THE DETERMINANTS OF MONEY DEMAND IN CROATIA AND SIMULATION OF THE POST-STABILIZATION PERIOD

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1. Introduction

Initial disinflationary success of the first phase of Croatian Government's stabilization program is reflected in disconnection of hyperinflationary links between monetary expansion and inflation. Consequently, it lead to tremendous increase in demand for domestic money. Croatian monetary authorities are faced with a dilemma whether to remonetize the national economy rapidly and fully meet the given level of demand for domestic currency or to approach this problem step by step and remonetize carefully. Obviously, the optimal strategy depends upon the direction and dynamics of demand for money in Croatia. The focus of this paper is analysis of determinants of demand for money in Croatia in period January 1991 - November 1993. Econometric estimation of the money demand function for that period serves as a basis for simulation of real money demand for the period of December 1993 - May 1994 and recommendations for conducting monetary policy by the end of May 1994 - when a new Croatian currency - Kuna - is to be introduced.

The importance of monitoring, estimating and forecasting the demand for money throughout the world is easily illustrated by a fact that in 1990-1993 period only in economic literature a 1000 journal articles, books and Ph.D. dissertations in the field of money demand have been published. This figure comprises journal and university publications regularly updated by the **Journal of Economic Literature.** Strong interest of economists in this subject is not surprising having in mind that the field of money demand provides abundance of theoretical and applicative segments still to be studied. Since this paper is the first attempt to study the demand for money in Croatia, one of its objectives is to initiate and stimulate further research in this field in Croatia.

For this purpose, the second chapter presents rather extensive overview of money demand theory, links between money demand and consumption, and results of previous empirical studies of money demand functions. In the same chapter a specification of money demand function in conditions of high inflation and currency substitution is derived. Third chapter shows the results of econometric estimation of money demand function in Croatia. In chapter four real money demand is simulated for the following six months. Special thanks go to my colleagues at Ekonomski Institut - Zagreb, Željko Rohatinski and Velimir Šonje for useful comments and suggestions.

2. Money demand theory

2.1. Money demand from classics to Keynes

The demand for money was one of the central issues in the keynesian-monetarist debate. According to monetarist school of thought, the money demand function (M_d) follows from velocity identity (V=PY/M):

$$\mathbf{M_d = k\ P\ Y} \qquad (1)$$

where k=1/V. The key monetarist assumption of constant velocity had its roots in observing the actual data, largely the long-run (annual) time series. If nominal income (PY) is accepted as a measure of total transactions in the economy, equation (1) states that demand for money changes proportionally with value of transactions. Furthermore, equation (1) implies unit price and income elasticity of nominal money demand. It follows that

$$\mathbf{M_d / P = kY} \qquad (2)$$

According to monetarist theory, real demand for money depends exclusively on real income in the economy. Increase in prices if fully matched by increase in nominal money demand.

Keynes (1936) introduces the speculative component of money demand, M_L, along with the transaction component in the classical concept of money demand. The speculative component of money demand is represented by liquidity preference schedule, L, which depends negatively upon the nominal interest rate, i:

$$\mathbf{M_L = L(i)} \quad \text{with} \quad \partial\mathbf{L}/\partial\mathbf{i} \prec \mathbf{0}$$

Total nominal money demand is the sum of transaction and speculative components:

$$\mathbf{M_d} = \mathbf{k\,P\,Y} + \mathbf{L(i)} \tag{3}$$

Introduction of speculative component substantially changes the classical theory results and interpretations. Firstly, real money demand ceases to be a fixed proportion of real income even in case of constant velocity:

$$\mathbf{M_d/P} = \mathbf{k\,Y} + \mathbf{L(i)/P} \tag{4}$$

Furthermore, the term L(i)/P indicates that real money demand need not be independent of the price level.[1] From (3) it follows that income and price elasticity of nominal money demand need not be either unitary or constant. Due to speculative component, the velocity parameter becomes dependent on interest rate, price level and real income, which does not exclude a case for its constant value in particular time period. In general form, the real money demand equation may be expressed as

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[1] *If it is assumed that the liquidity preference L(i) is of the linear form, $L(i)=L_o$- mi, where L_o denotes autonomous liquidity preference and m marginal liquidity preference with respect to nominal interest rate (m is greater then 0), it follows that L(i)/P=LR_o-mr, where LR_o denotes autonomous real liquidity preference and r real interest rate in form of r=i/P. This is the only case when the real money demand is independent of the price level, which is in the economic literature often labeled as the absence of "money illusion' (Patinkin, 1965, Evans, 1969, Gapinski, 1982). Generally, the shape of the liquidity preference function can not be restricted to linearity, which imposes no restriction on 'money illusion", i.e. L(i)/P=f(i,P), or in dynamic form L(i)/P=f(i, π), where π denotes the inflation rate.*

$$M_d / P = f(Y, i, \pi) \quad (5)$$

without prior restrictions on "money illusion" or

$$M_d / P = f(Y, i) \quad (6)$$

as a special case under prior assumption of absence of "money illusion". Money demand functions such as (5) or (6) are in the literature often labeled as traditional or standard money demand functions.

Prior to collapse of the Bretton-Woods agreement, the traditional money demand functions attained favorable results in estimating and monitoring long-run and short-run money demand. However, in the last two decades the traditional money demand functions have featured high unreliability in estimating, and, particularly forecasting the demand for money (Judd and Scadding, 1982). Shortcomings exhibited by traditional specifications are:

1. Traditional money demand functions do not fully reveal the preferences of economic subjects for holding money; how the development of financial and, particularly, foreign exchange markets affects money holdings; how economic subjects react to high inflation and which is the desired liquidity level (desired money stock) under conditions of domestic currency substitution and high inflation.
2. By assuming equilibrium condition in the money market and proportionality between money demand and desired level of money holdings, the traditional money demand functions imply instantaneous adjustment of money supply to any level of money demand and desired money holdings (if monetary policy is accommodating) or instantaneous adjustment of money demand to any level of money supply. In reality, particularly in short periods such as one month, high flexibility of either actual or desired money stock can hardly be expected. Short-run

equilibrium in the money market is more likely to be an exception rather than a rule.

3. Since the traditional money demand functions were designed primarily for estimating and forecasting the demand for money in the USA, their specification generally neglect the influence of foreign trade variables (such as the exchange rates, volume and structure of transactions, etc.) on demand for domestic money in the short and long run.

The analysis of demand for money in Croatia should not omit either of three mentioned shortcomings of the traditional money demand functions. Since modern theories of money demand supported by numerous empirical studies have tackled majority of shortcomings, it is necessary to review them, establish to which extent they describe the present state of the Croatian economy and financial system, and determine their applicability to estimating money demand function in Croatia.

