1.011 Project Evaluation

Prices & Inflation

Carl D. Martland

1. Review of prices
2. Price indices
3. Real vs. nominal discount rates

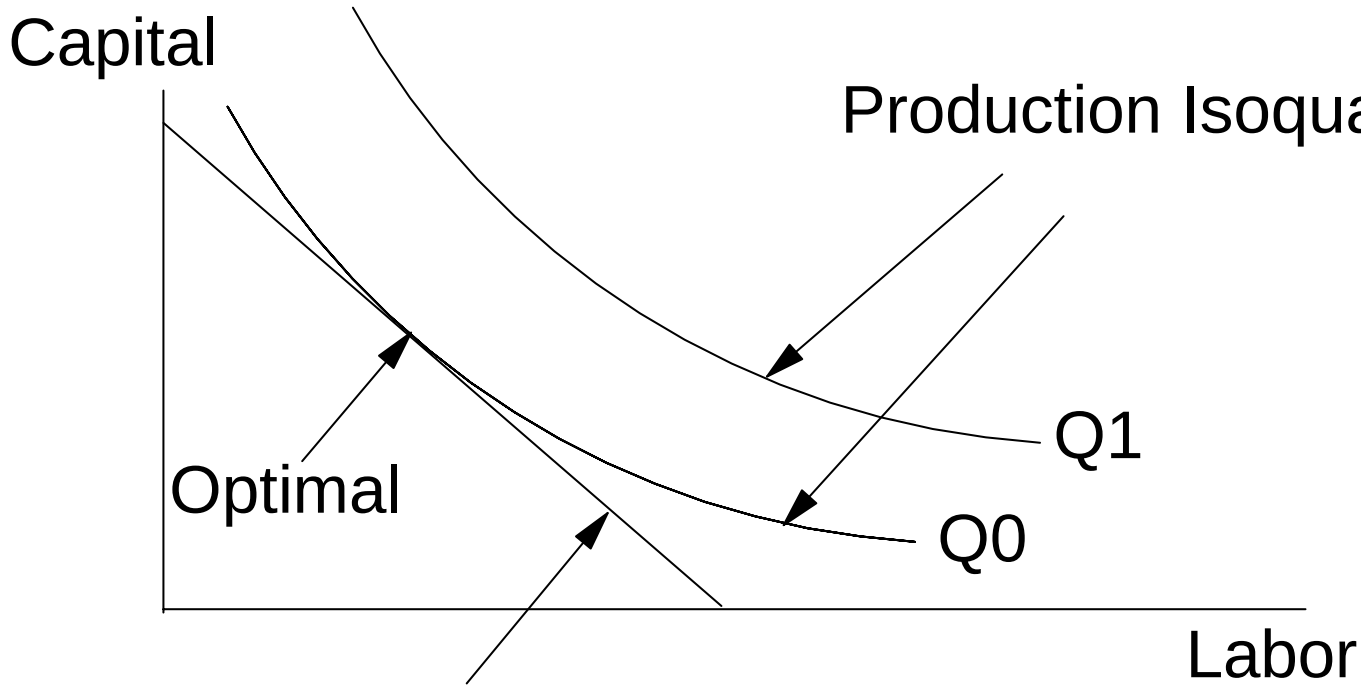
Review of Prices

- Prices are determined by the interaction of supply and demand
- Demand issues:
  - Willingness-to-pay depends upon the VALUE of the service or product, not its COST
  - The lower the price, the greater the demand
- Supply issues
  - Min price > marginal cost (or supplier won't produce)
  - Avg price > avg cost (or supplier won't make a profit)
  - Choose design, production process, machines, materials for expected volume/demand and desired level of service

