

# The impact of monetization on the money demand in Poland

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## Introduction

Money demand theory suggests the level of broad money income elasticity of about one. This is supported by the empirical studies, which for the majority of countries find broad money income elasticities not far from what the theory says. If the elasticity exceeds unity, this is usually by no more than 0.7. The excess over 1 is explained as a result of not including into the money demand equations any variables that could capture the wealth effect.

The estimations of broad money demand for Poland yield income elasticities exceeding two. One can hardly blame the wealth effect for such a significant contradiction with the theoretical and other countries' empirical findings. It calls for some other explanation – for instance by adding new variables to the money demand function specification.

The explanation can be found in the monetization developments. Monetization, defined as a ratio of money stock over output, reveals upward trending in Poland, while it is fairly stable in Hungary, Czech Republic and many other countries. Broad money monetization is typically lower in CEEC countries than in eurozone countries with the exception of Czech Republic, so one can interpret the Polish upward

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trending as a convergence process towards the patterns of more developed economies. Approximating the monetization trend with the logistic curve and including it into the money demand equation gives the commonly accepted income elasticity of 1.2.

This paper contribution is twofold. First, using the data on the investment funds assets and other close substitutes to bank deposits it proposes a new broad money series for Poland, which is adjusted for the November 2001 Belka tax and the March 2002 methodology change structural breaks. Second, it shows the reasons for faster pace of growth of broad money compared to GDP which results in the improbably high income elasticity of money. Adding the monetization trend to the money demand equation makes it possible to estimate the income elasticity which is acceptable and stays in-line with the theory and empirical results for other countries.

The paper is organised as follows. The first section contains a short review of the money demand theory and empirical results for broad money modelling. Subsection 2.1 describes the recent developments in Polish broad money and proposes a new broad money aggregate for Poland. In subsection 2.2 broad money income elasticity for Poland is estimated, with the application of the standard money demand specification. The next subsection investigates the developments of the monetization in Poland and some other countries. Subsection 2.4 contains the estimations of the monetization augmented broad money demand. The last section concludes.

## 1. Empirical modelling of money demand

Modelling money demand is an important issue in the applied economics. Money demand functions play crucial role in the central banks operating under monetary targeting regime. Direct inflation targeting framework, gaining more and more popularity, puts less attention to the demand for money, but still developments in the monetary aggregates belong to the set of indicators taken into account in DIT countries. Empirical money demand modelling is based on the theory developed mainly by I. Fisher, A. Marshall, J.M. Keynes, and later by W.J. Baumol, J. Tobin and M. Friedman (see [25], [16], [23], [20], [21], [3], [27], [28]).

A money demand function takes usually the following form:

$$\frac{M}{P} = f(Y, oc) \quad (1)$$

where  $M$  is the nominal stock of money,  $P$  is the price level,  $Y$  denotes a scale variable mirroring the economic activity, and  $oc$  stands for the opportunity costs of holding money. Nominal stock of money is

measured by the monetary aggregates – the composition of narrow aggregates is fairly homogenous across countries while that of broad aggregates differs substantially.  $Y$  is usually proxied by the GDP or private consumption, which in most countries are available at quarterly frequency. If higher frequency needed, than one can use industrial output or retail sales series, usually published on the monthly basis. The interest rates series are usually used for the opportunity costs of holding money  $oc$ . Division of nominal stock of money  $M$  by the price level  $P$  gives the real money stock, so  $Y$  and  $oc$  should also be in real terms. However, many researchers replace real rates with the nominal ones, because they see the improvement of the statistical properties of the models or because they claim the existence of the nominal illusion. Sometimes also other explanatory variables are added to the equation (1), such as the inflation rate, expected inflation rate or some proxies for wealth.

