

# The Dynamics of Currency Substitution, Asset Substitution and De facto Dollarization and Euroization in Transition Countries

Edgar L. Feige \*

## Abstract:

This paper presents new evidence on the dynamics of dollarization and euroization for twenty-five transition countries. Estimates of the amount of foreign currency in circulation (FCC) in transition countries are used to develop a new comprehensive dollarization index (CDI) and separate indices of currency substitution (CSI) and asset substitution (ASI). When the CDI is compared to the traditional dollarization index (DI) that relies solely on foreign currency deposits as a proxy for the extent of dollarization, I find that the comprehensive dollarization measure provides a more complete picture of the extent of de facto dollarization and euroization, and that it better reflects the separate influences of currency substitution and asset substitution. I find that the dynamic evolution of currency substitution and asset substitution in transition countries is both more variable and complex than is usually believed to be the case.

These new dollarization indicators enable researchers to examine the causes of the dollarization process and its tendency to lead to irreversibility (hysteresis). Moreover, the currency substitution and asset substitution indices shed light on the dynamic consequences of these processes for the effectiveness of monetary policy. Finally, the new estimates of FCC make possible the measurement of effective currency/deposit ratios that can be used to develop new estimates of the size and growth of underground economies in transition countries.

**JEL classification:** F3 E26 E41 E42 E5 O17 K4 F3 P2 P3

**Keywords:** dollarization, euroization, transition economies, currency substitution, asset substitution, underground economies, foreign currency, network externalities, irreversibility.

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# **The Dynamics of Currency Substitution, Asset Substitution and De facto Dollarization and Euroization in Transition Countries**

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Dollarization is the process of substituting a foreign currency for a domestic currency to fulfill the essential functions of money as a medium of exchange (currency substitution) and/or as a store of value (asset substitution). Dollarization is official, when a nation adopts de jure, the currency of a foreign nation to wholly replace its domestic currency. The foreign currency thus becomes the authorized transaction medium, the store of value and the unit of account. When, in the absence of such sanctions, firms and individuals nevertheless voluntarily substitute a foreign currency for the domestic currency as a means of payment (currency substitution) and/or choose to hold foreign rather than domestic denominated monetary assets as stores of value (asset substitution), the dollarization process is described as unofficial, spontaneous or de facto dollarization.

De facto dollarization is typically the rational response of economic agents to a loss of confidence in the domestic currency, often resulting from episodes of inflation, currency devaluations and/or currency confiscations. It may also be related to the growth of underground or “unrecorded” economic activities since currency; particularly foreign currency is often the preferred medium of exchange for such transactions. De facto dollarization leads to a loss of seigniorage, thwarts the monetary authority from pursuing inflationary finance and inhibits its effectiveness in controlling exchange rates. It also lowers the costs of tax evasion and thereby reduces the ability of the fiscal authority to command real resources from the private sector. By facilitating underground activities, de facto

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dollarization can also lead to a distortion in various measures of macroeconomic activity making the formulation of macroeconomic policy more difficult.

However, since de facto dollarization represents a revealed preference for holding foreign currency as a means of reducing the risks of domestic inflation and exchange rate devaluations, its salutatory consequences include the efficiency gain from portfolio diversification, as well as reduced incentives for inflationary finance, and capital flight.

The dollarization literature is replete with normative discussions concerning the wisdom of official dollarization, but has suffered from a fundamental empirical problem when attempting to assess positive issues concerning the causes, consequences, costs and benefits of currency and asset substitution. Calvo and Vegh (1992) observed that this “fundamental problem” was due to the fact that “there is usually no data available on foreign currency circulating in an economy” and hence, “the importance of currency substitution” was “basically unobservable”. In the absence of empirical estimates of FCC, the profession lacked a comprehensive measure of de facto dollarization, as well as separate empirical measures of currency substitution and asset substitution. This paper attempts to overcome these measurement issues by presenting new time series evidence on the extent to which residents of transition countries choose to use foreign currency denominated monetary assets as substitutes for domestic currency and deposits, both as a means of payment, (currency substitution) and as a store of value (asset substitution).<sup>1</sup> In particular, I develop estimates of the amount of foreign cash (foreign currency in circulation [FCC]) held in the form of dollars and euros (European legacy currencies) in transition countries. These estimates of FCC are first used to develop a comprehensive dollarization index (CDI), defined as the percentage of the total effective broad money supply ( $M2+FCC$ ) composed of foreign currency in circulation and foreign currency deposits ( $FCC+FCD$ ). The resulting (CDI) is then compared

to the traditional dollarization index (DI) defined as the percentage of the broad money supply (M2) composed of FCD. The traditional dollarization measure, widely employed in dollarization studies of the IMF, understates the magnitude of dollarization because it relies exclusively on foreign currency deposits (FCD) to proxy the extent to which a nation is dollarized without taking account of FCC holdings.

The first section of the paper evaluates the available evidence on the total amount of US dollars held abroad, and concludes that roughly 50 percent of US currency was held abroad at the end of 2001. I then cumulate estimates of net dollar outflows to specific transition countries (the difference between gross outflows and inflows) to obtain the amount of US dollars circulating in each transition country at the end of the year 2001. I find that roughly 29 percent of US currency in circulation was held in the transition countries. These dollar holdings comprise the major component of the foreign currency in circulation (FCC) in FSU countries. Additionally, we employ available survey data to obtain estimates of the amounts of European legacy currencies<sup>2</sup> in circulation in several CEE countries. Eleven of the transition countries are shown to have more than 50 percent of their total currency supply in the form of foreign currency.

Section II employs these FCC estimates to obtain a comprehensive dollarization index (CDI) of the extent of de facto dollarization in each transition country and to determine the temporal trend of dollarization over the last five years. These CDI measures are then compared to the traditional IMF measures of dollarization (DI). Both measures suggest that levels of de facto dollarization are higher in the FSU countries than in the CEE countries. Both measures indicate rising dollarization trends in all the FSU countries and in some of the CEE countries. I also identify declining dollarization trends in some of CEE countries with

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<sup>1</sup> Earlier efforts by Feige, et al. (2002a,) and Feige and Dean (2002) reported initial unadjusted point in time estimates of dollarization in various countries.

the lowest levels of dollarization. Across CEE countries, the correlation between the CDI and DI is .988, however, for the more highly dollarized FSU countries, the correlation drops to .657. The temporal correlations between CDI and DI within countries are consistently high for the CEE countries, but highly variable among the FSU countries, ranging from .222 for Russia .997 for Belarus.

In section III, I construct temporal indices of currency substitution (CSI) and asset substitution (ASI) for each of the transition countries. The currency substitution index (CSI) is defined as the fraction of a nation's total effective currency supply (local plus foreign currency in circulation) that is comprised of foreign currency. The asset substitution index (ASI) is defined as the ratio of foreign currency deposits (FCD) to total domestic deposits. The magnitudes and temporal trends of the estimated CSI and ASI are then examined for different countries over time<sup>3</sup> and space. Although currency substitution and asset substitution might be thought to be highly positively correlated over time, dominated by an income effect, it appears that for some countries, the substitution effect dominates, leading to a negative correlation between CSI and ASI measures. Indeed, the relationship between currency substitution and asset substitution appears to be much more complex and varied than is usually thought to be the case, requiring more detailed country analysis to fully understand the relationship between the two phenomena. The main purpose of this exercise is to provide the empirical underpinnings for subsequent substantive analyses of the causes and consequences of the dollarization phenomenon and to more fully understand the motives and the implications of currency and asset substitution in both a temporal and cross section context.

