THE OPPORTUNITY COST OF EDUCATION: WHERE DO THE LOST YEARS GO?

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Abstract

Economists often introduce their classes to opportunity cost concepts by pointing out the additional incomes students could be earning were they employed full time rather than attending university. A potential additional cost, a reduction in years of future labor force participation, is unlikely to be mentioned. We argue that although this 'work-life' effect may safely be ignored in calculating rates of return to education, it must be taken into account if the goal is to correctly identify the cost of individuals' time out of the labor force, particularly for purposes other than education. The fact that this issue was raised in a court case by a vocational analyst provides "real" life example of how this "work life" effect matters and may serve to intrigue our students and validate the study of our discipline. Our paper demonstrates the appropriate methodology and information necessary to identify work-life costs and suggests introducing the concept at introductory levels.

Key Words: opportunity cost, labor market, work-life effects of time out of labor force

JEL Classification: A22

Introduction

Introductory texts and principles instructors frequently illustrate opportunity costs with an example designed to capture classroom interest: the earnings students sacrifice when they take time out of the labor force to pursue degrees.[2] The goal, presumably, is to help personalize the fact that economic cost is a complex notion and to make clear that accounts recording flows of expenditures and receipts will seldom be adequate to the task of measuring it.

The same information is routinely utilized by researchers investigating internal rates of return to higher education. They solve for the discount rate that equates the present value of direct costs plus earnings foregone to the present value of future income increases predicted to flow from possession of the relevant academic credential.[3] Mention is unlikely to be made of the fact that remaining out of the labor force during study may also result in fewer years of potential employment. We observe below that in estimating rates of return to education those 'lost' years may safely be ignored, the omission of what we term a "work-life" effect is far from moot in

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[2] Casual sampling of texts and conversations with colleagues teaching introductory economics courses suggest that lists of either texts or instructors *not* at some stage presenting an education example would be quite short.

[3] Becker (1964) is the classic human capital reference, and the already-vast empirical literature following Mincer (1974) is continually expanding. Psacharopoulos (1973, 1994), Psacharopoulos and Patrinos (2002) provide a useful summary and updates, while informative discussions of the rate of return estimation process are provided by Appleby *et al* (2002) and Boothby and Rowe (2002).

other applications.

Frank (2005) argues that introductory economics courses pay too little attention to real-world opportunity cost applications, while Ferraro and Taylor (2005) suggest that economists may not explain, understand, or quantify those costs as well as they ought. Ignoring work-life effects might reflect an imperfect understanding of opportunity cost. Alternatively, failure to mention them could be a deliberate simplification made to avoid distracting introductory students from the core concept of opportunities foregone; or it may be in tacit recognition of the fact that for some purposes the effect can be ignored. Whatever the reason, it is shown below that the cost of events or activities that keep individuals out of the labor force will be systematically understated if work-life impacts are not taken into account.

The following section turns to a discussion of work-life impacts in cost-of-time questions. Section 3 describes an approach that takes those effects into account. Section 4 considers extended retirement ages associated with education. Section 5 concludes.

Time Costs, Education and Rates of Return

In a recent civil trial (Manke, 2005) a vocational analyst testifying on the cost of mitigating an earning capacity loss by a plaintiff who had suffered a disabling injury explained that he had measured the cost of time out of the labor force to attend university using two different methods. The first, conventionally, estimated the wages and other employment benefits that would be foregone during the five years he judged it would take his client (a recent high school graduate) to earn a degree. The second, in contrast, comprised the earnings of individuals with high school but no further education currently in the five years prior to normal retirement age. He then offered as a best estimate the mean of the two figures.

Under cross-examination the analyst defended his methodology by pointing out that although someone who had recently completed high school might be giving up (for example) earnings averaging $20,000 a year while pursuing a degree, she would at the same time be shortening her potential working years by five – in effect, the last five, during which foregone income would be substantially higher. (The injury itself was not expected to affect the injured party's life or work-life expectancy.) Thus, he argued, an alternative cost measure would be the earnings given up in the five years at career-end, and a reasonable estimate of the true cost would be the mean of the two figures.

