Currency substitution, inflation, seignorage and welfare : The Case of Cambodia

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Abstract

This paper aims at examining the declining inflation rate, the shape of the Laffer curve, welfare and Seignorage-optimizing inflation rate in a small open economy with flexible prices and exchange rate, under currency substitution. The model shows that, in the steady state, the equilibrium demand for foreign and domestic real balances is not a stable equilibrium. However, the model shows that there is a positive relationships between the demand for domestic and foreign real balances. In the empirical section, It is found that the higher the ratio of foreign currency deposit (FCD) to narrow or broad money supply, the lower the inflation rate and that the domestic inflation rate converges to foreign inflation rate which is lower than the domestic inflation rate.

1-Introduction

The purpose of this paper is to find the interactions theoretically and empirically amongst foreign inflation, domestic inflation, exchange rate and seigniorage-government revenues from monopoly control over the creation of money under a high degree of currency substitution in a small open economy. A small open economy in which both foreign currency and domestic currency are used by domestic residents, is studied to find the relationships amongst the above economic variables. The money-in-the-utility function model is used and a dynamic general equilibrium model is constructed. The model shows that, in equilibrium, the demands for domestic and foreign real balances have positive relationship and vary with the change in the growth rates of the ratio of foreign currency to nominal GDP(Gross Domestic Product).

In the empirical section, which is the last section of this paper I will test whether there is a discipline imposed as currency substitution greatly reduces

the government's ability to fuel inflation through monetized fiscal deficits. If such a fiscal discipline exists in the economy, there should be a negative relationship between domestic inflation rate and the ratio of foreign currency deposit to narrow or broad money supply. The higher the ratio of foreign currency deposit to narrow or broad domestic money demand, the more likely the situation that the inflation rate will converge to the foreign inflation rate which is lower than the domestic inflation rate. That is, if there is an increase in the ratio, the inflation rate should decrease, given lower foreign inflation rate.

A simple regression model is constructed to clarify that the relationship does exist or not in the economy of Cambodia. Unit root test for inflation rate and the ratio of foreign currency deposit to domestic money supply (M1) ratio and the test for cointegration between the two series are also implemented. The result shows that there is a significant negative relationship between the ratio of foreign currency deposit to domestic money supply and domestic inflation rate.

2-Declining Inflation Rate:A Global View

In 1947, there were 76 countries in the world; today there are 193. The largest country (China) has 1.2 billion inhabitants; the smallest (Palau) has 16,600. Many of today's countries are small in population: in 1995, 87 countries had a population of less than 5 million. The number of optimal currency areas happened to be around 70 in 1946 and about 169 in 2001. In fact, the increasing amount of trade and financial integration suggest that the number of optimal currency areas may actually have fallen in the last few decades. This occurs because some countries use a common currency -a strong currency. Currency unions typically take one of two forms. In one, which is most common, client countries (which are usually small) adopt the currency of a large anchor country. In the other case, a group of countries creates a new currency and a new joint central bank. For example, Ecuador has adopted US dollar as its legal tender.The first arrangement applies to thsi case.

Not only small countries are using foreign currencies along with its own currency in circulation but also some large countries are trying to abandon its own currencies to use a common one in a specific region -a situation which is called a currency union, like European Monetary Union. A group of European countries consisting of 12 nations creates a new currency and a new joint central bank. After the establishment of the European Central Bank (ECB) in 1998, the monetary policy of the ECB has been conducted since 1999. And the primary objective of the ECB is to maintain price stability in the EU area. When there is no inflation or deflation, we can say that there is price stability if, on average, prices neither increase nor decrease but stay stable over time. The Governing Council of the ECB is mandated to preserve the purchasing power of the euro. This mandate reflects a broad consensus in society that, by maintaining price stability, monetary policy contributes significantly to sustainable growth, economic welfare and helps create jobs. The ECB, like many central banks, is an independent central bank not subject to potential political pressures.

Using a foreign currency would result in loss of seignorage. Fischer [1982],

The case for using a foreign money then turns largely on the superior discipline imposed on domestic policymakers by removing their control over the money supply. The rate of high-powered money creation relative to GNP is typically greater for LDCs than for higher-income countries, and in some cases is even about 5 percent on average for more than a decade. Correspondingly, there are governments for which seignorage constitutes over 10 percent of total revenue on average. He also emphasized that seigniorage is not a minor factor for these governments. Further more with a certain kind of assumption, he estimated seignorage paid to the United States for countries in which US dollar is used .The flow rate at which seignoage , relative to GNP would have been paid to the united states by other countries if they use the dollar is an increasing function of the ratio of currency to GNP. The seignorage flow was found to be in the interval of 0.75 percent to 1 percent of GNP.The ratios are higher for LDCs , because their banking system are less well developed , and the currency-GDP ratio is therefore higher in those countries.

A country giving up use of its own currency faces a one-time cost of acquiring the initial stock of foreign high-powered money. And the cost is equivalent to currency-GDP ratio. The ratio is 2.5 percent in 1994 and 5.5 percent in 2003 fro Cambodia economy (ADB, Key Development Indicator 2005).

Along with these tendencies, it is observed that the world average inflation also have declined sharply. From 1991 to 1994 the world average inflation rate is 25.7 percent and 9.075 from 1995 to 1998, and it is very striking to see that it is only 4.9 percent from 1998 to 2002 and 3.9 percent from 2003 to 2005. Some countries are facing a near zero inflation rate, for instance Japan inflation rate has been continuously negative for about five years, which is on average minus 0.58 percent from 1999 to 2003 and the rate turns to zero in 2004 and declined to minus 0.1 percent in 2005.

It is interesting to find that Cambodia's inflation rate also has been declining with the decline in the world average inflation and it is equivalent to US inflation rate on average calculated from 2002 to 2004-which is about 2.77 percent on annual average. From 1990 to 1994 Cambodian average inflation rate was 103.35 percent and down up to 7.55 from 1996 to 1997, and it was continuing to slightly decrease to 4.56 percent from 1998 to 2001 and to 2.77 percent from 2002 to 2004 (ADB, Key Development Indicators 2005). While the US average inflation rate from 2002 to 2004 was 2.2 percent. The low inflation period-the period from 1998 to the present day, is the time when some banking laws were being implemented. In 1996, The National Bank of Cambodia(NBC)was established as the central bank as a result of the promulgation of the law on the organization and conduct of the national bank of Cambodia. Following the reestablishment Of NBC in 1996, the government adopted the Law on Banking and Financial Institutions (the banking law) in 2000. The banking law introduced more appropriate definitions for banking activities and a refined legal framework for banks.

The banking law has been helping to improve the independence of The National bank of Cambodia.

A number of studies have found that there has been a negative relationship

between central bank independence and inflation in industrial countries. The usual approach has been to create an index of central bank independence, and compare that with the inflation performances of the countries sampled. They show also that greater central bank independence is not associated with a lower rate of economic growth. This suggests that central bank independence is in the nature of a free lunch: increasing the independence of the central bank delivers lower inflation which, in the long run, is not at the expense of lower economic growth. Grilli et al[1991], the GMT index is composed of two sub-items, defined as political and economic independence of the central bank. The concept of political independence comprises nine sub-items covering appointment procedures for the members of the central bank's highest decision-making body, the relationship between this body and the government and the formal responsibilities assigned to the central bank. The economic independence of the central bank is composed of seven subitems, which include the issue of central bank financing of budget as well as the nature of monetary instruments. Every sub-item is scored using binary system. The overall index of legal central bank independence is obtained by a simple addition of unweighted scores on political and economic independence.

