
EMPIRICAL EVIDENCE FOR THE QUANTITY THEORY OF MONEY: ROMANIA – A CASE STUDY

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Abstract

The quantity theory of money is one of the most important theoretical propositions in monetary economic theory. However, in recent days more and more economists contest its validity. In this article we will attempt to offer additional empirical support for the quantity theory of money. We argue that the variation in the consumer price index (CPI) in Romania in the last six years can be fully explained by the variation in the supply of money.

Key words: *the quantity theory of money; money supply; regression analysis; consumer price index (CPI); purchasing power.*

1. Introduction

The quantity theory of money is probably one of the oldest theoretical propositions in modern economic thought. Some of its first formulations, at the hands of the English philosopher John Locke [1], date back to the 17th century. At the core of the quantitative theory of money lies the proposition that the price of money (i.e. the purchasing power of the monetary unit) is determined by the interplay of supply and demand for money. As L. von Mises [3] correctly points out: “*This theory is essentially an application of the general theory of supply and demand to the special instance of money*”.

However, historically the quantity theory of money had one major drawback, at least with regard to one of its more “primitive” formulations. Numerous economists interpreted that a change in the supply/demand for money would cause a *proportional* change in the level of prices¹. Probably,

1. It is true that there are examples of illustrious economists who rejected the alleged proportionality between movements in the monetary equilibrium on the one hand and prices on the other. Richard Cantillon’s “*Essai sur la Nature du Commerce en Général*” [2], published in 1755 clearly argued that an increase in the stock of money does not cause a *proportional* increase in all the prices of good and services, but that the structure of prices will be modified altogether. In his honor, the redistribution effects associated to an increase in the money supply are known today as “*the Cantillon effects*”.

the most famous example in this sense is Irvin Fisher's renowned equation of exchange $MV = PT$ ¹. This type of reasoning, which we consider erroneous, is probably the consequence of an endeavor to study phenomena only at an aggregate level and ignore the concrete actions of individual agents.

It was only until the first half of the 20th century when modern economic monetary theory correctly reincorporated the core of the quantity theory of money, i.e. the existence of a causal connection between the interplay of demand and supply of money and the purchasing power of the monetary unit². There was only one essential difference. Unlike the previous versions, the focus was moved from an alleged proportional change in the "level of prices" to a disproportional change in relative prices. In this sense, a change in the relation between the supply and demand for money would cause a modification in the whole structure of prices. For example, it is true that an increase in the stock of money causes an increase in all prices, but not all the prices rise to the same extent³.

These economic theories are, of course, a priori propositions which do not require any additional validation. However, we consider that there was a lack of attempts to illustrate the theory based on empirical data collected from Romania. Thus, in this article we will use statistical data to see whether additional support can be given to the quantity theory of money. Our main goal will be to show that the variation in the CPI, which is used as a yardstick to gauge inflation, can be explained by the variation in the stock of money.

In order to achieve our above stated goal, we will employ regression analysis. The data which we will use was collected from official sources like the Romanian National Institute of Statistics and the National Bank of Romania.

2. Inflation and the quantity theory of money

The quantity theory of money claims that there is a causal relation between a *ceteris paribus* increase/decrease in the supply of money and a change in the purchasing power of the monetary unit. Thus, the normal

1. Where M represents the total stock of money, V represents the so called "velocity of money", P stands for the general level of prices and T for the number of transactions.

2. See for example the works of Mises [4] and Hayek [5]. It is interesting that numerous economists today reject the idea that a causal connection between the purchasing power and the supply and demand for money exists.

3. It was Mises [4] and Hayek [5] who argued that an increase in the supply of money, via productive credit, has a disproportional effect on prices. In their view, an artificial increase in productive credit causes a higher increase in the prices of producer goods relative to the prices of consumer goods. This insight was used by the above mentioned authors to shape their renowned business fluctuations theory.

conclusion is that an increase in the stock of money will determine a decrease in the purchasing power of the monetary unit and a corresponding¹ increase in prices of goods and services. It is clear that according to the quantity theory of money, inflation is strictly a *monetary* phenomenon.