The following log-linear form of the equation (1) is usually used for the estimation:

$$m = \beta_0 + \beta_1 y + \beta_2 oc + \varepsilon \quad (2)$$

where  $m$  is the log of real stock of money,  $m = \ln \frac{M}{P}$  and  $y$  is the log of output,  $y = \ln Y$ . The economic theory gives suggestions as to the signs and magnitudes of the  $\beta_i$  coefficients. The scale variable  $Y$  represents income-transaction effects, so the expected sign of  $\beta_1$  is positive. In addition, the Baumol-Tobin inventory model of money demand suggests the value of the income elasticity of about 0.5. The Baumol-Tobin approach is particularly suitable for transaction money demand, so it should be applied when modelling narrow money rather than the broad one. For the broad money demand function, the income elasticity should lie closer to unity. Some empirical studies find  $\beta_1$  even higher than 1 – for instance Coenen and Vega [14] come up with the income elasticity of euro area M3 equal to 1.2; they explain the 0.2 overhang to result from the wealth effect, as none wealth-proxy variable is explicitly included in the model. The alternative costs of holding money are usually approximated by the bank deposits interest rates corresponding to the monetary aggregate modelled and by the rates of return on assets substitute to bank deposits, such as for instance treasury bonds. The coefficient sign predicted is positive for the bank deposits rates and negative for the substitute assets. When the inflation rate is included into the equation (2), than following Sriram [26] the expected sign on it is negative, because with the increase of inflation the demand for real goods increases, as they give better opportunity to preserve the real value over the period of higher inflation than money. However, this relation seems to hold only over the short run – over the long run, the increase in

inflation may lead to the fall in real interest rates and to the excess creation of credit resulting in the increase of money.

When estimating the money demand functions usually the cointegration analysis is applied. This is motivated mainly by the nonstationarity of money and output series. The ECM approach, which is the most widespread, gives the possibility for identifying the long-run equilibrium relationships as well as the short-run dynamics of adjustments to the equilibrium.

The income elasticity of broad money, suggested by the theory at the level of about one, is strongly supported by the long-run income elasticities estimated in many empirical studies. Browne, Fagan and Henry [9] have gathered the empirical results obtained for the European countries before the euro introduction. The broad money income elasticities reported stay in the range between 0.27 and 1.84, the mean equal 1.14. The results obtained later by ECB staff for the euro zone are very similar. Coenen and Vega [14], Brand and Cassola [8] and Calza, Gerdesmeier and Levy [12] came up with the euro zone M3 income elasticities equal 1.14, 1.34 and 1.31 respectively. Sriram's [26] similar breakdown of empirical broad money results includes also a wide range of non-European countries. The income elasticities lie in between 0.13 and 3.45, with the mean of 1.22. The value exceeding 2 was recorded only once – for Argentina. Figure 1 plots the histograms of the income elasticity results presented in the two above-mentioned papers.

## 2. Broad money demand in Poland

### 2.1. Broad monetary aggregates in Poland

M2 aggregate, composed of cash in circulation outside banks, demand deposits and time deposits of any maturity of private persons and non-financial enterprises used to be the official broad money aggregate of the National Bank of Poland until February 2002. From March 2002 on the National Bank of Poland

shifted to M3 aggregate to meet the ECB monetary statistics requirements and to stay in compliance with the ESCB standards. The differences between M2 and M3 aggregates are not negligible. On the one hand, M3 excludes some of the M2 components, and on the other it comprises subaggregates that were not a part of M2 before:

