ANALYSIS OF PRICE INCREASES BY THE INPUT-OUTPUT COSTING MODEL IN THE TURKISH ECONOMY, 1996

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1. INTRODUCTION

Inflation is an increase in the general level of prices in an economy that is sustained over a period. The most important factors effected inflation in an economy are money supplies, production, compensation of employees, expectations of people, exchange currencies and external prices. Effect levels on inflation of these factor changes according to economic conditions of countries.

Inflation has been the most important problem of the Turkish Economy since the oil crisis in 1973. By effects of internal and external factors, an increase made in the price of a good or service increases the prices of other sectors and then these increased prices rise the price of product which caused an increase on prices of other sectors in the beginning. Therefore, this case is called " avalanche effect".

There is no rule to determine the ratio of price rise of the other goods and services after a good or service price is increased. The input-output costing model solves this problem by using sectoral of basic inputs both separately and together which depends on effects of internal and external factors will occur at the different sectors of economy and by means of technological, price rises can be considered as level of "usual" and "reasonable".

In this study "expected" and "realized" price increases depend on effect of internal and external factors are estimated for 1996 and made an analysis of inflation in Turkey by means of 1992 Input-Output Table.

2. THE INPUT-OUTPUT COSTING MODEL

The basic assumption of the input-output production model is one of fixed proportionality, the required use of raw materials and semi-finished goods being proportional to the level of production. Each sector of production is seen as production processes, which must for one unit of output, consume a certain vector of inputs. By assumption, we have

$$x_{ij} = a_{ij} X_j \qquad (i = 1,2,...,n) ; (j = 1,2,...,n) \qquad (3.1)$$

Where;

x_{ij} : The consumption of *i*th good by sector *j*.
X_j : The total output level of the *j*th sector.
a_{ij} : The input-output coefficients.

a_{ij} coefficients are obtained by dividing the entries in the input-output table, through their column total ($a_{ij} = x_{ij} / X_j$).

Structure of input-output table, which has four quadrants, is given below each quadrant as a different matrix notation.

Structure of Input-Output Table

	Intermediate Consumption	Final demand	Total output
Production sectors	T_{11}	T_{12}	X
Primary inputs	T_{21}	T_{22}	h
Total output	X^T	g^T	

Where;

T_{11} : Matrix of intermediate consumption
T_{12} : Final demand matrix
T_{21} : Primary inputs matrix
T_{22} : Matrix of primary inputs of final demand categories
X : Vector of total production
h : Vector of primary input categories
g : Vector of final demand categories
T : Transpose

Coefficients matrix obtained from above flow matrix is given below.

A	B
C	D

Where;

A : Matrix of input-output coefficients
B : Coefficients matrix of final demand categories
C : Matrix of primary input coefficients
D : Matrix of Primary input coefficients of final demand categories

If we multiply (3.1) with p_i prices, we get following equation.

$$p_i\, x_{ij} = p_i\, a_{ij}\, X_j \qquad (i = 1,2,...,n\ ;\ j = 1,2,...,n) \tag{3.2}$$

$$r_i\, x_{ij} = r_i\, c_{ij}\, X_j \qquad (i = n+1,...,+\ n+m-2\ ;\ j = 1,2,...,n) \tag{3.3}$$

Where;

r_i : Prices of production factors
c_{ij} : Input coefficients of primary inputs

$$\sum_{i=1}^{n} p_i\, x_{ij} + \sum_{i=n+1}^{n+m} r_i\, x_{ij} = \sum_{i=1}^{n} p_i\, a_{ij}\, X_j + \sum_{i=n+1}^{n+m} r_i\, c_{ij}\, X_j + P^*_j\, X_j \qquad (i=1,2,...,n) \tag{3.4}$$

p^*_j : Vector of extra price rise

The left-hand side of (3.4) is total output in value.

$$p_i X_j = \sum_{i=1}^{n} p_i a_{ij} X_j + \sum_{i=n+1}^{n+m} r_i c_{ij} X_j + p^*_j X_j \qquad (3.5)$$

By (3.5) we will have, after deletion of common factor X_j,

$$p_i = \sum_{i=1}^{n} p_i a_{ij} + \sum_{i=n+1}^{n+m} r_i c_{ij} + p^*_j \qquad (j=1,2,...,n) \qquad (3.6)$$

This relation can be expressed in matrix notation,

$$p' = p' A + r' C + p^{*\prime} \qquad (3.7)$$

If we solve p' out of (3.7) and obtain following equation:

$$p' - p' A = r' C + p^{*\prime}$$
$$p' (I-A) = r' C + p^{*\prime}$$
$$p' = r' C (I-A)^{-1} + p^{*\prime} (I-A)^{-1} \qquad (3.8)$$

