio and the results of the inoculation campaign are proving to be just as dramatic. Since consumer rationalization appears to be inoperative in regards to health, the responsibility of preventive medicine must fall upon the state. Left up to the individual consumer, preventive health would be "undervalued, underpriced, and underproduced, unless administrative agencies (government or nonprofit) entered the market."[^120]

External economies resulting from preventive health measures seem to have aspects inherently their own. Abstracting from the effect age has upon capabilities, external economies arising from the inception of a skilled labor force can cease to exist if the skill becomes obsolete. But the ability used to acquire this obsolete skill is still present and can be used to acquire a new skill. If preventive health measures were such as to allow some mortal disease to run rampant, skills would not only be destroyed but also the capabilities of acquiring those skills along with a large part of the population. Thus, retrogression in this type of external economy can become much more severe.

The greatest loss from sickness and death is loss of earnings. In 1944, the "US Committee on the Costs of Medical Care" estimates "...that between $3,000,000,000 and $4,000,000,000 (between 1% and 2% of the national income) is the annual cost of temporary and permanent disability...."[^121] In 1950, it was estimated that tuberculosis alone cost the United States "1,000,000 years of future working-life."[^122] Hanlon in 1950 estimated that

[^122]: Ibid.
the death of a child in the United States represented a net loss to the economy ranging from $800 if at childbirth to $20,000 if at 18 years of age at which time repayment of the investment would normally commence. However, the latter figure is too low, for the opportunity cost of attending school was not taken into consideration.

Preventive medicine has a larger role to play on a world-wide basis than in the United States. In 1950, for instance, it was estimated that malaria affects about

...300 million persons per year, accounts for 3 million deaths and is responsible for a work loss of twenty to forty days per person per year. Irrigation and drainage programs are directly connected with such a disease as schistosomiasis, which is contracted through infection from polluted water. Such diseases prevail over wide areas of the African, Asian and American continents; it has been estimated that in the Middle East alone from 20 to 30 million persons, or 90 per cent of the rural population, are affected.

These estimates argue eloquently for balanced development projects.

Abstracting from the reduced efficiency resulting from illness, Ezekiel, in a lecture given in Pakistan, compares the number of births required in such a country to obtain "2,000 man-years" of productive labor with the number required in the United States to produce "2,000 man-years" of productive labor. In Pakistan, 750 births are required in contrast to 140 in the United States. If health standards were to be raised to levels comparable to developed countries, the resources invested in 610

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124 Ibid., p. 15.
births (750 - 140) of whom 300 reach 1 year of age, 200, 10 years of age, and only 100, 20 years of age, would release a very substantial sum for other purposes. Of course, the serious problem of preventing an expanding population above an optimum figure than rears its distorted head. 126 Here, too, education could play a leading role. The largely unsuccessful attempt in India in their birth control experiment by the counting-of-beads method does not detract from the role education can play but emphasizes the need for greater investment in education.

By way of demonstrating the importance of health, Winslow points out the very close correlation between poverty and poor health, implying that a major portion of poverty is caused by the ill health of the populace. 127 However valid the correlation might be, there exists the possibility that another, more important correlation is suggestive, viz., that both these attributes of the poorer countries (poverty and sickness) are inversely correlated with investment in skills and knowledge. That is, as the investment in human capital is increased, poverty and sickness decrease.

In summing up investment in human capital as broadly defined, Schultz makes nine policy observations: 128 1) human capital, like physical capital, "depreciates, becomes obsolete, and entails maintenance," but tax laws do not take this into consideration; 2) "Human capital deteriorates when it is idle because unemployment impairs the skills that workers

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126 Ceteris Paribus, an optimum population is defined as that stable population which will produce the maximum output per capita.