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<sup>2</sup> The currencies reported in the surveys of the Austrian National Bank include Austrian schillings (AST), Deutsch marks (DM) and Swiss Francs (SW) in addition to US dollar (US) holdings.

<sup>3</sup> These temporal estimates of FCC have been employed by Feige, et al. (2002b) to analyze the consequences of network externalities and the hysteresis problem for the case of Argentina, and in the study by Oomes and Shikevich (2002) for Russia.

Interestingly, although the currency and asset substitution processes are both believed to be driven by similar forces (i.e. instability), we find that empirically, they need not move hand in hand, and may therefore, be driven by different incentive mechanisms. This finding is reinforced when the dollarization indices are related to currency and asset substitution indices. The final section contains a summary of our findings and conclusions as well as suggestions for further extensions of this work, particularly into the domain of monetary estimates of the unrecorded economies of transition countries.

To anticipate some of our key findings, we observe that for the CEE countries, the extent of understatement of the DI is only a few percentage points on average, whereas for some of the FSU countries, the DI understates the CDI by as much as twenty-forty percentage points. Our CDI measure suggests that many of the transition countries are so highly dollarized that network externalities are likely to make the dollarization process very costly to reverse.<sup>4</sup> We find that in 2001, Kazakhstan, Azerbaijan, Georgia, and Russia exhibit the highest degree of de facto dollarization of the FSU countries with more than 70 percent of their effective broad money supply held in the form of foreign denominated assets (currency plus deposits). For the CEE countries, only Croatia, Macedonia and Romania have comprehensive dollarization ratios in excess of 50%. The lowest de facto dollarization (CDI<20%) is found in the Czech Republic, Hungary, Poland and the Slovak Republic.

## **I. Measurement of Foreign Currency in Circulation in Transition Countries**

### **A: Direct measurement of dollars held abroad.**

There is now a growing body of evidence (Feige 1994, 1996, 1997; Porter and Judson 1996) suggesting that between 40-60% of US cash is held abroad. The “official” estimate now published by the Bureau of Economic Analysis (BEA) and the Federal Reserve Board of

Governors (FED) is based on a variant of a proxy measure proposed by Feige, (1994). The official estimate indicates that in 2001, 50% of the \$580 billion of US currency in circulation was held abroad. These aggregate measures indicate the amount of US currency held abroad is substantial, but they are incapable of determining the location of that currency.

US currency has many desirable properties. It has a reputation as a stable currency, and is therefore a reliable store of value. It is available in many countries, is widely accepted as a medium of exchange, and protects foreign users against the threat of domestic bank failures, devaluation and inflation. Cash usage preserves anonymity because it leaves no paper trail of the transaction for which it serves as the means of payment and is therefore the preferred medium of exchange in underground transactions. Indeed the very characteristics that make the US dollar a popular medium of exchange also makes it difficult to determine the exact amount and location of US notes circulating abroad. Nevertheless, there is a direct source of information that can be used to determine the approximate amounts of US cash in circulation in different countries.

Over the past two decades, the United States Customs Service has been mandated to collect systematic information on cross border flows of US currency. The Currency and Foreign Transactions Reporting Act (also known as the "Bank Secrecy Act") requires persons or institutions importing or exporting currency or other monetary instruments in amounts exceeding \$10,000 to file a Report of International Transportation of Currency or Monetary Instruments (CMIR). The information contained in the millions of accumulated confidential individual CMIR forms has been aggregated in order fully to preserve the confidentiality of individual filers' information. The aggregated data yield time series observations on the gross inflows and outflows of US currency to and from different destinations.<sup>5</sup> By cumulating the

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<sup>4</sup> Feige, et al. (2002b) estimate that for Argentina, a shift from high dollarization equilibrium to low level dollarization equilibrium would require a sustained 35% appreciation of the currency.

<sup>5</sup> A more detailed description of these data can be found in Feige, (1996, 1997).

recorded net outflows of US dollars to all destinations, Feige and Dean (2002) presented initial unadjusted estimates of the amount of US currency held abroad as well as the location of US currency in various transition countries for 1999.

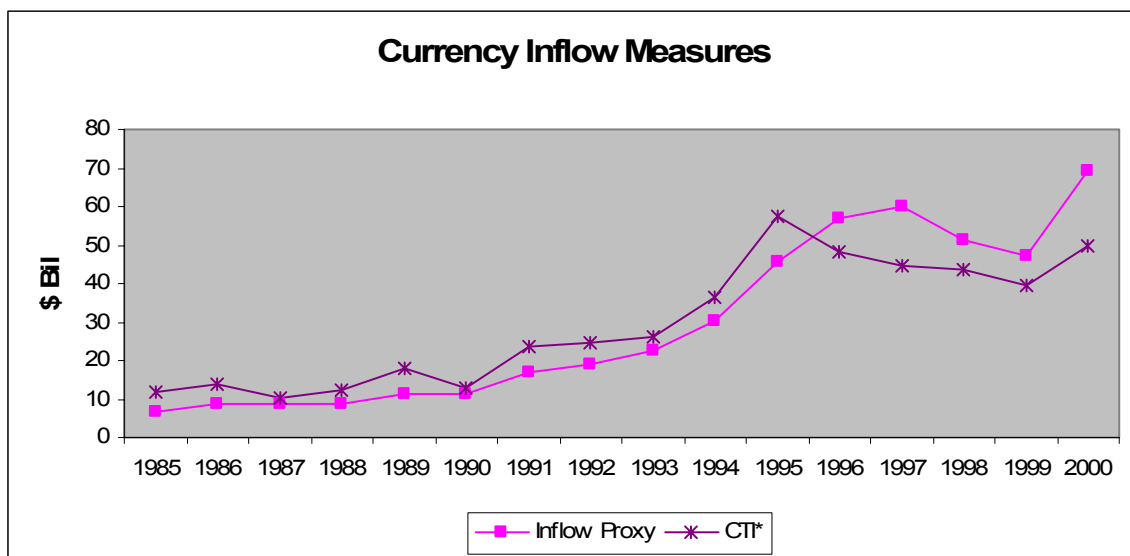
The Federal Reserve Flow of Funds Accounts and the Bureau of Economic Analysis employ a proxy measure of currency inflows and outflows to determine the aggregate net amounts of currency held abroad for balance of payments purposes. The proxy inflow measure is based on the total amount of \$100 bills received from circulation each month in the New York and Los Angeles Federal Reserve banks. Similarly, the gross outflows of US dollars abroad are proxied by the total amount of \$100 notes put into circulation each month by these two Federal Reserve offices. The proxy was chosen (Feige, 1994) because of its high correlation with the confidential estimates of net flows abroad calculated by the New York Federal Reserve.<sup>6</sup> However the proxy suffers from several obvious defects (Feige, 1997). First the proxy will overstate net outflows because some fraction of net injections of \$100 bills from these Federal Reserve banks are used to satisfy domestic demand. It will understate net outflows because it takes no account of smaller denomination notes shipped abroad and finally it takes no account of net shipments abroad from other Federal Reserve banks. Nevertheless, because the proxy represents the official US government estimate we compare below the gross outflows and gross inflows of currency based on the proxy measure and the corresponding estimates of these flows based on aggregate CMIR data.

