REAL EXCHANGE RATES AND REAL INTEREST DIFFERENTIALS: THE CASE OF A TRANSITIONAL ECONOMY - CAMBODIA

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ABSTRACT

This study examines the existence of long-run equilibrium relationship between the Cambodia's real exchange rates and real interest differentials. The results of cointegration tests (i.e. Engle-Granger tests, and Johansen's multivariate tests without and with structural breaks) show that these variables are cointegrated over the sample period of November 1994 - August 2009. This empirical finding illustrates the fundamental understanding of the role of real interest differential in determining real exchange rates in Cambodia, and it is useful for policy considerations.

Keywords: Cambodia; Real exchange rates; Real interest differentials

1. INTRODUCTION

Cambodia is one of the transitional economies in South East Asia, which has undergone several episodes of transition over the past decades. Starting from a planned economy to a market economy in the late 1980s, and continuing to make a substantial transition from an agricultural based economy to an industry and services based economy in the recent decades. Nevertheless, an important research concern has to be made on Cambodia since the country has been dollarized suddenly in the early 1990s.[1] It is mainly due to the lack of public confidence on the domestic currency (Riel) and also of politically instability. Interestingly, as the empirical evidence reported by Zamaroczy and Sa (2002), Cambodia has been virtually fully dollarized since 1995.[2] Under the era of dollarization, the essential economic policies such as monetary, fiscal, international trade policies and so on are not fully available to Cambodia (Kang, 2005, p. 201). Theoretically speaking, dollarization does help in stabilizing the domestic price level. However, it does not work well as the Cambodian inflation rates are rather unstable.[3]

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[1] The history of dollarization in Cambodia has been briefly documented and it is available to access at ftp://202.47.111.146/ftp/other_publications/NoteMD117-14%20article%20dollarization.pdf Accessed: 31 December 2009.

[2] Consistently, (Ra, 2008)'s study has found that the dollarization is the strongest for Cambodia than of Vietnam and Laos.

[3] The inflation rate is about 1.1% p.a (per annual) in 1995, and it was increased extremely to 10.1% p.a. in 1996. However, deflation of -0.8 and -0.6 have been occurred in 2000 and 2001, respectively. Recently, the Cambodian inflation rates are rising from 1.2 % p.a. (2003) to 7.7%p.a (2007), while there is as high as 25% p.a in the year of 2008. These statistics are obtained from the World Tables, World Bank.

As illustrated by the time series plots in Figure 1, the Cambodian foreign exchange has experienced depreciation in Riels over the period October 1994 - August 2009. A substantive depreciation occurred between 1995 and 1998, and it was followed by a significant depreciation for the remaining periods as shown by a gradually upward trend since 1998. The average exchange rates have depreciated from 2,486 Riels/$US in 2005 to 4,054 Riels/$US in 2008. In fact, the Cambodian government cannot protect its economy from outside shocks through the control of exchange rates and the foreign exchange market (Kang, 2005, p. 205) due to the loss of flexibility and independence in monetary and exchange rate policies as a result of dollarization. Meanwhile, the banks and the financial institutions have been authorized to determine the level of interest rates on deposits and loans in both of the local currency and foreign currencies according to each institution's ability and interest rate policy.[4] Recently, the other interest rates on financial assets such as T-bill rates, bond rates and so on do not exist in Cambodia – no such financial market recently exists in Cambodia. The deposit rates are decreasing from an average of 8.39 % p.a (2008) to 1.91% p.a (2008), while the lending rates (cost of borrowings) are slightly declined from 18.59 % p.a in 2005 to 16.01% p.a in 2008. Both the deposit rates and the lending rates are co-moving since 1995 to 2001, but divesting then with a wider differential between these interest rates, for example as in August 2009, the deposit rate is 1.5% p.a., while the lending rate is 15.97% p.a. These volatilities can be explained by the structural reforms in the interest and external policy that have been proposed and partly implemented such as the Financial Sector Development Strategy for 2006-2015, and Financial Sector Blueprint for 2001-2010.

