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B.COM. PART 1

CORE CONCEPT OF BUSINESS MATHMATICS & STATISTICS

INDEX NUMBER

Reversibility Tests- For an ideal index number it is necessary that it should satisfy reversal test, which are as follows:

1) **Time Reversibility test-** Time reversal test provides that if the index number of current year (P_{01}) is constructed on the basis of base year and then the index number of base year (P_{10}) on the basis of current year, both should be reciprocal to each other.

$$\mathbf{P_{01} * P_{10} = 1}$$

Fisher's ideal index number satisfies this test as explained below:

$$\mathbf{(P_{01})} = \sqrt{\frac{\Sigma P1q}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1}} * 100 \qquad \text{or } \mathbf{(P_{10})} = \sqrt{\frac{\Sigma P0q0}{\Sigma P1q0} * \frac{\Sigma P0q1}{\Sigma P1q1}} * 100$$

Thus, $\mathbf{P_{01} \times P_{10}} = \sqrt{\frac{\Sigma P1q}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1} * \frac{\Sigma P0q0}{\Sigma P1q} * \frac{\Sigma P0q}{\Sigma P1q1}}$

$\mathbf{P_{01} \times P_{10}} = 1$

2) **Factor Reversibility Test-** It is provides that if quantity index number (Q_{01}) is constructed by substituting 'quantity' in place of 'price' and 'price' in place of 'quantity' and index number is multiplied by current year's price index number, product should be in ratio of total expenditure of current year (Σp_1q_1) and total expenditure of base year (Σp_0q_0).

$$\mathbf{P_{01} * Q_{01}} = \frac{\boldsymbol{\Sigma P1q1}}{\boldsymbol{\Sigma Poq0}}$$

Fisher's formula satisfies also this test as explained below:

$$\mathbf{(P_{01})} = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1}} * 100 \qquad Q_{01} = \sqrt{\frac{\Sigma q1p0}{\Sigma qop0} * \frac{\Sigma q1p1}{\Sigma qop1}} * 100$$

$$\mathbf{P_{01} * Q_{01}} = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1} * \frac{\Sigma q1p0}{\Sigma q0p0} * \frac{\Sigma q1p1}{\Sigma q0p1}}$$

$$\mathbf{P_{01} * Q_{01}} = \frac{\boldsymbol{\Sigma P1q1}}{\boldsymbol{\Sigma Poq0}}$$

Example-19: Compute Laspeyre's, Paasche's, Marshall-Edgeworth's, Dorbish Bowley's, Fisher's Ideal Index Number. Also satisfy the test from the following data:

	Base Year		Current Year	
Items	**Price(Rs.)**	**Quantity**	**Price(Rs.)**	**Quantity**
A	10	30	12	50
B	8	15	10	25
C	6	20	6	30
D	4	10	6	20

Solution-19: Construction of Price Index Number

	Base Year		Current Year		p_0q_0	p_0q_1	p_1q_0	p_1q_1
Items	p_0	q_0	q_0	q_1				
A	10	30	12	50	300	500	360	600
B	8	15	10	25	120	200	150	250
C	6	20	6	30	120	180	120	180
D	4	10	6	20	40	80	60	120
					580	960	690	1150

1) **Laspeyre's Method:** $(P_{01}) = \left[\frac{\Sigma P1q0}{\Sigma Poq0} * 100\right]$

$$(P_{01}) = \left[\frac{690}{580} * 100\right] = 1.1896*100 = \mathbf{118.96}$$

2) **Paasche's Method:** $(P_{01}) = \left[\frac{\Sigma P1q1}{\Sigma Poq1} * 100\right]$

$$(P_{01}) = \left[\frac{1150}{960} * 100\right] = 1.1979 = \mathbf{119.79}$$

3) **Marshall-Edge worth's Method:** $(P_{01}) = \left[\frac{\Sigma P1q0+\Sigma p1q1}{\Sigma Poq0+\Sigma P0q} * 100\right]$

$$(P_{01}) = \left[\frac{690+1150}{580+960} * 100\right]$$

$$(P_{01}) = \left[\frac{1840}{1540} * 100\right] = 1.1948 = \mathbf{119.48}$$

4) **Dorbish & Bowley's Method-** $(P_{01}) = \left[\frac{\Sigma P1q0}{\Sigma Po} + \frac{\Sigma P1q1}{\Sigma Po}\right] * 100/2$

$$(P_{01}) = \left[\frac{690}{580} + \frac{1150}{960}\right] * 50$$

$$(P_{01}) = [1.1896+1.1979]*50$$

$$(P_{01}) = [2.3875]*50 = \mathbf{119.375}$$

5) **Fisher's Index Number =** $(P_{01}) = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Po}} * 100$

$$(P_{01}) = \sqrt{\frac{690}{580} * \frac{1150}{960}} * 100$$

$$(P_{01}) = \sqrt{1.1896 * 1.1979} * 100$$

$$(P_{01}) = \sqrt{1.4243031} * 100$$

$$(P_{01}) = 1.1934*100 = \mathbf{119.34}$$

Reversibility Tests-

1) **Time Reversibility test**.

$$P_{01}*P_{10} = 1$$

Fisher's ideal index number satisfies this test as explained below:

$(P_{01}) = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1}} * 100$ or $(P_{10}) = \sqrt{\frac{\Sigma P0q0}{\Sigma P1q0} * \frac{\Sigma P0q1}{\Sigma P1q1}} * 100$

Thus, $P_{01} \times P_{10} = \sqrt{\frac{\Sigma P1q0}{\Sigma Poq0} * \frac{\Sigma P1q1}{\Sigma Poq1} * \frac{\Sigma P0q0}{\Sigma P1q0} * \frac{\Sigma P0q1}{\Sigma P1q1}}$

$$P_{01} \times P_{10} = \sqrt{\frac{690}{580} * \frac{1180}{960} * \frac{580}{690} * \frac{960}{1180}} = \sqrt{1}$$

$P_{01} \times P_{10} = 1$