

# Lecture 5: The MARR and Shadow Wages

September 17, 2021

# Required Reading (fine to skim)

- McIntosh, E. (2010). Shadow pricing in health care cost-benefit analyses. In McIntosh, E., Clarke, P., Frew, E. J., & Louviere, J. (Eds.). *Applied methods of cost-benefit analysis in health care*. Oxford University Press. Retrieved from <https://ebookcentral-proquest-com.ezproxy.library.uvic.ca/lib/uvic/reader.action?docID=975570&ppg=54>
- **A thorough, readable and practical discussion of shadow pricing in an applied context.**
- **It's fine to skim it - if you're short on time, don't feel you have to read it closely.**

# Recommended Viewing

- Kriti Bedi. (2020, March 23). Meaning of shadow price/what is shadow price/UNIDO Approach [Video File].  
[https://youtu.be/3acj2RI\\_mH0](https://youtu.be/3acj2RI_mH0)

# Case Studies

- Almeida, A. N. & Bravo-Ureta, B. E. (2019). Agricultural productivity, shadow wages and off-farm labor decisions in Nicaragua. *Economic Systems*, 43(1), 99-110. <https://doi-org.ezproxy.library.uvic.ca/10.1016/j.ecosys.2018.09.002>
- Trung, L. D. & Oostendorp, R. H. (2017). Regional Labor Market Integration, Shadow Wages and Poverty in Vietnam. *World Development*, 89, 34-56. <https://doi-org.ezproxy.library.uvic.ca/10.1016/j.worlddev.2016.07.011>

# Other sources

- Boardman, A.E., Moore, M. A. & Vining, A. R. (2010). The Social Discount Rate for Canada Based on Future Growth in Consumption. *Canadian Public Policy*, 36(3), pp. 325 – 343. Retrieved from <https://muse-jhu-edu.ezproxy.library.uvic.ca/article/396282>
- Evans, D. J. (2005). The Elasticity of Marginal Utility of Consumption: Estimates for 20 OECD Countries. *Fiscal Studies*, 26(2), pp. 197 – 224. Retrieved from <https://www-jstor-org.ezproxy.library.uvic.ca/stable/24440019>
- Ford, C. (2020, September 17). 1,100 jobs to be created as Lighthouse Lab Covid-19 testing facility confirmed for North East [Web Page]. Retrieved from <https://www.business-live.co.uk/economic-development/1100-jobs-created-lighthouse-lab-18950303>
- Sartori, D., Vignetti, S. & Del Bo, C. (2015). In *Guide to Cost-Benefit Analysis of Investment Projects*. EU: European Commission. Retrieved from [https://ec.europa.eu/regional\\_policy/en/information/publications/guides/2014/guide-to-cost-benefit-analysis-of-investment-projects-for-cohesion-policy-2014-2020](https://ec.europa.eu/regional_policy/en/information/publications/guides/2014/guide-to-cost-benefit-analysis-of-investment-projects-for-cohesion-policy-2014-2020)

## We also call the MARR a 'discount rate'.

- The MARR is a discount rate; not all discount rates are MARRs.
- Why discount rate?
- Even without considering inflation & uncertainty (later in the course!):
- **A dollar tomorrow is worth less than a dollar today...**
- ...because you can turn a dollar today into MORE than a dollar tomorrow.
- → We pay LESS than \$1 today for a sure promise of \$1, 10 years from now.
- **The future dollar is discounted by a factor proportional to the MARR:**
- $P = F/(1+i)^N \rightarrow \$1 \text{ in 10 years is worth } \$1/(1+\text{MARR})^{10}$
- (Assuming MARR is in % per year.)

# Common MARRs used in business

- For more details, see (Chit, A et al., 2015):
- Depends on how the business raises money for the project:
- Interest on bonds (if paid for with bond issue)
- Rate of return in other available investments with similar risk (why give money to YOUR project if you can do better elsewhere?)
- Weighted Average Cost of Capital - WACC (weighted average cost of capital – i.e. of the different sources you use to raise money)
- Adjusted market-wide return using the CAPM (CApital Pricing Model) formula. Adjusts for firm's risks & market expectations.

