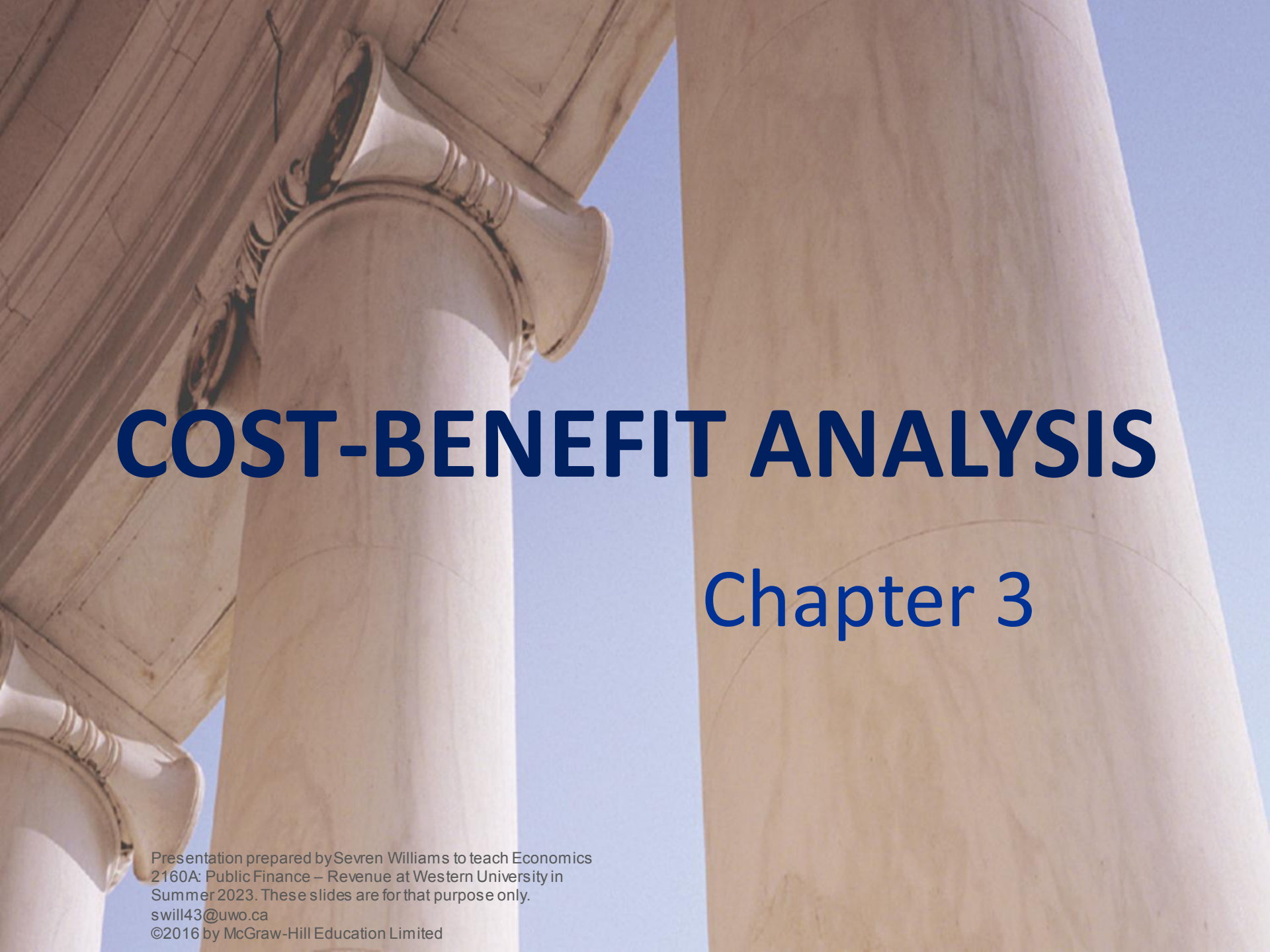

COST-BENEFIT ANALYSIS

Chapter 3

Presentation prepared by Sevren Williams to teach Economics 2160A: Public Finance – Revenue at Western University in Summer 2023. These slides are for that purpose only.
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Questions For Discussion (1 of 5)

Suppose the interest rate is r = 5%. The government creates a project with an up-front cost of $100 in year 1, and a return of $100 in years 2,3 and 4.

- What is the present value of the project?
- Is the project admissible?
- Suppose the inflation rate is 2% and the inflation is anticipated. What is the present value of the project now?
- What if the inflation is not anticipated in the payments? What is the present value of the project?

Key Points – Question 1

- Apply the present value formula (slide 14) with cost –100 in time period 0 (today), benefit 100 in time periods 2,3, and 4, and r=5%
- Yes, the project is admissible since it's PV is positive
- The same as before
- The payments are nominal in this case. Use both the (1 + inflation) and (1+r) in the denominator to create a nominal interest rate.

Questions For Discussion (2 of 5)

Suppose there are two competing projects. The interest rate is 4%. The cost and benefit schedule for each is listed below:

Project 1			Project 2		
Year	Cost	Benefit	Year	Cost	Benefit
0	$0	$100	0	$1000	$0
1	0	200	1	800	1,200
2	0	300	2	600	1,600
3	0	400	3	400	2,000

- What is the present value of each project?
- Which projects, if any, are admissible?
- Which project is optimal?

