CURRENCY SUBSTITUTIO N IN A DOLLARIZED ECONOMY: THE CASE OF UKRAINE

by

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Abstract

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In highly dollarized economies, the distinction between currency substitution and asset substitution becomes crucial for policy decisions. In this study, the hypothesis of currency substitution in the two dollar aggregates – foreign currency denominated deposits and dollar cash in circulation – is tested based on the estimation of inflation equation for the case of Ukraine. An unconventional proxy measure of dollar cash in circulation in Ukraine is considered for the first time. With due notice of data and model limitations, the results of this research provide some evidence in support of currency substitution hypothesis for the dollar cash in circulation aggregate. Although the hypothesis of currency substitution in foreign currency deposits also appears to be supported by empirical evidence, currency substitution effect in this aggregate may be much smaller than that in dollar cash in circulation. Importance of these findings for policy decisions is discussed in the paper.

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ABBREVIATIONS

$C	Suggested in this paper measure (proxy variable) of DCC
ADF	Augmented Dickey-Fuller [test, or test statistic]
AS	Asset Substitution
bn	Billion
BIS	Bank for International Settlements
CBD	Cross Boarder Deposits (deposits of residents in foreign Banks)
CC	Domestic currency (Hryvnia) in circulation
CE	Cointegrating Equation
CS	Currency Substitution
DCC	Cash foreign currency circulating in a given country.
FCD	Foreign Currency Denominated Deposits
FSU	Former Soviet Union
GC	Granger Causality
Hrn	Hryvnia
M1	CC plus sight deposits in domestic currency
M2	M1 plus time deposits in domestic currency and sight and time deposits in foreign currency
MA	Monetary Aggregate
MB	Monetary Base
mln	Million
NBU	National Bank of Ukraine
SFD	Sight Foreign Currency Deposits
TFD	Time Foreign Currency Deposits
VAR	Vector Autoregression Model
VEC	Vector Error Correction Model

GLOSSARY

Asset Substitution. The use by residents of foreign currency as a store of value, without the use of it as a medium of exchange in domestic transactions.

Currency Substitution. The use by residents of foreign currency as a medium of exchange in domestic transactions.

Dollar aggregate. Any of the three forms of holding foreign currency by residents, which are typically considered in the studies of CS: FCD, DCC, or CBD.

Dollarization. The holding by residents of foreign currency and foreign currency-denominated deposits at domestic banks.

Inflation Targeting. Price Stability as the main goal of a monetary authority. This goal is achieved through all available channels of influence, using many information variables as a guide to the success of inflation targeting.

Information Variable. Any indicator such as interest rate or monetary aggregate used *ex post* to evaluate the stance of monetary policy in order to make further decisions, but not to return to the predetermined *ex ante* value of this indicator.

Intermediate Target. Easily and quickly observed variable such as interest rate or monetary aggregate, which has strong link with the final goal of the monetary authority (such as inflation or output). This variable is targeted by the monetary authority to achieve set in advance value over a path of time *under the assumption* that this will translate into the desired dynamics of the final goal variable.

Monetary Aggregate. Any of the following aggregates: MB, CC, M1, or M2-FCD, as well as the aggregates obtained by adding one or both dollar aggregates to these ones (CC+$C, M1+$C, M2-FCD+$C, M2, or M2+$C).

Ratchet Effect. Continued high levels of dollarization in a country after economic stabilization has been achieved.

Seigniorage. The revenue collected by the government as a result of its monopoly power to print money.

INTRODUCTION

The "Monetary Theory" section in any basic Economics textbook derives its conclusions based on the implicit assumption that there is only one money circulating in an economy. Monetary authority in each country has an exclusive right to issue this money, and thus has considerable control of its supply. Effectiveness of the monetary policy and important relationships between macroeconomic variables rest on this "single money" assumption.

However, in reality we often observe that people hold not only the domestic currency, but also money issued by other countries. This is especially evident in transitional economies, such as Ukraine. In literature, the holding by residents of foreign currency and foreign currency-denominated deposits at domestic banks received the name *dollarization*, and main components of foreign currency denominated holdings are called *dollar aggregates*[1]. Why do people hold foreign money? And does this demand for foreign money create any important consequences that should be taken into account by policymakers? To clarify these issues, let us start with the functions of money. Money fulfils three main functions: store of value, unit of account, and medium of exchange. Depending on which of these functions motivates people to hold foreign currency, two types of dollarization are distinguished. *Asset substitution* (AS) is defined as the use by residents of foreign currency as a store of value, without the use of it as a medium of exchange in domestic transactions. *Currency Substitution* (CS) is defined as the use by residents of foreign currency as a medium of exchange in domestic transactions[2].

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[1] This somewhat restrictive term appeared because in countries with high levels of dollarization dollar is the dominant alternative currency. However, the term "dollarization" is applied generically to aggregates in any foreign currency. The term "dollarization" sometimes is also used to denote the full establishment of a foreign currency such as the dollar as legal tender, in place of a domestic currency (see Berg and Borensztein (2000b)). My usage of this term does not include such full dollarization.

[2] This distinction is standard in the literature, as shown in the survey by Calvo and Vegh (1996), referenced in Berg and Borensztein (2000a).

Effects of AS are in essence equivalent to those of high capital mobility (Berg and Borensztein 2000a). Although closely linked to domestic macroeconomic conditions, AS dollar aggregates do not influence them directly any stronger then other liquid financial assets do. Situation is different in the case of CS. Imagine that the total stock of dollar aggregates in a country is equal (at the current exchange rate) to domestic money supply. If now domestic currency suddenly depreciates, say, by 20 percent, then the *total* money supply valued in terms of domestic currency will automatically increase by 10 percent overnight! Insofar as the central bank uses information about the money supply in its policy decisions, for example, as an information variable under inflation targeting[3], it should definitely take into account dollar aggregates in this situation. Dollarization in the form of CS also has important consequences for the choice of exchange rate regime, strengthening the case for fixed exchange rates (Berg and Borensztein 2000a). Finally, large CS effect in the foreign cash currency aggregate implies significant losses of seigniorage by the government (Fischer 1982). If, for example, in the case of Ukraine money supply grows by 20 percent per year[4], and the ratio of US dollar currency to GDP is 15 per cent[5], then the loss of seigniorage would be equal to 3 per cent of GDP a year[6]. This may give monetary authorities a reason not only to take into account, but also to try to reduce the level of dollarization in a country[7]. All these potential problems lead to a very important practical

[3] For the last several years, inflation targeting has been an official (at least declared) policy of the NBU. For a useful brief introduction to the modern concept of inflation targeting, see Debelle, Masson, Savastano, and Sharma (1988). In Christoffersen and Wescott (1999) some more technical issues can be found related to the specifics of inflation targeting in transitional economies. A somewhat extended discussion of the use of monetary aggregates in monetary policy, including the formal definition of the information variable concept, is provided in Appendix D.

[4] In 96-99 currency in circulation aggregate in Ukraine grew, respectively, by 54, 52, 17, and 34 per cent annually. The same dynamic for M2 aggregate was 45, 38, 24, and 41 per cent (Source: NBU 2000).

[5] This is the average figure for 1998 year that indirectly follows from the assumptions done in this study.

[6] This result should be treated only as an illustration of possible losses and not as an estimate of the actual figure. It should be remembered that the measure of dollar cash in circulation employed in this paper (introduced later) is only a proxy variable assumed, under rather strong assumptions, to reflect the dynamics of the actual aggregate. Exact estimation of the dollar cash circulating in the country is not feasible. Also, it is not possible to take into account the developments in the unofficial sector.

[7] For a more detailed review of the problems and benefits of dollarization see Appendix C.

question of whether any dollar aggregates in a particular dollarized economy represent the CS effect. This is the question that I explore in this paper for the case of Ukraine.

Ukraine is well suited for such a study. The level of dollarization in Ukraine has been very high for the last decade[8], and common observations allow for the possibility of either AS or CS reason of dollarization hypothesis to be found correct after formal study. Many transactions are stated and cleared in cash foreign currency (mainly US dollars), which is clear evidence to expect large CS effect to be present in this aggregate. On the other hand, the use of any currency other then national currency (hryvnia) as a medium of exchange in domestic transactions is forbidden by law. Thus, where it is difficult to hide transactions by circumventing state monitoring (like in the case of bank deposits), CS may be less significant.