The arithmetic is straightforward: if the current earnings of individuals nearing the end of their work lives are $60,000 annually compared with today's starting wages of $20,000 for comparably-educated workers, the analyst's methodology generates a sacrifice caused by taking five years out of the labor force immediately following high school averaging $40,000 and totaling $200,000.

The methodology obviously is deficient in failing to account for differences in current and future dollars. Although un-discounted figures may provide tolerable approximations for short time periods, over a span of forty years or more they clearly do not. At a real discount rate of two per cent the present value of $60,000 to be earned forty years hence would be only $27,173. Thus, even if averaging were an appropriate procedure, the 'correct' annual figure would be on the order of $23,500 rather than $40,000.

Although the averaging approach is clearly flawed, it highlights a potentially important omission in the usual discussion of the opportunity cost of time out of the labor force. To show this, we briefly discuss of rates of return to investment in education.

Figure I reproduces the standard diagram used to illustrate educational returns. The

process begins with a comparison of average earnings, by age, of individuals who have attained a particular education level and the respective earnings of those who have attained the next higher level, adjusting when possible for individual ability differences (Leigh and Ryan, 2006). In legal proceedings the estimate generally is of earning capacity rather than actual earnings, but in practice the latter are often used to estimate the former. For the purposes at hand, no distinction need be made between them.

In the diagram, α represents the annual earnings for an eighteen year old high school graduate. The dotted line shows age-specific earnings of individuals with high school education only, assuming for simplicity that the work-life of those individuals begins at age eighteen and terminates at sixty-five regardless of his choices about labor market participation. [4]

The dashed line shows the earnings profile of otherwise identical individuals who have taken five years out of the labor force between eighteen and twenty-three. They join the work-force with degree in hand where γ represents the annual earnings of this twenty three year old university graduate.

