CURRENCY SUBSTITUTION AND
THE DEMAND FOR MONEY IN
UKRAINE

by

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Abstract

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Currency substitution is a common issue in transition countries. Its existence partially reflects the economic processes, which operate in economies of those countries, produced by insufficient market reforms at early stages. It goes without saying that the high degree of trust to domestic money is crucial for formulating and conducting effective monetary policy. The problem is that transition countries and Ukraine as well suffer from distrust of domestic currency, which is perceived mainly as a mean of payments but not as a store of value. The later function is done by the "hard" foreign currency and that determines currency substitution as a phenomenon in transition countries.

This paper addresses the issue of currency substitution in the context of the demand for real balance in Ukraine that was studied for two periods: 1994:4-1996:6 and 1996:6-1998:12, which have different characteristics in terms of macroeconomic conditions determined by government policy. The key point of the work is the effect of stabilization program on the determinant of currency substitution in the demand for domestic money. In order to detect this, a partial adjustment model of the demand for real balance was implemented, which incorporated the parameters of currency substitution such as expected exchange rate approximated by lagged value of current rate and foreign currency interest rate represented by LIBOR. These parameters are treated in the literature as determinants of direct and indirect currency substitution respectively. The model was estimated by OLS with additional employment of Cochane-Orcutt procedure to adjust for serial correlation. The results show that in the first period exchange rate is the main determinant of currency substitution while in the second one it is the foreign currency interest rate. It is found that these determinants produce different effects on the demand for real balances. Namely the first exert negative impact while the second has a positive. This basically explains high velocity of circulation during the first period and its slowdown in the second.

Estimated model for the demand for foreign currency in the second period displays high sensitivity to the domestic and foreign interest rates that prove the ability of the central bank to control purchases of foreign currency through the provision of high interest rate. The results also show insensitivity to the real income of the economy that supports the fact that the demand for foreign currency is speculative.

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ACKNOLEDGEMENT

GLOSSARY

Currency substitution-a circulation of two or more currency within a single economy or region to facilitate transactions that are unrelated to international trade and finance.

Hysteresis-asymmetric response to the changes in one of the determinants of currency substitution. That is an increase in the expected exchange rate produce larger effect on the degree of currency substitution than the decrease in it.

Effectiveness of monetary policy-a sensitivity of economy's output to the central bank's targets.

Exchange rate-the price of one currency in terms of the other.

Monetary policy-the set of actions of a central bank aimed to influence real sector development and concern with monetary targeting, interest rate targeting and exchange rate targeting.

Demand for real balance-a demand for certain amount of money, which guarantee purchasing power stability and satisfies to all current motives to hold money.

Elasticity of the demand-a sensitivity of the demand to its determinants. Shows how the demand will change in response to unit change of a variable.

INTRODUCTION

The phenomenon of currency substitution refers to the situation when two or more currencies circulate within a single economy or region to facilitate transactions that are unrelated to international trade and finance. One reason why a rational agent prefer holdings of foreign money to domestic one can be found in the high degree of purchasing power stability which is provided by foreign currency when expectations of high inflation or exchange rate devaluation take place. Recent experience of Ukraine, especially the period of hyperinflation, gave a good example of that. The importance of that period, which characterized almost all transition economies in the early 90's, can be seen by the creation of hysteresis, that is the degree of currency substitution is growing and persistent even after inflation has been stabilized to a moderate or low level. The explanation to that fact can be found in fixed cost paid by the public during the period of high instability when they were used to operate with foreign money. In the aftermath they do not see any reason to switch back to the domestic money, at least immediately. As experience has shown, the hysteresis requires a long lag after stabilization has taken place before the public changes its attitude toward the structure of their money holdings.

The other reason why agents may prefer to hold foreign money is that it may pay higher returns adjusted for risk than domestic one and therefore creates an opportunity cost of holding domestic money versus having it invested in foreign.

In the literature, these two causes of currency substitution are treated as direct and indirect.

Speaking of Ukraine, we may see that there is no firm evidence of hysteresis if we judge on the base of the conventional measure of the degree of currency substitution, namely foreign deposits to total deposits ratio (graph 5). But on

the other hand, the amount of foreign currency transactions is constantly growing regardless of central bank restrictions on them. One reasonable explanation is that excessive and sometimes inadequate central bank regulation fuels development of black market of foreign exchange. We may also interpret it as the fixed cost paid by the public to establish and develop infrastructure to guarantee a constant source of stable currency independently of central bank will. The existence of shadow economy itself makes a crucial contribution to the development of the black market of foreign exchange. It should be mentioned that the main part of "shadow" activities is served by foreign currency. This suggests that currency substitution behavior in case of Ukraine should be considered in the context of actual situation within the economy, i.e. covering also the informal sector.

In this case the effect of currency substitution can be investigated through the demand for domestic money specification by inclusion of appropriate variables for opportunity cost of holding domestic money, i.e. expected devaluation of exchange rate and interest rate on foreign money. The coefficients of these variables will give a sensitivity of the money demand to the external factors and also it will allow to detect the pattern of currency substitution (whether it is direct or not). Taking into account the fact that during the period since independence Ukraine had implemented monetary reform and tight monetary policy, it allows estimating in the context of the demand for domestic money how the determinant of currency substitution had changed if it had. The main reason why I suggest studying currency substitution in Ukraine through the demand for domestic money is the quality and availability of the data produced by internal economic conditions.

The questions, which are supposed to be answered in this work, are the following:

What effect does currency substitution have on the demand for domestic money?

How do changes in monetary policy affect the demand for domestic money?

What determines the demand for foreign currency in Ukraine?

Currency substitution is a common issue in the design of monetary policy in transition economies. It can be argued that currency substitution behavior, especially in case of excessive degree, affects the stability of the velocity of circulation of the domestic money as well as the demand for domestic money. The stability of the last in its turn is the cornerstone in formulating and conducting monetary policy. Also currency substitution behavior in transition and developing economies leads to constant pressure on the exchange rate undermining the ability of the central bank to maintain it at a constant level, when fixed exchange rate regime was chosen, as in most cases and Ukraine as well. Besides, currency substitution undermines the basis for domestic monetary targeting, by constantly reducing the amount of money in circulation. Therefore it is extremely important to consider the impact of currency substitution on the effectiveness of monetary and fiscal policy and visa versa.

The bulk of existent literature on currency substitution investigates the phenomenon through the impact, which it exerts on basic macro indicators. General question, which is typically asked in the literature, is whether a central bank is able to affect the degree of currency substitution by the mean of appropriate policy that would alter relative costs of holding money. In case of Ukraine it is also reasonable question. In the case when persistent degree of currency substitution is mainly determined by shadow activity, the role of central bank is limited to official sector and more radical measures will be required, such as taxation reforms, legalization of shadow capital etc.

1. Survey of literature

The literature, which was used to study the field, covers topics of money demand, currency substitution and analysis of monetary sector development in transition economies. The common particularity of chosen articles is that they attempt to analyze or model such phenomenon as currency substitution (CS) and the role played in macro policy effectiveness.

For example, the bulk of articles investigate the impact of CS on the exchange rate stability, money demand stability and effectiveness of monetary policies. There are a lot of researches were made in attempt to determine the impact of the phenomenon on neighboring economies as well as the impact of this economies on the degree of CS and economic performance of the home country.

The greatest part of studies on the CS has estimated simple regression equations that posit the demand for domestic and foreign money as a function of the yield on both monies. Such an approach left a lot of space for critics. For example, as soon as empirical studies produced useful but also ambiguous results, some researcher argues that they provide only partial measure of the impact of CS as a result of static specification derived from the model, which abstracted from important intertemporal channels through which CS may exerts its pressure.

In contrast to this approach, more progressive studies use utility based model to estimate parameters of CS and assess their impact on the effectiveness of macro policies. They as well can be used to assess the welfare implication of alternative degrees of CS.