Figure 1 reveals that in the years prior to 1995, the CMIR estimates [CTI\*] (adjusted for direct Federal Reserve receipts from abroad that are not required to be reported on CMIR forms) recorded a higher amount of US currency inflows to the US than the official proxy series. However, after 1996, the proxy estimates of inflows actually exceed those captured by CMIR data.

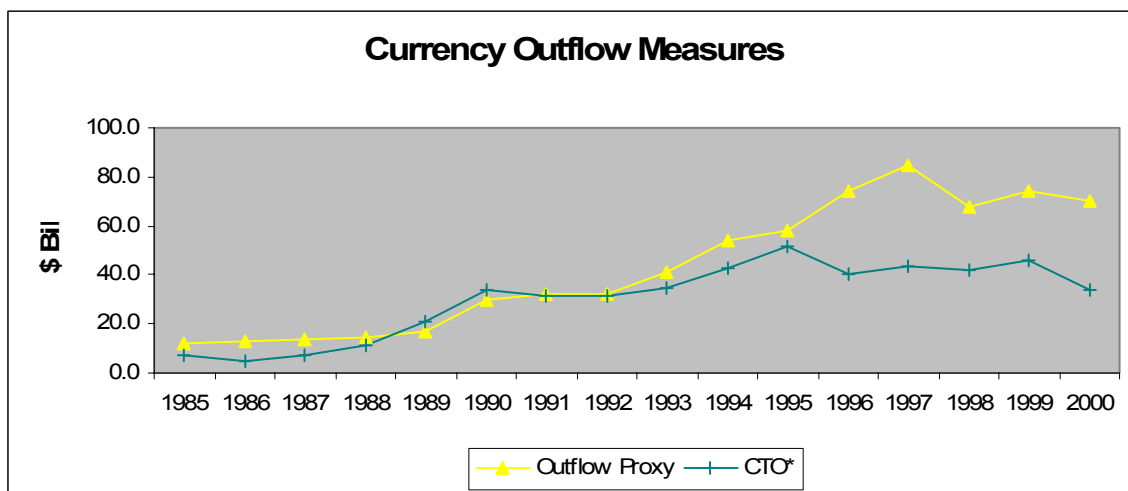


A similar pattern is observed when the two alternative estimates of gross outflows of US currency are compared. Figure 2 reveals that the two series diverge significantly in the post 1996 period. One explanation of these anomalous results may be an unintended consequence of the introduction of the Extended Custodial Inventory (ECI) program by the Federal Reserve.

**Figure 1: Alternative Estimates of Aggregate US Currency Inflows**



**Figure 2: Alternative Estimates of Aggregate US Currency Outflows**



<sup>6</sup> The initial proxy included only inflows and outflows of \$100 bills from the New York FED office that accounts for a substantial portion of the currency sent abroad.

The Federal Reserve established the ECI program, as a means of assuring an adequate supply and rapid dissemination of newly designed US bank notes. It also served to expedite the repatriation of old-design notes from abroad in order to eliminate from circulation older notes that were more likely to be targets of counterfeiting. The cost efficient means of achieving these goals required the Federal Reserve to strategically stockpile newly designed notes at ECI sites in Europe and repatriate old-design notes to the same ECI facilities. The ECI's also served to subsequently re-circulate new-design fit notes to the international currency market. The establishment of the cost efficient ECI system, however, appears to have introduced a downward reporting bias in the CMIR estimates of currency held abroad, requiring a change in CMIR reporting practices to specifically include shipments and receipts of currency dispersed and collected from the FED's ECI facilities overseas. Notes sent to and returned from ECI facilities from the US are captured by CMIR reporting, however the final destination of subsequent re-shipments and receipts of these notes to foreign demanders are not properly captured in the CMIR reports because these notes are already reported as being overseas.

As such, the establishment of the ECI and the oversight of not accommodating the CMIR reporting requirement to the new institutional setting results in an understatement of outflow and inflow data in the CMIR reports for the year 1996 and beyond. Since the aim is to capture all net outflows of US currency to final destinations in transition countries, the data have been adjusted to reflect the effects of net outflows of currency from ECI to transition countries in the post ECI period.

#### **B) Survey Estimates of European legacy currencies held abroad.**

There is considerable anecdotal evidence to suggest that in addition to dollars, CEE countries also employed legacy currencies of some European nations as co-circulating currencies. Unfortunately CMIR type data are not available for legacy currencies or for the

euro.<sup>7</sup> Residents of several transition countries are however known to have held various amounts of German currency (DM), Austrian schillings (AST) and the Swiss Francs (SF). Earlier studies by Seitz (1995) and Doyle (2000) found that between 35-70% of Deutsch-Marks (DM) were held outside of Germany.

In anticipation of the euro conversion, the Austrian National Bank (ONB) commissioned Gallup to conduct a series of surveys in several CEE countries in order to determine the extent of FCC holdings of various legacy currencies. Each of the ten surveys conducted between June 1997 and November 2001 involved approximately 1000 persons above the age of 14.<sup>8</sup> Survey results concerning self-admitted currency holdings are best considered as lower bound estimates of actual currency holdings since such surveys are known to suffer from considerable underreporting bias. For example, the Federal Reserve Survey of Currency Usage (SCU) reveals that US household admit to holding less than 10% of the nation's total currency supply in circulation outside of banks. Official estimates of US dollar holdings abroad suggest that roughly 50% of US currency is held overseas. Since firms hold a negligible amount of cash, the Federal Reserve's currency survey results indicate that such survey data require a blow-up factor of five in order to obtain a true estimate of actual domestic currency holdings.<sup>9</sup> Moreover, repeated SCU surveys show a relatively stable temporal pattern of underreporting bias. The Austrian Bank survey estimates are also likely to

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<sup>7</sup> A proposal to the European Central Bank to carefully monitor the historic introduction of the Euro by setting up an ECI type program that would record the gross outflows and inflows of euros and returning legacy currencies from outside the EMU was ultimately rejected by the ECB. However, with the support of the IMF and the Croatian National Bank, a number of CEE central banks have undertaken independent efforts to survey their commercial banks in an effort to collect data on the amounts of euros in circulation.

<sup>8</sup> The author is indebted to the Austrian National Bank for providing its survey estimates.

<sup>9</sup> The appropriateness of this fivefold adjustment is confirmed by independent estimates of the amount of FCC in circulation in Croatia. The Croatian National Bank monitored flows of foreign currency into and out of the banking system during and after the Euro conversion process and estimated that the holdings of FCC in Euros was 3.1 billion (Kraft, 2002). A fivefold blow-up of the Austrian National Bank (ONB) survey estimate of non-dollar FCC holdings in Croatia yields a corresponding estimate 3.05 billion. These estimates are also within the range of indirect estimates of FCC in Croatia based on money demand and denomination displacement methods (Feige, et al., 2002a). Since Croatia is the only country for which the appropriateness of the blow-up factor could be independently tested, we employ the actual survey results without the blow-up factor for all CEE countries covered by the ONB survey.

be subject to an underreporting bias, however, the precise magnitude of the bias is unknown. I therefore employ the ONB estimates without further adjustment since the primary concern of this paper is with the dynamic temporal development of FCC holdings rather than with their absolute level. As long as the degree of bias is relatively constant over time, it will not affect dynamic inferences. The estimated amounts of legacy currencies held in the surveyed CEE countries reflect the actual yearly average holdings obtained by the Austrian surveys.