I consider two types of dollar aggregates: foreign currency-denominated deposits (FCD) and foreign cash in circulation (DCC) in Ukraine. While the first aggregate is conventionally used in all studies of dollarization[9], it is much more difficult to find a reliable measure of the DCC. Berg and Borensztein (2000a) included DCC in the test for CS for five dollarized countries[10], but based on their measure of this aggregate they had to reject the hypothesis of CS. As they indicate, the main problem may be in the low quality of data available on DCC in their sample countries. In the case of Ukraine, this problem is also very serious and, to the best of my knowledge, none of the

[8] By 1995, IMF classified Ukraine as a "moderately dollarized" economy, with the dollarization ratio represented by the ratio of FCD to broad money reaching 32% (Balino, Bennett, and Borensztein 1999). The threshold for the "highly dollarized" group of countries was set at 34%. In January – February of 1995 Ukraine exceeded this threshold, with dollarization ratio reaching 36%, although later the ratio remained below 30% (Appendix A, Figure A1). Mongardini and Mueller (1999) use a similar but somewhat different proxy of dollarization – ratio of FCD to total deposits – and show that by mid-1998 this indicator averaged 40% for transition economies (generally considered to be highly dollarized). For Ukraine by the end of 1999 this figure was 44% (Appendix A, Figure A2).

[9] For example, Piontkivsky (2000) has recently used this aggregate to test the hypothesis of asset substitution and ratchet effect in dollarization in Ukraine

[10] Peru, Argentina, Turkey, Bolivia, and Philippines.

previous studies considered DCC in this context. However, in this research I attempt to introduce an unconventional proxy measure of DCC in Ukraine, based on the regular information about the sales and purchases of foreign currency by households through the official exchange points. I denote this measure "$C" throughout the paper to stress that it is only a proxy variable and is not DCC itself.

I test the hypothesis of CS in these aggregates on monthly data covering the period as long as the data permits, from January 1996 to January 2000. My method is based on the estimation of the price equation in VAR with money, exchange rate and prices. According to theory, addition of CS motivated dollar aggregates (but not those motivated by AS) to the domestic money supply would statistically improve explanation of inflation. I use this relationship as a test for CS[11].

The results of my study indicate that inclusion of the $C measure into the monetary aggregates improves explanation of inflation in the test sample. This may be evidence of the CS effect in DCC. The addition of FCD to the broad domestic monetary aggregate also improves the explanation of inflation, but only slightly. This result differs from that obtained by Berg and Borensztein (2000a), who have found that FCD significantly improve the link between monetary aggregates and inflation for all countries included in their study. However, we should remember about possible regulatory differences in Ukraine and those countries, first of all, the legal prohibition of payments in foreign currency in internal transactions. Under such conditions, it is difficult to expect large CS effect in this aggregate. Of course, these findings should be considered with proper attention to possible limitations of the simple VAR model employed and of the data available for Ukraine. Additional subsequent

[11] This type of technique was used by Berg and Borensztein (2000a) in an analogous research, as well as by other authors approaching similar questions, including Estrella and Mishkin (1996), Friedman and Kuttner (1996), and Feldstein and Stock (1994) (the latter two as referenced in Berg and Borensztein (2000a)).

research over a longer period and with a more comprehensive model would be desirable to establish the conclusions presented here.

If maintained, these conclusions could provide a way to enhance the quality and precision of policy decisions based on monetary indicators by taking into account the effect of CS in dollar aggregates. The same information will also find application in economic research, including the studies conducted by EERC students within the scope of their MA theses. In many cases, monetary aggregates enter as inputs in the models, and conclusions made based on this research would allow the researchers to make educated choice among available alternatives. Finally, the results received in this study may be used as a building block on the way to broader generalizations about the patterns of CS in transitional economies. Similar types of institutional arrangements or preferences of the population in these countries may lead to certain tendencies and common features in these patterns. To reveal such tendencies would be possible only after substantial empirical evidence has been accumulated, and this research is a contribution to such process.

The rest of the paper proceeds as follows. Chapter 1 reviews the methodology suggested in the literature to detect CS. Chapter 2 presents theoretical assumptions underlying the model that I chose. Chapter 3 describes the measures of dollarization in Ukraine and other data. Chapter 4 presents econometric specification and estimation output, and discusses the results. Chapter 5 describes policy implications, and Conclusion summarizes the main findings. Appendix A contains data on dollarization in Ukraine. Appendix B includes summary tables with estimation results and other econometric output. Appendix C provides an overview of costs and benefits of dollarization, as well as possible measures to reduce it. Appendix D discusses the related issue of the use of monetary aggregates in modern monetary policy.

Chapter 1

LITERATURE REVIEW

1.1. Dollarization: History of the Problem

The phenomenon of dollarization is by no means limited to developing and transitional economies, as could be inferred from the recent literature on the topic. In each open economy, some agents prefer to hold part of their money balances in a foreign currency. These include multinational corporations, importers and exporters, businessmen who travel abroad, tourists, and residents of boarder areas, as well as anybody who uses foreign assets for diversification purposes. First studies of dollarization began to appear as early as in 1970s and were concerned with the extensions of the modern monetary theory in an open economy, foundations of which were laid down by Friedman, Mundell and Flemming[12]. These studies looked at the ability of flexible exchange rates to insure monetary independence in presence of dollarization and the implications of this for the choice of exchange rate regime[13] [14]. The authors tested their hypotheses on the data for developed countries. However, these authors found that empirical evidence did not support the fears of increased exchange rate volatility in an open economy

[12] Robert Mundell and J. Marcus Flemming have developed a conceptual framework of modern open-economy macroeconomics, known as Mundell-Fleming model. Their now classical writings include Mundell (1968) and Fleming (1962) (as cited in Sachs and Larrain 1993). Milton Friedman is known as the founder of the modern monetary theory. His works on which the first papers on dollarization had relied include Friedman (1953), Friedman (1968), and Friedman (1975).

[13] Several works can be cited as an example. Calvo and Rodriguez (1977), Girton and Roper (1981), and Thomas (1985) concentrate on the theoretical aspects of the problem, while Miles (1978) and Bordo and Choudri (1982) conduct empirical studies for the case of Canada.

[14] As a matter of terminology, these authors did not make the distinction between currency substitution and asset substitution yet, and referred to what we now call dollarization as "currency substitution" (although on the descriptional level the difference in motives for holding dollar assets was explicitly discussed). An early reference to this distinction on the level of terminology is found at Lamdany and Dorlhiac (1987) (as cited in Berg and Borensztein 2000a). Although the distinction has become common since then (see a survey by Calvo and Vegh (1996)), it is not universally accepted. For example, Mongardini and Mueller (1999) use the term "currency substitution" to denote dollarization.

with flexible exchange rates, because the level of dollarization in general was relatively constant and insignificant[15].

The situation changed when the attention of researches turned to developing and transitional economies. For these countries, it has been found that dollarization is mainly a response to economic instability and high inflation, when agents in the economy search for ways to preserve the value of their assets from sharp depreciation, and only as a second reason – the desire of domestic residents to diversify their asset portfolios (Balino, Bennett, and Borensztein 1999).[16] As the hyperinflation in some of these countries was rampant and instability persisted, so did dollarization, reaching very high levels. Consequently, most empirical studies of dollarization during the last decade concentrated on developing and transitional economies[17]. Prevalence of the U.S. dollar as the main alternative to national currencies in these countries influenced even the terminology describing the phenomenon. Empirical material of the transitional and developing economies has been also sufficiently rich to distinguish meaningfully the CS motive in dollarization, and the discussion of methodology to test for CS evolved in the literature once again in 1990s. The next section provides an overview of this discussion.

[15] Bordo and Choudri (1982) show that previous finding of significant dollarization in Canada by Miles (1978) was based on a misspecified model.

[16] For FSU countries, one more effect was at work. After these countries lifted restrictions on foreign currency holdings as part of the effort to liberalize their economies, immediate increase in dollarization represented a one-time stock adjustment, because in the former Soviet Union strict prohibition on domestic residents to hold foreign currency existed. This is an observation noted by many authors, including Mongardini and Mueller (1999).

[17] See Balino, Bennett, and Borensztein (1999) for additional references to such studies.

