EFFECT OF VALUE ADDED TAX RATE CHANGES ON MARKET EQUILIBRIUM

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The article focuses on theoretical and practical aspects related to the effect of the value added tax (VAT) rate changes on market equilibrium. The article examines a model developed by the authors allowing to forecast the effect of the VAT rate changes on the market price, sales amount and other indicators. The basic model structure along with the main formulae derived from the model is examined in the article; the practical model approbation discussed. The latter considered outcomes of the model implementation for assessing the effect of the rate reduction of VAT on food in Latvia.

Value added tax (VAT), market equilibrium, food consumption

Introduction

The issue of the value added tax (VAT) rate's effect on market equilibrium has both a theoretical and practical significance in management theory. VAT is widely used in all EU member states. Most goods and services are taxed with VAT.

Currently this issue is quite topical in the Baltic countries. Due to increasing inflation some experts suggest that Governments should reduce VAT rate on food.

The processes of equilibrium in the consumers market are discussed in the following article due to the reason that the influence of VAT is topical just for the consumers market. The article is based on the results and conclusions of the research carried out by the authors (Auziņš, 2007).

General aspects of market equilibrium

In general, market equilibrium refers to a situation where demand equals to supply at a market price. At market equilibrium all participants of the market are at the state of equilibrium (see Fig. 1). These equilibriums can be divided in two types – buyers' equilibrium and suppliers' equilibriums.

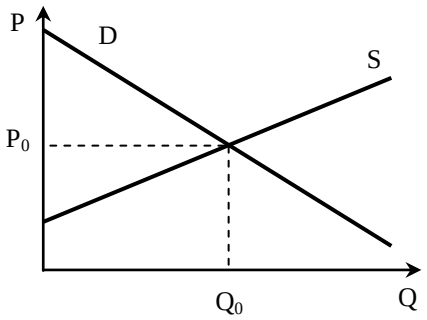

Fig. 1 Market equilibrium

The demand curve depicts the equilibrium for all the buyers in the market. Therefore, the separate analysis of the buyer equilibrium is not usually necessary.

The general supplier's or firm's equilibrium can be expressed as follows (Nešpors, 1999; Samuelson, 1998):

$$MR = MC, \tag{1}$$

where MR – marginal revenues;
MC – marginal costs.

MR is determined by the market: the demand curve and the extent of competition. MC is determined by the production output (sales) and cost levels of companies (suppliers). This general equation of firm's equilibrium (see Equation (1)) is used to analyse the effect of the VAT rate changes.

General effect of VAT on market equilibrium

In case of consumers market, buyers are individuals buying goods (or services) for personal consumption, not for business. Therefore, buyers are not VAT payers from the legal point of view. They cannot deduct the VAT paid to sellers for purchases. Thus, the gross price (the price including VAT) affects the buyers' reaction in the market.

In many industries (especially grocery business) sellers (suppliers) are VAT payers. They can deduct the VAT paid to their vendors from the VAT payable to the government. If the proportion of non-deductible VAT is insignificant, VAT does not affect the costs of sellers (suppliers), hence, their MC.

VAT affects seller's revenue, as the VAT received from buyers should be used to cover VAT payments to vendors or to the Government. Thus, the actual selling price from the firm's perspective is as follows:

$$P^* = \frac{P}{1+T}, \tag{2}$$

where P – purchase price (gross price) of a good or service;
P^* – net price or selling price without VAT;
T – rate of VAT

On the basis of the Equation (2) and mathematical characteristics of the derivation, the firm's MR can be expressed in the following formula given that VAT is applicable:

$$MR^* = \frac{MR}{1+T}, \tag{3}$$

where MR^* – marginal revenue, if VAT is applicable;

Therefore, the general condition of the firm's equilibrium (see Equation (1)) is modified in the following way to consider VAT:

$$MR^* = MC = \frac{MR}{1+T} \quad (4)$$

Model to consider the effect of changes in the VAT rate

The general model to consider the effect of changes in the VAT rate on market equilibrium was developed by the authors when the research on possible consequences of the reduction of the VAT rate on food in Latvia was conducted. The model underlies basic economic principles and general aspects of the VAT affect considered above. The basic idea of the model is that the sellers (firms) will try to maximise their profits in case of the change in the VAT rate. It is applicable to three types of competition – perfect competition, monopoly and monopolistic competition.

Three basic factors are used in the model:

- Market demand D – demand that refers to the whole market;
- Aggregate demand for goods (services) of individual firms d – demand obtained by aggregating the demand for goods (services) of an individual firm;
- Aggregate marginal cost MC – marginal cost for all firms on the whole.

The aggregate demand for goods (services) of individual firms d should be distinguished from the market demand D. These demands are not identical. The aggregate demand for goods (services) of individual firms is only the mathematical aggregation of the demand for goods (services) of an individual firm. It does not characterise the demand on the scale of the whole market.