In that respect there is very important article by Gaufman and Leiderman(1993), where this approach was stated for the first time. Here a utility based model of CS with a CES function was developed. This model allows for separation of parameters characterizing behavior that result from risk from the behavior resulting from intertemporal substitution. This class

of models is also known as non-expected utility. One of the main advantages of the model is that it makes possible estimation of elasticity of substitution between domestic and foreign money and between consumption and liquidity services, as well as the parameters of risk aversion and interetemporal substitution.

There is also one more important article by Golikov(1998). Here the main cause of CS is hysteresis, which in author's opinion appears because of asymmetry of the adjustment costs - costs of installation or replacement of institutions, learning to operate in the markets with different assets structure and the cost of exchange between different assets. The main assumption of the model is that changes in money structure are endogenous outcome of individual optimization.

The usefulness of this analytical model is that it was built on the example of Russian economy that has experienced almost the same processes and in almost the same sequence as the Ukrainian economy, even though it does not even mention the macro policies used.

The theory developed here can be easily incorporated in the model stated previously.

The remaining set of articles represents alternative view on the CS where it was investigated typically through the demand for money specification. They are of interest here for the following reasons:

 -each article contains theoretical model of which was developed to emphasize particular aspect of CS and impact it exerts either on economic stability or on policies effectiveness;

 -the hypotheses derived from these models are not mutually exclusive and must be considered for Ukraine.

For example, Girton and Roper (1982) develop a two-currency model of the exchange rate, assuming that the quantities of money are exogenous. Here the authors emphasize the positive relationship between exchange rate instability and degrees of CS, such that with perfect CS exchange rate is indeterminate.

To dampen exchange rate fluctuation money issuer should alter either explicit interest rate or quantity of the money imposing loss or gains on money holders. This implies increasing impact of real return on the exchange rate with the growth of CS degree. Therefore, when money issuer behavior is incorporated in the model relaxing the assumption of exogenous money supply, the pressure exerting by the CS induce coordination of monetary policies of competing in money countries or equivalently rate of return competition. This, as Girton shows, would produce stability of exchange rate. As turned out now the absence of CS results in exchange rate instability because country now would pursue independent monetary policies.

Miles (1978) investigates the effect of CS on monetary policy. Specifically he examines whether changes in monetary policy change relative costs of holding currency and thus induces offsetting inflow or outflows of money. One of the conclusions of his analysis is that in the presence of CS even perfectly flexible exchange rate regime may not guarantee monetary independence. That is inflation transmitted between countries even if government does not intervene in the foreign exchange market. That contrasted to general belief as to insulation effect of flexible exchange rate. Developing his specification for empirical studies Miles proceeds from maximizing behavior of individual toward the production of money services, assuming CES production function. Based on derived specification he found great degree of CS in Canada especially in the period of floating exchange rate regime.

But this conclusion was refuted by Borda and Choudhri (1982) who investigate the empirical importance of CS in the framework of the demand for money function. They argue that if it is, then expected change in the exchange rate should be a significant determinant for the demand for home currency. They found that Miles's model was incorrectly specified and therefore produced result were inconsistent with obtained by them.

Their results show insignificance of CS in the demand for domestic money in Canada.

Chen and Tsaur (1983) were interested in the same topic as Miles (1978). In particular they were trying to build theoretical model explaining how the domestic rate of inflation is affected by an increase in the rate of inflation abroad, given that two currencies circulated and agents hold both. They consider domestic government response to the increase in the foreign inflation, which may behave in three ways: stick to the original rate of inflation; alter the rate of inflation in order to insulate the real sector from external disturbances; maximize its seigniorage for fiscal purposes. The main implication is that the money is no longer neutral in the inflation equilibrium context.

Saurman (1986) also reexamines the role played by generally accepted money demand parameters in the exchange rate determination in the long term under the assumption that a subset of money holders are substituting agents. Here the author's hypothesis, as to a cause of CS, rest on the optimization behavior of firms that minimize the costs associated with exchange. The ratio of the optimal stocks of foreign to domestic money holding is negatively depends on foreign inflation and positively on domestic inflation, while the change in real interest having no impact on the efficient stock of monies held inversely influences the relative marginal holding costs. Therefore as suggested in the article the increase in the real interest rate would cause reduction of relative marginal costs of holding more expensive money resulting in substitution behavior of firms in favor of this money. If the domestic currency were depreciating on the exchange market and the real interest were to increase the firm would increase amount of domestic money held because the last becomes relatively cheaper to hold. This effect author calls the effect of "shipping bad money in" and he argues that it is the source of long-term exchange rate change.

Calvo and Rodriguez (1977) also investigated the topic of exchange rate determination under CS. They developed a two-sector model of exchange rate determination for a small open economy with flexible prices and two currencies held by individuals. The real exchange rate is shown to depend on inflation rate measured as the rate of monetary expansion in the short run and fully determined by real variables in the long run. A higher rate of monetary expansion results in immediate increase in exchange rate and price level, in such a way that the increase in the former is much greater relative to the latter. This policy would result in following after transition period during which the economy accumulates foreign exchange. The implication of the analysis for optimal "crawling peg" is incorrect way of indexation of the nominal exchange rate by the difference of domestic and rest of the world inflation rates, if the objectives to guide the economy along the path of self-fulfilling expectations.

The paper that concludes my bibliography is constructed in the form of survey of literature itself. It is Sriram (1999). In the light of importance of money demand for macro policies effectiveness the paper provides brief review of the theoretical work within the field beginning from the classical economists and explains relevant empirical issue in modeling and estimating money demand. It summarizes features of a number of recent studies, which were based on cointegration / error-correction models in 1990's. The main advantage is bibliography that contains set of basic publications aimed to guide researchers.

This paper concludes the part of article that support the idea of assessment of CS on the basis of money demand specification which in contrasted to the utility based approach since it supports the view of indirect assessment of currency substitution impact on the monetary policy effectiveness.

Recent experience of Ukraine leaves a lot of space for investigation of the phenomenon, which unfortunately has not studied properly before. But

availability and quality of the data substantially narrows the field of research. So conducting research on currency substitution in Ukraine we have to make some very strong assumptions, which may not be valid in reality. For example, the crucial data for the paper is a measure of currency substitution such as the ratio of foreign currency deposits to total deposits or some other like the amount of foreign currency in circulation to M2 ratio. Any data, which can be found for Ukraine, will give only approximation and we may expect that this approximation does not conform to reality. Informative character of the data to the great degree affected by central bank or government policy toward foreign currency, exchange rate, taxation, etc. If we assume that conventional measure of currency substitution represents the whole economy we are likely to obtain wrong results. The existence of "shadow" economy and black market of foreign exchange also to the great extent complicates assessment of actual situation. Therefore, taking all these facts into account, the only way to obtain more or less close approximation is through indirect study of currency substitution, that is through the demand for domestic money. This approach can be widely criticized on the ground that this provides only static version of currency substitution, but given the data constraints the alternative approach is likely to arrive with incorrect results at all.

By studying the demand for domestic money and currency substitution we are answering the question what effect has currency substitution on its stability that is what is the elasticity of domestic money with respect to foreign one and what actually determines currency substitution in the money demand specification. That in turn allows to make some guesses as to effectiveness of monetary policy in the presence of currency substitution and whether authorities can control or not this phenomenon.