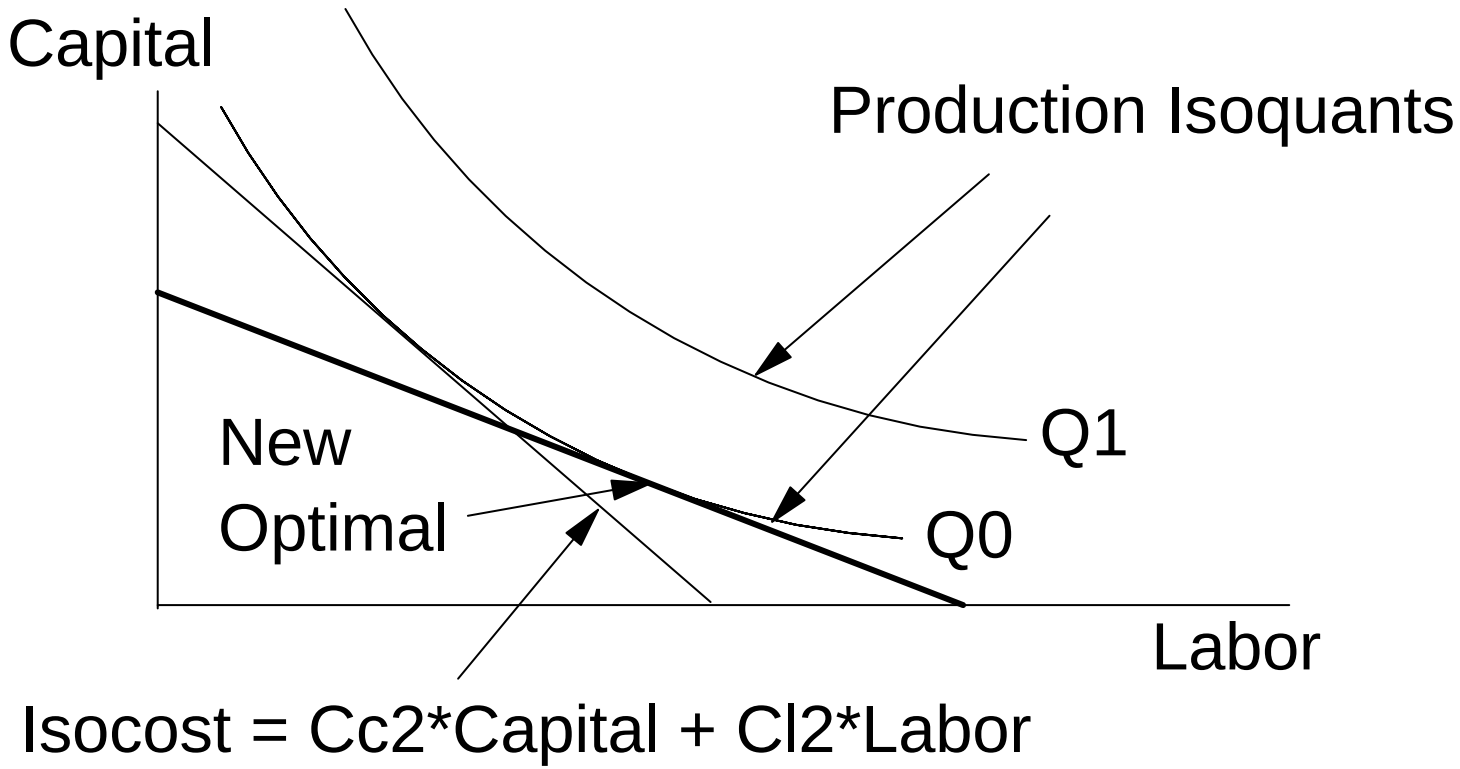
Lower Costs Allow Lower Prices

- Choice of process depends upon the relative prices of inputs
  - Input substitution
- Average and marginal costs vary with the size of the project
  - Economies of Scale
- Technological change allows lower costs through introduction of new machines, materials, processes, designs, etc
  - Technological change