2.2. Desired level of money holdings - motives, mechanisms and theories

Every individual and household draws utility from consumption. Higher level of consumption implies higher level of utility. If an individual chooses to save a portion of his current income, he lowers his current but increases his future consumption. If it is assumed that the time horizon consists of two periods, an individual's objective is to maximize utility which is a function of real consumption in the first period (C_1) and real consumption in the second period (C_2):[2]

[2] *The following presentation of interimporal optimization of consumption in presence of domestic money and bonds follows Sachs and Larraine (1993) and partly Blanchard and Fischer (1991). Their presentation, however, neglects the currency substitution option, i. e. the presence of foreign currency as commonly used financial mean in the domestic market.*

$$\max U(C_1, C_2)$$

It is assumed that an individual earns nominal incomes P_1Y_1 and P_2Y_2 at the beginning of each period. Incomes may be consumed or held in form of money (M) or interest-earning bonds (B).[3] Furthermore, it is assumed that at the beginning of period 1 an individual holds neither money nor bonds and that all financial sources are to be spent by the end of period 2. In period 1 nominal consumption is determined by:

$$P_1C_1 = P_1Y_1 - (B_1 + M_1) \qquad (7)$$

where P_1 denotes price level in period 1, C_1 and Y_1 real consumption and real income, and B_1 and M_1 nominal investment in bonds and nominal money holdings in period 1. In the next period, nominal consumption is given by:

$$P_2C_2 = P_2Y_2 + (1+i)\,B_1 + M_1 \qquad (8)$$

where P_2 stands for the price level in period 2, and i for nominal interest rate. Equation (8) can also be expressed as:

$$P_2C_2 = P_2Y_2 + (1+i)\,(B_1 + M_1) - iM_1 \qquad (9)$$

Substituting (7) into (9) for B_1+M_1, dividing the result by P_1, and expressing $P_2 / P_1 = (1+\pi)$, where π denotes the inflation rate, and $(1+i)/(1+\pi)=(1+r)$, where r denotes real interest rate, leads to intertemporal budget constraint for individual's (household's) consumption:

$$C_1 + C_2/(1+r) = Y_1 + Y_2/(1+r) - i(M_1/P_1)/(1+i) \qquad (10)$$

For every nonzero interest rate, any level of money holding induces a decline in total potential consumption. Since the first derivative of total

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[3] *For simplicity we assume absence of taxes and direct investment by individuals.*

consumption with respect to nominal interest rate is negative, it can be concluded that the cost of holding money (in terms of real consumption) rises with the interest rate. From a standpoint of a consumption maximizing individual, the optimal cash holdings are equal to zero. Why then individuals do hold money at all? The answer lies in the factors that induced development of money - lowering of high transaction costs immanent to the barter system. In modern financial systems the share of cash transactions has been diminishing a fact that reduces, but not fully eliminates, the necessity of holding cash. Analysis of financial transactions costs is the focus of the most popular theory of money demand, the Baumol-Tobin theory.[4]

Initial proposition of the Baumol-Tobin theory of money demand is that an individual maintains a certain level of "money inventory" in the same fashion as firms maintain a certain level of goods inventories. At every point the individuals hold a portion of their income in form of (non-interest earning) money in order to easily perform transactions in the goods market. The rest of the income is held in form of interest-earning bonds. If individuals maintain high level of liquidity, they suffer a substantial interest loss; if they maintain low liquidity level, they pay a "brokerage fee" for bond-money conversion every time they fall short of money.

By assumptions of the Baumol-Tobin model, the income is automatically stored into bonds, while transactions payments can be done only by money, and not by bonds.[5] Furthermore, it is assumed that consumption expenditures are uniformly distributed within a period. Before making a transaction, an individual has to convert a share of bonds into money.

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[4] *Their inventory approach to money demand was presented in two separate papers, Baumol (1952) and Tobin (1956).*

[5] *Under the term "bonds" a reader may also understand the individual's savings account.*

For every conversion service a fixed "brokerage fee", Pb, is charged where P stands for a price level and b for real fixed brokerage fee per conversions.[6]

At the beginning of a period, an individual decides to withdraw (convert) M^* of money, which is then linearly spent on transactions. When liquidity reaches zero or falls below a threshold, M^* is again withdrawn from bonds. Since transactions are uniformly distributed throughout period, the amount converted (withdrawn) is always M^*. If by PY we denote nominal income earned during a period, the total number of withdrawals equals PY/M^*. With respect to linear spending assumption, the average money stock for the whole period is $M^*/2$ regardless of the number of withdrawals.

The optimal amount of withdrawing is obtained by minimizing all costs related to particular level of liquidity. On one hand, average money holdings of $M^*/2$ produces the opportunity cost (OT) in terms of interest foregone:

$$\mathbf{OT} = \mathbf{(M^* / 2)}\ i \tag{11}$$

On the other hand, transaction cost (TT), incurred for every conversion (withdrawal), for total number of withdrawals equals

$$\mathbf{TT} = \mathbf{Pb\ (PY / M^*)} \tag{12}$$

The transaction cost is a declining function in M^* in which price level, real brokerage fee and real income determine the curvature. Since the marginal transaction cost rises with M^* (larger M^* implies fewer visits to a bank or a broker which increases the marginal cost of every next visit), the TT schedule has a shape of a rectangular hyperbola.

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[6] *If money is withdrawn from a savings account, the conversion cost comprises rime and money spent on going to a bank.*

Total cost of withdrawing money (UT) in the Baumol-Tobin model is the sum of both costs:

$$\mathbf{UT} = (\mathbf{M}^{*}/2)\mathbf{i} + \mathbf{Pb}(\mathbf{PY}/\mathbf{M}^{*}) \tag{13}$$

It follows that the optimum amount of withdrawing nominal money is:

$$\mathbf{M}^{*} = \mathbf{P}\sqrt{(2\mathbf{bY})/\mathbf{i}} \tag{14}$$

Since money demand (Md) is commonly identified with average money holdings (average level of liquidity)

$$\mathbf{M}_{d} = \mathbf{M}^{*}/2 = \mathbf{P}/2\sqrt{(2\mathbf{bY})/\mathbf{i}} \tag{15}$$

The Baumol-Tobin theory of money demand implies a unit price elasticity of money demand. Therefore, (15) can be expressed as:

$$\mathbf{M}_{d}/\mathbf{P} = 1/2\sqrt{(2\mathbf{bY})/\mathbf{i}} \tag{16}$$

The Baumol-Tobin theory thus implies absence of money illusion in the same manner as the traditional specifications. However, unlike the traditional money specifications, in Baumol-Tobin theory the income elasticity of money demand equals 0.5 and interest elasticity -0.5. The inelasticity of real money demand with respect to income is explained by higher level of rationalization and innovations in money management at higher levels of income. Similarly, the elasticity of real money demand with respect to real brokerage fee is 0.5 and in original Baumol's version considered to be constant.

2.3. Desired level of liquidity under high inflation and domestic currency substitution

The following discussion considers the theoretical basis for specification and economic estimation of money demand in the Republic of Croatia. The period under observation comprises the pre-stabilization months and

October 1993 with high inflation rates, and November 1993 in which the first disinflationary effects of the stabilization program have been witnessed.

The Baumol-Tobin theory of money demand has tackled only the first of three shortcomings of traditional theories - analysis of motives for holding money and determination of desired level of liquidity. When applied to high inflation countries, in which the flee from domestic currency is more severe than predicted by the model, the other shortcomings of the Baumol-Tobin theory appear as a very strong constraint. A part of problem lies in the fact that in high inflation countries nominal variables change substantially within a single period of time (i.e. one month). Furthermore, in such countries the advantages of holding foreign exchange and foreign interest-earning bonds (including savings accounts abroad) rise with the inflation rate. The objective of this chapter is to incorporate these elements in presented theories of holding money and money demand in order to be applicable to high inflation countries.

The first step is to determine how money, inflation and the exchange rate affect intertemporal structure of consumption in high inflation countries.