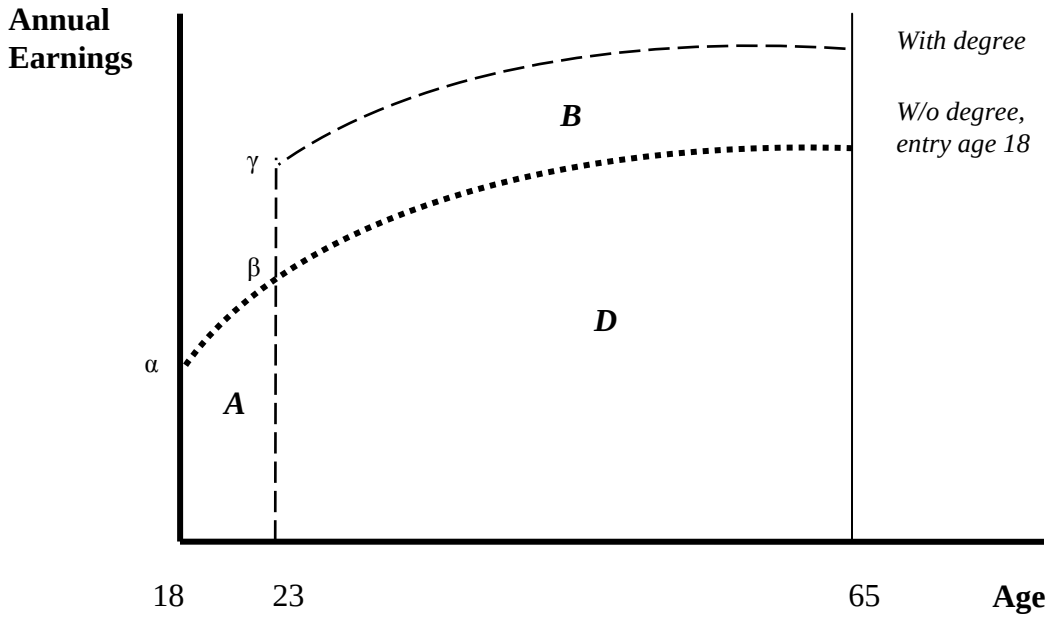

Figure I
Earnings Profiles With and Without a Degree

For purposes of illustration, direct costs such as tuition, books and additional living expenses are ignored, as are the effects of education on retirement age (cf Trostel and Walker, 2006) while earnings during study are shown as zero. The pattern of actual earnings and the time taken to complete "four year" degrees will vary by individual, for although student earning capacities typically rise with age (via education) and with experience (usually part-time), so will the cost of delaying graduation.[5]

[4] Given world-wide changes in social security and pension payment, one could, of course, legitimately argue for a different age, for example, sixty-seven.

[5] As is standard when this diagram is used by introductory texts, for the purposes of illustration, we make a few simplifying assumptions. These include a uniform retirement age and ignore such issues as potential earnings

Area *A* thus shows earnings foregone during enrollment in undergraduate study. Area *B* shows the additional earnings of those who have acquired degrees, over and above the earnings of those with high school completion and no further education (area D) for the period between graduation and retirement.[6]

The standard diagram does not address the question of the pay levels that would result were an individual to remain out of the labor force for the years between eighteen and twenty-three, but *not* upgrade their capabilities or credentials. In the absence of this discussion, one might assume that if she started her career at age twenty-three her annual earnings would be identical to those she would have received had she worked full time during the previous five years. Figure II illustrates a more plausible case.

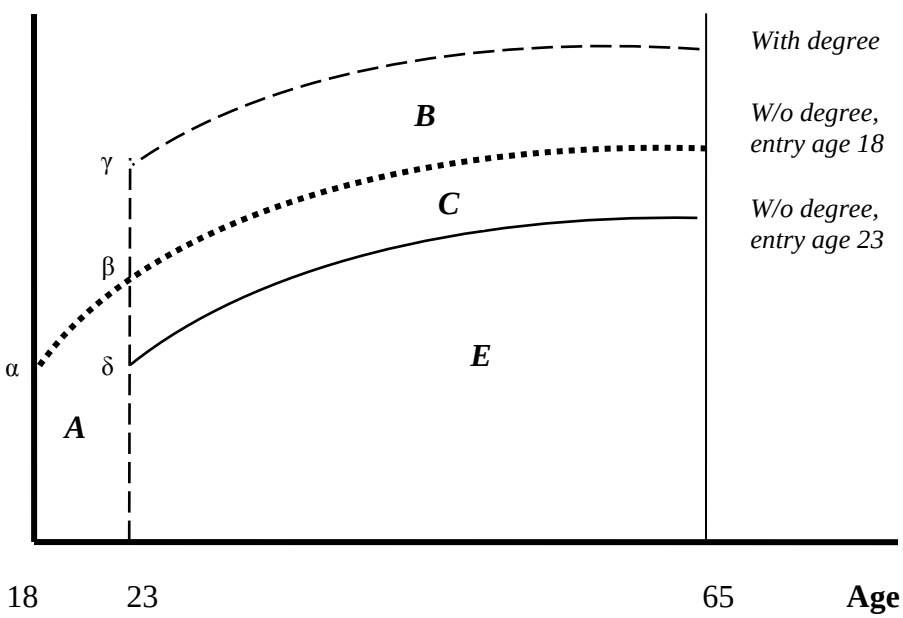

Figure II
Earnings Adjusted for Time Out of the Labor Force

In Figure II, the earnings profile of someone beginning a career after remaining out of the labor force for five years following high school without obtaining additional education (the solid line, beginning at δ) lies below the profile of the same individual with five additional years of work experience (the dotted line passing through β.) The effects on earnings of age alone, reflected in the level of β and the subsequent potential earnings path, will vary by individual and occupation. However, someone first entering the labor force at twenty-three with a high school education earned at eighteen is expected to earn less at each age than had the same person begun work at eighteen and thus gained five additional years' experience.