1.2. Testing for currency substitution: review of methodology

Early empirical studies can provide little evidence on the presence of CS, because they did not take fully into account possible effect of AS in the estimated models. The traditional approach has been to identify CS from the coefficients on the rate of return variables included in money demand functions. These authors added a variable representing expected exchange rate depreciation to the usual determinants of domestic money demand and interpreted this variable as the opportunity cost of holding domestic versus foreign *currency*[18]. The problem with this approach arises because the rate of depreciation also affects the yield of foreign *assets*, which is also an opportunity cost to domestic money. This opportunity cost will affect not the composition of money demand between its foreign and domestic components, but the total size of money demand, through shifts from money to foreign-currency-denominated aggregates held as *assets*. In this situation, the domestic money demand will depend on the rate of exchange rate depreciation even in the absence of CS. This leads to the conclusion (Balino, Bennett, and Borensztein 1999) that a test to distinguish between CS and AS would include both the rate of return on foreign assets in domestic currency and the rate of depreciation itself in the money demand regression, with a negative and significant coefficient on the rate of depreciation variable suggesting CS as distinct from AS. These authors were not the only ones who made this conclusion. Already in 1985 Thomas (1985) developed a model which incorporates this distinction, and Sahay and Vegh (1996) later used his theoretical framework to stress these problems encountered in specifying correct empirical models to test for currency and asset substitution[19].

[18] Miles (1978) and Bordo and Choudri (1982) are the best known examples of such studies.

[19] Moreover, all three mentioned studies refer to Cuddington (1983) as the first author who pointed out this problem in early money-demand based models.

Unfortunately, the two rates of return variables that should both enter money demand equation in testing for CS are closely correlated, particularly in countries likely to have CS (Balino, Bennett, and Borensztein 1999), and their independent effects are difficult to distinguish. Because of the described problems with the traditional methodology, Berg, Borensztein, and Chen (1997) (as referenced in the next source), Balino, Bennett, and Borensztein (1999), and recently Berg and Borensztein (2000a) adopted a different approach to the problem of testing for CS effect. They use as a test relationship not the link between CS and money demand, but the relationship between CS and inflation. These authors argue that although money demand functions look quite similar to asset demand functions, and the explanatory variables that may distinguish between the two are highly correlated, it is the stock of money, and presumably not of assets, that is closely correlated with the volume of transactions and the rate of inflation (Berg and Borensztein 2000a). The main idea here is that if a particular dollar aggregate is part of the total stock of money used for transactional purposes in the economy (that is, it represents CS), and if there exists a positive relationship between the dynamics of such stock of money and prices, then inclusion of this dollar aggregate to the total money supply will produce a variable which better reflects money supply conditions in the economy. When included into the inflation equation, this variable should improve its fit. Positive finding of such improvement will thus be the evidence of CS effect present in the dollar aggregate under consideration. Described above approach to testing for CS is the one that I have chosen for this study. In the next chapter, I introduce the main assumptions underlying my model.

Chapter 2

THEORETICAL MODEL

Strict application of the approach described in the previous chapter would require the estimation of structural inflation equations to look for the role of various monetary aggregates in explaining inflation. Such models have been developed, for example, by Kuijs (1998) for Nigeria, Lim and Papi (1997) and Metin (1995) for Turkey, Juselius (1992) for Denmark, and De Brouwer and Ericsson (1995) for Australia (the latter three as cited in Berg and Borensztein (2000a))[20]. At the same time, other authors have applied a simpler but more direct method, examining the role of different aggregates in dynamic reduced form models. This group of studies includes, in particular, Estrella and Mishkin (1996), Friedman and Kuttner (1996), and Feldstein and Stock (1994) (the latter two as cited in Berg and Borensztein (2000a)).

The latter approach has been also applied to examine the problem of choice of the most informative monetary aggregate in the presence of dollarization. For example, Berg and Borensztein (2000a) test in quarterly VAR the link between various monetary aggregates and prices (with the inclusion of exchange rates) for Peru, Argentina, Turkey, Bolivia, and Philippines. Given a rather narrow objective of such studies, this method is quite acceptable. It requires minimum structural assumptions on the economy, and at the same time is sufficiently powerful to determine the relative performance of the variables under comparison. As Berg and

[20] Findings in these papers are not uniform and sometimes are even contradictory with respect to the role of money aggregates. For example, Metin (1995) (as cited in Berg and Borensztein (2000a)) does not find an important role for monetary aggregates in explaining inflation in Turkey, instead indicating other factors such as labor market disequilibria and deviations from PPP. On the other hand, Lim and Papi (1997) conclude that money play a central role in the inflationary process in this country.

Borensztein (2000a) note, these features have made such simple VAR tests popular among researchers who compare large sets of variables such as different monetary aggregates.

In this work, I apply a similar model to study the hypothesis of CS in the case of Ukraine. My choice of variables has been determined by the desire to make the model simple enough but self-sufficient. Sometimes the studies of information content of monetary indicators are limited to bivariate Granger causality VAR tests. However, such models may suffer from a number of econometric problems, because closely related endogenous variables could be omitted[21]. I consider a trivariate VAR model with money, prices, and exchange rates, which implies that prices in the inflation equation are determined by their own past values, and the lagged values of money and exchange rates. Theory provides a justification for such choice of variables in a narrow model.

As long as inflation is defined as the condition of a continually and rapidly rising price level, it can be shown that only a continually increasing money supply can cause inflation in a closed economy. Both under the monetarist and under the Keynesian analysis no other phenomenon, neither from the demand side nor from the supply side, can cause inflation[22]. This statement, however, does not guarantee that money supply itself is always determined exogenously. Factors such as demands of workers for higher wages, desire of

[21] See Baumgartner, Ramaswamy, and Zettergren (1997) both for an example of estimation of a large number of bivariate causality tests and for the discussion of some of the associated econometric problems. One more example follows from the considerations related to co-integration. In the case of money-price relationship, both time-series are likely to be first-order integrated (this is a conventional empirical result, see Nelson and Plosser (1982), Berg and Borensztein (2000a)). Moreover, for a closed economy or large open economy quantity theory predicts that they should also be co-integrated Granger (1987). However, in an open economy exchange rate may be the third variable closely related to the first two. In this situation, bivariate co-integrating vector between money and prices may not be found, although trivariate vector with exchange rates exists. Given no co-integration between money and prices, they should be modeled in first differences. However, as Johnston (1997) notes, this would be a usual case of the omitted-variable problem, because important relationship has not been taken into account.

[22] For the formal proof and discussion, see Mishkin (1998).

the government to maintain a below-natural rate of unemployment, or unsustainable through normal ways of financing budget deficits can put pressures on the central bank to increase monetary base by "printing money". If the central bank accommodates these pressures, money supply will increase and will cause a corresponding increase in prices. Repeated continuously, this process leads to inflation. And once the agents in the economy begin to anticipate constant increases in prices, inflation itself becomes a driving force behind the discussed above factors that cause pressures for increases in money supply (Sachs and Larrain 1993). This shows that, in general, money supply and prices are endogenously determined variables, and their effects should be considered only jointly.

Finally, exchange rate can potentially be the third endogenous variable in this group, if we allow for the openness of an economy (Sachs and Larrain 1993). In an open economy like Ukraine[23], increases in money supply can influence prices not only directly, but also indirectly through the exchange rate, provided there is a floating exchange rate regime. At given prices and interest rates, as households attempt to convert part of their excess money into foreign assets, exchange rate depreciates endogenously. Through the increased prices of imported inputs and final goods, this leads to price inflation. Under fixed exchange rate regime, on the contrary, it is the money supply that adjusts endogenously to changes in the exchange rate. Changes in the money supply then lead to changes in prices in a usual way. Exchange rate regime in developing and transitional countries like Ukraine is typically mixed and subject to frequent adjustments[24], so in general the assumption of mutual influence between the money supply and exchange rate, with the inclusion of the exchange rate in the set of jointly estimated endogenous variables, is reasonable.

[23] Ratio of the sum of exports and imports to GDP (conventional measure of openness of the economy, see Sachs and Larrain (1993)) for Ukraine varies around 70% per cent (UEPLAC, 2000).

[24] See Markiewicz, Dekhtiarchuk, and Gorski (1999) and IMF (1999) for an overview of exchange rate policy in Ukraine over the period of 1996-1999.

One more question is worth mentioning on the theoretical level before I proceed with the econometric specification of the model: which monetary aggregate out of several conventionally measured should be considered as the best representation of the money supply in such a model *per se*, before I add dollar aggregates to it? The answer is rather simple: theory can provide almost no guidance in this question (Friedman (1990), referenced in Sahay and Vegh (1996)). Because of this, I will have to solve an intermediate task on the way to answer my main question: to choose such an aggregate empirically. I do so by estimating the model for all monetary aggregates, both narrow and broad. The results are then analyzed not only by comparing a single monetary aggregate with its counterpart that includes dollar aggregates, but also by looking on such pairs across different monetary aggregates.

