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9. July 2014

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Abstract

In this paper, we investigate whether or not nominal devaluation leads to real devaluation in Laos by using the ARDL bounds testing and the Granger causality test in a VECM framework. Our empirical evidence shows that nominal devaluation Granger causes real devaluation in short run and long run. This finding implies that nominal devaluation leads to real devaluation.

Keywords: Nominal devaluation, real devaluation, Laos

JEL classification: F31

1. Introduction

The devaluation of the nominal exchange rate is a key policy to stimulate exports in many LDCs. The nominal devaluation could improve the trade balance in two ways. First is by making exports cheaper in terms of foreign currency that leads to an increase in the exports' demand in international markets. Second is by making imports more expensive in terms of domestic currency that leads to a decline in imports (Bahmani-Oskooee, and Kandil, 2007). However, another cost of devaluation is an increase in the inflationary pressure that damages the export sector and hence the whole economy. Therefore, investigating the relation between real and nominal devaluation is crucial. The depreciation of the nominal effective exchange rate could improve trade if the nominal devaluation leads to real devaluation only in short run, and if it leads to depreciation of real effective exchange rate (Bahmani-Oskooee, 2001a; Shahbaz, 2009).

However, the relation between nominal and real effective exchange rates is inconclusive in the literature. Most studies find that the nominal devaluation leads to real devaluation in short and medium runs (Vaubel, 1976; Connolly and Taylor, 1976, 1979; Bruno, 1978; Edwards, 1988, 1994). But some researchers find that nominal devaluation leads to real devaluation in short and long runs; for instance, Bahmani-Oskooee and Miteza (2002) for 19 LDCs and Bahmani-Oskooee and Kandil, (2007) for MENA. But, Holmes (2004) finds that nominal devaluation does not lead to real devaluation in African countries. And, Bahmani-Oskooee and Gelan, (2007) show that real devaluation results from nominal devaluation in medium and long runs but in short run, the results is inconclusive. Bahmani-Oskooee and Harvey (2007) investigate the relation between nominal and real devaluation by using data from LDCs. They find that nominal devaluation leads to real devaluation. In single country studies, Shahbaz, (2009) applies the ARDL bounds testing approach to establish a long-run relation between both of the variables. The results indicate that nominal devaluation is positively linked with real devaluation but that the causality is running from real to nominal devaluation in Pakistan. In the Philippines, Wahid and Shahbaz, (2009) report that nominal devaluation leads real devaluation in short run as well as in long run.

Laos has faced large chronic trade deficits since her independence in 1975. These trade deficits accounted for 6.95 % of the GDP in 2011 (BOL, 2011). In addition, Laos also experienced high inflation during the Asian financial crisis in 1997. Therefore, management of the exchange rate is a crucial factor for Laos in order to control inflation and to promote trade. Nominal and real effective exchange rates of industrial countries have been constructed by the IMF since 1971. However, the IMF does not provide these rates for LDCs. The real effective exchange rates for some LDCs were constructed by Bahmani-Oskooee (1995) and Bahmani-Oskooee and Miteza (2002). However, Laos is not content with their studies. Therefore, in this study, we construct nominal and real effective exchange rates' indices. However, to the best of our knowledge, there is no study investigating the relation between these rates for Laos.[1] This study is a pioneering effort to examine this relation for Laos by using the ARDL bounds testing approach. This study contributes to the literature in three ways. Firstly, it is a pioneering effort in investigating the relation between nominal and real effective exchange rates in Laos. Secondly, the study uses the ARDL bounds testing approach developed by Pesaran et al. (2001). Finally, we investigate the direction of causal relation between nominal and real devaluations by applying the VECM Granger causality test.

The remainder of this paper is organized as follows. Section 2 describes the theoretical framework and the empirical modeling. Section 3 contains the empirical results. Section 4 concludes.

2. Theoretical framework and empirical model

The empirical method follows Bahmani-Oskooee and Miteza (2002), Bahmani-Oskooee and Kandil (2007), and Shahbaz (2009) who expanded the method. The empirical equation is modeled as follows:

$$\ln REER_t = a_1 + a_2 \ln NEER + \mu_t \qquad (1)$$

Where, $REER_t$ is real effective exchange rate, $NEER_t$, is nominal effective exchange rate, and μ_t is the error term. All of the series are converted into natural logarithms[2]. The study consists of quarterly data from 1993Q1 to 2010Q4. This time span is the longest period of data that is available for Laos. The data on all of the variables comes from the International

[1]Chansomphou and Ichihashi (2010) estimate the misalignment of the exchange rate in Laos. Kyophilavong and Toyoda (2007) analyze the impact of the exchange rate on the Laos economy using a macroeconometric model.

[2]The log-linear specification generates more efficient results as compared to the typical specifications (Layson, 1983; Shahbaz, 2010).