Along with assumptions behind expression (10), we impose the assumption that individuals can at any time convert domestic money (M) into foreign exchange (FC) at going exchange rate. Nominal consumption in the first period is a difference between nominal income and financial investment including domestic money:

$$\mathbf{P_1C_1 = P_1Y_1 - (B_1 + M_1 + E_1\, FC_1)} \qquad (17)$$

where FC, denotes value of purchased foreign exchange in period 1, and E_1 the corresponding exchange rate. Similar to other financial variables in equation (7), it is assumed that individual's foreign exchange savings at the beginning of period 1 were zero. Consumption in period 2 is financed by current income and total savings in period 1:

$$\mathbf{P_2C_2 = P_2Y_2 + (1+i_1)\,B_1 + M_1 + E_2\,FC_1} \tag{18}$$

where i, denotes nominal interest rate on deposits in period 1. Second period nominal variables are deflated by implicit price deflator P_2/P_1 (or equivalently, $1+\pi$), i.e. expressed in first period prices:

$$\mathbf{P_1C_2 = P_1Y_2+((1+i_1)/(1+\pi))B_1+(1/(1+\pi))M_1+(E_2/(1+\pi))FC_1} \tag{19}$$

Summation of equations 17 and 19 gives:

$$\mathbf{P_1(C_1+C_2) = P_1(Y_1+Y_2)+FC_1E_1(\frac{1+e}{1+\pi}-1)+B_1(\frac{1+i_1}{1+\pi}-1)+M_1(\frac{1}{1+\pi}-1)} \tag{20}$$

which is the intertemporal budget constraint in constant (first period) prices. Parameter a denotes the rate of change of nominal exchange rate, $e=E_2/E_1-1$. Alternatively, the expression can be divided by P_1 in order to obtain the intertemporal budget constraint in real terms:

$$\mathbf{(C_1+C_2) = (Y_1+Y_2)+FC_1\frac{E_1}{P_1}(\frac{1+e}{1+\pi}-1)+\frac{B_1}{P_1}(\frac{1+i_1}{1+\pi}-1)+\frac{M_1}{P_1}(\frac{1}{1+\pi}-1)} \tag{21}$$

which emphasizes that total real consumption depends on total real income, but also upon the first-period levels of real exchange rate index (E_1/P_1), real bonds and real money. The first two parenthesis represent the chain index of real exchange rate and chain index of real interest rate, respectively.[7] Parameter with real money attains a negative value for every non-zero rate of inflation, which indicates that under high inflation holding domestic money negatively affects real total consumption. Expression $((1+e)/(1+\pi)-1)$ takes a positive sign in case of real effective depreciation of domestic currency. Expression $((1+i_1)/(1+\pi)-1)$ is probably the most interesting part of equation (21).

[7] *Zero inflation rate in partner countries is assumed.*

From an individual's standpoint, a relevant real interest rate includes the nominal interest rate from previous period rather than current period. It implies that under increasing inflation rate this expression is not likely to have a positive sign. The uncertainty regarding the positive return on domestic interest-earning financial means requires a larger positive margin than one on foreign exchange. Consequently, in conditions of high inflation, floating exchange rate and free access to foreign exchange market, the flee of domestic money into foreign exchange and "bonds" is likely to be a rule regardless of attractiveness of domestic deposit interest rates. By contrast, the attractiveness of holding domestic money increases in deflationary conditions in relation with prevailing exchange rate and interest rate policies.

The broader version of the intertemporal budget constraint in consumption provides an initial insight in formation of individual's financial choice in Croatia in period after announcement of October stabilization program. The response of rational consumers to relatively high real appreciation of Croatian Dinar (due to nominal exchange rate decline) was to sell foreign exchange. Initial inflation due to exchange rate depreciation in October was followed by temporary price stability. In this short period the most profitable financial decision had probably been to save domestic currency, which was destimulated by introduction of interest income tax. The following deflation had given additional boost to money demand in Croatia.

Existence of foreign exchange as (easily accessible) alternative financial asset in individual's portfolio substantially changes the concept of the opportunity cost of holding domestic money. The slope of the opportunity cost line now depends on combination of rates of return on two financial assets - nominal interest rate and the rate of change of the nominal exchange rate:

$$\mathbf{OT} = \phi(\mathbf{i,e})\ (\mathbf{M^{*}/2}) \qquad (22)$$

On the other hand, high inflation within a unit period of time may cause a significant distortion in relative price of the brokerage fee incomparison with nominal income. The distortion is due to nonsynchronized timing of accounting income compensation and the brokerage fee - nominal income is paid out at the beginning of the period in prices P_o, while the brokerage fee is charged with each transaction in prices higher than at the beginning of the period. In that case, the transaction cost can be expressed in average period prices P' (while in high inflation $P^* \succ P_o$) as:

$$TT = P^* b \frac{P_0 Y}{M^*} = P^* b \frac{P^* Y}{P^*/P_0 M^*} = P^* b \frac{P^* Y}{(1+\pi)^{š} M^*} \qquad (23)$$

$0 \preceq Š \preceq 1$, where Š represents the degree of indexation of unit transaction cost within a unit period of time. The total cost of money conversion is in this case:

$$UT = \phi(i,e)\ (M^*/2) + \frac{1}{(1+\pi)^{š}}\ P^* b \frac{P^* Y}{M^*} \qquad (24)$$

and M^* for which total cost function is minimized:

$$M^* = P^* \sqrt{(2\ b\ y) / \ ((1+\pi)^{š}\ \phi(i.e))} \qquad (25)$$

Consequently, demand for real money in an open economy with high inflation can be expressed as:

$$M_d = P^* = M^* / (2P^*) = 1/2 \sqrt{(2\ b\ y) / \ ((1+\pi)^{š}\ \phi(i.e))} \qquad (26)$$

As in the Baumol-Tobin version (equation 16), the demand for real money depends positively on real income, real brokerage fee and negatively on nominal interest rate. By contrast to that model, the rate of inflation provides a negative impact on demand for real money. This modification might also be labeled as a general form of the money demand function - the case of zero degree of indexation (Š=0) replicates the Baumol-Tobin version. In other words, expression (26) presets no restriction upon appearance of "money illusion".

Presence or absence of "money illusion" has to be empirically tested in every case study.

The shape and structure of the opportunity cost in an open economy (in 26 expressed in functional form $\phi(i,e)$) has been the object of polemics in the economic literature. Some authors emphasize the importance of interest rates abroad and/or exchange rates in determining the money demand not only in small open economies but also in a country such as the USA. Arango and Nadiri (1981) include the nominal interest rate and real effective exchange rate in their specification of money demand. While they expect a negative sign with the interest rate variable, with real effective exchange rate they allow for both positive and negative sign. A possibility of positive relationship between real money demand and real effective exchange rate the authors base on assumption that individuals evaluate their portfolios in domestic currency. In that case a depreciation of domestic currency increases the value of domestically held foreign bonds and decreases the value (in domicile currency) of domestic bonds held abroad. At the same time, it induces broadening of domestic monetary base, reduction of domestic interest rates and an increase in money demand. A case of negative relationship is explained by far simpler mechanism depreciation of domestic currency stipulates expectations of further future depreciation which leads individuals to demand more foreign exchange and less domestic currency. A positive relationship is empirically established for low-inflation countries such as USA, Japan and Canada (Bahmani-Oskooee i Pourheydarian, 1990). For open economies with high inflation a negative relationship between exchange rate and money demand (currency substitution hypothesis) makes much more sense. Hypothesis of negative impact of currency substitution on demand for domestic money under high inflation has been investigated by Blejer (1978), Abel et al. (1979), and, recently, Taylor (1991), and Phylaktis and Taylor (1993).[8] In their studies they

provide empirical evidence of currency substitution hypothesis and also find that inflation rate has significant dominance over return on foreign exchange (exchange rate) in the money demand function.

2.4. The mechanism of partial adjustment of money aggregates

The most severe problem in analysis of money demand is the identification problem. What is the size of demand for money and which statistical publication provides the corresponding data? Changes in monetary aggregates such as cash, base money, M1, M2, etc. may be caused, at least in the short run, by demand side factors but also by supply side factors. A monetary analyst, however, has at his disposal only information regarding the level of certain monetary aggregate but not a measure of eventual short-run disequilibrium between money demand and money supply. Since the short-run disequilibrium can not be established on the same data set due to identification problem, it is assumed that disequilibrium results from inertia in the speed of adjustment of actual money stock to its "desired" level.