This problem of choice of monetary aggregate is not a narrow technical question encountered only in this study. It is in itself a very important question of modern monetary policy. Because I indirectly find an answer to this question for the case of Ukraine (even though I look at the restricted version of the problem, limited to the inclusion or exclusion of dollar aggregates), it is relevant to provide a brief discussion of the problem of choice of monetary aggregate as an intermediate target or information variable in monetary policy. Such information can be found in Appendix D.

Chapter 3

DATA

Studies of the CS typically consider three types of dollar aggregates as potentially representing CS: foreign currency in circulation within the domestic economy (DCC), foreign-currency deposits (FCD) in the domestic banking system, and cross-boarder deposits held at banks abroad (CBD). I include in the estimation only the first two aggregates, using monthly data over the period from 1996:1 to 2000:1. Specifics of each aggregate in Ukraine are discussed below. At the end of the section, I also briefly state my proxies of other variables in the model.

Cross Boarder Deposits

This aggregate may play a role in CS because of its potentially close substitutability with FCD (Balino, Bennett and Borensztein 1999). However, the data available on this aggregate is very imprecise. The best source of such data are the statistics published by the Bank of International Settlements (BIS), which compiles data on deposits held by nonresidents at all reporting institutions classified by the country of nationality of the depositor[25]. Figure A3 in Appendix A shows the dynamics of total Ukrainian claims on banks resident in 18 industrial countries and 6 offshore centers, calculated on the basis of BIS data for the period of 1993-1999 (reproduced from Piontkivsky (2000)). As the author correctly notes, however, the main shortcoming of the series is that it represents claims of both financial and non-financial sector. At the same time, financial sector's claims may reflect corresponding accounts of Ukrainian banks, influenced in turn by FCD. An additional bias in this

[25] BIS publishes regular statistical reports. See, for example, Bank for International Settlements (1999) (semiannual data), or BIS-IMF-OECD-World Bank (1999) (quarterly data).

measure comes from the fact that many offshore operations are conducted through third countries for legal and tax-related reasons, and thus may be not represented correctly in these statistics. Given also that information is available only at quarterly frequency, I decided not to include this dollar aggregate in my study, limiting it to the next two aggregates.

Foreign Currency Deposits

This aggregate is the only one on which reliable monthly data are available. These data are regularly reported by the National Bank of Ukraine and can be most easily found on its official Web-site (NBU 2000). FCD comprise time foreign currency deposits (TFD) and sight foreign currency deposits (SFD)[26]. With respect to TFD, it is reasonable to expect no CS in this aggregate. The loss of foregone interest associated with premature withdrawals could discourage agents from frequent conversions of their holdings into more liquid forms. As for SFD, prior expectations are not certain. SFD are readily convertible into domestic currency and are thus relatively liquid. However, direct payments in foreign currency for local transactions are not allowed by law. Reasons such as costs associated with the conversion or fears of depreciation may potentially restrict actual liquidity of this aggregate. In total, *a priori* the dominant effect in the FCD aggregate in Ukraine is uncertain and can be found only empirically.

Dollar Cash in Circulation

This is the most interesting aggregate among the three. It may be the largest dollar aggregate in Ukraine – informally NBU officials estimate that net inflows of dollar cash in Ukraine were about $1,5-2 bn annually during the last three years (Piontkivsky 2000). By comparison, by the beginning of 2000 total FCD were equal only to about $1 bn (NBU 2000)! However, any official statistics do not exist, and even no official estimate of dollar cash holdings in

[26] Figure A4 in Appendix A shows the shares of TFD and SFD in FCD over the period of 97:1-00:1.

the country has been ever made. DCC is also the aggregate that is most likely to be used as CS, thus exerting the greatest pressure on inflation. It is true that in many countries with tight capital controls and absence of domestic dollar-denominated instruments, foreign currency becomes the only reliable asset in periods of high inflation and is held by residents as a store of value (Sahay and Vegh 1996). But observations of large transactions settled in Ukraine in foreign currency (mainly US dollars), especially in purchases of real estate and expensive durables[27], as well as in routine business transactions in shadow economy, are in sharp contrast with, for example, finding by Sachs (1986) (referenced in Sahay and Vegh (1996)) that even in the height of the Bolivian hyperinflation dollars were rarely used as a medium of exchange in that country.

Such large-scale cash dollarization is characteristic not only of Ukraine, but also of other transitional economies (Mongardini and Mueller 1996). Together with other reasons, this makes it extremely desirable to include DCC in an empirical study of CS. However, lack of data is the main obstacle. Balino, Bennett, and Borensztein (1999) use the data on flows of US currency to other countries, based on the US Customs forms, where shipments of dollar cash in the amount of $10,000 or more are recorded. Being very imprecise perhaps even for relatively isolated countries, these data are grossly incorrect for the countries of the FSU taken each separately. Cumulative figure for Ukraine for the period of 1989-1996 is $37 mln, while for Russia it is more that thousand times larger - $43 bn (Balino, Bennett, and Borensztein). Clearly these figures only reflect the fact that Russian banks were the main importers of US currency for the whole region, because of their advantage in the level of development after the breakdown of the USSR. Through "shuttle trade" and in other ways dollar cash was later transmitted into the neighbor-countries.

[27] Model developed by Curtis and Waller (2000) explains this prevalence of large transactions in the total volume of transactions settled in foreign currency, as well as possible alternative patterns.

As Mongardini and Mueller (1999) point out through the cross reference to Savastano (1996), some authors, including Melvin and La Parra (1989) and Kamin and Ericson (1993), attempted to estimate the amount of foreign currency bills in circulation in certain LDCs, but the usefulness of these estimations, according to Savastano, is doubtful given the extremely restrictive assumptions made for the money velocity and other variables.

Because of these difficulties present research is, to the best of my knowledge, the first one that attempts to include DCC in the study of dollarization in Ukraine. As a proxy variable of DCC, I use data on monthly net purchases of foreign currency by households from the official exchange points, which is available from NBU beginning with 1995:7[28]. As was mentioned earlier, I denote this proxy by "$C", to stress that it is not the same as actual DCC.

I recognize that this measure also has very significant shortcomings. Clearly, it is not the measure of DCC in the strict sense, but in my opinion, it is the best proxy of the dynamics of the actual aggregate among all available alternatives. The main assumption that I make in using this variable, the assumption which places such DCC measure at advantage comparing to US Customs data, is that this aggregate includes all dollar cash, both imported officially by commercial banks and that brought into the country by black market transactions from the neighbor-countries. This occurs because residents of Ukraine cannot buy consumer or other goods in official trade system with foreign currency (this is forbidden by law, and the system of control is built so that no retail outlet will not even attempt to accept foreign cash). Now imagine someone whose income arises from unregistered business activities and is solely in dollar cash. To buy food, closing etc. such a person will need to convert part of the income into hryvnia — and the most convenient way to do this is through the official exchange points. Other people, in turn, may buy this cash for quite different reasons, including also precautionary motives

[28] Actual source of data on this aggregate, as well as on prices and exchange rates, were UEPLAC (2000) and UEPLAC (1998). Information on monetary aggregates was obtained from NBU (2000).

against expected inflation (AS). But eventually this cash may again turn up in market transactions. Of course, part of such exchange transactions occurs in the black market, still another part of foreign currency is never exchanged and never leaves unofficial sector. However, we may assume that this variable at least captures the dynamics in the actual DCC aggregate.

Already after I have conducted the empirical part of this study, I encountered the paper by Mongardini and Mueller (1999), in which the authors describe their study of the ratchet effect in dollarization in Kyrgyz Republic. From the description given in the paper, it appears that the authors used the same proxy variable of DCC in their research that I suggest here. One interesting observation is that for Kyrgyz Republic this variable was of the magnitude of about 16 per cent of FCD and 4 per cent of domestic currency in circulation. In the case of Ukraine my proxy measure of DCC was (as of December, 1999) 5.5 times larger than FCD, 3.5 times larger than domestic currency in circulation, and amounted to 24% of nominal GDP (all numbers at December current exchange rate). Net cumulative purchases of foreign currency for the last 3 years averaged $0.7 bn per year. These large numbers may have two possible implications. First, it is possible that we in fact deal with a net drain of dollar cash out of the country. However, it is not consistent neither with the estimates cited by Piontkivsky (2000)[29], nor with the tiny numbers of dollar cash imported by Ukraine, as registered by US Customs Service. But if the numbers are correct and dollar cash is being accumulated, than it is perhaps an indication of the relative size of unofficial economy which it mainly services (if this paper's finding of large CS effect in this aggregate is correct).