127 C. E. A. Winslow, op. cit., p. 75-7.

have acquired;" 3) several types of hindrances are present in the choice of professions: racial, religious, and professional; 4) the capital market is more imperfect in human capital investment than in other types of capital investment; 5) "Internal migration, notably the movement of farm people into industry, made necessary by the dynamics of our economic progress, requires substantial investment." Although the cost of moving for farm parents might be too great in relation to the probable returns, it would pay society because "...the children of these families would be better located for employment when they were ready to enter the labor market." The over-all quality of urban education, dollar for dollar, is undoubtedly better than the quality of education in the country schools or small farming communities. 6) the low income of most of the problem groups (the Negroes, the different nationals, the migratory workers, the depressed area people) can be construed primarily as the result of non-investment in education, migration, and health; 7) on the whole, Schultz feels there is underinvestment in education; 8) he briefly debates the question of whether all the returns from an investment in education should accrue to the individual since part of the cost is supported by the state. He suggests that the progressive income and inheritance tax take care of the question. 9) investment in human capital is all to likely to be excluded from the plans of undeveloped countries.

129In elementary education, the country schools as a whole undoubtedly get the less-qualified teachers. The high schools of the small farming communities cannot afford as adequate laboratories or libraries as can the larger high schools, and the best teachers usually seek schools that are better equipped.
CHAPTER III

Human Capital and Underdeveloped Areas

In the last ten years, the idea of economic growth has experienced a tremendous boom. "The idea of progress was not held by the Greeks or Romans or by the Medieval and Renaissance Europeans" but originated "in the rationalistic philosophy of the Enlightenment." The reason for the recent boom is somewhat of a moot question. However, the improvement in communication, the growth of nationalism, and the "Cold War" probably explain the biggest portion. Better communication has brought about the realization that poverty is not an act of God and that something can be done about it, while nationalism and the "Cold War" have stimulated initiation of the "something."

The original answer to the causes of economic progress was the acquisition of physical capital and an increase in the labor supply. But, as was demonstrated earlier, these in themselves cannot account for the growth of income in the United States. The data presented suggest that human capital has played an important part. Schultz claims that to omit human capital "...in studying economic growth is like trying to explain Soviet ideology without Marx." Horvat claims that the rate of investment is necessarily limited by the amount of investment that has taken place in human capital. He

131 Theodore W. Schultz, "Investment in Human Capital," op. cit., p. 3.
calls the amount of human capital the "absorptive capacity" and designates it as the "(A) factor" which is determined as follows: 1) the zeal and willingness of the people brought about by the desire for "personal consumption." His two exceptions are where there exist "extreme inequality" and where "mass enthusiasm" has been generated; the former dampening the effects of a desire for consumption and the latter stimulating zeal and willingness despite the desire for personal consumption (or in addition to it). 2) "Health," of course is obvious; 3) "Factor knowledge" comprises "all degrees of skill, including scientific research." "The experiences of planning seems to suggest that knowledge (and certainly not investment resources) is the most important scarce factor in underdeveloped countries with otherwise favourable social climate." 4) the last is termed "economic and political organization." For instance, an unstable government certainly is not conducive to investment. These four make up the "(A) factor" above. Material investment (I) makes it possible to expand the "(A) factor" and "(A)" limits (I).

Planning must be carried forward as far in the future as approximations are feasible, and adjustments will have to be made constantly. It is possible, he claims, that the "(A) factor," or the limits imposed on investment (I) could with time be completely adjusted except for knowledge. Although knowledge is limitless, the rate at which it can be acquired is not and might serve as the most serious stumbling block. Furthermore, a constant "readaptation" of the whole social and political structure becomes necessary as development proceeds, and the speed of its "readaptation" is another limiting factor.