"Equilibrium theories" of money demand capture the long-run dynamics in the money market. Establishing the short-run dynamics and factors affecting the demand for money is often done by specifying the partial adjustment mechanism (PAM). According to Hwang (1985), actual money stock adjusts to its desired level gradually. The adjustment process is motivated by minimizing costs that occur in the state of disequilibrium. Total cost of adjustment consists of disequilibrium cost and adjustment cost. Disequilibrium cost, TN, is a function of difference between actual and desired money holdings:

[8] *The analytical framework in these studies was Cagan's hyperinflationary model of money demand (Cagan, 1956). Most authors used the actual black-market exchange rate as the relevant variable.*

$$\mathbf{TN} = \mathbf{f}[\mathbf{ln(M^*_t/P_t) - ln(M_t/P_t)}] \qquad (27)$$

where M^* denotes desired money stock, M_t actual money stock, and P_t price level. Expression (27) can be rewritten as:

$$\mathbf{TN = f[ln\ M^*_t - ln\ M_t]} \qquad (28)$$

indicating that disequilibrium cost is identical for both nominal and real levels of money aggregates.

Adjustment cost, TP, occurs with either expansion or contraction of money stock in the current period. If adjustment is performed in nominal terms:

$$\mathbf{TP_N = g_N\ [ln\ M_t - ln\ M_{t-1}]} \qquad (29)$$

the cost of adjustment is a function of the rate of change of **nominal** money stock. By contrast, the cost of adjustment of real money stock

$$\mathbf{TP_R = g_R\ [ln(M_t/P_t) - ln(M_{t-1}/P_{t-1})] =}$$
$$\mathbf{= g_R\ [(ln\ M_t - ln\ M_{t-1}) - (ln\ P_t - ln\ P_{t-1})]} \qquad (30)$$

is a function of the rate of change real money. Nominal adjustment hypothesis states that the adjustment cost occurs when individuals "actively" change their level of money holdings. The rate of inflation does not induce a "passive" cost under nominal adjustment hypothesis. By contrast, the model of real adjustment implies that individuals adjust their real money holdings. Since real money stock changes are caused either by changes in nominal money stock or by the inflation rate, emerging cost of adjustment comprises both active and passive components.[9]

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[9] *If an individual manages to eliminate the passive cost of adjustment (i.e. keeps the real money stock constant) by active adjustment of nominal money holdings, the total adjustment cost in the real adjustment model will be zero. Many authors label this model outcome as a paradox. Literature on theoretical difference and empirical evidence between nominal and real PAM is extensive. I refer the interested reader to*

A general specification of the adjustment cost nests both cases:

$$\mathbf{TP} = \mathbf{g}\,[(\ln \mathbf{M_t} - \mathbf{ln\ M_{t-1}}) - \delta\,(\mathbf{ln\ P_t} - \mathbf{ln}\ P_{t-1})] \qquad (31)$$

where δ denoted the relative weight of the passive component of the adjustment cost. Parameter δ takes value $\delta=0$ for nominal PAM (equation 29), $\delta=1$ for real PAM (equation 30) while its value of $0<\delta<1$ implies a combination of the two.

Total cost of adjustment, UTP, is a sum of disequilibrium cost (28) and adjustment cost (31):

$$\mathbf{UTP = f[ln\ M^*_t - ln\ M_t] + g[(ln\ M_t - ln\ M_{t-1}) - \delta\,(ln\ P_t\ ln\ P_{t-1})]} \qquad (32)$$

In order to specify the functional forms f and g it is assumed that components of the total cost are positive symmetric functions (in case of disequilibrium cost it implies $TN=f|\ln M^*_t-\ln M_t|$) and that larger disequilibrium and/or adjustment generate larger unit cost. Therefore, UTP is commonly expressed as a quadratic function in both costs (Hwang, 1985):

$$\mathbf{UTP} = \alpha_1[\ln \mathbf{M^*_t} - \mathbf{ln\ M_t}]^2 + \alpha_2[(\ln \mathbf{M_t}\text{-}\mathbf{ln\ M_{t-1}}) - \delta(\mathbf{ln\ P_t}\text{-}\mathbf{ln}\ P_{t-1})]^2 \qquad (33)$$

where α, and α_2 represent the relative weights of corresponding UTP components.[10] Minimizing UTP with respect to M_t gives:

$$\ln \mathbf{M_t}\text{-}\ln M_{t-1} = \beta_1\,(\ln M^*_t - \ln M_{t-1}) + \beta_2\,(\ln P_t - \ln P_{t-1}) \qquad (34)$$

where $\beta_1=\alpha_1/(\alpha_1+\alpha_2)$ stands for the weight of the disequilibrium cost in UTP and $(\beta_2=\alpha_2\delta/(\alpha_1+\alpha_2)=\delta(1-\beta_1)$ represents the cross-product of adjustment cost's weight and the weight of its passive component.

Goldfeld and Sichel (1990), Fair (1987), Gupta and Moazzami (1990), Hetzel (1984), Melbourne (1983) and Hwang (1985).

[10] *Not necessarily a linear combination.*

Equation (34) is a general form of PAM which can also be expressed in real terms:[11]

$$\mathbf{In\ m_t = \beta_1\ In\ m^*_t + (1\text{-}\beta_1)\ In\ m_{t-1} - (1\text{-}\delta)(1\text{-}\beta_1)\ In\ (1+\pi_1)} \qquad (35)$$

where the small letters demote the real levels, $m_t=M_t/P_t$, $m^*_t=M^*_t/P_t$, (In P_t - In P_{t-1})=In (1 $+\pi_t$), and n the inflation rate.

Desired money stock is determined by (25) which can be expressed in log form as:

$$\mathbf{In\ m^*t = \gamma_0 + \gamma_1\ In\ y_t - \gamma_2\ In\ (1 + \pi_t) - \gamma_3\ In\ (\phi(i,e))} \qquad (36)$$

where γ_1, γ_2 i γ_3 > 0. Expected value of γ_2 depends on the indexation parameter Š and ranges between zero (Š=0, i.e. absence of indexation) to 0.5 (Š=1, i.e. full indexation).

Insertion of (36) into (35) gives a final specification of the short-run money demand function without any restrictions regarding absence or presence of "money illusion" in determining the desired stock of money:

$$\mathbf{In\ m_t = \gamma_0\beta_1 + (1\text{-}\beta_1)\ In\ m_{t-1} + \beta_1\gamma_1\ In\ y_t}$$
$$\mathbf{- (\beta_1\gamma_2 + (1\text{-}\delta))\ In\ (1+\pi_t) - \beta_1\gamma_3\ In\ (\phi(i,e))} \qquad (37)$$

By econometric estimation of equation (37) on actual data parameter β_1 may be identified (from estimate of parameter with In m_{t-1}, and then obtain estimates for γ_1 and γ_3, i.e. income and interest elasticities of the desired money stock. By contrast, it is impossible to identify and quantify the mechanism of inflationary impact on money demand - after identification of β_1 in the coefficient with In (1 $+\pi_1$) there still remain two unidentified parameters - γ_2 i δ (parameters of "money illusion" and

[11] *In M_t/P_t - In M_{t-1}/P_{t-1} = β_1 (In M^*_t/P_t - In M_{t-1}/P_{t-1}) +*
+ (β_2-1 + β_1) (In P_t - In P_{t-1}),
and since $\beta_2=\delta(1-\beta_1)$,
In M_t/P_t - In M_{t-1}/P_{t-1} = β_1 (In M^*_t/P_t - In M_{t-1}/P_{t-1}) +
+(δ-1)(1-β_1) (In P_t - In P_{t-1})

adjustment mechanism). Unscrambling the coefficient with the inflation rate is possible only by establishing a priori assumption regarding the strength of these two effects. For example, if absence of money illusion is assumed (γ_2=0), one can establish the actual adjustment mechanism (δ=z/(1-β_1)+1, where z denotes the estimated parameter with In (1+π_t)).