My contribution will be in defining appropriate variables to measure the impact of currency substitution in the money demand and estimation of the model for two periods, which differ in economic environments. The first

period was characterized by high instability, which can be seen in extremely high inflation, almost absence of the reforms, collapse of the economy as a whole. The second period is a period of stabilization, which was accompanied by desperate measures of central bank to renew the credibility of local currency and attempts by the government to reform the economy. As a measure of currency substitution in the demand for domestic money I suggest two variables, which are going to be included in the model simultaneously. They are lagged one period value of official exchange rate that represents the expectation of exchange rate devaluation, and nominal deposit rate on foreign currency deposits represented by the LIBOR that reflects opportunity costs of holding domestic money versus having it invested in foreign. The former variable implies direct currency substitution while the later-indirect (Sriram,1999).The significance of the coefficients of these variables states null and alternative hypotheses. To be precise it is possible to state four hypotheses, which would differentiate positive, negative effects and insignificance of the variables. That is, for instance, in principle an increase in the expectation of exchange rate devaluation might cause increase or decrease of the demand for real balance. The same can be said about foreign currency interest rate.

2. Preconditions of currency substitution in Ukraine.

The beginning of the phenomenon of currency substitution in Ukraine was started by the capital account liberalization in 1992, which was accompanied by high inflation as a result of fiscal imbalance of the economy.

In the soviet times the economy of USSR and Ukraine as well was experiencing hidden inflation that was persistent in nature. The sole cause of this inflation was commodity shortages associated with money overhang and excess of precautionary savings. The estimation of hidden inflation annual rate in this period vary from 3% to 6% (Golikov, 1998). Later on, in the

beginning of 1990s, macroeconomic policy pursued by Soviet authorities led to the failure by the domestic currency to provide the exchange within the economy, which in its turn boosted the hidden inflation to 15-20% per month (graph 1). There was excessive budget deficit financed mainly by seigniorage. That introduced dangerous trends into the real sector development and total welfare of the economy, which require immediate reforms and the lack of them only worsened economic state of the country.

Beyond that, private sector development resulting from early steps toward economic liberalization and subsequent price liberalization made inflation open.

Legal circulation of the foreign currency in Ukraine began by opening the Ukrainian Interbank Currency Exchange in 1992 and lifting the restrictions on foreign currency holdings by individuals in late 1991. Later on, when the new regulation of commercial banks was established, agents were allowed to open foreign currency deposit accounts. These accounts were not trustworthy from the public's standpoint, nor was the banking system itself after the failure of several banks at the early 90's, which imposed severe losses on the public.

Since then foreign currency started active legal circulation in the economy, although black market of foreign exchange continued to exist as it does by now.

It should be mentioned that together with a decline in the real sector we might observe active development of the informal sector, which was fueled by excessive and sometimes improper government regulation. Although the last existed in Soviet times, now it started to be more visible and transformed in new forms of activities. If previously "shadow capitalists" held their wealth mainly in the form of rubles, now they began to prefer more liquid assets, i.e. dollars, DM, etc, which first, preserve wealth from fast depreciation and, second, provides liquidity services in the international sense (i.e. they can be easily transferred and then used abroad). That substantially fuels the

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development of the black market of foreign exchange, where the agents pay typically higher prices for currency than if they do it legally in order to hide their incomes or to acquire currency in the period of currency shortages or crisis.

A policy of the central bank toward exchange rate regime also made a substantial contribution to the development of black market of foreign exchange. By fixing the exchange rate at the overvalued level, the central bank periodically found itself unable to satisfy the whole demand for USD and was forced to devalue. In the periods when there is a shortages of currency in the official economy the demand is satisfied exclusively on the "black" market, which operate according to market conditions and therefore has a much higher exchange rate then central bank set. Well-developed schemes of operations allow traders at this market to extract high rent from currency trading.

All that made foreign currencies grow in popularity, especially hard ones, which in turn led to replacement where it is possible in transactions domestic money with foreign. In 1993, by government decree the usage of foreign currency in internal transactions forbidden, which resulted in a small decline in the amount of purchased foreign currency but that was compensated by the growth of the "black" market.

3. Monetary reforms and monetary policy in Ukraine

The period of transition was characterized by rapidly changing macro conditions.

During this period Ukraine has experienced two monetary reforms. The first was an introduction of kharbovanets- so-called transition currency- in 1992, which was aimed to exit ruble zone and obtain ability for independent monetary policy. Initial stabilization was very short and soon inflation started growing very fast. The whole period of existence of kharbovanets was characterized by extremely high inflation, which sometimes achieved 10000% (graph 1). The sole cause of high inflation was fiscal imbalance resulting from

excessive budget deficit and inflationary financing. The huge size of the deficit in its turn was a result of large share of government sector in the economy, which was subsidized by the government. Therefore radical reforms were required such as massive privatization and restructuring, social reform etc, and the lack of them at that time significantly contributed to the worsening of overall economic conditions. Since independence Ukraine's economy is constantly and persistently collapsing and the process was started at that time, what emphasize the importance of the period 1992-1996 in the current and future stages of the development of Ukraine's economy. The sequence of events, which have occurred in this period, produced incentives that promised to have prolonged impact on the economy, especially that concerning inflationary expectations. A high level of the letter destroys one of the main functions of money, namely the store of value. Exactly in this period people learned how to operate with foreign currency, which found its reflection in the development of new institutions. The existing literature on currency substitution addresses this issue as a fixed cost, which public pays learning to operate with foreign money. By hypothesis, this should result in related to the currency substitution phenomenon, which is common for transition economies, namely hysteresis. That is during the period of high instability peoples learn how to operate with foreign currency, i.e. pay some costs and in aftermath after stabilization takes place they do not see any reason to change their attitude toward money holding at least immediately.

Among other characteristics of this period was a constant shortage of the currency supplied officially, because of high expectations of exchange rate devaluation. This in turn led to active development of the "black" market of foreign exchange.

More intensive reforms were started in the next period 1996-up to now.

The second monetary reform was an introduction of hryvna – national currency. Before the hryvna was introduced, significant measures had been undertaking by the central bank to stabilize the economy. First of all central

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bank achieved independence of government in order to prevent attempt to run printing money. Then the borrowing strategy of the government also was changed radically together with reduction of budget deficit to acceptable by IMF level (4-5%). Now the government issued short-term bills, the main buyers of which were commercial banks. After hryvna had been introduced, it was allowed to hold government bills by non-residents of Ukraine. Rather high yield on them made it attractive investment for foreigners, which resulted in little revaluation of exchange rate.

In order to stabilize the economy and reduce inflationary expectations, the central bank had chosen fixed exchange rate regime (to be precise, currency band). The capital inflow as result of foreign short-term investment in government bills, assisted to the central bank to maintain the hryvna but it was only temporarily. Soon the central bank was forced to devalue.

Inflationary expectations within the economy remain very high. As can be argued the sole measure of inflationary expectations can be the level of "monetization" (the reverse to the velocity of circulation) of the economy, that is the ratio of M2 to the GDP. It shows how the money serves its traditional functions namely as a store of value and as a mean of exchange. The level of "monetization" of Ukraine's economy remains very low. From the late 1995 and up to now it has risen only from 10,4% to 13,5% of GDP(Hoffmann;1998). It shows very high speed of circulation of domestic currency, which mainly perceived as a mean of payment but not as a store of value. The main reason for that is the loss of trust by the public and that will require a long period after stabilization to renew its trust in domestic currency.

4. Two period division

The reforms in Ukraine are not a good example of the appropriate timing and structure, which turned the direction of economy's development. But implementation of them, although not in the desirable quantity, in the mid of 1995 had some favorable consequences for the economy in terms of partial

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stabilization. In general the pattern of authorities' behavior remained unchanged even after this stabilization.

Therefore taking into account the monetary history of Ukraine and corresponding variation in the data it is quite reasonable to divide the whole period since 1993 and up to now in two separate and then apply developed model to each. High budget deficit, high inflation and low credibility of the government can characterize the first period. While the second can be characterized by moderate budget deficit, low inflation and high credibility of the government.

