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Neutrality of the Regulated Price Shock on Price Indices When All Primary Factors' Endowments Are Adjusted

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Abstract

The regulated price policy may be implemented for some products. It is generally implemented for some products such as electricity, natural gas, water and so on that are supplied as monopolist. The regulated price shock on these products may lead to an adjustment in the endowments of primary factors. The aim of this paper is to investigate the effects of a regulated price shock on price indices when all primary production factors adjust their endowment with respect to a price shock. To this end, in addition to a mathematical approach, the matter is demonstrated practically for Iran's economy through an extended Standard Leontief Price (SLP) model. The Input-Output table of Iran for the year 2001 is employed as the database of the research. The result of the research indicates that in a similar case, the regulated price shock is neutral and has no benefit for the monopolists who brought it up.

Keywords: Regulated price shock, Standard Leontief Price (SLP) Model, Neutral policy, Iran.

JEL Classification: C67, E31, L52.

1. Introduction

The regulated price policy may be implemented for some products. Like the U. S. gas product (Thompson and Singleton, 1984), Brazil's electricity and telephone services (Fraga et al., 2004), Canada's electricity case (Ontario Energy Board, 2005), and European airports' pricing (Bel and Fageda, 2010). This policy is generally implemented for the price of products such as water, gas, electricity, gasoline and telecommunications which are often supplied in a monopolistic market as studied in Sappington and Weisman (2010), Choi et al. (2011) and Maeda (2011).

Since an increase in the price of these products may influence the products' prices, in the case where there is a considerable amount of consumption, it is expected that this increment cause a reflection in payments for primary factors as well.

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For instance, based on the Second Development Plan of Iran, to control the consumption of energy components, the price of these products had to have a 20% increment annually (The Expediency Discernment Council of the System). This policy leads to an expected inflation in the country. So, although other policies of the government may influence prices during these periods, irrespective of cost-push inflation, the prices of almost all products increased around the beginning of the years. For example, although a 20% increment in fuel prices leads to less than 2% increment in transportation expenditures, due to increment in the wage rates of the driver and the benefit of the investor, the transportation fee increased about 20% annually.

It is notable that the cost push inflation theory is one of the economic theories which has been proposed for the reason of inflation. Based on this theory, the production cost increment that shifts the supply curve can be considered as the main reason for inflation. Thus, any increment in the primary factors' endowment can lead to production cost rise.

There are a number of studies in terms of regulated price effects on economies. For instance, Kim and Kim (1999) investigated the effect of regulated price on economy in South Korea. Fraga et al. (2004) investigated using a monetary policy to compensate the effect of regulated price shock in Brazil's economy.

In addition, there are several studies on the effect of regulated prices shock in Iran. Using a Social Accounting Matrix (SAM), the effects of adjusting the price of energy in order to reach the international level of inflation in Iran was investigated in the Prmeh (2005) study. The impact of one hundred percent rise in price of energy on other economic sectors' prices in Iran was studied through an input-output analysis by Abbasinezhad (2006). An input-output model was also employed to assess the inflationary impacts of energy subsidy removal in Iran by Sharifi et al. (2009). The effect of energy subsidy reform on inflation and GDP was evaluated using the standard computable general equilibrium model by Hoseininasab and Hazeri Niri (2012). Moghimi Feyzabadi and Shahnoushi (2012), Eslami Andargoly et al. (2012a and 2012b) and Noferesti and Jalouli (2012) studies on regulated price shock effects on price indices of sectors and inflation are also the other relevant researches in Iran.

However, this paper did not find a study in order to investigate a similar case, in which all value added components are adjusted with respect to price shock, for either support or comparison. Using an open input-output model, this paper proves the neutrality of the regulated price

shock when all value added components are adjusted with respect to the price indices. In addition, an empirical example illustrates the neutrality of the regulated price shock in this condition.

The paper contains four sections. The subsequent section describes the methodology of the paper. In section 3, we prove the neutrality of the regulated price shock. Using the input-output table of Iran, the results of the research are demonstrated in section 4. Finally, the concluding section ends the paper.

2. Methodology

2.1 The Base Model

To see the effects of a regulated price shock on an economy, we start with a simple SLP model, as in Equation 1.

$$P = (P.A + \bar{w} + \bar{s}).(1 + t) \quad (1)$$

wherein P refers to the row vector price index for products, A to the input-output technical coefficient matrix, $\bar{w}$ and $\bar{s}$ to the row vectors of the contribution of labour and capital in production, respectively, and 1+ t to a row vector where t is the tax rate in an ad valorem tax policy.