3. Econometric estimation of money demand function in Croatia in period 1991:1-1993:11

Figure 1. shows the monthly values of real M1 in Croatia in period January 1991 - November 1993. Real M1 is obtained as the ratio between end-of-month nominal M1 and implicit GDP deflator.[12] Significant decline in real money stock is characteristic for most countries that have experienced high inflation periods. From January 1991 to November 1993 real money stock shrunk almost five times. Since in the same period average annual real GDP was cut to one-half, it is obvious that the M1 velocity in the same period almost quadrupled.

Monthly value of real transactions in Croatia is represented by monthly real GDP in the economy excluding government services.[13] Furthermore, this variable does not capture a portion of private sector activity.[14]

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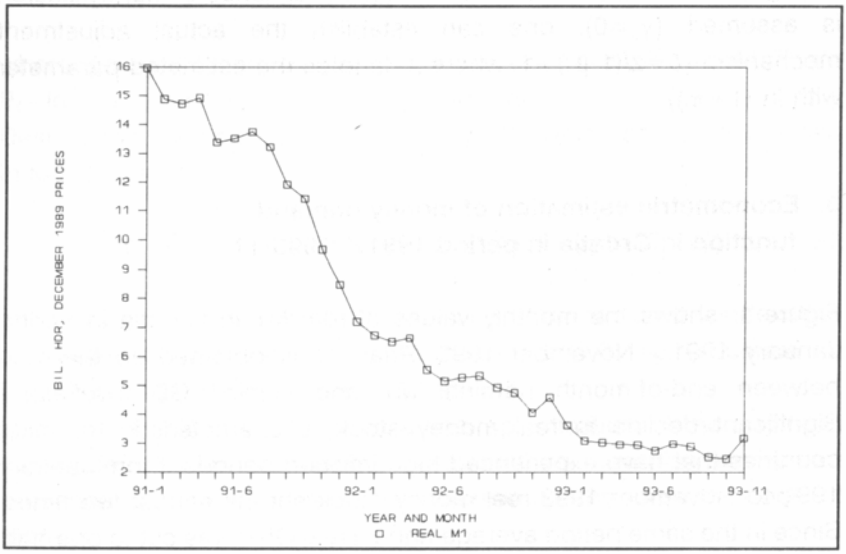
[12] *Implicit GDP deflator is calculated as the arithmetic mean of monthly retail price index and industrial producers' price index. Both components are base indices with value 1.0 in December 1989.*

[13] *Nominal monthly GDP in this sector of economy is calculated as a difference between total revenue and total cost as reported to ZAP. Source of data is ZAP Bulletin, various issues.*

[14] *The problem of specification and the structure of the transaction variable or economic activity variable (including a problem of regular statistical coverage and estimating activity in the shadow economy) has occurred in most empirical studies of money demand. Some authors emphasize that using GDP figures leads to overestimation of the level of transactions in the economy and suggest alternative measures such as the level of consumption (Mankiw and Summers, 1986), the ratio of total expenditures and demand deposits (Goldfeld and Sichel, 1990). Judd and Scadding (1982) show that the search for alternative measure of the transactions level does not lead to improvement in money demand function estimate.*

Figure 1.
REAL M1 IN THE REPUBLIC OF CROATIA, 1991:1-1993:11



It was mentioned earlier that different specifications of the opportunity cost were discussed in many monetary studies. In analysis of money demand in USA and developed countries, the opportunity cost is most frequently captured by a set of interest rates (Goldfeld and Sichel, 1990; Judd and Scadding, 1982). Specification of money demand in Croatia also includes an alternative opportunity cost of holding domestic money instead of foreign exchange, which is in (37) still expressed in a functional form $\phi(i,e)$.

Econometric estimation of equation (37) for period 1991:1-1993:11 obtained the following results:

$$\begin{aligned}
\mathbf{lm_t} = {} & \mathbf{0.3353} + \mathbf{0.7663\ lm_{t-1}} + \mathbf{0.1833\ ly_t} - \mathbf{0.8852\ LINFLA_t} - \\
& \mathbf{(3.63)} \quad \mathbf{(18.01)} \qquad \mathbf{(3.75)} \qquad \mathbf{(-4.56)} \\
& - \mathbf{0.0205\ LTECAJ_{t-1}} - \mathbf{0.1917\ LTECAJ_{t-2}} - \mathbf{0.4984\ LKAM_{t-1}} + \\
& \mathbf{(-0.49)} \qquad \mathbf{(-3.85)} \qquad \mathbf{(-1.61)} \\
& + \mathbf{0.0735\ DUM78_t} + \mathbf{0.0858\ DUM10_t} + \mathbf{0.1903\ DUM12_t} \qquad (38) \\
& \mathbf{(3.22)} \qquad \mathbf{(3.15)} \qquad \mathbf{(4.76)}
\end{aligned}$$

$RBAR^2 = 0.9962$; DW = 1.72; SEE = 0.0387; F = 988; Period: 91:1-93:11

where:

lm = natural log of real M1 at the end of month, $lm_t = ln(Mi_t/P_t$, where P_t denotes implicit GDP deflator,

ly = log of real GDP,

LINFLA = log of the chain index of implicit GDP deflator, $LINFLA_t = ln(i+\pi_t = ln(P_t/P_{t-1})$, π_t=inflation rate,

LTECAJ = log of the chain index of nominal exchange rate of Croatian Dinar to a basket of 7 selected currencies (E) at the end of month, $LTECAJ_t = ln(1 + e_t = ln(E_t/E_{t-1})$,[15]

LKAM = log of interest rate on short-term deposits in five largest banks in Croatia, monthly average, $LKAM_t = ln(1 + i_t)$, where i_t denotes nominal interest rate.

DUM78 = dummy variable for July and August; DUM78=1 in July and August 1992 and 1993, zero otherwise. Due to war in 1991, DUM78=0 in July and August 1991 !

DUM10 = dummy variable for October; DUM10=1 in October 1991, 1992 and 1993, zero otherwise,

DUM12 = dummy variable for December; DUM12=1 in December 1991 and 1992, zero otherwise.

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[15] *A detailed description of this variable is given in Anušić (1993).*

In parenthesis below the estimated coefficients corresponding t-ratios are given.

A specification of money demand in Croatia contains all relevant variables according to theory behind (37). However, the initial empirical analysis has indicated that the specification containing inflation rate, interest rate and the rate of change of the exchange rate in period t suffers from high degree of multicolinearity. Econometric estimate of (37) for Croatia has clearly confirmed findings by Blejer (1978), Abel et al.(1979) and Taylor (1991) of dominance of the inflation rate over various measures of the opportunity cost (exchange rate or interest rate). For that reason the opportunity cost is in (38) specified as a function of previous-month interest rate and the rate of change of exchange rate in two previous months. Such lag structure is established after experiments with PDL-s on these two variables.

