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THE HISTORICAL ROOTS OF THE CONCEPT OF HUMAN CAPITAL

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IN RECENT years, economists have devoted a great deal of effort to developing and quantifying the concept of "human capital" and to applying it, through the concept of investment in the formation of human capital, to such activities as education, whether academic study or on-the-job training, migration, and medical care.[1] The concept of human capital, however, is by no means new. The object of this paper is to review some of the past literature, in order primarily to determine which authors treated human beings as capital, their motives for doing so, and their procedures for valuing man as capital. Although this essay is not exhaustive, it will be shown, in essence, that the concept of human capital was somewhat prominent in economic thinking until Marshall discarded the notion as "unrealistic."

Economists who considered human beings or their skills as capital include such well-known names in the history of economic thought as Petty, Smith, Say, Senior, List, von Thünen, Roscher, Bagehot, Ernst Engel, Sidgwick, Walras, and Fisher. Basically, two methods have been used to estimate the value of human beings: the cost-of-production and the capitalized-earnings procedures. The former procedure consists of estimating the real costs (usually net of maintenance) incurred in "producing" a human being; the latter consists of estimating the present value of an individual's future income stream (either net or gross of maintenance). Several motives for treating human beings as capital and valuing them in money terms have been found: (1) to demonstrate the power of a nation; (2) to determine the economic effects of education, health investment, and migration; (3) to propose tax schemes believed to be more equitable than existing ones; (4) to determine the total cost of war; (5) to awaken the public to the need for life and health conservation and the significance of the economic life of an individual to his family and country; and (6) to aid courts and compensation boards in making fair decisions in cases dealing with compensation for personal injury and death.

I

Statisticians and actuaries have developed relatively scientific procedures for estimating the money (or capital) values of either a human being as such or the population of a nation. Their methods, which are essentially a cost-of-

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[1] See, for example: Schultz (1959, 1961*a*, 1961*b*, 1962); Weisbrod (1961); Machlup (1962); Mushkin (1962); Becker (1964).

production approach or some form of a capitalized-earnings approach, are examined in this section, as are variations in the approaches.

One of the first attempts to estimate the money value of a human being was made around 1691 by Sir William Petty. Labor to him was the "father of wealth." It must therefore be included in any estimate of national wealth. This led Petty to place a money value on laborers. Petty's interest in the monetary evaluation of human beings developed out of his interest in public finance (Hull, 1899, I, 589–95). Soon, however, he used the notion of human capital in attempts to demonstrate the power of England (Hull, 1899, I, 505–13; II, 192), the economic effects of migration (Hull, 1899, I, 192), the money value of human life destroyed in war (Hull, 1899, I, 152), and the monetary loss to a nation resulting from deaths (Hull, 1899, I, 108–10). Petty estimated the value of the stock of human capital by capitalizing the wage bill to perpetuity, at the market interest rate; the wage bill he determined by deducting property income from national income (Hull, 1899, I, 108).[2]

Petty's method makes no allowance for the cost of maintenance of workers before capitalization.[3] In spite of this limitation, his procedure gives a close approximation for determining the capital value of a nation. It is wholly inadequate, however, when used for purposes where human-capital values by age, sex, and economic status are needed, as in several of the cases mentioned above.

The first truly scientific procedure and the one followed today by many economists and others for finding the capital or money value of a human being was devised in 1853 by William Farr. Like Petty's, Farr's interest in the evaluation of human capital developed out of his interest in public finance. He advocated the substitution for the existing English income tax system of a property tax that would include property consisting of the capitalized value of earning capacity. His procedure for estimating the latter was to calculate the present value of an individual's net future earnings (future earnings minus personal living expenses), allowance being made for deaths in accordance with a life table (Farr, 1853). Farr's work suggests a way in which "human capital" can be a misleading analogy. He suggested that since human beings are productive they should be regarded and taxed as capital. Since this would oblige people to pay tax on wealth that they do not have in hand, it could lead to absurd results.[4] Farr's method was almost identical with the method utilized some eighty years later by Louis Dublin and Alfred Lotka (1930). Their procedure is discussed below.

Ernst Engel, writing around 1883, preferred a cost-of-production procedure for estimating the monetary value of

[2] Petty's evaluation of human beings in money terms was bitterly satirized by Dean Swift in his "A Modest Proposal for Preventing the Children of Poor People from Being a Burden to Their Parents or the Country."

[3] Perhaps, however, no great error is committed if maintenance costs are not considered when this approach is taken. Almost three hundred years later Mushkin and Weisbrod (1963, p. 595) assert: "Maintenance of physical capital prolongs its life, and thereby reduces annual depreciation. The result is that the reported stock of physical capital net of depreciation is larger than it would be if maintenance expenditures were lower. If depreciation were reduced by the exact amount of maintenance expenditures this would be equivalent to counting the maintenance as investment. Thus the treatment of maintenance of human and non-human capital may be reasonably consistent after all."