Vakil and Brahmanand are quite critical of India's Second Plan for not taking into consideration the "factor knowledge" mentioned by Horvat. The lack of adequate technicians and skilled workers contributed to the slackening of the growth rate. Competition among employers will not bring about an automatic increase of supply because of the lack of excess capacity in India's training institutions. The authors present three alternatives: 1) import foreign specialists. This method, though, would kill "the spirit of initiative." 2) native personnel can be exported for technical training. 3) reorganize India's educational system. To shorten the "period of gestation in regards to the process of specialization in various techniques and skills" seems to be a possibility. To facilitate the shortening of this period, perhaps specializations could be broken down into smaller units of study. An added advantage of shorter "gestation" periods would be the longer period of productive life. Another quite serious limiting factor besides that of technicians and skills pointed out is the inefficiency and lack of entrepreneurs. "...because of the increasing difficulties of management when the size of the unit expands, the owners or entrepreneurs might prefer to be content with only a limited rate of development."135

Ezekiel points out that more is involved than just planning for and constructing the necessary institutions. Teachers have to be trained as well as institutional administrators. An underdeveloped country just starting to develop can expect to look forward to "15 to 20 years of hard


135Ibid., p. 298.
work" before acquiring "a sufficient supply of all the trained people" it needs. He reiterates what List, Kyznets, Schultz, Horvat, et. al., maintain; viz., "One of the greatest differences between developed and under-developed countries is what their people know and can do, more than any differences in their resources."

Ezekiel illustrates what he means by a seemingly unimportant, but actually very important example—the education of women in underdeveloped countries. They have little or no dietetic knowledge, and the typical home garden is planted to only one or two food plants with the results manifesting itself in poor health.

You can grow in a vegetable garden in a quarter of an acre with 50 or 75 kinds of vegetables, more food than you could grow in an acre of wheat or an acre of rice in total calories and a great deal more food in the essential items necessary for growth and health, both vitamins and minerals.

Another example is the beating of clothes during the washing process. Beating wears them out about six times as fast as would be the case if other means of washing were used. An improvement in the education of women would have the obvious effect of releasing considerable resources for other investment purposes. In summing up his lecture, Ezekiel states:

I suspect you could double the standard of living, the consumption standard of living, from the kind of food you eat, the kind of clothes you wear, the kind of comforts you have in your home, with no more basic production in this part of the world, if only women were trained today.

Maybe this is an exaggeration, but the point is well taken.

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137 Ibid., p. 571.
138 Ibid., p. 572.
A report by the United Nations states that the highest priority in investment in human capital should be channelled toward the agricultural section, at least in the initial stages of development. "We believe that an increase of 50 per cent in two decades or less would be possible even without any substantial reorganization of the agricultural system, if farmers were taught modern techniques..."¹³⁹ The expense involved in gaining a 50 per cent increase in agricultural production, the report maintains, would require a minimum of 1 per cent of the national income of underdeveloped countries.

A study done by Montague Yudelman on agricultural development in Iraq tends to confirm the importance of investments in human capital directed towards the agricultural section. From approximately 1935 through 1956, the Government of Iraq increased the cultivatable land acreage by about 60 per cent through irrigation and reclamation projects. The outputs of barley and wheat, which accounted for 88 per cent of the new acreage, also increased by 60 per cent. Thus, output per acre remained approximately the same as before.¹⁴⁰ It was hoped, Yudelman says, that giving ownership status to the settlements on the new land would result in an improvement on the traditional methods of farming. Yet, the general results were a "rapid decline in yields from initial yields."¹⁴¹

"Thus in Iraq, as in many other underdeveloped areas, the tendency in public investment in agriculture is to stress the improvement of resource


potential but not improvement of methods of exploiting this potential."\textsuperscript{141}

A study done on the possible effects of an improved labor force by Arnold C. Harberger concerning Chile also emphasizes the importance of human capital. He attempts to determine whether better allocation of resources would facilitate growth in that country. He sets up a formula given by

\[ g = S_L + i + m + r + q_L = t, \]

where "\(g\)" is the growth rate,

\[ S_L \] \text{is} the share of labor in the national income, \(L\) the percentage rate of growth of the (employed) labor force, \(i\) the fraction of national income devoted to net investment, \(m\) a weighted average of the net marginal productivity of capital in the various segments of the economy, \(r\) the contribution to the rate of income growth of reallocations of the resources of the economy, \(q_L\) the contribution of the improvements in the quality of the labor force, and \(t\) the contribution of technological advance.\textsuperscript{142}

He assumes in the \(S_L\) factor that "...neither the share of labor in the national income nor the rate of growth of the labor force would be affected by improved allocation policies."\textsuperscript{143} He discounts the "im\(^n\) factor because the low level of income in Chile predisposes savings and thus investment to a relatively small figure. He had previously estimated that by a more judicious handling of Chile's tariff, \textit{viz.}, using an across-the-board policy instead of the present discriminatory policies,

\textsuperscript{141}Ibid., p. 87.