Financial Statistics CD-ROM (2012). The calculation of $REER_t$ is based on Bahmani-Oskooee and Miteza, (2002) and Bahmani-Oskooee and Kandil, (2007) and is shown below:

$$REER_j = \sum_{i=1}^{n} \alpha_{ij} \left(\frac{(P_j * EXR_{ij} / P_i)_t}{(P_j * EXR_{ij} / P_i)_{95}} X\ 100 \right) \qquad (3)$$

where $REER_j$ is an index of the real effective exchange rates in Laos, the P_j is the consumer price index (CPI) in Laos, the P_i is CPI for trading partner i, EXR_{ij} is nominal bilateral exchange rate between Laos and country i that is defined as the number of i's currency per unit of Laos' currency (kip), then is the number of trading partners, the α_{ij} is the share of Laos' import from trading partner i in the base period (1995), and the $\sum \alpha_{ij} = 1$. The nominal effective exchange rate ($NEER_j$) is constructed the same way as the $REER_t$:

$$NEER_j = \sum_{i=1}^{n} \alpha_{ij} \left(\frac{(EXR_{ij})_t}{(EXR_{ij})_{95}} X\ 100 \right) \qquad (4)$$

EXR_{ij} is defined as the number of units of i's currency per unit of Laos' currency (kip) that indicates that the decrease in $REER_j$ and $NEER_j$ reflects the depreciation, and the increase reflects the appreciation of Laos' currency in real and nominal terms. This equation makes possible the selection of Laos' five main trading partners[3].

We now apply Pesaran et al.'s (2001) ARDL bounds testing approach. A number of advantages exist to this approach that can be compared to the Johansen cointegration techniques (Johansen and Juselius, 1990).[4] The ARDL bounds testing approach makes a distinction between the dependent and explanatory variables. In order to implement the bounds testing procedure, (1) is transformed to the unconditional error correction model (UECM) below:

[3] The main trading partners of Laos are Thailand, Vietnam, China, Korea, and Japan.

[4] Firstly, a smaller sample size is required to compare it to the Johansen cointegration technique (Ghatak and Siddiki, 2001). Secondly, the ARDL bounds testing approach does not require that the variables be integrated at the same order. The approach can be applied whether the variables are purely I(0) or I(1), or mutually integrated. Thirdly, the approach provides a method of assessing the short- and long-run effects of a variable on another simultaneously, and it also separates the short- and long-run effects (Bentzen and Engsted, 2001).

$$\Delta \ln REER_t = c_0 + \sum_{i=1}^{p} c_i \Delta \ln REER_{t-i} + \sum_{i=1}^{p} d_i \Delta \ln NEER_{t-i} + \pi_1 \ln REER_{t-1} + \pi_2 \ln NEER_{t-1} + u_{1t} \quad (5)$$

$$\Delta \ln NEER_t = d_0 + \sum_{i=1}^{p} e_i \Delta \ln REER_{t-i} + \sum_{i=1}^{p} f_i \Delta \ln NEER_{t-i} + \lambda_1 \ln REER_{t-1} + \lambda_2 \ln NEER_{t-1} + u_{2t} \quad (6)$$

where Δ denotes the first different operator, the c_0 and d_0 are the drift components, p is the maximum lag length, [5] and u_t is the usual white noise residuals. The procedure of the ARDL bounds testing approach has two steps. The first step is a F-test for the joint significance of the lagged-level variables. The null hypothesis for the non existence of a long-run relation is denoted by $\ln REER_t / \ln NEER_t$ and H_0: $\pi_1 = \pi_2 = 0$ against H_a: $\pi_1 \neq \pi_2 \neq 0$. Pesaran et al. (2001) generate lower and upper critical bounds for the F-test. The lower bound's critical values assume that all of the variables are I(0), while the upper bound's critical values assume that all of the variables are I(1). If the F-statistic exceeds the upper critical bound, then the null hypothesis of no cointegration among the variables can be rejected. If the F-statistic falls below the lower bound, then the null hypothesis of no long-run relation is accepted[6]. The next step is the estimation of long-and-short run parameters by using the error correction model (ECM). To ensure the convergence of the dynamics to long-run equilibrium, the sign of the coefficient for the lagged error correction term (ECM_{t-1}) must be negative and statistically significant. Further, the diagnostic tests comprise the testing for the serial correlation, functional form, normality, and the heteroscedasticity (Pesaran and Pesaran, 2009).

Once the variables are cointegrated for the long-run relation, then long- as well as short-run causality can be investigated (Tiwari and Shahbaz, 2013; Shahbaz and Rahman, 2012). The existence of a long-run relation between nominal and real effective exchange rates requires us to detect which direction the causality takes between the variables by applying the VECM

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[5]Pesaran et al. (2001) cautions that it is important to balance choosing the lag length.

[6]If the calculated F statistics falls between the lower and upper bounds, it is inconclusive. The alternative efficient way of establishing cointegration is testing significant negative lagged error-correction term (Kremers et al. 1992; Bahmani-Oskooee, 2001b).

