Cost Indices

What is a Cost Index?

- A cost index compares cost or price changes between periods for a fixed quantity of goods or services
- A cost index is a dimensionless number for a given year showing the cost at that time relative to a base year.

$$C_c = C_r\left(\frac{I_c}{I_r}\right)$$

- C_c = Present cost or cost of period of interest
- C_r = Reference Cost
- I_c = Index number at present or at period of interest
- I_r = Index number of reference period

- Using a cost index we can obtain the cost of a similar design without going through detailed estimation.

Example

- Construction of a 1000-m^2 warehouse is planned for next year. A similar warehouse was constructed in year 2000 for a unit cost of SR 500 per square meter. The relevant index for such construction was 110 in 2000. The forecasted index for next year is 150. Estimate the cost of the new warehouse.
  - $C_c = C_r \, (I_c/I_r)$
    $= 500\,(150/110)$
    $= 682\ \text{SR}/m^2$

- An index can be constructed for a *single* item showing the variations in its cost over time, or for a *combination* of items (Composite index) to show the cost changes of the combination over time.
- Quantity and quality (specifications) of the items must be fixed for all periods.
- To compute the price index for a single material, prices are gathered overtime for a specific quantity and quality of the material.

Example: Assume the following prices have been collected for the price of 100 bricks (of a standard type brick)

	Period, year					
	1	2	3	4	5	6
Price	55	57	60	61	64	66
Index	91.7	95	100	101.7	106.7	110

- Year 3 was selected as the base year, and the price at year 3 was assigned the index value of 100
- $I_n = (P_n/P_3) \times 100$
- $I_1 = (55/100) \times = 91.7$

Periodic Change

- The change in index from period to period is expressed as a percentage change as follow (refer to Table in previous slide):
  - Index of period 6 110.0
  - Index of period 5 106.7
  - Index point change 3.3
  - Divide by initial Index 106.7
  - Equals 0.0309
  - Index Change 3.09%

Average Periodic Change

- The average periodic change resulting from these indexes can be found by using the following formula:
  - $r = [(I_e/I_b)^{1/n} - 1] \times 100$ (%)

  r = Average percentage change rate per period

  I_e = Index value at end period

  I_b = Index value at beginning period

From the example: $r = [(I_6/I_1)^{1/5} - 1] \times 100$

$r = [(110/91.7)^{1/5} - 1] \times 100$

$= 3.71\%$

Forecasting Future Indexes

- The average rate of change of the index can be used to forecast future indexes by reformulating the equation of the rate of change and so we have:
  - $I_e = I_b\,(1+ r/100)^n$
  - The index for period 8

    $I_8 = I_1\,(1+ 0.0371/100)^7$

    $= 118.3$

Computation of a Composite Index

1. Simple Index

- Suppose we want to construct an index for the construction of a concrete-block wall.
- We determine the quantities and costs required to build one sq meter of wall.

$$I = \sum(C_i / C_b) / \sum i$$

		Year			
		1		2	
	Quant	Unit Cost	Total	Unit Cost	Total
Block	15 pc	4	60	5	75
Mortar	0.1 m^3	100	10	110	11
Labor	1 hr	40	40	45	45

Computation of a Composite Simple Index

- Select year 1 as base year

	Year			
	1		2	
	Cost	Index	Cost	Index
Block	60	100	75	125.0
Mortar	10	100	11	110.0
Labor	40	100	45	112.5
		300		347.5
Composite Index	Divide by 3	100		115.8

Comments on the Simple Index

- In this case all items are weighted equally.
- But concrete block as a proportion of total cost is 6 times more important than mortar.
- Consequently a high rise in mortar cost will have a disproportionate effect on the index, which is not representative of the increase of cost of block work
- This problem is addressed in the Weighted Index where resources are assigned “weights” in accordance with their importance.

Weighted Indexes

- The relative importance of a component in an index is assigned by weighting the components.
- The two methods of adding weights to components are:
  - Using base year values as weights (Laspeyres Index)
  - Using year-under-consideration values as weights (Paache Index)

$$I = [\sum(W_i \times C_i) / C_b) / \sum W_i]$$

Computation of a Composite Index
2. Weighted Index (Base year values as weights)

	Year				
	1		2		
	Cost (a)	Index (b)	Cost (c)	Index (d)	W Index (a) x (d)
Block	60	100	75	125.0	7,500
Mortar	10	100	11	110.0	1,100
Labor	40	100	45	112.5	4,500
Sum	110				13,100
Composite Index		100		115.8 (Simple)	119.1

Suppose that in Year 2 labor productivity improves by 30%. Then the weights for the year are adjusted by adjusting the cost of the base year)

	Year				
	1		2		
	Cost (a)	Index (b)	Cost (c)	Index (d)	W Index (a) x (d)
Block	60	100	75	125.0	7,500
Mortar	10	100	11	110.0	1,100
Labor	28	100	45	160.7	4,500
Sum	98				13,100
Composite Index		100		115.8 (Simple)	133.7

Engineering News Records Cost Indexes

- Building Cost Index
- Construction Cost Index
- Material Cost Index
- Construction Cost Index has components shown in this table with prices averaged over 20 US cities. Base Year is 1913.

	Unit	Quantity
Steel	lbs	2,500
Cement	lbs	2,256
Lumber	fbm	1,088
Labor	hr	200