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DETERMINING MONEY DEMAND AT PRICE FLUCTUATIONS IN THE MARKET

FozliddinAmonullayevichAllayarov*

Abstract

This article is devoted to ways of determining money demand and supply. It should be noted, that one of peculiarities of the economy of Uzbekistan is a slight dependence of the inflation rate from the change of money supply. Moreover, the article provides developed economic-mathematical model and the ways of stabilizing money issue while changing prices in the market. Inaddition, thearticledemonstratesthequantitative example of the demand for money issue while price fluctuations.

Keywords:demand, supply, inflation, money supply, money circulation, equilibrium, sustainability, price changes, money circulation velocity.

Introduction

One of the peculiarities of the economy of Uzbekistan is a slight dependence of the inflation rates on the rates of the money supply change. Thisisjustifiedbythefactthatpricechangesarepriortomoneychanges, i.e. prices are considered to be causative in relation to money. Themainreasonforthechangeoftheoverallpricelevelarenon-monetaryinflationfactorssuchasraising the level of pensions, allowances, salaries for government officials, gradual administrative release of prices on the energy resources, external economic factors (changes of exchange rates, oil prices in the world markets, etc.) and fiscal ones. The change of price level is resulting in changing of the money demand which is satisfied by banks

* **SeniorrearcheroftheBanking and Finance Academy of the Republic of Uzbekistan**

through internal borrowings. However, inspiteofthefactthatmonetarypolicyhasafulfilling role, inflation processes at the end are supported by additional money issue in circulation. Tocurbtheinflation it is necessary to introduce a tight monetary policy, therefore it is advisable to forecast equilibrium demand and supply of the money issue while price fluctuations in the market.

Model

It is known that money circulation is determined by the equation of I. Fisher [1]

$MV = PQ(1)$

where:M– moneysupply; V– moneycirculationvelocity; P–average price for goods and services; Q–physical amount of productive goods and services.The leftsideoftheequation(1) representsatotalvolumeofexpenditures of buyers (money supply) on purchasing production benefits. The right side of the equation (1) represents overall receipts of sellers of these benefits, in other words, it is demand on money.

If we rewrite the right side of the equation (1) in the form of the demand lineD: $P^D = k_1 q + b_1$and the left side in the form of the supply line S: $P^s = k_2 q + b_2$,where– k_1 and q- average price and the volume of goods and services in the demand lineD; b_1- demand for money for transaction expenditures; k_2 and q −velocity of circulation and money supply (issue) in the supply lineS;b_2 − share of other money aggregates in the money supply. If to take into account (1),

$k_2 q - P^s + b_2 = k_1 q - P^D + b_1$ (2)

Changesoftheeconomic indicators depend on the scales of measuring thus they can be incomparable. Forexample, in(2)thevalueoftheindicatorofmoneyissuevolumeP^Dcan be incomparable with the average indicator of the equilibrium price of supply of goods and services P^s. Thereforeitismoreconvenienttoconsidernot absolute changes of economic variables but relative ones [2].With their help it is possible to compare money markets and market of goods and services when the result is considered in the portions of units or per cents. Relativevalues are

convenient not only for measuring but also for comparison. Thereforeforequation(2) the ratio of the equilibrium of the money issue is to be determined.

Demand line Dand supply lineS of money are compared with the general form of equations:

$$\begin{cases} A_1 q + B_1 p + C_1 = 0 \\ A_2 q + B_2 p + C_2 = 0 \end{cases} \quad (3)$$

where,

$A_1, B_1, C_1 u A_2, B_2, C_2$ – real (actual) numbers,

$$A_1 = K_1,\ B_1 = -1, \qquad C_1 = b_1\ u\ A_2 = K_2,\ B_2 = -1,\ C_2 = b_2$$

Solution of the equation system (3) can be determined by the matrix method

$$P = \begin{vmatrix} C_1 A_1 \\ C_2 A_2 \end{vmatrix} : \begin{vmatrix} A_1 B_1 \\ A_2 B_2 \end{vmatrix} = \frac{C_1 A_2 - C_2 A_1}{A_1 B_2 - A_2 B_1} \quad (4)$$

Todeterminetheequilibriumcoefficient ofthemoneyissueforforecastedperiodtimet [3] isintroduced.

IfP–moneysupplythen$\frac{dP}{dt} = P'$ −will be the tendency of formulating money issue (derived money supply in time period), money supply will be functions of the stated values [4].

Differentiating (4) by$t$: $\frac{dP}{dt} = \left[\frac{C_1 A_2 - C_2 A_1}{A_1 B_2 - A_2 B_1}\right]' = 0,$

as the derivative of some number or ration is equal to zero.

Transferringtherightsideoftheequation (4) into the left side and recording as $\frac{dP}{dt} = 0$the following equation is developed:

$$\frac{dP}{dt} + P - \frac{C_1 A_2 - C_2 A_1}{A_1 B_2 - A_2 B_1} = 0,$$

where,

$A_1, A_2, B_1, B_2, C_1\ and\ C_2$ – real (actual) numbers. Indicating their relations for further calculations through $F = \frac{C_1 A_2 - C_2 A_1}{A_1 B_2 - A_2 B_1}$, the result of $\frac{dP}{dt} + P - F = 0$ is achieved.