All three factors are expressed as liner functions:

- The demand D:

$$P(Q) = a \cdot Q + b, \quad (5)$$

where P(Q) – the inverse function of the demand D;
a – the coefficient of slope;
b – intercept.

- The demand d:

$$p(Q) = m \cdot Q + x, \quad (6)$$

wherep(Q) – the inverse function of the demand d;
m – the coefficient of slope;
x – intercept.

The value of the coefficient m depends on the extent of competition in the market. If there is perfect competition m=0 because the demand is absolutely elas-

tic. In case of monopoly m=a because the demand for the goods of an individual firm is the same as the demand on the scale of the whole market. In case of monopolistic competition a is in the interval: 0<m<|a|.

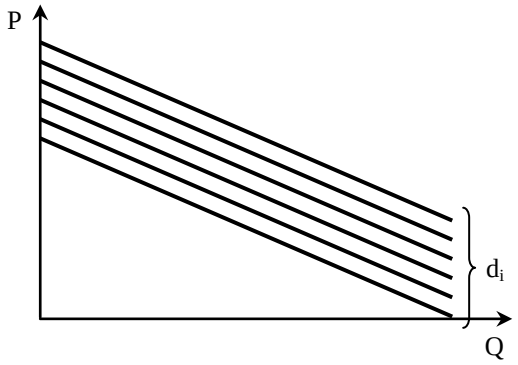

Fig. 2 Set of the curves for the demand d

The demand d is not a single curve but a set of infinite curves (see Fig. 2) because the curve of the demand d moves when the price in the market changes. Therefore, the intercept x is a variable not a constant. Thus p(Q) in essence is a function with two arguments:

$$p(Q,x) = m \cdot Q + x \tag{7}$$

- Aggregate marginal cost MC:

$$MC(Q) = k \cdot Q + l\,, \tag{8}$$

where k – the coefficient of slope;
l – intercept.

The function for MR is derived from p(Q, x):

$$MR(Q,x) = 2 \cdot m \cdot Q + x \tag{9}$$

Generally the model is expressed from P(Q), p(Q), MR(Q, x) and MC(Q) in the following system of equations:

$$\begin{cases} p(Q,x) = P(Q) \\ MR(Q,x) = MC(Q) \end{cases} \tag{10}$$

By inserting the functions for P(Q), p(Q), MR(Q, x) and MC(Q) (see equations (5), (7), (8), (9)) in the system of equations (10), the mode is expressed as follows:

$$\begin{cases} m \cdot Q + x = a \cdot Q + b \\ 2 \cdot m \cdot Q + x = k \cdot Q + l \end{cases} \tag{11}$$

The system of equations (11) is shown graphically in Fig. 3.

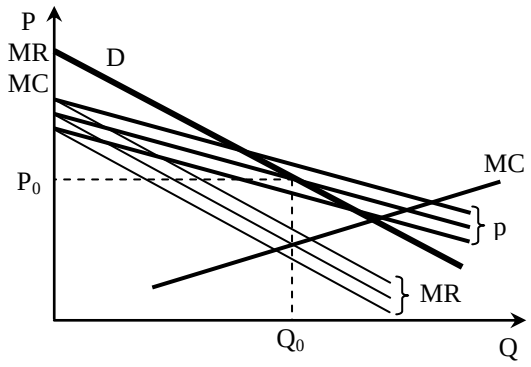

Fig. 3 General graphical illustration of the model

It should be noted that the system of equations (11) is only the general expression of the model and does not consider VAT. The full formulation of the model that deals with VAT is the following:

$$\begin{cases} m \cdot Q + x = a \cdot Q + b \\ \dfrac{2 \cdot m \cdot Q}{1+T} + \dfrac{x}{1+T} = k \cdot Q + l \end{cases} \tag{12}$$

The system of equations (12) allows calculating the effect of the change in the VAT rate on equilibrium amount of sales (Q), market price (P), etc. The formula for Q derived from the model is the following:

$$Q = \frac{l \cdot (1+T) - b}{m + a - k \cdot (1+T)} \tag{13}$$

The formula for P is the following:

$$P = a \cdot \frac{l \cdot (1+T) - b}{m + a - k \cdot (1+T)} + b \tag{14}$$

The formulas (13) and (14) explicitly indicate that that the increase of the rate of VAT causes the decline of Q and increase of P. The reduction of the rate of VAT causes the increase of Q and the decrease of P.

