CM 2: DISCOUNTING: HIGHER EDUCATION AND CHILDREN (3/24/21)

MOST, BUT NOT ALL, OF WHAT YOU SHOULD KNOW

1. What is the difference between the value of something and its price?

2. What is a "shadow" price?

3. Why is it important to try to place a dollar value (an implicit price) on statistical life extension?

4. What are the reasons that economists talk about statistical life extension rather than the value of a life?

5. What are the differences between explicit and implicit costs and benefits? 6. Which items listed in the WWU Bulletin are costs of attending WWU?
7. What, for most students, is the largest cost of a university education?
8. What are the benefits of a university education?

9. How do we calculate the rate of return on an investment?

10. What is compounding and what, if anything, does it have to do with inflation?

11. What is the Rule of 72 and what has it to do with compounding? 12. What is discounting and how does it relate to compounding?

13. Why is it necessary to discount the flows of expenditures and incomes over time?

14. Why is a student loan like a mortgage?

15. What are the two problems with the USDA estimate of the cost of a child?

This Commentary looks at two applications of the idea of opportunity cost.

1. SHADOW PRICES

"A cynic is a man who knows the price of everything, and the value of nothing" Oscar Wilde *"Lady Windermere's Fan"*1892

1. Oscar Wilde's definition of a cynic fits an economist well.[1] Although microeconomics was once called the theory of value, what economists do is to attach prices to economic activities. *The "value" of something is its intrinsic worth*, but what you value I may not – rap versus opera. An economist cannot assess the "value" of something because that would involve her in making a value judgment.[2] Instead she seeks a money price that reflects other people's valuations – how much they are willing to pay is a proxy for the "value" that they attach to the marginal[3] unit. Some of those prices are ready to hand, there is already a market price attached to the activity, but sometimes the economist has to estimate a price of an activity, estimate or impute a price. Such a notional price is said to be *a "shadow" price* or just an implicit price. It *is a way of attaching a monetary value to something that is not sold in a market.* (A good economist is someone who can think logically but also laterally to come up with creative solutions to these problems of imputing values.)

2. For example, when national income accountants attempt to estimate how much of your house you use up in a year, they use what you could rent the house for as an estimate (sophisticated guess) of the housing services it provides to you as owner-occupier. The obvious number to use is the annual rent your house would generate if you rented it rather than occupied it yourself.

If an economist is asked to estimate the cost of commuting in Seattle, she will look for two people doing the same job but who have different commuting times. She will assume that the person with the longer commute will have to be compensated for the time wasted sitting in traffic jams, and she will use the higher wage per hour as her

[1] My favorite definition of an economist is that she is the sort of person who comes onto the battlefield, after the battle is over, and bayonets the wounded. An economist might argue that the wounded are better dead than lying in agony.

[2] A value judgement is a claim that something is good or bad. Ethics – not to be confused with morality – is the domain of philosophers, who have spent more than 2,500 years attempting to answer questions about what actions are good or bad with little success. (This year is the 2,500th anniversary of the battle of Platea, when the Greeks finally defeated the Persians.)

shadow price of commuting. This idea has a long pedigree; we can trace it back to Adam Smith.

3. My ex-colleague, Julia Hansen, did a study in which she estimated shadow prices of the value of the view from a house in Bellingham. She looked at how the prices of essentially identical houses vary with the quality of the view from the house – overlooking the San Juan islands or down Lake Whatcom or the back of Walmart – by rating the views from 7,000 houses on a scale from 5 (gorgeous view) to 1 (lousy view) and then holding constant all of the other things that affect the price of the house – the size of the house, the number of bedrooms, the number of bathrooms, the age and composition of the roof, the type of heating system, access to schools and shopping etc., etc. She estimated that the very best views added 120% to the price of the house. So, if there were two otherwise identical houses, A with no view and B with the best view in Bellingham, and if A sold for $750,000 then B would sell for $1,650,000

4. The Northern Spotted Owl is an endangered species in Washington (although there are more of them in Oregon and Northern California). At the beginning of the first Clinton Administration there was a policy debate about whether logging should be allowed in the "Old Growth" forests of the Pacific North West. The policy argument focused on employment issues but conservationists argued that logging would destroy the habitat of the Northern spotted Owl, an indicator species. My ex-colleague, Dan Hagen (who is married to Julia Hansen) did a very sophisticated study in which he sent an extremely carefully designed survey to randomly selected households in the US and asked them how much they would be willing to pay – each year – just to know that there were Old Growth forests in Washington. This was a way of pricing or valuing the "existence" of those forests – it had nothing to do with using the forests, or visiting the forests in the future, both of which can be "valued" by environmental economists. He found that if he multiplied the number of US households by his most conservative estimate of the existence value of the forests that the dollar existence value far outweighed the value of the cut timber. And, as noted, the existence value is only part of the value of the forest. The Clinton Administration allowed timber firms to log some of the publicly owned Old Growth forests because the logging kept loggers employed – some in jobs that would not have existed if the US Forest service had not supplied the industry with a subsidy by cutting roads into the forests so that the lumber companies can access and transport the timber.