# The Social Discount Rate: What perspective?

- What about society? How much should society value costs & benefits today, vs. in the future (perhaps to future generations)?
- Two main perspectives:
- Social Rate of Return on Private Investments (SSRI): Societal rates are mostly used for evaluating public projects. Public projects crowd out private investment, and the discount rate should reflect this opportunity cost. Leads to high discount rates. Used by Canada.
- Social Rate of Time Preference (SRTP): 'Society' has a rate at which it's willing to trade off present and future consumption. Public projects should consider this, and take into account the well-being of all generations. Widely used in Europe.
- China uses a weighted average of the two approaches.



## SSRI: Public investment crowds out private investment

- Using this perspective, some Canadian agencies recommend an 8% rate of return, plus 3% and 10% 'sensitivity' calculations.
- Very loosely, Boardman et al. (2010) report a study that breaks down the SSRI into the weighted average of the opportunity cost of:
  - Inflation-adjusted, before-tax return on investment (ROI).
  - Inflation-adjusted, after-tax return on savings
  - Inflation-adjusted cost of foreign borrowing.
- The Boardman paper suggests replacing ROI with WACC (cost of borrowing), and the other two with the inflation-adjusted, expected after-tax return to government bonds.

# SRTP: How society trades off present & future.

- Ideally: government should somehow add up individual preferences for consumption now vs later and use those in planning, while taking into account future generations.
- How? One famous method uses the Ramsey equation:
- **$SRTP = p + e \times g$**
- **$p$  = pure time preference**
- **$e$  = elasticity of marginal utility of income**
- **In English:** (roughly) adjusts for \$1 meaning more to someone poor, than someone rich.
- **Utility:** An important economic term meaning satisfaction/happiness/well-being. The goal of doing things is to gain or not lose utility. More is better.
- **$g$  = growth rate of per capita consumption**
- **In English:** (roughly) tracks whether the average person is getting richer or poorer through time.

# p: Pure Time Preference

- Why should *society* prefer consumption now to consumption later?
- This parameter is usually seen as the sum of two factors: myopia and extinction risk.
- **Myopia**: People are impatient, and want things now. (1%-3%/year measured.)
- e.g.: A toddler left alone in a room with a marshmallow, being told she can have two if she leaves it alone for an hour.
- Considered immoral to set this different from zero: future generations hurt just because they're born later. 0.1% sometimes argued as a compromise.
- **Extinction Risk**: Consumption now is better than consumption later because society may not be around later.
- Can be estimated by annual death rate of population. (Deaths/Population)

## e: Elasticity of Marginal Utility of Income

- Marginal utility of income (benefit from an extra \$) falls with income: an extra \$ means more to someone with very few \$ than to someone rich.
- → If society's income is rising over time, a dollar today brings more utility than a dollar later.
- How can we measure this for a whole society?
- In a democratic society, the tax system can be seen as a 'social judgment' about transferring consumption across people and time.
- Ideally, tax rates at different incomes should impose an 'equal absolute sacrifice of satisfaction' (Evans, 2005).
- In that case, letting  $t$  be the average tax rate and  $t'$  the marginal tax rate (tax on the next \$) for an average taxpayer, it can be shown (Evans, 2005) that
- **$e = \ln(1 - t') / \ln(1 - t)$**
- On average for the OECD, Evans finds  $e$  is about 1.4.

## g: Expected per-capita consumption growth

- This helps us keep track of whether future generations are more (or less) well off than the current generation, and by how much.
- If consumption is growing over time, it makes sense to discount benefits (and costs) to future generations, making the poorest generation (ours) a priority.
- Similarly, if consumption is falling over time (say, due to agricultural problems related to climate change), it makes sense to prioritize the future (at least to some extent).
- In practice, we can use estimates of real per capita GDP growth (inflation-adjusted, per-person growth in production) or income growth as a measure of g.