Where;

p' : New sectoral price vector
r' : Price vector of primary inputs
C : Matrix of primary input coefficients
$(I-A)^{-1}$: Inverse matrix of input coefficients
p*' : Domestic sectoral price vector
' : Transpose

Here r and p* are price vectors in the beginning and price levels in all the sectors are the same and equal one.

r_0' = [1.00 1.00 …….. 1.00]

$p^{*\prime}$ = [1.00 1.00 …… 1.00]

If the input prices of import goods increases 30% depend on exchange rate, the new level of r' will be as follows,

r_1' = [1.00 1.30 ……. 1.00]

If the prices of petroleum products produced in domestic increases 50%, the new level of p^* will be as follows,

p^*_1' = [1.00 1.00 …. 1.50 ….. 1.00]

If the index prices of final demand categories are indicated as d';

$$d' = p' B + r' D \qquad (3.9)$$

Substitute for p' out of (3.8) into (3.9) and obtain;

$$d' = [r' C (I-A)^{-1} + p^{*'} (I-A)^{-1}] B + r' D$$

$$d' = r' C (I-A)^{-1} B + p^{*'} (I-A)^{-1} B + r' D$$

$$d'=r'[C(I-A)^{-1}B+D] + p^{*'}(I-A)^{-1} B \qquad (3.10)$$

3. APPLICATION OF THE INPUT-OUTPUT COSTING MODEL TO THE TURKISH ECONOMY

An application of input-output costing model mentioned on chapter 2 is done in this chapter. First, price vectors were calculated for sectoral price levels depend on equation (3.8), and then, price vectors was calculated for final demand components depend on equation (3.10).

It is very important for analysis to indicate correctly the rows of primary inputs. Inputs of import goods and services must be taken within the primary inputs. In Turkey, input-output tables are prepared according to equation of total supply = total demand like 15th chapter of SNA93. For this reason, to take inputs of import goods and services to the primary inputs, subtracted from 1992 Input-Output Table to 1992 Import Matrix. The rows of matrix C are indicated as follows.

(1) Imports of petroleum products
(2) Other imports
(3) Indirect taxes, net
(4) Consumption of fixed capital
(5) Compensation of employees
(6) Operating surplus

In this chapter, sectoral prices effected by internal and external factors, which is calculated from equation (3.8), is examined for 1996. Internal effects are the price increases of petroleum products and electricity, and the increases of net indirect taxes, consumption of fixed capital, compensation of employees and operating surplus. External effects are the price increases of imports of petroleum products and increases of exchange rate.

The prices of petroleum products and electricity were increased 96.6% and 104.5% respectively, and also net indirect taxes, consumption of fixed capital, compensation of employees and operating surplus, taken as internal effects, were increased respectively 105.6 %, 15.6%, 109.1%, and 89.0% in 1996. The prices of import petroleum products and exchange rate taken as external effects were increased 96,6% and 74,4% in 1996.

The sectoral price indices, expected prices, calculated depend on increases by the input-output costing model is given on Table 1. On the first and second column of table are seen internal and external effects. On the third column of table is seen total effect, internal and external effects.

As you seen on the first column of table, the prices of agricultural products were increased 89,29% depend on increases of internal effects and 3,61% depend on increases of external effects. Total increases in agricultural products are 91,16%. The prices of sugar products were increases 89,08% depend on increases of internal effects and 5,12% depend on increases of external effects in 1996.

Maximum price increases depended on internal effects are manufacture of railroad equipment, highway transport (other land transport), forestry, iron ore mining and stone quarrying etc. According to external effects, maximum increases are other manufacturing industries, manufacture of fertilizers, manufacture of other chemical products and manufacture of other transport equipment etc. As total effects, maximum increases are manufacture of railroad equipment, highway transport, iron ore mining, forestry and stone quarrying etc.

It is possible to compare these increases with wholesale price indices, which are given on the fourth column of table 1. Differences between expected price increases that are calculated from input-output costing model and real price increases are given on the last column. As you seen table, there are some differences between figures. Price increases in 11 sectors are higher than expected prices. In other words, these increases show us that these sectors got extra profit in 1996.

When we examine table 1 as general price increases, inflation rate obtained from the costing model is 88.78%, but realization price increase is 75.90%. Difference between these two figures is 12.87%.

Price increases of final demand components obtained from equation (3.10) are given on Table 2. As you seen table, increase of private final consumption expenditure is 79.45% depend on effects of internal factors and 9.81% depend on external factors. Total effect is 89.26%.

It is also possible to compare this total effect with retail price index, which is 80.40%. Differences between these two indexes are 8.86%.