\textsuperscript{142}Arnold C. Harberger, "Using the Resources at Hand More Effectively," \textit{American Economic Review}, XLIX (May, 1959), 140.

\textsuperscript{143}Ibid., p. 141.
by reducing the rate of inflation, and by reducing "the internal, inter-
sectoral distortions" in regard to capital and labor, Chile's level of
income could probably be increased about 15 per cent. These reallocation
measures belong in the "F" factor but are only a one-shot method. After
they have been completed, only the slightly higher rate of savings and the
"increased precision of cost calculations" will affect the rate of the
growth of the economy. It is in the last two factors, "qF" and "F", on
which Chilean hopes should ride.

He draws a parallel with Brazil. Despite Brazil's equally poor
resource allocation, she has been progressing at the rate of from 2 to 3
per cent a year. "I find the only plausible source of this difference to
be a differential rate of technical progress." Technical progress is
brought about by investments made in human capital. "The rewards given by
the market to engineers, technically trained managers, agronomists, and
other technicians themselves justify the investment in their training at a
rate of real return which compares favorably with the best returns on
investment in physical capital equipment...." Following other writers
on the subject, he feels that more investment in technical training should
be made in Chile rather than by sending Chilean workers to foreign countries
to acquire training. Human capital investments are not a one-shot invest-
ment but a constantly recurring one. Consequently, the training of
technicians should take place in the mother country.

Blitz approaches investment in human capital in underdeveloped areas
from a different angle. Even though labor is relatively plentiful in

\[144\] Ibid., p. 144.
\[145\] Ibid.
underdeveloped countries, "...the costs of skilled labor services in
general and of maintenance work in particular turns out to be very
high."\textsuperscript{146} He maintains that maintenance costs are an important factor
in considering investments in physical capital. The "mechanization"
of maintenance always tends to lag behind "mechanization" of industry.
Underdeveloped countries, then, might be making a mistake by investing
in highly labor-saving machinery because skills of great complexity are
necessary for maintenance.

He feels that another alternative is possible. Perhaps they can
take advantage of their overpopulation problem by investing in more second-
hand (obsolete) equipment and in skills of less complexity. Secondhand
equipment is more labor intensive because, if for no other reason, of more
breakdowns. "To the extent that underdeveloped areas make use of their
labor surplus to train maintenance personnel and to gain a comparative
advantage in maintenance service, they will be better able to take advan-
tage of secondhand equipment."\textsuperscript{147} There are several aspects of this
approach: 1) the difference in the interest payments alone between the
purchase of new and secondhand equipment might amount to more than the
added maintenance costs of the poorer equipment and the wages of idled
workers during breakdowns; 2) the training of a skilled labor force would
not only help to reduce the ranks of the unskilled but also complement
them. "All industries require some skilled labor and their ability

\textsuperscript{146} Rudolph C. Blitz, "Maintenance Costs and Economic Development,"
Journal of Political Economy, LXVII (December, 1959), 560.

\textsuperscript{147} Ibid., p. 567.
to absorb unskilled labor is generally limited by the supply of skilled workers.\footnote{Ibid., p. 565, Footnote No. 15.} \(\text{148}\) 3) Investment in skills is conducive to greater labor force mobility. It seems axiomatic that a certain amount of mobility is a necessary condition of development. Also, underdeveloped areas have an advantage relative to developed areas in the training of skills because of low opportunity costs.

Blitz asserts that another reason why underdeveloped countries should invest in skills is that countries that import their capital equipment have no chance to train their maintenance workers during the production process as is the case in developed countries.

