Currency Substitution and Financial Sector Developments in Cambodia

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The tendency to substitute domestic for foreign currency (as a way of holding wealth and a means of transaction for goods and services) is common throughout the world, and particularly so in countries attempting to overcome thin financial institutions or errant monetary policy. This paper uses monthly data to analyze the phenomenon of currency substitution in Cambodia during the recent economic and financial reform process, 1993-2001. Results show that there is a significant long run relationship between the expected rate of depreciation in market exchange rates and holdings of US dollars. The implications of this result for macroeconomic policy and broader financial sector developments in Cambodia are also examined.

I.   INTRODUCTION

The currency substitution phenomenon—the use of foreign currency along with domestic currency by domestic residents as a means of payment, unit of account and a store of value—has drawn the attention of many studies over the last two decades, mainly in the context of developing and transitional economies[1]. These countries are normally exposed to prolonged periods of high and variable inflation and high expectations of exchange rate depreciation. As a result, residents in these countries have usually managed to shield the real values of their wealth by increasing their holdings of foreign currency. When economic imbalances are aggravated, prices of goods and services begin to be quoted in foreign currency and as the process drags on, increasing numbers of transactions in the domestic economy are performed in a foreign currency. This occurs in, for example, Argentina, Bolivia, Brazil, Mexico, Peru, Uruguay and others in Latin America.

From the early 1990s, the currency substitution phenomenon has been one of many topical issues in the transitional economies in Eastern Europe and the former Soviet Union. Along with its neighbours (Laos and Vietnam), Cambodia has been noticeably affected by currency substitution from the onset of its economic reform process.

The prevalent use of foreign currencies has been basically beyond the control of monetary authorities in Cambodia. The most preferred foreign currency is the US dollar, and it is held in the form of cash in circulation and banking deposits. Up to early 2001, the share of US dollar deposits in domestic banks to broad monetary aggregates reached almost 70 percent. Along with US dollars, the Thai baht is also widely circulated in some major provinces bordering with Thailand, although Cambodian banking deposits in baht do not seem to be in existence[2].

This paper aims to measure the extent and the process of currency substitution and examine its impact on macroeconomic policies in Cambodia. The paper is organized as follows. The definitions of currency substitution are discussed in part II, followed by a further

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[1] For example, Ortiz (1983) examined the Mexican case, Fasano-Filho (1986) looked at Argentina's case, Ramirez-Rojas (1985) identified the currency substitution in Argentina, Mexico and Uruguay, Canto (1985) studied Dominica's case and El-Erian (1988) checked the presence of currency substitution in Egypt and the Yemen Arab Republic. More recently, Rojas-Suarez (1992) tested dynamic inflation under the presence of currency substitution in the Peruvian economy. Sahay and Végh (1996) discussed currency substitution in transitional economies in Eastern Europe and the states of former Soviet Union.

[2] Due to unavailability of data on currency in circulation and banking deposits in Thai baht, this study is limited to the use US of dollars in the domestic banking system to estimate the degree of currency substitution.

discussion of the way currency substitution is measured in the literature. Part IV examines the importance of currency substitution in economic development. The paper briefly highlights some stylized facts and historical background of currency substitution in Cambodia in part V. An economic model of currency substitution is presented in part VI. Part VII shows the empirical results of currency substitution in Cambodia, which includes some econometric issues and interpretation of results. Finally, some conclusions are drawn in part VIII.

II.   DEFINITIONS OF CURRENCY SUBSTITUTION

The motivations for domestic residents to hold foreign currency can include: international transactions, precautionary demands and speculative purposes. For example, a commercial company may need a certain amount of yen to pay its Japanese supplier, whereas an individual may hold some US dollars while she is going to the U.S. to pay for food, accommodation and other purchases. A couple may also keep part of their savings in Australian dollars for their child's future education in Australia. On the other hand, an economic agent may hold interest-bearing securities in both domestic and foreign countries, and may switch his wealth between both domestic and foreign currencies and bonds depending on his expectations of interest rate and exchange rate movements.

However, in an extreme case, domestic agents hold foreign currency because they distrust the domestic currency. That is foreign currency is accepted as a means of payments, unit of account and store of value in the domestic country. In this case, foreign currency is preferred. This phenomenon is referred in literature as "*currency substitution*". This extreme case is prevalent in Latin America and some transitional economies of Central and East.
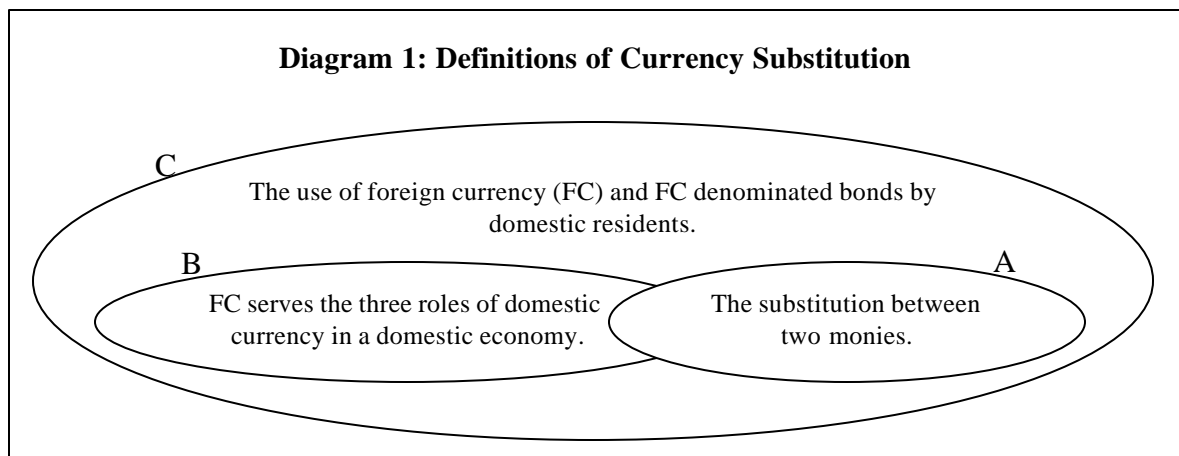
Even though there have been many studies on currency substitution, its precise definition is still open to debate. Mizen and Pentecost (1996), Ramírez-Rojas (1985) and Rojas-Suarez (1992) simply refer to currency substitution as the substitution between two monies. Giovannini and Turtelboon (1992) refer to currency substitution as the complete replacement of a domestic currency by another currency, as experienced in Panama. Some authors, such as Tanzi and Blejer (1982), Rogers (1990), and Marquez (1985), argue further that currency substitution is a substitution in which domestic currency demand is influenced by foreign economic variables. These types of definition of currency substitution are represented in the subset A, in Diagram 1.

Others view currency substitution as a phenomenon where the three fundamental roles of domestic currency are replaced by foreign currency, which is depicted in Diagram 1 by the

subset B. These roles are: *store of value*, *means of payment*, and *unit of account*. For instance, see Cuddington (1989), Calvo and Végh (1992), El-Erian (1988), Clements and Schwartz (1992), Agénor and Khan (1992), and Baliño at al. (1999).

McKinnon (1982), on the other hand, goes one step further to define currency substitution as the use of foreign currency (*direct* currency substitution) and foreign currency denominated bonds (*indirect* currency substitution) by domestic residents. This is shown by the subset C in Diagram 1. It is, however, generally agreed that McKinnon's definition goes too far [see Mizen and Pentecost (1996), and Leung and Ngo (1999)].

In the context of this paper, the definition of currency substitution follows Calvo and Végh (1992) as subset B. The following Venn diagram can be used to summarize the numerous definitions of currency substitution.

Diagram 1: Definitions of Currency Substitution

C
The use of foreign currency (FC) and FC denominated bonds by domestic residents.

B
FC serves the three roles of domestic currency in a domestic economy.

A
The substitution between two monies.