Hence the differential equation is developed:

$\frac{dP}{P - F} = -dt.$

Integratinglastdifferentialequationandthenpotentiating, wewill get that $P = Ce^{-t}$+F

Having applied the value Fthe following equation is developed:

$$P = Ce^{-t+\frac{C_1A_2-C_2A_1}{A_1B_2-A_2B_1}}, \qquad (5)$$

Then Cat initial conditions $t_0 = 0\ uP_0 = 1{,}00$ (or 100%) is calculated:

$$C = 1 - \frac{C_1A_2 - C_2A_1}{A_1B_2 - A_2B_1}.$$

Setting Cin the final equation, the following equation is formulated"

$$P_t^* = \left[1 - \frac{C_1A_2-C_2A_1}{A_1B_2-A_2B_1}\right] e^{-t} + \frac{C_1A_2-C_2A_1}{A_1B_2-A_2B_1}, \qquad (6)$$

where $e = 2{,}7183; t$ −forecasted time period.

Thus, tomaintainequilibrium between the money demand and money supply it is necessary to change money supply according to the last formula (6). $P_t^*$is a relative value. Absolute or actual value of the forecasted money supply for time t (P_t^m)is to be determined according to the formula

$$P_t^m = P_t^* * P_0 \qquad (7)$$

whereP_0 −money supply at the beginning of the forecasted period.

OneofthewaysofcalculatingmoneyratiosA_1, A_2, B_1, B_2, C_1andC_2 linesofdemandDandsupply S is the method on the basis of marketing research for analyzed forecasted period of time to determine coordinates of the minimum and maximum values of (P_1^D, q_1^D)and (P_2^D, q_2^D)by demand (P_3^S, q_3^S)and(P_4^S, q_4^S)by supply.

Fromtheanalyticalgeometryitisknownthattheequationofsolid lines of the demandDand supply S, passing through two points are recorded as it follows:

$$\frac{p - p_1}{p_2 - p_1} = \frac{q - q_1}{q_2 - q_1}; \frac{p - p_3}{p_4 - p_3} = \frac{q - q_3}{q_4 - q_3},$$

After transformations these equations will look like:

$$\begin{cases}(p_2 - p_1)q - (q_2 - q_1)p + p_1q_2 - q_1p_2 = 0\\(p_4 - p_3)q - (q_4 - q_3)p + p_3q_4 - q_3p_4 = 0\end{cases}$$

However, thesesolidlinesofthedemandandsupplyare similar to the equation of the solid lines (3). Being compared they look as it follows

$$\begin{cases} A_1 = p_2 - p_1, B_1 = -(q_2 - q_1), C_1 = p_1 q_2 - q_1 p_2 \\ A_2 = p_4 - p_3, B_1 = -(q_4 - q_3), C_1 = p_3 q_4 - q_3 p_4 \end{cases} \quad (8)$$

Thus,values$A_1, A_2, B_1, B_2, C_1 and C_2$ by formulas (8) and put their values in (6). Thenfortime$t = t_1, t_{2,\dots,} t_n P_t^*$is determined and used it in (7) we are forecasting the value of money issue for the analyzed period.

This case can be evidenced by the example. Onthebasisofstudyingtheconditionsofthemarketofgoodsandservices, marketingservice unit has determined that monthly reduction of prices in the first quarter and its increase in the second quarter is supposed. Inadditiontheydefinedthatwhile price reduction on the forecasted first quarter by the demand: $P_1^D = 0{,}98$ and $P_2^D = 0{,}95$, $q_1^D = 0{,}82$ and $q_2^D = 0{,}90$; (9)
by supply:$P_3^s = 0{,}99$ and $P_4^s = 1{,}07$, $q_3^s = 1{,}18$ and $q_4^s = 1{,}01$.

And in forecasted second quarter while the price growth by demand: $P_1^D = 0{,}99$ and $P_2^D = 1{,}05$, $q_1^D = 0{,}97$ and $q_2^D = 0{,}88$; (10)
by supply:$P_3^s = 1{,}04$ and $P_4^s = 1{,}07$, $q_3^s = 1{,}08$ and $q_4^s = 1{,}27$.

It is necessary to determine the equilibrium coefficients of money issue change by month of the first and second quarter.

With this aim, first it is advisable to develop the demand and supply equation for the first quarter. We are detecting the values of $A_1, B_1, C_1 \; and \; A_2, B_2, C_2$ from formulas (8) at the price reduction (9): by demand:

$A_1 = -0{,}03$; $B_1 = -0{,}08; C_1 = 0{,}98 * 0{,}90 - 0{,}82 * 0{,}95 = 0{,}103$orconsidering the equation of the demand line: $-0{,}03q - 0{,}08p + 0{,}103 = 0$;
by supply:$A_2 = -0{,}02;\ B_2 = 0{,}17;\ C_2 = 0{,}99 * 1{,}01 - 1{,}18 * 0{,}97 = -0{,}145;$
or considering the equation of the supply line: $-0{,}02q + 0{,}17p - 0{,}1450 = 0$.