He suggests that the investment in skills and secondhand machines was a major reason for Japan's very rapid growth. Japan established compulsory education (1871) even before Great Britain, and her educational outlays as a per cent of national income have been among the highest in the world. From 1950 to 1956, Japan's educational outlays have topped the world with the exception of Russia's. They ranged from a low of 4.81 per cent of national income to a high of 6.12 per cent during the 7 years stated above; by comparison, the respective range for the United States was from 4.09 to 5.19 per cent.\footnote{Ibid., p. 567, Footnote No. 21.} \(\text{149}\) Having more or less accomplished the investment in skills, then, Kindleberger is only half right in declaring that Japan's success in the textile industry was because the "...industry grew to power on secondhand British machines..."\footnote{Ibid., p. 567.} \(\text{150}\) He should have added
that part of the answer to Japan's success in textiles was because of her investment in education. (It is assumed that the opportunity costs were not taken into consideration in the above figures. If not, then the comparative value of these figures are in question but not the fact that Japan made and is making large investments in education.)

If underdeveloped countries would concentrate more on investment in skills and on secondhand (obsolete) equipment for their capital requirements, prices of these capital goods would be bid up. And this would tend to cause a more rapid replacement by newer or more advanced equipment in the developed countries. In the United States, higher prices for secondhand equipment would accelerate what Blitz believes to be a decreasing capital longevity. He has arrived at this opinion by noting the decreasing net capital formation to gross capital formation ratio.

The data are not adequate enough to say definitely that the capital longevity is decreasing in the United States, but the NCF/GCF ratio suggests this possibility. One of Blitz's tentative explanations of the apparently decreasing NCF/GCF ratio is that "An increase in the stock of knowledge may lead to increased anticipation of obsolescence, which in turn should result in the deliberate shortening of capital longevity." \(^{151}\)

Kindleberger sums up the case for economic development in regard to education in underdeveloped areas very well. He says:\(^{152}\)

In underdeveloped countries...it is not enough to cultivate a handful of entrepreneurs and business executives. Partly the requirement is for vocational education which can succeed only against a background of literacy and elementary schooling;

\(^{151}\) Ibid., p. 563.

partly it is for in-plant training. In part, however, it requires wide diffusion of the values of industrial society.

The relative importance of each requirement will have to be left up to conjecture and experience.

If the data presented in this paper are in any sense valid, it seems reasonable to assume that investment in human capital could explain in large part the difference in growth rates between the United States and Great Britain. Actually, the difference in the amount that has been invested in formal education between the two countries is striking. Time reports that "Britain spends less than half as much per capita on education as the U. S. One result: in proportion of university students to population, Britain ranks 25th among all countries, behind Spain, for example, and even Bulgaria."153 Schultz reports that in 1900, 1.8 per cent of the labor force in the United States "...was employed in state and local schools, whereas in 1901 in Great Britain, the per cent was only 0.9."154 In 1950, the figures were 2.4 and 1.4 per cent respectively. He presents a table which gives a still better picture.155

PER CENT OF POPULATION OF VARIOUS AGES ENROLLED IN SCHOOLS IN GREAT BRITAIN AND THE UNITED STATES IN 1950

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*Based on total enrollment in college and university (thus not restricted to the ages 19-22) as a % of the number of individuals in the population of ages 19-22.

153 Time, LXXVIII (September 1, 1961), 57.
155 Ibid.
One would suppose, a priori, that these differences would manifest themselves in capital-output ratios in which the amount of investment in human capital had not been taken into consideration. Kuznets, in an intensive study of capital-output ratios (excluding human capital) in 12 countries, demonstrates in his "TABLE I" that whereas no definite trend in the capital-output ratios are present in Britain, a very definite downward trend is apparent for the United States.

Now, a study of capital-output ratios over time for a particular country that has been experiencing economic growth, where the "capital" figure in the ratios includes only physical capital, should manifest a definite downward trend given that investment in human capital is not merely a consumptive good but is, in part, similar to an investment made in physical capital.