[4] Imagine a tax structure in which Elizabeth Taylor's tax bill at age sixteen is the same function of her capitalized expected earnings as a landlord's tax bill is of his capitalized expected earnings.

human beings. Although he discussed Petty's approach and modified it somewhat to allow for the limited number of years a man is employed, he felt that the yield value of certain human beings (for example, a Goethe, Newton or Benjamin Franklin) could not be determined. Since, however, their rearing was a cost to their parents, it might be estimated and taken as a measure of their monetary value to society. This monetary value at age x may be determined from a formula:

$$C_x = c_0\{1 + x + k[x(x+1)/2]\},$$

where C_x is the total cost of producing a human being (neglecting interest, depreciation, and maintenance) through age x, c_0 denotes costs incurred up to the point of birth, and k is the annual percentage increase in cost. The constant, c_0, was empirically found by Engel to be 100, 200, and 300 marks for the lower, middle, and upper German social classes, respectively. He observed k to be 0.1. This formula applies, however, only when $x \leqq 26$. After age twenty-six the individual was assumed by Engel to be "fully produced" (Engel, 1883, pp. 15–20, 58–78; Sencini, 1908, pp. 481–86).[5]

There is, however, no simple and necessary relationship between the cost of producing an item and its economic value. This is especially true for human beings, whose cost of production is not undertaken primarily with a view to economic gain. Although I see very little use for the cost-of-production procedure in evaluating human beings as such, a modification of Engel's approach is useful in determining the components, such as education and health-service capital, of a human-capital value. This is so simply because it is less difficult to estimate the direct (and opportunity, if appropriate) cost incurred in forming a particular component of human-capital value than to attribute future earning differentials to specific items such as education and health services.

Theodor Wittstein in 1867 defined human beings as capital goods and employed a variation of both Farr's capitalized-earnings and Engel's cost-of-production approaches to value human capital. Wittstein's interest in the concept of human capital arose from a desire to determine a guide to be used as a basis for claims for compensation from loss of life. Since he assumed that an individual's lifetime earnings are equal to his lifetime maintenance cost plus education, the approaches yield the same estimates —which inevitably come out to be zero at birth. His procedure may be summarized in the following formulas:

$$C_{(n)} = aR_{(0)}\frac{L_{(0)}}{L_{(n)}}\,r^n - aR_{(n)},$$

$$C_{(n)} = XR_{(N)}\frac{L_{(N)}}{L_{(n)}}\,p^{N-n} - aR_{(n)},$$

where a is annual consumption expenditures including education for an average German male in a particular occupation, $r = (1 + i)$, where i is the market interest rate; $p = 1/r$; $L_{(n)}$ is the number of men living at age n in a life table; $R_{(n)}$ is the value at age n of a 1-thaler annuity (for a given r and purchased at birth); X is the value of the future output of an average man in a particular occupation; N is the age at which this man enters the labor force (Wittstein, 1867).

[5] A French economist of the early eighteenth century, Richard Cantillon, discussed the cost of rearing a child (both free and slave) to working age. He estimated this cost to be equal to twice the value of the land needed to sustain an adult male. This formula applied to both slaves and freemen, since "free peasants . . . will probably maintain them[selves] upon a better foot than slaves according to the custom of the place he lives in" and will require, therefore, more land (Cantillon, 1959, p. 35).

Wittstein (1867, p. 50) assumed for simplicity that a and X are constant over the life of an individual. He asserted, moreover, that the former equation (which is based on past values) for valuing a human being in money terms should be used when $N > n$ but that when $N < n$ the latter equation (which is based upon expected values) could be utilized more easily (Wittstein, 1867, p. 53). Although Wittstein's analysis is interesting, his basic postulate that lifetime earnings and lifetime maintenance cost are equal is unjustified. Moreover, any combination of the capitalized-earnings and cost-of-production methods is dangerous, owing to the possibility of duplication of values.

Dublin and Lotka were in the life-insurance business. They considered that calculations of human values could be useful in ascertaining how much life insurance a man should carry. Such calculations might also be useful in estimating the economic costs of preventable disease and premature death (Dublin and Lotka, 1930, Preface). The result of their calculations was a formula:

$$V_0 = \sum_{x=0}^{\infty} v^x P_x (y_x E_x - c_x),$$

where V_0 is the value of the individual at birth; $v^x = (1 + i)^{-x}$ is the present value of \$1.00 due x years later; P_x is the probability at birth of an individual living to age x; y_x is yearly earnings per individual from age x to $x + 1$; E_x is the proportion of individuals employed from age x to $x + 1$ (Farr had assumed full employment); c_x is the cost of living for an individual from age x to $x + 1$. To find the money value of an individual at a particular age, a, the formula may be modified (Dublin and Lotka, 1930, p. 167) to

$$V_a = \frac{P_0}{P_a}\left[\sum_{x=a}^{\infty} v^{x-a} P_x (y_x E_x - c_x)\right].$$

This method of capitalizing an individual's earnings, minus his consumption or maintenance, gives a useful estimate for some purposes. It estimates, for example, the economic value of the man to his family—which was Dublin and Lotka's purpose. If the wage earner is killed, his family is impoverished by the amount of his contribution to them—which, presumably, is his income less his maintenance. There is considerable question, however, as to the validity of such an approach when the value of a human being to himself or in society is sought. To make estimates for these purposes, the capitalized-gross-earnings procedure (including living expenses) should be used.

The cost of producing (rearing) an individual, C, up to age a, according to Dublin and Lotka, is

$$C_a = \frac{1}{P_a}\left[\sum_{x=0}^{a-1} v^{x-a} P_x (c_x - y_x E_x)\right],$$

which may be simplified to

$$C_a = V_a - \frac{1}{P_a v^a} V_0.$$

Hence, the cost of producing an individual up to age a is equal to the difference between his value at age a and his value at birth, multiplied by $(1 + i)^a / P_a$ (Dublin and Lotka, 1930, p. 168). This is, of course, a sophisticated version of Engel's approach.

Dublin, somewhat earlier, had estimated the capital value of the population of the United States in 1922 to be *five* times the stock of material wealth.

The basis of this estimate is unknown and the estimate itself not entirely plausible, though it has been often quoted. His estimate of the size of this stock led him to advocate a more liberal expenditure policy for maintaining it (Dublin, 1928).