An added contribution of the ONB surveys is that they provide information on the currency composition of FCC holdings. Table 1 reveals that in each of the five countries

**Table 1: Percentage Distribution of FCC Holdings by Currency**

<b><u>Country</u></b>	<b><u>Currency</u></b>			
	<b>AST</b>	<b>DM</b>	<b>SF</b>	<b>US</b>
<b>Croatia</b>	3	76	3	18
<b>Czech Republic</b>	12	44	7	37
<b>Hungary</b>	22	46	2	30
<b>Slovenia</b>	11	71	3	14
<b>Slovak Republic</b>	10	31	27	31

Source: Author's calculations based on Austrian Central Bank Survey data-Average values 1997-2001

surveyed, the DM comprises the largest component of FCC holdings, followed by the US dollar. The consensus estimate of DM held outside of Germany is roughly the equivalent of \$50 billion. Using the ONB survey estimates of total DM held in the five countries implies that these countries collectively accounted for roughly 23 percent of the DM believed held outside of Germany. The Czech Republic appears to hold almost 10% of estimated DM abroad, followed by Croatia with 6%.

### **C: Estimates of Foreign Currency in Circulation in Transition Countries.**

The combined estimates of US dollar and legacy currency holdings are reported in Table 2, which displays estimates of the per capita FCC holdings in transition countries in 2001.<sup>10</sup>

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<sup>10</sup> The data reported for Croatia, Czech Republic, Hungary, Slovenia, and the Slovak Republic include both dollar holdings and the holdings of European legacy currencies as estimated from survey data obtained from the Austrian Central Bank. These are the only countries for which independent estimates of European legacy

**Table 2: Estimates of Per Capita Foreign Currency Holdings in Transition Countries**

Country	Per Capita	Percent of total
	FCC	currency held as
	2001	foreign currency
	2001	2001
	\$ Per Capita	Percent
Albania*	46	14
Armenia*	55	62
Azerbaijan*	169	82
Belarus*	17	34
Bulgaria*	125	41
Croatia** <sup>11</sup>	117	35
Czech Republic**	129	21
Estonia*	414	59
Georgia*	123	79
Hungary**	25	6
Kazakhstan*	1024	95
Kyrgyzstan*	20	48
Latvia*	1209	79
Lithuania*	25	11
Macedonia*	5	5
Moldova	NA	NA
Poland**	93	27
Romania*	61	55
Russia*	903	87
Slovak Republic**	123	28
Slovenia**	329	54
Tajikistan	NA	NA
Turkmenistan*	64	51
Ukraine*	131	64
Uzbekistan*	10	44

Sources: Authors Calculations based on: \* CMIR (adjusted); \*\*Austrian National Bank Survey data.

We find that FCC holdings of US dollars in transition countries accounted for roughly 29 percent of the \$580 billion of US currency in circulation with the public in the year 2001.

The second column of the table reports the percentage of total currency (FCC+LCC) estimated held in the form of foreign currency. The highest percentage of FCC holdings are found in Kazakhstan, with Russia, Azerbaijan, Georgia, and Latvia all having more than 70

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currencies are available. The results reported for all other countries therefore include only estimated holdings of US dollars.

<sup>11</sup> The FCC estimates based on the Austrian Central Bank survey data are likely to underestimate total FCC holdings. For example, Kraft (2002) estimates that Croatia's FCC holdings in 2001 were approximately \$3.1 billion or roughly \$665 per capita. This would raise the estimate of the percent of FCC in total currency to 75.

percent of their total currency supply held in the form of FCC. Both the high per capita holdings and the high percent of total currency held in Latvia is a surprise, and may reflect currency shipped to Latvia that was subsequently transferred to other FSU countries. In particular, the estimates for Belarus seem very low when compared to an informal treasury department estimate (US Treasury, 2000) suggesting per capita dollar holdings of some \$300 dollars. Given the proximity of the two countries, it is likely that a considerable portion of Latvia's net dollar inflows is subsequently transshipped to Belarus. Similar cross border shipment effects could affect other countries as well.

## **II. Dollarization Measures: A Comparison of Alternative Dollarization Indices.**

### **A. Measures, Magnitudes and Trends**

Given the estimates of FCC holdings displayed in Table 2 it is now possible to examine the consequences of employing alternative measures of unofficial dollarization. Feige et. al. (2002a and 2002b) point out that in an economy with unofficial dollarization, the *effective* broad M2 money supply consists of local cash in circulation outside the banking system (LCC), foreign cash in circulation outside the banking system (FCC), local demand deposits (LDD), local currency time and savings deposits (LTD) and foreign currency deposits (FCD) held with domestic banks. Quasi money (QM) is defined as LTD and FCD. The typical definition of broad money therefore falls short of the effective broad money supply by the unknown amount of FCC. The narrow M1 money supply is typically defined to include only LCC and LDD. However in a dollarized economy, the effective narrow money supply (EM1) should also include FCC.

Unofficial (de facto) dollarization or euroization takes place when individuals and firms voluntarily choose to use foreign currency as either a transaction substitute (currency substitution) or a store of value substitute (asset substitution) for the monetary services of

domestic currency. In a regime with de facto dollarization, the recorded money supply falls short of the effective money supply due to the omission FCC, which is typically unknown and not directly controllable by the local central bank. Due to the previous lack of data on foreign currency in circulation (FCC), research on the de facto dollarization process has been forced to accept the observable amount of foreign currency deposits (FCD) as a proxy for dollarization. Studies of dollarization and currency substitution, often associated with the International Monetary Fund (IMF), employ the ratio of FCD to broad money (FCD/M2) as the measure of the extent to which countries are dollarized. We denote this traditional dollarization index (DI) where:

$$1) (DI) \equiv (FCD/M2)$$

De facto dollarization is often a response to hyperinflation, currency devaluations or a history of bank confiscations. Under such circumstances, a foreign currency may first serve as a unit of account and store of value and only later as a circulating medium of exchange. Asset substitution refers to a foreign currency serving as a store of value, whereas currency substitution occurs when the foreign currency also serves as a medium of exchange. When both asset substitution and currency substitution take place, or when FCD's are used by firms to make transactions with international partners, we define a *comprehensive dollarization index* (CDI) that represents the fraction of a nation's broad effective money supply composed of foreign monetary assets. Thus:

$$(2) CDI \equiv (FCC+FCD)/ (M2+FCC)$$

The extent of de facto dollarization depends upon various incentives to hold the different assets described in the denominators and numerators of the dollarization indices. These incentives include relative rates of return as reflected in interest rate differentials, inflation differentials, and exchange rate depreciation, as well as the relative benefits and costs associated with network externalities and switching costs. The traditional dollarization

index (DI) will be an adequate proxy of de facto dollarization when foreign currency holdings are of marginal importance, or when FCC and FCD are highly complementary. If, however, significant amounts of foreign currency circulate for transaction purposes, or if FCC and FCD are in fact substitutes, the traditional dollarization measure performs poorly as an indicator of de facto dollarization. The DI index understates the true extent of dollarization due to its omission of FCC holdings.