Theoretically, currency substitution can be thought of as *symmetrical* and *asymmetrical.* According to McKinnon (1985), the underlying concept of currency substitution in developed countries involves symmetrical currency substitution, where domestic and foreign residents hold both domestic and foreign currencies. However, currency substitution is asymmetrical in the context of developing and transitional economies, where domestic residents hold domestic and foreign currencies but foreigners do not have a demand for domestic currency. In Latin American countries and some transitional economies, the US dollar is the preferred foreign currency. In these countries, US dollars play almost all of the three traditional roles of domestic currency. First, the US dollar is used as a store of value and as the process goes on, prices of

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goods begin to be quoted[3] in US dollars and, hence, its role as a means of payment starts, especially for purchases of durable goods, rent and other high-cost items. This phenomenon is often referred to as "dollarization"[4]. *In the context of this study, dollarization is viewed as asymmetrical currency substitution.*

In addition, recent literature on dollarization has classified the expectation of government behavior toward the US dollar holdings in developing countries and transitional economies into three categories: Official (full) dollarization, semi-official dollarization and unofficial dollarization (see Meyer, 2000). *Official dollarization* means local currency is completely replaced by foreign currency as the only legal tender (mainly US dollars), which is the case, for example, in Panama and Ecuador. *Semi-official dollarization* refers to a situation where both domestic and foreign currencies are freely used in a domestic economy with the public's perception that the government accepts the use of the dollar, although the dollar is not officially accepted as legal tender. This, for instance, has been the case in Cambodia, Laos, and Haiti. Finally, *unofficial dollarization* means that local currency is the only legal tender with the dollar used in black market transactions and it is generally expected by the public that the government may place restrictions on the use of the dollar. This is the case in Vietnam, for example[5].

III.   CONCEPTUAL MEASURES OF CURRENCY SUBSTITUTION

In theory there are two main concepts in understanding the degree of currency substitution in a domestic economy: the *stock* concept and the *behavioral* phenomenon (or process)[6]. The stock concept refers to the amount of foreign currencies in a country, which conventionally can be viewed in terms of the volume of foreign currencies circulating in a country and the foreign currency bank deposits of its residents expressed as a ratio of domestic money. On the other hand, the "behavioral" phenomenon measures the *propensity* for domestic residents to switch into foreign currency holdings in response to changes in economic determinants such as exchange rate depreciation, changes in the inflation rate and interest rate. The measurement of the process of currency substitution requires an econometric model of

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[3] Basically, this occurs as a result of high and variable inflation in the domestic economy.

[4] See Sahay and Végh (1996) for details of dollarization in transitional countries, and Leung and Ngo (1999) for the Vietnamese case. For discussion of dollarization in Latin America, see, for example, Savastano (1996), Guidotti and Rodriguez (1992).

[5] For further discussion on full dollarization, one can consult with Andrew Berg and Eduardo Borensztein (2000a, 2000b).

[6] Leung and Ngo (1999) discuss this issue.

currency substitution. Of course, the stock and the process are related. In measuring the process of currency substitution, changes in the stock are needed as a dependent variable. This is examined in Part VII.

The measurement of the stock of foreign currency is a very difficult task because it is closely associated with the perception of domestic residents towards the government's regulatory policy in holding foreign currency. Foreign currency held by domestic residents is divided into three main forms: foreign currency deposits (*FCD*) in the domestic banking system, foreign currency in circulation (*FCC*) within the domestic economy and cross-border deposits (*CBD*) held at foreign banks. *FCC* consists of the amount of foreign currency circulating in the country and held in the hands of the public and the government.

But, in the context of developing countries and transitional economies, measuring *FCC* is empirically impossible and there may be fear of forced conversion into domestic currency. Instead of banking deposits, households in many developing and transitional economies usually hold currency (domestic or foreign) in the form of cash, kept under the mattress or in the safe. Thus, *FCC* is normally not included in the measurement of currency substitution.

However, examples of measurement of foreign currency holdings (*FCC*) can be found in some studies on currency substitution in Latin America. For instance, Melvin and Ladman (1991) attempted to measure the supply of foreign currency in Bolivia by relating it to statistics on the illegal drug trade. Alternatively, Kamin and Ericsson (1993) used data on shipments of US dollar notes to Argentina to estimate the stock of foreign currency in that country. On the other hand, although data on *CBD* is available for some countries (see, for instance, Baliño at al., 1999), it is not reported for Cambodia. Hence, *CBD* is not included in this study.

Since data on *FCC* and *CBD* are not usually available, the only option for measuring the extent of foreign currency holdings in a domestic economy is *FCD*. In some cases, however, holdings of foreign currency are illegal. For example, forced conversion of foreign currency deposits into domestic currency occurred in Mexico (August 1982), Bolivia (November 1992) and Peru (July 1985). The measurement of foreign currency holdings, in this case, is very difficult to deal with, because the restriction simply drives foreign currency out of the domestic banking system as people either seek to save them at home or transfer the fund to foreign banks. Thus, in this case, *FCD* cannot be used as a proxy for the stock of foreign currency in these situations.

Even when the holding of foreign currency is legal, the use of *FCD* as a proxy for the actual stock of foreign currency in a domestic economy still has some limitations and, hence,

estimation results should be interpreted carefully. Firstly, *FCD* does not distinguish between domestic and foreign holders, whereas currency substitution conceptually refers to demand for foreign currency by domestic residents only. Secondly, data on *FCD* does not show the maturity structure of these deposits. The usual assumption is that these deposits are relatively short-term.

Despite these limitations, the use of the ratio of *FCD* over broad money is still the most common approach to gauge the extent of currency substitution in a domestic economy. Sometimes this ratio is known as "dollarization" or "currency substitution" *ratio*, [see, for example, Agénor and Khan (1992), Sahay and Végh (1996), Savastano (1996) and Clements and Schwartz (1992)]. The use of this ratio—with *FCD* as a proxy for the stock of foreign currency—is reasonable for the estimation of currency substitution in Cambodia, because during the period under study there has not been any legal restriction on *FCD* holdings in the domestic banking system.

In other words, without government regulation on foreign currency holdings being in place, it is argued that *FCD* forms a stable relationship with *FCC* and *CBD* so that changes in *FCD* adequately reflect changes in total foreign currency holdings. In a nutshell, foreign currency deposits in the domestic country should be considered a lower bound of the level of currency substitution.

IV.   WHY CURRENCY SUBSTITUTION IS IMPORTANT IN ECONOMIC DEVELOPMENT

There are both advantages and disadvantages with the presence of currency substitution in a domestic economy. The positive side of currency substitution is that allowing *FCD* in the domestic financial system may enhance the opportunity for reintermediation and promote financial deepening in economies that have experienced long periods of high and variable inflation and unfavorable macroeconomic conditions. The reintermediation process can be started when economic agents may be more willing to return to domestic intermediaries, as they are confident that foreign currency deposit in domestic banks is allowed. As a result, domestic banks can expand their operations rapidly by competing for *FCD*s. In addition *FCD*s could also facilitate the integration of the domestic market into the rest of the world and lower the cost of international financial transactions. Thus, financial deepening is promoted.

Another benefit of official or semi-official dollarization is that it can lower inflation by tying money supply to the US monetary policy. This, in turn, would make longer-term lending and borrowing possible, enabling firms to finance long-term investment projects with long-term

rather than short-term debt, which contributes to stable investment environment and higher economic growth. According to an IMF Staff country report on Cambodia (No. 00/135, October 2000), the success of recent economic reconstruction and stabilization programs in Cambodia can be attributed to the semi-official policy of dollarization in the domestic economy. However, this conclusion was drawn without consideration of other major factors such as establishment of relative peace and political stability, which can be instrumental in shaping the public's expectations of the government's economic strategy.

Meanwhile, there are also complicated negative impacts of currency substitution on macroeconomic policies. Empirically, the substitution of foreign currency for domestic currency is more likely in an economy with a high inflation rate due to the purchasing power loss of the domestic currency. An economy in this situation may experience a significant reduction in the real demand for domestic currency. Under currency substitution, the traditional definition of *domestic demand for money*, which is also the *demand for domestic money*, has to be redefined. A more appropriate definition may include the foreign currency component as well. Since domestic monetary authorities can control only the domestic money component, the effectiveness of monetary and exchange rate policies may be very limited in this case. Furthermore, the theoretical literature points out that a key implication of currency substitution is that the volatility of a floating exchange rate will tend to be greater. Girton and Roper (1981), for example, show that the higher the degree of currency substitution the wider the fluctuation of exchange rates[7].

In addition, the theoretical literature and empirical evidence suggest that currency substitution may have inflationary impacts on an economy through two main channels: *monetary growth induced inflation* and *speculative bubble induced inflation*.

