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The Incubator of Human Capital:
The NBER and the Rise of the Human Capital Paradigm

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ABSTRACT: The human capital construct is deep in the bones of economics and finds reference by many classical economists, even if they did not use the phrase. The term "human capital," seldom mentioned in economics before the 1950s, increased in usage starting in the 1960s. By the early 2000s, about 20% of all books concerned with economics mentioned the phrase human capital. In the early 1980s, about 15% of NBER working papers referenced human capital whereas just 6% of all economics articles did. Today the figure for the NBER exceeds 25% and is 20% among all economics articles. The concept of human capital is part of almost every field of economics. The NBER played an outsized role in the rise of the concept of human capital mainly because of its emphasis on empiricism. We explore how the NBER was an incubator of human capital research and the ways human capital theory transformed and broadened its research agenda.

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The field of human capital was not invented by NBER researchers, but it was nurtured and expanded at the NBER. We explore how the NBER was an incubator of human capital research and the ways human capital theory brought the NBER into the modern era of economics.

1. What is Human Capital Theory?

Human capital theory is the notion that an investment in human beings today has a payoff in the future. The investment can be in education, training, health, job search, migration, or anything that impacts income or productivity in the future. One implication of human capital theory is that individuals have a capitalized value (based on their expected future earnings) that can be augmented through investments, as well as reduced by depreciation, illness, injury, or job loss. The theory expands the static notion of the value of skills and places it in a dynamic framework.

When aggregated across all individuals, human capital is the economy's stock of intangibles embedded in individuals.[1] Human capital is the wealth of a nation separate from the stock of land and physical capital. Human capital theory became ascendant when the economic growth of many richer nations became increasingly difficult to fully attribute to the growth of the physical capital stock and the size of the labor force.

The concept of human capital is the neuronal fiber that connects the two halves of the economist's brain—the micro and macro. The micro advances of human capital concern the dimension of time, its value, and the allocation of time use over the life cycle. Human capital gives individuals the ability to transform time today into more productive time tomorrow. Getting more goods tomorrow involves borrowing from one's own time today, and possibly also from the capital market.[2]

Even though human capital theory has become a staple of micro theory, it was called into being through the macro part of the economist's brain. The impetus was to understand the residual in growth accounting and the fact that increases in physical capital were slowing even though output was greatly increasing. The fact that economic growth was so much higher than could be explained by increases in conventional inputs was apparent to many economists long before Robert Solow gave it mathematical precision. Deming's (2022) recent review of research on human capital since Becker (1962) concludes that

[1] Intangible capital items (including software and computerized data bases, R&D, and brand equity and firm-specific resources) are increasingly recognized as a source of national wealth and economic growth (Corrado, Hulten, and Sichel 2009, and Corrado, et al. 2022). See Abraham and Mallatt (2022) on the measurement of the aggregate human capital stock.
[2] See Ghez and Becker (1975).

observed measures of human capital explain at least one third of the variation in labor market earnings within countries and differences in human capital stocks may explain at least half of the variation in income per capita between counties.

2. Spread of Human Capital Ideas

The human capital construct is deep in the bones of economics and finds mention by many of the classical economists, even if they did not use the precise phrase. In his fourth definition of capital, Adam Smith noted: "The acquisition of … talents during … education, study, or apprenticeship, costs a real expense, which is *capital in [a] person*. Those talents [are] part of his fortune [and] likewise that of society" (emphasis added). Marshall noted that "the most valuable of all capital is that invested in human beings," and he termed the concept "personal capital." Irving Fisher used the precise phrase, "human capital."[3]

But the term "human capital" was seldom used in economics and related literature before the 1950s. That is clear from the Google N-Gram of Figure 1, which gives the ratio of all books using the phrase "human capital" to those that mention the word "economics."[4] We will take this ratio to mean the percentage of all books concerning economics that reference "human capital."

In 1950, only about 0.1% of all books concerning economics referenced "human capital." Astoundingly, when the series ends in 2019, around 18% did. The human capital series increases almost continuously from around 1958. The peak around 2005 is robust to the use of various corpuses (e.g., British English). The sharp rise in the 1990s may be indicative of a realization that rising inequality was due, in part, to the increased returns to human capital. The subsequent decrease is less easily explained. It should also be noted that an N-Gram of the term "education," although many times the magnitude of "human capital," does not reveal as large an increase in the late 1950s. The term "business cycle," of great importance in the early history of the NBER, was far more popular in economics until around 1970 when, according to the Google books search, the term "human capital" surpassed "business cycle" in importance. Today three times the fraction of economics books use human capital relative to business cycle.

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[3] This discussion and the references draw on Kiker (1966). On Smith, see also the discussion in Spengler (1977).

[4] The graph gives the ratio of books that use the phrase "human capital" to those that use the word "economics." One cannot search for all books that use the word "economics" and that also contained the phrase "human capital." But no books that were randomly searched that used the phrase "human capital" did not have the word "economics" in the pages available on Google. The addition of other terms, such as "personal capital," has little impact on the series.

It should come as no surprise that the concept of human capital was known and discussed throughout the history of our profession. The question is why the phrase did not become a serious part of the economists' jargon until the late 1950s and why it took so long for the phrase to be widely used.

We use the term today as if it were always part of our lingua franca. But it wasn't. Not that long ago, even economists scoffed at the notion of "human capital." As Theodore Schultz noted in his American Economic Association presidential address in 1961, many thought that free people were not to be equated with property and marketable assets (Schultz 1961). To them, that implied chattel slavery.

In *Human Capital* (published first in 1964 and preceded by his 1962 *Journal of Political Economy* article, "Investment in Human Capital"), Gary Becker admitted that he hesitated to use the term "human capital" as the title of the book and employed a long subtitle—*A Theoretical and Empirical Analysis, with Special Reference to Education*—to guard against criticism (Becker 1964). Becker noted that "passions are easily aroused on this subject," and he offered several reasons why.

Many in the early 1960s viewed education as serving a multitude of purposes that went beyond increasing future income. Education has cultural aims, it uplifts, and it gives meaning to life. The idea that education was undertaken primarily to increase income was seen by many as base and disreputable.