5. Economists argue that we cannot just refuse to talk about the value of a human life, although economists would argue that we should rephrase this as the value of statistical

life extension (VSL).[3] If we refuse to place a "shadow" price on human lives then we are reduced to claiming that either a life is infinitely valuable, and you do not behave as if you believe this even if you say that this is what you believe, or, that a life is valueless, which is equally absurd. In practice government agencies have to choose between implementing policies that involve the probability that different numbers of lives will be "saved". For example, straightening out a dangerous curve in the road. It surely would make sense for the government agencies to all use the same dollar value but as you will see if you read the links they do not do so. Currently the EPA uses $11 million in its VSL calculations but the estimates are based on people of working age – mostly males – which is probably inappropriate for doing a VSL for an 82-year-old like me.

Economists emphasize that we all eventually die – even you will croak someday – and so we only extend lives we do not save them. This is markedly different from the medical and epidemiological professions who talk in terms of saving lives, when they are really discussing life extension. "Saving my life" may mean extending it by five years, saving my oldest grandchild's life may mean adding 80 years to her life. Your Mom's life is more valuable to you than other women's and so economists talk about statistical lives – the life of someone you do not know and do not care about, except in the abstract. Health economists talk about QALYs – quality adjusted life years.

The problems of placing a shadow price on statistical life extension are fascinating but I do not want to go into this issue at this point; here are some links that you can follow up if you are interested.

http://web.archive.org/web/20111015082515/http://stats.org/stories/2011/value_statistical_life_jun27_11.html

https://fivethirtyeight.com/features/what-should-the-government-spend-to-save-a-life/?ex_cid=trump-approval

http://conversableeconomist.blogspot.com/2014/11/the-origins-of-value-of-statistical.html
http://www.motherjones.com/blue-marble/2011/07/statistical-value-human-life

Here is a link about the Northern Spotted Owl:

http://www.nytimes.com/2011/07/01/us/01owls.html?pagewanted=all

[3] Economists talk about statistical life extension because they want to keep the discussion as dispassionate and objective as possible. So, we talk about an abstract statistical person not your mother and life extension because everyone dies.

2. THE COSTS OF HIGHER EDUCATION

2.1 HOW MUCH DOES IT COST TO ATTEND WWU?

1. In CM1 we saw that just as there are explicit costs (dollars that you pay), and there are also implicit costs (opportunity costs that are not actual dollar expenditures but are nonetheless costs because you have to give up something). Implicit costs should be treated on a par with explicit costs. For example, when you buy a textbook then you have an explicit cost (the payment to the bookstore) and an implicit cost (the value – shadow price – or cost of the time spent acquiring the book).[4]

2. Only some of the items listed in the University Bulletin are true costs of attending WWU. Tuition and Fees and Books and Supplies are explicit costs, say about $10,000 per year or $40,000 over four years (although the costs in years 2-4 should be discounted when making your human capital investment decision). On the other hand, as economists love to say, housing and meals, transportation, and personal expenses ($55,000) should only be included as costs if they are specific to WWU – you would probably continue to eat and take showers even if you were not at WWU.[5] Some of your travel costs may also be specific to WWU although I guess that most of you would spend more on travel if you were not at WWU.

3. *For most students the largest cost of spending four years at WWU will be the implicit costs – the lost earnings and benefits (health insurance and contributions to pension plans),* say $30k per year or $120k over four years – again not discounted. $30k is a very conservative estimate for what you would earn in a full time career job given your superior performance in high school; if you work 40 hours per week for 50 weeks during the year then your annual hours of work would be 2,000 – most people work less than this, and some of us work more than this – the $30k would mean that you were making $15 an hour. Your lost earnings, although they are expressed in money terms, are not actual money expenditures and so they are implicit costs.[6] Note that the implicit costs vary from student to student depending on your abilities. Think of Mick Jagger deciding to be the lead singer of a rock band, dropping out of the LSE and giving up the chance to be an accountant. (As all Monty Python fans are aware accounting is the most boring

[4] You should also take into account any resale value for the text.

[5] Some of the *costs* of the "wars" in Iraq and Afghanistan are not costs at all. The military has to be housed and fed, ammunition will be used in training, and some military personnel will lose their lives during training.