The works of Farr and Dublin and Lotka should be starting points for anyone interested in estimating either human-capital values or their components. Dublin and Lotka's discussion of the capitalized-earnings approach (either net or gross of living expenses) is clear, concise, and one of the best expositions available. Although there are obvious conceptual difficulties associated with this approach, it gives the most accurate results if the data necessary for measurement are available.

Allowances for depreciation are not taken into account when the cost-of-production approach to determine human-capital value is utilized. The capitalized-earnings approach, however, implicitly includes depreciation. Since a young man, *ceteris paribus*, is expected to be productive over a longer period than an older cohort, his capital value would be greater.

Maintenance costs were neglected by Petty and Engel. They were, however, considered to be equal to personal living expenses by Farr, Wittstein, and Dublin and Lotka. This was a dubious procedure then, particularly at the date Dublin and Lotka published, and would be wrong in developed countries today. Maintenance costs have been neglected by present-day economists who have advocated the human-capital concept. Some of these costs, however, are incurred during the investment period; a portion of them are continuous throughout the life of the human capital.[6]

II

From time to time throughout the history of economic thought, economists have included human beings, or their acquired abilities and skills, as a component of capital. Although some of them attempted to estimate the value of this capital—on both the microeconomic and the macroeconomic levels—and to employ these estimates for a specific purpose (for example, to estimate the total economic losses resulting from war), others have merely included human beings, or their acquired abilities and skills, in their definition of capital and recognized the importance of investment in human beings as a means of increasing their productivity. The latter group, generally, neither attempted an evaluation of human capital nor employed the concept for any specific purpose.[7] Most of these economists held that human beings should be included in the concept of capital for three reasons: (1) the cost of rearing and educating human beings is a real cost; (2) the product of their labor adds to the national wealth; (3) an expenditure on a human being that increases this product will, *ceteris paribus*, increase national wealth.

Although he did not specifically define the term "capital," Adam Smith included in his category of fixed capital the skills and useful abilities of human beings. The skill of a man, he said, may be regarded as a machine that has a genuine cost and returns a profit (Smith, 1937,

[6] For other work similar to that discussed in this section see: Lüdtge (1873*a*, 1873*b*), Lindheim (1909), and Meyer (1930–32).

[7] There are, however, a few exceptions: List used the notion in demonstrating the importance of protectionism, and von Thünen advocated utilizing the notion as an aid in dealing out social justice. Marshall, moreover, offered some estimates of human-capital values.

pp. 101, 259–66). Jean Baptiste Say (1821, pp. 92–94) asserted likewise that since skills and abilities are acquired at a cost and tend to increase worker productivity they should be regarded as capital. This was also the contention of John Stuart Mill (1909, p. 47), William Roscher (1878, p. 151), Walter Bagehot (1953, pp. 55–56), and, at the microeconomic level, Henry Sidgwick (1901, pp. 132–34). According to W. Stark, Jeremy Bentham's most interesting passage, from the point of view of economic theory, was one in which he stated that "labour is distinguished into mere physical exertion and the skill or mental power displayed in the exercise of the bodily act" (Stark, 1952, p. 53).

To Friedrich List, skills and acquired abilities of human beings, which are largely an inheritance from the past and the result of past labor and self-restraint, were the most important components of a nation's stock of capital. He asserted that, in both production and distribution, the contribution of this human capital to output must be considered (List, 1928, pp. 108–18).

These economists, who basically define capital as "produced means of production," do not explicitly include the human beings as capital. J. S. Mill (1909, p. 47) asserted: "The human being himself I do not class as wealth. He is the purpose for which wealth exists. But his acquired capacities, which exist only as a means, and have been called into existence by labor, fall rightly, as it seems to me, within that designation." Their reason for not explicitly including the man himself may be found in their interest in distribution and production. Sidgwick (1901, p. 134) pointed out: "We have to consider it [conventional capital] as a joint factor with labour in production, by the aid of which the labourers . . . are enabled to produce more than they would otherwise do; and in order to keep this view of it clear, we have to maintain the distinction between capital and labourers."

In contrast, J. R. McCulloch clearly defined the human being as such as capital: "Instead of understanding by capital all that portion of the produce of industry extrinsic to man, which may be made applicable to his support, and to the facilitating of production, there does not seem to be any good reason why man himself should not, and very many why he should be considered as forming a part of the national capital" (McCulloch, 1870, p. 66; see pp. 57, 67). He said, moreover, that there is a close analogy between conventional and human capital. An investment in a human being should yield a rate of return consistent with other investments, plus a normal rate of return determined by the market interest rate, during the probable lifetime of the individual (McCulloch, 1870, p. 66).

Nassau Senior suggested that human beings can usefully be treated as capital. In most of his discussion of the topic he referred to skills and acquired abilities and not to man himself (Senior, 1939, pp. 68–69, 204–6). On occasion, however, he treated the human being himself as capital with a maintenance cost—incurred with the expectation of obtaining a future yield (Senior, 1939, pp. 68–69). He asserted that there is little difference between talking about the value of a slave and about the value of a free man. The principal difference is that the free man sells himself for a certain period of time and only to a certain extent, whereas the slave is sold for his lifetime (Senior, 1939, p. 10).

Several current writers, dealing with investment in education, maintain that

this investment is undertaken primarily for future return. It is interesting to compare this view to that of Senior (1939, pp. 205–6), who considered the higher education of a gentleman's son: "Neither the labour which the boy undergoes, nor the expense borne by his father, is incurred principally in order to obtain future profit. The boy works under the stimulus of immediate punishment. It never occurs to the father that . . . he is engaging in a speculation which is likely to be unprofitable. To witness a son's daily improvement is, with all well-disposed men . . . one of the sources of immediate gratification. The expense incurred for that purpose is as much repaid by immediate enjoyment as that which is incurred to obtain the most transitory pleasures. It is true that a further object may also be obtained but the immediate motive is ample."