Becker also mentioned another factor, one that went in the opposite direction. The derision of the term human capital was not just that education was largely for economic gain. It was that economists had not proven that the relationship between economic gain and education was causal since the correlation of education with ability or parental income could produce major biases. Therefore, some were revulsed at the notion that education was mainly for economic gain and others questioned that the gain was caused by education.

Yet, by the third edition of *Human* Capital, published in 1993, Becker marveled that the phrase and concept had gained traction in economics, and across a variety of academic fields and by the general public. The N-Gram of Figure 1 gives credence to that statement. Between the publication of the first and the third editions of *Human Capital*, the use of the phrase in books that mentioned economics had increased more than seven times and was found in 9% of books mentioning economics. The phrase had lost its offensiveness and had caught on.

But it is not clear what enabled the phrase to lose its negative press. Perhaps it was the greater acceptance of the economic model for providing insights into many areas of "non-market" behaviors including marriage and cohabitation, fertility, child rearing, crime, and education (Becker 1976). Perhaps it was stronger causal evidence that education actually boosted earnings (even as it elevated the soul).[5] Perhaps, in addition, economists and economics became more respectable (actually, banish the thought).

"Human capital" as a concept was, according to this logic, called into being by various changes in the economy. As Schultz noted, the "unexplained rise in the economic value of man" (1972, p. 1) needed an explanation. Furthermore, the greatly increased use of the term in the 1990s was necessitated by vastly increased income and wage inequality in the US and elsewhere coinciding with rising economic gaps by educational attainment. Human capital had become more fashionable because it was needed to help explain various aspects of the economy in the modern era, such as labor productivity changes.[6]

3. The Early Human Capital Incubators of the NBER

a. Early Macro Incubators

The NBER played an outsized role in many facets of the rise of the concept of human capital and in its measurement. In large part this was because of the critical importance of empiricism at the NBER ever since its founding.

As Becker noted in his preface to the first edition of *Human Capital* in 1964: "The origins of this study can be traced … to the finding that a substantial growth in income in the United States remains after the growth in physical capital and labor has been accounted for." That is, the subject was motivated by a need to understand the "residual" in economic growth estimates.

NBER researchers were among the first to notice that changes in physical input measures could not explain changes in aggregate output (see Griliches 1995 on the discovery of the residual). Many at the NBER, including Stigler (1947) and Abramovitz (1956), breathed empirical life into these theoretical notions.[7] Kendrick's important work on productivity trends (Kendrick 1961), discussed the notion of human capital, which he

[5] See the summary in Card (2001).
[6] Holden and Biddle (2017) discuss the impact that the human capital concept had on education policy in the US beginning in the early 1960s. Engerman (1971) is an early economic history paper that discusses the role played by human capital formation to economic growth.
[7] Griliches notes that Copeland (1937) provided the earliest attempt to express an index of outputs divided by inputs. Stigler has written that his own empirical work on the subject was probably the first ever.

termed "investment in persons," and in chapter 4, "Productivity and Economic Growth," he considered the potential importance of education and health to productivity. But, because his book was on productivity trends in separate industries and data on the education and health of workers by industry over time did not exist, Kendrick could not incorporate these inputs into his analyses. The job of adding the role of education to aggregate productivity measures was left to others, such as Edward Denison.

In his work on the capital stock, Kuznets bemoaned that "the concept of capital formation … was too narrow" and that conventional ways of measuring capital understated it. "For many purposes—particularly the study of economic growth over long periods and among widely different societies—the concept of capital and capital formation should be broadened to include investment in the health, education, and training of the population itself, that is, *investment in human beings*" (1961, p. 390; emphasis added).

The study of human capital gave NBER research on productivity and growth a means to comprehend the mystery of the residual. It connected the world of macroeconomics and financial capital with that on investments in people.

b. Early Micro Incubators

Becker's preface to *Human Capital* included a second motivation for the study human capital: "the importance of education in the promotion of economic development." Oddly, few NBER studies before 1962 mention education at all. The neglect seems odd since educational advances in the US were already enormous, both in absolute terms and relative to educational improvements in other nations (Goldin and Katz 2008). The US had been a leader in the education of its people. How could NBER researchers have neglected such an important part of the US economy?

One reason concerns measurement. Until the publication of the 1940 US population census, there were no national data available that could reveal the relationship between earnings and education. But, there were a host of other data that could have been mined on the increase of educational inputs and their role in enhancing skill. See, for example, the many series in Goldin and Katz (2008) from the US Office (Bureau) of Education that chart the expansion of education, as well as those that use occupational wage data and the 1915 Iowa state census containing micro-data on earnings by education level.

Another possibility for the absence of an NBER study of education is that NBER research was steered toward the issues that had preoccupied Mitchell, Burns, and Fabricant. Until the late 1950s, these did not include areas such as education, health,

training, and other aspects of the labor market, although several important publications early in NBER history concerned international migration and labor unions.[8]

There was one important exception, and that study used data that were part of a survey by the US Department of Commerce that eventually spanned the years 1929 to 1936. The data had been collected to inform national income statistics and provide better estimates of the incomes of those in private professional practice. The project that used these data became the most controversial published book in the history of the NBER.

The initial author was Simon Kuznets, whose interest in the data concerned national income statistics. But Kuznets was preoccupied with his other studies at the NBER and hired a research assistant to help with the study. That researcher was Milton Friedman, who would become among the most important economists of the twentieth century.

Friedman had already earned an MA at the University of Chicago and then worked in Washington, DC on New Deal projects.[9] He became a staff economist at the NBER in 1937. The study with Kuznets, *Income from Independent Professional Practice* (1945), became Friedman's PhD dissertation at Columbia University, which he earned around 1940. But the NBER volume was delayed for four years in large part due to a dissent by one of the NBER directors, although also because of the exigencies of the war.[10]

The research was important in a host of ways. It introduced the concepts of permanent and transitory income and it grappled with many of the issues at the heart of human capital theory, including investment under uncertainty, the financing of strangers, "equalizing differentials," "non-competing groups," and the reasons for variability in individual professional incomes as well as differences in earnings across professions.[11]

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[8] Blank and Stigler (1957) on the demand and supply of scientific personnel was somewhat of an aberration. It was not apparently motivated by productivity concerns and was funded by the NSF.