IV.1.   MONETARY GROWTH-INDUCED INFLATION

Since the start of economic liberalisation in 1989 up to now, the Cambodian government has financed part of its budget deficit through inflation tax. One of the effects of currency substitution is that the government has to accept a loss of inflation tax revenue, as currency substitution implies a contraction in holdings of domestic currency (riel) and hence shrinkage in the inflation tax base. To generate a given amount of inflation tax, therefore, domestic money needs to increase more rapidly, resulting in a higher domestic inflation rate.

Furthermore, as currency substitution tends to enhance tax evasion as well as reduce the contribution of state owned enterprises (SOEs)[8] to the budget revenue through siphoning their products to the parallel market in return for foreign currency ($US), the pressure on monetisation is increased. Thus, domestic monetary growth can depend positively on the rate of change in foreign versus domestic money holdings. This process is examined in Leung and Ngo (1999), consistent with results of the empirical work by Rojas-Suarez (1992), which analyses the effects of currency substitution on the dynamics of inflation in Peru for the period of 1978-1985. Leung and Ngo finds evidence for the role of currency substitution as a transmission mechanism through which domestic monetary and fiscal policy impact on inflation.

IV.2.   SPECULATIVE BUBBLE-INDUCED INFLATION

According to Kompas and Leung (1999) currency substitution has the potential to set off speculative bubbles. It could work as follows. As the domestic agent's expectation of domestic inflation increases, induced by the expected increase in domestic money supply, there will be a shift into foreign currency (US dollar)[9] in order to avoid inflation tax. This would lead to the domestic currency (riel) depreciation vis-à-vis the foreign currency (US dollar) in the parallel market, resulting in capital gains for foreign currency holders. This would enhance further shifts into foreign currency holdings, further depreciation in the parallel market, and so on[10]. Furthermore, the depreciation adds to price increases of goods denominated in the domestic currency (riel). This type of speculative bubble, together with inflation induced by an accommodating monetary policy, could be a source of great instability.

Finally, currency substitution involves the loss of *seigniorage*, the profits accruing to the monetary authority from its right to issue legal tender. It is estimated that from 1996 to 1999 the average annual loss of seigniorage in reserve money for Cambodia is around one to two and a half percent of GDP (IMF Staff Country Report No. 00/135, October 2000).

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[7] For further discussion on implications of currency substitution for monetary and fiscal policy and exchange rate management see, for example, Calvo and Rodriguez (1977); Calvo (1985), Miles (1978); Sturzenegger (1994).

[8] This is important for transitional economies, for example Vietnam. In Cambodia, SOEs played an important role during the early stage of economic reform. Currently, as a result of SOEs privatization process, the private sector has become a dominant source in domestic production.

[9] In Cambodia, the US dollar is conventionally the most preferred choice of financial asset holding by domestic residents to substitute for the riel in shielding against the loss of the riel's value.

[10] This phenomenon was experienced in Cambodia during the early stage of its economic and financial reform in very early 1990s. During those days, the parallel market rates (US dollar versus the riel) were heavily driven by the poorly regulated exchange market and speculation.

V. HISTORICAL BACKGROUND AND SOME STYLIZED FACTS OF CURRENCY SUBSTITUTION IN CAMBODIA

V.1. HISTORICAL BACKGROUND AND SOURCES OF CURRENCY SUBSTITUTION

Causes of currency substitution in Cambodia have a close relationship with the long history of changes in political, social and economic regimes. These changes can be split into two periods—before and after 1993.

After its independence from France in 1953, Cambodia enjoyed almost two decades of peace and prosperity. Cambodia's economic status was on a par with its neighboring countries in South East Asia during the 1960s. However, this good time came to an end. Growing regional conflicts and civil war spilled over into Cambodia, which brought in a coup in March 1970. During the period 1970-75, economic growth was jeopardized as internal conflict increasingly went out of control which brought the Khmer Rouge to power in April 1975. The so-called "killing field" regime embarked on a radical campaign based on agro-economy. People were evacuated from the city to the countryside, forced into slave labour, and paid in very low food rations. Intellectuals were imprisoned, executed or starved to death. Educational institutions were turned into prisons or farmhouses. The market economy base was completely destroyed: private property was outlawed, the riel (the local currency) and banks were removed, and even barter trade was officially prohibited.

The collapse of the Khmer Rouge era brought in a new socialist regime supported by the Vietnamese government in January 1979. The new riel was introduced one year later, despite the lack of economic infrastructure and unstable political and social conditions. Between 1979 and 1993, the banking system was directed by a single state-owned-bank and its activity was sluggish because of the ineffectiveness of interest rates and the low public confidence.

Therefore, it is reasonable that after two decades of civil war and strife in Cambodia, confidence in the domestic currency (the riel) and the banking system is very low, which is a major cause of a high degree of currency substitution (the widespread use of US dollar and Thai baht) in the domestic economy.

In 1993 Cambodia had its first democratically elected coalition government, after the election sponsored by the UNTAC (United Nations Transitional Authorities in Cambodia). During this transitional period, Cambodia also embarked on significant economic and financial

reforms towards a market-oriented-system[11]. Financial sector reform in Cambodia is principally reform of the domestic banking system. Private banks were allowed to enter the market. Cambodia now has a two-tier-banking system. The National Bank of Cambodia (Cambodia's central bank) conducts monetary policy and acts as a regulatory body to oversee domestic banking practice[12].

Cambodia follows a managed floating exchange rate regime. Recent monetary policy actions include limited intervention in the exchange market to reduce exchange rate variability. The gap between official and parallel market exchange rates has been kept to below one percent during most of reform period (see Figure 1)[13]. The National Bank of Cambodia (NBC) sets the official exchange rate each morning based on surveys of the rates quoted by three major dealers in the market the day before. When necessary, the NBC is quick to conduct foreign exchange auctions in which it sells to the private sector a portion of the government's foreign exchange receipts from nonproject foreign aid. The last foreign exchange auction was done in the second half of 1997, where the exchange market was hit hard by the Asian financial crisis and internal conflict. The auction system has not been practised since then, as economic and political conditions stabilized and business confidence improved.

With a legal mandate to avoid monetization of the budget deficit and to follow monetary restraint, the NBC focuses on building confidence in the riel by limiting inflation. It is noted that Cambodia has successfully brought the inflation rate down from triple digits in the early 1990s (112.5 percent in 1992) to single digits in 1995-97 (average rate of around 7.1 percent) (NBC Annual Report, 1997). The inflation rate was hitting 15 percent between July 1997 and July 1998 due to the Asian financial crisis and internal political turmoil. However, the rate has been brought down below the 5 percent level in 1999 and close to zero in 2000 (see Figure 1), which was attributed to political stability and improved macroeconomic environment since late 1998.

Like the transitional economies in Eastern Europe, the former Soviet Union, and Indochina (i.e. Lao PDR and Vietnam), Cambodia has experienced the impact of currency substitution during its economic liberalization from a centrally planned to a market-based

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[11] Actually, economic reform in Cambodia began in 1985, as private land title was first introduced since the war began. However, it did not develop momentum until the early 1990s. For detailed discussion of recent economic reform and development in Cambodia, see World Bank and IMF Country Reports, various issues.

[12] Cambodia has two state-owned banks (Foreign Trade Bank and Rural Development Bank), 7 foreign bank branches and 22 private commercial banks (IMF Country Report No. 99/33, 1999). However, by early 2001 some insolvent banks were shut down.

system in the early 1990s. On the supply side, the opening up of the domestic economy to the outside world enhances the mass inflows of foreign currency (US dollar). On the demand side, people tend to hold a strong foreign currency as a means of protecting against depreciation of the domestic currency and variable inflation rates. This process has been experienced in many transitional economies. In many cases, although the inflation rate is brought down to low single digit, foreign currency holdings by domestic residents still continue. This phenomenon is known in the literature as "hysteresis" of currency substitution, which has been seen in many Latin American countries [see, for example, Clement and Schwartz (1992), Guidotti and Rodriguez (1992) and Ramirez-Rojas (1985)].