In order to illustrate this conclusion we have chosen to apply regression analysis to see to what extent the variation in the CPI can be explained by the variation in the intermediary money mass (M2).

In Romania, according to the National Institute of Statistics, inflation is calculated based on the Consumer Price Index [6]. Thus, the rate of inflation is computed according to the formula $CPI - 100$.

2.1 Methodological note

The data set is composed of monthly values in Romania between January 2008 and September 2013. In order to describe the evolution of the money stock we have employed data made available by the National Bank of Romania. The chosen indicator was M2 (the intermediary money stock) which comprises the monetary base (M1) plus demand deposits². Because the data was given in absolute terms (millions of lei), we chose to express it as indexes having as reference point the prices in January 2008, according to the formula $M2 \text{ in the current month} / M2 \text{ in January 2008} \times 100$. Table 1 shows the transformation from absolute values to indexes.

The second set of data is composed of CPI's collected from the National Institute of Statistics. The indexes are calculated in the same fashion, having as reference the month January 2008. Table 1 illustrates all the available data.

M2 and CPI

Table 1

Date	Intermediary money stock (M2) (thousand lei)	M2 Indices	CPI
Sep. 2013	231,258,651.6	156.83	130.22
Aug. 2013	229,631,996.2	155.73	130.96
Jul. 2013	225,700,118.5	153.06	131.23
Jun. 2013	227,563,263.3	154.32	131.67
May. 2013	225,821,616.5	153.14	131.66
Apr. 2013	225,547,340.1	152.96	131.36
Mar. 2013	225,111,160.4	152.66	131.23
Feb. 2013	219,301,444.9	148.72	131.18
Jan. 2013	219,147,477.5	148.62	130.74
Dec. 2012	221,829,585.8	150.44	129.01
Nov. 2012	220,506,477.0	149.54	128.23
Oct. 2012	220,230,597.1	149.35	128.18
Sep. 2012	220,774,195.5	149.72	127.81

1. But not necessarily proportional.

2. NBR Glossary [7].

Aug. 2012	220,022,033.7	149.21	126.33
Jul. 2012	221,067,093.9	149.92	125.69
Jun. 2012	216,449,666.0	146.79	124.96
May. 2012	218,572,694.0	148.23	125.01
Apr. 2012	216,330,914.2	146.71	124.76
Mar. 2012	214,288,680.5	145.32	124.68
Feb. 2012	213,529,316.6	144.81	124.16
Jan. 2012	212,438,910.7	144.07	123.37
Dec. 2011	212,058,932.7	143.81	122.93
Nov. 2011	205,061,031.0	139.06	122.64
Oct. 2011	203,293,125.2	137.87	122.13
Sep. 2011	204,772,154.4	138.87	121.35
Aug. 2011	200,475,279.5	135.95	121.60
Jul. 2011	199,479,568.3	135.28	122.03
Jun. 2011	196,089,551.3	132.98	122.46
May. 2011	194,621,235.8	131.98	122.81
Apr. 2011	192,978,965.3	130.87	122.55
Mar. 2011	192,901,079.1	130.82	121.75
Feb. 2011	194,801,032.2	132.11	121.03
Jan. 2011	196,007,997.5	132.92	120.10
Dec. 2010	199,572,050.7	135.34	119.18
Nov. 2010	194,198,200.9	131.70	118.56
Oct. 2010	191,704,036.6	130.01	117.94
Sep. 2010	192,590,356.1	130.61	117.30
Aug. 2010	192,677,069.6	130.67	116.65
Jul. 2010	190,772,964.2	129.37	116.38
Jun. 2010	192,278,793.7	130.40	113.46
May. 2010	190,109,290.1	128.92	113.28
Apr. 2010	188,254,277.7	127.67	113.12
Mar. 2010	187,820,575.7	127.37	112.72
Feb. 2010	185,677,151.7	125.92	112.48
Jan. 2010	184,278,386.8	124.97	112.25
Dec. 2009	188,013,003.5	127.50	110.40
Nov. 2009	184,057,637.9	124.82	110.05
Oct. 2009	182,564,198.4	123.81	109.32
Sep. 2009	182,531,764.7	123.79	108.85
Aug. 2009	182,785,263.3	123.96	108.43
Jul. 2009	180,372,955.9	122.32	108.63
Jun. 2009	179,481,958.3	121.72	108.70
May. 2009	176,620,828.5	119.78	108.49
Apr. 2009	175,808,287.1	119.23	108.48
Mar. 2009	174,881,688.3	118.60	108.18
Feb. 2009	175,838,113.1	119.25	107.64
Jan. 2009	175,769,982.6	119.20	106.71
Dec. 2008	173,628,814.6	117.75	105.40
Nov. 2008	164,370,148.3	111.47	105.16
Oct. 2008	162,147,537.0	109.96	104.82
Sep. 2008	166,012,915.1	112.58	103.72
Aug. 2008	162,279,874.3	110.05	103.31
Jul. 2008	161,220,678.7	109.33	103.40
Jun. 2008	161,462,978.7	109.50	102.69
May. 2008	157,568,259.2	106.86	102.40
Apr. 2008	157,044,736.4	106.50	101.91
Mar. 2008	151,794,126.0	102.94	101.38
Feb. 2008	149,685,164.6	101.51	100.70
Jan. 2008	147,457,999.5	100.00	100.00