By contrast in a group of developing countries neither inflation, nor growth are related to legal independence. This is most likely due to the fact that, at least till the early nineties there was hardly any link between actual and legal independence within this group of countries. When behaviorally oriented proxies of independence like the actual turnover of CB governors and the index of political vulnerability are used, a negative relation between inflation and independence emerges within the group of developing countries as well, Cukierman, Webb and Neyapti (1992) and Cukierman and Webb(1995).

From the argument about the relationship between central bank's independence and inflation stated above and the fact that independence of central bank of Cambodia has been improved, the low rate of inflation in Cambodia economy can be explained partly by the improvement in the institutionally- independent central bank. Here a question can be raised why might a nation wish to establish a politically independent central bank. Two related arguments stand out from all the rest.

First, it may be helpful to insulate monetary policy from the political process, especially in democratic societies. Elected officials have incentives to exploit monetary-policy decisions for short-run gains - such as winning the next election. Politicians may even be tempted to pursue personal goals that do not coincide with the genuine purposes of the electorate at large.

Second, it may be helpful for society to guard against its own tendencies to put too much emphasis on short-run considerations, thereby wrongly neglecting long-run goals. It is not just politicians, in other words, who can temporarily confuse priorities, sacrificing more fundamental long-run interests for short-run gratification. Maintenance of a low inflation rate is a classic example of a long-run goal that societies have lost sight of in shorter runs. If the members of a society tie their own hands by creating a politically independent central bank, such institutional arrangements may be able to offset the bias toward inflation
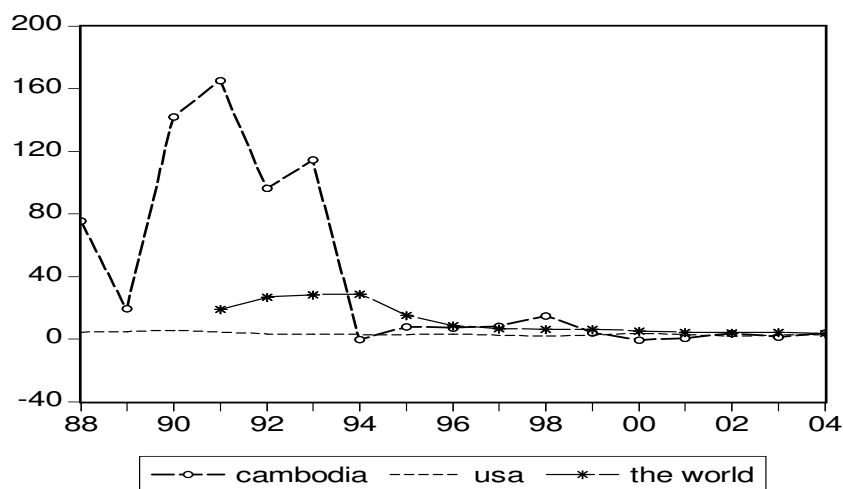
Figure 1: Inflation rate of the WOrld, Cambodia and US .

that would otherwise exist.

Another view that can explain the declining inflation rate can be found in Romer[1993]. Romer successfully showed that average rate of inflation are lower in smaller, more open economies. The negative association between average inflation and openness, for which the ratio of import to GDP is used as a proxy can be explained by two factors. The first explanation lies on the endogenous openness. He argued that the ratio of import to GDP depend not just on country's side but also on the country's policy choices. For example, it is possible that countries that adopt protectionist policies also adopt other policies benefiting particular interest groups, and that this in turn leads to large budget deficits and hence to high rates of inflation to generate seignorage revenues. Consequently, a negative correlation between openness and inflation could arise through this channel. The second factor rests on the budgetary explanations. The argument for this factor takes two specific forms. First, the amount of revenue generated by a given tariff is an increasing function of openness. Thus, the governments of smaller countries may obtain larger fractions of their revenues from tariffs, and may therefore rely less on other sources of revenue, including seignorage. The result may be lower rates of inflation. Second , the elasticity of demand for domestic currency with respect to the inflation rate may be higher in more open economies :greater trade may make foreign currencies more easily available, and may therefore make it easier for residents to obtain substitutes for domestic currency. Thus the optimal tax rate on domestic currency is lower in more open economies.

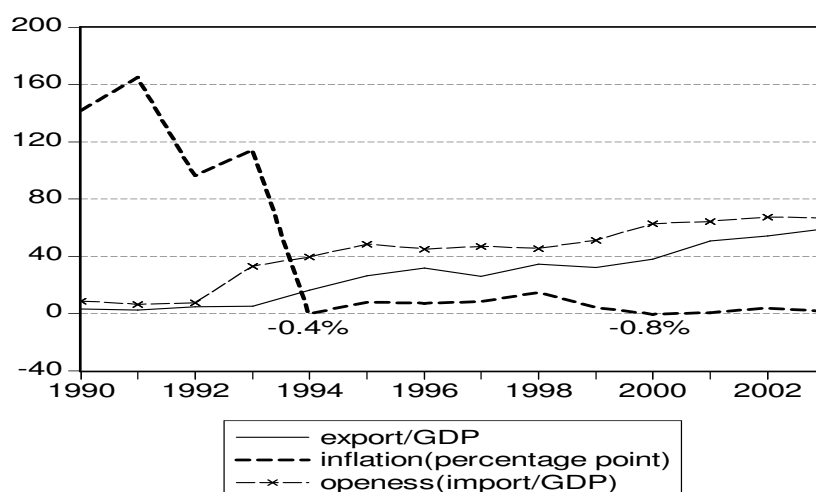**3- Financial Institution And Key historical Events:Cambodia**

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Figure 2: Openess and Inflation (Cambodia:1990-2003).

To understand economic situation in Cambodia, it would be necessary to understand some history of Cambodia. So in this section I introduce to readers key historical events since the country gained independence from France in 1953 and some economic overviews since the period.

After independence from France in 1953, Cambodia enjoyed almost two decades of peace and prosperity. Cambodia's economic status was on a par with neighboring countries in Southeast Asia in the 1960s. However this good time came to an end. Growing regional conflicts and civil wars spilled over into Cambodia, which brought in a coup in 1970. Political upheaval during the period 1970-1975 brought the khmer-rouge to power in April 1975. In the regime, people were evacuated from the city to the countryside, forced to do hard labor, and allowed to have a small portion of food for each meal under a regulated meal plan. Schools, Buddhist pagodas and other educational institutions were transformed into prisons or farmhouses or were leaf abandoned. The market base economy was completely destroyed: there were no private property rights, the national currency and banks were removed and barter trade was officially prohibited.

The collapse of the Khmer Rouge regime was followed by 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, a single state-owned bank directed the banking system and its performance was very poor because of the ineffectiveness of interest rates and the low public confidence in the banking system. Structural reforms were initiated in 1989 through a govern-

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ment decree to establish a two-tier banking system by separating the function of commercial banks from NBC. This decree allowed the formation of private commercial banks as limited liability companies. In 1990, treasury operations were transferred to the Ministry of Economy and Finance, and NBC was designated as a ministry and largely used to finance budget deficits. In 1991, the first private commercial bank was established as a joint venture between NBC and the Siam commercial bank of Thailand. Commercial banks were operated under the framework of a law on the supervision of financial institutions which were enacted in August 1992, and the subdecree on the supervision of commercial banks was approved in November 1992.