In Figure II, δ, base pay at twenty three (net of educational or other benefits from use of the previous five years) is the same as the individual would have earned entering the labor force

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from part-time jobs during study, variable length of study to complete "four year" study, etc. The exclusion of direct costs does not change the *nature* of the illustrations in Figure I and Figure II and the differences highlighted between them.

6 Impacts on the probability of involuntary unemployment are accounted for in the magnitudes of B and D.

at eighteen (α) and thus is below what he or she could have been earning at twenty-three after five years of experience (β). That is, the *base* wage for a high school graduate beginning work at age 23 must be the same whether the five years out of the labor force were used to raise a family, ski the Alps, or earn a degree. The solid line in Figure II thus shows the 'pure' effect of time out of the labor force, allowing clear separation of costs from the consequences of whatever use was made of the time.

Given entry-level pay rates rising through time it is plausible that first-year earnings could be higher for a person entering the labor force after a gap of several years than would have been the case immediately following high school. That is, δ could be greater than α. Even then, employers would almost certainly not offer as high pay rates (β) to job applicants with five years fewer work experience and no educational or other achievement to show for those years. Starting pay for recent high school graduates might even be higher than for 23-year-olds who had completed high school five years earlier and taken those years out of the labor force *without* enhancing their credentials or capabilities in the interim. Ultimately, the size of the differential is an empirical issue; but it would be typical to find β higher than δ.[7]

Remaining out of the labor force between ages 18 and 23 thus can be seen to have a total cost represented by area *A* (foregone earnings) *plus* area *C* (reduced future earnings or earning potential.)

Despite having no obvious association with the lost years that worried the vocational analyst, area *C* shows the sacrifice of future earning capacity resulting from time out of the labor force, abstracting from any income gains that could flow from use of that time to acquire additional human capital. Area *C* is not an alternative measure of opportunity costs, however, but a distinct component of them.

Work-life costs are hidden in Figure I because observed age-earnings profiles do not identify what could have been earned by degree-bearing individuals had they remained out of the labor force and *not* obtained degrees. Fortunately, that omission is of no consequence in calculating *ex post* rates of return to education. In that procedure, comparison of areas *A* and *B* – or in standard econometric practice, *A* plus *D* with *B* plus *D* – is sufficient. Area *C* in Figure II can be ignored because as both a cost (of time out of the labor force) and a benefit (from enhanced education presumably undertaken during that time) its magnitude does not influence the internal rate of return to educational investment.

For individual decision-makers, however, the issue is of more than purely academic interest whether valuing the cost of a gap year, the time a parent might take out of the labor force to raise a family or a daughter to serve as a caregiver for elderly parents,. Nor would this issue be trivial for someone who spends an extended period as a discouraged worker during a period of high unemployment, as has recently been the case for many young people in Europe as well as North America. Since even in present value terms the cost calculations cannot be as simple as averaging the earnings sacrificed at the beginning and end of a career, the next section turns to discussion of the appropriate methodology.

[7] Jacobsen and Levin (1995) discuss issues and evidence. There are obviously other possible scenarios such as partially completed degrees, certificates and diplomas which will put earnings of individuals somewhere between high school diploma and college degree.

Earning Capacities and Time Costs: Present Values

Table I displays hypothetical age-specific earning capacity profiles consistent with the numerical example presented earlier in Section 2 for the civil trial case.