With the above hypothesis in mind, Kuznets' "TABLE I" shows that the gross domestic capital formation to gross domestic product ratio for Britain rose from 9.0 in 1855-1914 to 10.6 during the years 1895-1914, 1921-1938, and 1952-1958. During approximately the same number of years for the United States, the ratio fell from 21.9 in 1869-1913 to 20.1 during the years 1894-1913, 1919-1938, and 1946-1955. The net domestic capital formation to net domestic product ratio shows a downward trend for both the United States and Britain. During the years stated above, Britain's ratio fell from 7.3 to 6.0 respectively. For the United States, the ratio fell from 13.1 to 8.4 respectively. To recapitulate, from approximately

1880 to 1955, the GDCF/GDP ratio in Britain rose from 9.0 to 10.6; for the United States the ratio fell from 21.9 to 20.1. The NDCF/NDP ratio for the same approximate number of years fell from 7.3 to 6.0 in Britain; in the United States the ratio fell from 13.1 to 8.4. Concentrating on the NDCF/NDP ratio only, it is seen that the ratio for the United States has experienced a much greater decrease than has the same ratio for Britain. Taking into consideration the much greater amount the United States has invested in formal education relative to Britain, it would appear that at least part of the reason why the United States has experienced a greater relative growth rate is because of the greater amount of investment she has put into human capital. However, this conclusion has to be discarded for four reasons: 1) too little is known about the amount of investment in human capital in Great Britain; 2) there is a substantial difference in the natural resource endowments between the two countries; 3) Great Britain has experienced two devastating wars (World War I and II) that affected her productive capacity to a greater extent than was true for the United States; 4) Kuznets, in the same study cited above, presents other capital-output data (excluding human capital) computed on different bases that do not bear out the conclusions from his "TABLE I". No doubt part of the problem in the consideration of capital-output data is as Kuznets suggests on page 14 of this paper. That is, the non-consideration of an all-inclusive definition for capital causes erroneous fluctuations in the computations of capital-output ratios. Until more accurate data become available, the precise part human capital plays in economic growth will remain unknown.
CONCLUSION

Although capital in economic theory has been variously defined over the years, it became traditional to include only physical capital in the definition. Adam Smith is reputed to have been the first to include the "acquired and useful abilities" (human capital) of the populace within the concept of capital. However, the classical notion of land, labor, and capital as being the only productive factors, along with the great influence of Marshall, excluded any investment, except for health, that improved the productivity of labor. Inadequate statistics tended to obfuscate labor's real role in economic growth. Consequently, labor was generally considered as a homogeneous unit.

Technology was suggested as the missing factor of the cause for increased productivity in the United States, but a question remains. What are the causes of technology? It began to be realized that technology, however defined, depended upon greater knowledge being possessed by the populace. In order to acquire greater knowledge, investment in the way of labor and physical capital is necessary. This investment should be considered as capital investment to the extent that it increases income. As Kuznets intimates, if only physical capital is taken into consideration, a true measure of productivity is impossible because of the resulting fluctuations in capital-output ratios.

From 1900 to 1956, the total amount of investment made in human capital in the United States as a per cent of gross physical capital formation rose from 9.0 to 34.0. Over the same period, the total amount of investment entering human capital as a per cent of national income rose
from 2.7 to 8.2. Both comparisons are in current prices. Foregone earnings of high school and college students comprised a surprising amount of the total cost. In 1900, foregone earnings averaged 26 per cent of the total cost and in 1956 they averaged 43 per cent.

Attempts to measure the returns from investments made in human capital are not too successful because of the difficulties encountered from the possible returns ensuing from external economies. Nevertheless, Becker estimates that returns are approximately 9 per cent.

There is no doubt that investing in an education enhances life-time incomes. Von Thünen realized this fact in 1826, and various education-income studies made during fairly recent times confirm it. Of course, it could be that the observed education-income relationship is the result of other causes such as greater intelligence or family background.