Furthermore, the regression estimate is based on original (seasonally unadjusted) data. Therefore, the specification includes three dummy variables in order to capture the seasonal impact of the tourist season on money demand (DUM78), October high season (DUM10) and December holidays (DUM12).[16]

Estimated equation (38) provides quite robust results. All estimated coefficients have correct signs. Coefficient with $LTECAJ_t$, is insignificant, with $LKAM_t$, significant at the level of 6.5%, while all other coefficient are significant at the level of 2.5% of one-tail t test. $RBAR^2$ takes a high value of 0.9963 indicating that the specification leaves unexplained less than 1 % of the total variance. Contribution of three dummy variables to high degree of variance explanation is minor.[17] Standard error of estimate (SEE) of only 3.87% and f-statistic of 988 confirm the robust

[16] *Initial testing of seasonal component was performed by inclusion of 11 seasonal dummy variables in (37). The results showed that significant seasonal impact occurs in July, August, October and December.*

[17] *In specification excluding dummy variables $RBAR^2$ equals 0.9914; estimated coefficients with lagged money, GDP and interest rate remain almost unchanged, while those with inflation and exchange rate variables fall by approximately 25%.*

regression results. Although the DW statistic of 1.72 suggests a slight presence of first-order positive autocorrelation, additional residual analysis rejects the need for explicit inclusion of first-order autoregressive process into the specification.[18]

Coefficient with Im_{t-1}, of 0.7663 suggests that inertia in the demand for money is relatively low. Similar values of this coefficient for India, Singapore and Korea are obtained in the study of money demand in 11 Asian countries (Gupta and Moazzami, 1990), and almost identical for Australia (Milbourne, 1983) and USA in period 1952-74 (Goldfeld and Sichel, 1990). In the study of money demand in 27 countries (Fair, 1987), in 14 cases the value of coefficient with lagged money is found to be between 0.7 and 0.9.

According to theoretical specification (equation 37), the relative weight of the disequilibrium cost β_1 in Croatia is 0.2337 for period under observation.

Total income elasticity of money demand equals 0.1833 which is similar to corresponding values for the USA (Goldfeld, 1976), Indonesia and Sri Lanka (Gupta and Moazzami, 1990), Australia (Milbourne, 1983) and Greece, Portugal, Turkey, Peru and India (Fair, 1987).

Decomposition of this coefficient according to (37) reveals that income elasticity of the desired money stock γ_1 in Croatia equals 0.784, which is slightly higher than Baumol-Tobin's hypothetical value of 0.5 but also less than 1 indicating that in Croatia there are tendencies of improving efficiency of money management.

---

[18] *Econometric estimate of equation (37) in which residuals follow a first-order autoregressive process:*

$$Im_t=X_t+\rho u_{t-1}+\epsilon_t\,,\quad \epsilon\sim N(0,\sigma^2_\epsilon),$$

where X_t denotes a list of independent variables in (37) for period 1991:11993:11 gives ρ of 0.1556 but with high standard error of 0.224. Durbin's H statistic of 0.9566 indicates absence of higher-order autocorrelation. Other regression statistics do not significantly differ from those in (38).

Total interest elasticity of money demand of -0.4984 is much higher in comparison with most previous studies of money demand. This is primarily a consequence of using interest term $(1 + i_t)$ instead of i_t as in most money demand studies. When (38) is reestimated with interest rate i_t, estimated interest elasticity stands at -0.031 which is slightly higher than the interest elasticity reported by Fair (1987) for all 27 countries, lower than elasticity for Australia (Milbourne, 1983), and almost identical to interest elasticities in Indonesia, Phillipinnes, Thailand and Singapore presented by Gupta and Moazzami (1990). From estimated interest elasticity in Croatia it follows that the elasticity of the desired money stock with respect to interest term $(1 + i_t)$ equals 2.13.[19]

Elasticity of real money demand with respect to inflation stands at high -0.8852. Due to identification problem, contribution of neither PAM (parameter δ) nor "money illusion" (parameter γ_2) to total elasticity can be determined. However, most empirical studies that compare nominal and real PAM prove that nominal PAM has a significant dominance over real PAM in describing actual short-run monetary disequilibrium.[20] If we assume that nominal PAM mechanism was present in Croatia (δ=0), from (37) and (38) it follows that the "money illusion" coefficient in Croatia equals -0.509 which corresponds to theoretical value of the extended Baumol-Tobin model (parameter γ_2 in equation 36) under full indexation of the brokerage fee (Š=1). In period under observation it was indeed close to reality.[21]

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[19] In comparison with the Baumol-Tobin hypothesis (interest elasticity of money demand of -0.5), elasticity of desired money stock with respect to nominal interest rate in Croatia stands at -0.13.

[20] Fair (1987) identifies presence of Nominal PAM in 24 out of 27 analyzed countries. Gupta and Moazzami (1990) give advantage to nominal PAM in 9 out of 11 studied countries.

[21] If we assume that δ=0, from (37) and (38) it follows

$$\beta_1 \gamma_2 + (1 - \beta_1) = 0.8852$$

Since from (38) we get $\beta_1 = 0.2337$, it follows that $\gamma_2 = 0.509$.

Real money demand in Croatia significantly reacts to exchange rate changes with a two-months lag. Dominance of interest rate over exchange rate in the opportunity cost specification is primarily due to relatively high correlation between these two variables in certain subperiods. This finding, however, does not shed doubts on a statement (derived from a theoretical expression 21) that under high inflation domestic money is primarily converted into foreign exchange but rather confirm previous empirical result of actual inflation rate as a principal informational variable in determination of money demand. From estimated equation (38) it follows that formation of a subjective measure of the opportunity cost takes a form of a learning process in sense that individuals adjust the actual nominal values by experience reaching two months in the past.

Estimated coefficients with dummy variables DUM78, DUM10 and DUM12 are interpreted as seasonal elasticities of real money demand. During the tourist season in July and August real money demand is on the average 7.34 percentage points higher, in October 8.58, and in December even 19 percentage points higher than average monthly money demand.

The period under observation comprises relatively heterogeneous subperiods - entire 1991, when the Croatian Dinar had not yet been introduced, 1992 and first nine months of 1993 which is characterized by near-hyperinflation monthly rates of inflation, and, finally, October and November when the first effects of the stabilization program started to show up. Since implementation of the stabilization program achieved success in rapid disinflation, it is necessary to investigate the structural stability of money demand at this turning point. For that purpose, (38) was estimated for period 1991:1-1993:9:

$$
\begin{aligned}
\mathbf{lm_t} = &\ \mathbf{0.2992 + 0.7730\ lm_{t-1} + 0.1894\ ly_t - 0.8528\ LINFLA_t\ -} \\
&\ \mathbf{(1.87)\quad (14.58)\qquad\quad (3.59)\qquad (-3.18)} \\
&\ \mathbf{-\ 0.0206\ LTECAJ_{t-1} - 0.1877\ LTECAJ_{t-2} - 0.4496\ LKAM_{t-1}\ +} \\
&\ \mathbf{(-0.43)\qquad\qquad (-3.63)\qquad\qquad (-1.31)} \\
&\ \mathbf{+\ 0.0723\ DUM78_t + 0.0951\ DUM10_t + 0.1871\ DUM12_t} \\
&\ \mathbf{(3.05)\qquad\qquad (2.65)\qquad\qquad (4.50)}
\end{aligned}
\tag{39}
$$

$RBAR^2 = 0.9958$; DW = 1.71; SEE = 0.0399; F = 841; Period: 91:1-93:9

Comparison of full-period estimated regression (38) with prestabilization estimate (39) clearly reveals high stability of estimated coefficients. Chow test of 0.25 for equations (38) and (39) indicates that significant structural change in determination of real money demand had not occurred in period after implementation of the stabilization program in Croatia. A slight change in estimated coefficients is observed only with LINFLA and LKAM. From (37) and (39) it follows that in the pre-stabilization period elasticity of desired money stock with respect to inflation was -0.352 (under assumption of nominal PAM), and interest elasticity of money demand -1.98, which is in both cases somewhat lower than in the full period.

High stability of specification improves the probability for obtaining a reliable forecast of the money demand. Prior to forecasting, it is necessary to test the goodness of fit for the period of estimation. Since the specification contains a lagged dependent variable, both static and dynamic simulations may be performed for the observed period.[22] The results of the static and dynamic simulations for period 91:1-93:11 are shown in Figure 2. High goodness of fit of the dynamic simulation assures low forecast error due to specification.