Then, applyingthesevaluesinformulas(6) we are determining an equilibrium coefficient of the money issue at price reduction. Relativestartingtime$t_0 = 0$, forecasted monthly time of the quarter $t_1 = 1, t_2 = 2\ and\ t_3 = 3$.

If$t_0 = 0$, $P_0^* = 1{,}00$or 100%, i.e. equal to the money supply at the starting point of P_0. If$t_1 = 1$,theequilibrium coefficient of the money issue in the first month of the quarter will be:

$P_1^* = \left(1 - \frac{-0{,}103*(-0{,}02)-(-0{,}145)*(-0{,}03)}{(-0{,}03)*0{,}17-(-0{,}02)*(-0{,}08)}\right) * 2{,}7183^{-1} + \frac{-0{,}00206-0{,}00435}{-0{,}0051-0{,}0016} = (1 - 0{,}9567) * 0{,}3679 + 0{,}9567 = 0{,}97263$or97,263%from the starting point.

If $t_2 = 2$,the equilibrium coefficient of the money issue in the second month of the quarter will be:$P_2^* = (1 - 0{,}9567) * 0{,}1353 + 0{,}9567 = 0{,}96256$or 96,256%.

If$t_3 = 3, P_3^* = 0{,}0433 * 0{,}04979 + 0{,}9567 = 0{,}958856$or 95,8856%.

Thenhavingdetermined$P_3^m = P_3^* * P_0 = 0.958856 *$

P_0forthebeginningofthesecondquarterwewillconsiderthiscoefficientas100% or for the initial equilibrium coefficient of the starting point of the second quarter.

We are developing the equation of the demand and supply using the formulas (8) and the data (10):

bydemand:$A_1 = 0{,}04;\quad B_1 = 0{,}09; C_1 = 1{,}01 * 0{,}88 - 0{,}97 * 1{,}05 = -0{,}1297$or we are having the equation of the demand line$0{,}04q + 0{,}09p - 0{,}1297 = 0$;

bysupply:$A_2 = -0{,}02;\ B_2 = 0{,}17;\ C_2 = 0{,}99 * 1{,}01 - 1{,}18 * 0{,}97 = -0{,}145$ or we are having the equation of the supply line$0{,}03q - 0{,}19p + 0{,}1652 = 0$.

Applying these values in formulas (6), the equilibrium coefficient of the money issue while the price growth can be determined.

If$t_0 = 0$, $P_0^* = 1{,}00$or 100%, i.e. equal to the money supply at the starting point $0.95699P_0$.

If$t_1 = 1$,the equilibrium coefficient of the money issue for the first month of the second quarter is calculated:

$P_1^* = \left(1 - \frac{(-0{,}1297)*0{,}03 - 0{,}1652*0{,}04}{0{,}04*(-0{,}19) - 0{,}03*0{,}09}\right) * 2{,}7193^{-1} + \frac{-0{,}003891 - 0{,}006608}{-0{,}0076 - 0{,}0027} = -0{,}0071 + 1{,}0193 =$ 1,0122or 101,22%

In addition, calculations are made for the second $t_2$and third t_3 months of the second quarter:

$P_2^* = -0.0193 * 0.1353 + 1.0193 = 1.0167$ or 101,67%

$P_3^* = -0.0193 * 0.04979 + 1.0193 = 1.0183$or 101,83%

Absolute or real (actual) value of the forecasted money supply by months of the first and second quarter can be determined according to the following formula (7). As a result of calculations the following values are received for the first quarter: $\text{EMD}_1^1 = 0.96256P_0$; $\text{EMD}_2^1 = 0.96256P_0$, $\text{EMD}_3^1 = 0.958856P_0$,for the second quarter: EMD_1^2 =1,0122*0,958856*P_0; $\text{EMD}_2^2 = 1{,}0167 * 0.958856P_0$, $\text{EMD}_3^2 = 1{,}0183 * 0.958856P_0$. Here$\text{EMD}_t^k$ – (t – number of monthand k –number of quarter) means forecasted value of the money issue of the appropriate period.

Conclusion

It should be noted that in spite of intensive development of various means of implementing non-cash settlements, cash circulation remains one of the most important spheres of the modern economy. Some specialists think that dynamic development of non-cash payments in the sphere of retail payments is being currently observed all over the world. Asaresult, the illusion that the era of "cash" is coming to the end appears. Some experts already consider cash as outdate means of payment. However, as the practice illustrates, the amount of cash money in circulation is constantly increasing [7].

In modern economy in many countries cash money circulation comprises of the smaller part of money circulation but has a significant functional importance. It is justified that final realization of produced goods and services is implemented and the compliance of supply and demand is checked in the sphere of the cash money circulation. Purchasing power parity of the national currency mainly depends on the condition of the cash money circulation.

This is also justified by the great attention paid to the modernization and development of cash circulation, raising efficiency of cash circulation in most countries of the world. In this aspect, improving the organization and regulation of money circulation play an important in predictingmoney issues.

In conclusion, it should be noted that the determination of demand for money if prices are fluctuating are forecasted in relative valuesand the privacy of the money issue is being maintained.

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