Hence, not all education is undertaken with a view to future yields. It is, however, capital, and it is the "quantity and diffusion of this capital" that determine the wealth of a nation. Senior (1939, pp. 134–35) asserted, moreover, that the value of the stock of England's human capital exceeded the value of the stock of all Great Britain's "material capital."

Henry D. Macleod considered productive human beings as fixed capital. In his view, however, if they are not productive they do not enter economic analysis (Macleod, 1881, pp. 134, 205–6, 213). This view contrasted sharply with that of Léon Walras, who included all human beings in the concept of capital. And the value, or price, of these human beings, Walras (1954, pp. 40, 214–16, 271) said, is determined like that of any other capital good. He, moreover, was aware of the inner reluctance of economists to treat human beings as capital. He argued, however, that in pure theory "it is proper to abstract completely from considerations of justice and practical expediency" and to regard human beings "exclusively from the point of view of value in exchange" (Walras, 1954, p. 216).

Johann H. von Thünen also recognized this reluctance to evaluate human beings. But from this reluctance, he said, "stems lack of clarity and confusion of concepts on one of the most important points of political economy" (von Thünen, 1875, p. 5). "Moreover, it may be proved that freedom and dignity of man may be successfully preserved, even if he is subject to the laws of capital" (von Thünen, 1875, p. 5). Von Thünen asserted that many social injustices might be eliminated if expenditures that increase labor productivity were treated within the human-capital analytical framework. The capital value of these expenditures, moreover, should be included as a component of the aggregate capital stock (von Thünen, 1875, pp. 1–10). While many present-day writers attribute the absence of the notion of human capital from the mainstream of economic thought to sentimentalism (Schultz, 1959, p. 110), it is interesting to note that here (and in a number of other cases in the past) the presence of the idea was due to sentimentalism.

Although Alfred Marshall admitted that an estimate of the capital value of a man might be useful and discussed clearly the capitalized-net-earnings approach to human-capital evaluation (consumption being deducted from earnings before capitalizing), he disregarded the notion as "unrealistic," since human beings are not marketable (Marshall, 1959, pp. 469–70, 705–6).

Human beings are included in Irving Fisher's definition of capital. Capital, he asserted, is a "useful appropriated material object," and since human beings

have these characteristics, consistency requires that they be included in the concept of capital (Fisher, 1897, pp. 201–2; 1927, pp. 5, 51–52, 68; 1965, pp. 12–13). Moreover, the skill of an individual is not capital in addition to the individual himself. It is, Fisher (1927, p. 9) said, the skilled individual who should be placed in the category of capital.

This brings up the interesting question: Are the value of skills and useful abilities and the value of an individual possessing them the same? Edward Denison (1964, p. 91) suggests that to speak of technological progress embodied in physical capital is simply to refer to changes in the quality of capital goods. An analogy may be made regarding human beings. Skills and acquired abilities are embodied in the human being and presumably increase his quality as a producing unit. Since these skills and abilities acquired by an individual are inalienable, it is questionable whether one should speak of them alone as capital; it is, if this view is taken, the skilled individual who is the capital. It has been suggested, however, that the answer to the question posed above depends upon the definition of value. If value is defined as "net benefit" to society where the excess of total output over total consumption determines net benefit, the addition of a skill or useful ability would increase output, whereas the addition of an individual increases not only output but also consumption. The value of a skill and a useful ability and the value of an individual, both measured by the amount of net benefit added, in this case might certainly be different (Dublin and Lotka, 1930, p. 4). Whether we call skills and acquired abilities only, or the acquirer of them, capital is relatively unimportant. The distinction, however, between skills and acquired abilities and the person is in any event important, for example, for purposes of taxation.

T. W. Schultz (1961*b*, p. 3) has pointed out that, "among the few [economists] who have looked upon human beings as capital, there are three distinguished names . . . Adam Smith . . . von Thünen . . . and Irving Fisher." Schultz (1959, p. 110) has asserted also that "the mainstream of modern economics has bypassed undertaking any systematic analysis of human wealth." It would be interesting to know the time period denoted by Schultz's use of the word "modern." Presumably, he means "current." If, however, another definition of "modern" were adopted (it has been said that modern economics began with Sir William Petty), his comment would be questionable.

III

As suggested above, the concept of human capital has been used to demonstrate the magnitude and economic importance of the stock of human resources. Estimates of the value of a nation's human wealth were thought to give some insight into the economic power of a nation.

While attempting to estimate the stock of human, or "living," capital in the United Kingdom in 1891, J. Shield Nicholson (1891) capitalized the portion of national income that he assumed to be derived from "living" capital.[8] To do so he attempted to find the capital value of such things as the wage bill, the earnings of management, the earnings of capitalists, the earnings of salaried government officials, and "domesticated humanity" (that is, the people of a nation

[8] This article appears as chapter v in Nicholson (1896). The central idea of these works (that is, recognizing human beings as capital and estimating their money value) is found also in Nicholson (1892).