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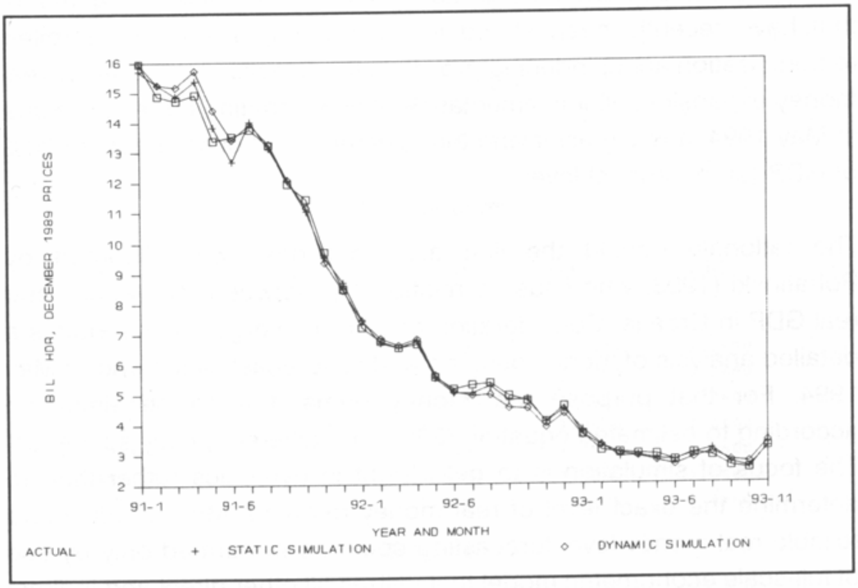
[22] *Static simulation utilizes actual data values, while dynamic makes use of model (simulated) values of the lagged dependent variable.*

Figure 2.
STATIC AND DYNAMIC SIMULATION OF REAL MONEY DEMAND IN CROATIA, 1991:1 - 1993:11



4. Simulation of money demand in Croatia by the end of May 1994

The most significant impacts of the stabilization program have been observed in the monetary sphere. Croatian citizens today hold much more cash dinars in their wallets than they did in previous several years. At the same time, the practice of withdrawing large amounts of money from demand deposits, checking and savings accounts and its conversion into foreign exchange is not observed anv more. Demand for Croatian Dinars has increased substantially. The monetary expansion of over 10% per month in the last few months (despite announcement of restrictive monetary policy) is accompanied by deflation rather than inflation. The process of remonetization, which is obviously under way in the Croatian economy, opens important questions. How should the monetary authorities approach and respond to the process of remonetization?

Should the objective of the money supply policy be to meet any level of money demand or should remonetization be performed gradually and carefully? Three arguments that have recently been stated in favor of rapid and uncontrolled remonetization are (i) inducing growth in the Croatian economy by real money expansion, (ii) implementation of new Croatian currency - Kuna in May 1994, and (iii) achieving the "desired" level of M1 equal to 20% of GDP pat the annual level).

The rationale behind the first argument has been disputed by Rohatinski (1993) who finds no relationship between real money and real GDP in Croatia. Consideration of other two arguments requires a detailed analysis of money demand and its forecast till the end of May 1994. For that purpose real money demand is to be simulated according to estimated equation (38) under different policy scenarios. The focus of simulation is to get insight in dynamics rather than to determine the exact level of real money demand. More precise and reliable real money level forecasting could be performed only by use of full-scale econometric model that utilizes all other direct and indirect links between the right-side variables in (38).

In all following simulations it is assumed that the seasonally adjusted real GDP remains constant by the end of May 1994. In December 1993 real GDP is assumed to be 2% lower than real GDP in November.[23] Monthly rates of change of real seasonally unadjusted GDP in period 1994:1-1994:5 match the rates of change of corresponding seasonal index established by averaging monthly residuals from quadratic trend in period 1991:1-1993:11.[24]

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[23] *Following the officially reported figures for industrial production in December which is 5.1 lower than in November.*

[24] *In January 1994 the chain index of real GDP equals 90, in February 100, March 110, April 106, and in May 95.*

Assumptions for Simulation 1 are listed in the first part of Table 1. For comparison, series also include actual values of exogenous variables in November 1993. Simulation 1 assumes fixed prices and the exchange rate, and monthly interest rate of 6% by the end of May 1994.

Table 1.

SIMULATION 1

Assumptions

year and month	y_t prices 89:12	$(1+\pi_t)$	$(1+e_t)$	$(1+i_t)$
1993:11	3.3211	0.9822	0.9187	1.0520
1993:12	3.2547	1.0000	1.0000	1.0600
1994:1	2.9292	1.0000	1.0000	1.0600
1994:2	2.9292	1.0000	1.0000	1.0600
1994:3	3.2222	1.0000	1.0000	1.0600
1994:4	3.4155	1.0000	1.0000	1.0600
1994:5	3.2447	1.0000	1.0000	1.0600

Results

year and month	m_t pri. 89:12	$M1_t$ bil. HRD	$\Delta m_t/m_{t-1}$	$\Delta M1_t/M1_{t-1}$	M1UDIO %
1993:11	3.1994	3316	-	-	11.56
1993:12	4.8861	5064	0.5272	0.5272	18.01
1994:1	5.6704	5877	0.1605	0.1605	23.23
1994:2	6.2532	6481	0.1028	0.1028	25.62
1994:3	6.8588	7109	0.0968	0.0968	25.54
1994:4	7.4413	7713	0.0849	0.0849	26.14
1994:5	7.8469	8133	0.0545	0.0545	29.02

Results of the first simulation are presented in the second part of Table 1. Data reported in the table are real demand for money, m_t, in December 1989 prices (billions of Croatian Dinars), nominal money stock, $M1_t$, rate of change of real money stock, $\Delta m_t/m_{t-1}$, rate of change of nominal money stock, $\Delta M1_t/M1_{t-1}$, and the share of real M1 in real GDP (M1 UDIO) at the annual level (m_t/y_t*12). Results show a tremendous increase in money demand in December 1993 for 52.7% or 1748 billion HRD. Under these circumstances, full demand satiation would rise M1 UDIO to over 20% in January 1994.[25] Such policy would lead to M1 expansion to the level over 30% of GDP which might endanger further price stability. Important simulation result is decreasing monthly growth rate of money demand from 16.1 % in January to 5.5% in May. This indicates that the monetary system in Croatia moves towards stabilization of money demand rather than its explosion.

In the second simulation prices and the exchange rate increase by 5% every month while the monthly interest rate stands at 6%. Results from Simulation 2 are presented in Table 2. If inflation and nominal currency depreciation in Croatia are restored, familiar statistics of the monetary flows in inflation are to be observed again - high growth rates of nominal money accompanied by low positive or negative rates of change of real money. In this simulation the growth rate of real money declines throughout the period, while nominal M1 growth rates stand above 10% except in May. This is an argument in favor of gradual remonetization process designed in such a manner to avoid inflationary pressures in the long run. If the monetary impulse to inflation, which was quite strong in 1991 and 1992 (Anušić, 1993), returns, the non-inflationary remonetization might be unsustainable and control over nominal money impossible - which is suggested by a difference in M1 of 1000 billion HRD between the first two simulations.