Figure 1. Monthly Exchange Rates and Inflation Rates: January 1993-April 2001
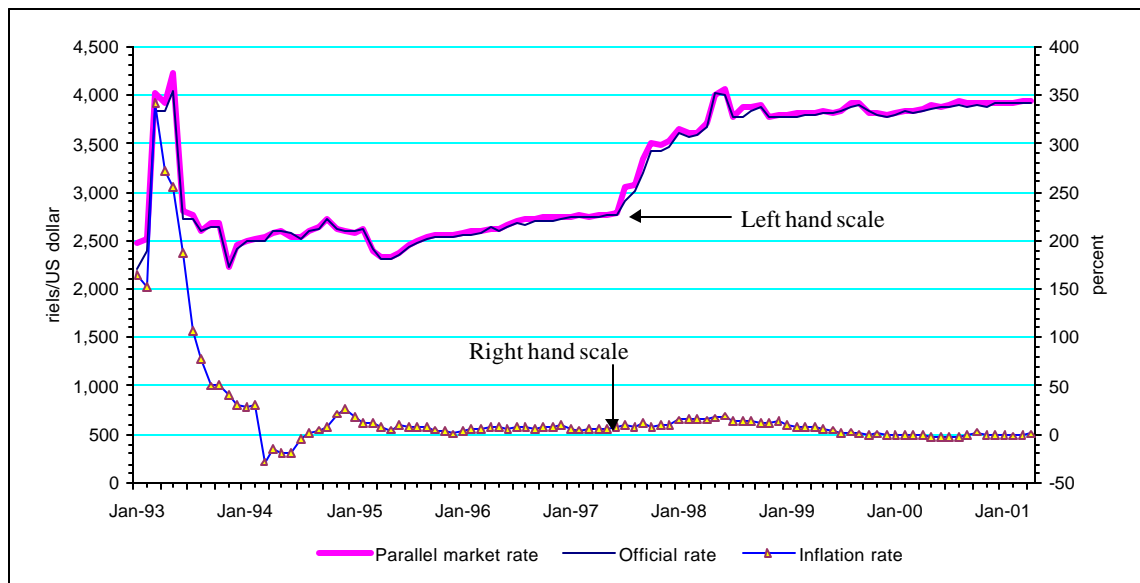
The hysteresis phenomenon of currency substitution also exists in the Cambodian financial system. Up to now, despite the low inflation rate, Cambodia's monetary system is characterized by a high degree of currency substitution[14] and cash transactions, limiting significantly the central bank's scope for running an active and effective monetary policy. The use of the riel is confined to small transactions and wage payments for government employees. There are some major factors contributing to currency substitution in Cambodia:

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[13] Keeping the gap between official and market exchange rates low is a very important factor in stabilizing market exchange rate in the context of the Cambodian economy because market sentiment is very sensitive.
[14] Currency substitution in Cambodia is characterized by dollarization, although the Thai baht plays a partial role in the Cambodian monetary system. In practice, the Thai baht is mainly used for transaction purposes.

Firstly, weak confidence in domestic banks which is the legacy of over two decades of civil strife, the change in the riel during Khmer Republic period (1970-75)[15], and the destruction of money and banking system under the Khmer Rouge era (1975-78). It will take a very long time to build this confidence.

Secondly, the prevalence of uncontrollable smuggling activities, which are predominantly transacted in US dollars and Thai baht. Weak administrative capacity to control the borders (land and sea) encourages the smuggling activities, especially along the Cambodian-Thai border, which swamp the Cambodian economy with foreign currencies.

Thirdly, the arrival of UNTAC in 1993 (with about 20,000 personnel) marked a significant increase in US dollar circulation in the Cambodian economy. The United Nations spent close to two billion US dollars on the election organization. Due to the poor banking system in Cambodia, the conventional cash-transactions made US dollar's popularity spread very quickly throughout the country, even in the provincial areas.

Fourthly, economic liberalization and the opening of the economy to trade and investment with the world had the effect of bringing back savings of Cambodians living abroad. A significant quantity of these remittances, brought into the country in US dollars, is outside the control of the monetary authority.

Finally, the under-developed financial and banking system is also a major cause of currency substitution in Cambodia. The nonexistence of monetary instruments such as bonds, treasury bills, credit cards, has left the US dollar the only available financial asset for domestic residents to hold besides the riel.

VI.2.   THE SCOPE OF CURRENCY SUBSTITUTION IN CAMBODIA

Measured in terms of stock, Cambodia stands among the highly dollarized economies. Table 1, which presents the ratios of foreign currency deposits to broad money in selected countries, shows that by the end of 1995, Cambodia was the most dollarized economy in Indochina, with its currency substitution ratio of 56.4 percent, followed by Laos and Vietnam at the rates of 35.6 and 19.7 percent, respectively.

In 1997, the increase in total liquidity (*M2*) was 16.6 percent, significantly lower than the 38.5 percent average increase over the preceding four years. Currency in circulation (34 percent of *M2*) grew by less than 19 percent, slower than in 1996. Also in 1997, foreign

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[15] When the new government came to power, which was a result of the March-1970's coup, the existing currency was abandoned and new riels were printed.

currency deposits (63 percent of *M2*) grew by 15.7 percent, a sharp drop from the average growth over the preceding four years of 73 percent. The slowdown in foreign currency deposits (*FCD*) is attributed to withdrawals mid-year triggered by the unrest, from which levels only slowly recovered by year-end (see Figure 2). In general, the currency substitution ratio (share of *FCD* in domestic banks over total broad money) has been on an increasing trend since the reform began. The ratio dropped temporarily during the 1997-98 crisis. As economic recovery was regained in 1999, the ratio bounced back and reached a record high of 68.8 percent in April 2001 (see Figure 2).

Table 1: Reported Ratios of Foreign Currency Deposits (FCD) to Broad Money
in Some Selected Countries with IMF Arrangements Since 1986

Country	1990	1991	1992	1993	1994	1995
Argentina	34.2	35.1	37.1	40.4	43.2	43.9
Bolivia	70.8	76.8	80.8	83.9	81.9	82.3
Peru		59.9	65.0	70.2	64.2	64.0
Mexico		3.9	4.1	3.6	6.2	7.2
Costa Rica		37.7	31.9	29.5	30.3	31.0
Nicaragua		28.7	37.4	45.6	48.6	54.5
Honduras		3.1	5.1	7.6	11.4	13.0
Azerbaijan				14.8	58.9	50.3
Croatia				53.8	50.2	57.4
Georgia					80.1	30.8
Lithuania					27.0	25.9
Estonia			23.0	3.8	9.9	11.4
Latvia				27.2	27.5	31.1
Bulgaria	12.0	33.4	23.4	20.3	32.6	28.4
Hungary	12.2	16.5	14.3	18.7	20.4	26.6
Russia				29.5	28.8	20.6
Czech Republic					7.2	5.9
Slovak Republic				11.5	13.0	11.1
Ukraine				19.4	32.0	26.9
Uzbekistan			20.1	5.1	22.5	15.5
Cambodia			**26.3**	**38.8**	**51.8**	**56.4**
Lao P.D.R.	42.0	39.4	36.8	41.4	34.4	35.6
Vietnam			25.9	20.9	20.4	19.7

Source: Baliño, Bennett, and Borensztein. "Monetary Policy in dollarized Economies" *IMF Occasional Paper, No. 171*, 1999.

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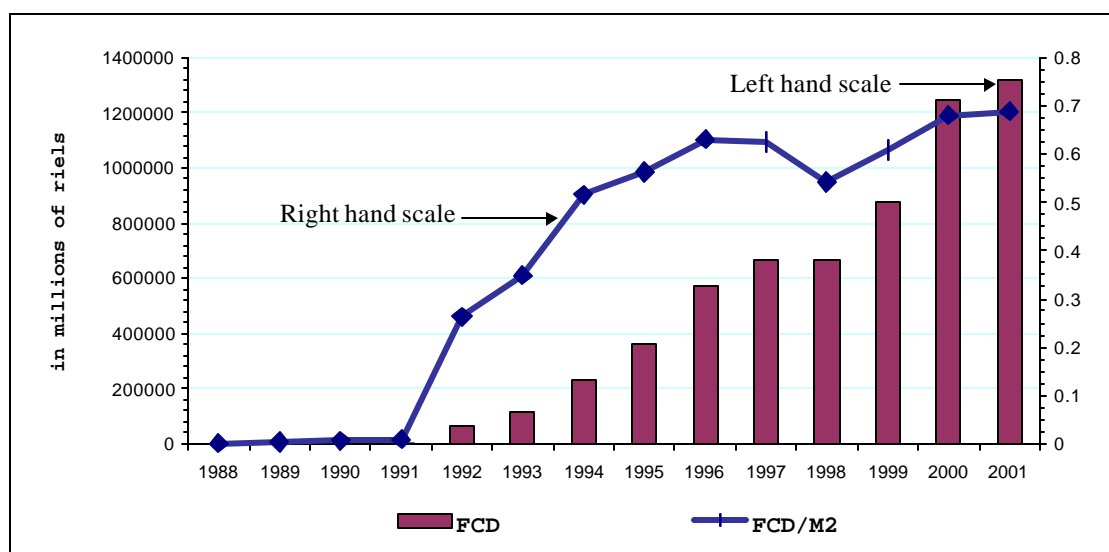**Figure 2. Foreign Currency Deposit: 1988-2001**

Figure 3 below shows the trend of currency substitution in Cambodia by using the ratio of foreign currency deposits to *M1* (narrow money) and *M2* (*M1* plus quasi-money, which includes time and saving deposit plus *FCD*) from July 1993 to April 2001. According to this Figure, the large gap between *FCD/M1* and *FCD/M2* reflects the fact that broad money absorbs a large portion of *FCD*, and hence changes in total broad money are mainly explained by changes in *FCD*.