Prices, Money, and Exchange Rates

As a proxy of prices I use CPI index. This is standard in the literature (Berg and Borensztein 2000a).

MB, CC, M1, M2 and M2 are the aggregates officially published by NBU. Other monetary aggregates are calculated by me as specified in Notes to Figure 2 (p. 28).

There are three main types of Hrn/USD exchange rates widely published in Ukraine: Official exchange rate, Inter-bank currency exchange rate, and Weighted average cash exchange rate in non-commercial bank transactions (UEPLAC 2000). Inter-bank rate series has missing observations starting from 1999:4, when the Interbank market was closed. Of the other two rates, I use the cash exchange rate as more closely reflecting market conditions.

[29] If only these estimates themselves were not based on these same figures.

Chapter 4

ECONOMETRIC MODEL AND RESULTS

4.1 Model specification and estimation

I estimate the model with monthly data over the sample of 1996:1 – 2000:1, with 49 observations. This is the longest sample for which data on all monetary aggregates are available[30]. According to general theoretical assumptions presented in Chapter 3, I consider three variables treated as endogenous: prices, money, and exchange rates.

All variables are in a logarithmic form. This is a usual approach to modeling such time series, first of all because of its practical convenience (assuming the data enter the model in first differences, which should be so because of the typically found non-stationarity in these series (Nelson and Plosser 1982, Berg and Borensztein 2000a), regression coefficients represent elasticity of prices with respect to money and exchange rates) (Gujarati 1995). Some difficulties arise with the $C series, because these data are available only in the first difference form (monthly net purchases of foreign cash). To make logarithmic transformation, some assumption about the initial level base has to be done. I assume that this aggregate was equal to zero at the beginning of 1993[31], and also assume that accumulation of foreign cash by households occurred

[30] For earlier periods information is available only for M2 and MB aggregates (UEPLAC 2000 and 1998). The next series for which data limitations are binding after the monetary aggregates are the series of net purchases of foreign cash from official exchange points. This statistics is available starting from 1995:7.

[31] While it is not clear whether such assumption can be valid for entire DCC in Ukraine, at least for my proxy variable it looks reasonable. After the breakdown of the USSR, national banking system in Ukraine started to develop only by the end of 1991, and it took some time to expand the range of services such as cash currency exchange throughout the country. This is also consistent with the observation by Sahay and Vegh (1996) that dollarization in Ukraine started later than in Russia, appearing for the first time in March 1992.

throughout 1993 - first half of 1995 at the same rate that it did in 1995[32]. These two assumptions allow to estimate the level of $C variable as of 1995:6. To this figure I then add subsequent actual net monthly purchases of foreign currency to receive the series of the variable in levels.

Transformed to logarithms variables I use to estimate a Vector Error Correction model (VEC) in the EViews (1996) econometric software package. The main advantage of such approach is that it allows to incorporate cointegrating equations (CE) in the estimation of the price equation.

Approach to cointegration is one of the important questions in this model. Augmented Dickey-Fuller Test (ADF) indicates that all time series in the model are I(1), while theory also tells us that these series should be cointegrated[33]. It is known that cointegrating relationships are unstable in small samples (Berg and Borensztein 2000a), but as Granger (1987) stresses, models estimated in first differences while the data are actually cointegrated will be misspecified (we will have the case of the omitted-variable bias). Here VEC model in EViews (it uses Maximum Likelihood (ML) method in the Johansen procedure to find cointegrating relationship(s)) becomes essential, because in small samples ordinary estimation of cointegrating regressions becomes sensitive to the choice of the dependent variable. With the ML method, this problem does not arise (Maddala 1992).

Johansen rank procedure indicated the existence of cointegrating vectors (in the form of a linear combination of the levels of variables) for models with all monetary aggregates. Such a vector (or both, when there were two of them) was included in the equations (as usually, dependent variable and other explanatory variables enter the model in first differences). Many empirical

[32] Mongardini and Mueller (1999) use different bases for extrapolation. They assumed that foreign cash holdings moved proportionately to foreign currency deposits. Absence of official data for Ukraine about FCD over the required period does not allow comparing this alternative with my method.

[33] This follows from Quantity Theory formulations and from the PPP relationship. See Granger (1987), Jonsson (1999).

studies concerned with modeling inflation pay much attention to the interpretation of cointegrating vectors, looking for their economic meaning according to some theory[34]. However, as inflation model *per se* plays only an auxiliary role in the present research, I do not discuss these properties of the model here[35]. Moreover, as Maddala (1992) notes,

> … "cointegration" is a purely statistical concept based on the properties of the time-series considered. It is "A-theoretical Econometrics". Cointegrated relationships need not have any economic meaning. But even if they do not, they can be used to improve predictions from the VAR models[36].

Lag length of the model, determined based on the Schwarz Criterion (SC) (Gujarati 1995), is one period. Such short lag period may reflect large inflationary expectations and quick reaction of the public to all changes in financial indicators. Money velocity in countries with unstable macroeconomic situation is usually larger than in developed countries. Berg and Borensztein (2000a) also find such small lag periods in countries covered by their study (they use quarterly observations).

I estimate VEC models with each monetary aggregate in turn across the whole sample. Having thus obtained numerical coefficients of the cointegrating vectors, I re-estimate the price equation with each aggregate by OLS procedure. According to theory (Johnston 1997), such independent estimation of VAR or VEC equations is possible in two cases: if the disturbances in the equations are pairwise uncorrelated, or if the matrix of

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[34] See, for example, Jonsson (1999).

[35] In the first approximation CEs like those presented in the Figure B5, Appendix B, appear to be consistent with the Quantity Theory and PPP relationships, at least in signs and relative sizes of coefficients. However, interpretation of the exact values of the coefficients as elasticities may be more complicated (Jonsson 1999).

[36] This should not be confused with the earlier case when I referenced authors saying "from theory follows that such and such variables should be cointegrated". In this case mathematical form in which theoretical relationship is expressed and assumptions behind that relationship just "hint" to the researcher that corresponding time series perhaps have such statistical properties, and he or she should look for them to avoid misspecification.

explanatory variables is the same in each equation. The second condition holds in this case, and OLS procedure can be employed. Estimation of price equations by OLS is convenient because it allows conducting all usual tests to verify that OLS assumptions hold.

Berg and Borensztein (2000a) suggest the following criteria to compare the results across different monetary aggregates: goodness of fit as measured by R2, Granger causality of inflation by money, and stability of the relationships. In the present case, as follows from the Figure 1, main influence from money to prices goes through the cointegrating relationships. Coefficients by differenced money variables are insignificant, and compare their p-values would be impractical because in some cases they have the wrong sign. Because of this, I compare monetary aggregates only by the R2 statistics in their equations (results of this comparison will be discussed separately in the next section). In addition, I look for potential problems with the estimated equations such as heteroscedasticity, autocorellation in residuals, or lack of stability. All relevant test statistics are also given in Figure 1. The most important information comes from the Chow Breakpoint Test. Its statistics calculated for each observation show that there were two structural breaks during the sample period (the timing of breaks is easily identified as the introduction of new Ukrainian currency in September 1996, and financial crisis in the fall of 1998, accompanied by severe monetary and exchange restrictions). This instability is also demonstrated by the significant statistics of the RESET test (Figure 1). To capture possibly larger effect of monetary aggregates in the price equation during the stable period, I estimate each equation once more over the shorter sub-sample between the two structural breaks. As the small number of observations in the sub-sample will not allow for estimation of cointegrating relationships, I use price equations in first differences to detect the exact timing of the breaks for such models. These

tests suggest 1996:11-1998:7 as the stable period[37]. Estimation results for the sub-sample are also presented in Figure 1.

Two important observations follow from this period. First, all equations are now stable at very high significance levels, with no indication of heteroscedasticity, autocorrelation in residuals or other specification errors. Second, during this period monetary expansion is the dominant determinant of inflation, with the exchange rate entering in equations insignificantly. Consequently, this allows for more pronounced differences among the aggregates. In particular, all p-values of their coefficients are now highly significant and are plotted together with the values of R2 statistic in the Figure 2 in the next section. Figures 1-2 and discussion in the next section summarize main findings of this research. Documentation about the testing procedure for both samples is presented in the Appendix B (Figures B1-B5).

[37] See as examples Figures B3-B4 in Appendix B, with the values of the Chow Breakpoint Test plotted against time.