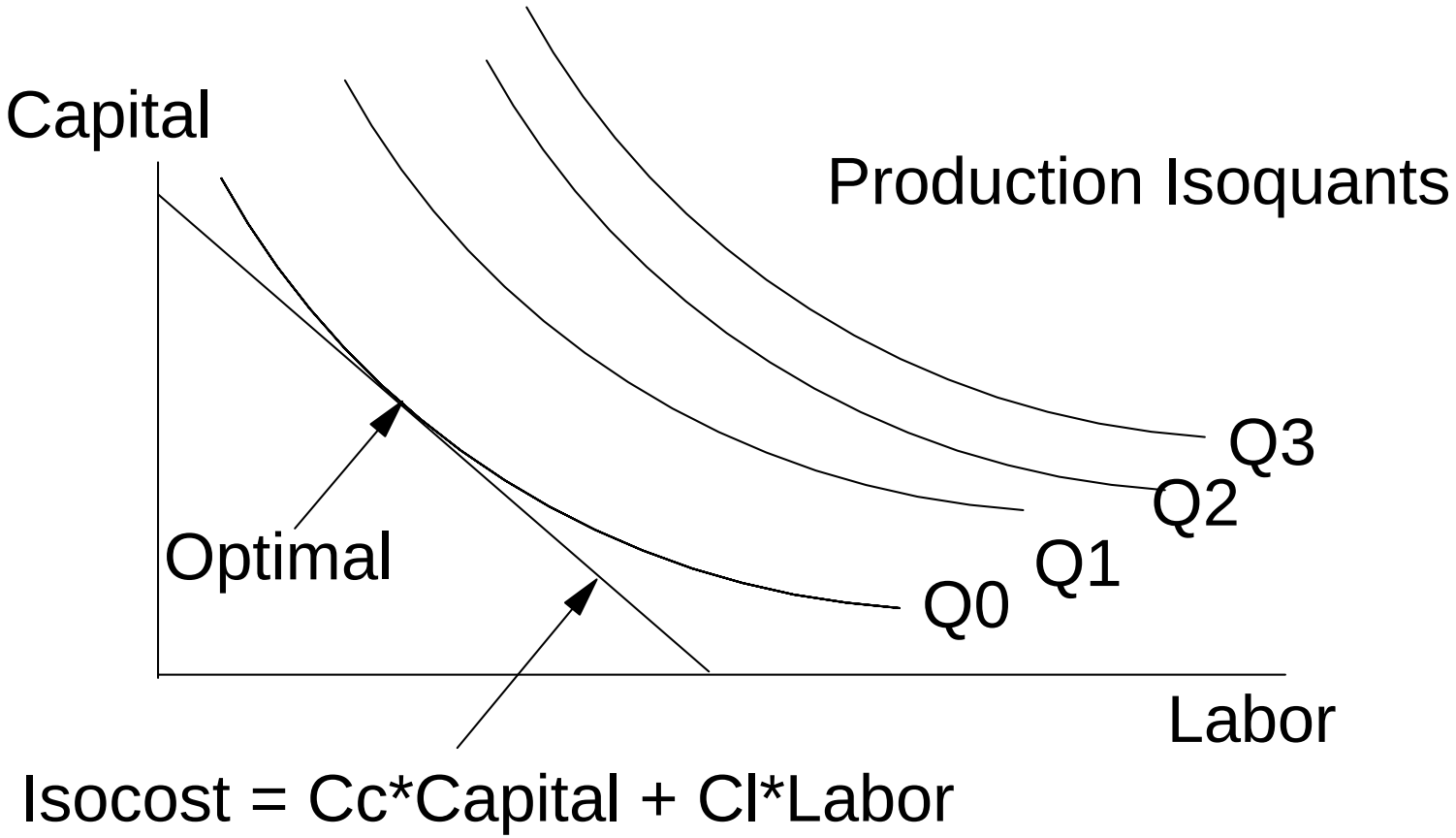
Minimum Cost Combination of Inputs to Produce Q0 is Where Isocost Curve is Tangent to Isoquant for Qo



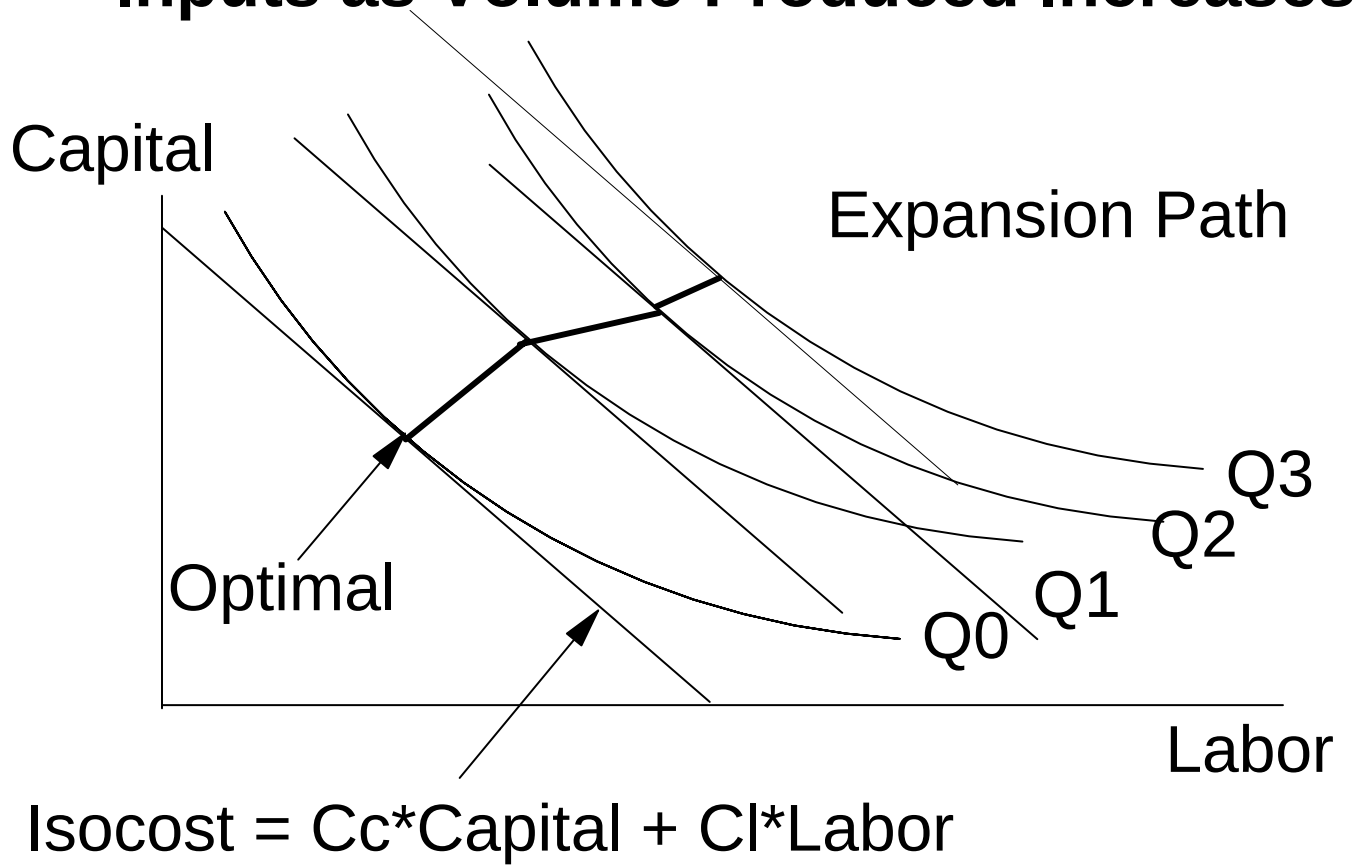
Input Substitution:
As Prices of Inputs Change, Different Processes or Materials are Used