Although foreign currency in circulation cannot be effectively measured, there are rough estimations that its share of total money supply stood in a range of 85-90 percent [IMF Staff Report, No. 00/135, 2000]. This suggests that the volume of foreign currency held outside the banking system is several times larger than measured broad money. According to this report the share of domestic currency to total deposits remained less than 7 percent, which suggests a strong presence of asset substitution[16] in Cambodia.

Total liquidity recorded by the NBC is only about 10 percent of GDP, including the liquidity in riel (40 percent) and the amount of US dollars circulating through the banking system (60 percent). Furthermore, riel deposits in banks is very low and mostly held in the form of non-interest bearing vault cash and reserves with NBC. A number of institutions do not accept riel deposits, and bank intermediation in local currency is minimal. In addition, restrictions on current and capital account transactions are close to zero.

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[16] Asset substitution is referred to as the use of foreign currency denominated assets as a store of value.

Figure 3. FCD/M Ratios: July 1993—April 2001
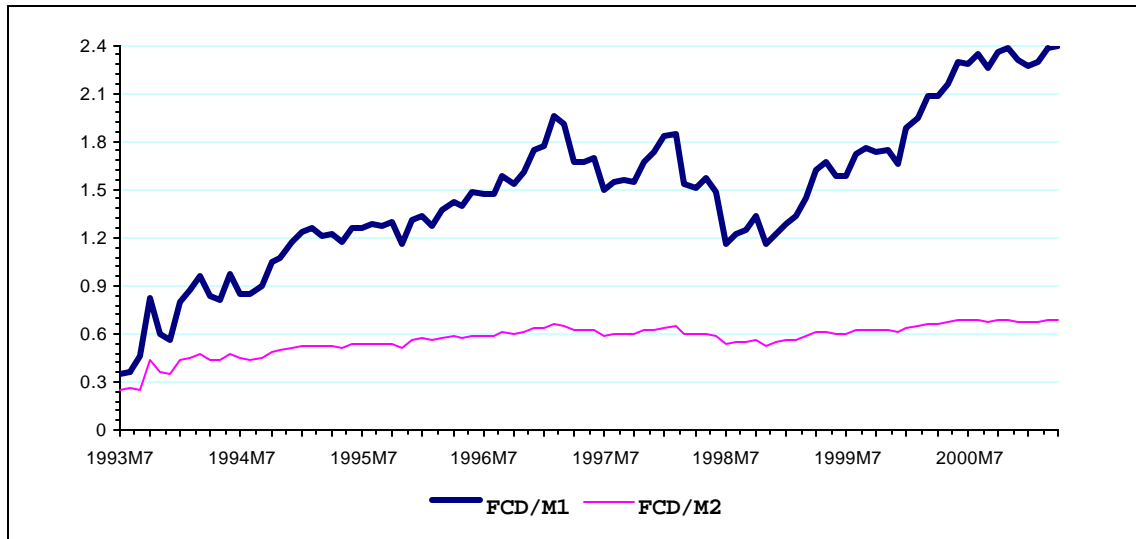
In short, despite improvements in financial sector reform since 1993 which brought about reduction in the inflation rate, falling velocity of money, and stable exchange rates, the Cambodian people are still not fully confident about the domestic developments. This can be supported by the fact that there is a negative net domestic credit, which suggests that Cambodians still prefer foreign banks as a safer prospect. There is no sign of reduction of foreign currency holdings in the short to medium term, indicating clearly that hysteresis of currency substitution still continues. The return of foreign currency deposit in domestic banks was mainly attributed to the return of relative peace and stable political and economic environments. However, this does not necessarily ensure public confidence in the domestic currency, although it suggests the improvement of public trust in the domestic banking system.

VI.   ECONOMIC MODEL OF CURRENCY SUBSTITUTION

The aim of this section is to model currency substitution, based on Suarez-Rojas (1992). Suppose there are two kinds of goods in an economy: tradable (with price P) and nontradable goods (with foreign price P^*). Let e denote the nominal exchange rate. Assume the price of foreign goods is equal to one, so that the real exchange rate can be written as e/P. Assume also that money is the only form of wealth. Domestic residents may allocate their portfolio holdings between domestic money and foreign money. Foreign money is assumed to be an imperfect substitute for domestic money.

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The representative agent is assumed to maximize the following value function:

$$V(M_t, F_t, P_t, e_t) = MaxE_t \left\{ U_t\left(C_t^H, C_t^T \right) + bV\left(M_{t+1}, F_{t+1}, P_{t+1}, e_{t+1} \right) \right\}$$ (1.1)

where:

C_t^H :   consumption of nontradable goods

C_t^T :   consumption of tradable goods

M_t :   stock of domestic money at the beginning of period t $(M_t = M_{t-1} + t_t)$, where t_t is a

transfer of domestic money given by the government at the beginning of period t

F_t :   stock of foreign money at the beginning of period t

b: the discount rate

E_t :   expectation operator

It is assumed that the utility function is separable in both goods and $U(.)$ is strictly concave. That is, U_H and U_T are positive and diminishing. The representative consumer faces the following budget constraint:

$$Y_t + \frac{M_t}{P_{t-1}}\left(\frac{1}{1+p_t} \right) + \frac{e_{t-1}F_t}{P_{t-1}}\left(\frac{1+x_t}{1+p_t} \right) = C_t^H + \frac{e_t}{P_t}C_t^T + \frac{M_t}{P_t} + \frac{e_t F_t}{P_t}$$ (1.2)

where:

p_t :   the inflation rate of the nontradable goods

x_t :   the rate of change of the exchange rate, and

Y_t: total real income derived from the production of both goods. That is, $Y_t = Y_t^H + (e_t / P_t)Y_t^T$.

The individual also faces a liquidity in-advance constraint of the form:

$$C_t^H + \frac{e_t}{P_t}C_t^T \leq l\left(\frac{M_t}{P_t}, \frac{e_t F_t}{P_t} \right)$$ (1.3)

This equation follows Calvo and Végh (1990), where $l(.)$ is liquidity services production function and assumed to be a linear homogenous function where the marginal productivities of domestic and foreign real currencies (l_1 and l_2) are positive and diminishing. Also assume that $\partial l_1 / \partial(eF/P) < 0$ to ensure that domestic and foreign currencies are imperfect substitutes.

Maximizing (1.1) subject to (1.2) and (1.3), where l_t denotes the Lagrange multiplier for budget constraint and g_t denotes the Kuhn-Tucker multiplier for the liquidity-in-advance constraint, first-order conditions yield the following equations:

$$U_H(.) = l_t + g_t \tag{1.4}$$

$$U_T(.) = \frac{e_t}{P_t}(l_t + g_t) \tag{1.5}$$

$$b E_t\left[\frac{l_{t+1}}{P_{t+1}} + \frac{g_{t+1}}{P_{t+1}}l_1\left(\frac{M_{t+1}}{P_{t+1}}, \frac{e_{t+1}F_{t+1}}{P_{t+1}}\right)\right] = l_t\left(\frac{1}{P_t}\right) \tag{1.6}$$

$$b E_t\left\{\frac{e_{t+1}}{P_{t+1}}\left[l_{t+1} + g_{t+1}\,l_2\left(\frac{M_{t+1}}{P_{t+1}}, \frac{e_{t+1}F_{t+1}}{P_{t+1}}\right)\right]\right\} = l_t\left(\frac{e_t}{P_t}\right) \tag{1.7}$$

The ratio of equations (1.4) and (1.5) yields the marginal rate of substitution between tradable and nontradable goods and equals the real exchange rate. Equations (1.6) and (1.7) show that the marginal value of carrying an additional unit of currency into period $t+1$ is set equal to its marginal cost, which is l_t/P_t for domestic currency and $(l_t e_t/P_t)$ for foreign currency.