[9] Milton Friedman appears as a member of the NBER research staff with the 1937 Report of the Executive Director.

[10] All NBER publications had to undergo NBER Board review, and one member of the Board (C. Reinhold Noyes) disagreed with the Friedman and Kuznets conclusion, particularly the discussion in chapter 4, that supply restrictions for doctors (due to the American Medical Association) increased the earnings of physicians above those of dentists, who faced fewer entry restrictions. See, also, a letter from Mitchell to Burns, from the Duke University archives, that shows Mitchell's agreement with Noyes and his lack of confidence in Friedman. The letter is cited in Edward Nelson's book on Milton Friedman (Nelson 2020).

[11] "A young man must not only have the ability to practice a profession and must not only want to enter it; he must also be able to finance his training and be cognizant of opportunities; and both entry into the profession and his success in it will be greatly facilitated if he has the proper background and connections. ... Unlike high returns on capital invested in machinery, high returns on capital invested in professional training need not lead to an increase in investment. Capital

Many of Friedman's key lifetime insights were nascent in this early work including income contingent loans to finance occupational training and the theory of the consumption function.

The volume had a seminal impact on another great mind of human capital research—Jacob Mincer. That influence came up in an interview one of us (Goldin) did with Mincer in 2002.[12] The story, of how Mincer in 1957 saw the "human capital" light and its impact on his life, was told by Mincer as follows.

> *Mincer*: [The Friedman and Kuznets] work had a very big impact on me … [As a graduate student] at Columbia my interest was in wage determination … I was approaching it like a Bureau person by looking at various comparisons — by industry, occupation, age, sex, race. I had chapters along those lines. A fellow student of mine … suggested looking up [*Income from Independent Professional Practice*]. When I read this book it took me back to Adam Smith and then I realized that all the comparisons I was making had as a basic principle education and age. If you pushed the comparisons, each one of them had underlying differences in human capital.
> *Goldin*: Would you have used that term, "human capital" at that point?
> *Mincer*: Yes, I used it immediately … This was like a revelation. That same afternoon … I had this principle established, written out and shown with empirical data. My sponsor, [Harold] Barger, immediately said "this is great" and sent a copy to Ted Schultz. I didn't know there was a whole industry brewing in Chicago involving economic growth and human capital … It took me [just] a few days to turn around all the material I had into an organized analysis of wage differentials. I then got the offer from Ted Schultz to come to Chicago for a post-doctoral fellowship … [It was] 1957 … I immediately went to Chicago.

4. The Flowering of Human Capital at the New York City NBER

The NBER was enabled to explore education and human capital in large measure because of several grants from the Carnegie Corporation. A Carnegie grant was first mentioned in the 1958 NBER annual report as funding Becker's research on the returns to education. Becker later credited the grant and other NBER support with why he took a job at Columbia and the NBER rather than a higher-paying one at Chicago, after completing his PhD at Chicago. "For twelve years I divided my time between teaching at Columbia and doing research at the Bureau. My book on human capital was the outgrowth of my first

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invested in human beings is not separable from the individual and cannot be bought and sold on the open market." (Friedman and Kuznets 1945, p. 391).

[12] See NBER Historical Archives, Oral Histories of the NBER, Mincer.

research project for the Bureau."[13]

A Carnegie grant also funded an event, sponsored by the Universities-NBER Committee for Economic Research and held in 1961, called "The Exploratory Conference on Capital Invested in Human Beings." The planning committee included, among others, George Shultz (chair), Theodore Schultz, Robert Solow, and Gary Becker.

The resulting volume, published as a special supplement in the *Journal of Political Economy*, foretold the outpouring of research on human capital that was to come. As Selma Mushkin, one of the participants, surmised: "A theory of human capital is in the process of formulation" (1962, p. 129).

Looking back, the conference contained the "Who's Who" of human capital. The volume opens with Schultz's overview of the subject and continues with a star-studded cast: Becker on human capital, Mincer on on-the-job training, Sjaastad on migration, Stigler on modern search theory, Weisbrod on education, Denison on economic growth and augmented labor, and Mushkin on health—the human capital Oscars and Emmys rolled together!

By 1970, research on human capital had become sufficiently important that John Meyer, then the president of the NBER, asked Schultz to head one of the Fiftieth Anniversary colloquia. Its purpose was to assess the human capital efforts of the NBER and to evaluate the future. The Human Resources Colloquium was held in 1971 and was published in Schultz (1972).

Another NBER conference on human capital was organized by Schultz (1974) and published as a special issue of the *Journal of Political Economy*. The volume was titled "Marriage, Family, Human Capital, and Fertility" and added a host of new subjects that were informed by human capital and featured newly minted researchers, including James Heckman, Arlene Liebowitz, and Sol Polachek.

Prior to the 1962 volume, just a handful of NBER pieces directly related to human capital subjects and notions. We just mentioned the Friedman and Kuznets volume. Research on fertility was begun by Easterlin (1962) in a short piece that presaged his important work on the baby-boom and his theory of fertility cycles. Easterlin (1968) is a major work tying together the business cycle side of the NBER with the emerging one relating to fertility, family, and human capital more generally.

[13] Quoted from Gary Becker's Nobel Prize Facts.

Becker presented an early version of his work on fertility at a Universities-NBER conference and published as an NBER volume (Becker 1960). According to Becker, his paper was savaged by all except Kuznets, who also gave a paper at the conference.[14] Becker was grappling with an explanation for long-run changes in fertility. He had not yet worked out the model in his piece with H. Gregg Lewis (Becker and Lewis 1973) on the "quality-quantity" tradeoff and a comparison of the two papers shows how human capital theory altered Becker's thinking on the subject.

We would be remiss if we did not mention the work by NBER researchers on slavery. The now-famous paper by Alfred Conrad and John Meyer, published in the *Journal of Political Economy* in 1958, was originally presented at a Universities-National Bureau Committee on Economic Research conference.[15] Although Conrad and Meyer did not use the phrase "human capital," they did use the term "slave capital."