[6] You would probably have pension and health benefits by your second year of employment.

subject ever devised to torture students, and if you become an accountant you will become an unutterably boring person!☺)

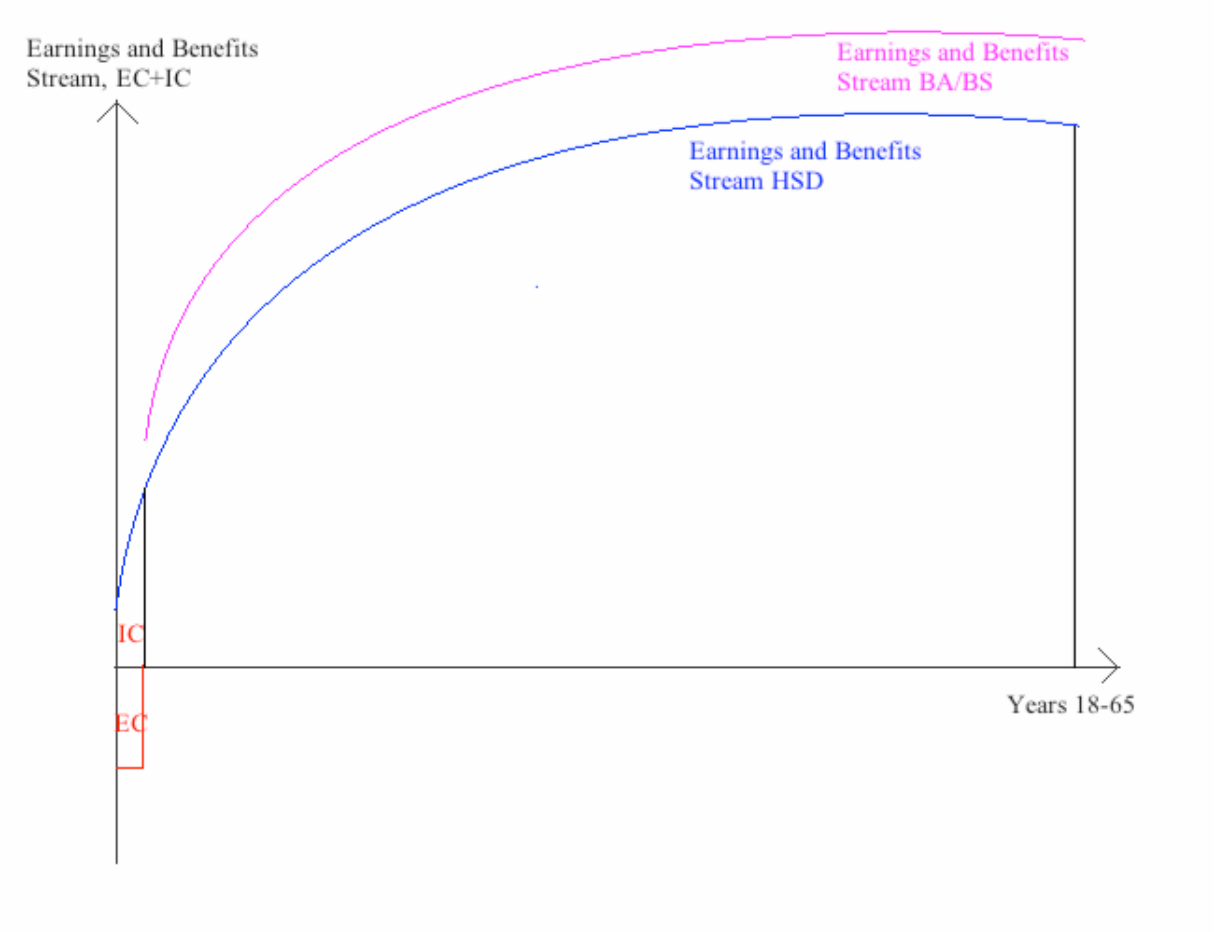
So, Total Cost = Explicit Costs + Implicit Costs = $40,000 + $120,000 = $160,000 over four years (again not discounted) versus the WWU estimate of $95k (a difference of 40%). (I am using 2019 data.)

http://www.celebritynetworth.com/articles/entertainment-articles/richest-rock-lead-singers- world/

2.2 WHAT ARE THE BENEFITS OF ATTENDING WWU?

1. Benefits also come in two flavors: explicit benefits that are benefits that we receive in monetary form, and implicit benefits such as psychological gains that are not received in monetary form. *The explicit benefits from getting a degree are the higher lifetime earnings and health and pension benefits that you receive because you have an undergraduate degree.* Just attending a community college for a year will raise your lifetime earnings relative to a person with a high school diploma. *The* implicit benefits *are the psychological benefits that you get from being better educated*, and the intangible but invaluable benefits that you get from listening to me droning on for hour after hour! (Some students will end up with better life partners because of their better education. Economists talk about "assortive mating", which means that you are likely to choose someone from the same socio-economic group as yourself.)

