CONSUMER AND PRODUCER SURPLUS CHANGES AFTER TAXATION
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Abstract

In every market equilibrium we can calculate the values of consumer surplus and producer surplus. These are the values that they get above the price under which they make the transaction. In this paper is analyzed how consumer and producer surplus are being changed with the introducing of taxes. The analysis will be done for taxes which are imposed to buyers as well as for taxes which are imposed to buyers. After the comparison of the taxation effects on consumer surplus and producer surplus, the analysis will show what can determine how much of the tax will be paid by producers and how much by buyers.

Key words: consumer surplus, producer surplus, elasticity, supply, demand

1. INTRODUCTION

One of most analyzed topics in microeconomics is the analysis of market equilibrium. Market equilibrium is simply defined as the situation in which supplied quantity equals demanded quantity. In market equilibrium the quantity that producers are ready to sell at some price $P_E$ is the same as the quantity that buyers are ready to buy at the same price. There are no surpluses and no shortages on the market. This can be represented by next graph.

Graph 1: Market equilibrium

As it is shown on the Graph 1, at the price $P_E$ sellers offer quantity $Q_E$, which is the same as the quantity that buyers are ready to buy. Now we can define consumer surplus and producer surplus.

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2. METHODOLOGY

The topic of this paper is from the field of theoretical economics, and because of this fact, the whole analysis is done using theoretical framework. Instead of data and numbers, the core of the analysis are graphically shown functions. The main two used functions are the supply function and the demand function. Their intersection is the market equilibrium, which is determined by the equilibrium price and the equilibrium quantity. The idea is to show what are the consumer and producer surplus in the equilibrium state, and to analyze how they change after introducing the tax. After that, in the analysis will be discussed what can determine the share of the tax burden that is paid by consumers and producers.

3. CONSUMER SURPLUS AND PRODUCER SURPLUS

Consumer surplus is the difference between the total benefit which consuming a product or service gets to a consumer and the market value of that product or service.\(^2\) It is the monetary gain obtained by consumers because they are able to purchase a product for a price that is less than the highest price that they would be willing to pay. Graphically it is the area under the demand curve, but above the equilibrium price.

Producer surplus is the difference between the market price and marginal cost of production.\(^3\) It is the amount that producers benefit by selling at a market price that is higher than the least that they would be willing to sell. It is represented on the graph by the area above the supply curve, but under the equilibrium price.

Consumer and producer surplus are shown on next graph.

Graph 2: Consumer and producer surplus in market equilibrium

Consumer surplus and producer surplus can be calculated as the area of the triangles which represent these surpluses.

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Consumer surplus is

\[ CS = \frac{(P_1 - P_E)Q_E}{2} \]

Producer surplus is

\[ PS = \frac{(P_E - P_2)Q_E}{2} \]

Now we can calculate the total surplus on the market, which is the sum of consumer surplus and producer surplus. Is it equal to

\[ TS = CS + PS = \frac{(P_1 - P_E)Q_E}{2} + \frac{(P_E - P_2)Q_E}{2} \]

\[ TS = \frac{P_1Q_E - P_EQ_E + P_EQ_E - P_2Q_E}{2} \]

\[ TS = \frac{P_1Q_E - P_2Q_E}{2} \]

\[ TS = \frac{(P_1 - P_2)Q_E}{2} \]

After analyzing consumer and producer surplus, we can analyze what are the effects of introducing tax.

4. INFLUENCE OF TAXATION ON CONSUMER SURPLUS AND BUYER SURPLUS

Tax rates can be divides into two groups, according to the way of calculation tax. The first is the ad valorem tax, which depends on the value of a good or service that is being taxed. The tax is calculated as the proportion of the value. The other type is per unit tax, which is defined as a fixed amount for each unit of a good or service sold. For all values of good or service, the tax is added in the same amount. In this paper the analysis will be done under the assumption of per unit tax.

Introducing the tax will raise the problem of who will pay this tax. This can be either seller or buyer. Here are both situations. The first one is the situation when the tax is paid by buyers. It is shown on next graph.

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Graph 3: Tax shifting S curve

When the tax should be paid by the buyers, the supply curve S shifts up for the tax t and becomes S'. Now the equilibrium quantity falls from Q_e to Q'_e. Buyers pay P_B, and sellers get P_S. It is obvious that tax burden is divided between buyers and sellers.