Economies of Scale: Production Isoquants Are Close Together



Expansion Path: Optimal Combination of Inputs as Volume Produced Increases



Prices for a Particular Project Will Not Necessarily Follow General Price Indices

- Relative changes in prices of inputs may allow input substitution
- Increases in demand may allow economies of scale
- New technologies or designs may reduce costs

Why a Price Index is Useful

- We want to compare $ from different time periods or different countries, and it is desirable to compare $ in terms of purchasing power
- We want to project future costs and revenues taking into account expected changes in prices of inputs and outputs
  - e.g. we may expect fuel prices to rise and computer prices to decline relative to labor
  - We can treat major categories of cost and revenue separately

Creating a Price Index for a Base Year

1. Choose a base year
2. Choose a "market basket of goods & services"
3. Identify

    a. Base year prices for each item i = Pio
    b. Base year wieghts Wi (i.e. share of cost of basket)

4. Choose a scale factor s.t. base year index = 100

    PI(0) = $\sum$ Pio*Wi*So, summed over all i

Creating a Price Index for Year t

1. Choose year t
2. For the same "market basket of goods & services",

   Identify Year t prices for each item i = Pit

3. Use the base year weights Wi (i.e. each item is weighted by its share of costs in year 0)

4. Calculate the price index for year t:

$$PI(t) = \sum Pit*Wi*So / \sum Pio*Wi*So$$

Adjusting the Price Index

- The price index needs to be adjusted periodically:
  - New commodities need to be considered
  - Because of relative price changes, the weights need to be revised
- The adjustments can be made annually or at intervals of many years

Nominal vs. Real Discount Rates

ir = real discount rate (time value of money & risk)
ic = nominal discount rate (include inflation as well)

Future price of "market basket" = $(1+f)_t$ Po
Present value = $(1+f)_t$ Po/$(1+ic)_t$

Equivalent future value, 1 year in future:
(1+ic)Po = (1+f)(1+ir)Po = (1+ir+f+ir*f)Po
1+ic = 1 + ir +f(1+ir) = 1 + f + ir(1+f)
So that ic = ir + f +ir*f and ic approx. = ir + f

ir = (ic-f)/(1+f) approx. = ic - f

If ir = 6% and f = 3%, then
ic = 6% + 3% + .03*6%
= 9.18% approx. = 9%

Real vs. Nominal Financial Analysis

If we have calculated IRR using actual $, we can get the IRR in real terms by using:

$$\text{IRR real} = (\text{IRR nominal} - f)/(1+f)$$

We can use nominal discount rates and current (ie. inflated) costs and benefits, then use the above relationship to adjust the IRR.

If costs and revenues inflate at the same rate, then we can use constant dollars for cost and revenue and discount using the real discount rate.

Nominal vs. Real Rates in Project Evaluation

- Financing from a bank will use nominal interest rates (based upon what the bank and the market anticipate for inflation); you will pay in actual dollars over time (although your payment may in fact be constant)
  - If there is inflation, you generally pay back your loan with cheaper dollars
- Some care may be needed to get the proper analysis - you need to make sure that all the costs and benefits are expressed in the same kind of dollars and that you use the proper discount rate.

Use the Correct Approach!

	Nominal Interest Rate	Real Interest Rate
Actual $	Correct	Incorrect (bias toward investment)
Constant $	Incorrect (bias against investment)	Correct