2. *In the diagram the EC are the actual money costs of attending WWU, and the IC are forgone earnings relative to someone with a high school diploma.* The Blue line is the earnings and benefits stream of someone who enters the labor force at 18 having completed high school, and the magenta line is the earnings and benefits stream of someone who completes an undergraduate degree and enters the labor force at age 22. *These benefits should be discounted.*



These links are a bit old. I'll come back and update them if I have time. Unemployment rates and median weekly earnings by educational attainment in 2011 are available in this link:

https://www.nytimes.com/2019/09/20/business/liberal-arts-stem-salaries.html

https://www.nytimes.com/interactive/2019/05/23/opinion/sunday/college-graduation-rates-ranking.html

https://www.bls.gov/spotlight/2019/education-projections/home.htm

http://www.frbsf.org/economic-research/publications/economic-letter/2015/january/wages- education-college-labor-earnings-income/

http://www.bls.gov/emp/ep_chart_001.htm

This link quotes lifetime earnings of people with only a high school diploma, $1.3m versus $2.27m with a degree (I don't know if these figures include benefits such as contributions by your employer to your 401k.)

http://www.usnews.com/education/best-colleges/articles/2011/08/05/how-higher-education- affects-lifetime-salary

https://www.newyorkfed.org/research/college-labor-market/index.html

This link provides data on earnings according to major. Clearly the return to math and IT and finance are higher than to social and helping skills. Choice of major may be more important than choice of university except for very prestigious (and expensive) colleges the so-called Ivy League universities and Liberal Arts colleges.

http://www.payscale.com/best-colleges/degrees.asp

If you are interested there is a lot more information in these links:

https://www.princeton.edu/futureofchildren/publications/journals/article/index.xml?journalid=79&articleid=580

http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/collegepayoff-summary.pdfone, two, three and four

Many university students would be better off if they became electricians or plumbers who commonly make six figure incomes and are usually paid during their apprenticeships. Half of students who enroll at four year colleges never drop out without a degree.

2.3 WHAT IS THE RATE OF RETURN ON YOUR INVESTMENT?

1. To calculate the return to your human capital investment we must convert *future* dollars – their future value (whether spent or earned) – into their *current* (present value) dollar equivalents. *A dollar received in the future is worth less than a dollar received today* because *the future dollar cannot be invested today and so we forgo interest*. This has ***nothing*** to do with inflation, the idea – an *opportunity cost* concept – is true if the price level never changes. If we delay the receipt of a dollar for ten years the we *give up* the potential income we would get if we had invested it for ten years instead.

We cannot just add dollars spent in years one, two, three, and four because they are paid in *dollars with different values*, and we cannot add forgone earnings and benefits in year one to those in year four because the dollars received have different values today.

2. **Compounding**:[7] Say you invest $100 at a 10% rate of interest (a reasonable approximation to the nominal return on stocks 1926-2020) at the beginning of year 1. At the end of the year you get your $100 back plus $10 interest = $100 + $10 = $110.

You then reinvest the whole $110 for a second year at the end of which we have $110 plus 10% interest on $110 = $11. Therefore, your initial investment of $100 is worth $121 = $110 +$11 at the end of year two.

You now invest the whole $121 for another year at 10% and at the end of the year you have $121 plus $12.10 in interest making a total of $133.10 at the end of year three.

If you invest the $133.10 for another year you would have $133.10 + $13.31 = $146.41. Therefore your $100 on day 1 of year 1 is worth $146.41 at the end of four years if you can earn a 10% rate of return.

3. Note that compounding is not the result of inflation, these returns ignore inflation. Compounding is the result of continual reinvestment. If we take account of inflation then we determine what economists call "real" returns (in constant dollars; dollars with a constant purchasing power, 2021 dollars.) Those future dollars have less purchasing power than they do today because the average price level increases because of inflation. "Nominal" (current dollar – ignoring inflation) returns will be higher than real returns. A very rough rule of thumb would lower nominal returns by three-percentage points to account for historical inflation; that is from 10% to 7%, although inflation in recent years has been below 2%.

4. The Rule of 72 is useful way to approximate doubling times when compounding. Anything growing at a compound rate of 1% will double in value in approximately 72 years (periods).

The **Rule of 72** says that anything growing at 10% per period will double in approximately 7.2 periods.

Say you invest $1,000 out of your first year's salary. Your $1000 will be worth $2,000 after 7.2 years (x2), $4,000 after 14.4 years (x4), $8,000 after 21.6 years (x8), $16,000 after 28.8 years (x16), $32,000 after 36 years (x32), $64,000 after 43.2 years (x64).

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[7] Compounding is a form of *exponential* growth, for example, 2^1=2, 2^2 = 4, 2^5 = 32, 2^{10} = 1,024, 2^{15} = 32,765, 2^{20} = 1,048,576. Continuous compounding uses the constant e = 2.7182818284... instead of an integer. https://wealth.visualcapitalist.com/visualizing-power-compound-interest/

If you join the labor force at 22 and retire at 65 you will have worked for 43 years and so that $1,000 you saved from your first year's salary will have grown to almost $64,000 *if* you get a 10% rate of return. If the rate of inflation is 3% over that period, then your real rate of return will only be 7% with a doubling time of 10.29 years and so your $1,000 will grow to about $16,000 of real purchasing power by the time you retire.