4.2. Discussion of the results

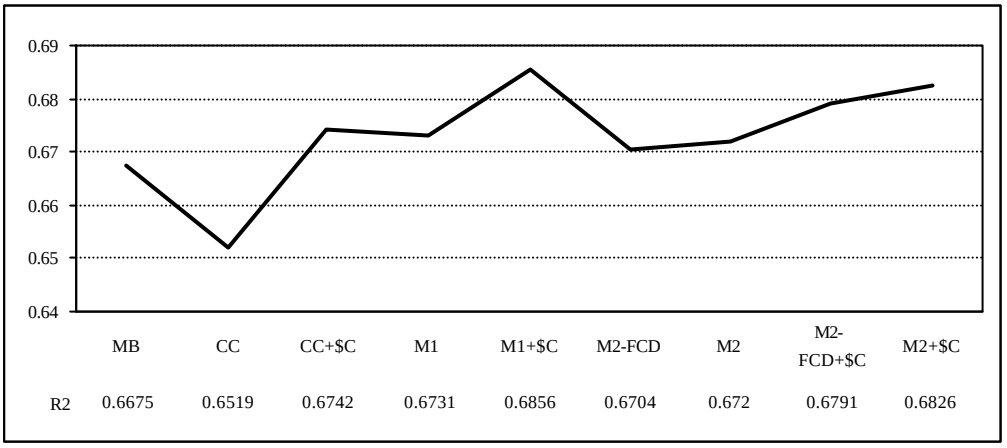
Figure 1 in graphical form (p. 26) and Figure 2 in tabular form (p. 27) summarize main indicators that I use to compare the performance of different dollar aggregates in the price equation. Graphical representation may be especially convenient for a quick comparison. Part (a) in Figure 1 presents the results of estimation over the entire period of observations, 96:1-00:1. Part (b) gives the results for the sub-period of 96:11-98:7. Because of the insignificance of coefficients by monetary aggregates in the full sample, part (a) contains only one indicator: R2 of the price equation. In part (b) both the R2 and the measure of the Granger causality from money to prices are plotted on the left and right axes, correspondingly. Looking at the two figures, be aware that actual swings of R2 in the first table are ten times smaller than in the second one, as reflected by the different scales on the left axes. More detailed information in tabular form, as well as test results for the price equation in VAR, can be found in Figure 2.

The main conclusion that seems to follow is that addition of DCC measure to all aggregates, CC, M1 and M2, improves the explanation of inflation. This is especially clear in the sub-sample, where differences in R2 are of the magnitude of 10 to 20 percentage points, accompanied by consistent improvements in Granger causality. In the full sample, these differences are less pronounced due to the low role of money supply in general over the period, but they are still much larger comparing to those caused by the FCD aggregate. This may be evidence that CS effect dominates in DCC, and this aggregate should be part of the relevant money supply measure. Inclusion of FCD also improves explanation of inflation slightly, but this change is much smaller. This may be evidence that foreign currency deposits serve mainly as a store of value in Ukraine, which is consistent with the finding of asset substitution effect in this aggregate by Piontkivsky (2000). This can be further explained by regulatory and natural restrictions on the use of this aggregate for transactional purposes.

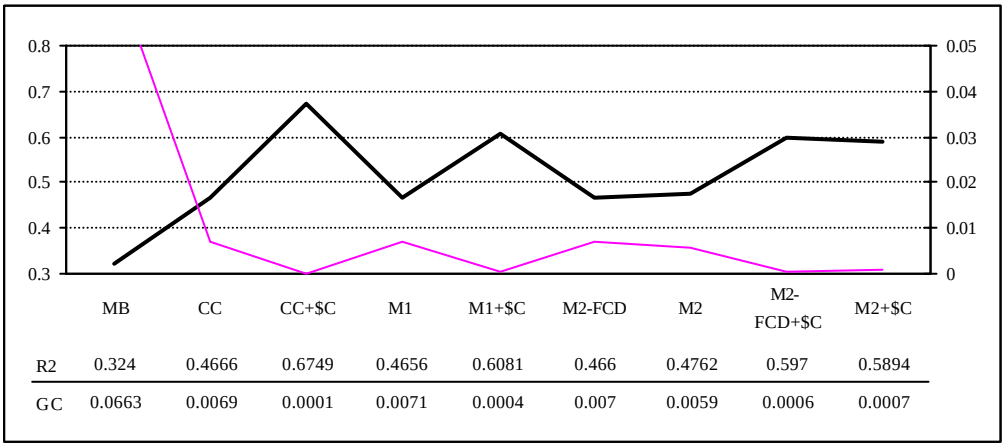
FIGURE 1

R2 AND GRANGER CAUSALITY: SUMMARY GRAPHS
(VAR[38] with prices, Exchange Rate, and Money)

Left Scale: R2 of the Price Equation in VAR[39] (upper, thicker line)
Right Scale: Granger Causality[40] (lower, thinner line)



(a) Full Sample (96:1-00:1), Error Correction



(b) Sub-Sample (96:11-98:7), No Cointegration

Source: NBU (2000), UEPLAC (1998, 2000)

[38] See p.29 (Notes) for exact model specification and other information.

[39] Note that in the full sample (part (a)) R2 changes on the interval from 0.65 to 0.69, while in the sub-sample (part (b)) this interval is from 0.32 to 0.68.

[40] p-value of the H0: No lags of the money variable belong in the Price Equation

FIGURE 2 [41]

SUMMARY OF SIGNIFICANCE TESTS FOR MONETARY AGGREGATES
(Estimation Output from the Price Equation In monthly VAR
with Prices, Exchange Rate, and Money 1/)

	Monetary aggregate								
	MB	CC	CC+$C	M1	M1+$C	M2-FCD	M2	M2+$C-FCD	M2+$C
Full Sample (1996:1-2000:1), 1 lag, With Error Correction Term									
Granger Causality 2/	-0.798	0.929	0.712	-0.825	0.898	-0.947	0.650	0.857	0.490
R-squared 3/	0.6675	0.6519	0.6742	0.6731	0.6856	0.6704	0.6720	0.6791	0.6826
R-squared adjusted	0.6372	0.6203	0.6363	0.6433	0.6491	0.6405	0.6421	0.6418	0.6457
White's Test for Het-ty 4/	0.10	0.00	0.03	0.01	0.07	0.02	0.10	0.06	0.11
Ramsey RESET Test 5/	0.04	0.01	0.07	0.06	0.16	0.06	0.04	0.13	0.10
Chow Breakpoint Test 6/	Evidence of breaks in the inflation equation at the end of 1996 and 1998 (see also Table A3 and Section 5.1 in the text)								
Sub-Sample (1996:11-1998:1), 1 lag, No Cointegration									
Granger Causality	0.0663	0.0069	0.0001	0.0071	0.0004	0.0070	0.0059	0.0006	0.0007
R-squared	0.3240	0.4666	0.6749	0.4656	0.6081	0.4660	0.4762	0.5970	0.5894
R-squared adjusted	0.2047	0.3724	0.6176	0.3713	0.5390	0.3718	0.3838	0.5258	0.5170
White's Test for Het-ty	0.95	0.77	0.71	0.92	0.90	0.94	0.55	0.91	0.61
Ramsey RESET Test	0.81	0.02	0.47	0.38	0.72	0.47	0.29	0.80	0.19

Source: NBU (2000), UEPLAC (1998, 2000)

[41] See the next p.29 for notes to Figure 2.

NOTES TO FIGURE 2

1/ All Monetary Aggregates are measured in millions of Hryvnia. Definitions:

MB: base money;
CC: domestic currency (Hryvnya) in circulation;
M1: CC plus sight deposits in domestic currency;
M2-FCD: M2 minus sight and time deposits in foreign currency;
M2: M1 plus time deposits in domestic currency and sight and time deposits in foreign currency;
CC+$C, M1+$C, M2-FCD+$C, M2+$C — corresponding aggregates plus foreign currency cash in circulation measure.

Definitions of Variables in VAR:

Prices: Δ log (CPI);
Exchange Rate: Δ log (Cash exchange rate (average per month), Hrn/USD);
Money: Δ log (Monetary Aggregate).

2/ Statistic shown is the p-value of the hypothesis that no lags of the money variable belong in the price equation. Negative number for some MAs indicates that estimated coefficient by this variable in the price equation has negative sign.

3/ The R-squared and (next line) Adjusted R-squared for the price equation in the VAR.

4/ Statistic shown is the p-value of the hypothesis: no heteroscedasticity in residuals. The test employed was the White's test for heteroscedasticity.

5/ Ramsey's RESET test (Regression Specification Error Test) is applied to detect specification errors in the form of omitted variables, incorrect functional form, or correlation between some of the explanatory variables and the disturbance term. Statistic shown is the p-value of the hypothesis that there is no specification error in the price equation. EViews (1996) allows to change the number N of fitted variables included into an auxiliary regression for calculating RESET statistic. For the model estimated here, maximum number is six. Statistic shown for each MA is the minimum one for different N from 1 through 6.