**Table 3a Alternative Measures of De Facto Dollarization in FSU Countries\***

<b>The Baltics</b>	CDI	DI	CDI Trend	DI Trend
Estonia	33.7	17.2	↑	↑
Latvia	67.5	30.0	↑	→
Lithuania	34.7	32.9	↑	↑
<b>MEAN FOR GROUP:</b>	<b>45.3</b>	<b>26.7</b>		
<b>Western FSU</b>				
Belarus	57.2	52.8	↑	↑
Moldova	27.3	27.3	↑	↑
Russia	73.5	24.5	↑	↑
Ukraine	37.8	19.4	↑	↑
<b>MEAN FOR GROUP:</b>	<b>56.2</b>	<b>31.0</b>		
<b>The Caucasus</b>				
Armenia	68.1	46.5	↑	↑
Azerbaijan	82.3	48.8	↑	↑
Georgia	80.2	44.5	↑	↑
<b>MEAN FOR GROUP:</b>	<b>76.9</b>	<b>46.6</b>		
<b>Central Asia</b>				
Kazakhstan	89.7	47.5	↑	↑
Kyrgyz Republic	52.3	25.2	↑	↑
Tajikistan	29.5	29.5	↑	↑
Turkmenistan	54.4	39.9	↑	↑
Uzbekistan	40.7	24.4	↑	↑
<b>MEAN FOR GROUP:</b>	<b>59.2</b>	<b>33.3</b>		
<b>MEAN FOR FSU:</b>	<b>59.5</b>	<b>33.2</b>		

\*The data employed to derive these estimates include the following sources: Various Central Bank Annual reports, the IMF International Financial Statistics (2002) and the internal IMF European II database kindly provided by Oleh Havrylyshyn. Unfortunately, for some countries, the internal IMF data and the published IFS data are discrepant. In these cases we have used the definitional relationships between monetary aggregates to derive our best estimate of the components of the dollarization indices reported. The CDI and DI trends are based on the period 1997-2001.



Table 3a and 3b display a country-by-country comparison of the comprehensive dollarization proxy (CDI) that takes explicit account of the estimated amount of FCC in circulation in each nation with the traditional dollarization index (DI). The tables also display the trends in dollarization as revealed by each index.

**Table 3b: Alternative Measures of De Facto Dollarization in EU Border Countries**

<b>EU Border Countries</b>	CDI	DI	CDI Trend	DI Trend
<i>Croatia*</i>	69.2	67.9	↑	↑
<i>Czech Republic</i>	13.7	11.1	↓	→
<i>Hungary</i>	17.1	16.3	↓	↓
Poland	19.0	15.6	↓	↓
<i>Slovak Republic</i>	19.4	15.6	↑	↑
<i>Slovenia</i>	39.1	35.3	↑	↑
<b>MEAN FOR GROUP:</b>	<b>29.6</b>	<b>27.0</b>		
<b>The Balkans</b>				
Albania	26.2	22.4	↑	↑
Bulgaria	48.5	39.2	↓	→
Macedonia	58.6	58.1	↑	↑
Romania	50.7	42.8	↑	↑
<b>MEAN FOR GROUP:</b>	<b>46.0</b>	<b>40.6</b>		
<b>MEAN FOR CEE:</b>	<b>36.2</b>	<b>32.4</b>		

\* Inter-temporal estimates of FCC derived from Šošić and Faulend (2002). Countries whose names appear in italics include both European legacy currency and dollar holdings.

Balino et al (1999) classify countries as “highly dollarized” if their DI is greater than 30 percent. According to this classification criterion, the following eight FSU countries are highly dollarized: Belarus, Azerbaijan, Kazakhstan, Armenia, Georgia, Turkmenistan, Lithuania and Latvia. The CDI index includes all of these countries (except Lithuania) among the eight most dollarized countries. Notably the CDI index identifies Russia as the fourth most highly dollarized FSU country. For the CEE countries, the “highly dollarized”

countries would include, Croatia, Macedonia, Romania, Bulgaria and Slovenia, and these same five countries are selected as the most highly dollarized by the CDI index. For regions, both indices indicate that for the FSU, the highest degree of dollarization is found in the Caucasus region while the lowest dollarization has occurred in the Baltic States. Similarly, for the CEE countries, both indices suggest higher levels of dollarization in the Balkans than in the EU border countries.

Examining the five-year trend in dollarization over the period 1997-2001, the CDI indicates increasing dollarization for all of the FSU countries. The DI shows similar trends except for Latvia, whose dollarization trend appears stable over the period. For the CEE countries, both indices suggest growing dollarization in Croatia, Slovak Republic, Slovenia, Albania, Macedonia and Romania.

In short, all of these countries display hysteresis effects, in which the lack of confidence in domestic monetary assets resulting from past inflations, devaluations and bank confiscations appears difficult to reverse, even when macroeconomic conditions stabilize. To the extent that the dollarization involves currency substitution, Feige et al. (2002a) and Oomes and Shinkevich (2002) have shown that network externalities in the use of foreign currency will also make dollarization difficult to reverse. The only countries that exhibit falling or stable dollarization trends are Hungary, Poland, Czech Republic and Bulgaria. Hungary, Poland and the Czech Republic also had the lowest levels of dollarization and therefore may well have been below the threshold where network externalities in the use of FCC become significant. The downward trend observed in Bulgaria, which has a relatively high level of dollarization may be explicable in terms of a gradual substitution of dollars by other European currencies that could not be included in the FCC measure.

## **B. Cross County and Inter-temporal Relationships**

We now turn to an examination of the consistency between the CDI and DI measures of dollarization for the transition countries. One simple measure of consistency is the correlation between the two indices across countries. For all of the transition countries in our sample we find the correlation to be .734. For the CEE countries alone it rises to .988, but for the FSU countries the correlation drops to .657, suggesting that the omission of the large dollar holdings in the FSU may produce a severe understatement of the extent of dollarization when the traditional DI measure is used rather than the CDI.