If you invest $1,000 at the beginning of *every* year for 43 years at a 10% (nominal) rate of interest then you will end up with $592,000; $43,000 invested and $549,000 of interest.

Notice how compounding starts slowly but builds up rapidly towards the end of the time period[8]; in the first 7.2 years you added $1,000 but in the last 7.2 years you added $296,000. This is why people with high incomes also save a significant part of their income, and become wealthy and why the wealthy become wealthier if they invest sensibly. [If I ever get around to it – which is not likely – I will write you a Prologue that explains how economic systems generate inequality.]

Most people, including many journalists have difficulties distinguishing between wealth and income. **Wealth** refers to net worth – the difference between your assets and your liabilities (what you owe). Wealth is a *stock* variable and can be calculated at any instant of time. Your **income** is a *flow* variable, it has a time dimension, and can only be calculated over a given period of time, usually a year. A stock variable is like the water in Lake Whatcom at the moment you read this sentence, while a flow variable is like the amount of water flowing along Whatcom Creek in a day.

5. ***Discounting** is the inverse of compounding.* If you are paid $64,000 in 43 years' time, how much is that worth today if the interest rate is 10%? The answer is $1,000 because $1,000 will compound to $64,000 in 43 years if the rate of return is 10%. Therefore, we have to discount future earnings and benefits to get Present Values (PV) – the amount that we would need to invest today, at a given rate of interest, in order to get a certain Future Value (FV). (There are formulas for doing more sophisticated calculations. You can learn more about "the time value of money" if you take an introductory finance course.)

Notice that *compounding* is a *multiplicative* process and *increases* things, whereas *discounting* is a *division* process and *reduces* things.

[8] An invasive weed doubles its coverage of a lake every year. When the weed has covered half the surface of the lake, how many years will it take for it to completely cover the lake?

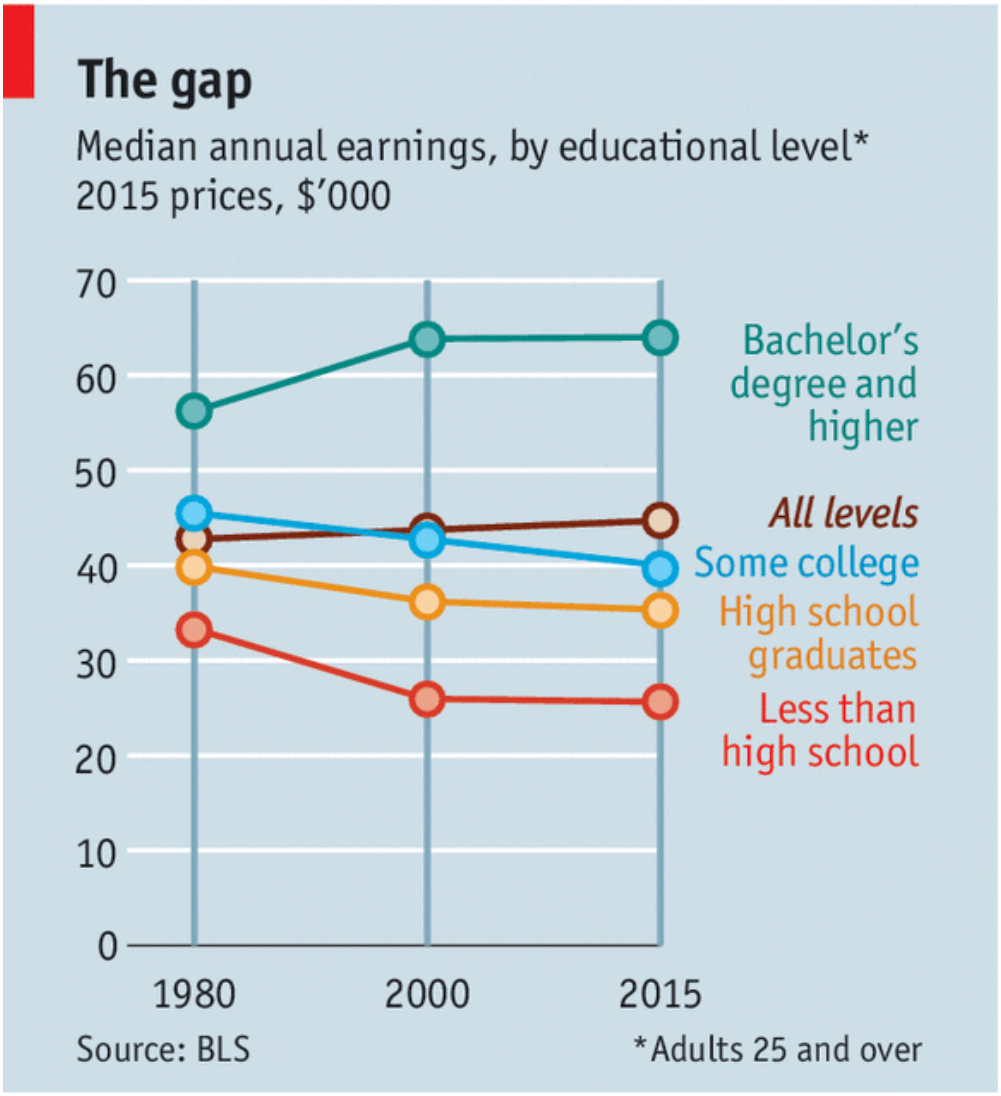
6. If you convert the flow of higher earnings and benefits into a PV and the four years' explicit cost into a PV then you can work out a rate of return on your investment – the $40,000 you pay to WWU. What your rate of return will be will depend on how much you earn over your lifetime, but currently the average college student is doing better than the stock market.