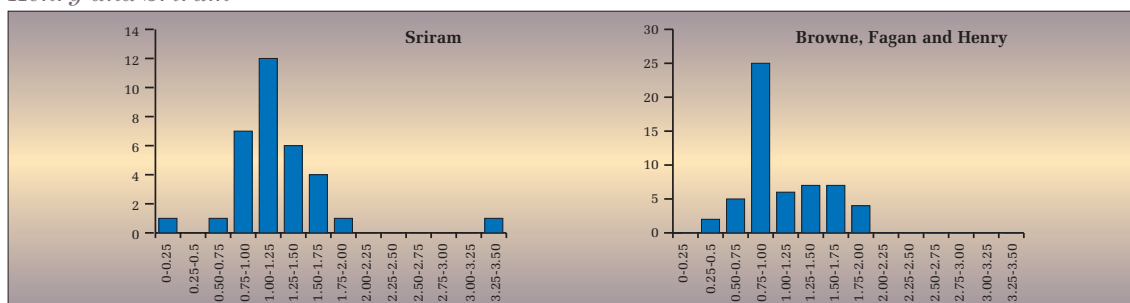
- time deposits with the maturity above 2 years, which were included into M2, are no longer a component of M3,
- deposits of local governments and social security funds are counted into M3, but were not included into M2,
- deposits redeemable at notice up to three months, repurchase agreements and debt securities issued by commercial banks with the maturity below 2 years are M3 components whereas they were not stacked in M2.

National Bank of Poland has estimated backward the M3 monthly series for the period starting from December 1996. The comparison of M2 and M3 developments over the beginning of the period reveals a striking similarity in the monthly rates of growth (see Figure 2). Based on this and possessing the historical data on M2 since 1992 it is possible to produce the estimate of M3 series for the period prior to December 1996 – one has to assume the equality of the monthly rates of growth of M3 and M2. So estimated series of M3 for the period from 1992 on is shown at Figure 3.

The developments of M3 aggregate reveal an interesting pattern. Starting from 2002 the clear upward trend suddenly levels off. The M3 aggregate starts to fluctuate around the level of 320 bln zloty. Some explanation for the slowdown in M3 growth comes from the fall in inflation and weak GDP growth in 2002, but still the most serious reasons are the transition from M2 to M3 combined with the introduction of taxation on interest rates incomes – called the “Belka tax<sup>2</sup>”.

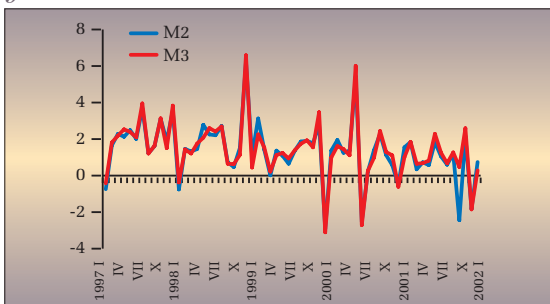
<sup>2</sup> Marek Belka was the Finance Minister in Polish government in 2001. He decided to put the tax on interest incomes.

Figure 1 Histograms of broad money income elasticities reported by Browne, Fagan and Henry and Sriram



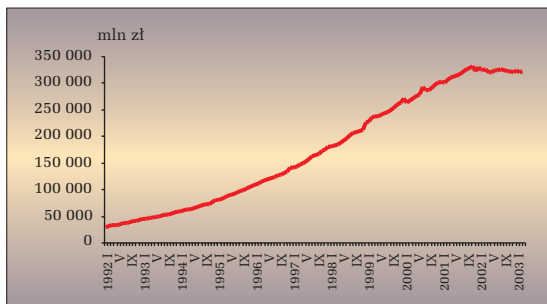
Source: [9], [26].

Figure 2 Comparison of monthly rates of growth of M2 and M3



Source: NBP data and own computations.

Figure 3 M3 series for the period from 1992 to 2003



Source: NBP data and own computations.

The move to tax the interest rate incomes, decided by the government in November 2001 and coming in force since December 2001, triggered sudden changes in the structure of households' financial assets. To avoid the taxation households started setting long-maturities deposits and transferring their savings from banks to investment funds and treasury bonds. The shifts in the structure of deposits were rapid, as there was only less than a month left for settling new "anti-taxation deposit" arrangements. In consequence, much money included into the M2 aggregate before November 2001 flew out of it. Even more came beyond the M3 scope of coverage after its introduction in March 2002. This contributed to the horizontal trend in broad money data. From the economic point of view the "moneyness" of the "anti-taxation deposits" remained the same – the degree of liquidity didn't decrease. With the easy and non-costly redemption from investment funds one can even say that the liquidity increased. Summing up, modelling the broad money developments with the standard M3 aggregate in Poland has many drawbacks that call for correction.