**Table 4a: FSU Inter-Temporal Correlations between CDI and DI**

	<b>CDI-DI</b>	<b>Period</b>
Estonia	0.912	93-2001
Latvia	0.804	93-2001
Lithuania	0.923	93-2001
Belarus	0.997	92-2002
Russia	0.222	93-2001
Ukraine	0.596	92-2001
Armenia	0.928	92-2001
Azerbaijan	0.415	94-2001
Georgia	0.981	95-2001
Kazakhstan	0.363	94-2001
Kyrgyz Republic	0.929	93-2001
Turkmenistan	0.959	94-2001
Uzbekistan	0.864	92-2001

**Table 4b: CEE Inter-Temporal Correlations Between CDI and DI**

	<b>CDI-DI</b>	
Croatia	0.997	93-2000
Czech Republic	0.972	93-2001
Hungary	0.985	90-2001
Poland	0.969	90-2001
Slovak Republic	0.950	97-2001
Slovenia	0.960	97-2001
Albania	0.736	92-2001
Bulgaria	0.971	91-2001
Macedonia	0.999	95-2001
Romania	0.994	90-2001

An examination of the inter-temporal correlations for each separate country allows a more detailed examination of the problem. As displayed in Table 4b, the inter-temporal correlation between the CDI and DI indicators exceeds .95 for all countries except Albania. However, in the FSU group (Table 4a), the inter-temporal correlations show considerable variations between countries. The correlations between the two indices are particularly low for Russia (.222), Kazakhstan (.317) Azerbaijan (.415) and the Ukraine (.596). These differences may be highly significant when researchers address the positive issues of the nature, causes and consequences of de facto dollarization, which require an accurate dollarization indicator. The coherence and proper interpretation of the two de facto dollarization indicators will depend upon the extent to which different countries experience different degrees of currency and asset substitution. It is to this issue that we now turn.

### **III. Currency and Asset Substitution.**

#### **A. Measures, Magnitudes and Trends**

Currency substitution occurs when a foreign currency largely displaces the domestic currency as the medium of exchange. Feige et al. (2002a, 2002b) suggest an explicit measure of the extent of currency substitution that they call the *currency substitution index* (CSI). It shows the fraction of a nation's total currency supply held in the form of foreign currency.<sup>12</sup> Thus,

$$(3) \text{ CSI} \equiv \text{FCC} / (\text{FCC} + \text{LCC}).$$

When dollarization primarily involves the use of foreign denominated monetary assets as substitutes for domestic ones in their capacity as stores of value, it is useful to define an *asset*

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<sup>12</sup> Some foreign banknotes may be hoarded for long periods and might therefore be considered largely as a store of value. When the fraction of FCC that is in long term hoards can be estimated, it should be treated as a store of value and included in the asset substitution index rather than the currency substitution index.

*substitution index* (ASI) as the ratio of foreign denominated monetary assets to domestic denominated monetary assets excluding currency outside banks.<sup>13</sup>

$$(4) \text{ ASI} \equiv \text{FCD}/(\text{LDD}+\text{LTD}) = \text{FCD}/(\text{M2}-\text{LCC}-\text{FCD})$$

Since the motives for currency substitution and its implications can be quite different from those of asset substitution, we now turn to an examination of currency and asset substitution indices for the transition countries.

**Table 5a: Currency and Asset Substitution in FSU Countries**

The Baltics	CSI	ASI	CSI Trend	ASI Trend
Estonia	59	26	↑	→
Latvia	79	76	↑	↓
Lithuania	11	75	→	↑
MEAN FOR GROUP:	50	59		
Western FSU				
Belarus	34	194	↑	↑
Moldova	NA	78	NA	↑
Russia	87	51	↑	↑
Ukraine	64	50	↑	↑
MEAN FOR GROUP:	62	93		
The Caucasus				
Armenia	62	377	↑	↑
Azerbaijan	82	578	↑	↑
Georgia	79	543	↑	↑
MEAN FOR GROUP:	74	499		
Central Asia				
Kazakhstan	95	164	↑	↑
Kyrgyz Republic	48	181	↑	↑
Tajikistan	NA	160	NA	↑
Turkmenistan	51	137	↑	↑
Uzbekistan	44	60	↑	↑
MEAN FOR GROUP:	59	140		
<b>MEAN FOR FSU:</b>	<u>61</u>	<u>183</u>		

<sup>13</sup> When data on M2 and/or LTD are unavailable, but measures of QM are available, the asset substitution index can be approximated by the ratio of FCD to total deposits, which equals LDD+QM. These two measures tend to be closely correlated. However, just as some FCC is used for hoards, some portion of FCD may be used for

Tables 5a and 5b, respectively display estimates of the currency and asset substitution indices for the FSU and CEE countries for the year 2001 as well as the five year inter-temporal trend of each index for each country for which data are available. Table 5a reveals that the CSI, representing the fraction of the total currency supply made up of US dollars, exceeds 50 percent for Kazakhstan, Russia, Azerbaijan, Georgia, Latvia, Ukraine, Armenia, Estonia and Turkmenistan. These are countries in which the use of foreign currencies is so widespread, that seniorage losses are substantial. The extensive use of foreign currencies in response to inflationary and financial instability incentives result in network externalities in foreign currency usage which may now exceed the threshold level (Feige et al. (2002b) at which it is unlikely that the use of FCC will be reversed. The surprisingly high and rising demand for dollars in both Latvia and Estonia may be due to continued trade with other FSU countries that also use dollars as a primary medium of exchange. Moreover, the more than 20% decline in the euro/dollar exchange rate after the initial launch of the euro provided an incentive for firms and individuals to maintain dollar denominated monetary assets. Every country, with the exception of Lithuania, displayed increasing degrees of currency substitution during the period 1997-2001. On a regional basis, both currency substitution and asset substitution are highest in the Caucasus region and lowest in the Baltic States.

Table 5a also reveals the Azerbaijan, Georgia, Armenia, Belarus, Kyrgyz Republic, Kazakhstan and Tajikistan display the highest degrees of asset substitution of the FSU countries. The trend of asset substitution over the period 1997-2001 has been increasing for all countries with the exception of Lithuania, where asset substitution has been relatively stable, and Latvia, where asset substitution has actually decreased.

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transactions purposes. Where this transaction component can be determined, the appropriate empirical treatment would be to include it in the currency substitution index rather than the asset substitution index.

Table 5b displays currency and asset substitution indices and trends for the CEE countries. Only Romania and Slovenia have more than 50 percent of their total currency supply in the form of FCC. For these countries, it seems realistic to infer that the marginal

**Table 5b: Currency and Asset Substitution in CEE Countries:**

<b>EU Border Countries</b>	<b>CSI</b>	<b>ASI</b>	<b>CSI Trend</b>	<b>ASI Trend</b>
<i>Croatia</i>	46	283	↓	↑
<i>Czech Republic</i>	21	14	↓	→
<i>Hungary</i>	6	24	↓	↓
Poland	27	21	↓	↓
<i>Slovak Republic</i>	28	22	↓	↑
<i>Slovenia</i>	54	59	↑	↑
<b>MEAN FOR GROUP:</b>	26	64		
<b>The Balkans</b>				
Albania	14	47	→	↑
Bulgaria	41	111	↓	↑
Macedonia	5	315	↑	↑
Romania	55	97	↑	↑
<b>MEAN FOR GROUP:</b>	29	143		
<b>MEAN FOR CEE:</b>	<u>29</u>	<u>99</u>		

Countries whose names appear in italics include both European legacy and dollar holdings.

costs of shifting from one foreign currency into another (i.e. from dollars into euros) are lower than the marginal costs of shifting from foreign to domestic currencies. Hence, those countries that have partially dollarized are more likely to move toward euros than back to local currencies since the relative benefits attached to euros as opposed to dollars – at least for transactions purposes – will rise as contiguous and nearby countries euroize. The existing domestic network externality effect is likely to be supplemented by a neighborhood network externality effect as official euroization spreads eastward. Thus, over time, incentives will rise for these CEE countries to move unilaterally from unofficial partial dollarization to official, exclusive euroization.