In 1996, NBC was promoted as the central bank as a result of the promulgation of the law on the organization and conduct of the national bank of Cambodia. Following the reestablishment of NBC in 1996, the government adopted the Law on Banking and Financial Institutions (the banking law) in 2000. The banking law introduced more appropriate definitions for banking activities and a refined legal framework for banks. It also allowed microfinance institutions (MFIs) to undertake financial operations under the supervision of the NBC.Furthermore, in 2000 the Government embarked on a comprehensive bank restructuring program with the assistance of the international moneytary Fund (IMF) to enhance public confidence in the banking system (ADB:key issue in the financial sector)

Cambodia still has the lowest rates of banking intermediation in the world: bank loans and deposits account for approximately 8 percent and 12 percent of gross domestic product as of December 2000, respectively. Deposit in Khmer riel was just 0.8 percent of GDP while 10.9 percent in foreign currency. This makes deposit in foreign currencies, predominantly in US dollars, up to 93 percent of total banking deposits.The US dollar is the primary medium of exchange, with the Khmer riel used primarily in rural areas. The formal banking sector is concentrated in Phnom Penh, although 90 percent of the population resides in rural areas. The Microfinace operations of nongovernmental organization (NGOs) are the main and de facto providers of credit there. Currently, about 90 NGOs supported by funding agencies such as Kreditanstalt fur Wiederaufbau, Gesellschaft fur Technische Zusammenarbeit of Germany, United Nations Children's Fund, International Fund for Agricultural development, United States Agency for International Development provide microfinance to nearly 420.000 poor households, or 15 percent of the total poor population, with most of the borrowers being women. Borrowings and lending are conducted overwhelmingly through informal sectors, which are friends, relatives, money lenders, input suppliers, loan sharks. The transactions in the informal sectors are hard to be measured.

Despite the low level of lending and borrowing, asset quality in the banking system is poor. According to the NBC, the volume of the nonperforming loans in the banking system is reported to be substantial and growing. In addition, the banking sector maintains excess liquidity with the percentage of cash to total assets at about 19 percent. The high risk and operating costs associated with bank lending are reflected in a high interest rate spread and the prevalence

of short-term lending. The spread between loan and deposit interest rates is estimated to be around 13 percentage points, as loan interest rates are around 20 percent.

In November 2000, just before the first phase of NBC's bank relicensing program, the commercial banking system consisted of 31 banks, including two government-owned banks, and 7 foreign bank branches. In 2000, Foreign Trade Bank of Cambodia (FTBC) was separated from the former direct management of NBC in order to transform its permanent identity into a State-owned commercial bank with the features of a Public Economic Enterprise and an aim to conduct autonomous business operations. Currently, Cambodia has just 20 commercial banks as a result of NBC's relicensing program. Banking was known and practiced mostly by people in urban areas.

In 1993 Cambodia had its first democratically elected coalition government, after an election sponsored by the UNTAC (United Nation Transitional Authorities in Cambodia). During this transitional period, Cambodia also embarked on significant economic and financial reform towards a market-oriented system. Financial sector reform in Cambodia was principally focused on banking system. Private banks were allowed to enter the market. In the present day, the National bank of Cambodia conduct monetary policy and acts as a regulatory body to monitor domestic banking practice.

Cambodia follows a managed floating exchange rate regime. Recent monetary policy actions include limited intervention in the exchange market to reduce exchange rate volatility. The gap between the official and parallel market exchange rates has been kept to be under one percent during most of the reform period. The national bank of Cambodia sets the official exchange rate each morning based on surveys of the rate quoted by three major dealers in the market the day before. Previusly, The NBC was quick to conduct foreign exchange auctions. A portion of the government foreign exchange was sold to the private sector. The last auction was done in the second half of 1997, where the exchange market was strongly influenced by the Asian financial crisis and internal conflict. The auction system has not been practiced since then, as economic and political conditions stabilized and business confidence improved.

With the legal mandate to avoid financing budget deficit by money creation, the NBC focuses on building confidence in the riel by limiting inflation. It is noted that the inflation rate were brought down from triple digits in the early 1990s (112.5 percent in 1992) to single digit in 1995-1997 (average rate of around 7.1 percent) (NBC annual report, 1997). The inflation rate hit a 15 percent mark between July 1997 and July 1998 due to the Asian financial crisis and internal political turmoil. However, the rate was below 5 percent from that time.

4- High Ratio of Foreign Currency Deposit(FCD) to Money Supply in Cambodia

Like the transitional economies in Eastern Europe, the former Soviet Union, Latin America, Cambodia has experienced the impact of currency substitution during its economic liberalization from centrally planned to a market-oriented

economy in the early 1990s. On the supply side, the opening up of the domestic economy to the outside world enhances mass inflows of foreign currency. After the peace agreement in 1991, the FCD started to increse.The staff of UN spend million of dollar in Cambodia. The dollar started to spread all over the country. In 1991 FCD is only 0.7 billion riel and it jumps to 65.4 billion riel in 1992. The second emergence of FCD may stem from the increase in export of garment sectors. The export of garment product to the U S and other countries has earn Cambodia millions of dollars. Another supply side is the aid from rich countries. The last supply side is the increasing arrival of tourists.

On the demand side, people tend to hold a strong foreign currency as a means of protecting against depreciation of the domestic currency and domestic high inflation. In many cases, although the inflation rate is brought down to a low single digit, foreign currency held by domestic residents still continues. This phenomenon is known in the literature as "hysteresis" of currency substitution.

Explanations of the hysteresis vary. The role of financial adaptation is discussed by Dornbusch and Reynoso(1989). Switching to a new currency in the period of high inflation is costly and requires a learning process. Most prices of goods and services and wage payment are quoted in Dollar. Changing the menu may incur large cost.

Another explanation (Giovannini and Turtelboom,1992) is linked to the degree of liquidity of a currency. If the domestic currency has low expected returns, the foreign currency becomes a significant liquid investment for domestic residents. Subsequently, the less the aggregate willing share of domestic currency is, the less likely it is for a consumer to find a counterpart to accept it in payment for a good or a service. This externality can be used to explain hysteresis.

The hysteresis phenomenon of currency substitution does exist 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, which is measured as a ratio of foreign currency deposit to money supply. According to Bulletin of statistics No 59 -November 2000 issued by Ministry of statistics and finance, inflation rate in Phnom Penh in 1992 and 1993 are 227.7 percent and 41.7 percent respectively. The data from ADB, the inflation rate for the above stated both years were 96 and 114 percent respectively. Despite the high rate of inflation during the transformation period, the economy has faced twin deficit-budget deficit and current account deficit, since 1988.

The economy has run budget deficit, especially since the start period of economic transformation from social economy to a market-oriented economy. In 1987, budget surplus was 3.1 percent of GDP while in 1988 it dropped to minus 2.3 percent of GDP and it continued to decrease to minus 7. 3 percent in 1995-the highest deficit since 1988; and started to slightly decrease since that period.

On the other hand, Cambodia economy has also encountered trade deficit since before the change in economic system. From 1990 to 2003, the deficit was on average 10.2 percent of GDP. There was a sharp decrease in the deficit in 1991 compared to 1990 , which was 5.5 percent in 1990 and 1.7 percent in 1991.The
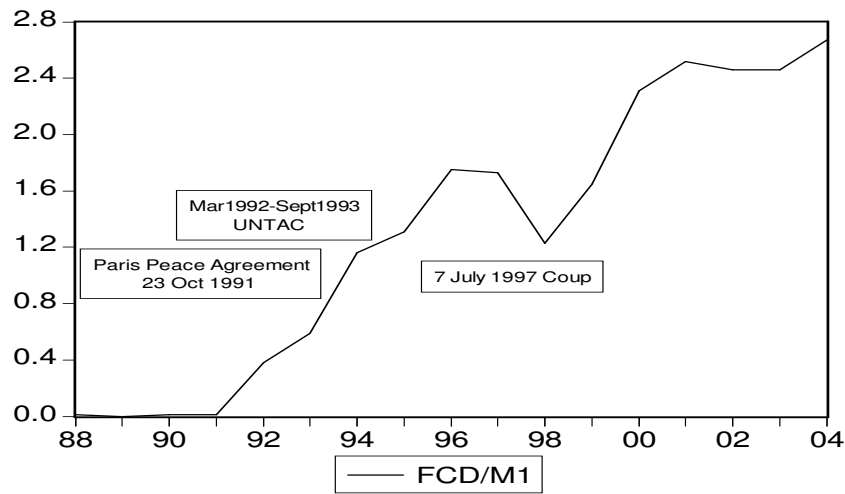
Figure 3: The ratio of FCD to M1(FCD/M1).

decrease in trade deficit in 1991 is due to the sharp increase in export-which was 11.4 percent of GDP in 1991 and 6.1 percent in 1990 (ADB,Key Indicators 2005).