Figure 1: Plot of nominal exchange rate, deposit rate, lending rate for
October 1994 – August 2009
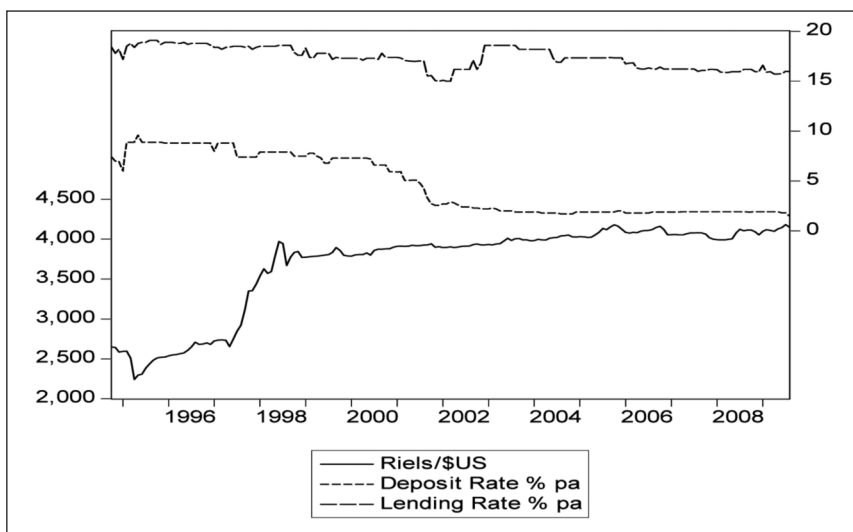
Source: International Financial Statistics, IMF

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4 Prakas on The Liberalization of Interest Rate Setting The Governor of the National Bank of Cambodia, Article 1.
   http://www.nbc.org.kh/read-prakas.asp?id=67#top (Accessed: January, 6 2010).

More recently, Cambodia has been considered as a case study for empirical investigations of the fundamental topics of international macroeconomics. For example, in 1998 Joyeux and Worner (1998) studied the PPP (purchasing power parity) hypothesis in Cambodia. By using monthly observations of January 1991 to April 1997, they found that the market rate (bilateral buy end-of-period market rate Riels/$US) is determined by PPP in the long-run. Consistently, Bahmani-Oskooee, et al. (2009)'s study finds that the Cambodian real exchange rates are stationary - which is validating the PPP hypothesis. Recently, Ra (2008) has modeled the dollarization phenomenon for three transitional economies in south-east Asia, namely Cambodia, Laos, and Vietnam. The empirical tests suggest positive effects of the expected rate of depreciation in market exchange rates on dollarization, and the coefficients are statistically significant only for Cambodia and Laos (not for Vietnam). By using quarterly data of 1996-2006, Lau and Tang (2009)'s study finds an empirical support of twin deficit hypothesis in Cambodia, in which the budget deficits do cause external deficits in the short-run, and a long-run relationship does exist between these fiscal and external variables.

The main objective of this study is to investigate the existence of a long-run equilibrium relationship between real exchange rates and real interest rate differentials in Cambodia by using cointegration approach. This study extends the existing knowledge on the literature of international macroeconomics with a special reference to Cambodia. This theoretically identified equilibrium relationship is an essential input to understand the predictability of real exchange rates, which is relevant for the exchange policy discussions, and evaluate the monetary authority interdependent.[5]

Next section briefly describes the conceptual framework of this study, and the variables and data are then discussed. Section 3 reports the empirical results of cointegration tests between real exchange rates and real interest differentials for Cambodia, and conclusion is made in Section 4.

2. THORETICAL FRAMEWORK AND DATA

Long-run equilibrium relationship between real exchange rates and real interest differentials is theoretically derived from both the PPP (purchasing power parity) and the UIP (uncovered interest parity) (see Meese and Rogoff, 1988). The final derivation yields an equation which captures long-run equilibrium relationship between real exchange rate and real interest differentials (Nakagawa, 2002, pp. 632-633) as in equation (1). It is more commonly named as sticky-price model of exchange rate determination which *ex ante* purchasing power parity is held in the long-run (see, Bahmani-Oskooee, *et al.* 2009) that the PPP is hold for Cambodia).

$$q_t = \beta (r_{t,k} - r^*_{t,k}) + c + \varepsilon_{t+k} \qquad (1)$$

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[5] T,k – r*t,k) +

where q is real exchange rate; r is real domestic interest rate; *denotes foreign (world) country; c is a constant term; and ε is residuals. This reduced form equation depicts the real exchange rate of the home currency is reversely related to the difference between domestic and foreign real interest rates (Nakagawa, 2002, p. 633). Equation (1) is similar to Model Ia by Beng and Ying (2000, p. 96).