"as 'things in themselves,' or rather superior domestic animals reared for their affectionate disposition and intellectual and moral activities") (Nicholson, 1896, pp. 112–14). He, unfortunately, included the latter category because it has a cost of maintenance, and he estimated its value by assuming that, since people spend 10 per cent of their income on their own maintenance and 10 per cent on rent, it is proper to value an individual as "a thing in itself" as equal in value to the house he occupies (Nicholson, 1896, p. 109). There is, of course, no simple relationship between the cost of production (or maintenance) of a good and its monetary value. Any attempt, moreover, to estimate in money terms the sentimental value of a human being "appears to be trifling with a serious subject."[9]

Nicholson capitalized the wage bill to determine the capital value of the "wage earner," and he added this to the other values he estimated, including the value of "domesticated humanity." Since the cost of production of wage earners appears in the estimate of the value of "domesticated humanity" and also in the estimate of the capitalized value of their earnings, there is a duplication of values, which seems to be historically characteristic of combinations of the cost-of-production and capitalized-earnings approaches. He concluded by asserting that the value of the stock of "living" capital of the United Kingdom was about *five* times the value of the stock of conventional capital (Nicholson, 1896, p. 114).

In his attempt to estimate the value of the stock of capital in France around 1900, Alfred de Foville asserted that any procedure for estimating the value of the stock of human capital by capitalizing the earnings before deducting consumption expenditures is incorrect. It is the error in this procedure, he averred, that has led writers to assert that the value of the stock of human capital is greater than the value of the stock of conventional capital. By deducting consumption expenditures (maintenance) from earnings and then applying Petty's method, he estimated the value of the stock of human capital in France. For some purposes, this approach is an improvement over Petty's, and it improves the analogy between the valuations of the aggregate stocks of human and conventional capital. He cautioned, however, that the whole notion of human capital is dubious. How can the capital value of a Goethe, a Newton, or a Jeanne d'Arc be determined? he asked (De Foville, 1905).[10]

A French actuary, A. Barriol, in 1908 utilized Farr's capitalized-earnings procedure, although he did not deduct maintenance from earnings, to determine the "social value" of a man in France. He defined "social value" as the amount of his earnings that an individual restores to society. Since he implicitly assumed that lifetime consumption equals lifetime earnings, the "social value" of an individual depends upon his total earnings. He attempted to estimate this value by age groups by assuming certain earnings scales and capitalizing them, allowance being made for deaths in accordance with a mortality table (Barriol, 1910).

He used these values to attempt to estimate the total and per capita value

[9] This phrase was borrowed from Longfield (1931, pp. 201–2). He, however, was referring to estimating the cost of producing common laborers.

[10] This, of course, is the same question asked by Engel. Engel's answer was that, although their cost of production could be estimated, it was impossible to determine their capitalized yield to society.

of the stock of human capital in several countries. The French values were multiplied by the population in the various age groups of the particular country. These values were then summed and divided by the total population figure to obtain a weighted per capita average value of a citizen of the country in question. Since the countries he considered had different levels of economic development and therefore different levels of wages, he applied a coefficient of increase or reduction to his estimates to compensate for the difference. He recognized, moreover, that the values obtained were too high, since he had assumed the female to earn as much as the male. He adjusted for this by multiplying his estimates by a "reduction coefficient." Although his estimates of the capital (or social) value of a human being were not definitive, he concluded that they might offer some insight into the economic power of nations (Barriol, 1911).

Barriol's procedure for adjusting his figures is interesting but the results obviously dubious. His adjusted estimates, as will be pointed out subsequently, were used as a basis for computation by other writers.

Human capital, according to S. S. Huebner (1914), should receive the same scientific treatment that is given to conventional capital. This can be done, he said, by "capitalizing human life values with bonds to give them perpetuity as a working force and fluidity as a source of credit, of subjecting them to the principles of depreciation, and of using the sinking-fund method to assure realization of the contemplated object whenever man has a future business or family obligation to fulfill that involves the hazard of uncertainty of the duration of the working life" (Huebner, 1914, pp. 18–19). This scientific treatment of human values is justified, he said, because of their importance in economic affairs.

In general equilibrium theory, with short-term contracts postulated, entrepreneurs have little incentive to invest in the work force. Today, however, with long-run growth widely recognized as a dominant factor in business planning, Huebner's comment is particularly relevant. Entrepreneurs are becoming increasingly cognizant of the importance of investments that become an integral part of man, and such awareness is leading to deliberate investment in human beings (see Becker, 1962). Hence, a symmetrical treatment of the work force and conventional capital may be necessary.

Huebner (1914, pp. 18–19) estimated the value of the stock of human capital in the United States around 1914—capitalized at the market interest rate and allowing for deaths in accordance with a mortality table—to be *six* to *eight* times the value of the stock of the nation's conventional capital.

Edward A. Woods and Clarence B. Metzger employed five procedures to obtain five different estimates of the stock of human capital in the United States in 1920. They did this to show the very large monetary value and importance of the nation's population and "to awaken a sluggish public . . . by appealing to its material interest" to the needs of conserving human life (Woods and Metzger, 1927, p. 32).

Woods and Metzger's (1927, p. 101) first estimate of the value of the 1920 stock of human capital was based upon governmental suggestions of life insurance for workers. Their second method of valuing the stock of human capital was to base its value upon the value of property, that is, to approximate the

former by applying a multiplier to the latter (Woods and Metzger, 1927, pp. 104–5). They applied several multipliers but concluded that "the multiple *five* seems to be the most accurate one to express life values to the national wealth" (Woods and Metzger, 1927, p. 106). Neither of these procedures, however, is scientifically valid.

Their third estimate employed the capitalized-national-income and the capitalized-wage-bill approaches. In the former case they capitalized the 1920 national income (Woods and Metzger, 1927, p. 108). This estimate made the unrealistic assumption that all national income is the product of labor. In the latter case, following Petty, they capitalized the wage bill to obtain an estimate of the value of the human-capital stock (Woods and Metzger, 1927, pp. 110–11). The difficulty here is the separation of returns to conventional capital from those to labor. Moreover, they assumed that labor earnings were constant through time. Neither approach considers depreciation or maintenance. Both procedures imply that the "value of American society" goes on indefinitely (Woods and Metzger, 1927, p. 111).