Despite the twin deficit-budget and trade deficit, the high growth rate of foreign currency deposit (FCD) has been observed. The ratio of foreign currency deposit to narrow money supply has been larger than one since 1995 and it jumped to slightly below 3 in 2004. The use of the riel is confined to small transactions and wage payments for government employees. Privately owned companies like garment factories make salary payment mostly in US dollar. And it is also observed that individuals save their money in dollar.

Foreign currencies have been allowed to circulate in market. Among them dollar is used freely and holds the largest share of liquidity, especially after 1991.The greenback plays the three roles of currency, namely a medium of exchange, a store of value and a unit of account . It is common that the prices of most goods and services are indexed to the green back and to the Thai bath in some provinces sharing border with Thailand and to the Vietnamese dong in some areas closed to Vietnam. The two countries are important trade partners from which Cambodia imports similar products ranging from low-priced goods like foods, fruits to luxurious goods like perfume and construction materials.In recent years , the amount of import from Thailand is the largest.

From 2000 to 2004, the Dollar-Riel exchage rate and inflation rate seemed to have been stable , which is 4000 Riel per Dollar and 1.5 percent on yearly average respectively. There were two main depreciation in cambodia' monetary history.In 1991 the exchage rate was 520 riel per dollar when in 1992 the riel value plummeted to 2000 riel per dollar.Again in just one year the riel value fell

from 2713 in 1996 to 3452 in 1997. The last jump of the exchange rate can be thought of as a result in the Asian financial crisis and fighting in July 1997.

Narrow money supply growth rate was on average 105.3 percent from 1988 to 1992. The rate slumped to 39.1 percent from 1993 to 1996 and 14.4 percent from 1997 to 2000 and 21.2 percent from 2001 to 2004 (ADB, Key indicators 2005). While the growth rate of FCD was on annual average ,1826 percent from 1988 to 1992. The rate slumped to 73 percent from 1993 to 1996 and 22 percent from 1997 to 2000 and 26 percent from 2001 to 2004 (ADB, Key indicators 2005). . On the other hand, the monthly data from 1995M1 to 2005M7 show that the average growth rate is 2 percent for real FCD and 1.06 percent for real balance M1 (IMF,International Financial Statistics).
Inflation rate was on average 99.46 percent from 1988 to 1992. The rate slumped to 39.43 percent from 1993 to 1996 and 6.5 percent from 1997 to 2000 and 2.1 percent from 2001 to 2004 (ADB, Key indicators 2005). The strong tendency to use foreign currency can be thought of as one of the reasons why the growth rate of rarrow money supply has declined and consequently inflation rate has decreased.

5-Seignorage and Inflation Under Currency Substitution:Review

5-1 Seignorage Under Currency Substitution

The world average inflation rate has been declining in the last few decades, especially since 1990s, while many countries have been using some kinds of common currencies and some countries are substituting their own currencies for strong ones, dollar. Especially, in countries with high rates of inflation there is typically movement away from the use of the domestic currency to the use of another lower inflation. Fisher(1982) found that the rate of high-powered money creation relative to GNP is typically greater for LDCs than for higher-income countries, and in some cases is even above 5 percent on average for over more than a decade. The creation of high-powered money has been an important source of revenue for the governments of several LDCs. High use of seigniorage is examined in high-inflation countries, such as Argentina, Uruguay, Chile, and Brazil.

On the other hand, the flow of seigniorage payments for the use of the dollar is estimated to be in the interval of 0.75 to 1 percent of GDP. The ratios are higher for LDCs, presumably because their banking systems are less well developed, and the currency/GDP ratio is therefore higher in those countries. Another estimate of seignorage payment for use of the dollar can be found in table 4 of Philip N.(1997) .The payment of seignorage that the rest of the world made to the US has surpassed the payment made by US residents in recent years. In Cambodia economy, seigorage is one of the important sources of government revenues.

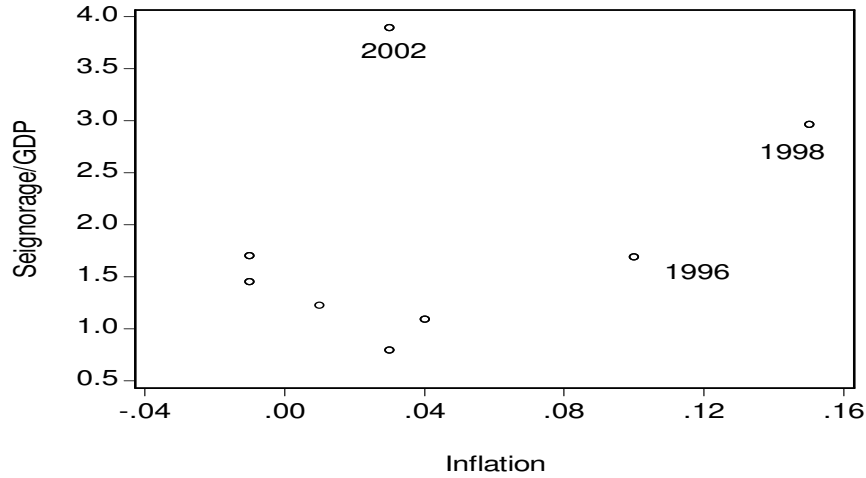In 1998 the seignorage reach up to 3 percent of GDP and in 2002 it jumped

Figure 4: Laffer Curve: 1996-2003.

to nearly 4 percent of GDP[1] . There seems to be a negative relationship between inflation rate and seignorage except for years 1996, 1998 ,2002. 1998 and 2003 were marked by the country general election and 1996 saw the insurgence acroos the country before the 1997 July coup. However with the high rate of seignorage , inflation rate is presumably on the inefficient part of the laffer curve- the righ part of the curve.

Li and Matsui[2005] use a two-country two-currency search theoretic model to study currency competition between governments and its effect on the circulation of currencies. They assume that each government use signorage to provide public goods. Agents consume private goods, and the public goods of their own country. They found that if the degree of economic integration is sufficiently low, there exists an equilibrium where the two currencies circulate only locally. The higher the degree of economic integration becomes, the more likely it is for one of the currencies to circulate internationally. In particular the larger countries are more likely to have its currency circulate internationally than small countries. The higher the inflation rate on a given currency is, the less likely the local and international circulation of the currency is. More specifically, the greater the foreign inflation tax is relative to home inflation tax , the more attractive home curency becomes relative to foreign currency.,and therefore , the higher incentive agents have to use home currency. A sufficiently high inflation tax elimnates its chance of domestic circulation as well as worlwide

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[1]The Seignorage here is obtained by the following formula:

$Seignorage_t = \frac{H_t - H_{t-1}}{H_{t-1}} \frac{H_{t-1}}{P_{t-1}}$ where H stands for monetary base and then $\frac{seignorage_t}{realGDP_t}$ is calculated

circulation. In their policy game in which all the agents and the government believe a particular equilibrium to prevail, and the two governments choose tax rates simultaneously. For the country that issues the international curency, two opposing forces affect the optimal inflation rate: the enlarged tax base, and the tax burden that falls partially on foreigners. They argue that if the former effect dominates the latter, a lower inflation rate on a currency circulating abroad can be observed compared to situation under autarky. The country with the local currency, on the contrary, has an incentive to raise the inflation rate to collect seignorage, because the tax base shrinks due to the use of foreign currency. As a result, this brings about the possibility of abondoning the use of home currency and this possibility provides a force to curb the inflation tendency. The force is stronger as the degree of openess facing the country is higher, since this increases the gains of using foreing currency.