From the practical standpoint rather high variation in the inflation in the first period, which sometimes attained 90% per month (see the graph#1), may obscure or even misrepresent the results of our estimation. Besides, it is of interest here what actually determined the demand for real balance and the demand for foreign currency in the first period and in the second and how its determinant changed as a result of monetary policy and reforms implemented at the end of first period. Although data availability imposes some constraints on the estimation, especially that concerning foreign currency purchases. That makes impossible to estimate foreign currency demand in the first period.

Graph 1.Monthly % change of CPI
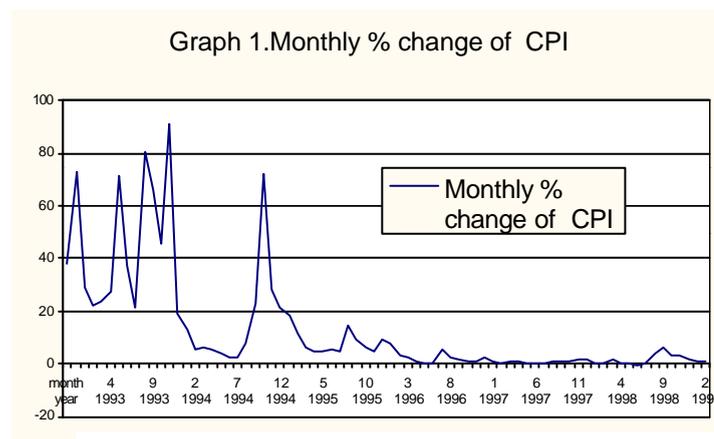
Source: UEPLAC calculations.

As can be seen from the graph 1 the variation in the monthly inflation is great in the first period and almost absent in the second. That show how effective was stabilization package implemented by the central bank. It can be argued central bank achieved its

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goal, but how this affected the determinants of the demand for domestic and foreign money is an empirical issue. So an increase in credibility of the government will be shown in the increase of elasticity of the demand for domestic money with respect to domestic interest rate (see the section on the theory). In the extreme case when it turns from inelastic to elastic, we may argue that the public had changed it's attitude toward banking system and government credibility.

In the context of currency substitution in transition, the first period is the crucial one because it is in charge of the lost credibility to the government as an authority. That in turns born adverse incentives, which influenced the monetary and real sectors. They are currency substitution and the growth of informal economic activities. The correlation between these two factors in reality should be high, but it is almost impossible to address this issue through the empirical test.

5. Theory and practice of the demand for money and currency substitution in application to Ukraine. Partial adjustment model.

Money is the medium of exchange and the standard unit in which value of different goods is expressed. Money serves four major functions, namely medium of exchange, store of value, unit of account and deferred payment. Money demand is basically the demand for real balance, i.e. the amount of money, which satisfy to the all current motives of agents to hold them. The evolution of the theory of money demand followed such stages:
- ✓ Classical economics-money serves as a numeraire, i.e. commodity whose unit is used in order to express prices and values (Leon Walaras);
- ✓ Quantity theory-emphasizes a direct and proportional relationship between the quantity of money and price level. There are two alternative but equivalent expressions. The first is "equation of exchange" (Irvin

Fisher) -concentrate on institutional details of the payment mechanism-and the second is the "Cambridge approach"-concentrates on the motives for holding money (A.C. Pigou).

✓ Neoclassical approaches -considered the primary role of money as a medium of exchange and as a store of value;

✓ Keynesian theory-also focuses on the motives of holding money, it postulates that there are three motives of holding money: transactions, precautionary and speculative. In some sense it covers all previous theories.

✓ Post-Keynes Theories of Money Demand:

✓ Inventory-theoretic approach-view the money as an inventory held for transaction purposes;

✓ Precautionary demand for money approach-arises because people are uncertain about the payments they might want to make;

✓ Money as an asset approach-emphasize the store of value function and the demand for money is a part of the problem of allocation of wealth among alternative assets in the portfolio.

✓ Consumer demand theory approach-"restatement of the quantity theory of money" in which Friedman argues that the demand for assets should be based on the axioms of consumer choice.

To summarize theory we may write the demand for real balances as a simple relationship:

$$\frac{M_{ti}}{P_t} = f\left(\underset{-}{i_d}; \underset{+}{Y}\right); (1)$$

where i_d -return on alternative assets; Y-real income or other scale variable.

The empirical analysis extends this relationship by defining a set of opportunity cost variables, which may differ from case to case and are determined by country's internal and external conditions (Sriram,1999).

There are three main approaches in empirical analysis of the demand for money, namely partial adjustment model (PAM); buffer stock model and finally error correction model. The last two was developed in response to "missing money episodes" (i.e. over-forecasting by standard models based on partial adjustment specification in the early 1970's) and were aimed to improve predictability of the demand for money. Regardless of the critique of PAM I'm going to use partial adjustment model to study the phenomenon of currency substitution because here I'm concentrating mainly on the explanation of the past rather than forecasting the future and this approach allows direct estimation of parameters, which are of the most interest here.

The PAM has the following general form:

$$Log\left(\frac{M_{dti}}{P_t}\right) = b_0 + b_1 \cdot \log(i_d) + b_2 \cdot \log(Y) + b_3 \cdot \log(x) + r \cdot \log\left(\frac{M_{it-1}}{P_{t-1}}\right)$$
(2)

where M_{dit} -monetary aggregate; typically it is M_1 or M_2;

P_t -price level;

i_d is nominal deposit rate;

Y -real income;

x -a vector of opportunity cost variables.

It is derived from the conventional money demand formulation, which is rested on the relationship (1), but also assumes the following partial adjustment scheme:

$$\frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}} = d \cdot (\frac{M_t{}^*}{P_t} - \frac{M_{t-1}}{P_{t-1}})$$; It is derived from one period quadratic

cost of adjustment $\left(\frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}}\right)^2$ and cost of disequilibrium

$\left(\frac{M_t}{P_t} - \frac{M_t{}^*}{P_t}\right)^2$ (Sriram;1999).

By substituting linear identity derived from relation (1) in the scheme we obtain specification (2).

It should be mentioned that derivation of partial adjustment model assumes equilibrium state of the money market initially and when original conditions have changed dependent variables also should adjust to equilibrate the market such that desired money balances equal to actual money stock.

The coefficient ρ shows the long run adjustment, while all other coefficients are considered short run and represent the elasticity of the demand for real balance with respect to chosen variables.

For Ukraine we may write the following partial adjustment specification:

$$Log\left(\frac{M_{1t}}{P_t}\right) = b_o + b_1 \cdot \log(i_d) + b_2 \cdot \log(i_f) + b_3 \cdot \log(Y) + b_4 \cdot \log(E^e) + r \cdot \log\left(\frac{M_{1t-1}}{P_{t-1}}\right)$$
; (2)

where

P_t -price level;

i_d - nominal deposit rate on domestic currency deposits;

i_f -nominal deposit rate on foreign currency deposits;

E^e -expected exchange rate.

Y- real income;

The first three variables represent opportunity cost of holding domestic money, while the last is conventional scale variable, which is a proxy for the amount of transactions.

The expected signs of coefficients in accordance with theory is the following: β_1 negative-an increase in the deposit rate would lead to fall in the demand for real balance by raising opportunity costs; β_2- positive-an increase in the foreign currency deposit rate would lead to increase in the demand for domestic currency and foreign currency purchases; β_3- positive-an increase in income would lead to increase the amount of transactions and as a result the demand for real balance; β_4-the sign of this coefficient is conditional on the measure of expected exchange rate and can be negative or positive.