1	2	3
Age (years)	**Earning Capacities w/ High School Education** (constant dollars)	**Earning Capacity Loss in First 5 years Only** (constant dollars)
18	$18,991	$0
19	$19,483	$0
20	$19,987	$0
21	$20,504	$0
22	$21,035	$0
23	$21,579 →	$21,579
24	$22,138	$22,138
25	$22,710	$22,710
.	.	.
.	.	.
.	.	.
63	$59,961	$59,961
64	$61,513	$61,513
65	$63,104	$63,104
PV (2% discount rate)	**$600,023**	**$508,629**

In this example the individual does not suffer loss of earnings capacity at age 23 for being away from the labor force because annual income is the same as those who started working at the age of 18.

Table I
Earnings Losses from Time Out of the Labor Force,
Income Effects in the First Five Years Only

The undiscounted loss of potential earnings from remaining out of the labor force between ages eighteen and twenty-three averages $20,000 per year while the (also un-discounted) average over the final five years is $60,000. For simplicity, earnings from age 18 through 22 again are assumed to be zero and direct costs are ignored.

Potential earnings in the second column of Table I display constant year-over-year percentage increases (of approximately 2.7 percent) for years in which the individual is employed, rather than the decreasing marginal earnings pattern shown in Figures I and II. In practice, earnings tend to rise fairly steeply early on in one's career, after which they rise more slowly.[8] Fortunately the logic here is unaffected by differing potential earnings patterns, and as a practical matter the precise shapes of the profiles generally will be of relatively minor significance to the differing opportunity cost patterns. What matters for the purposes of measuring both costs and benefits are the shifts from one profile to the other – downward as a consequence of time out of the labor force and upward as a result of additional education.

The third column of Table I shows the same annual earning capacities as the second except for the zero values in the first five years of potential employment. The horizontal arrow

[8] Thanks to two referees for suggesting this addition.

emphasizes the point that earning capacities at age twenty three and beyond are identical whether or not the individual has previous work experience. The cost of being out of the labor force from ages eighteen through twenty two is given by the difference in the present values of the two streams, represented by area A.

For a two percent real discount rate (risk-free investment earnings two percentage points above average annual increases in employment earning capacity) that difference amounts to approximately $91,000. At a discount rate of 4 percent, it is just over $88,000. Even with differences only in the initial five year period, the $100,000 that would normally be used in classroom examples can diverge from the discounted value. Failing to account for work-life effects can result in considerably greater discrepancies.

Table II replicates Table I except that (as indicated by the sloping arrow) the earning capacities of otherwise equivalent workers now depend entirely on years of labor force participation. In Table I, a labor force entrant aged twenty-three was assumed able to earn the same amount at each age as could an otherwise identical counterpart who had begun work five years earlier at age 18. Table II parallels Figure II in assuming that the potential earnings of a 23-year old with no work experience would be the same as those of a comparably educated 18-year old beginning employment without experience.

1	2	3
Age (years)	**Earning Capacities w/ High School Education** (constant dollars)	**Earning Capacity Loss in First Five Years & Over Career** (constant dollars)
18	$18,991	$0
19	$19,483	$0
20	$19,987	$0
21	$20,504	$0
22	$21,035	$0
23	$21,579	$18,991
24	$22,138	$19,483
25	$22,710	$19,987
.	.	.
.	.	.
.	.	.
63	$59,961	$52,770
64	$61,513	$54,136
65	$63,104	$55,537
PV at 2% discount rate	**$600,023**	**$447,633**

Note as per R1-8: In this example the individual *does* suffer loss of earnings capacity at age 23 for their lack of experience for being away from the labor force for five years.

Table II
Earnings Losses from Time Out of the Labor Force,
Income Effects in the First Five and Later Years

Table II shows that with a two percent real discount rate the present value of lifetime earnings of an individual with a high school education and continuous employment from age eighteen through sixty five would be some $152,000 greater than that of a counterpart who began work at age twenty three at the same wage as the eighteen-year old. That cost figure is two

thirds greater than the $91,000 from Table I and more than fifty per cent greater than the un-discounted five-year figure.