Miller also found that whereas the elementary-high school income ratio has been increasing, the high-school-college income ratio has been comparatively stable. An ever-greater proportion of the population is becoming high school graduates, and a still greater proportion is gaining a college education. These two trends should cause the ratios to move toward unity. Such has not been the case. Miller proffers a tentative explanation by noting that the demand for high school graduates has increased at a faster rate than has the demand for elementary graduates whereas the demand for college graduates has been just enough to maintain a stable high school-college income ratio.

Investing in a formal education is just one of several ways of investing in human capital. Data on on-the-job training are most inadequate. Nevertheless, there is evidence to suggest that large investments
are being made here. Most of the major industrial concerns in the United States have some type of employee training program. The American Management Association and the American Bankers' Association both have numerous training courses directed toward management. Labor unions, the armed forces, and literally hundreds of private and public high schools have courses designed for skills.

Adult education is still another form of investment in human capital. This type of education is distinguishable from on-the-job training by the individual assuming the initiative and pursuing his course of study independently. In 1951, the National Education Association estimated that the "public-school adult education" enrollment was 4,750,000. By way of comparison, the 1961 estimate for enrollment in higher education is about 4,300,000. These figures adequately demonstrate that investments in formal education are only a portion of the total investment being made in education. Data are not available to determine the size of that portion, but Clark feels that formal education is less than one-half the total amount of resources entering education.

Indications are that on-the-job training and adult education were major factors in the rapid growth of the Soviet economy. Whereas only 50 per cent of Russian children in the 14 to 17 age bracket are enrolled in high school in comparison to 90 per cent in the United States. Schultz reports that almost every industrial plant in Russia has a training program for employees. Managers, technicians, and engineers are given incentives through pay raises and promotions to complete study programs. Russia has consciously emphasized the practical side of education.
Two other forms of investment that contribute to human capital but which do not require learning per se are migration and the improvement of health. By migrating from areas of poor job opportunities to areas of good job opportunities, life-time earnings are increased. Depending upon their income bracket, migration by people in middle age or older might not pay because of a shorter period of time over which they must recoup the expense of moving. However, society would still realize a gain because the children of these older people would be better situated to enter the labor market when they became of age.

Health, of course, is basic for labor productivity. The general consensus is that more could be done in the way of preventive medicine. The greatest loss resulting from illness is not the direct costs of the illness, but the loss in working time. Thus, if greater effort were to be put into discovering and eliminating the causes of the ailments that inflict mankind instead of into curing sickness when it appears, lost working time would be reduced. Preventive medicine is one area in which consumer choice is inoperative. All the evidence suggests that the majority of consumer expenditures for health purposes have been made as a result of sickness and not for the prevention of sickness. Left up to the consumer, much less would have been spent on preventive medicine than has been the case. Consequently, the state must assume the responsibility.

Human capital should be a major consideration in the plans for developing the underdeveloped areas of the world. Development was originally thought to require an ever-greater amount of physical capital relative to labor. No doubt this is true, but development also requires more complex physical capital which in turn requires a more knowledgeable and thus a
more efficient labor force. Human capital predates physical capital.

Ezekiel adequately demonstrates the theoretical returns possible from theoretical investments made in the education of women alone. And Yudelman demonstrates a more general and concrete confirmation.

Human capital also should be a consideration in the choice of physical capital required by underdeveloped areas. That is, if underdeveloped countries would invest more in skills and secondhand equipment, a certain amount of relief would be given to their over-population problem besides the gaining of a skilled labor force. Blitz suggests that the buying of secondhand machines instead of new ones would save enough in interest payments alone to cover the added costs of maintaining the older machines. He feels that a major reason for Japan's success in her drive toward economic development was the early emphasis she placed on education and because of her concentration on the purchasing of secondhand textile equipment from Britain.

If human capital is as important in economic growth as it appears to be, then, theoretically, it should be possible to distinguish a country that has made lesser investments in human capital by comparing capital-output ratios in which the amount of human capital has been excluded. However, an attempt at such a comparison between the United States and Britain has to be discarded because of the paucity of data for Britain and because as yet too little is known about the causes of the fluctuations in capital-output computations.
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