The monthly data of real exchange rates (q) and real interest rate differentials (i.e. deposit rate - inflation rate, r^D and lending rate - inflation rate, r^L) spans between November 1994 and August 2009. The raw data are obtained from the *International Financial Statistics,* International Monetary Fund. The real interest rates are constructed by multiplying nominal exchange rates, Riels/\$US with a ratio of foreign price level to domestic price level (i.e. U.S.'s CPI and domestic CPI, respectively). The real rate of interest is the difference between nominal interest rate *(i)* and inflation rate. The domestic interest rates *(i)* are deposit rates (i^D) and lending rates (i^L) since the relevant rates of returns such as T-bill rates and bond rates do not exist in Cambodia.

A standard procedure to cointegration is to ensure the underlying macroeconomics variables are non-stationary or $I(1)$ process (Engle & Granger, 1987). Table 1 illustrates the results of augmented Dickey-Fuller (ADF) tests that the three variables are non-stationary in levels, but stationary after the first-differenced $\sim I(1)$. It allows cointegration testing.

Table 1: Augmented Dickey-Fuller (ADF) tests (Dickey & Fuller, 1979)

Variables	Test statistics
q	-0.609 (0.978) [1]
Δq	-4.240 (0.001)*** [7]
r^D	-0.934 (0.949) [11]
Δr^D	-22.057 (0.000)*** [0]
r^L	-1.864 (0.669) [8]
Δr^L	-22.067 (0.000)*** [0]

Notes: Level constant and trend, first-differenced constant only. Maximum of 13 lags modified AIC [.] p-value in (.)
*** denotes significant at 1% level.

3. EMPIRICAL RESULTS

Initially, Engle and Granger (1987)'s two-step procedure is applied on equation (1). The Ordinary Least Squares (OLS) estimations and ADF tests on the estimated residuals, ε (ε') are reported in Table 2. The real interest rate differential for Cambodia's deposit rates (r^D) has significant negative impact on the Cambodian real exchange rates, while the real interest rate differential for Cambodia's lending rate (r^L) exhibits positive relationship. However, the ADF tests on the residual series (u and u') suggest cointegrating relation $q - r^D$, but it is not the case for $q - r^L$. Hence, a long-run estimation of relation $q - r^L$, can be considered as 'spurious' regression, or no long-run relationship between q and r^L.

Table 2: Engle-Granger cointegration tests

$q = -0.016r^D + 8.219 + u$	$q = 0.009r^L + 8.092 + u'$
p-value (0.000) (0.000)	*p*-value (0.028) (0.000)
ADF (ε) test statistic, -1.682 (0.088)**	ADF (ε') test statistic, -1.267 (0.189)

Notes: ** denotes significant at 5% level.

The long-run relationship between real exchange rates and real interest rate differentials is further reaffirmed by the Johansen's multivariate tests Johansen and Juselius (1990) with imposing various lag length as suggested by a set of information criterions (see Table 3). Both the trace statistics and maximum eigen-value statistics show a cointegrating vector of $q - r^d$ rather than of $q - r^L$, which is in line with the former finding of Engle-Granger tests.

Table 3: Johansen's multivariate cointegration tests

	$q - r^d$			$q - r^L$		
	SC	HQ	LR, FPE & AIC	SC & HQ	FPE & AIC	LR
Lag length	2	3	12	2	5	9
Trace statistics	20.509***	18.731**	23.605***	11.006	10.252	7.441
	(0.008)	(0.016)	(0.002)	(0.211)	(0.262)	(0.527)
Max-Eigen statistics	18.648**	17.281**	19.048***	9.659	7.101	4.535
	(0.010)	(0.016)	(0.008)	(0.235)	(0.477)	(0.799)

Notes: The trend assumption allows for liner deterministic trend in data, while the intercept (no trend) is imposed into cointegrating equation and test VAR. LR: sequential modified LR test statistic; FPE: final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; and HQ: Hannan-Quinn information criterion. The null hypothesis of none cointegration vector is being tested by the trace statistics and maximum eigen-value statistics. *** and** denote significant at 1% and 5% level, respectively, and (.) is *p*-value.

To note that both cointegration testing procedures of the Engle-Granger tests and the Johansen's multivariate tests do not take the possible structural breaks into account since it is relevant for Cambodia which is experiencing a series of structural reforms and shocks in the country over the past decades. Applying the approach proposed by (Lanne, *et al*. (2002), two break dates have been detected and identified i.e. 1995M4 for the q, and 1997M7 for both r^D and r^L.[6] The Johansen's multivariate tests with two break dates show the existence of a cointegrating vector between q and r^d, while no cointegration has been suggested for between q and r^L (Table 4).