http://www.aei.org/article/education/higher-education/is-college-worth-the-investment/

A rate of return is the ratio of what you gain (what you end up with minus what you started with) to what you started with. If you started with $100 and a year later you have $110 ($10 of interest) then your rate of return is ($110-$100)/$100 = 10/100 = 0.10. We usually multiply the decimal by 100 to get a percentage return: 0.10 x 100 = 10%.

7. Benefits should include the implicit benefits you get from the education process and the future benefits of being educated (a better spouse?). Because of "credentialism" you may need to go to university in order to get an interview for a job that once required only a high school diploma (when a high school diploma was a high school diploma!)

https://www.cnn.com/2019/06/06/success/college-worth-it/index.html



Economist.com

2.4 WHAT ABOUT LOANS?

1. Most students finance all or part of their total expenditures while at university by taking out loans. You should think of the loan as a way of spreading out the cost of an expenditure over a longer time period. *A student loan is just like a mortgage or a car loan*. You do not hear people complaining about the burden of their car loans or the burden of their mortgages, although there are frequent complaints about the burden of student loans: "I left college owing $100,000". (Students who end up owing tens of thousands of dollars usually do so because they do graduate courses.)

2. The way to think of a student loan is that you are borrowing at a low rate of interest in order to buy an investment (your education) that will yield a higher rate of return. The

trick is to get the higher rate of return, which involves three things: choosing the right major, getting an excellent GPA, and getting into the right school. The last of these three is probably only really important if you extend your higher education into graduate work, law school, MBA's, and medical school. (Pay careful attention to my "Grandfatherly Advice" in the Syllabus.)

3. Shop around for the best loans – do research using your web browser. The Federal government finances 90% of all student loans. The rates on these loans are tied to the rate of interest on 10-year Treasury notes. Most rates are around 4%, slightly higher for post-graduate loans. If you borrow $100,000 to cover all your expenses for your four years at university and you repay this over 10 years your total repayment will be about $120,000 = $100,000 (Principal) + $20,000 (Interest) – your monthly payments would a bit more than $1,000.) Over the 43 years you will be in the labor force you will earn roughly $1,300,000 more than if you just had a high school diploma. That $1.3m should be discounted to get a Present Value.

https://www.brookings.edu/blog/up-front/2019/11/12/five-facts-about-student-loans/

3. THE COSTS OF CHILDREN.

1. Your first child may be the most expensive thing you ever buy: $300,000 expenditures over 18 years for a middle-income family, which does not include prenatal costs or college costs, or the expense of larger houses and cars, say, about $325,000 over 22+ years. The data is usually taken from USDA calculations; *they are **not** discounted* and ***they only include some EC***.