As for the welfare issue, a country that successfully has its currency circulated abroad will enjoy higher welfare than under autarky. The welfare of the country that allows foreign currency to circulate depends on the positive effect of an increase in tradeopportunity and the negative effect of losing the tax base.

Their findings shed some light on the decreasing average worlde inflation rate. If many small countries with persisitently hight inflation rate and increasing trade volume allow a given strong or key currency to circulate freely in its home country, the inflation rate of the home country will become lower. As a result, the average worldwide inflation rate would be declining.

5-2 Inflation transmission under currency substitution

The famous article by Kydland and Prescott [1977] demonstrates that the absence of precommitment in monetary policy can lead to highly inefficient inflation. When imperfect competition or a distortionary tax system causes the natural level of output to be sub optimal and when monetary authority can affect real output, policy-makers have an incentive to attempt to create surprise inflation. But policy cannot on average be more expansionary than price-and wage-setters expect. As a result, in a one-time game without binding commitment, the equilibrium rate of inflation is inefficiently high, and output remains at the natural rate. In a dollarized economy ,Assume that the foreign currency-denominated inflation rate is lower that the domestic inflation rate and that actual output is the following function of target output and surprise inflation:

$$y = by^\star + d(\pi - \pi^e)$$

Where $b < 1$ reflects the presence of monopoly power in product market and $d > 0$measures the effect of surprise inflation on output through real wage. The policy-maker is assumed to view higher output as desirable and higher inflation as undesirable. Assume that the policy-maker maximize the following function:

$$W = -\pi^2/2 + \gamma y$$

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We can derive the equilibrium $\pi = \pi^e = d\gamma$ and $y = by^\star$. In the presence of dollarization, d would decrease as some firms stop accepting domestic currency and start to accept foreign currency instead. From this argument, we can derive a short conclusion that the low inflation rate in Cambodia is partly a result of the use of low-inflation foreign currency. Through this channel, equilibrium inflation rate in dollarized economy is lower than in autarky.

Calvo and Rodriguez [1977] analyze a two-sector model of exchange rate determination for a small open economy with flexible price. Residents are assumed to hold both domestic and foreign currencies and to have rational expectations. Their assumption about currency substitution is that the ratio of domestic to foreign currency holdings is a function of the expected difference of the rates of return of both assets, which, under perfect foresight, is equal to the actual change in the exchange rate. They found that an announced higher rate of monetary expansion leads to upward jumps of both the price of the home good and the nominal exchange rate. Since the real exchange rate is increased, the rise in the nominal exchange rate must exceed the rise in the price of the home good. Consequently, the expansion is followed by a transition period during which the economy accumulates foreign exchange.

John Roger [1990] analyzes the transmission effects of an unanticipated, permanent rise in foreign inflation on the demand for domestic real balances, the domestic velocity of money, and particularly the domestic inflation rate, under currency substitution, in a small open economy with flexible exchange rate and prices and with the assumption of endogenous time preference. He argues that, for a small open economy, which floats its currency, a degree of insulation from foreign price shocks may be lost in the presence of currency substitution. Moreover, the higher the initial stock of foreign real balances held domestically, all else constant, the greater the magnitude of the transmission effects. He also finds that in a steady state, an unanticipated, permanent increase in foreign inflation causes consumption to rise and foreign currency holdings to decrease.

Chau-nan and Tien-wang Tsar [1983] In a small open economy with flexible exchange rate and with the assumption that domestic and foreign currency are the only available assets in the economy and that there are two prices for domestic goods: the price expressed in terms of domestic currency and the price expressed in terms of foreign currency. They also assume that the net inflow of the foreign currency has to be financed by a trade surplus and total output is fixed at the full-employment level. They argue that if the rest of the world raise its rate of inflation, three possibilities may occur. In the simple case the domestic rate of inflation will converge to the rate of money growth. The second possibility is that the government may alter the rate of monetary expansion in order to insulate the real sector from external disturbances. In this case, in response to the change in the rate of monetary expansion of the rest of the world the domestic rate of monetary expansion should be determined as to offset the change in trade balance caused by the rise in the monetary expansion of the rest of the world. Consequently, the change in the rate of domestic monetary expansion depends on the own price elasticity of the demand for foreign cur-

rency, the cross elasticity of demand for foreign currency, and the magnitude of domestic and foreign monetary expansion. The third possibility is that the government is maximizing its seigniorage for fiscal purposes. And the optimum domestic monetary expansion varies with the change in elasticity. Their findings shed some light on Hayek[1976]'s proposal that citizens be allowed to use foreign currency as a means of payments in order to put a check on national governments' tendency to rely on the seignorage for fiscal purpose.

6-A Model of Currency Substitution

The model in this section is borrowed from Federico(1994). Federico extended Sidrauski's money-in-the-utilily model to explain some economic variables in an economy in which an indexed currency is introduced

Consider a small open economy that operates under flexible exchange rates and perfect capital mobility. Transactions may be carried out by using both domestic and foreign money. The economy is inhabited by a fixed number N of indefinitely live agents with perfect foresight. Foreign residents do not hold domestic money balances. I also assume that foreign real balance is exogenous and it is a fraction of nominal gross domestic product. There is no need to run current acount surplus in order to purchase the stock of foreign monetary balances. The stock of foreign real balances can be reasonably cosidered as amount of aid. There are neither impediments to trade nor transport costs, so that purchasing power parity holds instantaneously. Individuals maximize their lifetime utility function subject to a wealth constraint. Seignorage is the only source of government revenues and a balanced budget is imposed each period. The overall government revenue is used as a lump-sum transfer to individual.

6.1 Consumer Optimization Problem

A reperesentative agent derives utility from per capita consumption c and per capita money service s. Money serveices are provided by both domestic real money balances per capita and foreign real money balances per capita:

$$s_t = s(m_1, m_2) \tag{1}$$

The representative domestic resident maximizes her life-time utility function $U : R_+ \times R_+ \times R_+ \longrightarrow R$

$$\int_0^\infty \left[u(c, s(m_1, m_2)) \right] e^{-\rho t} dt \tag{2}$$

Where $\rho < 1$is the discount factor,$m_1$and$m_2$are per capita real balances of domestic and foreign currency, c is consumption and$p_1$and$p_2$are the prices of consumption goods in terms of the domestic and foreign currencies, respectively. Domestic inflation rate and foreign inflation rate are given by$\pi_1 = \frac{\dot{p_1}}{p_1}and\bar{\pi}_2 = \frac{\dot{p_2}}{p_2}$

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respectively. The dot express the first order derivative of a variable with respect to time. There is no government bond. Each individual receives an endogenous constant endowment y and a lump-sum transfer of x_t. Each household's budget constraint for period t in per capita real terms is given by:

$$\dot{m}_1 + \dot{m}_2 + \pi_1 m_1 + \bar{\pi}_2 m_2 + c = y + x \tag{3}$$

And the total asset can be written as

$$a = m_1 + m_2 \tag{4}$$

The current-value Hamiltonian is given by

$$H = u(c, s(m_1, m_2)) + \lambda(y + x - \pi_1 m_1 - \bar{\pi}_2 m_2 - c) + \chi(a - m_1 - m_2) \tag{5}$$

The first order-condition can be obtained as

$$u_c = \lambda \tag{6}$$

$$u_{m_1} - \pi_1 \lambda - \chi = 0 \tag{7}$$

$$u_{m_2} - \bar{\pi}_2 \lambda - \chi = 0 \tag{8}$$

$$-\dot{\lambda} + \rho\lambda = \chi \tag{9}$$

$$(m_1 + m_2)e^{-\rho t} = 0 \tag{10}$$

Where partial derivatives on the utility function are denoted by subscripts.