The ratio of equations (1.6) and (1.7) in the steady state, where $x_t = p_t$, can be expressed as follows:

$$\frac{l_1(M/P, eF/P)}{l_2(M/P, eF/P)} = 1 + \frac{x}{1 - b} \tag{1.8}$$

Since the function $l(.)$ is homogenous of degree one, equation (1.8) implies that:

$$\frac{M/P}{eF/P} = g(x) \tag{1.9}$$

In more general continuous time models (see Calvo, 1985), equation (1.9) can be written as:

$$\frac{M/P}{eF/P} = g\left(x, \frac{M/P}{eF/P}\right) \tag{1.9'}$$

where g is also a function to the stock of money balances.

For $g'(x) < 0$, equation (1.9) says that, in the steady state, the ratio of holdings of domestic to foreign currency (in terms of domestic currency) and the rate of change of the exchange rate are negatively related.

Equation (1.9) can be estimated by the following specification:

$$m_t - f_t = \boldsymbol{a} + \boldsymbol{n}E(e_{t+1} - e_t) + u_t \tag{1.10}$$

where:

$$f_t = f_t^* + e_t$$

m_t log of holdings of domestic money

f_t^* *log* of holdings of foreign currency

e_t *log* of the nominal exchange rate

u_t the residual term from the relationship, where u_t is distributed as $N(0, \boldsymbol{s}_u^2)$.

Equation (1.10) shows that a representative agent adjusts holdings of domestic currency to achieve their desired ratio of domestic to foreign currency and that the ratio depends on the expected rate of depreciation of the exchange rate. The empirical application of this model is discussed in part VII to estimate the likelihood of currency substitution in Cambodia.

VII. EMPIRICAL EVIDENCE OF CURRENCY SUBSTITUTION IN CAMBODIA

This section uses econometrics to estimate the substitution of riels into US dollars in Cambodia from July 1993 to April 2001. The basic form of estimated equation, following (1.10), can be expressed as:

$$LFM_t = \boldsymbol{a}_0 + \boldsymbol{a}_1 x_t + u_t \tag{1.11}$$

where LFM_t is $\log(F/M)_t$, and F represents the nominal stock of foreign currency (US dollars), for which foreign currency deposits in domestic banks is used as a proxy; M denotes the nominal stock of domestic currency (riel); x is defined as the expected rate of change of the exchange rate (in this analysis, the parallel market exchange rate is employed since it is the relevant exchange rate for the decision-taking process of economic agents); and u is the disturbance term, where u_t is distributed as $N(0, \boldsymbol{s}_u^2)$.

Equation (1.11) can be thought of as a long-run relationship between *F/M* and *x*. Assuming that total holdings of domestic and foreign currency remain unchanged at a given

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level of real income and the interest rate, then a positive a_1 would mean that an increase in the expected rate of depreciation of domestic currency would imply an increase in the holdings of foreign currency (US dollars) relative to the riel. Therefore, a_1 captures the degree of substitution between US dollars and riels.

A time trend (*T*) is included in equation (1.11), to capture any inertia in the currency substitution process. In addition, a dummy variable (*DUM*) is also incorporated to capture any structural change in the demand for foreign and domestic currency (*F/M*) over the period of 1997 and 1998, when Cambodian economy was negatively impacted by the Asian financial crisis and domestic political instability.

VII.1.   DATA

This paper uses monthly data on exchange rates and the monetary survey provided by the National Bank of Cambodia (NBC). The data are also consistent with those used by International Monetary Fund's (IMF) various publications on Cambodia.

It is important to understand clearly the components of the currency substitution ratio (*F/M*), which is the dependent variable for estimating Equation (1.11). The foreign currency stock *F* is approximated by foreign currency deposits, *FCD* (expressed in terms of Cambodian riels), of the non-bank sector in Cambodia. As mentioned in part III, there is no necessary one-to-one relation between the level of *F* and that of the *actual* stock of foreign currency (US dollar). The implicit assumption is that *FCD* changes proportionally in response to changes of the actual stock of US dollars in Cambodian economy. That is, the relative change of *FCD* to *CBD* and to *FCC* is assumed to be proportional. In addition, since it is impossible to measure the stock of US dollars in Cambodia accurately, *FCD* is used as a proxy for the actual stock of US dollars, which is the normal procedure in this literature.

There are three definitions of domestic money used in the *F/M* ratio, namely *M1*, *M3* and *M2*. *M1* is composed of domestic currency held outside banks and demand deposits. *M2* consists of *M1* plus quasi-money, which includes time and saving deposits plus foreign currency deposits (in terms of domestic currency). *M3* is equal *M2* less *FCD*.

The choice of proxy for the expected rate of domestic currency depreciation, *x*, is a difficult task. The inconvertibility of the riel and the nonexistence of future markets in Cambodia add to the difficulties in this choice. Following El-Erian (1988) and Rojas-Suarez (1992), the actual change of the exchange rate is taken as a proxy to represent the expected rate

of change of the exchange rate. Rojas-Suarez, in particular, argues that this is possible for Peru because the rate of change of the exchange rate was found to be a stationary AR(1) process.

Table 2 presents summary statistics for each of the main series. This table shows that, at the mean level, the ratio of *F/M1* and *F/M3* are very high at 149 percent and 141 percent respectively. This means that, on average, the stock of US dollars is almost 1.5 times larger than the volume of riels. Although *F* probably represents the lower bound of the actual level of foreign currency, these ratios likely indicate that there is a strong presence toward currency substitution in Cambodia.

Table 2: Descriptive Statistics for Main Variables

	Mean	Maximum	Minimum	Std. Dev.	No. of observations
F/M1	1.492	2.397	0.359	0.471	94
F/M3	1.417	2.223	0.337	0.447	94
F/M2	0.570	0.690	0.252	0.090	94
LFM1	0.342	0.874	-1.024	0.363	94
LFM3	0.288	0.799	-1.087	0.375	94
LFM2	-0.576	-0.372	-1.377	0.185	94
x	0.004	0.097	-0.179	0.033	93

The *F/M1* and *F/M3* ratios are approximately three times larger than *F/M2* ratio. This suggests that total broad money absorbs a substantial share of foreign currency (US dollars) and hence changes in broad money are mainly explained by changes in stock of foreign currency holdings. This is also displayed graphically in Figure 3 (in part V), showing that the *F/M2* lies very well below that of *F/M1*.

Table 3 presents unit root tests for all variables tested in equation (1.11). The test, which is based on Augmented Dickey-Fuller (ADF) test for a unit root, covers the period of July 1993 to April 2001. Since all ADF statistics are greater than their critical values at the 99 percent significance level, the null hypothesis of a unit root process is rejected. Thus, all main series, namely *LFM1*, *LFM3*, *LFM2* and *x* are stationary processes. Since *x* is a stationary

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process, the actual rate of change of depreciation of domestic currency can be used as a proxy for the expected rate of change of depreciation of the exchange rate.

Table 3: Unit Root Tests for Non-Stationary Variables

	LFM1	*LFM3*	*LFM2*	*x*
Constant	0.006	-0.001	-0.203	0.005
	-0.268 [0.789]	-0.029 [0.976]	-4.318 [0.000]	1.442 [0.152]
$y(-1)$	-0.235	-0.231	-0.291	-1.178
	-4.727 [0.000]	-4.308 [0.000]	-5.384 [0.000]	-7.531[0.000]
$\Delta y(-1)$	-0.060	-0.218	-0.259	0.072
	-0.634 [0.527]	-2.320 [0.022]	-2.933 [0.004]	0.700 [0.485]
Time	0.002	0.002	0.001	
	2.942 [0.004]	2.525 [0.013]	2.714 [0.008]	
F statistic	F(2,88) = 8.612	F(2,88) = 9.703	F(2,88) = 14.750	F(2,88) = 54.589
	[0.000]	[0.000]	[0.000]	[0.000]
RSS	0.818	1.035	0.319	0.090
D-W	2.045	2.154	2.261	1.970
Lag order	1	1	1	1
ADF(s)	-4.727	-4.308	-5.384	-7.531
ADF(c)	-4.060	-4.060	-4.060	-3.503

Note:

Dependent variable is $\Delta y(t)$. *LFM1* is the log of ratio of foreign currency deposit (in terms of riels) over narrow money (*M1*). *M1* includes domestic currency outside banks plus demand deposit. *LFM3* is the log of ratio of foreign currency deposit over *M3*, where *M3* is *M1* plus time and saving deposits. *LFM2* is the log of ratio of foreign currency deposit over *M2*, where *M2* is *M3* plus foreign currency deposit. *x* is the expected rate of depreciation of domestic money. *t*-ratios follow coefficient values, followed by probability values in square brackets. The lag order is determined by a two-step Hall (1994) procedure using Schwarz-Bayesian criteria. ADF(c) is the MacKinnon critical value at 99% confidence level and ADF(s) is the test statistic.