One has two ways to correct for the above-mentioned structural changes. The first is to use dummy variables that would catch the effect. The second is to construct updated M3 series, with the long-maturity deposits, treasury papers held by households and the assets of investment funds added to the M3 stock. Updating the series seems superior to dummifying spurious structural breaks of purely statistical origin.

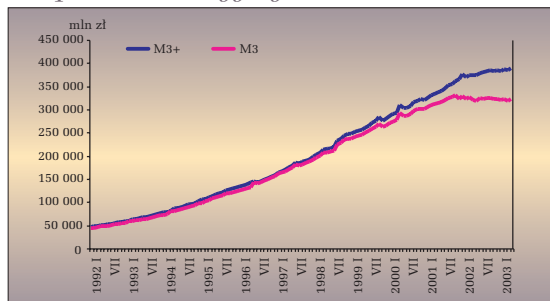
Denote the updated M3 series by M3+. It consists of M3 components plus the commercial banks deposits of maturity above two years, deposits in Savings and Loans Associations<sup>2</sup>, treasury securities and investment funds assets owned by households<sup>3</sup>. The available

estimates of non-bank deposits covered only the period since December 2000. The estimates for the period December 1996 – November 2000 were obtained by prolonging backward the trend of the ratio of the households non-bank deposits to the sum of all their bank deposits. This ratio was only 0.15% in December 1996, so for the period before December 1996 the M3+ series was constructed the same way as the M3 series, i.e. with the use of M2 monthly rates of growth. The M3 and M3+ series comparison is pictured at Figure 4.

2.2. Broad money income elasticity in Poland

Broad money demand models for Poland can be divided into two subgroups, depending on the time period used for estimations. Models estimated on the data from centrally planned economy (until the first years of nineties) have the income elasticities of about 1.5, which is fairly similar to the results for other countries. When estimating the long run broad money income elasticity for Poland in the ECM framework on the quarterly data for period starting in mid-nineties one usually comes up with the results significantly above those for other countries. Estimating a model on the data from periods both before and after the economic regime change in 1990 doesn't make much sense as there is a huge gap between structural

Figure 4 Broad money M3+ aggregate compared to M3 aggregate



Source: NBP data and own computations.

<sup>2</sup> Savings and Loans Associations are the small quasi-banks operating under non-bank law; original Polish name: SKOK – Spółdzielcze Kasy Oszczędnościowo-Kredytowe.

<sup>3</sup> Only the household data was available at proper frequency. Adding the data on investment funds assets and treasury securities owned by corporates would not have significant impact.

relationships in centrally planned and market economies.

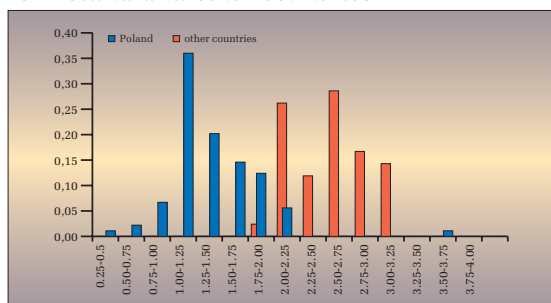
To give a clear picture of the phenomenon the estimations of the following long-run relationships were carried:

- 1a.  $\log(M3r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate$
- 1b.  $\log(M3+r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate$
- 2a.  $\log(M3r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate + \alpha_3 srate$
- 2b.  $\log(M3+r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate + \alpha_3 srate$
- 3a.  $\log(M3r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate + \alpha_3 srate + \alpha_4 CPI$
- 3b.  $\log(M3+r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate + \alpha_3 srate + \alpha_4 CPI$
- 4a.  $\log(M3r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate$
- 4b.  $\log(M3+r) = \alpha_1 \log(pkbsa) + \alpha_2 lrate$
- 5a.  $\log(M3r) = \alpha_1 \log(pkbsa) + \alpha_2 srate$
- 5b.  $\log(M3+r) = \alpha_1 \log(pkbsa) + \alpha_2 srate$

where  $M3r$  and  $M3+r$  denote respectively real M3 and M3+ aggregates deflated with consumer prices index and seasonally adjusted with the moving average method,  $pkbsa$  – a scale variable – GDP in constant prices seasonally adjusted with the moving average method,  $srate$  and  $lrate$  – average interest rates on respectively demand deposits and time deposits in commercial banks,  $CPI$  – annual consumer price inflation. The estimations were carried with OLS and Johansen methods, on the samples ranging from 1995q1 and 1997q2 until 2002q4. Exactly the same computations were performed for private consumption instead of GDP. The order of integration of the  $M3r$ ,  $M3+r$ ,  $pkbsa$ , real and nominal rates and private consumption series was tested with the ADF, showing all the series to be I(1). For all the specifications from 1a to 5b both for GDP and private consumption the cointegration tests suggested the existence of cointegration relationships.

The resulting income elasticities histogram is plotted in Figure 5 along with the histogram for the results reported by Sriram [26] and Browne et al. [9]. It shows clear evidence that the income elasticities for Polish data for the nineties significantly exceed those found elsewhere. It turns out that. The differences may be successfully explained with the help of the developments of monetization.

Figure 5 *Broad money income elasticities for Poland and other countries*



Source: [9], [26] and own computations.

### 2.3. Monetization in Poland compared to other countries

Monetization is usually defined as the share of broad money to GDP and as such may be interpreted as an amount of money necessary to “serve” all the economic activities in a country. Since the money can be characterized as a stock and GDP as a flow, an integration of GDP over a specified period is necessary to compute the monetization properly. This period is usually set as a year. Hence, the quarterly monetization can be derived according to the formula:

$$Monet_t = \frac{M_t}{\sum_{s=t-3}^t GDP_s} \quad (3)$$

where  $Monet_t$  denotes the quarter  $t$  monetization,  $M_t$  is the money stock at quarter  $t$  and  $GDP_s$  stands for the GDP at quarter  $s$ . Following the equation (3) the broad money monetization in the years 2001 and 2002 was computed for some European countries and Russia<sup>4</sup>. The results are presented in Table 1. A relationship between the economic development and the monetization can be drawn from this table – the more developed the country, the higher the monetization. Advanced countries, such as the euro zone or Great Britain, record the monetization of about 70%, whereas in Russia, Ukraine or Lithuania it is below 30%. Poland, with the monetization 49%<sup>5</sup>, is half way in between.

Interesting conclusions stem from the analysis of the monetization developments over time. Figure 6 below plots the monetization for Poland, Hungary and Czech Republic for a few last years. The monetization in Hungary remained on a reasonably stable level of about 45% over the period. The monetization in Czech Republic, the highest in the three countries, reversed after a period of decline and has been slowly increasing since 1998. The upward trend of monetization is the most apparent in Poland – the monetization has risen from about 35% in 1995 to almost 50% in 2002. Most probably, the Polish monetization increase results from the increase in the wealth level, which is reflected in the growth of financial assets overtaking the growth of GDP, and also from the strong need for money going along with the development of the economy. The change in social patterns, enabling the money to play more its transaction and store of value roles also contributes to the process. Finally, as the confidence in the domestic currency and the banking system strengthens, the foreign currency held indoor is being exchanged to zloty or deposited in the banks, so it becomes visible to the official monetary statistics. The quantity of broad money in relation to GDP in Poland is still lower than in the euro zone, so the monetization increase can be also interpreted in terms of the convergence process.

<sup>4</sup> Official broad monetary aggregates were used.