I suggest using the following variables in accordance with specification above:

- CPI as a measure of prices in the economy;
- Nominal average deposit rate on domestic currency deposits (NDR);
- London Interbank Offered Rate (LIBOR for short) as a proxy for domestic foreign currency deposit rate. Although average individual may held his money in domestic banks and not in foreign, the data on deposit rate on foreign currency deposits is not available till 1998 when it started to be mandatory in the banking reports.
- Real income, i.e. real GNP(RINCOME);
- Lagged value of official exchange rate as a proxy for expected exchange rate. Here it is assumed that public forms their expectation concerning future exchange rate on the base of previous period exchange rate. Actually the exchange rate was constantly devaluing over the period under consideration to the exclusion of relatively stable period after introduction of hryvna, when exchange rate was kept unchanged and even revalued a little. But this was only temporarily. The validity of the

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assumption concerning lagged value of exchange rate can also be proved by the fact that official exchange rate represents AR(1)-process, i.e. there is a strong correlation between subsequent and current values of the exchange rate. By assumption the official exchange rate also correlates with "black market" exchange rate therefore it should give more or less actual picture of currency substitution covering and informal sector as well.

There is other measure of expectation toward future exchange rate in the literature such as forward market rate (Adam;1992). But as soon as Ukraine has not well-developed forward market, employing previous value of exchange rate will serve as a good proxy.

According to previous studies of currency substitution in the context of demand for real balance it has two patterns namely direct and indirect (Sriram;1999). The former is determined by the expectation of exchange rate devaluation that encourages agents to transform their savings which they made in domestic currency into foreign one or simply convert the excess of real balance into foreign currency. That would maintain purchasing power stability of their real balance.

The later is determined by foreign currency deposit rate. That is agents would prefer to hold money, which pays higher interest. It also can be interpreted as an asset substitution rather than currency substitution, because the sole reason, which determines the preferences of agents for the assets with the same liquidity characteristics, is interest that can be earned or opportunity costs of holding money.

The inclusion of both variables represents the null and alternative hypotheses and will answer the question what determines currency substitution in the demand for money in both periods, i.e. high inflation and post high inflation periods, as well as it will give the elasticity of the demand for domestic money with respect to the determinant of currency substitution. That is

H_0: $\beta_4<0$; against H_1: $\beta_4=0$;

H_0: $\beta_4>0$; against H_1: $\beta_4=0$;

and

H_0: $\beta_2>0$; against H_1: $\beta_2=0$;

Implicitly it also will cover the issue of neutralizing the impact of currency substitution effect on the demand for domestic money.

Alternatively we may write the specification for the demand for foreign currency as function of yield on both currencies-domestic and foreign-exchange rate expectation and real income.

$$Log\left(e \cdot M_{fti}\right)=\boldsymbol{a}_0 + \boldsymbol{a}_1 \cdot \log(i_d) + \boldsymbol{a}_2 \cdot \log(i_f) + \boldsymbol{a}_3 \cdot \log(Y) + \boldsymbol{a}_4 \cdot \log(E^e)$$

(3)

where $e \cdot M_{ft}$-stock of foreign currency supplied by authority in units of domestic currency or simply the purchases of foreign currency by individuals;

This specification also rests on the conventional demand for money identity like (1), which relates opportunity costs and income as a proxy to the amount of transactions to the monetary aggregate. Here the purchases of foreign currency were used.

One crucial difference from the demand for domestic money is that it does not assume the partial adjustment scheme.

All other variables are the same as in the demand for domestic money.

It is natural to expect the following signs of coefficients: α_1-negative-higher deposit rate on domestic currency would lead to the lower purchases of foreign currency; α_2-positive-higher yield on foreign currency would result in increased willingness of agents to hold it;; α_3-positive-it is assumed that income elasticity of the demand is equal to 1, i.e. increase in income

would not affect the structure of portfolio, α_4-positive, the higher future exchange rate the more currency people would buy now.

The form of the specification allows answering the question concerning the determinants of the purchases of foreign currency. Hypotheses here are similar to that in the demand for domestic money. They ask which of coefficients of variables determining currency substitution, i.e. foreign currency interest rate or expected exchange rate or both is significant in the model.

$$H_0: \alpha_4 > 0; \text{ against } H_1: \alpha_4 = 0;$$

and

$$H_0: \alpha_2 > 0; \text{ against } H_1: \alpha_2 = 0;$$

The significance of any will support the hypothesis as to certain pattern of currency substitution. For example, the significance of the coefficient of foreign currency yield in the model will imply that regardless substantial difference between foreign and domestic interest rate the former is perceived as more safety alternative because of high risk component of domestic yield or equivalently low real rate of return.

The logarithmic form of specification allows estimating partial elasticity of the demand for foreign currency with respect to included variables.

I suggest using as a dependent variable purchase of foreign currency in USD by individuals. The problem here is that foreign currency trade in some periods was restricted by the central bank, especially in the period of high demand for currency and associated with it foreign currency shortages. In this periods the demand was satisfied mainly on the black market. As a result the data may not cover real situation and that should be taken into account in interpretation of results. For completeness of the picture the data on the purchases of foreign currency unofficially should be added, which unfortunately is not available.

Also absence of data for the high inflation period restricted our attention to the post high inflation period.

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One point should be mentioned on the issue of performance of the lagged value of the exchange rate, which is served in the model as a proxy for the expected rate. It is quite reasonable to expect the poor performance of the last in the second period as a result of central bank policy toward exchange rate regime and to commercial bank's trade of foreign currency. The situation is different in the first period for two reasons. First, exchange rate was constantly devaluing. Second, there was a constant shortage of foreign currency, such that central bank could not satisfy the whole demand. That lead to the development of black market of foreign exchange. But, regardless of the difference between black market rate and official exchange rate it makes sense to assume that they are correlated. Therefore the inclusion of official exchange rate may produce results close to reality. Although the same reasoning can be applied to the second period, the two facts mentioned above can refute them in reality.

6. Data and methodology.

Developed models were applied to the monthly data on the following macroeconomics indicators:

- M1-money in circulation and demand deposits in thousands of Hryvnas at the end of period (Source:NBU);

-Consumer price index (CPI) as a measure of prices in the economy with the base 1990 (Source: Derzhkomstat and UEPLAC calculations);

-Real Income (RINCOME) in billions constant 1990 Rb, which cover paid wages and pensions, payments by kolkhoz and sales of private plots to the state, other transfer incomes (stipends), other social benefits and interest payments on saving accounts. Since July 1995 new element appeared in "other incomes" as "sales of foreign currency". The last is expected to be cash dollars exchanged by households in exchange points and they do not represent income in its economic meaning. The fact is that monetary income underscore factual private income and that should be taken into

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account to interpret results (Source: Derzhkomstat and UEPLAC calculations);

-Nominal deposit interest rate (NDR) of commercial banks average % (Sourse:NBU);

-London Interbank Offered Rate (LIBOR) on 3-month deposits, % (Sourse: IFS);

- Purchases of foreign currency (PFC), from the household's balance of income and expenditures, million of Hrn (Source:Derzcomstat and UEPLAC calculations);

- Official exchange rate (OEXRT), is set by the NBU with the reference to the currency fixing at the Ukrainian Interbank Currency Exchange, Hrn/USD (Sourse: NBU and UEPLAC calculations).

The rationale for the inclusion of these variables sees in the previous section.

Defined specifications, which include variables for alternative and null hypotheses, are estimated by the mean of standard OLS with additional employment of Cochane-Orcutt procedure to adjust for serial correlation. Models were estimated for the monthly data for two periods separately: 1994:4-1996:6 and 1996:6-1998:12, and then for the whole period in order to check for structural stability. Monthly data for the period up to 1994:4 is not available, but existing data 1994:4-1996:6 is a representative sample for the whole period of high inflation. Also tests for data stationarity and cointegration were employed in order to guarantee validity of all conventional econometric tests in the context of long run relationship.

7. Empirical results.

The results of estimation of the PAM of the demand for real balance are summarized in the table 1. Here model was applied to the monthly data for two periods: 1994:4-1996:7 and 1996:7-1999:1. Then, to check for structural stability the model was estimated for the whole period. The results of structural stability test presented in the table 2, which shows that coefficients are not the same for the whole period and were changed as a result of radical reforms (see section on two period division).