To test the null hypothesis that a series y_t is a unit root process, the following equation is estimated using ordinary least squares:

$$\Delta y_t = \boldsymbol{m} + \boldsymbol{b}t + \boldsymbol{g}y_{t-1} + \sum_{j=2}^{n} \boldsymbol{f}_j \Delta y_{t-j+1} + \boldsymbol{e}_t \qquad (1.12)$$

Given that both the ratio of foreign to domestic currency and the rate of change of domestic money depreciation are stationary processes, it is appropriate to apply the ordinary least square (OLS) method to estimate equation (1.11).

VII.2   EMPIRICAL RESULTS

Equation (1.11) is estimated using three alternative definitions of domestic money. Initial results are shown in Table 4, with a time trend (T) and dummy variable (*DUM)* incorporated as exogenous variables. Since the estimation results produce very low values for Durbin-Watson (DW) statistics, serially correlated errors are a likely possibility. In this case, given that both dependent and independent variables are stationary, the low values of DW statistics may also reflect the presence of a partial adjustment process. In other words, this may suggest that representative individuals may not fully adjust their long run holdings of foreign to domestic currency within a one-month period[17].

Partial adjustment versions of equation (1.11) can be expressed as follows:

$$LFM_t = a_0 + a_1 x_t + b\,LFM_{t-1} + a_2 T + a_3 DUM + u_t \qquad\qquad (1.13)$$

in lagged dependent variable form.

Estimation results for equation (1.13) are presented in Table 5. From Table 5, the inclusion of a lagged dependent variable provides a better estimation. That is, higher values of adjusted R-squared and DW statistics and lower values of standard errors are obtained. More importantly, we can see that the effect of a lagged dependent variable on the behavior of holding US dollars by domestic residents is very significant.

Although LM tests suggest serial correlation in residual terms (i.e., a small p-value implies that the null hypothesis that there is no serial correlation can be rejected), the RESET test indicates that the null hypothesis of no misspecification is not rejected.

Table 6 presents estimated results for a form of equation (1.13) with a lagged independent variable included,

$$LFM_t = a_0 + a_1 x_t + b\,LFM_{t-1} + g\,x_{t-1} + a_2 T + a_3 DUM + u_t \qquad\qquad (1.14)$$

Table 6 shows that the effects of x_{t-1} on the dependent variable are very significant. It indicates that economic agents not only adjust their portfolio balance depending on the previous

month's composition of wealth, but also on parallel exchange rate movement being realized within one month. Furthermore, results on LM and RESET tests indicate that there is no evidence of residual serial correlation or misspecification errors, although the J-B test suggests that there may be a departure from normality of the disturbance term.

However, the values of J-B tests can be improved significantly by re-estimating equation (1.14) with the first four observations dropped, where most of the variance of x in the data occurs. Since the new values of J-B tests (reported in the last line of Table 6) are not significant at any confidence levels, the null hypothesis of normality of disturbance term cannot be rejected. The exclusion of the first four observations alters the size of the estimated coefficients very slightly. For example, the new estimated coefficients of x_t (a_1) are 1.13, 1.13 and 0.61 when *M1*, *M3* and *M2* are used as monetary aggregate, respectively. Furthermore, the overall significance of the estimated equations is also unchanged. In all cases the point estimate of the coefficient on x_t remains relatively unchanged.

Finally, to ensure the robustness of the OLS estimations, Wu-Hausman's test is also conducted to check the endogeniety of x_t. The test can be summarized as follows[18]. First, regress x_t on all exogenous variables and the instruments, x_{t-2} and the official exchange rate changes. Save the residuals. Second, augment the original model with these residuals. Third, test on the residual estimated coefficient by using the standard *t*-test. The results show that the *t*-values of the residual coefficient are -0.96, -0.74 and -0.41 when *M1*, *M3* and *M2* are used, respectively. The 5 percent critical value for t_{84} is 1.67. Therefore, the null hypothesis is not rejected and the parallel market exchange rate change (x_t) may be regarded as an exogenous variable.

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[17] The partial adjustment mechanism is also applied in related papers, such as Ramirez-Rojas (1985) and Rojas-Suarez (1992).

[18] Here, we follow a version of the Wu-Hausman's test proposed by Davidson and MacKinnon (1989, 1993), which carries out the test by running an auxiliary regression.

Table 4: OLS estimation results for equation (1.11)

Dependent variable: log of foreign currency deposit/domestic money (*LFM*)

		$LFM1_t = a_0 + a_1 x_t + a_2 T$ $+ a_3 DUM + u_t$		$LFM3_t = a_0 + a_1 x_t + a_2 T$ $+ a_3 DUM + u_t$		$LFM2_t = a_0 + a_1 x_t + a_2 T$ $+ a_3 DUM + u_t$	
x_t	[SE]	1.40*	[0.610]	1.38*	[0.652]	0.76*	[0.361]
t-statistic	(P-value)	2.30	(0.023)	2.12	(0.036)	2.12	(0.037)
T	[SE]	0.01**	[0.001]	0.01**	[0.001]	0.005**	[0.001]
t-statistic	(P-value)	15.53	(0.000)	14.87	(0.000)	12.42	(0.000)
DUM	[SE]	-0.19**	[0.048]	-0.18**	[0.051]	-0.09**	[0.028]
t-statistic	(P-value)	-3.9	(0.000)	-3.44	(0.000)	-3.18	(0.002)
Adjusted R-square		0.73		0.71		0.63	
DW statistic		0.36		0.41		0.46	
F-statistic (P-value)		85.48	(0.000)	77.82	(0.000)	55.21	(0.000)
LM test. $\chi^2_{12\ d.f.}$ (P-value)		64.98 (0.000)		66.73 (0.000)		60.80 (0.000)	
RESET test. $F^4_{85\ d.f.}$ (P-value)		22.16 (0.000)		27.08 (0.000)		40.15 (0.000)	

Note*:*

- ** and * indicate 1% and 5% significance level, respectively.
- LM test is a test for serial correlation of residuals up to order 12.
- Ramsey RESET test is a test for misspecification using the square of the estimated dependent variable.

Table 5: OLS estimation results for equation (1.13)

Dependent variable: log of foreign currency deposit/ domestic money (*LFM*)

		$LFM1_t = a_0 + a_1 x_t + bLFM1_{t-1} + a_2 T + a_3 DUM + u_t$		$LFM3_t = a_0 + a_1 x_t + bLFM3_{t-1} + a_2 T + a_3 DUM + u_t$		$LFM2_t = a_0 + a_1 x_t + bLFM2_{t-1} + a_2 T + a_3 DUM + u_t$	
x_t	[SE]	1.06**	[0.292]	0.99**	[0.342]	0.55**	[0.197]
t- statistic	(P-value)	3.62	(0.000)	2.89	(0.005)	2.78	(0.007)
LFM_{t-1}	[SE]	0.76**	[0.043]	0.75**	[0.048]	0.72**	[0.049]
t- statistic	(P-value)	17.38	(0.000)	15.39	(0.000)	14.51	(0.000)
T	[SE]	0.002**	[0.001]	0.002**	[0.001]	0.001**	[0.000]
t- statistic	(P-value)	3.51	(0.001)	3.37	(0.001)	3.25	(0.002)
DUM	[SE]	-0.07**	[0.023]	-0.08**	[0.027]	-0.04**	[0.016]
t- statistic	(P-value)	-3.09	(0.003)	-3.05	(0.003)	-2.75	(0.007)
Adjusted R-square		0.94		0.92		0.89	
F-statistic (P-value)		451.78	(0.000)	272.35	(0.000)	191.66	(0.000)
DW statistic		2.12		2.39		2.49	
LM test. $\chi^2_{12\,d.f.}$ (P-value)		20.43 (0.059)		26.98 (0.008)		35.84 (0.001)	
RESET test. $F^3_{85\,d.f.}$ (P-value)		2.01 (0.117)		1.53 (0.210)		0.69 (0.503)	

Note:

- ** indicates 1% significance level.
- LM test is a test for serial correlation of residuals up to order 12.
- Ramsey RESET test is a test for misspecification using the square of the estimated dependent variable.