The fourth estimate employed the familiar Farr-type capitalized-earnings approach. They estimated both gross and net values for the value of the 1920 stock of human capital. Unlike Farr, however, they assumed constant earnings and consumption expenditures in all age groups (Woods and Metzger, 1927, pp. 114–39).

Woods and Metzger realized that symmetry of treatment as between human and conventional capital is achieved only if depreciation, maintenance, and obsolescence are considered. Maintenance is accounted for when consumption expenditures are deducted from earnings and depreciation and obsolescence are allowed for by the manner in which average earnings are estimated: "This factor [depreciation and obsolescence] is taken into consideration in the make-up of the 'average yearly wage' for workers, which included the lower wages of old workers along with the higher ones of the more efficient producers. The former naturally receive less salary and wages than workers in the prime of life, health, and efficiency but the wages of the latter are diluted in the 'average' by the lower wages of the former group plus those of the very young, untrained workers" (Woods and Metzger, 1927, p. 122).

To make their fifth estimate of the value of the stock of human capital, Woods and Metzger (1927, p. 142) applied the per capita human-capital estimates of some Americans who had previously valued human beings to the 1920 population data. Several of these estimates, however, were limited to adult male values at specific ages for workers or were otherwise limited in scope.

They concluded that the monetary value of the population is a country's greatest asset, and that it is "important that public-spirited citizens and students of social welfare strongly support those movements conducive to the conservation of human life and the enjoyment of as perfect health as possible, so that the lives of productive individuals might be further lengthened and thereby add to the wealth of society" (Woods and Metzger, 1927, p. 162). This conclusion contrasts sharply with that of one present-day economist, who argues that the point has now been reached in developed countries where further increases in health expenditures will be "health-producing but not wealth-producing" and

therefore, in an economic sense, unproductive (Lees, 1962). Although I view the latter argument as doubtful, definitive judgment cannot be reached until the quality of our information on this subject has improved. As will be pointed out below, many writers of the early twentieth century held Wood and Metzger's view.

IV

Economists and statisticians have utilized the human-capital concept to estimate the total economic losses to combatants resulting from war. The presumption is that a man's capitalized-earnings stream is capital and that his death or disability reduces the stock of wealth.

In attempting to estimate the total cost to the combatants of the Franco-German War, Sir Robert Giffen used what was essentially Petty's method of valuing in money terms the lives destroyed in the war. He emphasized, however, that his estimates were crude and imperfect and that the loss of human life was not amenable to monetary evaluation. Hence, he omitted it from his estimate of the total cost of the war (Giffen, 1880, pp. 29–31, 76).

Several writers utilized Barriol's estimates of the capital value of a man in an attempt to estimate the money value of human life destroyed as the result of World War I (Guyot, 1914; Crammond, 1915; Bogart, 1919, pp. 274–77). Man is capital, Yves Guyot (1914, pp. 1193–98) said, and society should be interested in loss of life not only for humanitarian but also for economic reasons. Although Ernest Bogart (1919, p. 274) asserted that an estimate of the monetary value of human lives destroyed in war is "a procedure of doubtful statistical propriety," he felt that only a monetary value could convey to the mind the enormous economic importance of these human lives destroyed.

These writers erred, however, in taking Barriol's adjusted estimates of the capital value of an average individual in the population to apply to the casualties of male combatants mainly of military age, particularly when the original unadjusted values were available. Bogart recognized the error. He said, however, that "it is evident from the fact that the estimates are low that the figures err on the side of underestimation rather than exaggeration, and that no grave error will be committed in using them" (Bogart, 1919, p. 275).

William S. Rossiter questioned the significance of including the capital value of life destroyed in estimates of the economic costs of war. The only case in which an estimate of human capital destroyed by war would have any significance, he said, would be that in which the value of the total stock of a nation's human capital had been computed and included in national wealth estimates. Then the loss resulting from war might be meaningfully compared with this estimate. With this in mind, he used Barriol's estimates to estimate the value of human life within the active male age group in the population of the nations at war in World War I (Rossiter, 1919).

Harold Boag (1916, p. 7) in 1916 considered the question of whether it is "correct to include in any estimates of the cost of war the diminution of capital due to loss of human life." He concluded that it is correct since there is a close analogy between "material and personal" capital (Boag, 1916, p. 9). Boag, moreover, enunciated several important points pertinent to human-capital evaluation: the method of evaluation should depend upon the purpose for which the estimates

are to be used; care should be taken to avoid counting an item as both human and conventional capital; and the interdependence of the values of conventional and human capital should be kept in mind (Boag, 1916, p. 10).

Boag (1916, pp. 16–17) pointed out that the capitalized-earnings approach to human-capital evaluation is preferable since it attempts to value material things, while the cost-of-production approach may include expenditures on the individual apart from those that increase his earning power. And the "gross" concept is preferred when valuing monetary losses resulting from war: "In calculations of material loss, the loss of income is usually compared with the total national income and not with the national savings and, therefore, it is often better to arrive at a capitalized value of the diminution of gross income instead of the surplus income" (Boag, 1916, p. 14). Although Senior had previously suggested it, Boag was the first to point out explicitly one of the difficulties associated with the cost-of-production approach to human-capital evaluation: "It is impossible to determine how much of the cost of education, maintenance, etc., is strictly necessary to produce an income-earner, as distinct from those capacities for 'love, joy and admiration,' which may not be incidental to the production of material wealth" (Boag, 1916, p. 17). It has been suggested recently that the inseparability of consumption and investment makes the entire analysis of human (education) capital dubious (Shaffer, 1961, p. 1027). T. W. Schultz (1961*c*, p. 1035) correctly points out, however, that, although a wholly satisfactory empirical method for dealing with the consumption-investment dichotomy has not been found, the economic logic for allocating (education) expenditures between consumption and investment is clear.