The data chosen for estimation is not stationary what is natural for money demand components but it is cointegrated as shows Johamsen-test (see Table 7 and 8). This implies long term relationship between variables, especially it stable in the second period where as test shows a single relationship exists in contrast to the first period to which corresponds three relationships, and does not refute results predicted by t- and F-tests.

In general estimated results presented in the Table 1 corresponds to expectations predicted by the theory. As can be seen the sign of all coefficients are correct (for more details see section on the theory).

The results for the high inflation period shows that nominal deposit rate, foreign currency deposit rate and trend variable are not significant in the model. By applying standard F-test, which measures marginal contribution we may reject the hypothesis that the contribution of these variables is significant. The problem here can be in multicollinearity, that is one variable bears explanatory power of collinear variables. The correlation matrix for the high inflation and post high inflation periods is presented in the table 3 and 4 respectively. It is obvious from this table that there is strong multicollinearity between lagged one period exchange rate, nominal deposit rate, foreign currency deposit rate and trend variable in the high inflation period. That may obscure results for this period, although the existence of uncovered interest parity justifies this correlation. Besides, econometric theory says that multicollinearity produces unbiased but not efficient estimates. The exclusion of lagged exchange rate from the model partially resolve the problem without

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destroying theoretically justified specification, but that yield lower explanatory power of the model for this period and also produces wrong sign of the foreign currency deposit rate. It should be positive rather than negative. On the base of standard F-test, we may argue that addition of exchange rate significantly improves the performance of the model. Taking into account these two facts (i.e. lower explanatory power and marginal contribution) we may argue that exchange rate was significant determinant of the demand for domestic currency. Besides, the significance of the exchange rate and insignificance of the nominal deposit rate confirm the reality. As soon as in that period the real interest rate was extremely low because of high inflationary expectations which in addition to weak public trust in the banking system makes it very risky and unattractive to hold money in the banks' deposits. Given the assumption about agents' rationality, the last fact should make foreign money even more popular.

Therefore I'm more likely to conclude that the effect of currency substitution estimated from the demand for real balance for the high inflation period is determined by exchange rate

The demand for domestic money is inelastic in the short run with respect to real income and exchange rate (They are the only significant coefficients in the model), but very elastic in the long run. The elasticity of the demand for money with respect to expected exchange rate is -0.37 in the short run and –1.33 in the long run, which means that one point increase in the expected exchange rate leads to 0.37 points reduction in the demand for domestic money immediately and 1.33 in one month. That can explain very high velocity of M1 in this period (see the graph 2.). The constant term shows the influence of all other factors not included in the model and it is highly significant.

In the regression for the second period all coefficients have expected signs and are significant at 10% level to the exclusion of expected exchange rate. The insignificance of the last is quite reasonable to expect in advance, because

of two factors. First, the exchange rate regime in this period was currency band and devaluation was not as substantial as in the previous period; second, in this period central bank periodically restricted currency trade by commercial banks in order to protect currency from devaluation. As a result the exchange rate is not very informative and can be a poor proxy for expected one. We may also interpret that as increase in the government credibility.

Also, the multicollinearity is not a problem in this period as soon as the correlation between the variables is admissible.

The significance of foreign currency deposit rate allows making a conclusion about indirect currency substitution in the post high inflation period. That is, deciding which currency to hold agents are guided by the opportunity costs represented by interest rate which holding of foreign money provides rather than expected exchange rate. The last is a poor measure of expectations as have been already mentioned.

In this period the demand for money is not elastic with respect to any of included variables neither in the short run or in the long run. The coefficient which reflects long run adjustment is less than one corresponding long run elasticity will be higher than those short run but lesser than unit.

The elasticity of the demand for domestic money with respect to the parameter, which determines currency substitution in the model, namely LIBOR is 0.33 in the short run and 0.6 in the long run. Now unit change in the foreign currency interest rate will lead to 0.33 points immediate increase in the demand for domestic money rather than decrease as in the case with expected exchange rate.

It also worth noting that elasticity with respect to domestic interest rate is lower 1.4 times than that with respect to foreign currency. This means that if central bank wants to preserve stability of domestic money demand in case when foreign rate had changed, it has to provide 1.4 times higher interest rate in response to one unit increase in the foreign.

The significance of foreign interest rate signifies two facts. First, is that the inflationary expectations in the economy remains high. Second which results from the first, agents substitute currency because its real interest rate is higher, which in turn implies assets substitution rather than currency substitution. These give implicit evidence of uncovered interest parity condition, where interest differential is equal to expected rate of depreciation and risk component.

An other interesting point, which can be seen by comparing results of two periods, i.e. the elasticity of the demand for money with respect to income is lower in the second period than in the first. That can be explained by the fact that real income does not represent actual situation in the economy because of huge informal sector. As can be seen from the graph 3 the "shadow" economy is growing over time, while the output of real sector is constantly and persistently declining (see the graph 4).

The significance of trend variable indicates the appearance of seasonally in the demand for real balance.

Since the models contains stochastic dependent variable it suffers from serial correlation, which was removed by employing Cochrane-Orcutt procedure.

The performance of both models, which was judged on the base of R^2, is quite high, which for the first period is 0.96 and 0.97 for the second. However, this does not imply that prediction ability of the model will be good enough.

In table 6 the results of estimation of the demand for domestic and foreign currency for the post-high inflation period are presented. Here the specification for the domestic money demand differ from the partial adjustment model by the autoregressive term in order to make elasticity comparable with those of the demand for foreign currency.

As can be seen the signs of coefficients correspond to our expectations.

In the demand for domestic real balance the expected exchange rate is not significant at 10% level as in the partial adjustment model for the same period. It is turned out that this coefficient is not statistically significant in the demand for foreign currency. In contrast to that the coefficient of foreign currency interest rate is highly significant in both models, which confirm the conclusion drawn form the PAM as to indirect currency substitution. But elasticity differs substantially: from 0.89 in the foreign currency demand to only 0.31 in the domestic demand for real balance.

The same situation is with domestic interest rate. It is highly significant in both specifications but the elasticity is larger in the foreign currency demand (0.7-in foreign compared to 0.25-in domestic). The significance of the domestic interest rate signifies the fact that the demand for foreign currency can be controlled by the central bank by providing higher interest rate on domestic deposits.

One possible explanation of the substantial differences in the elasticities can be found in the kinds of demand represented by tested specifications. If domestic demand for real balance combines transaction as well as speculative demand, the demand for foreign currency is only of speculative character.

The insignificance of real income in the foreign money demand means that it is not affected by that variable that corresponds to the speculative character of the demand.

The goodness of fit of the foreign currency demand is quite low ($R^2 = 0.60$) in comparison to the domestic one ($R^2 = 0.94$), which basically means that there are other factors not included in the model and reflected as a constant term that influence the purchases of foreign currency. Although the right value of D-W-statistics (1.94) shows that there is no strict pattern in disturbances that can be addressed as an omission of important variable.