Hungary, Macedonia and Albania appear to have unusually low degrees of currency substitution, however, it must be recalled that FCC estimates for these countries do not

include euro holdings, which may be considerable, particularly for Macedonia. Even accounting for this likely underestimation of total FCC holdings, it is striking that overall, the CEE countries have a mean CSI of 27 percent compared to the FSU mean of 61 percent. Moreover, six of the ten CEE countries display a declining five-year trend in the currency substitution index whereas all of the FSU countries save Lithuania display an increasing trend in currency substitution. This is consistent with the hypothesis that at lower levels of currency substitution there are smaller gains from network externalities and hence higher transactions costs in the use of FCC. Under such circumstances, improving domestic macroeconomic conditions and more stable expectations patterns can give rise to a reversal in the currency substitution process. In Bulgaria, this may also be a response to increased credibility achieved by the establishment of a Currency Board.

Macedonia, Croatia and Bulgaria display the highest degrees of asset substitution as well as increasing trends over time. The lowest degrees of asset substitution is found in the Czech Republic, Poland, Slovak Republic and Hungary with all but the Slovak Republic displaying stable or declining asset substitution over time. Overall, the CEE countries exhibit a much lower degree of asset substitution than the FSU countries as exhibited by the means for country groupings. The mean ASI for the CEE countries is 96 compared to a mean for the FSU countries of 183.

## **B. The Relationship between Currency and Asset Substitution**

We now turn to the important question of the relationship between currency substitution and asset substitution. In principle, the two processes need not go hand in hand given the differences between transactions and asset motives for holding foreign currencies.

Table 6 displays the cross-country correlations between our key measures of currency substitution (CSI), asset substitution (ASI) and the two measures of overall dollarization CDI



and DI.<sup>14</sup> Column two reveals that for all of the transition countries in our sample, the correlation between currency substitution and asset substitution is positive as expected, but remarkably low (.355) The FSU countries score a correlation of only .312 whereas for the CEE countries, the relationship between currency and asset substitution drops virtually to zero.

**Table 6- Cross Country Correlations – Currency and Asset Substitution Indices**

Region	CSI-ASI	CSI-CDI	CSI-DI	ASI-CDI	ASI-DI
FSU*	0.312	0.763	0.113	0.628	0.692
CEE	0.021	0.431	0.347	0.886	0.932
FSU*+CEE	0.355	0.748	0.218	0.711	0.695

\*Excluding Tajikistan and Moldova

These findings have important implications for both the interpretation and the relative reliability of the comprehensive dollarization index (CDI) as compared to the traditional dollarization index (DI). Columns 3 and 4 of Table 6 reveal that the CDI is significantly more correlated with currency substitution than is the DI, whereas columns 5 and 6 indicate that both dollarization indices reflect measures of asset substitution to roughly the same degree.

A more detailed analysis of these relationships can be found in Tables 7a and 7b. Column 2 reveals that the inter-temporal relationship between currency substitution and asset substitution are indeed much more varied and complex than is usually thought to be the case. For many of the countries, currency substitution and asset substitution appear to be positively correlated over time, but the degree of this positive correlation ranges from a low of .078 for Azerbaijan, to more than .90 for Macedonia, the Czech Republic and Georgia. Moreover, five of the transition countries exhibit a temporal pattern in which increases in asset substitution are associated with declines in currency substitution. This is of course possible when rising confidence in the domestic banking system and improvements in its provision of transactions services induces a shift from FCC to domestic monetary deposits. One important set of

<sup>14</sup> This analysis is contingent on the caveats mentioned in footnotes 12 and 13.

factors that will affect the choice of FCC but not that of bank deposits, are the incentives that drive individuals into the underground economy. Where the incentives for underground activity are growing at the same time that banking systems are improving, we could observe an increase in FCC holdings (and hence a rise in CSI) even as individuals shift from FCD into domestic monetary assets (hence a decrease in ASI). In short, the complex relationship between asset substitution and currency substitution requires careful dynamic country-by-country analysis, an undertaking made possible by the newly developed estimates of CSI.

**Table 7a: Inter-temporal Currency and Asset Substitution Correlations - FSU**

	CSI-ASI	CSI-CDI	CSI-DI	ASI-CDI	ASI-DI
Estonia	0.249	0.888	0.454	0.666	0.971
Latvia	0.580	0.991	0.793	0.672	0.728
Lithuania	-0.162	0.323	-0.066	0.856	0.962
Belarus	0.540	0.455	0.391	0.961	0.952
Russia	-0.039	0.929	-0.096	0.279	0.988
Ukraine	0.534	0.938	0.275	0.783	0.942
Armenia	0.635	0.816	0.547	0.901	0.904
Azerbaijan	0.078	0.739	-0.269	0.560	0.853
Georgia	0.934	0.994	0.955	0.948	0.968
Kazakhstan	0.346	0.984	0.275	0.429	0.983
Kyrgyz Republic	0.832	0.970	0.816	0.921	0.930
Turkmenistan	0.835	0.957	0.863	0.931	0.918
Uzbekistan	0.564	0.829	0.438	0.925	0.980

**Table 7b: Inter-temporal Currency and Asset Substitution Correlations - CEE**

	CSI-ASI	CSI-CDI	CSI-DI	ASI-CDI	ASI-DI
Croatia	0.158	0.452	0.141	0.947	0.988
Czech Republic	0.915	0.974	0.905	0.999	0.999
Hungary	0.160	0.485	0.325	0.933	0.977
Poland	-0.658	-0.452	-0.581	0.930	0.966
Slovak Republic	-0.786	-0.525	-0.759	0.938	0.999
Slovenia	0.532	0.776	0.567	0.947	0.999
Albania	-0.494	0.411	-0.315	0.539	0.927
Bulgaria	0.784	0.893	0.814	0.962	0.941
Macedonia	0.973	0.969	0.968	0.985	0.985
Romania	0.882	0.894	0.840	0.992	0.985

Table 7a and 7b also display the inter-temporal correlations for each country between the CSI and ASI and the two dollarization measures. The CDI is positively related to the CSI for all countries except for Poland and the Slovak Republic whereas the relationship between CSI and DI is more variable and reveals six countries where currency substitution and dollarization are negatively related. Asset substitution, on the other hand, is positively and strongly related to both dollarization indices.

We conclude that the relationship between asset substitution and currency substitution is both more varied and more complex than is usually thought to be the case, requiring a country-by-country analysis of the separate incentives for holding FCC as opposed to FCD and domestic deposits. We also find that both measures of dollarization capture the major consequences of asset substitution, but that the CDI clearly dominates the DI as a measure capturing the effects of currency substitution. We are left with the enigma that in some cases, currency substitution and asset substitution are actually negatively related over time. One provisional explanation of this phenomenon can be found in improvements in the domestic banking system that leads firms and individuals to convert foreign currency holdings into foreign currency bank deposits. Such a shift will simultaneously produce in a fall in CSI and a rise in ASI. Conversely, a decline of confidence in the domestic banking system can lead to a shift of bank deposits into FCC as well as a shift from domestic deposits into foreign currency deposits. Once again, this portfolio realignment can give rise to a negative relationship between CSI and ASI.