6/ In addition to specified tests to each price equation was also applied a test for detecting serial correlation in residuals. The test employed was the Ljung-Box *Q*-test (known to have better performance in small samples compared to Breusch Godfrey test (Gujarati 1995)). In all price equations test statistics indicated no first or higher order correlation in the residuals at the conventional level (95% confidence interval).

Chapter 5

POLICY IMPLICATIONS

The positive finding of CS effect in Ukraine in dollar cash circulating in the economy and, to a smaller extent, in foreign currency deposits, has several implications. First, this means that actual level of monetization of the economy can be larger than is usually assumed. It also bears some evidence in support of the potentially large relative size of the unofficial economy.

While helping to remonetize the economy in times of small credibility of domestic currency, CS in the form of DCC has also large negative effects. Meaning even greater role of cash in domestic market transactions than follows from the official statistics, it lessens the predictability of monetary transmission process and limits the effectiveness of monetary policy tools. This effectiveness may be reduced even more, if the National Bank even does not recognize the need to monitor dollar aggregates as relevant for inflationary developments. As Sahay and Vegh (1996) note, these were some of the important factors that contributed to sustained inflation in several transitional economies, including Ukraine.

CS in the DCC aggregate also implies substantial losses of seigniorage by the government, as well as the need for the government to keep especially restrictive approach to the budget deficits. Quick shifts to foreign currency substitutes will exacerbate the inflationary consequences of such deficits and will put additional pressure on the exchange rate, especially in the view of present proclaimed flexible exchange rate regime.

Finally, flexible exchange rate regime in a country with large CS motivated dollar aggregates in some cases may be not the optimal one. Any devaluation in such an economy automatically increases the value of foreign currency

assets in terms of the domestic currency, and the overall money supply increases. As derived formally by Berg and Borensztein (2000a), the elasticity of substitution between domestic and foreign currency would be high in this case. This would make the exchange rate more sensitive to any expected changes in the domestic money supply or other factors that influence monetary equilibrium[42]. Shocks in demand for domestic money relative to foreign money would also increase this volatility. These reasons lead to the stronger case for fixed exchange rate system in an economy with CS. However, even under increased volatility of the exchange rate, the source of shocks to it still matters. As Berg and Borensztein (2000a) note, the traditional distinction holds true here: if the shocks come from the money markets, fixed exchange rates provide greater stability, but real shocks are better offset by floating exchange rates. The main conclusion is that under any exchange rate regime monetary authorities should be aware of the CS effect, and should take into consideration the impact that it can have on the exchange rate and other related monetary variables.

Described problems may prompt the policymakers to fight CS itself rather than to deal with its consequences[43]. However, direct administrative measures to reduce CS may be not effective. Instead, institutional reforms are required to change the underlying structure of the economy, which determines the level of CS. First of all, strengthening domestic banking system would increase its credibility and would lead to general reduction of the cash sector. General economic reforms and political willingness to reduce unofficial economy (lack of such will appears to be the main obstacle in Ukraine) would also have the same effect, and the two processes are closely interrelated.

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[42] More generally, interest elasticity of domestic money demand (the demand for domestic component of the money supply) will be higher in presence of currency substitution, because in addition to the usual effect of interest rates on overall money demand, the domestic component of money will be also affected by changes in its opportunity cost relative to foreign money. While the implications of the higher interest elasticity depend in a complex way on the structure of the economy, the effect on the exchange rates is rather straightforward. (This observation belongs to Balino, Bennett, and Borensztein 1999).

[43] Appendix C discusses some of the usual means applied to reduce dollarization and, in particular, CS.

However, such measures may take a long time to implement, and this makes the question of the immediate operational response of the monetary authorities to the presence of CS very important. While it is not clear whether the direct influence of the foreign currency component in money supply is possible, at least information about the developments in this component should enter policy decisions. To the best of my knowledge, imports of cash foreign currency in Ukraine by commercial banks and further distribution of this currency are not presently monitored for this purpose, while such monitoring could be done relatively easily. However, in general a solution of this problem requires a complex approach at the international level. Repeated finding of the significant CS effect in cash dollar aggregates in transitional economies calls for better techniques of measuring the movements of offshore cash balances. This could be done by uniting the efforts of individual governments and international organizations.

CONCLUSIONS

The study presented in this paper indicates that currency substitution may be significant in dollarized economies, especially in transitional countries that tend to have large cash sectors and low levels of financial intermediation. Using an unconventional proxy measure of foreign cash in circulation for the case of Ukraine, this study finds that currency substitution effect may be large in the foreign cash in circulation aggregate. Unlike recent studies for some other dollarized economies, this paper also finds that currency substitution effect in foreign currency deposits aggregate appears to be only slightly significant. The discrepancy in results may be due to regulatory differences.

However, findings presented in this paper depend strongly on the assumptions made for the dollar cash aggregate. Small sample of observations, limited by data availability, also weakens the strength of the conclusions. If supported by further studies with a more comprehensive model and over the longer time period, conclusions of this paper imply the need for monetary authorities to take into account cash foreign currency aggregates in their policy decisions. This task also calls for the joint approach to the problem of measuring foreign currency cash flows by the governments of all transitional economies. On the fundamental level, negative effects of the currency substitution may be eliminated only by the institutional change to strengthen financial sector and reduce unofficial economy, as well as to promote general macroeconomic stability and thus increase confidence in the domestic economy.

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APPENDIX C

DOLLARIZATION IN TRANSITIONAL AND DEVELOPING ECONOMIES: SOME OBSERVATIONS

Dollarization is not necessarily a bad thing that requires full elimination. A certain level of dollarization exists in any, even well developed and stable, economy. Even higher levels of dollarization should not give rise to concerns if they reflect or enhance positive changes that occur in the economy.

One of the most important benefits of dollarization is increased amount of assets available to domestic residents for diversification of their portfolios. In this sense, the rapid increase in dollarization that occurred in transitional economies immediately after liberalization and took the form of one-time stock adjustment was a positive process, leading to a more efficient allocation of resources. Dollarization also provides a source of remonetization of economies that have experienced periods of very high inflation, which reduce the willingness of residents to hold local currency and deposits. This is especially important because favorable conditions for holding foreign currency aggregates within the country can stimulate the reversal of capital flight and thus bring additional liquid assets and investment capital into economy. For the government, such inflows imply an opportunity to build substantial international reserves.

All these developments, especially absence of restrictions on FCD, also mean that the volume of operations conducted through domestic financial intermediaries increases significantly. This leads to the process of financial deepening. By competing for available resources among themselves and interacting with foreign financial institutions, domestic banks expand the

range of their operations, learn new techniques of financial management, issue new financial instruments and stimulate the grows of more sophisticated financial markets. Reduced cost of international transactions is still another benefit achieved in this process.

But dollarization also entails serious costs, either direct or indirect, in the form of reduced effectiveness of traditional policy tools. Perhaps the largest potential cost of dollarization may arise from the fragility of the banking system. If substantial part of local currency loans is financed by foreign currency denominated liabilities, than even small devaluation can bring commercial banks to the brink of bankruptcy. Even when loans are also denominated in foreign currency, this does not eliminate the problem. In case of devaluation loan defaults would increase, unless lending is done mainly to debtors whose net financial position improves from devaluation, for example exporters. This may force the central bank to keep the exchange rate fixed at any cost, even if otherwise there are strong economic reasons to devalue. Dwindling international reserves become an additional cost of dollarization. Moreover, when credit expansion occurs mainly through the large inflows of foreign capital, than even strong and growing economies may be forced to devalue, after international reserves have been depleted, entirely due to an unpredictable reversal in investors' moods and sudden capital outflow. Once again, devaluation in such situation leads to numerous bankruptcies of firms whose liabilities increased suddenly, and economy goes into a large recession. This was one of the major reasons of recent Asian financial crisis[44], and now many countries plan to restrict the ability of banks and firms to borrow from abroad in foreign currency. Potential fragility of the banking system also requires special prudential supervision by the central bank. Level of reserve requirements and risk exposure, financial reporting, quality of preparation of bank management are all the issues that receive special meaning in the

[44] Radelet and Sachs (1999) and Krugman (1999) are some of the most insightful writings on the causes of this crisis.

presence of dollarization. Other negative sides of dollarization are by no means less important. These include increased volatility of the exchange rate[45], reduced effectiveness of monetary policy, and losses of seigniorage.