Table 6: OLS estimation results for equation (1.14)

Dependent variable: log of foreign currency deposit/domestic money (*LFM*)

		$LFM1_t = a_0 + a_1 x_t + g x_{t-1}$ $b LFM1_{t-1} + a_2 T$ $+ a_3 DUM + u_t$		$LFM3_t = a_0 + a_1 x_t + g x_{t-1}$ $b LFM3_{t-1} + a_2 T$ $+ a_3 DUM + u_t$		$LFM2_t = a_0 + a_1 x_t + g x_{t-1}$ $b LFM2_{t-1} + a_2 T$ $+ a_3 DUM + u_t$	
x_t	[SE]	1.15**	[0.281]	1.14**	[0.326]	0.61**	[0.184]
t- statistic	(P-value)	4.10	(0.000)	3.51	(0.000)	3.31	(0.001)
x_{t-1}	[SE]	1.13**	[0.275]	1.38**	[0.319]	0.85**	[0.179]
t- statistic	(P-value)	4.11	(0.000)	4.33	(0.000)	4.74	(0.000)
LFM_{t-1}	[SE]	0.71**	[0.044]	0.70**	[0.048]	0.64**	[0.049]
t- statistic	(P-value)	16.08	(0.000)	14.50	(0.000)	13.08	(0.000)
T	[SE]	0.002**	[0.001]	0.002**	[0.001]	0.001**	[0.000]
t- statistic	(P-value)	4.48	(0.000)	4.25	(0.000)	4.36	(0.000)
DUM	[SE]	-0.09**	[0.022]	-0.10**	[0.026]	-0.05**	[0.014]
t- statistic	(P-value)	-3.89	(0.000)	-3.89	(0.000)	-3.56	(0.000)
Adjusted R-square		0.94		0.92		0.89	
F-statistic (P-value)		285.65	(0.000)	224.59	(0.000)	155.76	(0.000)
DW statistic		1.82		2.16		2.27	
LM test. $\chi^2_{12\,d.f.}$ (P-value)		1.11 (0.365)		1.17 (0.317)		1.58 (0.115)	
RESET test. $F^3_{83\,d.f.}$ (P-value)		0.97 (0.411)		0.98 (0.406)		0.11 (0.901)	
J-B test. $\chi^2_{2\,d.f.}$ (P-value)		15.66 (0.000)		199.93 (0.000)		432.18 (0.000)	
J-B test. $\chi^2_{2\,d.f.}$ (P-value)		0.91* (0.633)		0.234* (0.889)		3.35* (0.187)	

Note:

- ** indicates 1% significance level.
- LM test is a test for serial correlation of residuals up to order 12.
- Ramsey RESET test is a test for misspecification using the square of the estimated dependent variable.
- Jacque-Berra (J-B) tests for the normality of the disturbance term.
- * indicates results when the first four observations omitted.

VII.3   INTERPRETATION OF THE RESULTS

Given the estimated results, several conclusions can be drawn. Firstly, as predicted by the theory of currency substitution, the expected rate of depreciation of the exchange rate significantly impacts on the desired ratio of foreign to domestic currency in Cambodia. The coefficient of currency substitution (a_1) is significant at the 5 percent significant level for the estimation of equation (1.11) [Table 4], and at 1 percent significant level for equation (1.13) and (1.14) [Table 5 and 6].

Secondly, by using results from Table 5, the implied long-run semi-elasticity of currency substitution[19] equals 4.41 using *M1* and 3.96 using *M3* as the domestic money aggregate, which indicates an especially strong tendency toward currency substitution in Cambodia compared to other developing and transitional economies. For instance, in Argentina the long-run semi-elasticity of currency substitution is 3.5 in *absolute* terms (Ramirez-Rojas, 1985), and 1.159 using *M1* and 1.277 using *M2* for the case of Vietnam (Ngo, 1997). This is mainly because foreign currency holdings in Cambodia have never been prohibited during the period under study, whereas in other countries, governments have banned the use of foreign monies. For instance, the US dollar holding in the form of currency in circulation has been strongly tightened in Vietnam.

Thirdly, the speed of adjustment in the stocks of money is in the range of 72 to 76 percent of desired change being realized within one period (one month), compared to Vietnam, which is between 48 and 55 percent. This means that the convergence speed to long-run equilibrium is slower in Cambodia than in Vietnam. This may be consistent with the fact that there is a presence of the *semi-official sanction* of dollarization in Cambodia, in which domestic economic agents anticipate that the government agrees with their foreign currency holdings, in contrast with the *unofficial* dollarization in Vietnam. Therefore, residents do not need to adjust their wealth balances immediately after a change in *F/M* ratio from the previous month.

Fourthly, the desired composition of portfolio balance by economic agents is also significantly influenced by the exchange rate movement in the previous month. In other words, γ represents the dynamic adjustment process by domestic residents under the presence of

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[19] At the long run steady state, $LFM = a_0 + a_1 x + b LFM + a_2 T + a_3 DUM$. So $dLFM / dx = a_1 /(1 - b)$ represents the long-run semi elasticity. In the case of equation (1.14), the long-run semi elasticity is $(a_1 + g)/(1 - b)$. Thus, when *M1*, *M3* and *M2* are used as monetary aggregate, the long-run semi elasticity of currency substitution are 7.86, 8.40 and 4.05, respectively.

currency substitution in response to the previous month's exchange rate changes. The one percentage depreciation of the riel in one month changes the *F/M* ratio by about 1.13 and 1.38 percent when using *M1* and *M3*, respectively.

Fifthly, the effects of *T* on *F/M* ratios are statistically significant for all three regression results. These results suggest that the currency substitution phenomenon has a positive trend during period under study. This may be consistent with the scarcity of monetary instruments and other institutional constraints in the Cambodian financial sector.

Finally, a negative sign and reasonable size of a_3 indicates that the behavior of economic agents in holdings of US dollars is adversely affected by external factors such as the Asian financial crisis and the internal political turmoil in mid-1997 to mid-1998. The negative sign in a_3 is mainly attributed to the temporary drop in the US dollar bank deposits in domestic banks, as consumer confidence in banking system was low during the crisis period. Domestic residents apparently withdrew their US dollar deposit from domestic banks in Cambodia and either kept them at home or transferred the fund to foreign banks. In fact, there is considerable evidence for capital flight during this period.

VIII.   CONCLUDING REMARKS

The hypothesis of the presence of currency substitution in Cambodia over the period July 1993-April 2001 was tested in this paper. The results suggest strong evidence of currency substitution in Cambodia, explaining the short-run behaviour of domestic residents in substituting Cambodian riel in favor of US dollars. It is indicative that changes in the expected rates of depreciation of riels vis-à-vis US dollars have a significant impact on the composition of the US dollar holdings by an economic agent.

It is understandable that the initial cause of currency substitution in Cambodia was the lack of public confidence in the domestic banking system, which resulted from two decades of war. The under-developed financial system, weak legal and institutional structures, and political and economic instability are also likely causes of this phenomenon.

Currency substitution generates difficulties for the National Bank of Cambodia in running an effective monetary policy, since it can control only part of total broad money. Under the presence of currency substitution, the government faces the loss of seigniorage and its ability to run an inflationary tax is disciplined. The prevailing literature also shows that

currency substitution may act as a transmission mechanism through which domestic monetary and fiscal policy impacts more heavily on inflation.

Despite the success of stabilization programs by the government, which brought a low inflation rate and stable exchange rate (the economic variables that impact currency substitution), the ratio of currency substitution (*F/M*) is still very high compared to other developing countries. This suggests the presence of hysteresis of currency substitution in Cambodia, or perhaps a continued lack of confidence in the domestic banking system.

The question of whether or not the Cambodian government should officially dollarize is the subject of further research.

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