A suggestive, albeit preliminary investigation of this hypothesis can be undertaken by examining the cross-country correlation between our dollarization, currency substitution and asset substitution measures and the EBRD index of banking sector reform (BR) in the various transition countries.

Table 8 displays the cross-country correlations between our key indicators and the EBRD index of banking reform (BR). We find that improvements in banking reform are

**Table 8: Relationship Between CDI, DI, CSI, ASI and Banking Reform**

Correlations	CDI-BR	DI-BR	CSI-BR	ASI-BR
FSU*+CEE	-0.423	-0.276	-0.303	-0.260

\*Excluding Tajikistan and Moldova

negatively correlated with both dollarization measures, suggesting some shift in portfolios from foreign to domestic assets. Moreover, improvements in banking sector reform are negatively correlated with indices of both currency and asset substitution. The negative correlation with CSI suggests that domestic banking sector reform can lead to a shift from FCC to foreign denominated bank deposits. This finding is consistent with our observation of a negative relationship between CSI and ASI for some countries. The negative correlation between banking reform and ASI suggests that greater confidence in the banking sector may also induce a shift from FCD to domestic deposits. A complete analysis of this issue will require a dynamic analysis of the relationship between banking reforms and CSI and ASI over time for each country.

#### **IV. Summary and Conclusions**

Unofficial or de facto dollarization is the result of both currency substitution and asset substitution. Currency and asset substitution are typically induced by past inflations, devaluations, currency confiscations and the growth of underground economies. When de facto dollarization is widespread, the effective money supply is much larger than the domestic money supply and is, moreover, less easily controlled by the monetary authority because of the public's propensity to substitute foreign for domestic currency. For example, de facto use of FCC will thwart government efforts to employ inflationary finance to impose implicit taxes on domestic monetary assets. Extensive currency substitution not only makes

domestic monetary policy less effective, it also makes active exchange rate interventions more dangerous.

Currency substitution also has fiscal consequences that are particularly salient for transition countries. Foreign cash transactions reduce the costs of tax evasion and facilitate participation in the unreported or “underground” economy. This weakens the government’s ability to command real resources from the private sector and deepens fiscal deficits. The shifting of economic activity toward the underground economy distorts macroeconomic information systems (Feige, 1990, 1997), thereby adding to the difficulty of formulating macroeconomic policy. By obscuring financial transactions, currency substitution reduces the cost of enterprise theft and facilitates corruption and rent seeking.

In order to learn more about the extent, causes and consequences of the dollarization process, we present newly collected time series data on the amounts and locations of US dollars and some European legacy currencies held in transition countries. These data enable us to circumvent the problem of “unobservability” that has plagued the currency substitution literature since its inception, permitting a refinement of definitions and measures of currency substitution, asset substitution, and the construction of a new comprehensive measure of de facto dollarization. Once foreign currency in circulation is measurable, it becomes possible to directly examine the causes and consequences of de facto dollarization, as well as the circumstances under which it is likely to become persistent, if not irreversible. These issues are essentially dynamic in nature, requiring time series evidence on de facto dollarization, currency substitution and asset substitution. Employing such time series for Argentina and Russia, Feige et al. (2002a, 2002b) and Oomes and Shinkevich (2002) respectively find that hysteresis and irreversibility can be induced by network externalities associated with the use of foreign currency. When network externalities become sufficiently large, countries may decide to dollarize or euroize their economies, forgoing the seigniorage, and the flexibility of

domestic monetary management in exchange for greater financial stability and an enhanced ability to attract foreign investment.

Earlier measures of dollarization largely relied on foreign currency deposits as an indicator of currency substitution because actual measures of foreign currency in circulation were unavailable. Employing aggregated data derived from Currency and Monetary Instrument Reports, (adjusted for anomalies introduced by the Extended Custodial Inventory Program) on dollar inflows and outflows to and from the US, as well as estimates of other European currencies that co-circulate with local currencies, we estimate the total amounts of FCC in various transition countries. We find that total FCC holdings of US dollars in the included transition countries account for some 29 percent of the total amount of US currency believed to be held abroad. Our temporal estimates of the comprehensive dollarization index (CDI) suggests that there has been an upward five year trend in dollarization for all FSU countries, but a decline in dollarization is several of the CEE countries.

Cross country and inter-temporal correlations reveal that our comprehensive dollarization index (CDI) is highly correlated with the traditional measure of dollarization (DI) for the CEE countries, but the relationship is less consistent for the FSU countries. The traditional (DI) that relies exclusively on measures of foreign currency deposits, is found to be indicative of asset substitution but perform poorly as measures of currency substitution. Our CDI dollarization indicator suggests that many of the transition countries have already surpassed threshold levels of currency substitution. When this occurs, network externalities are likely to make the dollarization process irreversible. We find that Kazakhstan, Azerbaijan, Georgia, and Russia, exhibit the highest degree of de facto dollarization with more than 70 percent of their effective broad money supply held in the form of foreign denominated assets. Kraft (2002) addresses the difficulties faced by monetary policy makers in transition

countries operating in environments where currency and asset substitution issues are paramount.

The provision of data on FCC in circulation in transition countries permits the construction of more refined indicators of currency substitution (CSI) and asset substitution (ASI). Cross country and inter-temporal correlations reveal that the relationship between currency substitution and asset substitution is much more varied and complex than is usually thought to be the case. These findings suggest that future research should concentrate on the estimation of demand functions for both domestic and foreign monetary assets, taking account of the substitution possibilities between them as well as the influence of other key aspects of the transition process, including, but not limited to the progress of a countries banking reforms, and its record on macroeconomic stabilization and liberalization. Preliminary analysis suggests that bank reform is associated with lower levels of overall dollarization and its components, currency and asset substitution.

The provision of data on FCC holdings also lays the empirical foundations for the application of monetary methods for estimating the size and growth of underground economies in transition countries during the decade of transition. Monetary methods employing the domestic currency/deposit ratio have been employed in most countries for estimating unobserved (unrecorded) income, however the absence of data on the amount of FCC in circulation has led to significant biases in these estimates, and has largely precluded monetary estimates of unrecorded income growth in transition countries. To date, temporal estimates of unrecorded or unobserved economic activity [Kaufman, (1994); Kaufman and Kilberda, (1996); Johnson, et al. (1997) and Eilat and Zinnes (2000)] in transition countries have been based exclusively on variants of the electrical consumption method. However, Feige, (2002d) has shown that these methods produce highly questionable results. As such, virtually the entire literature assessing the performance of transition countries during the past

decade has been based on official estimates of GDP growth rather than on a more comprehensive measure of total economic activity, namely recorded plus unrecorded income growth. The availability of FCC estimates in transition countries permits the estimation of the effective currency deposit ratio  $[(FCC+LCC)/(LDD+LTD+FDC)]$  and hence the application of monetary methods to estimate unrecorded income growth. As shown by Feige, (2002d), the resulting estimates of total economic activity reveal a rather different picture of transition country performance, and hence require a reexamination of the factors implicated in both the observed success stories as well as the transition failures. In short, it is hoped that the availability of more comprehensive measures of dollarization and its currency and asset substitution components will lead to a deeper level of understanding of both the dynamics and implications of the dollarization process and the process of transition from planned to market economies.



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