J. M. Clark, in a discussion of the costs of World War I to the American people, included the monetary value of human life destroyed in the war and set forth a modified Farr-type capitalized-net-earnings procedure for computing the capital values. In order to determine the loss in human capital to dependents resulting from the war, Clark constructed an "imaginary army" which represented the characteristics (age and number of dependents) of the actual losses. He then multiplied human-capital values by age by the estimated corresponding numbers of losses so as to obtain the total value of human capital destroyed in the war (Clark, 1931).

V

The human-capital analytical framework has been employed in the past for some of the same purposes for which it is currently being used, namely, to demonstrate the economic profitability of human migration, health investment, premature-death prevention, and education.

An interesting discussion occurred around the end of the nineteenth century regarding the monetary value of immigration to the United States. There was general agreement that immigration was economically profitable to the United States and that the subject fitted properly within the human-capital analytical framework. There was, however, some question as to the degree of profitability and the procedure for calculating an immigrant's monetary value.

Friedrich Kapp utilized Engel's cost-of-production procedure which, it will be recalled, neglects depreciation and maintenance, to estimate the capital value of an immigrant arriving in the United States. He concluded that if the immigra-

tion trend continued the country would gain almost a million dollars a day in the value of its human capital (Kapp, 1870). Charles L. Brace criticized both Kapp's procedure for valuing immigrants and his estimates of their value.[11] He argued correctly that the capital value of an object is not determined solely by its cost of production but also by the demand for it. Hence, he said, each immigrant is worth to the country the capitalized difference between his contribution to output and his maintenance: "Each laborer's average cost to his employer is, say $20 per month and 'keep,' or about $400 per annum. It is believed that an ordinary profit on common labor upon a farm is from 15 to 18¾ per cent. This would leave the gain to the country from $60 to $75 annually. This, at seven per cent interest, would represent the capital value . . . about $1,000 or $1,100 for an average male laborer" (Kapp, 1870, p. 149).

Richard Mayo-Smith, in 1895, followed Brace in criticizing Kapp's procedure for the monetary evaluation of immigrants. An immigrant who has ability and finds an opportunity to use it, Mayo-Smith said, has a monetary value to the country which he enters whatever the cost of his production. He furthermore considered the cost of rearing a child as a consumption expenditure. Although Mayo-Smith explicitly excluded human beings from the concept of capital—on the basis of the ownership criterion for defining capital—he clearly enunciated Farr's capitalized-net-earnings approach as the means for estimating their "economic" value. There is, however, a fallacy in this procedure, Mayo-Smith asserted, because the capitalized value of an immigrant's future earnings depends on his having an opportunity to earn them. Hence, he must secure employment upon his arrival. He must, moreover, secure it without displacing another worker. Otherwise, the stock of human wealth in the receiving country will not have increased (Mayo-Smith, 1901).[12]

In an article written in 1904, Miles M. Dawson proposed the use of actuarial principles for human-capital evaluation. He asserted correctly that the methods used by courts for determining compensation to others for the pecuniary injuries resulting from a death where another party is liable are unscientific. Actuarial science, utilizing the capitalized-net-earnings approach to human-capital evaluation, he said, furnishes the means of computing the monetary value of life destroyed—given the age, net earnings, and general health of the decedent (Dawson, 1904). Although the human-capital concept is now being used on a small scale for such purposes, the concept should be exceedingly useful and likely to be more widely utilized.

Several works appeared in the first quarter of the twentieth century in which the authors utilized the human-capital analytical framework to attempt to ascertain monetary losses resulting from preventable illness and death (Fisher, 1908; Forsyth, 1914–15; Crum, 1919; Fisk, 1921). Their hypothesis was that illness and death involved a loss in human wealth and that a saving could be effected by preventing or postponing some of the preventable illnesses and deaths that occurred. To determine this saving, Irving Fisher suggested that

[11] The relevant part of Brace's criticism, which appeared in an article in the New York *Tribune*, is quoted by Kapp (1870, pp. 147–49).

[12] Similar discussions regarding the monetary, or capital, value of immigrants to other countries are now taking place. See, for example, Abraham-Frois (1964).

Farr's capitalized-net-earnings approach be used to estimate the value of human beings. He estimated the money value of an average American by adjusting Farr's estimates to correct for the higher average earnings in the United States. He then used the age distribution of deaths and the "percentages of preventability" to estimate the average capital value of lives sacrificed by preventable deaths in 1907. The value of an average American multiplied by the 1907 U.S. population, Fisher said, gives a minimum estimate of the value of the stock of human capital existing in that year. This value, he asserted, greatly exceeded all other wealth (Fisher, 1908, pp. 739–41). There is, however, a serious error in Fisher's analysis. By substituting only average earnings of an American for average earnings of an Englishmen in Farr's computations, Fisher implicitly assumed that maintenance costs were constant over time and equal in the two countries.[13]

Theoretically, since investments in health services increase the labor supply by reducing mortality, disability, and debility, it is necessary to assume that the existing population is below the optimum size (defined by a zero rate of return on the existing stock of conventional capital). Neither this assumption nor the assumption of full employment (when unaccounted for in the statistical procedure) was explicitly made by most past writers. General acceptance of the stationary-state notion and Say's Law accounts for this.