6-2 Governments

The government creates money (make transfer) to keep the rate of money growth at δ_1

$\frac{\dot{M}_1}{M_1} = \delta_1$ and $\frac{\dot{m}_1}{m_1} = \frac{\dot{M}_1}{M_1} - \frac{\dot{p}_1}{p_1}$ Hence the growth rate of real balance is given by

$$\frac{\dot{m}_1}{m_1} = \delta_1 - \pi_1 \tag{11}$$

The government transfer is totally financed by seigniorage : $\delta_1 m_1 = x$

Foreign currency held by domestic residents is a fraction of μ_t of domestic nominal domestic product. The relationship between foreign currency and gross domestic product can be written as

$$e_t M_2 = \mu_t p_1 N y$$

Taking logs on both sides of this equation and performing first-order derivative with respect to time, the growth rate of foreign real balance is given by

$$\frac{\dot{m}_2}{m_2} = \nu + \pi_1 - \bar{\pi}_2 - \epsilon \tag{12}$$

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Where $\nu = \frac{\dot{\mu}}{\mu}$ and $\frac{\dot{e}}{e} = \epsilon$ are the growth rate of the inverse velocity and exchange rate respectively.

Substituting (6) into (9) we have $\chi = \rho u_c - \dot{c}u_{cc}$ and again substituting this result into (7) and (8), we obtain the inflation rates

$$\pi_1 = \frac{1}{u_c}\left[u_{m_1} - \rho u_c + \dot{c}u_{cc}\right] \tag{13}$$

$$\bar{\pi}_2 = \frac{1}{u_c}\left[u_{m_2} - \rho u_c + \dot{c}u_{cc}\right] \tag{14}$$

By plugging (13) and (14) into (11) and (12) respectively, we obtain

$$\frac{\dot{m}_1}{m_1} = \delta_1 - \frac{1}{u_c}\left[u_{m_1} - \rho u_c + \dot{c}u_{cc}\right] \tag{15}$$

$$\frac{\dot{m}_2}{m_2} = \nu - \epsilon + \frac{1}{u_c}\left[u_{m_1} - u_{m_2}\right] \tag{16}$$

Under the assumption that PPP holds ,we have

$$\frac{\dot{e}}{e} = \frac{1}{u_c}\left[u_{m_1} - u_{m_2}\right] \tag{17}$$

For simplicity we assume that the marginal utility of consumption is constant and money service production function is a Cobb-Douglas form with constant elasticity of substitution, which is equal to unity.

$$u(c, s(m_1, m_2)) = \theta c + (1 - \theta)\left[\gamma ln m_1 + (1 - \gamma)ln m_2\right]$$

After some calculations and rearrangements, (15) and (16) can be expressed as

$\dot{m}_1 = \frac{1}{\theta}\left[\theta(\delta_1 + \rho)m_1 - \gamma(1 - \theta)\right]$

$\dot{m}_2 = \frac{1}{\theta m_1}\left[m_2(\theta(\nu - \epsilon)m_1 + (1 - \theta)\gamma) - (1 - \theta)(1 - \gamma)m_1\right]$

Analytical Solutions

In equilibrium the changes in both domestic and foreign real balance are zero, we can obtain the equilibrium real balance as follows.

when $\dot{m}_1 = 0$ we have

$$m_1^\star = \frac{\gamma(1 - \theta)}{\theta(\delta_1 + \rho)} \tag{18}$$

From (11), in equilibrium ,we have $\pi_1 = \delta_1$ When $\dot{m}_2 = 0$, we have

$$m_2 = \frac{(1 - \gamma)(1 - \theta)m_1}{(\nu - \epsilon)\theta m_1 + (1 - \theta)\gamma} \tag{19}$$
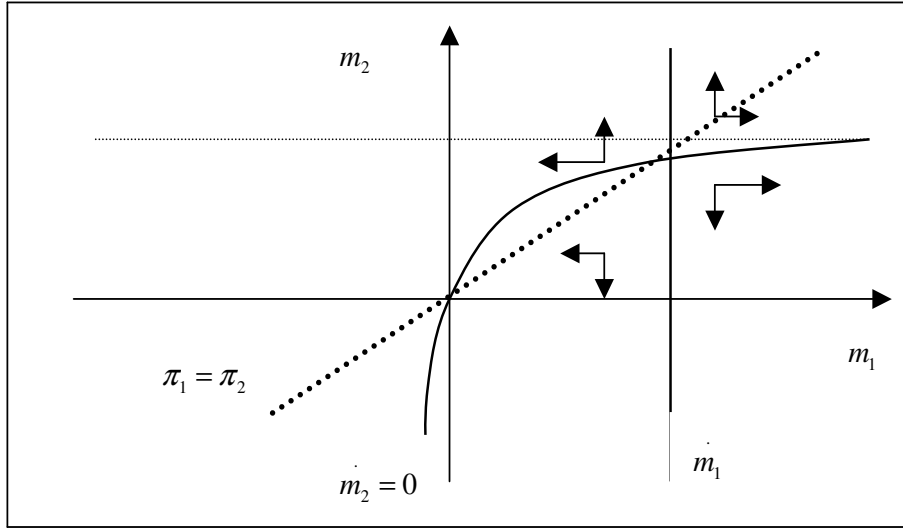
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Figure 5: The Case where $\nu > \epsilon$.

By substituting (18) into this equation the foreign real balance is given by $m_2 = \frac{(1-\gamma)(1-\theta)}{\theta(\nu+\delta_1+\rho-\epsilon)}$ and by plugging this result into (14) we obtain

$$\bar{\pi}_2 = \nu + \delta_1 - \epsilon \tag{20}$$

From (17) and (11) , we have in equilibrium $\pi_1{}^\star = \delta_1 = \bar{\pi}_2$ and then (20) becomes $\nu^\star = \epsilon^\star = 0$ and again $m_2{}^\star = \frac{(1-\gamma)(1-\theta)}{\theta(\delta_1+\rho)}$

$$m_2 = \frac{(1-\gamma)m_1}{\gamma}$$

The phase diagram of (m_1, m_2) can be drawn in three different ways.

Graphical Solutions

a-the case where $\nu > \epsilon$

In this case, because the holdings of both real balances are positive,the point where the curve $\dot{m}_1 = 0$, $\dot{m}_2 = 0$ and $\pi_1 = \bar{\pi}_2$ cross does not exist. Consequently there does not exist monetary equilibrium in this case. When the domestic monetary authority increases the rate of money supply, the curve $\dot{m}_1 = 0$ will shift to the origin and consequently the equilibrium (m_1, m_2) will also decrease. However, every equilibrium point (m_1, m_2) is not consistent with the assumption that π_1 is equal to $\bar{\pi}_2$. When the growth rate of ν - which is the ratio of foreign government aid to domestic nominal GDP is higher than the depreciation rate of the exchange rate, the inflation rate denominated in domestic currency
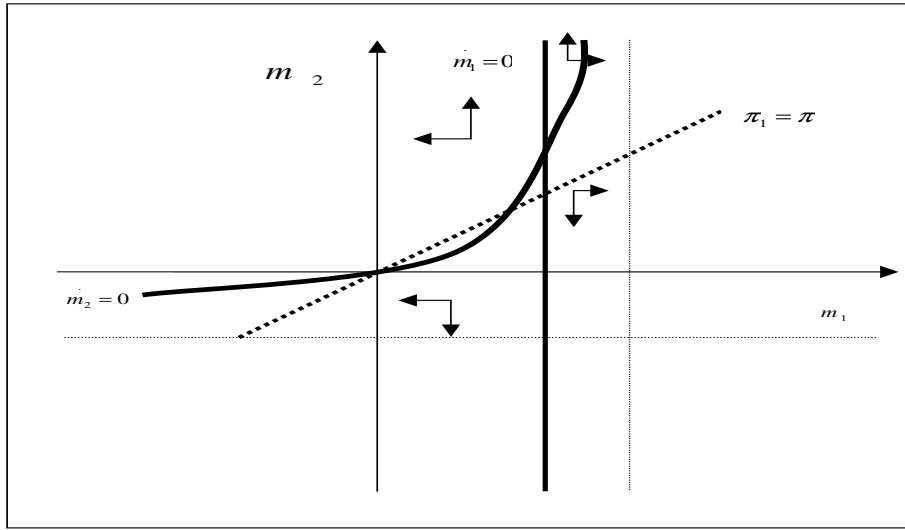
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Figure 6: The Case where $\nu < \epsilon$.