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Table 1. The demand for real balance in the high inflation and post high inflation periods

Dependent Variable LOG(M1/CPI)	High inflation period (1994:4-1996:7)		Post high inflation period (1996:7-1998:12)		The whole period (1994:4-1998:12)	
Variable	**Short run Coefficients**	**Long run Coefficients[1]**	**Short run Coefficients**	**Long run Coefficients**	**Short run Coefficients**	**Long run Coefficients**
C	3.479043* (0.0916)	12.4832	3.624675* (0.0000)	6.47518	3.203969* (0.0000)	11.350644
LOG(RINCOME)	0.624967* (0.0002)	2.24244	0.224104* (0.0000)	0.40034	0.383782* (0.0000)	1.3596177
LOG(NDR)	-0.101742 (0.2990)	***	-0.241451* (0.0000)	-0.43133	-0.066655 (0.1846)	***
LOG(LIBOR)	0.159047 (0.8573)	***	0.334191* (0.0770)	0.59700	0.256539 (0.3766)	***
LOG(OEXRT(-1))	-0.369962* (0.0005)	-1.327461	-0.057428 (0.4546)	***	-0.396268* (0.0000)	-2.807703
Trend	-0.002303 (0.8696)	***	0.008638* (0.0023)	0.01543	0.006908* (0.0206)	0.024473
AR(1)	0.721301* (0.0020)	***	0.440220* (0.0077)	***	0.717728* (0.0000)	***
R-squared	0.962036		0.971866		0.933524	
F-statistic	80.24564 (0.000000)		132.4188 (0.000000)		114.6842 (0.000000)	
Durbin-Watson stat	2.031690		2.050957		1.611983	
Inverted AR Roots	.72		.44		.72	

*means significant at 10% level; p-value is shown in parentheses.

*** means insignificant and therefore had not been included.

For the first period (high inflation): Sample(adjusted): 1994:05 1996:06;Included observations: 26 after adjusting endpoints. Convergence achieved after 17 iterations.

For the second period (post high inflation): Sample: 1996:07 1998:12.Included observations: 30.Convergence achieved after 8 iterations.

For the whole period: Sample(adjusted): 1994:05 1998:12;Included observations: 56 after adjusting endpoints. Convergence achieved after 18 iterations.

1 Long run coefficients obtained by dividing corresponding short run coefficient by (1-coefficient of AR(1)). The interpretation of the long run is conditional on the data frequency.

Table 2. Chow break point test for the period 1994:4-1999:8

Chow Breakpoint Test: 1996:07

F-statistic	5.066788	Probability	0.000315
Log likelihood ratio	34.28259	Probability	0.000015

The null hypothesis is that the demand for domestic money is the same in both periods versus the alternative hypothesis that they are not.Computed Value of F-statistic exceeds its critical value ($F_{critical(7;60)}$=1.82; $F_{critical(7;40)}$=1.87) and therefore the hypothesis of structural stability can be rejected. The same conclusion can be drawn from the p-value, which is very law.

Table 3. Correlation matrix for the high inflation period

	LOG(M1/CPI)	LOG(RINCOME)	LOG(OEXRT(-1))	LOG(NDR)	LOG(LIBOR)
LOG(M1/CPI)					
LOG(RINCOME)	0.7907				
LOG(OEXRT(-1))	-0.7519	-0.4171			
LOG(NDR)	0.4166	0.0006	-0.8214		
LOG(LIBOR)	-0.5091	-0.2716	0.7987	-0.5620	
TREND	-0.6392	-0.2880	0.8706	-0.9130	0.4613

Table 4. Correlation matrix for the post high inflation period

	LOG(M1/CPI)	LOG(RINCOME)	LOG(OEXRT(-1))	LOG(NDR)	LOG(LIBOR)
LOG(M1/CPI)					
LOG(RINCOME)	0.5614				
LOG(OEXRT(-1))	0.2996	0.2551			
LOG(NDR)	-0.6273	-0.2677	0.3367		
LOG(LIBOR)	0.8789	0.2748	0.2030	-0.5028	
TREND	0.7742	0.3245	0.7282	-0.0986	0.7793

Table 5. Correlation matrix for the whole period

	LOG(M1/CPI)	LOG(RINCOME)	LOG(OEXRT(-1))	LOG(NDR)	LOG(LIBOR)
LOG(M1/CPI)					
LOG(RINCOME)	0.7016				
LOG(OEXRT(-1))	-0.5272	-0.2104			
LOG(NDR)	0.1667	-0.0595	-0.8202		
LOG(LIBOR)	-0.0287	0.0277	0.6967	-0.6639	
TREND	-0.0500	0.0470	0.7504	-0.8575	0.7188

Table 6. The demand for foreign and domestic currency

Dependent Variable	LOG(PFC/OEXRT)	LOG(M1/CPI)[1]
Variable	Coefficients	Coefficients
C	5.885571* (0.0002)	5.6045* (0.0000)
LOG(RINCOME)	0.131969 (0.6576)	0.2295* (0.0001)
LOG(NDR)	-0.688337* (0.0062)	-0.2455* (0.0001)
LOG(LIBOR)	0.892632* (0.0561)	0.30886* (0.0729)
LOG(OEXRT(-1))	0.134464 (0.5519)	-0.06055 (0.4180)
Trend	***	0.005706 (0.0016)
R-squared	0.601135	0.939225
F-statistic	9.419480 (0.000087)	74.17931 (0.0000)
Durbin-Watson stat	1.936783	1.9002

*means significant at 10% level; p-value in parentheses.
Sample(adjusted): 1996:07 1998:12; Included observations: 30 after adjusting endpoints.
[1] as soon as original equation suffer from positive autocorrelation (D-W-statistic=1.16), Cochen-Orcutt procedure have been employed to remove it. Presented in the table results are corrected for autocorrelation.

Table 7. Johancen Cointegration Test for the high inflation period.
Sample: 1994:04-1996:06;
Included observations: 25
Test assumption: Linear deterministic trend in the data
Series: M1/CPI Nominal Deposit Rate LIBOR Real Income Exchange Rate
(-1)
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.887303	124.172	68.52	76.07	None **
0.762479	69.5956	47.21	54.46	At most 1 **
0.57041	33.65807	29.68	35.65	At most 2 *
0.347487	12.53495	15.41	20.04	At most 3
0.071768	1.86185	3.76	6.65	At most 4

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 3 cointegrating equation(s) at 5% significance level

Table 8. Johancen Cointegration Test for the post high inflation period.
Sample: 1996:06-1998:12;
Included observations: 31
Test assumption: Linear deterministic trend in the data
Series: M1/CPI Nominal Deposit Rate LIBOR Real Income Exchange Rate
(-1)
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.838372	102.6808	68.52	76.07	None **
0.525325	46.18468	47.21	54.46	At most 1
0.378712	23.0858	29.68	35.65	At most 2
0.222825	8.331042	15.41	20.04	At most 3
0.016516	0.51628	3.76	6.65	At most 4

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 1 cointegrating equation(s) at 5% significance level.
The amount of cointegrating equations corresponds to the amount of
possible long run equilibrium. As can be seen in the first period there is three
possible long run equilibrium while in the second only one. This corresponds
to the characteristics of each period.

Conclusion.

In this paper currency substitution hypothesis was checked in the context of the demand for real balance specification, which is assumed to have partial adjustment formulation, for two periods: high inflation period: 1994:4-1996:6 and post-high-inflation period: 1996:6-1998:12.

Chow break point test shows the absence of structural stability of the parameters of the model for the whole period.

The results show significance of the parameters that determine currency substitution in the model. Though the parameters differ across periods, which maybe the result of Central Bank policy or different reactions of economics agents to a process of hyperinflation and to one of relatively low inflation. So, in the first period it was determined by the expected exchange rate, which was assumed to equal to lagged one period value of current exchange rate. The constant devaluation of exchange rate and exchange rate regime in this period made lagged exchange rate a good proxy for the expected one. The significance of the expected exchange rate is an indicator of direct currency substitution, when agents substitute currency in order to preserve purchasing power stability, what basically confirms our expectations. The demand for real balance as coefficients show was inelastic with respect to this parameter in the short run and become very elastic in the long run.