<sup>5</sup> In Polish case the monetization was computed for the M3 broad money.

Tabela 1 *Broad money monetization in some countries*

Country	Period	Monetization	Country	Period	Monetization
Hangary	2001	46%	Ukraine	2001	22%
Czech Republic	2001	73%	Russia	2002	27%
Poland	2002	49%	Eurozone	2001	79%
Lithuania	2002	29%	Great Britain	2001	65%

Source: Central banks websites and IFS database.

As shown further, the changes in the monetization may successfully contribute to the money demand modelling.

#### 2.4. Monetization-augmented money demand function

##### 2.4.1 Monetization trend

Analysing the monetization across countries one can expect that the rate of monetization increase in Poland will diminish as the economy approaches the target saturation with money. Therefore applying a logistic curve to model the monetization trend in Poland seems reasonable. The logistic trend of monetization is of the following form:

$$\text{Monet}_t = \frac{\alpha}{1 + \beta e^{-\gamma t}} + c + \varepsilon \quad (4)$$

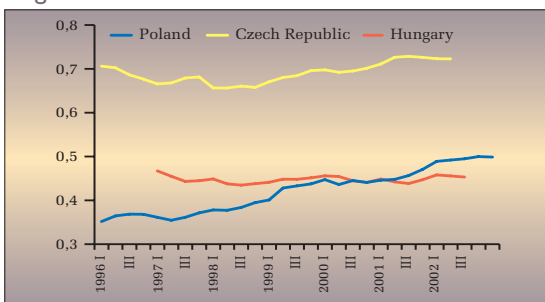
where  $\alpha$ ,  $\beta$  and  $\gamma$  are the coefficients,  $t$  stands for time and  $\varepsilon$  is an error term. Because

$$\lim_{t \rightarrow +\infty} \frac{\alpha}{1 + \beta e^{-\gamma t}} = \alpha \text{ and } \lim_{t \rightarrow -\infty} \frac{\alpha}{1 + \beta e^{-\gamma t}} = 0, \quad (5)$$

$c$  may be interpreted as the starting and  $c + \alpha$  as the target level of money saturation. Estimating equation (4) on Polish data with standard OLS gives the following parameters:

$$\alpha = 0.189379, \beta = 31.13976, \gamma = 0.146441, c = 0.338869.$$

Hence, the target broad money monetization in Poland is about 53%. This is well visible at figure 7.

Figure 6 *Monetization over time*

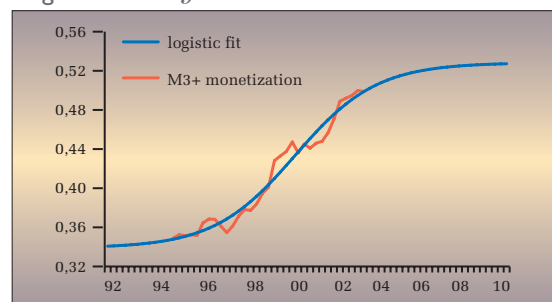
Source: Central banks websites and IFS database.

The estimated Polish target monetization stays below the current figures for the euro zone. It is possible to assume the equality of Polish and euro zone monetizations by incorporating necessary restrictions in the model. However, this was not done due to the significant structural differences in the Polish and euro zone economies. Besides, allowing for the non-horizontal trend in the euro zone M3 velocity developments [10], the today's euro monetization may not be necessarily touching the final equilibrium. Above all, the lower monetization for Poland seems plausible.

##### 2.4.2. Money demand equation

Applying the logistic trend of monetization estimated in the previous subsection in the broad money demand equation for Poland leads to the income elasticity which is close to the results reported in numerous empirical studies for other countries and which stays in reasonable accordance with the economic theory.

For the estimation of the broad money demand the ECM econometric framework was applied. The specification followed the equation (2), augmented with the monetization trend. GDP in real terms served as a scale variable, whereas many combinations of real and nominal interest rates were tested as proxies for the alternative costs. The estimations were performed with the Philips-Hansen FM-OLS method, on the quarterly data ranging from 1995q1 and 1997q2 until 2002q4.