Turning now to education, J. R. Walsh (1935, p. 255) in 1935 pointed out: "Since the days of Sir William Petty, many economists have included man in the category of fixed capital, because like capital man costs an expense and serves to repay that expense with a profit. Their conclusions, however, have been carried on chiefly in general terms, reference being made to *all* men as capital, and to *all* kinds of expenses in rearing and training as their cost." Walsh then took up the subject now being treated by T. W. Schultz, Gary Becker, and others, of the economic importance of higher education. Walsh was particularly interested in whether expenditures incurred by persons for professional careers were a capital investment made in a profit-seeking, equalizing market, and in response to the same motives that lead to investments in conventional capital. He asserted that they were. To test his hypothesis he examined the earnings of men at various levels of education. Their present value was estimated, using the capitalized-gross-earnings approach, at the average age at which their education ended. The costs of the various levels of education were then estimated, and a comparison was made of these costs and capital values to determine if they were equal (Walsh, 1935, pp. 255–69).

Walsh found that the value of a general college education exceeded the cost of its acquisition. Hence, his hypothesis of a competitive equalizing market in education was rejected. When he calculated the capital values and costs of professional training, however, he found that cost exceeded value in the cases of M.A., Ph.D., and M.D. degree holders. The reason for this, Walsh said, was that only monetary returns were considered and individuals with these degrees receive special satisfactions and advantages such as travel, vacations, and service to man. A consideration of these factors would equate the value estimate to its cost. Value exceeded cost in the

[13] For a historical discussion of the relationship between public health and the economic value of a man, see Sand (1952, esp. pp. 583–87).

cases of engineers, B.B.A. degree holders, and lawyers. The reason for this, Walsh said, was because of a short-run excess demand for their services, More people would be trained in the occupations over time, and value would become equated to cost. Hence, he said, there is no evidence that the ordinary adjustment which is characteristic of a competitive market is prevented from taking place (Walsh, 1935, pp. 269–84).

Walsh's optimistic conclusion about the competitiveness of the market for education was, however, arrived at by questionable ad hoc arguments. In actual fact, he found that value of education differed from cost of training in every professional-training case he studied. When training costs exceeded the increment to capital value resulting from the training, he assumed a long-run market equilibrium and explained the disparity by bringing in additional value attributable to non-monetary remuneration; but when value exceeded cost he abandoned the assumption of long-run market equilibrium, and he explained the disparity by a short-run disequilibrium which he arbitrarily assumed would be eliminated by a long-run adjustment.

Walsh's work is open to two other criticisms. First, his inclusion of all the costs of room, board, and personal expenses in his estimates of the average cost of various levels of education (Walsh, 1935, pp. 267–69) is clearly wrong, because an individual would have to incur these costs whether he attended college or not. Second, he overlooked the possibility that earnings differentials may result from factors other than the level of education.

It should be pointed out that Walsh's work is quite similar to that currently being done on the economics of education. He applied the human-capital analytical framework to the topic and asked many of the questions being posed today.

VI

In summary, treating human beings within the capital analytical framework is by no means new. Many past economists, and non-economists, have considered human beings or their skills as capital. Although several motives for treating human beings as capital and valuing them in money terms are to be found in this literature, most of the well-known names in the history of economic thought neither attempted an evaluation of human capital nor employed the concept for any specific purpose. They did, however, include humans or their skills in their definition of capital and recognized the importance of investment in human beings as a factor increasing their productivity. Although some economists included man himself as capital, most of them included only human skill. The former view was taken by economists such as Walras and Fisher, whose theoretical approach did not necessitate their classifying the factors of production into the traditional trio of land, labor, and capital. The latter view, held particularly by the English Classical school, was adopted by economists interested in the distribution of income and the theory of production. Whether or not we define skills and/or the acquirer of them as capital is relatively unimportant. The distinction between skills and the person is important however. Economists, legislators, and private institutions when faced with concrete policy questions have fairly consistently recognized both that skills require prior effort and continuous maintenance and that to deny this analogy between humans and conventional

capital in practice (for example, in tax laws and philanthropy) means a misuse of resources.

Since the human-capital concept was not fully explored by these economists, they did not calculate rates of return on investments in human beings. Recognition of the difficulty of resolving the investment-consumption dichotomy may have accounted for this failure.

Basically, two methods were used to estimate the value of human beings: the cost-of-production and the capitalized-earnings procedures. The former method is the less useful, since there is no simple and necessary relationship between the cost of producing an item and its economic value. The inseparability of consumption and investment and the difficulty of treating depreciation and maintenance make any cost-of-production value dubious. Economists engaged in research in this area will find little of value in past works in which this approach was adopted.

Farr's capitalized-earnings approach was the first truly scientific procedure and is the one followed today by the majority of economists for evaluating human beings. His work, and that of Dublin and Lotka, should be starting points for anyone interested in determining either human-capital values or their components. Use of this approach avoids the depreciation difficulty. Since a young man, *ceteris paribus*, is expected to be productive over a longer period than an older one, his capital value would be greater. Although maintenance costs were neglected by those who used the cost-of-production approach, they were considered by Farr and Dublin and Lotka to be equal to personal living expenses.

Current writers are employing the human-capital concept for many of the same purposes for which it was used in the past, namely, to demonstrate the economic profitability of human migration, health investment, premature-death prevention, and education. Since many of them fail to cite predecessors, it is hoped that this essay will be helpful as a reference source. The human-capital concept was also used by past writers to demonstrate the power of a nation, propose new tax schemes, determine the total cost of war, emphasize the economic significance of human life, and aid courts in making decisions in cases dealing with compensation for personal injury and death These uses may suggest interesting additional problems to contemporary economists.

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