The model can be developed for a case in which, for instance, in order to keep welfare at a fixed level, endowment of the capital holder is adjusted with respect to the Producer Price Index (*PPI*) and wages of the labour force are adjusted with respect to the Consumer Price Index (*CPI*) as specified in Equations (2) and (3) with respect to Sharify and Sancho (2011):

$$PPI = \frac{\sum_{i=1}^{n} Q_i^0 \times P_i}{\sum_{i=1}^{n} Q_i^0 \times P_i^0} = \frac{\sum_{i=1}^{n} Z_i}{\sum_{i=1}^{n} Z_i^0} \quad (2)$$

Z_i^0, Q_i^0 and P_i^0 denote the level of the total products value, the quantity and the price level for the i^{th} products before any price increment, respectively. Z_i and P_i refer to the size of the total products value and the level of the price index for the i^{th} products after the price increment, respectively. The *CPI* can also be acquired through the Laspeyres price index:

$$CPI = \frac{\sum_{i=1}^{n} Q_i^{C^0} \times P_i}{\sum_{i=1}^{n} Q_i^{C^0} \times P_i^0} = \frac{\sum_{i=1}^{n} C_i}{\sum_{i=1}^{n} C_i^0} \quad (3)$$

C_i^0 and $Q_i^{C^0}$ denote the value and the quantity of households consumption from the i^{th} products before any prices increment, respectively. C_i refers to the value of households' consumption from the i^{th} products after the increment in the prices.

Thus Equation 1 changes into Equation 4:

$$P = (P.A + P.B.l + P.F.k).(1 \hat{+} t) \quad (4)$$

B denotes the column vector of products' shares in households' consumption, l the row vector of direct labour coefficients, F the column vector of products' shares in total products and k the row vector of direct capital coefficients.

To study in the regulated price policy, let us take a look at a three-product- input-output price model in which the price of the third product is specified regularly. Thus Equation 4 changes into Equation 5 to determine the prices of the other products:

$$(p_1, p_2) = ((p_1, p_2).\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} + (p_1, p_2).\begin{bmatrix} b_1 \\ b_2 \end{bmatrix}.(l_1, l_2)$$
$$+ (p_1, p_2).\begin{bmatrix} f_1 \\ f_2 \end{bmatrix}.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix} +$$
$$(\bar{p}_3.(a_{31}, a_{32}) + \bar{p}_3.b_3.(l_1, l_2) + \bar{p}_3.f_3.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix} \Rightarrow \quad (5)$$
$$(p_1, p_2) = \bar{p}_3((a_{31}, a_{32}) + b_3.(l_1, l_2) + f_3.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix}.$$
$$[I - (\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} + \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}.(l_1, l_2) + \begin{bmatrix} f_1 \\ f_2 \end{bmatrix}.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix}]^{-1}$$

$\bar{p}_3$ refers to a scalar regulated price for the third product. I is the unitary matrix.

Now, in order to analyse the effect of a regulated price shock on the third product, it is assumed that the price of this product has an r percent growth as follows:

$$\bar{p}'_3 = (1+r).\bar{p}_3 \quad (6)$$

Considering Equation 6 in Equation 5, the effect of the regulated price shock on the price of other products can be calculated as Equation 7:

$$(p'_1, p'_2) = \bar{p}'_3.((a_{31}, a_{32}) + b_3.(l_1, l_2) + f_3.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix}.$$
$$[I - (\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} + \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}.(l_1, l_2) + \begin{bmatrix} f_1 \\ f_2 \end{bmatrix}.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix}]^{-1} =$$
$$(1+r).\bar{p}_3.((a_{31}, a_{32}) + b_3.(l_1, l_2) + f_3.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix}. \quad (7)$$
$$[I - (\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} + \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}.(l_1, l_2) + \begin{bmatrix} f_1 \\ f_2 \end{bmatrix}.(k_1, k_2)).\begin{bmatrix} 1+t_1 & 0 \\ 0 & 1+t_2 \end{bmatrix}]^{-1} \Rightarrow$$
$$(p'_1, p'_2) = (1+r).(p_1, p_2)$$

Thus the prices of the other products have the same growth as the regulated price. In addition, it is notable that due to adjusting the value added components of products with respect to the price change, as it is specified in the first part of Equation 5, the nominal sizes of these components will grow as much as the regulated ones do. As a result, when due to a regulated price shock all value added components adjust their endowment with respect to increment in prices, the monopolist, including the private producer who receives an operating surplus or government through indirect tax or subsidy, would only have a nominal increment in contrast to a real benefit.

2.2 Databases

The latest survey-based supply and consumption tables of Iran for the year 2001-2 that have been prepared by the Statistics Centre of Iran are employed as data base (Statistics Centre of Iran, 2006). These tables have been employed to prepare 147-commodity to 147-commodity input-output table. The table has been balanced by a relevant relationship. An aggregated 10-commodity to 10-commodity input-output table based on producer prices has been used as database of the research (Appendix).

3. The Empirical Results

To examine the model, the effect of regulated price shock in which all value added components are adjusted with respect to the prices change is investigated. To this end, 20% and 25% regulated increments, as two

scenarios of the regulated price shock in Electricity, Water and Gas products are imposed on the economy. Using Equation 5, as demonstrated in Table 1, the price indices of all products grow as much as the regulated price shock does.