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[25] *If we assume that the GDP figure is underestimated by 30%, M1 UDIO would rise over 20% in March 1994.*

Table 2.
SIMULATION 2

Assumptions

year and month	y_t prices 89:12	$(1+\pi_t)$	$(1+e_t)$	$(1+i_t)$
1993:11	3.3211	0.9822	0.9187	1.0520
1993:12	3.2547	1.0500	1.0500	1.0600
1994:1	2.9292	1.0500	1.0500	1.0600
1994:2	2.9292	1.0500	1.0500	1.0600
1994:3	3.2222	1.0500	1.0500	1.0600
1994:4	3.4155	1.0500	1.0500	1.0600
1994:5	3.2447	1.0500	1.0500	1.0600

Results

year and month	m_t pri. 89:12	$M1_t$ bil. HRD	$\Delta m_t/m_{t-1}$	$\Delta M1_t/M1_{t-1}$	M1UDIO %
1993:11	3.1994	3316	-	-	11.56
1993:12	4.6795	5093	0.4626	0.5358	17.25
1994:1	5.2487	5998	0.1216	0.1777	21.50
1994:2	5.5863	6703	0.0643	0.1175	22.88
1994:3	5.9629	7512	0.0674	0.1208	22.21
1994:4	6.3359	8381	0.0626	0.1157	22.26
1994:5	6.5754	9133	0.0378	0.0897	24.32

The third and last simulation's assumptions are opposite to those in previous simulation with purpose to evaluate the effects of announced further reduction in domestic prices on money demand. Domestic prices are assumed to decline by 3% every month while the exchange rate is assumed to remain at its November 1993 level. Simulation results (Table 3) show diametrically opposite results in comparison with Simulation 2. Substantially lower growth rates of nominal money stock induce significantly higher growth rates of real money. Satiation of money demand in deflationary conditions leads to severe increase in real money stock whose share in GDP rises over 30% by the end of May. Hence, in deflation remonetization should be performed with additional care - even nominal money freeze induces a growth in real money.

Table 3.

SIMULATION 3

Assumptions

year and month	y_t prices 89:12	$(1+\pi_t)$	$(1+e_t)$	$(1+i_t)$
1993:11	3.3211	0.9822	0.9187	1.0520
1993:12	3.2547	0.9700	1.0000	1.0600
1994:1	2.9292	0.9700	1.0000	1.0600
1994:2	2.9292	0.9700	1.0000	1.0600
1994:3	3.2222	0.9700	1.0000	1.0600
1994:4	3.4155	0.9700	1.0000	1.0600
1994:5	3.2447	0.9700	1.0000	1.0600

Results

year and month	m_t pri. 89:12	$M1_t$ bil. HRD	$\Delta m_t / m_{t-1}$	$\Delta M1_t / M1_{t-1}$	M1UDIO %
1993:11	3.1994	3316	-	-	11.56
1993:12	5.0196	5047	0.5689	0.5219	18.51
1994:1	5.9470	5800	0.1848	0.1492	24.36
1994:2	6.6629	6301	0.1204	0.0868	27.30
1994:3	7.3974	6788	0.1102	0.0769	27.55
1994:4	8.1006	7210	0.0951	0.0622	28.46
1994:5	8.6032	7427	0.0620	0.0302	31.82

5. Conclusion

Successful implementation of the first phase of October stabilization program is reflected in increased demand for domestic money, absolute price decline, domestic currency appreciation but also in higher degree of illiquidity in the economy. Croatian monetary authorities are faced with events that have been "unusual" for Croatian economy. Recently observed fact that strong monetary expansion does not induce inflation might lead to hasty conclusion that remonetization of Croatian economy should be performed rapidly and with full satiation of future money demand. The results in this paper show that real and nominal demand for domestic money in Croatia will have a tendency to stabilize **only in conditions of domestic price stability.** Even in that case, the process of remonetizing the Croatian economy should be approached carefully and gradually. Satiation of any level of money demand might lead to excessive monetary expansion even under absolute domestic price stability. Such scenario would almost certainly lead to restoration of hyperinflationary monetary mechanism.

6. REFERENCES

Abel, A., Dornbusch, R., Huizinga, J. and A. Marcus (1979): "Money Demand During Hyperinflation.", **Journal of Monetary Economics,** 5: 97-104.

Anušić, Z. (1993): "Dometi ortodoksne i heterodoksne stabilizacijske politike u obaranju inflacije u Hrvatskoj.", in Ž. Rohatinski (ed.), **Privredna kretanja** i **ekonomska politika,** 23: 21-44.

Arango, S. and M.I. Nadiri (1981): "The Demand for Money in Open Economies.", **Journal of Monetary Economics,** 7: 69-84.

Bahmani-Oskooee, **M.** and M. Pourheydarian (1990): "Exchange Rate Sensitivity of Demand for Money and Effectiveness of Fiscal and Monetary Policies.", **Applied Economics,** 22: 917-925.

Baumol, W.J. (1952): "The Transactions Demand for Cash: An Inventory Theoretic Approach.", **quarterly Journal of Economics,** 66: 545-556.

Blanchard, O.J. and S. Fischer (1993): **Lectures on Macroeconomics,** Cambridge, Mass.: **MIT** Press.

Blejer, **M.** (1978): 'Black Market Exchange Rate Expectations and the Domestic Demand for Money.", **Journal of Monetary Economics,** 4: 767-773.

Cagan, P. (1956): "The Monetary Dynamics of Hyperinflation.", in M. Friedman (ed.), **Studies in the ~uantlty Theory of Money.,** Chicago: University of Chicago Press.

Evans, M.K. (1969): **Macroeconomic Activity: Theory, Forecasting, and Control,** New York: Harper and Row.

Fair, R.C. (1987): 'International Evidence on the Demand for Money.", **Review of Economics and Statistics,** 69: 473-480.

Gapinski, J.H. (1982): **Macroeconomic Theory: Statlcs, Dynamics, and Policy, Economics Handbook Series,** New York: McGraw-Hill.

Goldfeld, S.M. (1976): "The Case of Missing Money.", **Brookings Papers on Economic Activity,** 3: 683-730.

Goldfeld, S.M. and D.E. Sichel (1990): "The Demand for Money.", in **B.M.** Friedman and F.H. Hahn (eds.), **Handbook of Monetary Economics,** vol. 1, Elsevier Science Publishers.

Gupta, L.K. and B. Moazzami (1990): "Nominal vs. Real Adjustment in Demand for Money Functions.", **Applied Economics,** 22: 5-12.

Hetzel, R.L. (1984): "Estimating Money Demand Functions.", **Journal of Money, Credit and Banking,** 16: 185-193.

Hwang, H. (1985): " Test of the Adjustment Process and Linear Homogeneity in a Stock Adjustment Model of Money Demand.", **Review of Economics and Statistics,** 67: 689-692.

Judd, J.P. and J.L. Scadding (1982): "The Search for a Stable Money Demand Function: A Survey Of the Post-1973 Literature.", **Journal of Economic Literature,** 20: 993-1023.

Keynes, **J.M.** (1936): **The General Theory of Employment, Interest and Money,** New York: Harcourt, Brace and World.

Mankiw, N.G. and L.H. Summers (1986): "Money Demand and the Effects of Fiscal Policies.", **Journal of Money, Credit and Banking,** 18: 415-429.

Mitbourne, R. (1983): "Price Expectations and the Demand for Money: Resolution of the Paradox.", **Review of Economics and Statistics,** 65: 633638.

Patinkin, D. (1965): **Money, Interest, and Prices,** New York: Harper and Row.

Phylaktis, K. and M.P. Taylor (1993): "Money Demand, the Cagan Model, and the Inflation Tax: Some Latin American Evidence.", **Review of** Economics **and Statistics,** 75: 32-37.

Rohatinski, Ž. (1993): "Prve naznake zaustavljanja hiperinflacije." in Ž. Rohatinski (ed.), **Privredna kretanja i ekonomska politika,** 24: 5-22.

Sachs, J. and P. Larraine (1993): Macroeconomics in the Global Economy, New York: Harvester Wheatsheaf.

Taylor, M.P. (1991): "The Hyperinflation Model of Money Demand Revisited.", **Journal of Money, Credit and Banking,** 23: 327-351.

Tobin, J. (1956): "The Interest Elasticity of Transactions Demand for Cash.", **Review of Economics and Statistics,** 38: 241-247.