http://money.cnn.com/2013/08/14/pf/cost-children/

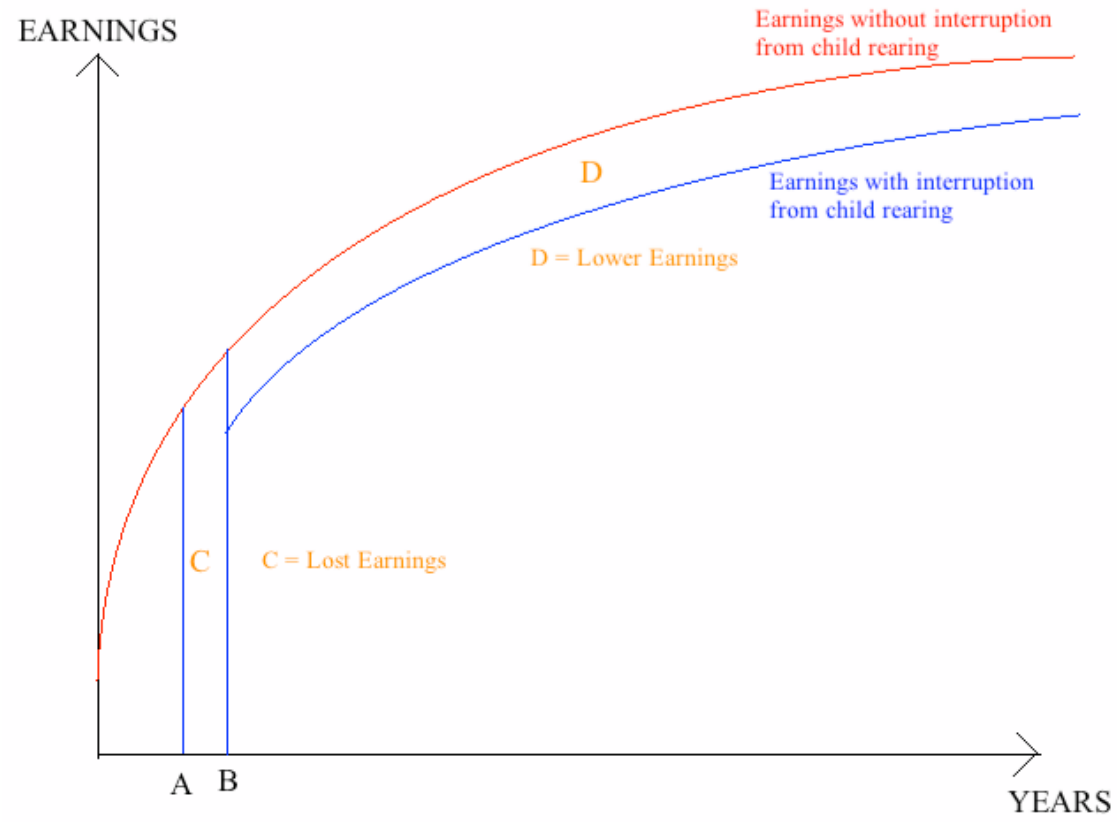
http://conversableeconomist.blogspot.com/2019/04/two-can-live-1414-times-as-cheaply-as.html

2. *Implicit Costs would include the time costs of raising children plus the psychological wear and tear associated with "terrible twos" and "teen angst".* Your parents are probably happier because they have finally got you out of the house. (The happiness literature, which we will look at later, shows an apparent dip associated with the presence of children in the home.)

3. *The most important Implicit Cost is lost earnings and benefits* when a parent – traditionally, and still usually, the mother – leaves the labor force to raise the child or children. In 1950 only about 19% of mothers with children under 6 were in the labor force and about 39% of mothers with children 6-17; in 1970 the percentages were 30 and 49;

in 1980 they were 45 and 62; in 1990 they were 59 and 74; in 2000 they were 63 and 77; and in 2011 they were 65 and 78 (there has been a decline in labor force participation by women with children because of the Great Recession and its aftermath). The COVID-19 pandemic has disproportionately impacted women: they are over represented in low paying service industries and lost jobs and hours and they provide most of the care of their children and do most of the online schooling.

The US is the only industrialized country that does not have federal laws entitling women to paid maternity leave. In Sweden parental leave is 15 months, with 80% of their salaries paid by the government. Fathers are required to spend two months at home with the baby on their own or they forfeit the pay and the time off. As a consequence, (?) Swedes now typically have three children per couple. Sweden also subsidizes day care, as do most Western European countries.



4. If you leave the labor force for five years (it used to be an average of twelve years) – A to B – then you lose earnings and benefits during those years (C), and when you return to the labor force you have lost five years seniority and your human capital will have depreciated and so your earnings and benefits trajectory will be lower (D) than someone without a career gap. These losses should be discounted too. *Lost and lower earnings and benefits are probably the largest cost of having children*.

https://www.nytimes.com/2018/04/09/upshot/the-10-year-baby-window-that-is- the-key-to-the-womens-pay-gap.html

The cost of a child is the discounted explicit expenditures on food, clothing, etc., plus the discounted lost and lower lifetime earnings.

6. *Children also generate benefits* (really?). They can look after you when you are too old to look after yourself – a burden born disproportionately by daughters and daughters-in-laws. In Less Developed Countries (LDCs) high child mortality was associated with large family size. There are psychological implicit benefits (IB) from children, although the Happiness data shows a clear dip during the years that children are at home. The probable reason is not that children do not directly increase our happiness but that they also reduce other aspects of our lives that add to our happiness, such as our ability to travel to places that adults enjoy but children do not.

https://www.youtube.com/watch?v=3FzgvXdQ9vE (**This is hilarious**.)