After the early 1960s, NBER work in various fields began to blossom under the direction and guidance of senior NBER staff members Becker, Victor Fuchs, F. Thomas Juster, and Mincer. In 1967 a program on health under the direction of Fuchs was announced with research contributions by Michael Grossman.

By 1970—the NBER's fiftieth anniversary—the list of human capital researchers who spent extensive or limited periods at the NBER expanded to include V.K. Chetty, Barry Chiswick, Carmel Chiswick, Isaac Erlich, Albert Fishlow, Gil Ghez, Reuben Gronau, Sherwin Rosen, Jim Smith, Lewis Solmon, and Robert Willis. Some were short-term research fellows in residence from other institutions; others were graduate students at Columbia. Still other Columbia and Baruch graduate students and faculty, whom we shall not separately enumerate, spent part of their days at the NBER, just as graduate students and faculty in the Cambridge and Boston area have done.

The work of Gil Ghez and Gary Becker on the *Theory of the Allocation of Time* that led to a co-authored volume of that title deserves special mention. That work was

[14] See NBER Historical Archives, Oral Histories of the NBER, Becker. Becker did not ingratiate himself with the demographers and sociologists by beginning his paper remarking on "the inability of demographers to predict western birth rates accurately in the postwar period ..."

[15] The event was held in 1957 at Williams College. The resulting volume (known as "volume 24") contains classics in economic history, but not the piece by Conrad and Meyer, possibly because they preferred publication in the *Journal of Political Econo*my. Another paper on slavery, by Robert Evans, was published in *Aspects of Labor Economics* (Universities-National Bureau Committee for Economic Research 1962a).

foundational and became the bedrock for much of human capital theory and Becker's work on the family.[16]

5. Transforming the NBER

a. Book publications and "human capital"

We previously noted the apparent paucity of research at the NBER on human capital until the early 1960s. But that may be misleading since the use of a catchword or phrase may indicate that a basic element had been discovered, not that the subject was entirely unknown. Biologists, for example, knew that various traits were inherited, but the use of the term "genetics" gained traction only after a key set of discoveries. Tracking the term "genetics" would miss various turning points in the intellectual journey of the discipline. Tracking "human capital" might do the same.

Therefore, in tracking NBER research from its inception in 1920, we have searched for topics that are associated with human capital research. These include education, labor, health, migration, women, children, demography, fertility, marriage, the family, and economic inequality.

NBER research, today, is disseminated through working papers, seminars, conference volumes, and other books. In the past, NBER research was circulated mainly in volume form. The "occasional research paper" series was begun in December 1940 and was continued by "Explorations in Economic Research" in 1974, during John Meyer's tenure as NBER president.[17] Shorter pieces in collected volumes have existed from the 1920s with different sponsors and interests, including the Conference on Research in Income and Wealth and the Universities-National Bureau Committee for Economic Research.

The most convenient way to track the content of NBER volumes since 1920 is to use existing coding schemes, of which the most extensive is that of the Library of Congress (LoC). We have looked up codes for all 1,269 NBER published volumes (not working papers) from 1920 to 2019 listed on the NBER website.[18] Subtracting duplicates, internal documents, and other items that do not have LoC codes, results in 819 volumes. (These codes are not listed with NBER books, but JEL codes have recently been added.) We also used our knowledge of the volume content (see Appendix). The results are shown in Figure 2, part A. In Figure 2, part B we use the NBER website to search all NBER book chapters

[16] Ghez and Becker (1975). Also see Heckman (2014).
[17] The original "occasional paper" series appears to have ended with #119 in 1972.
[18] The entire occasional working paper series has one LoC code and is numbered from 1 to 119.

from 1958 to 2022 for the term "human capital."[19]

Therefore, we have two complementary measures of research on "human capital" in NBER volumes. The first gives the human capital content of NBER volumes from 1920 to 2019. The second gives the fraction of book chapters that reference human capital as a phrase. The first series is broad and covers a long period; the second is more directly focused on "human capital." Because of the small number of observations for NBER volumes, we use ten-year bins in part A but five-year bins for part B.

About 37% of all NBER volumes today are concerned with material related to the human capital construct. The fraction was around 10% from the 1930s to the 1970s. A clear exception to the trend is the 1920s when about 27% were in the group. But there were only 16 books in that decade and most with human capital content concerned immigration, a hot topic during the 1920s period of immigration restriction. Another break is with the 1940s when many volumes concerned subjects related to WWII. The main takeaway is that human capital topics were not high on NBER researchers' lists until the 1970s but then became so, especially in the 1990s.

The book chapters show a clear increase in the 1970s and then a slight decrease as the NBER established a large number of programs that would be only tangentially concerned with human capital. Somewhere between 15% and 20% of NBER book chapters have mentioned human capital ever since 1978 with an increase in the mid-1990s, similar to that seen in the Google N-Gram with more research on inequality and the role of human capital. Interestingly, since the late 1990s about the same fraction of books in economics reference human capital as a phrase as do chapters in NBER volumes.

b. Articles, working papers, and "human capital"

NBER publications shifted decisively in favor of working papers after the 1970s. The official NBER working paper series was begun in June 1973 with Finis Welch's piece on "Education, Information, and Efficiency." Around 1977, with the transition from John Meyer to Martin Feldstein, new program names began to be attached to the working papers.

A direct comparison can be made between NBER working papers and all published articles using search routines in EconLit and JSTOR. We have categorized NBER working papers and all published articles two ways. In one, we use the EconLit search engine to

[19] Although most of the entries are actual book chapters, some items are front material and various portions of a volume. The NBER website calls them all "chapters." Most of the entries in the "monograph" series are not searchable since they are not posted as full text. We begin with 1958 because before then, the term "human capital" was rarely, if ever, used.

categorize both NBER working papers and all published articles and working papers. Because EconLit does not have the full text, the search can only be done over the title, abstract, and JEL code. The results for the search term "human capital" are given in Figure 3 in five-year bins from 1990, when EconLit began to categorize NBER papers, to 2019.

We also use the NBER website and JSTOR to search across the full text for all published articles (in English in economics journals) from 1978 to 2022 and those results are shown in Figure 4.