The model also allows calculating other indicators, for example:

- Revenue from VAT for the government (from goods or services sold in the market) Y_T:

$$Y_T = \frac{T}{1+T} \cdot \frac{a \cdot l \cdot (1+T) \cdot (l \cdot (1+T) - b) + b \cdot (m - k \cdot (1+T)) \cdot (l \cdot (1+T) - b)}{(m + a - k \cdot (1+T))^2} \tag{15}$$

- Consumers surplus in the market S_c:

$$S_c = -\frac{a}{2} \cdot \left(\frac{l \cdot (1+T) - b}{m + a - k \cdot (1+T)} \right)^2 \quad (16)$$

- Producers or sellers surplus in the market S_p:

$$S_p = \frac{l \cdot (1+T) - b}{m + a - k \cdot (1+T)} \cdot \left(\frac{a}{1+T} \cdot \frac{l \cdot (1+T) - b}{m + a - k \cdot (1+T)} + \frac{b}{1+T} - \frac{k}{2} \cdot \frac{l \cdot (1+T) - b}{m + a - k \cdot (1+T)} - l \right) \quad (17)$$

- The total society's benefit (in context of the market) S_T:

$$S_T = S_c + S_p + Y_T \quad (18)$$

The indicators Y_T, S_c, S_p and S_T are more necessary for macroeconomic analysis of the effect of the change in the rate of VAT.

Practical approbation of model and results of approbation

The model developed by the authors was approbated in the research on possible consequences of the reduction of VAT rate in Latvia on food (Auziņš, Nipers, Kozlinskis, et al., 2007). The model was used to forecast changes in prices, sales amounts (consumption), revenue in budget from VAT, consumers' surplus, sellers' surplus and total society's surplus. The forecasts were made both for food on the whole and for food subgroups.

The consequences of the reduction of the VAT rate were calculated by comparing the base scenario with two scenarios of the reduction of the VAT rate. The base scenario refers to a situation where the rate of VAT is not changed. The first scenario of the reduction of the rate of VAT refers to the reduction of the rate from 18% to 9%, the second one – to the reduction of the rate from 18% to 5%. The calculations were made for the period from 2008 to 2012 by analysing the effect if the reduction is made in one of the years that fall in this period.

The parameters for curve D (coefficient of slope and intercept) were derived from future forecasts on the levels of food consumption, inflation (price changes) of food items and coefficients of own-price elasticity (Seale, Regmi, Bernstein, 2003). The coefficient of slope for curve d was derived from the estimates of the extent of competition in Latvian grocery business (Vanags, Chandler, Paalzow, et al., 2006). The parameters for curve MC were derived through Equation (1) and from the proportionally variable costs to all variable costs ratio. This ratio was estimated from the financial statements of the two leaders of Latvian grocery business.

The main results obtained from the approbation of the model are the following:

- The reduction of the VAT rate on food from 18% to 9% will cause the decrease of average food retail prices by 5.8-6.1% (if compare to the base scenario). The redaction to 5% will cause the decrease by 8.4-8.9%. The forecasted decrease is higher if the reduction is implemented in earlier years. If the reduction is postponed to further years, the forecasted decrease is lower.
- The reduction of the VAT rate allows decreasing the inflation on food. For example, the forecasted decrease of the inflation on food is 7.1 percentage points if the rate of VAT is reduced to 9% and 10.2 percentage points if the rate of VAT is reduced to 5%.
- The forecasted increase of sales amount is 0.5-1.5% (rate of VAT reduced to 9%) and 1.0-2.1% (rate of VAT reduced to 5%) respectively.
- The reduction of the VAT rate causes a decrease of the revenue from VAT in the state budget. For example, the forecasted decline in the revenue from VAT in 2008 is 106.0 m LVL (150.8 m EUR) if the rate of VAT is reduced to 9% and 155.1 m LVL (220.7 m EUR) if the rate of VAT is reduced to 5%.
- The sum of the forecasted increase of consumer surplus and the forecasted increase of sellers surplus slightly exceeds the forecasted decrease of the revenue from VAT in the state budget.

Conclusions

VAT has quite a specific effect on the market equilibrium. The mechanism of the VAT affecting the market equilibrium differs both from direct taxes and indirect types of taxes. This is because VAT affects the market equilibrium (in case of the consumers market) through affecting the firm's (seller's) marginal revenue without affecting the demand itself.

The specific feature of the VAT effect is that the increase (decrease) of the VAT rate results in the increase (decrease) of the market price and decrease (increase) of the sales amount given that other factors remain unchanged (ceteris paribus).

The model discussed in the article considers the effect of VAT mainly on the scope of microeconomic level as it does not takes into account the possible indirect effects. Thus, this model is applicable to the management theory and similar disciplines (applied economics, etc.).

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PRIDĖTINĖS VERTĖS MOKESČIO POVEIKIS RINKOS PUSIAUSVYRAI

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Santrauka

Straipsnyje išanalizuoti pridėtinės vertės mokeščio (PVM) dydžio poveikio rinkos pusiausvyrai teoriniai ir praktiniai klausimai. Straipsnyje pateikiamas autorių sukurtas modelis, kurio tikslas nustatyti PVM dydžio poveikį į rinkos kainas, pardavimo apimtį ir kitus rodiklius. Pateikta ir suformuluota modelio struktūra, aprobuota modelio taikymo praktikoje strategija. Darbe pateikiami ekonominių skaičiavimų rezultatai, jei PVM dydis būtų mažesnis maisto prekėms.