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Professional paper

EVALUATE THE BALANCE IN THE MARKET

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Abstract

The work paper, present the evaluation of balance middle supply and demand in the market in the case where the price of the product depending on the price of other products (see [4], [6] etc.). Here, the quantity is presented with linear function of many variables and in the special case presented with function of second order of many variables or the function where, the conjunctions of the equations is resolved.
In the beginning with relations where, the quantity depending on the prices of some other products presents with functions of many variables:
Supply $Q_{v_i}^o = f_i^o(P_{v_1}, P_{v_2}, P_{v_3}, \dots P_{v_n})$,
Demand $Q_{v_i}^k = f_i^k(P_{v_1}, P_{v_2}, P_{v_3}, \dots P_{v_n})$,
where , i=1,2,3,...,n and $Q_{v_i}^o$, $Q_{v_i}^k$ are value of quantity of products vi depending from positive linear functions of many variable $f_i^o(P_{v_1}, P_{v_2}, P_{v_3}, \dots P_{v_n})$ and $f_i^k(P_{v_1}, P_{v_2}, P_{v_3}, \dots P_{v_n})$, presented for supply and demand of the market.
For equilibrium of the market, we get:
$Q_{v_i}^o = Q_{v_i}^k$,
where, i=1, 2, n, presented a system of equations which's the solution give us the balance prices of the products, from where we get the balance quantity for products. In the special case, is possible, others form of the function when for the system we may to find the result.

Keywords: market, demand, supply, balance, system etc.

1. Introduction

In begin, we will give the sense for system equations of the first order or system of linear equations. Let $\xi 1$, $\xi 2$, ..., ξn, are variables which's may to be positive value of the set R . Equation of the form:
$\alpha 1\xi 1+\alpha 2\xi 2+\dots+\alpha n\xi n = \beta$, (1)
where, $\alpha 1$, $\alpha 2$, ...,αn is number of the set R, called linear equation of the variable $\xi 1$, $\xi 2$, ..., ξn. Number αi called coefficient of the equation (1), and β is a free term.
Result of the equation (1) called any system of ordered numbers ($\lambda 1$, $\lambda 2$, ..., λn)$\in$Rn which's do the equation identity wen are replace variable with coordinates. If the set of the result of system (1) is empty, then the system called impossible.
System of m linear equations of n variables called the form:

$$\begin{cases} \alpha_{11}\xi_1 + \alpha_{12}\xi_2 + \dots + \alpha_{1n}\xi_n = \beta_1, \\ \alpha_{21}\xi_1 + \alpha_{22}\xi_2 + \dots + \alpha_{2n}\xi_n = \beta_2, \\ -------------- \\ \alpha_{m1}\xi_1 + \alpha_{m2}\xi_2 + \dots + \alpha_{mn}\xi_n = \beta_m. \end{cases} \quad (2)$$

Result of the system (2) called the result of all equations of the system. To find the result of the system, we mean to get the set of the results of the system. Exist some methods which's answer these questions. On of others is given:

Theorem 1. (Kramer rul). If we have the system (2) m=n and det A≠0, then the system has the result given with:

$$\xi j=\frac{\boldsymbol{det}(\boldsymbol{a}^{(1)},...,\boldsymbol{b},...,\boldsymbol{a}^{(n)})}{\boldsymbol{det}(\boldsymbol{a}^{(1)},...,\boldsymbol{a}^{(n)})}$$, were j=1, 2, ..., n,

and

$$a(1)=\begin{pmatrix}\alpha_{11}\\ \alpha_{21}\\ \vdots\\ \alpha_{m1}\end{pmatrix},\ a(2)=\begin{pmatrix}\alpha_{12}\\ \alpha_{22}\\ \vdots\\ \alpha_{m2}\end{pmatrix},...,\ a(m)=\begin{pmatrix}\alpha_{1m}\\ \alpha_{2m}\\ \vdots\\ \alpha_{mm}\end{pmatrix},\ b=\begin{pmatrix}\beta_{1}\\ \beta_{2}\\ \vdots\\ \beta_{m}\end{pmatrix}.\qquad A=\begin{pmatrix}\alpha_{11} & \alpha_{12} & \dots & \alpha_{1n}\\ \alpha_{21} & \alpha_{22} & \dots & \alpha_{2n}\\ \dots & \dots & \dots & \dots\\ \alpha_{m1} & \alpha_{m2} & \dots & \alpha_{mn}\end{pmatrix}$$

where, vector b is replaced with vector a(j) of the matrix A, and with det, we signed the determinant of the matrix A.

2. Main result

The work paper presents the balance of the market in the case where in the market of the price of the product depending on the price of other products. Starting in the simple case in the given equation of the demand and supply, where the price P present the linear or square function depending on quantity Q with:

supply Po=f(Qo)

demand Pk=g(Qk)

where, Po, Qo, are the value for price and quantity for supply and Pk, Qk, present the value for price and quantity for demand and satisfy , P>0, Q>0.

Example

If we have given the equations of supply and demand:

supply Pd =3 Q 2 -10Q+5

demand Pk =-Q 2+-3Q +20

then, because the equations neds to satisfy the condition

Pd = Pk

we have the equation of the second order

3 Q 2 -10Q+5=-Q 2+-3Q +20.

The solution of this equation is the balance value for product Q=3, Q=-1,25, but the price and quantity are the positive value, we get Q=3=Qe, and from where, Pd =Pk =Pe =2.

In the same way, we may to review the case were function f and g are polynomials of order small then 5 because for other case we may to find usually approximate result.