Source: [6], [8].

2.2 Trend Comparison

Before proceeding to the actual regression analysis, it is useful to examine the evolutions using a standard graphical representation. Figure 1 illustrates the trends corresponding to the two data sets collected between January 2008 and September 2013. There is no further need to point out that the two variables have had remarkably similar evolutions. As it can easily be observed, both variables had ascending trends, with M2 registering a higher increase in the analyzed period.

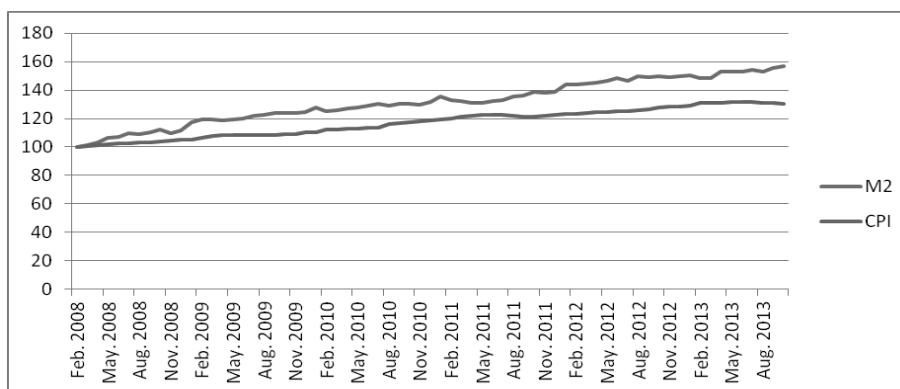
At the end of the analyzed period, in September 2013, the intermediary money stock was more than one and half times the size it represented in January 2008¹. This translates, in absolute values, in an increase of 83.800.652 thousand lei over a period of approximately 6 years.

As it was mentioned above, the Consumer Price Indices registered a similar ascending trend, increasing with approximately 30.2% over the same period.

Summing up, in the last month of the analyzed period (September 2013), the two variables, M2 and CPI, registered values that were 56.8%, respectively 30.2% higher than in January 2008. Thus, it can easily be noticed that the CPI increased throughout this period at a slower rate than M2.

M2 and CPI Trends Compared

Figure 1



Source: [6], [8]

1. Exactly 156.8%.

2.3 Regression analysis

Given the fact that we've described the way in which the data was collected and belabored on, we can now proceed to apply *linear regression analysis*. The X variable in our case will be the intermediary money stock (M2), while the Y variable is represented by the CPI. The reason for our endeavor is to see whether the variation in CPI can be explained by the variation in the money stock. The Microsoft Excel summary output, calculated based on a 95 percent confidence interval, is presented in Figure 2 below.