Key Points – Question 2

- Apply the project PV formula to both projects (slide 17)
- Both projects are admissible
- Project 2 is optimal

Questions For Discussion (3 of 5)

A project yields an annual benefit of $25 a year, starting next year and continuing forever. What is the present value of the benefits if the interest rate is 10 percent? (*Hint:* The infinite sum $x + x^2 + x^3 + \ldots$ is equal to $x/(1 - x)$, where x is a number less than 1.) Generalize your answer to show that if the perpetual annual benefit is B and the interest rate is r, then the present value is B/r.

Key Points – Question 3

- The PV is 25/0.1 = $250
- Let x = 1/(1+r)

$$x + x^2 + x^3 + \ldots = \frac{x}{1-x}$$

$$25\left(\frac{1}{1+r} + \frac{1}{(1+r)^2} + \ldots\right) = 25\left(\frac{\frac{1}{1+r}}{\left(1-\frac{1}{1+r}\right)}\right)$$

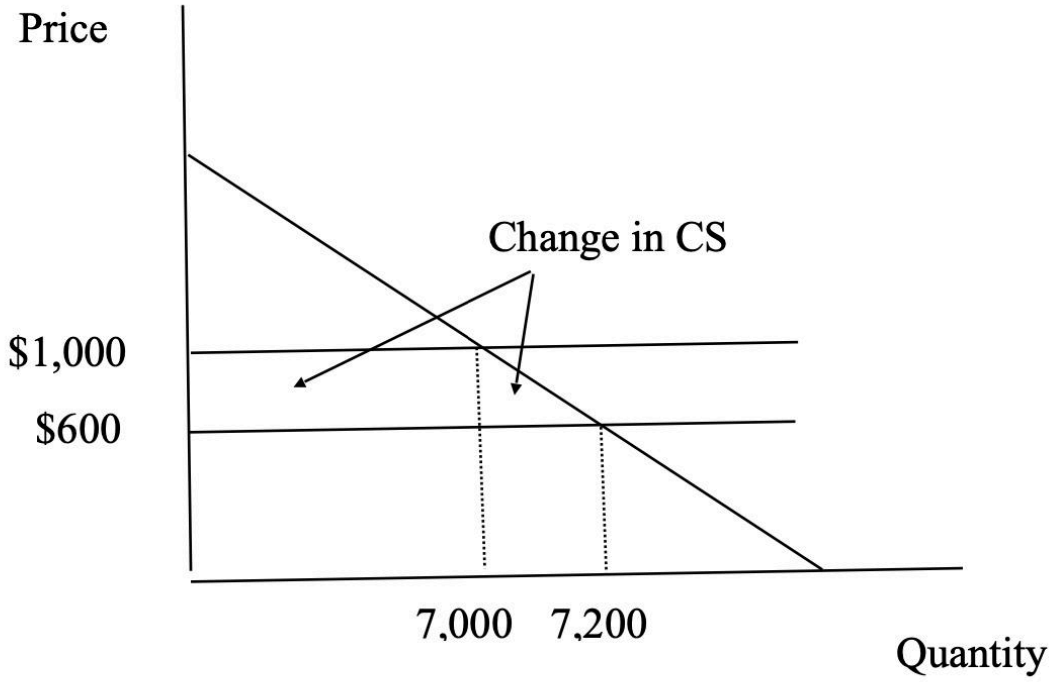
$$= 25\left(\frac{1}{r}\right)$$

Questions For Discussion (4 of 5)

A proposed irrigation project would lower the constant marginal cost of producing rice from \$1,000 to \$600 per unit. The local market for rice is competitive and has a demand curve given by $Q^D = 7{,}500 - 0.5P$ where P is the price. Draw a graph of the supply and demand for rice to show the change in consumer surplus due to the irrigation project. Calculate the increase in the net benefits to consumers. If the irrigation project will cost taxpayers \$28.1 million, is it worth undertaking?

Key Points – Question 4

- No, the project is not worth undertaking. The benefits do not cover the costs of 28.1M



Questions For Discussion (5 of 5)

Bill rides the subway at a cost of 75 cents per trip, but would switch if the price were any higher. His only alternative is a bus that takes five minutes longer, but costs only 50 cents. He makes ten trips per year. The city is considering renovations of the subway system that would reduce the trip by ten minutes, but fares would rise by 40 cents per trip to cover the costs. The fare increase and reduced travel time both take effect in one year and last forever. The interest rate is 25 percent.

a. As far as Bill is concerned, what are the present values of the project's benefits and costs?

b. The city's population consists of 55,000 middle-class people, all of whom are identical to Bill, and 5,000 poor people. Poor people are either unemployed or have jobs close to their homes, so they do not use any form of public transportation. What are the total benefits and costs of the project for the city as a whole? What is the net present value of the project?

c. Some members of the city council propose an alternative project that consists of an immediate tax of $1.25 per middle-class person to provide "free" legal services for the poor in both of the following two years. The legal services are valued by the poor at a total of $62,500 per year. (Assume this amount is received at the end of each of the two years.) What is the present value of the project?

d. If the city must choose between the subway project and the legal services project, which should it select?

e. * What is the "distributional weight" of each dollar received by a poor person that would make the present values of the two projects just equal? That is, how much must each dollar of income to a poor person be weighted relative to that of a middle-class person? Interpret your answer.

Key Points – Question 5

- Bill values time at 5c per minute. The NPV of the project to middle income earners is $4
- Benefits – costs = net benefits = $220,000
- The net benefit of the legal services project is $21,250
- The subway project has higher PV
- Each dollar to low income earners must be considered 3.21 times as valuable as a dollar to a middle income earner to make the value of the projects equal.