Ongoing we present the case where evaluated equilibrium of the market of demand and supply of products which's depending on other products, we main the value of the quantity depending on value of prices for some products.

Reality, if are given the equations of supply and demand for products v1, v2 with prices Pv1, Pv2 and corresponding the value for quantity Qv1, Qv2, we get:

Supply $Q_{vi}^{s}=f(Pv_1,P_{v2})$

demand $Q_{vi}^{d}=g(Pv_1,P_{v2})$

where, i=1,2 and f, g function of first order with two variables.
Now, from the condition of the balance in market for supply and demand, we have

$$\begin{cases} Q_{v1}^{s} = Q_{v1}^{d} \\ Q_{v2}^{s} = Q_{v2}^{d} \end{cases}$$

the system of two linear equations with two variables, now the solution of the sistem give as the equilibrium value Pv1=a, Pv2=b for prices of products v1 and v2 , from where we have the balance of market with value for products Pv1=a=P_{v1}^{e} , Pv2=b =P_{v2}^{e} .

Now, replace equilibrium value for price in the system, we find the equilibrium value for quantity for products Q_{v1}^{e} and Q_{v2}^{e}.

Example:

If we have given the equations of supply and demand for three products with:

supply
$$Q_{v1}^{s} = 6P_{v1} - 8$$
$$Q_{v2}^{s} = 3P_{v2} - 11$$
$$Q_{v3}^{s} = P_{v3} - 5$$

demand
$$Q_{v1}^{d} = -5P_{v1} - P_{v2} + P_{v3} + 23$$
$$Q_{v2}^{d} = P_{v1} - 3P_{v2} + 2P_{v3} + 15$$
$$Q_{v3}^{d} = P_{v1} + 2P_{v2} + 4P_{v3} + 19 .$$

Now, from the above condition for equilibrium of the market for all products we have the system of equations:

$$\begin{cases} 6P_{v1} - 8 = -5P_{v1} - P_{v2} + P_{v3} + 23 \\ 3P_{v2} - 11 = P_{v1} - 3P_{v2} + 2P_{v3} + 15 \\ P_{v3} - 5 = P_{v1} + 2P_{v2} + 4P_{v3} + 19 \end{cases}$$

then we have the system of three equations of second order and the solution we give, if exist, the equilibrium value of prices of products v1, v2 and v3, it's
Pv1=4=P_{v1}^{e}, Pv2=7=P_{v2}^{e}, Pv3=6=P_{v3}^{e},
from where we get the equilibrium quantity value for given products:
Qv1=16=Q_{v1}^{e}, Qv2=10=Q_{v2}^{e}, Qv3=1=Q_{v3}^{e}.
Similarly, the problem of this kind may to generalized in the case where we have many products, and the price of the product depends on the other prices of the products.
Let's have given the equations of the supply and demand with:
Supply $Q_{v_i}^{o}$=$f_i^{o}(P_{v_1}, P_{v_2}, P_{v_3}, \dots P_{v_n})$,
Demand $Q_{v_i}^{k}$=$f_i^{k}(P_{v_1}, P_{v_2}, P_{v_3}, \dots P_{v_n})$,
where price of the product has affected in the price of other products in the market.
Then, from the balance of the quantity's:
$Q_{v_i}^{o}$, $Q_{v_i}^{k}$, where i=1,2, 3, n, $n \in N$,
we have the system of the n- linear equations with n- variables:

$$\begin{cases} Q_{v_1}^{o} = Q_{v_1}^{k} \\ Q_{v_2}^{o} = Q_{2}^{k} \\ \dots \\ Q_{vn}^{o} = Q_{v_n}^{k} \end{cases} \quad \dots\dots\dots(1)$$

who, in the assigned conditions the system is resolved then, we can find the value for relevant prices, $P_{v_i} = l_i$, i=1, 2,n, also they are the equilibrium prices for products:
vi, i=1, 2, n, $n \in N$.
Finally, from the equilibrium value P_{v_i} , we may to find the equilibrium quantity Q_{v_i} for demand and supply, where i=1, 2, n, $n \in N$.

We must be careful where we treatment the price - quantity equilibrium in the market, at first must satisfy the conditions:

$$\begin{cases} Q_{v_i}^o \geq 0 \\ Q_{v_i}^k \geq 0 \\ P_{v_i} \geq 0 \end{cases}, \ i = 1,2, \dots n, n \in N.$$

The balance in the market may to treated and in the complicate case it ‘s., when the functions f_i^0 , and f_i^k , for any i are foursquare functions with n- variables and the other functions are linear.
Here, we can see that the function fi may to have the form, satisfy the above conditions and the system (1) to be resolved.
In the same way we may to treated and rhea case where value for price of the product depends on prices of the other products.
Then, we have:
Supply $P_{v_i}^o = f_i^o(Q_{v_1}, Q_{v_2}, Q_{v_3}, \dots Q_{v_n})$,
Demand $P_{v_i}^k = f_i^k(Q_{v_1}, Q_{v_2}, Q_{v_3}, \dots Q_{v_n})$,
and from the conditions:

$$\begin{cases} P_{v_1}^o = P_{v_1}^k \\ P_{v_2}^o = P_2^k \\ \quad \dots \\ P_{vn}^o = P_{v_n}^k \end{cases}$$

we can find the equilibrium value for Q_{v_i}, =1,2, 3, n, $n \in N$, finally from the equations given above we have the equilibrium value for P_{v_i}, =1,2, 3,...,n, $n \in N$.

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