The fraction of all NBER working papers that use the term human capital in the title, abstract, or JEL code increased from just under 4% to 10% across the past three decades. The human capital phrase does not increase as much for all published articles and working papers, rising from around 3.5% to 6%. Working papers in the NBER series should have a higher fraction with the term human capital than all economics papers since NBER working papers generally do not include pure theory pieces. The more rapid increase, however, is of interest.

The longer series in Figure 4 that searches over the full text reveals, not surprisingly, a higher share using the term human capital. Interestingly, although the trend is similar to that in Figure 3 for the period of overlap, Figure 4 reveals that the NBER began operations in Cambridge in 1978 with a larger number of groups and associates in the human capital area but was then diversified, adding many associates in finance, productivity, and international finance, for example. The fraction of NBER working papers referencing human capital actually declined in the 1980s, while that for all published articles increased. Yet, by 2022 around 27% of all NBER working papers referenced the term human capital, whereas 20% of all economics articles did.

6. The Human Capital Takeoff at the NBER

What accounts for the takeoff in NBER human capital publications relative to all in economics? Is it due to a change in the composition of NBER researchers or have NBER researchers across fields turned their attention more to human capital? We believe it is the latter, but we do not yet have a full answer.

In 1977, the NBER relaunch in Cambridge, MA under Martin Feldstein led to a reorganization with a focus on research programs, each with an ability to appoint NBER affiliates. The initial programs were in seven areas: Development of the American Economy; Economic Fluctuations and Growth; Health Economics; Labor Studies; Productivity; Monetary Economics; and Tax Policy (later renamed Public Economics). The rapidly growing network of NBER affiliates, NBER program meetings, conferences, working

groups, and the NBER Summer Institute all served during the last 40 years to create stronger connections among empirically-oriented scholars in economics and helped spread and foster advances in human capital research.

The NBER, today more than a century old, now has 20 formal research programs and 14 working groups, fostered first by Martin Feldstein and then by James Poterba. The Labor Studies, the Economics of Aging, Children, Development Economics, the Economics of Education, and Health Care programs helped catalyze research on core human capital issues. But these new program areas were also a way to attract federal research funding. NBER working groups in Behavioral Economics, Cohort Studies, Economics of Crime, Personnel Economics, and Urban Economics incorporated a broader range of scholars and human capital topics into the NBER network.

Increased federal research funding for economists through the National Institutes of Health (including the National Institute of Aging and National Institute of Child Health and Development) and the Institute for Education Sciences helped galvanize economic research on human capital that spanned the life cycle. Research flourished on the role of the in utero environment, early childhood education, health investments, K-12 and higher education, adult learning, retirement, aging, and life expectancy—human capital from womb to tomb.

NBER researchers, such as David Wise of the Aging program and Caroline Hoxby of the Economics of Education program, have played key leadership roles in facilitating research expansions into new human capital areas.

7. Discussion and Conclusion

The human capital revolution incubated at the NBER in mid-twentieth century by scholars such as Milton Friedman, Gary Becker, and Jacob Mincer has greatly influenced and enriched economic research and policy analysis in the late twentieth and early twenty-first centuries. NBER-affiliated researchers have shown that shifts in the demand for skills stemming from technological change, combined with changes in access to educational opportunities, have been central to alterations in the wage structure, earnings inequality, and cross-country differences in inequality (Autor 2014; Freeman and Katz 1995; Goldin and Katz 2008; Katz and Murphy 1992), and have studied the role of human capital and discrimination for understanding racial inequality (Bayer and Charles 2018; Card and Krueger 1992; Derenoncourt, et al. 2022; Lang and Manove 2011; and Margo 1990).

Research has flourished on the importance of early childhood education and environments for long-run economic outcomes and broadened the human capital perspective to examine the development and returns to social and emotional skills (Cunha

and Heckman 2007; Currie 2011; Deming 2017; Heckman 2008; Heckman, Pinto, and Savelyev 2013).

Access to large administrative, linked longitudinal data sets from Census and the Internal Revenue Service has enabled researchers to build on the conceptual insights of Becker and Tomes (1979). The result has been a better understanding of the determinants of, and geographical and racial variation in, intergenerational mobility (Chetty et al. 2014; Chetty et al. 2020). These huge administrative datasets have also furthered the human capital revolution by permitting more compelling empirical analyses of the long-run causal impacts of educational interventions and childhood neighborhood environments (Chetty et al. 2011; Chetty, and Hendren 2018; Chetty, Hendren, and Katz 2016).

The fruits of the human capital revolution are clear in the range of papers presented at the NBER's Summer Institute. One entire week of the Summer Institute in recent years has been devoted to research on labor markets, children, education, development economics, economics of crime, health economics, health care, gender in the economy, and aging.