Figure 7 *Logistic fit to Polish monetization*

Source: own calculations

Finally, the following long-run relationship has been considered to be the best:

$$\log(M3+r) = 1.19 \log(pkbsa) - 0.00145 lrater + 2.478 \logist2 - 0.8 \quad (6)$$

where *logist2* denotes the logistic trend of monetization, and the remaining notation is the same as presented in the section 2.2. Long-run income elasticity of the broad money M3+ equals 1.19, very similar to the values presented in [9] and [26]. Including *logist2* in the equation (6) *de facto* allows the income elasticity to change over time. It is diminishing to its limit value of 1.19. By adding the logistic trend one can split the income elasticity into two components: the persistent one equal 1.19, which is stable over time, and transitory one gradually decreasing to zero along with the decline of the growth rate of logistic curve. So the  $2.478 \logist2$  component of the equation (6) describes the convergence process of the monetization to the saturation level – this has an impact on the rate of growth of the money exceeding that of GDP, but the gap between the growth rates is closing as the first derivative of the logistic function approaches zero.

The relationship between the money and real long interest rates<sup>6</sup> is negative. Although at first glance it may seem counterintuitive, the negative sign for the long rates semielasticity in broad money demand is acceptable. The higher the rates, the lower the demand for credits, so the broad money increase ceases. The magnitude of the semielasticity, which is very small, says that the impact of the rates on the money is weak.

Short-run equation, obtained with the general to specific approach, is following:

$$\begin{aligned} d\log(M3+r) = & \\ = & -0.35(\log(M3 + r(-1)) - 1.19\log(pkbsa(-1)) + \\ & 0.00145lrater(-1) - 2.478\logist2(-1) + 0.8) + 0.467d\log(M3 \\ & + r(-1)) + 0.99d\log(pkbsa) - 0.016d(srater) - 0.545d(CPI) \\ & + 0.378d(CPI(-1)). \end{aligned} \quad (7)$$

The notation remains the same as in subsection

<sup>6</sup> As mentioned before, with *lrater* variable the long interest rates are proxied by the average rate paid by the commercial banks on time deposits

2.2. The estimation period started in 1995q2. All explanatory variables turned out to be significant at the 1% significance level. The test statistics were as follows:  $R^2=56.2\%$ ,  $DW=2.48$ ,  $JB=0.49$  (p-value=78%), autocorrelation of error terms was not significant and the stability test proved satisfactory.

The significance of the error correction term in the short-run equation confirms that the ECM approach was a proper one. The short-run dynamics is quite modest, but keeping in mind the short length of Polish time series it is not a reason for concern.

## Conclusions

The paper proposes a modification of a standard money demand specification to take into account the upward trending of the monetization in Poland. With that modification estimated broad money demand function has an acceptable magnitude of broad money income elasticity.

Analysis of broad money developments in Poland encounters some problems stemming from the structural changes in monetary aggregates. The source for it was the Belka tax introduction and subsequent change in the central bank official monetary measure from M2 to M3. In the paper a new M3+ aggregate is proposed that is much less affected by the problems just mentioned. Modelling broad money becomes more feasible with the M3+ aggregate.

Money models are usually based on long series covering tens of years. For Poland and other transition economies of central and eastern Europe this length of data series is unavailable. Linking the series dating from the centrally planned economy period with that of nowadays does not seem to make much sense as the organisation and structure of the two types of economy are very different. This paper makes an attempt to build only on the contemporary data. Probably with the improvement in the data availability, for instance by lengthening the series, more insightful research will be possible.

Modelling money is not crucial for the monetary policy in Poland, as the framework adopted by the National Bank of Poland is the Direct Inflation Targeting. But still money models may prove useful in assessing the pressures underlying inflation.

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