We see that together with large benefits dollarization may bring equally serious problems. This makes important the question of whether dollarization can be reduced by some explicit measures. Review of common patterns observed in highly dollarized economies may suggest some answers to this question.

It has been found that, although the main cause which usually initiates dollarization is high inflation and macroeconomic instability, in certain cases such as countries of the Latin America dollarization continues to persist or even grows after economic stabilization has been reached. Balino, Bennett and Borensztein (1999) explain this fact first of all by the reversal of capital flight and large inflow of foreign investments following stabilization. On the other hand, Mongardini and Mueller (1999) have found similar phenomenon in Kyrgyz Republic, and propose the notion of so-called "ratchet effect" as the main explanation[46]. They argue that once the fixed costs of developing, learning and applying new money management techniques to cope with inflation have been undertaken, households and enterprises have few incentives to switch back to the domestic currency after the end of the period of instability (which requires especially large effort by the government to "de-dollarize" the economy). This argument also seems to be reasonable, especially in the view of the high role that transactional, or "institutional", as

[45] By comparison, when the AS effect is dominant, flexible exchange rates may be preferable. In this case, the direct effect on the money demand is absent, but instead the level of substitutability between domestic- and foreign-currency-denominated assets becomes very large. This strengthens the links between interest rates on FCD at home, international interest rates, and domestic currency interest rates. To keep control over the level of domestic interest rates and other monetary conditions, the central bank may adopt the floating exchange rate regime (Berg and Borensztein 2000a).

[46] Technically, "ratchet effect" is hysteresis in dollarization.

Cheung (1986) calls them[47], costs play in determining the behavior of economic agents in general. Empirical verification of the hypothesis of ratchet effect in dollarization in Ukraine has been the central topic of recent study by Piontkivsky (2000). He found no evidence of ratchet effect in Ukraine. This means that there is a room to decrease dollarization in the economy.

It has been also noticed in all studies of dollarization that shift to foreign currency aggregates can be induced by the lack or thinness of the market for long-term securities denominated in domestic currency. Lack of such instruments usually arises after the periods of high inflation[48]. Given the lack of long-term securities, firms and individuals can satisfy the demand for credits that go beyond the longest horizon of domestic-currency instruments only by denominating the credits in foreign currency. In this situation government policy targeted on the development of financial market and lengthening the maturity of domestic securities may reduce the level of dollarization in an economy. In the simplest case it could be done by issuing long-term government bonds, which would in turn create market conditions for the introduction of long-term private securities (Mongardini and Mueller 1999).

Among other main policies that are used to influence the level of dollarization are policies that create interest rate wedge in favor of local currency denominated assets, introduction of indexed local currency denominated financial instruments, and direct administrative restrictions. However, these measures can potentially entail large distortionary costs and their implementation should be carefully evaluated against the costs involved.

Finally, to reduce dollarization specifically in the form of currency substitution without affecting the use of foreign aggregates as a store of value, monetary

[47] See Cheung (1986) for a discussion of the role of institutional costs in different economic systems.

[48] Mongardini and Mueller (1999) refer to Heymann and Leijonhufvud (1996) as the study in which full explanation of this relationship is provided.

authorities can introduce a set of policies to encourage the use of the local currency cash. These may include legal requirement that all internal transactions are conducted in the local currency[49], measures to widen the bid-ask spread in exchange operations[50] (but not too large to create a multiple currency practice), and restriction on sight FCD (but not time FCD) (Balino, Bennett and Borensztein 1999). And, of course, economic stabilization should be the first priority in dealing with dollarization, even though by itself it may be not sufficient to reverse it.

[49] However, such a requirement also entails costs. These costs may be both direct (enforcement costs) and indirect. Curtis and Waller (2000) show that there can be an important interdependence between the two currencies, and attempts to strengthen the value of the domestic currency through restrictions on foreign currency use may actually worsen the value of the domestic currency.

[50] In Ukraine 1 per cent levy to State Pention Fund from all purchases of cash foreign exchange in official exchange points partially serves this function.

APPENDIX D

MONETARY AGGREGATES AS INTERMEDIATE TARGETS OR INFORMATION VARIABLES IN MODERN MONETARY POLICY

Modern quantity theory of money, developed by Milton Friedman (1956) (referenced in Mishkin (1998)), postulates that nominal income in an economy is determined solely by the level of money supply. Mathematically this is described by the following expression linking together prices, real income and money supply:

$$M \cdot V = P \cdot Y$$

Initially this expression is nothing more than an identity, a definition of money velocity, which can be looked at in the form of $V = \frac{P \cdot Y}{M}$. It becomes a theory of how nominal income is determined when we accept the crucial assumption made by Milton Friedman: that money velocity is constant in the economy. If real income can be also viewed as constant, we receive a theory of price determination, in which changes in prices follow one to one changes in money supply[51]. Details of the proof of this statement are not important here. Assuming that the assumption of constant velocity holds, the theory is generally accepted.

Under such ideal conditions of constant velocity (implying unchanging money demand) monetary authorities could easily control the level of inflation or nominal income by managing money supply. In 1970s this

[51] Technically, it is sufficient for these variables to be stationary (Granger 1987).

was indeed an official policy of central banks in many countries, that received the name of monetary targeting. Under monetary targeting (as with targeting of any other variable) the central bank in advance determines desirable levels of the target variable over the path of time, and employs available to it instruments to meet these targets. This is necessary because the central bank cannot monitor immediately the impact of its operations on the final goals such as inflation or output, and it may be too late to correct the policy when this information becomes available. The key assumption behind the above procedure is that chosen intermediate targets are measurable, are controllable by the central bank through its tools and operating targets, and have a very predictable effect on the values taken by the final goal variable.

The last criterion is the most important one. Because the ability to affect goals is so critical to the usefulness of an intermediate-target variable, the linkage between the money supply and the goals – output, employment, and the price level – is a matter of many debates. Recent studies and practical experience of many central banks indicates that this link is much weaker than is required for effective targeting, because the assumption of constant velocity does not hold[52]. Recessions, external shocks to the economies, and especially financial innovation and deregulation that brought new types of financial instruments to the measures of monetary aggregates, are cited as possible reasons for the shifts in money demand and velocity.

These difficulties led central banks in many countries to adopt other key priorities for their monetary policy: exchange rate targeting or inflation targeting. The latter policy (meaning in essence that the central bank has only one final goal – price stability, which it achieves through all

[52] See Estrella and Mishkin (1996) for the study of this problem in application to the US and Germany, and Mishkin (1998) for a broad overview of practical experience with monetary targeting.

available channels of influence including, but not limited to, monetary aggregates management, and without concern for other government goals such as output and employment) has become especially popular during the last years. However, even under direct inflation targeting money supply retains an important role – although now in a less demanding form of one of the information variables.

Use of money as an information variable means adjusting policy operations during some interval in response to actual money growth that departs from the *ex ante* path and perhaps also in response to analogous departures for other variables, but in any case not in a way designed necessarily to restore money growth to the *ex ante* path[53]. Ideas suggested by Sims (1972) also helped to hone in further theoretical discussions the minimum requirement which should be satisfied by an information variable. Money may be useful as an information variable if not only fluctuations of money help predict future fluctuations of prices, but if they help predict future fluctuations of prices that are not already predictable on the basis of fluctuations of prices itself or other readily observable variables (Friedman and Kuttner 1992). If this is the case than, as the authors note, the arguments about the true nature of causality between the variables are not relevant. As long as changes in money supply contain information about future changes in prices, and this information is not captured by the lagged values of prices included into an autoregressive model, monetary policy can utilize this information by responding to observed money grows. This can be done under any pattern of causality between money and prices (true causation, reverse causation, or mutual causation by some independent but unobservable variable).

[53] This definition was for the first time formally introduced by Kareken, Muench, and Wallace (1973). See also Friedman (1975) and McCallum (1985) for a formal analysis and evaluation of the intermediate-target-variable procedure.

From this point of view, improved fit in price equation in the model developed in this study, obtained by the inclusion of some monetary aggregates (as reflected by significant coefficients of cointegrating vectors and Money variables in the price equation in VAR), means that these aggregates contain valuable for the conduct of policy information. The aggregates that demonstrate the best performance (as the results of this paper show, for Ukraine those are the aggregates that include both DCC and FCD dollar aggregates) can be used as such information variables in monetary policy[54].

[54] I do not consider in this research the exact ways in which such information could be applied. Those interested in this topic can find detailed information in Kareken, Muench, and Wallace (1973).