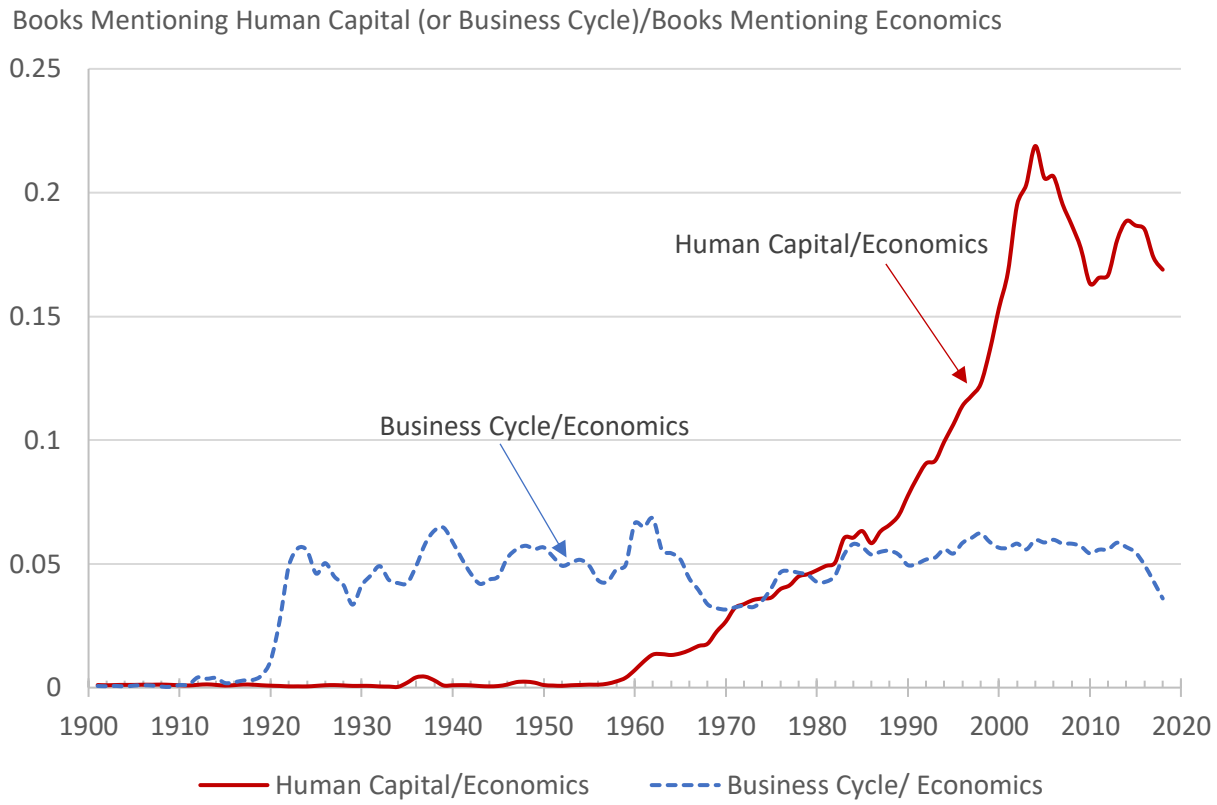
Mainstream public economics research now engages with the implications of human capital investments for optimal tax policy (Stantcheva 2017) and for the welfare analysis of tax and expenditure policies. At the 2019 Summer Institute, a paper by Hendren and Sprung-Keyser (2020) demonstrated that government programs that expand investments in children from low-income families provide the highest measured social return to public funds.

Macroeconomic research at the NBER has also been infused with human capital ideas. These include improvements in the measurement of the contribution of human capital investments to cross-country income differences (Jones 2016) and the central role of search models, building on Stigler (1962), for understanding unemployment and labor market fluctuations.

We have demonstrated the greatly increased importance of human capital research across all economics publications and its even greater increase for volumes and papers issued by the NBER. We have also indicated the ways that human capital research at the NBER was influenced by the dedication of NBER researchers to empirical research and also how research on human capital brought the NBER into the modern age of economics.

At the end of NBER's first century, we can confidently say that *we are all human capitalists now*.

Figure 1: Human Capital and Business Cycle Google N-Grams of US Books: 1900 to 2019

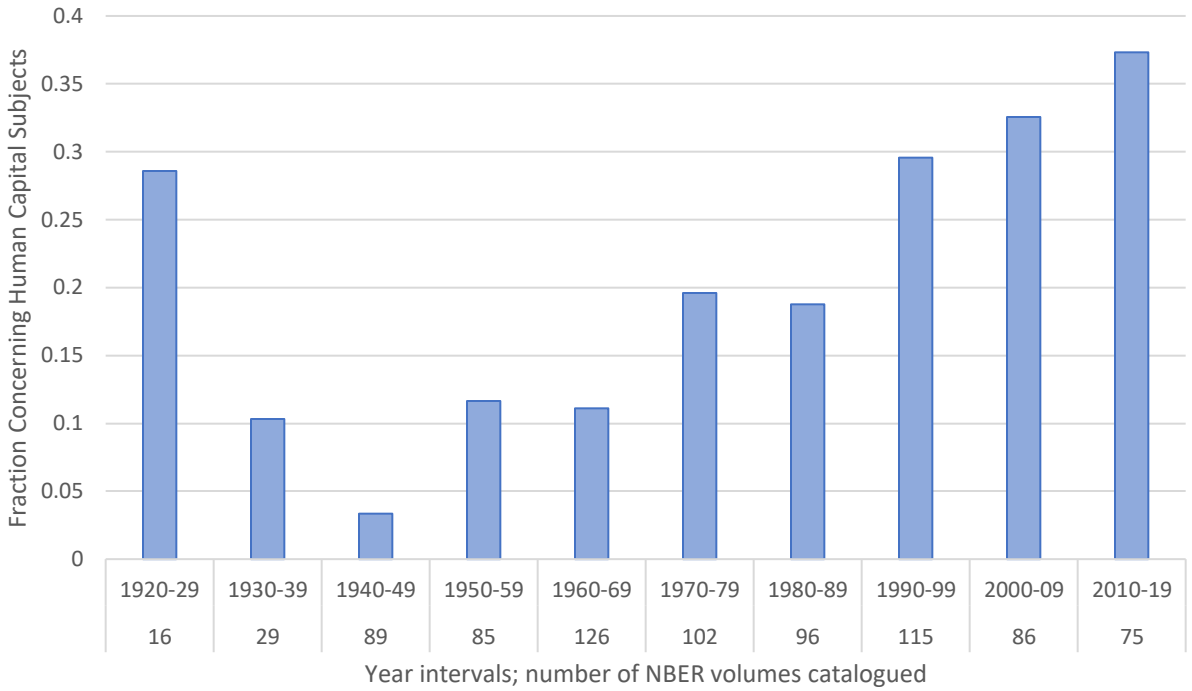


Source: Google N-Gram using the American English 2019 corpus with no smoothing and case insensitive.