# Market prices and opportunity cost

- Ideally, when deciding what to do, we should use prices that measure the *opportunity cost* of the resource we're using (machines, working hours, etc.)
- Under certain conditions, *market prices* will give us a *lot* of information about these opportunity costs – and be pretty much equal to them.
- Loosely: when buyers, sellers & goods are mostly interchangeable, trading is free, no big gaps in information, no transportation costs, etc.
- This does NOT describe much of the world we live in!
- Market *distortions* → lots of noise in the opportunity cost signal.
- BUT for engineering projects, common (& hopefully not harmful?) to use.
- For *societal* projects, though, such as public health, it DOES matter.

# Shadow Prices (and wages)

- *Shadow Prices* are an attempt to correct for the noise in the signal.
- *Wages* are the price paid for work, so ***shadow wages* are a measure of the opportunity cost of time spent working.**
- Example where this matters: Informal health care by family of patient.
- Account-wise: looks ‘free!’ Economics-wise: VERY EXPENSIVE.
- Treating family member care as ‘free’ → health authorities inappropriately shifting too much to the community.
- Caregiver burnout is common & harmful. (See the Lilly et al. papers)
- One approach: value informal work at rate of similar paid work.

## **Box 3.4 Additional costs associated with informal care include the following**

<b>Additional 'costs'</b>	<b>Shadow price</b>
Time spent travelling by patients, relatives, carers	<b>Value of time</b>
Time spent waiting for consultation, during consultation, treatment, and rehabilitation	<b>Value of waiting time Opportunity cost of time</b>
Leisure time lost (if time allocated to unpaid activity involves a displacement of non-working time)	<b>Value of leisure activities forgone</b>

(McIntosh, 2015)



# **1,100 jobs to be created as Lighthouse Lab Covid-19 testing facility confirmed for North East**



# “We’ve created so many jobs! (Sartori *et al.*, 5.6)

- **A LOT of projects claim job ‘creation’ as a benefit.**
- Many of these claims are over-stated.
- **If the project employs workers that *would have been unemployed* if the project didn’t exist, then yes! Job creation is a benefit. The **shadow price (opportunity cost) of work** << **the wages paid**.**
- What if we’re in a full employment economy? The project employs workers that would be working somewhere else, otherwise.
- Shadow wage is about equal to actual wage... or could even be higher!
- (e.g. If workers stop building affordable housing to build a statue of the mayor.)
- At best, **part** of each job (Wage - Shadow Wage) was created.

# How have we tried measuring Shadow Wages?

- So... how do we measure the opportunity cost of labour?
- Measure how much a worker adds to production in the work they're going to (if any) vs the work they left.
- (Could approximate this by wages in each, *if* the labour market is competitive.)
- Adjust for work being pleasant or unpleasant (utility goes up or down?)
- For countries with migrant labour, migration also included: if someone migrates from A to B for work, cost of their job in B is the forgone output in A.
- Also need to include (un)employment benefits, etc.
- All this is a LOT of work, requiring a LOT of data that is not always available...

# Compromise: A weighted average

- $SWR = \beta m_1 + (1 - \beta)w_2$
- SWR = Shadow Wage Rate
- 1,2 = Market Sectors. The project is in Sector 2, the workers come from Sector 1.
- $m_1$  = Marginal product of worker in sector they're leaving.
- $w_2$  = Wages in a *competitive* labour market in Sector 2.
- (Need to assume a competitive market so wages are an accurate measure of productivity.)
- $\beta$  = Regional welfare weight (more on this later). Imagine workers moving from a traditional cultural industry to working in a canned corn factory.

## EU approach: 4 classes (Sartori *et al.*, Annex IV)

- This one-size-fits-all approach can be tweaked.
- The EU uses 4 sub-cases: FSE, QKU, ULD, RLD
- FSE: **Fairly Socially Efficient**. Unemployment is frictional (vs structural), workers are paid close to their marginal product.
- QKU: **Quasi-Keynesian Unemployment**. Sticky wages lead to high unemployment, both short-run and long-run.
- ULD: **Urban Labour Dualism**. Mostly urban. Both formal & informal work. The informal sector attracts workers from agriculture.
- RLD: **Rural Labour Dualism**. Mostly rural. Both formal & informal sectors, but excess labour is absorbed by agriculture. High emigration.