In the second period exchange rate is insignificant determinant of currency substitution, because of different exchange rate regime. Therefore the parameter determined currency substitution in the model becomes foreign currency interest rate, which is highly significant in the second period. This is an indicator of indirect currency substitution, when agents are guided by the yield on foreign currency. We may also interpret this as evidence of uncovered interest parity condition, when interest differential should be equal to expected exchange rate depreciation. The risk component should be added to insure that this condition hold, which is crucial for Ukraine and other

transition countries. The elasticity of the demand for real balance with respect to foreign currency interest rate is inelastic in the short run and in the long run, what proves the fact that currency substitution effect declined a bit but still remains very significant. This elasticity is higher in absolute value than that of domestic interest rate, which also gives indirect evidence of the fact that foreign money perceived to be more reliable than domestic one.

The effect of currency substitution on the demand for real balance differs in the direction across the periods. So, in the first period it has negative effect, while in the second it is positive. That is expected devaluation of the exchange rate in the first period cause reduction of the demand for domestic money by substituting them for the foreign. This basically means that foreign money perceived as alternative and more safe means of payments and corresponds to the collapsing economy. Here foreign money serves as a kind of protection against faithless government. The situation is different in the second period where increase in foreign currency yield cause corresponding increase in the demand for real balance, which then transformed into foreign currency and deposited at foreign currency accounts. This is a sign of a healthier state of the economy, but it reasonable to expect high degree of currency substitution in response to the previous period high inflation. As can be deduced the difference in the economic conditions is substantial.

Estimated demand for foreign currency support the hypothesis concerning foreign currency interest rate as a determinant of currency substitution, since it has high positive effect on the purchases of foreign currency. The significance of domestic interest rate in this specification shows that central bank can affect purchases of foreign currency by providing higher interest rate on domestic one. In other words interest rate is significant policy variable in the foreign currency purchases.

To summarize, we may say that inflationary expectation in the economy remains high but national currency has not completely lost the trust of the

public. The only way to reduce these expectations is to raise domestic real return, which in its turn implies radical reforms of all sectors of the economy, creation of strong financial system etc.

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Data source: NBU-www.bankgov.kiev.ua
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Appendix 1. Currency velocity, "shadow" economy, real GDP and dollarization in Ukraine since 1994.
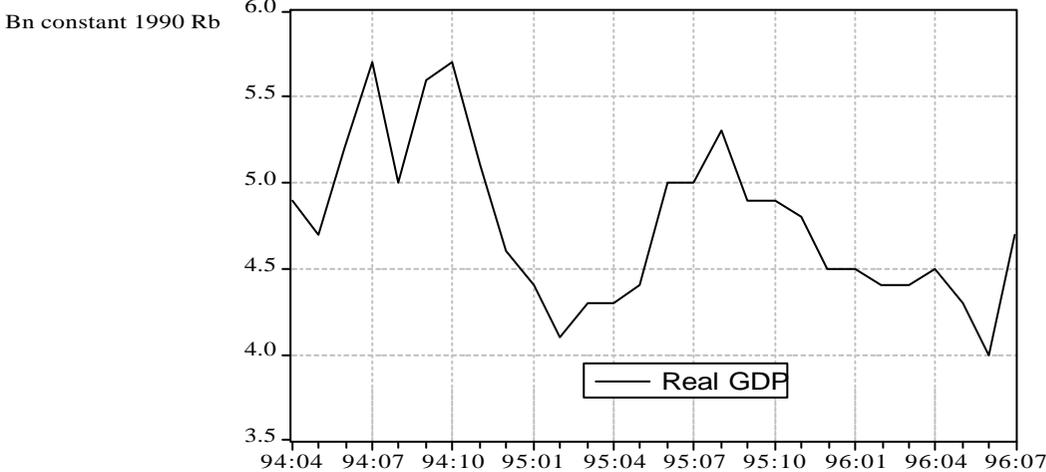
Graph 2. Currency Velocity (quarterly data).
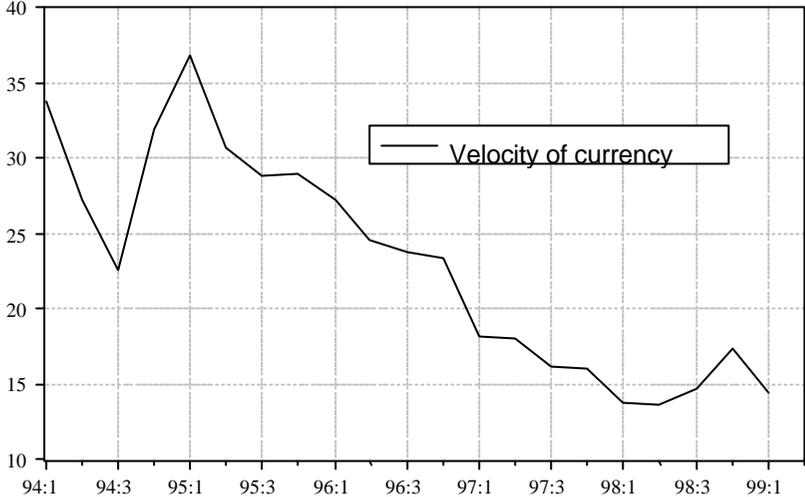
Velocity of currency

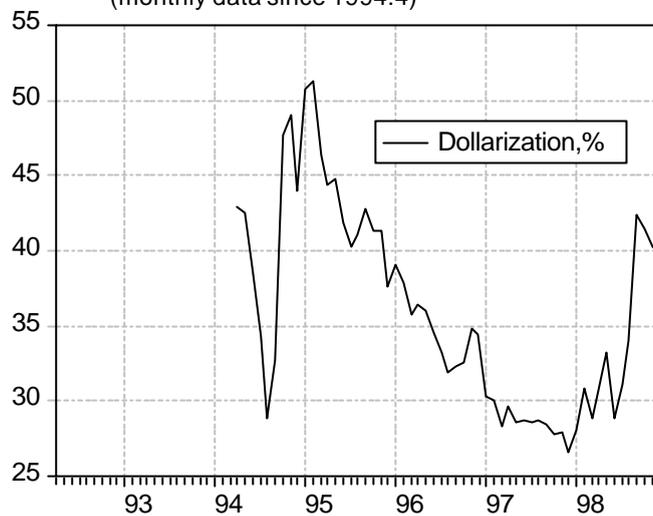Graph 3. The degree of "shadow" economy approximated by money in circulation to money supply ratio

"Shadow" economy

Graph 4. Real GDP of Ukraine in billion constant 1990 Rb. (monthly data)
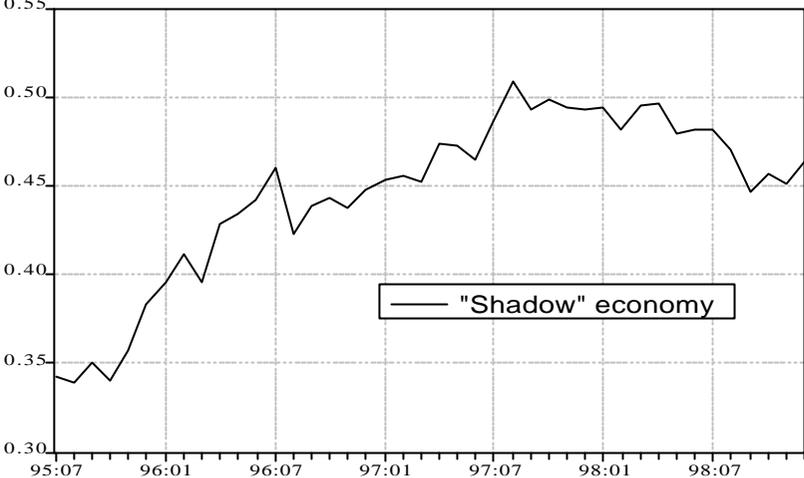
Bn constant 1990 Rb

Real GDP

Source: UEPLAC calculations (for all three graphs).

Graph 5. Dollarization ratio measured as foreign currency deposits to total deposits ratio, %
(monthly data since 1994:4)

Source: UEPLAC calculations