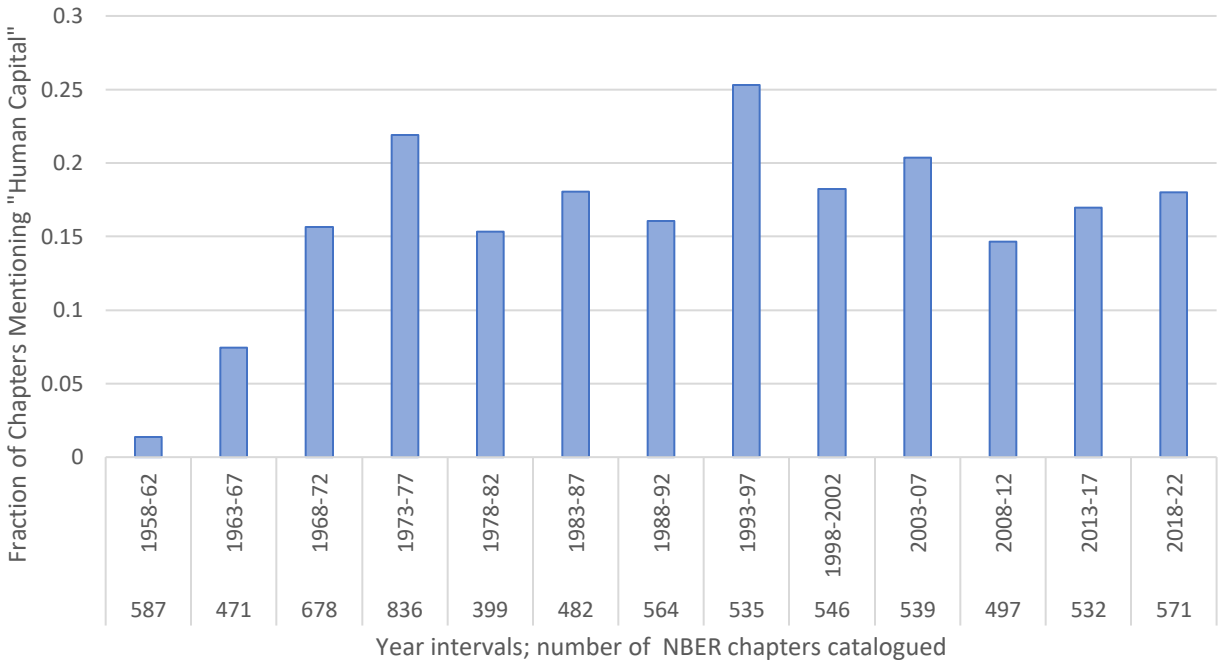
Notes: The graph gives the number of books mentioning human capital (business cycle) divided by those mentioning economics. Because almost all books that mention either human capital or business cycle also mention economics these graphs give the approximate fraction of all books that mention economics that also mention either human capital or business cycle. Three-year centered moving averages are shown.

Figure 2: NBER Volumes, 1920 to 2019, and Book Chapters: 1978 to 2022

A. NBER Volumes Concerning "Human Capital" Subjects

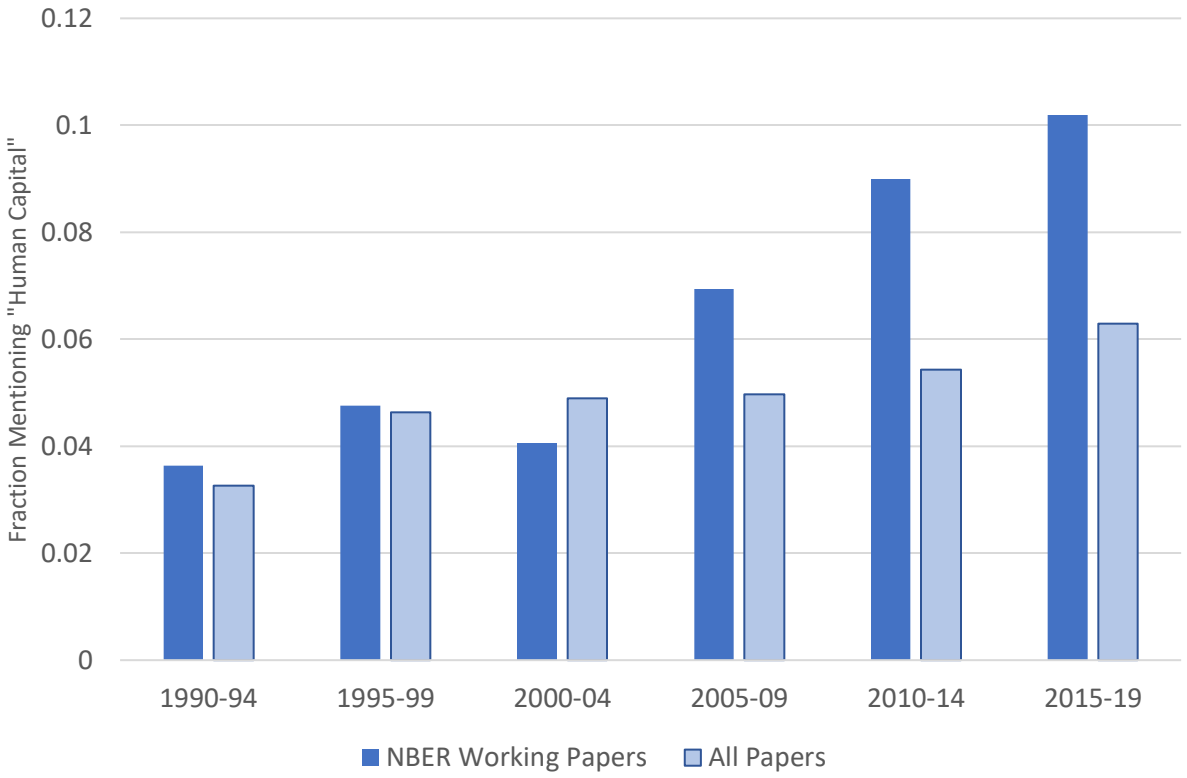


B. NBER Book Chapters Referencing "Human Capital"



Sources and Notes: See Appendix.