becomes lower than the inflation rate denominated in foreign currency.

b-the case where $\nu < \epsilon$

In this case , in every equilibrium point (m_1, m_2) ,π_1 is always higher than π_2 since the point of intersection between $\dot{m}_1$ and $\dot{m}_2$ lies above the dotted line - the line indicating that π_1 and π_2 are equal. If the PPP holds , there should be a depreciation in exchange rate every period of time. The curve shows that $d^2 m_2/dm_1^2 > 0$ (the second derivative of m_2 with respect to m_1). The implication behind this is that if there is an increase in the demand for real balances, the growth rate of demand for domestic real balance will be lower than that for foreign real balance.If there is a one unit increase in m_2, m_1 will increase by less that one unit. At a certain level, m_1 will be growing at a near-zero rate and m_2 will grow critically. The demand for m_2 will get larger than the demand for m_1.

when m_1 converges to $(1-\theta)\gamma/(\nu-\epsilon)\theta$, m_2 converges to infinity.Because the depreciation rate of exchange rate ϵ is always larger than ν , π_1 will be always higher than $\bar{\pi}_2$ and the three curves do not cross each other. There is also no steady-state equilibrium in this case. However the real data show that from 1995:2 to 2005:7, the monthly average growth rate of m_2 is 2 percent while it is only 1.07 percent for m_1.

c-the case where $\nu = \epsilon$

Besides the origin ,there exist a unique point where the three curves cross. And the point indicates that $\pi_1^\star = \bar{\pi}_2 = \delta_1$ and $\nu^\star = \epsilon^\star$. $\dot{m}_2 = 0$ curve is linear
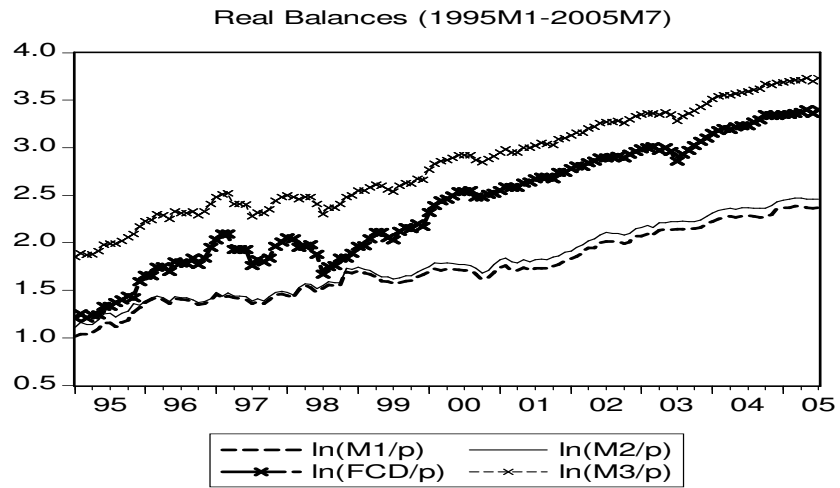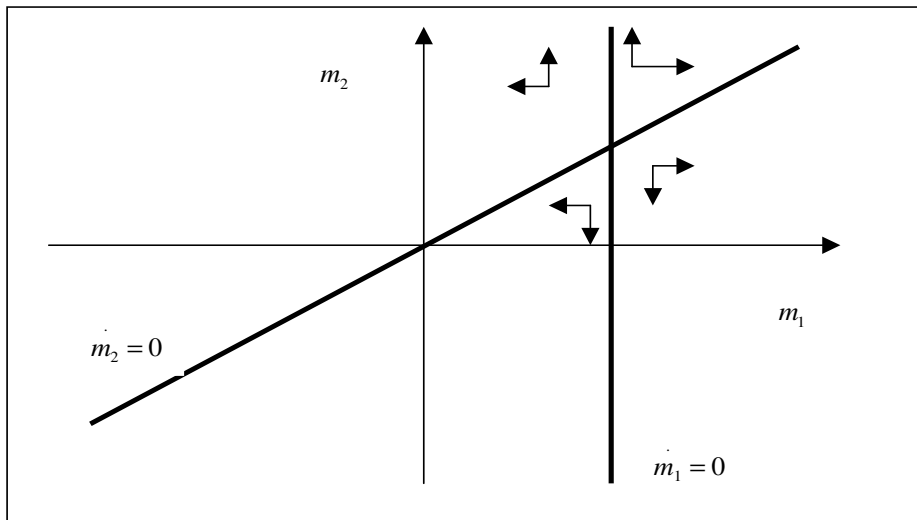
Figure 7: Real Balances .

Figure 8: Case where $\nu = \epsilon$.

and $m_2 = \frac{(1-\gamma)m_1}{\gamma}$ in the condition that $\pi_1 = \bar{\pi}_2$.It is interesting to observe that if $\gamma = 0.5$, in equilibrium the demand for domestic and foreign real balance will be equal. The real return on holding domestic currency is equal to the real return on holding foreign real balance .

The US inflation rate and cambodia inflation rate on average between 2003 and 2004 are equal ,which is 2.5 percent.The average $FCD/M1$ between 2003 and 2004 is 2.5 ($\approx \frac{m_2}{m_1}$) So that we can estimated γ by assuming that the inflation rate of 2.5 percent is an equilibrium inflation rate. $\gamma \approx 0.3$.

7-Empirical Analysis

In this section, I will test for the effect of the ratio of foreign currency deposit to domestic money supply, which is $eM_2/M_1 = m_2/m_1$. Foreign currency deposit (FCD) is used as a proxy for eM_2 . From (17) we see that if $m_2/m_1 \longrightarrow (1-\gamma)/\gamma$, $\pi_1 \longrightarrow \bar{\pi}_2$. The samaller the valu of γ, the larger the value of $(1-\gamma)/\gamma$ and $eM_2/M_1 = m_2/m_1$ needs to increase if the initial value of m_1 is large. In equilibrium, domestic monetary authority loses its power on conducting monetary policy or in other words fiscal discipline is imposed. Since in equilibrium $\pi_1 = \bar{\pi}_2 = \delta_1$. Consequently the higher the ratio, the lower the domestic inflation rate will become . The regression model to be estimated is

$$(\pi_1)_t = \beta_0 + \beta_1(eM_2/M_1)_t$$

Annual data:1988-2004

The result is shown in Tablea. From Table a, The results show that there is statistically significant negative association between the two series when the annual data from 1988 to 2004 is used. The data are from Asia Development Bank-key indicators 2005. Because the CPI is not available from 1987 to 1988, inflation rate from 1988 and 1989 is calculated by the change rate of implicit GDP deflator. And from 1989 to 2004 the inflation rate is calculated by the change rate of consumer price index CPI except for inflation rate in 1995 for which I use GDP deflator because there was adjustment in CPI at that time.