Regression Summary Output

Figure 2

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.972519
R Square	0.945793
Adjusted R Square	0.944971
Standard Error	2.277128
Observations	68

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	5971.114	5971.114	1151.544	1.6835E-43
Residual	66	342.2305	5.18531		
Total	67	6313.344			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95,0%</i>	<i>Upper 95,0%</i>
Intercept	34,65093	2,438796	14,20821	9,4E-22	29,78171581	39,52014	29,78172	39,52014
M2	0,626057	0,018449	33,93441	1,68E-43	0,589222348	0,662892	0,589222	0,662892

Source: own calculations.

As Figure 2 informs us, there is a very strong relationship between the independent and the dependent value. The coefficient of determination (R^2) has an approximate value of 0.95, which means that 95 percent of the variation in the CPI is explained by the variation in the intermediary money stock. Adjusted R Square also has an interestingly high value, which reinforces the conclusion that the connection between the two variables cannot be attributed to chance.

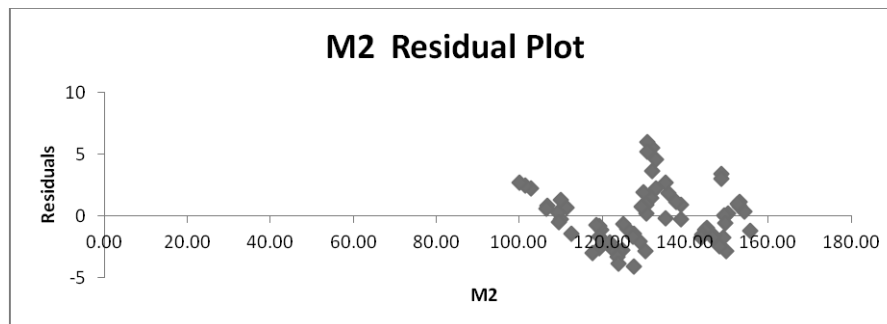
Going further, ANOVA is not extremely important for interpreting a simple linear regression, so we will only look at *Significance F* to see whether

our results are statistically significant or not. Usually *Significance F* should be below 0.05 for the result to be significant, but that does not prove a problem in our case because *Significance F* is practically 0¹.

The regression equation can be written as $yi = 34.65093 + 0.626057xi$. As we can see, the P-values are practically zero, which means that there is a zero probability that the coefficient was obtained by chance. The residual plot, presented in Figure no. 3 below, reinforces this conclusion. We can observe that there is no apparent pattern in the residual values, which appear to be somewhat normally distributed and concentrated around zero.

Residuals Plot

Figure 3



Source: own calculation

2.4 Qualitative interpretation

One can easily observe that it is not hard to find empirical support for the quantity theory of money. Economic theory clearly states that inflation is a monetary phenomenon and that any *ceteris paribus* increase in the supply of money and credit necessarily leads to a decrease in the purchasing power of the monetary unit. The present article is only meant to *illustrate* the conclusion of the quantity theory of money in a particular situation, i.e. the case of Romania between January 2008 and September 2013.

It is clear that the relatively low inflation rates that Romania has experienced in the past years are a consequence of the decision taken by the NBR to keep the money supply relatively constant². According to the quantity theory, the only way to fight inflation is by having a fix monetary supply. It is

1. If you turn the exponential expression $1,6835E-43$ into a number *Significance F* equals approximately 17×10^{-44} .

2. Although it is somewhat misleading to call an approximately 40% increase in the intermediary money stock over a period of 5 years and 9 months "constant".

our belief that the National Bank of Romania should continue and *intensify* its efforts in keeping a constant supply of money in order to prevent further inflation.

3. Conclusions

The quantity theory of money, as we have mentioned before, is an *a priori* proposition which does not require any additional validation. However, it is interesting to point out that the theory can easily be illustrated using statistical analysis. In Romania, in the time period between roughly 2008 and 2013, the variation in the CPI can be statistically explained by the variation in the supply of money. Thus, the best way to fight the *monetary phenomenon* known as inflation is *to keep a constant stock of money*.

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