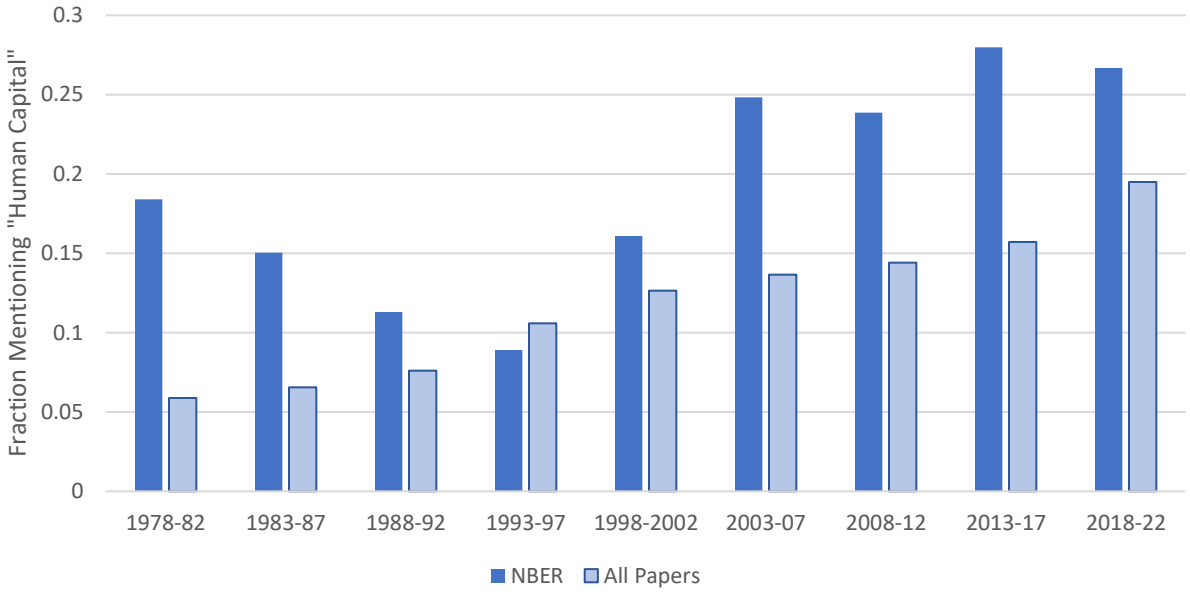
Figure 3: Fraction of NBER Working Papers and All EconLit Papers (Published Articles and Working Papers) Mentioning "Human Capital" (not full text): 1990 to 2019



Source: EconLit search engine. See Appendix.

Notes: "NBER Working Papers" gives the results for ("Human Capital" + "NBER Working Paper") divided by ("the" + "NBER Working Paper") as words/phrases used in the title or abstract of the working paper. "All Papers" gives the results for ("Human Capital") divided by "the" as words/phrases used in the title or abstract of the paper and is computed for all published articles and working papers in EconLit. The number of NBER working papers from 1990 to 2019 is 23,036. The total number of economics journal articles and working papers catalogued by EconLit from 1990 to 2019 is 1,007,473. Information in EconLit on NBER publications is not available after 2019, at the time of this writing.

Figure 4: Fraction of NBER Working Papers and All Published Articles Mentioning "Human Capital" (in full text): 1978 to 2022



Sources: NBER website; JSTOR.

Notes: All working papers on the NBER website were searched for the term "human capital" anywhere in the paper. All articles meeting certain criteria were searched on JSTOR for the term "human capital" anywhere in the paper. The criteria were: articles in English, in "content I can access," and searched only in the (183) economics journals.

Appendix

A. NBER Volumes (Figure 2, parts A and B)

NBER volumes are not fully searchable on the NBER website. Chapters in conference and other volumes are searchable, and we use the NBER search routine to identify chapters that mention "human capital" (Figure 2, part B). We have searched 4,665 chapters, which include front matter and references.

The classification of NBER volumes (Figure 2, part A) was done differently. To categorize NBER volumes beginning with the first in 1920, we have collected all Library of Congress (LoC) catalogue numbers for the volumes. (NBER staff have recently assigned JEL codes.) Note that NBER occasional papers are generally not coded under the LoC system.

We have coded 819 books. There were 1,270 books and occasional papers listed on the NBER site across the years shown to 2019 when we began the project. We eliminated repeat entries in the NBER system to the best of our ability.

The LoC coding scheme is a reasonable, but imperfect, device to code economics books. We have used the following LoC codes to indicate relevance to the concept of "human capital." The topics/words included are: labor, labor force, employment, compensation, health and disability, demography, income inequality, marriage, the family, women, children, human physical growth, scientific personnel, time use, pensions (but not savings and Social Security separately), and unions. The LoC codes used are as follows:

LoC Number	Content for "Human Capital" Designation
E1	History of the Americas, relevant portions
H11	Social Sciences, only if Labor Force, Employment, Servants, Compensation
HA	Health and disability, not Social Security; Health care, but not health costs
HB848-3697	Demography
HC106	Most listings, but not exclusively national income
HC110	Income inequality
HD4801-8943	Labor; not housing and not business cycles
HQ	Marriage and the family
HV	Items regarding women and children
GN	Anthropology (human physical growth)
JV6001-9480	Migration
L	Education
Q1	Scientific personnel
RA	Medicine and the state
TX	Home economics

All other codes are treated as not having "Human Capital" content.

B. NBER Working Papers and All Published Articles (Figure 3)

The EconLit search engine was used to find mention of the phrase "human capital" and "NBER Working Paper" in all working papers deflated by the number of working papers that mention the "NBER Working Paper." EconLit uses a limited number of fields (articles are not available to the coders): title, abstract of the article, and the JEL codes for the article. Therefore, counts of the term "human capital" will be understated for articles that use the phrase if it was not mentioned in the title or abstract or JEL code. Note that just two JEL codes (E24; J24) list the phrase "human capital" and any paper listing either of these codes will be included in the human capital group. EconLit provides JEL codes for NBER working papers only after 1990.

The fraction of all published articles referencing "human capital" is computed from EconLit by counting all articles with "the" in the abstract, title, or those having a JEL code (the presumption is that the number will be all articles). The numerator is the number that use the phrase "human capital" in the abstract, title, or JEL code and "the," to make certain that no articles omitted in the denominator are in the numerator.

C. NBER Working Papers and All Published Articles and Working Papers, Full Text Search, 1978 to 2022 (Figure 4)

All working papers on the NBER website were searched for the term "human capital" anywhere in the paper. All articles meeting certain criteria were searched on JSTOR for the term "human capital" anywhere in the paper. The criteria were: all articles in English, in "content I can access," and only in the (183) catalogued economics journals. There were 224,424 articles searched on JSTOR from 1978 to 2022. There were 31,066 NBER working papers searched on the NBER website.

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