Graph 4: New consumer and producer surplus with S'

Graph 4 shows the effects of taxation on consumer and producer surplus. Consumer surplus is now the area A, and producer surplus is the area B. The area C is the government revenue from taxation. Consumer surplus is now
Producer surplus is

\[ PS = \frac{(P_E - P_S)Q_E'}{2} \]

The government revenue from taxation is

\[ T = (P_B - P_S)Q_B' \]

Summarizing consumer surplus and producer surplus before taxation on one side, and consumer surplus, producer surplus and government revenue on the other side, we will not get the same value. The difference is the field D, which is called deadweight loss and represents the loss of total welfare caused by taxation.

But tax can also be introduced to sellers. That case is shown on next graph.
In this case sellers pay the tax. The demand curve $D$ shifts down for the tax $t$ and becomes $D'$. This has shifted the equilibrium quantity falls from $Q_E$ to $Q_E'$. Now buyers pay $P_B$, and sellers get $P_S$. It is obvious that tax burden is divided between buyers and sellers, just as in the previous example. From this we can conclude that tax burden will be divided between buyers and sellers, no matter who is obligated to pay the tax.

New consumer and producer surplus in this case are shown on next graph.

**Graph 6:** New consumer and producer surplus with $D'$

On Graph 6 are shown the effects of taxation on consumer and producer surplus. Consumer surplus is represented by the area $A$, and producer surplus by the area $B$. The government revenue from taxation is the area $C$, and the deadweight loss is the area $D$. Now we can calculate consumer surplus, producer surplus and government revenue.

Consumer surplus is

$$CS = \frac{(P_1 - P_B)Q_E'}{2}$$

Producer surplus is

$$PS = \frac{(P_E - P_S)Q_E'}{2}$$

The government revenue from taxation is

$$T = (P_B - P_S)Q_E'$$

Is we compare now consumer surpluses, producer surpluses and government revenues from taxation in the case when $S$ curve shifts up and $D$ curve shifts down, it is obvious that effects are identical. This
means that the effects on changing the consumer surplus and the producer surplus do not depend on who pays it. What can it then depend on? This question is discussed in next chapter of this paper.

5. WHAT DO CHANGES ON CONSUMER SURPLUS AND PRODUCER SURPLUS DEPEND ON?

In previous analysis it has been shown that tax burden is usually divided by the seller and the buyer, no matter whom is this tax imposed. This is so because of the price elasticity of supply and demand curves. Elasticity is the intensity of reaction in quantity on the change in price.

Price elasticity of supply is the percentage change in supplied quantity which is the reaction on the rise of price of 1%. The values of price elasticity of supply are usually positive because of the law of supply, according to which producers are ready to produce and sell higher quantity at higher prices and lower quantity at lower prices. If the percentage change in supplied quantity is higher than 1, the supply is elastic. For the values lower than 1, supply is inelastic.

Price elasticity of demand is the percentage change in demanded quantity which is the reaction on the rise of price of 1%. It usually has negative values because of the law of demand, according to which buyers are ready to buy higher quantity at higher prices and lower quantity at lower prices. If the percentage change in demanded quantity is lower than -1, the demand is elastic. Values of elasticity of demand between -1 and 0 are characteristic for inelastic demand.

If the supply curve is relatively elastic compared to the demand curve (which also means that the demand curve is relative inelastic compared to the supply curve), then the buyer will pay larger share of the tax. In the extreme example when supply curve is perfect elastic (this means that S curve is horizontal), buyer will pay the whole tax burden, and seller will not carry any part of tax burden. The same result will be in the case when the demand curve is perfect inelastic (the demand curve is then vertical).

If the supply curve is relatively elastic compared to the demand curve (which is equivalent to the relative inelasticity of the supply curve compared to the demand curve), then the bigger part of tax burden will be paid by the seller. The extreme case of this example is the perfect elasticity of demand. In that case the demand curve is horizontal, and the buyer pays the whole tax burden, while the seller does not pay anything. The same result occurs when the supply curve is perfect inelastic. In that case it is vertical on the graph.

6. CONCLUSION

In this paper we have analyzed the influence of taxation on microeconomic market equilibrium. Taxes can shift either the supply curve or the demand curve. The analysis has shown that the final results are equal, no matter which of these curves shifts. This is so because of the possibility to share the tax burden between the seller and the buyer. The proportion of sharing tax burden between buyers and sellers depends on relative elasticity of supply and demand curve. There are extreme cases in which the total burden of the taxation is carried only by seller or only by producer. These are cases of perfect elasticity or perfect inelasticity of the supply and demand curve.

REFERENCES