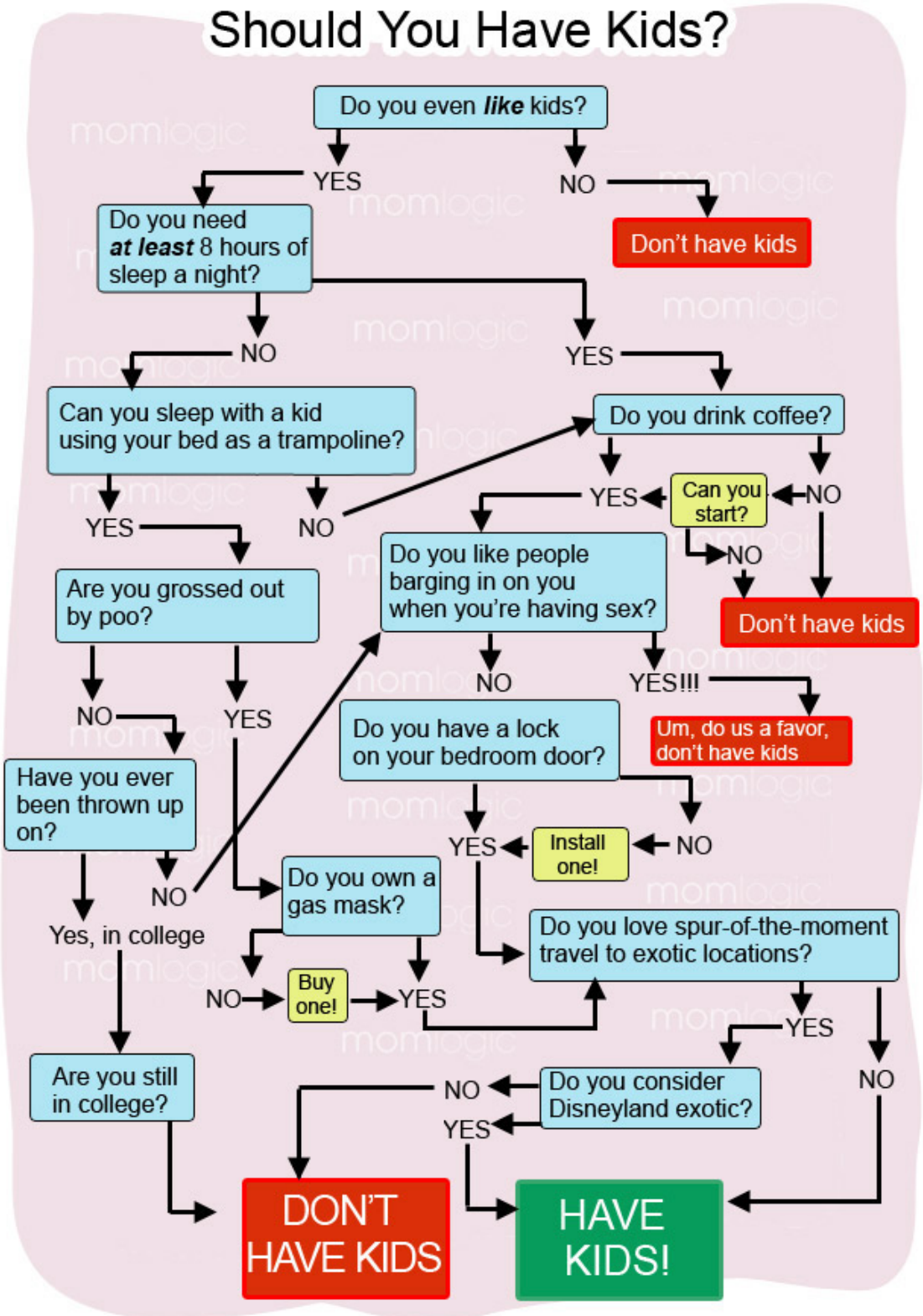
https://mpra.ub.uni-muenchen.de/53870/1/MPRA_paper_53870.pdf

This may be why grandparents are so keen for their children to have children. Being a grandparent generates many of the benefits of children without incurring the costs.

(4,714)

https://economix.blogs.nytimes.com/2012/12/17/the-mommy-penalty-around-the-world/

https://economix.blogs.nytimes.com/2010/12/06/m-b-a-s-have-biggest- mommy-penalty-doctors-the-smallest/


Should You Have Kids?
Do you even like kids?
YES
NO
Don't have kids
Do you need at least 8 hours of sleep a night?
NO
YES
Can you sleep with a kid using your bed as a trampoline?
Do you drink coffee?
YES
NO
YES
Can you start?
NO
NO
Are you grossed out by poo?
Do you like people barging in on you when you're having sex?
Don't have kids
NO
YES
NO
YES!!!
Um, do us a favor, don't have kids
Do you have a lock on your bedroom door?
Have you ever been thrown up on?
YES
Install one!
NO
NO
Do you own a gas mask?
Yes, in college
Do you love spur-of-the-moment travel to exotic locations?
NO
Buy one!
YES
YES
Are you still in college?
NO
Do you consider Disneyland exotic?
NO
YES
DON'T HAVE KIDS
HAVE KIDS!