Dickey-Fuller tests do not reject the hypothesis that the ratio of foreign real balances to domestic real balances and inflation rate are random walks. Unfortunately, the null hypothesis of no cointegration can not be rejected at both 1 and 5 percent level. However,The regression model show that there is a negative correlation between the two series, and the result is statistically significant at 5 or 10 percent level. The result is shown in table1.

Monthly Data:1995M1-2005M7

The regression model shows that there is a negative association between the two series but the result is not statistically significant at 5 or 10 percent level. Dickey-Fuller tests do not reject the hypothesis that the ratio of foreign real balances to domestic real balances and inflation rate are random walks. And the

null hypothesis of no cointegration can be rejected at both 1 and 5 percent level.

Seigniorage-Optimizing Inflation rate

Monthly data (1995M1:2005M7) taken from International Monetary Fund is used here. Monthly interest rate is obtained by dividing annual deposit rate by 12. The demand for domestic money is estimated by the following equation to find the seignorage-optimizing inflation rate. The optimum inflation rate would be $-1/b$.

$$Ln(M_1/p_1) = a + b\,interestrate$$

Dickey-Fuller tests do not reject the hypothesis that the ratio of foreign real balances to domestic real balances and inflation rate are random walks. And the null hypothesis of no cointegration can be rejected at 5 percent level. Finally, the revenue -maximizing rate of inflation is estimated to be close to $1/1.416 = 70.6$ percent per month.

8-Conclusion

This paper aims at examing the relationship among inflation rate, exchange rate and the degree of dollarization in a small open economy, which is considered to be Cambodia. Theoretically, in equilibrium, foreign inflation rate, domestic inflation rate and growth rate of domestic money supply are equal. The high ratio of real foreign balance to domestic real balance reduces domestic inflation rate. Domestic monetary authority are constrained to increase domestic money supply by $\bar{\pi}_2$. Empirical result shows that there is a negative relationship between domestic inflation rate and the ratio of foreign currency deposit to domestic money supply.

The estimate of demand for domestic money was also made and seignorage-maximizing inflation was also derived. The result was significant and the inflation rate was quite high , 70.6 percent per month.

The implication of the model is that when dedollarization is needed, appreciation in exchange rate and decrease in inflation is necessary. As shown in figure 5, the higher the growth rate of foreign aid -the high value of $\nu > \epsilon$, the exchange rate will become appreciate against US dollar and domestic inflation rate will become lower. Consequently, domestic residents will tend to hold domestic currency instead of foreign one. Aid will bring large benefits to the economy. However it is not an easy task for policy makers to fulfil their job because Cambodia is a small open economy and imports large volume of goods. And because, in equilibrium the demand for domestic and foreign real balances is not stable due to the unpredictability of the exchange rate in the economy. The exchange rate indeterminancy can be found in Karenken and wallace (1981), Lapan and Enders(1983). Because the loss of seignoarage is large, seigniorage sharing should be the important issue for Cambodia economy.

Sample: 1988 2004
Included observations: 17

$$\pi_t = \beta_0 + \beta_1 \frac{FCD}{M1}$$

	Coefficient	Std. Error	t-Statistic	Prob.
β_0	98.87836	16.60562	5.954513	0.0000
β_1	-44.56324	10.23330	-4.354730	0.0006
R-squared	0.558352	Mean dependent var		40.55294
Adjusted R-squared	0.528908	S.D. dependent var		58.96809
S.E. of regression	40.47340	Akaike info criterion		10.34930
Sum squared resid	24571.44	Schwarz criterion		10.44732
Log likelihood	-85.96903	Durbin-Watson stat		1.653449

Table 1: Effect of FCD/M1 on domestic inflation(Annual data:1988-2004.

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Unit root Test for Inflation

ADF Test Statistic	-1.187054	1% Critical Value*	-3.9635
		5% Critical Value	-3.0818
		10% Critical Value	-2.6829

Unit root Test for FCD/M1

ADF Test Statistic	-0.770800	1% Critical Value*	-3.9635
		5% Critical Value	-3.0818
		10% Critical Value	-2.6829

Cointegration test for Inflation and FCD/M1

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.496075	11.19254	15.41	20.04
At most 1	0.059028	0.912633	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates no cointegration at both 5% and 1% levels

Table 2: Unit root and cointegration test for inflation and $FCD/M1$.

Dependent Variable: INFLA
Method: Least Squares
Date: 01/03/06   Time: 10:41
Sample: 1995:01 2005:07
Included observations: 127

$$\pi = \beta_0 + \beta_1 \frac{FCD}{M1}$$

	Coefficient	Std. Error	t-Statistic	Prob.
β_0	0.006917	0.004679	1.478048	0.1419
β_1	-0.001577	0.002258	-0.698317	0.4863

R-squared	0.003886	Mean dependent var	0.003759
Adjusted R-squared	-0.004083	S.D. dependent var	0.013557
S.E. of regression	0.013585	Akaike info criterion	-5.744083
Sum squared resid	0.023069	Schwarz criterion	-5.699293
Log likelihood	366.7493	Durbin-Watson stat	1.890700

Unit root test FCD/M1

ADF Test Statistic	-1.050577	1% Critical Value*	-3.4847
		5% Critical Value	-2.8851
		10% Critical Value	-2.5792

*MacKinnon critical values for rejection of hypothesis of a unit root.

Unit Root Test Inflation

ADF Test Statistic	-3.881750	1% Critical Value*	-4.0380
		5% Critical Value	-3.4481
		10% Critical Value	-3.1489

*MacKinnon critical values for rejection of hypothesis of a unit root.

Test for cointegration between inflation and FCD/M1

Sample(adjusted): 1995:06 2005:07
Included observations: 122 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: FCD/M1 and inflation
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.220388	31.67318	15.41	20.04
At most 1	0.010601	1.300230	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels

Table 3: Effect of FCD/M1 on domestic inflation(Monthlydata:1995M1-2005M7).

Dependent Variable: ln(M1/p)
Method: Least Squares
Date: 01/03/06   Time: 20:13

Included observations: 127
Ln(M1/p)=a+b interest rate

	Coefficient	Std. Error	t-Statistic	Prob.
a	2.388531	0.028680	83.28229	0.0000
b	-1.416141	0.054845	-25.82082	0.0000
R-squared	0.842115	Mean dependent var		1.727572
Adjusted R-squared	0.840852	S.D. dependent var		0.365369
S.E. of regression	0.145758	Akaike info criterion		-0.998113
Sum squared resid	2.655679	Schwarz criterion		-0.953323
Log likelihood	65.38020	Durbin-Watson stat		0.142447

Unit root test for ln(M1/p)

ADF Test Statistic	-2.660982	1% Critical Value*	-4.0355
		5% Critical Value	-3.4469
		10% Critical Value	-3.1482

*MacKinnon critical values for rejection of hypothesis of a unit root.

Unit root test for interest rate

ADF Test Statistic	-0.489910	1% Critical Value*	-3.4847
		5% Critical Value	-2.8851
		10% Critical Value	-2.5792

*MacKinnon critical values for rejection of hypothesis of a unit root.

Cointegration test for interest rate and M1/p

Sample(adjusted): 1995:06 2005:07
Included observations: 122 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: LOGREALBALANCE MONTHLYINTERESTRATE
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.129943	17.23995	15.41	20.04
At most 1	0.002112	0.257919	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 1 cointegrating equation(s) at the 5% level
Trace test indicates no cointegration at the 1% level

Table 4: The Demand for Money(Monthlydata:1995M1-2005M7).

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