Table 1: The result of a 20% and 25% regulated price shock in Electricity, Water and Gas products

Commodities	Scenarios		Commodity and other indices	Scenarios	
	20%	25%		20%	25%
Agricultural Products	120	125	Other Services	120	125
Mining	120	125	Intermediate Expenditures	120	125
Industrial Products	120	125	Wage from Private Sectors	120	125
Electricity, Water and Gas	120	125	Operating Surplus	120	125
Construction	120	125	Net Indirect Tax	120	125
Bank and Insurance	120	125	Value Added	120	125
Education	120	125	Total Input	120	125
Health	120	125	*PPI*	120	125
Public Services	120	125	*CPI*	120	125

Source: findings of the research

As it is expected, the *PPI* and *CPI* of the economy have the same growth as product prices. In addition, since it is assumed that wages and capital endowments are adjusted with respect to the *PPI* or *CPI*, respectively, the price indices for these components also saw an increment equal to the regulated price shock. Moreover, using the ad valorem tax policy allows the net indirect tax of products to be adjusted with respect to other items as well.

Therefore, in a case like Iran's Electricity, Water and Gas services in which all components adjust their revenue from the production process, any regulated shock would have the same effect on production factors' endowments. Hence, with respect to the price indices of these components, the real value of all components remained unchanged. In addition, the only result of this policy is an equal price increment for all products and production factors.

4. Conclusions

It can be proved that in the case in which all production factors attempt to keep their real revenue at a fixed level, a regulated price increment without any benefits for the monopolist would lead to the same increment in the price of all products. Therefore, to achieve a desirable result, it is suggested that a similar policy by a government be supported by a financial or monetary policy.

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Appendix:

The Base Table: The aggregated input-output table of Iran for the year 2001-2002

Commodities	Items No.	1	2	3	4	5	6
Agricultural products	1	18590.4	154.9	48978.1	277.0	298.4	19.1
Mining	2	27.2	474.6	13005.8	897.3	681.7	1.1
Industries products	3	15080.1	2001.2	68565.9	3982.7	28150.8	457.6
Electricity, Water and Gas	4	1232.6	331.9	6172.2	4665.4	138.9	213.9
Construction	5	86.6	66.1	184.5	435.0	1370.9	121.5
Bank and Insurance	6	111.2	32.3	1335.9	101.4	168.9	989.8
Education	7	392.4	54.8	412.1	97.4	5.9	285.8
Health	8	358.4	49.0	564.5	84.6	5.1	242.9
Public Services	9	37.5	13.4	370.1	34.4	771.5	40.4
Other Services	10	15537.8	1767.2	52600.6	4263.3	14974.5	896.0
Intermediate Consumption	A	51454.1	4945.3	192189.6	14838.6	46566.6	3268.1
Wage from Private Sectors	B	4368.8	2972.8	25293.2	4498.9	16301.9	8187.2
Operating Surplus	C	78238.5	109201.2	83278.8	9527.8	17654.1	8200.9
Net Indirect Tax	D	-3110.7	2662.9	3171.0	144.4	999.9	363.1
Value Added	E	79496.6	114837.0	111742.9	14171.1	34956.0	16751.2
Total Input	F	130950.7	119782.3	303932.5	29009.8	81522.6	20019.3

Continued to the base table

Items No.	7	8	9	10	Total Intermediate Demand	Households Consumption	Net Other Final Demand	Total Output
1	120.1	204.4	371.1	3702.2	72715.6	43459.0	14776.1	130950.7
2	11.7	0.9	15.1	13.9	15129.2	121.1	104532.1	119782.3
3	1207.7	2535.8	5797.7	24309.9	152089.4	130066.3	21776.7	303932.5
4	254.2	343.9	968.3	2373.8	16695.2	10997.8	1316.7	29009.8
5	291.4	51.0	133.8	1714.1	4454.9	1249.9	75817.8	81522.6
6	114.9	134.3	246.2	11500.8	14735.8	1378.2	3905.2	20019.3
7	226.4	414.3	193.9	1482.1	3565.1	8698.5	20454.2	32717.8
8	199.4	350.0	182.1	1400.8	3436.8	8069.0	17148.6	28654.4
9	77.6	24.5	947.9	671.5	2988.7	1963.7	54698.5	59650.9
10	1882.9	2409.3	5132.8	32160.4	131624.6	191372.7	19880.2	342877.6
A	4386.3	6468.4	13988.9	79329.5				
B	24506.0	10558.7	28449.7	28297.9				
C	3920.1	11281.0	17341.8	230638.1				
D	-94.6	346.3	-129.5	4612.0				
E	28331.4	22186.0	45662.0	263548.1				
F	32717.8	28654.4	59650.9	342877.6				

Source: findings of the research