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[6]   The procedure involves choosing a reasonably large AR order as a first step, then picking the break date which minimizes the GLS objective function used to estimate the parameters of the deterministic part. The two break dates suggested above may be linked to the following events that the Cambodian economy has been expanded and financial intermediation has been deepened since 1995, which later causes the fluctuations in the composition of agents' dollar assets (Zamaroczy & Sa, 2002, p. 20). According to (Zamaroczy & Sa, 2002, p. 3), although, the country has achieved good economic progress during 1994-1995 under the International Monetary Fund (IMF) supported program, factional fighting broke out briefly in July 1997, resulting in a temporary setback in development and foreign investment.

Table 4: Johansen's multivariate tests with unknown structural breaks

Long-run relation	Trace statistics for the null hypothesis of none cointegrating vector, r0 = 0
q -r^D	38.38 (*p*-value, 0.0018)***
q -r^L	21.54 (*p*-value, 0.2554)

Notes: Two break dates have been identified i.e. 1995M4 for real exchange rates (q) and 1997M7 for deposit rates and lending rates (R^D and R^L). Three lags as suggested by AIC from a maximum of 12 lags. An intercept is included. *** denotes significant at 1% level. The computation of trace statistics with two break dates were carried out by JMulti statistical software (http://www.jmulti.de/).

4. CONCLUSIONS

This study explores the long-run equilibrium relationship between real exchange rates of Riels/$US and real interest differentials in a transition economy, Cambodia. A battery of cointegration tests i.e. Engle-Granger tests, Johansen's multivariate tests without and with unknown structural break(s), have been used for analysis. The monthly data between November 1994 and August 2009 supports this theoretical relationship between real exchange rates and real interest rate differentials (Cambodia's deposit rates). This finding initially enhances fundamental knowledge of the so-called sticky-price model of exchange rate determination in Cambodia, in which the country's real exchange rates can be predicted by the variation between domestic real interest rates (real deposit rates, r^D) and world real interest rates (r^*). By the same token, as following Beng and Ying (2000), the impossible holy trinity is held for Cambodia, in which theoretically, the monetary authority (National Bank of Cambodia) is not able to insulate the exchange rate from the effect of domestic monetary policy. Perhaps, the finding from this study is elementary in order to gather an empirical output on the basic real exchange rate model, rather than offering an advanced framework which taking into consideration of a dollarized country.

A brief policy implication can be made from the study. Both the real exchange rate (Riels/$US) and real interest differentials are moving together in the long-run - the traders in the foreign exchange market can consider the real interest rates differentials as explanatory variable to make reasonable [at least] prediction of the future real exchange rate between the trading countries when pricing forward exchange rates on the current market exchange rate futures contracts. It is particularly interesting for the situation that Cambodia has tried to implement (or partially implemented) forced de-dollarization such as forced conversion of $US deposit into domestic currency imposed by Mexico and Pakistan in 1982 and 1998, respectively. The costs of de-dollarization, in general are unpredictable for Cambodia with long period dependency of $US as trading currency - include substantial capital flight, decreases in private sector bank credit, lost of consumer confident, and so on.

A large differential between high lending rate and low deposit rate (Fig. 1) also results a need for a close monitor and an effective "financial" policy by the National Bank of Cambodia in

order to stabilize the inflation rate and achieve sustainable growth. However, it is not a practical case that high lending rate will discourage domestic investment due to high cost of borrowing while low supply of loanable fund results from low deposit rate – reducing the resources for domestic investment.

As noted early, with the support of impossible trinity hypothesis, Cambodia [theoretically] only can realize the free capital flow, but with fixed exchange rates and limited monetary policy under the dollarization era. For example, the basic instrument for the conduct of monetary policy – open market operations do not exist in Cambodia due to a lack of government-backed securities but rather to purchase of sell $US against the Riels in order to control the exchange rate fluctuation and maintain a desirable level of inflation.

However, further research is needed for this topic with a more developed and sophisticated analytical framework to be developed. A better (more precise) understanding of the inter-linkages between real exchange rate and real interest differentials in Cambodia can be generated by incorporated up-to-date issues such as financial openness and de-dollarization.

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