At a four percent discount rate, taking the work-life effect into account would increase the five-year cost of time out of the labor force from $88,000 to over $128,500, while at a *zero* percent rate the cost of delaying entry into the labor force by five years would amount to $300,000 rather than the conventional $100,000 classroom illustration.

Alternative discount rates, differing potential income streams (associated with different college majors, for instance) and patterns of time out of the labor force (such as in full-time versus part-time study) will generate varying discrepancies. In each instance, however, earnings foregone during university study will understate the true opportunity costs by amounts that could be quite substantial.

Retirement Age

Retirement decisions are driven by a complex set of factors faced by the individual that could vary along gender lines or with the manner in which incentive structures are set up. It is an empirical issue and one that could change with changing times and demographic factors (Diamond, 2011).

Empirical work suggests that increased education tends to correlate with later retirement ages. While it is possible that educated individuals are attempting to recapture the gains from the last five years of high earning capacity, while those who did not seek additional education conclude that they have worked the requisite forty seven years. It would seem more probable, however, that the character of the jobs one is likely to do with additional education put lower stress on the employee, reducing a push factor older workers might otherwise face. But once again, the individual who took time out but did not choose to obtain extra education, will find his options reduced and will be unable to capture what would have been higher earnings years.

Conclusion

Best estimates of opportunity costs incurred by taking time out of the labor force can be derived by identifying each future year's anticipated earning capacity under alternative scenarios and comparing present values of the differing income streams. Costs include the usual example of income foregone during the absence itself but also (typically) involve foregone future earning capacity. That future cost, omitted in introductory examples and hidden in educational rate of return calculations, is accounted for not by focusing on 'lost' years of potential future employment but by spelling out consequent year by year differences in earning capacities.

Time out of the labor force may – depending on its use – have benefits in the form of enhanced future earning capacity. In turn, those benefits may or may not be sufficient to offset one or both opportunity cost components. Only the net effect need be considered when the goal is determination of aggregate rates of return to investment in education, although it can always be misleading to ignore a cost simply because there are benefits to balance against it. At the individual level, where the outcomes flowing from specific choices (say, from choosing to major in accounting rather than English literature) may be associated with differential risks of achieving mean post-education income profiles, decision-makers' failure to be explicit about potential future work-life costs might have more serious implications.

Flowing out of the vocational analyst's testimony, discussion in this paper has considered time out of the labor force for educational purposes prior to the beginning of an individual's career. But it notes that the same qualifications apply no matter what the reason for the hiatus

and no matter which years of potential employment are involved – a 'gap year' between high school and university, graduation delayed to accommodate a part-time job, unemployment flowing from a bad economic times, a semester lost owing to illness, time out to raise a family, and so on. Only when an individual withdraws permanently from the labor force, in whole or in part, will foregone income during the period of absence or reduced participation comprise the total cost.

What is required to best answer questions involving the cost of time is straightforward: to be as precise as possible about alternative year-by-year earning capacities before, during and after the span for which cost is to be determined, holding other factors (including educational achievement) constant, then to compare present values of the alternative streams.

Whether we think about this case in the context of the value of education, a cost of the financial crisis, or a real life example raised by a vocational analyst testifying to earning capacity loss suffered by an injured plaintiff, our augmented diagram provides us as teachers of economics with a world of possibilities that we believe should not be limited to the value of education.

As Albert Einstein is frequently quoted, 'Explanations should be made as simple as possible, but not more so.'[9] When setting our students on the path to understanding opportunity costs, might failing to mention future work life effects be an instance of 'more so?'

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[9] The source of the aphorism appears to have been Einstein's rather less quotable statement that "[T]he supreme goal of all theory is to make the irreducible basic elements as simple and as few as possible without having to surrender the adequate representation of a single datum of experience." From "On the Method of Theoretical Physics" The Herbert Spencer Lecture, Oxford (10 June 1933); published in *Philosophy of Science*, Vol. 1, No. 2 (April 1934), pp. 163-169.

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