(vector error correction method) Granger causality framework. The vector error correction method (VECM) is as follows:

$$(1-L)\begin{bmatrix}\ln REER_t \\ \ln NEER_t\end{bmatrix} = \begin{bmatrix}\phi_1 \\ \phi_2\end{bmatrix} + \sum_{i=1}^{p}(1-L)\begin{bmatrix}a_{11i} & a_{12i} \\ b_{21i} & b_{22i}\end{bmatrix} + \begin{bmatrix}\xi_1 \\ \xi_2\end{bmatrix} \times \begin{bmatrix}\ln REER_{t-1} \\ \ln NEER_{t-1}\end{bmatrix} \times [ECM_{t-1}] + \begin{bmatrix}\mu_{1t} \\ \mu_{2t}\end{bmatrix} \quad (7)$$

where the difference operator is $(1-L)$ and the ECM_{t-1} is generated from long-run relation. The long-run causality is indicated by the significance of the coefficient for the ECM_{t-1} by using the t-test statistic. The F statistic for the first differenced lagged independent variables is used to test the direction of short-run causality between the variables.

3. Empirical results

The critical bounds are based on the assumption that the variables are I(0) or I(1) (Pesaran et al. 2001; Narayan, 2005). Therefore, before conducting the bounds test for cointegration, we apply a unit root test to make sure that our variables are not ordered at I(2), otherwise the F-test could be spurious if the variables are stationary at the second difference (Ouattara, 2004). We apply the augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979, 1981) and PP test (Phillips and Perron, 1988). The results of the unit root test show that $\ln NEER_t$ and $\ln REER_t$ are stationary at their different forms with the intercept and the trend (Table-1). This stationarity implies that our variables are ordered at I(1).

Table-1: Unit Root Test

Variable	ADF				PP			
	Level		Difference		Level		Difference	
	Intercept	With Trend	Intercept	With Trend	Intercept	With Trend	Intercept	With Trend
$\ln REER_t$	-1.1776 [0.6810]	-2.0896 [0.5439]	-8.3024* [0.0000]	-4.9091* [0.0008]	-1.3713 [0.5927]	-1.8474 [0.6728]	-11.1791* [0.0001]	-11.2713* [0.0000]
$\ln NEER_t$	-1.5418 [0.5073]	-1.3037 [0.8796]	-2.1016 [0.2447]	-2.3186 [0.4189]	-1.0455 [0.7337]	-1.0207 [0.9351]	-5.2858* [0.0000]	-5.3293* [0.0002]
Note: * show the significance at 1%.								

We select the optimal lag length based on the AIC. The result indicates that two is the optimal lag order[7]. In order to account for the fact that we have a relatively small sample size, we produce new critical values for the F-test that are computed with stochastic simulations that use 20,000 replications. Table-2 reports the computed F-statistics that test for the long-run relation between the variables**.**

Table-2: The Results of the ARDL Cointegration Test

Dependent Variable	$\ln REER_t$	
F-statistics	5.692**	
Critical values	5 per cent level	10 per cent level
Lower bounds	5.041	4.092
Upper bounds	5.867	4.839
Adi R-square	0.273	
F-Statistics	2.610	
Durbin Watson Test	1.892	
Note: ** shows the significance at 5% level.		

When $\ln REER_t$ is dependent variable, then our calculated F-statistic is $F(\ln REER_t / \ln NEER_t) =$ 5.692 and is greater than upper critical bound at 10% level of significance. In addition, F-statistic suggests that there is cointegration between $\ln REER_t$ and $\ln NEER_t$ in Laos. The long and short runs are shown in Table 3. In long run, nominal effective exchange rate is not statistically significant enough to determine $\ln REER_t$ because $\ln REER_t$ equation has relatively weak cointegration. The F-value exceeds upper critical bound at 10% significance level but falls between lower and upper bounds at 5% significance level. This result is consistent with Bahmani-Oskooee and Gelan (2006) for some African countries, Shahbaz, (2009) for Pakistan, and Bahmani-Oskooee and Kandil (2007) for some Middle Eastern and North African countries. In short run, the empirical evidence shows that $\ln NEER_t$ has a positive and significant impact on $\ln REER_t$. This impact implies that

[7] We set the maximum lag order up to eight to ensure sufficient degree of freedom for econometric analysis because our sample size is quite small. In order to save spaces, the results are not presented but are available upon request.

devaluation of $\ln NEER_t$ leads $\ln NEER_t$ in short run. However, the estimate of ECM_{t-1} is statistically significant with a negative sign at 5% level of significance. This finding shows the speed of adjustment from short run to long run. We find that the deviations in short run to long run are corrected by 20.30% in each quarter that shows the low speed of adjustment in $\ln REER_t$ model. The diagnostic tests are also applied for the adequacy of specification of model. The diagnostic tests suggest that the estimates are free from serial correlation and misspecification of short-run model, and heteroskedasticity (Table-4).

Table-3: Long-run and Short-run Analysis

Dependent Variable = $\ln REER_t$		
Long-run Results		
Variable	Coefficient	T-Statistic
Constant	2.037*	107.388
$\ln NEER_t$	-0.012	-1.042
Short-run Results		
Variable	Coefficient	T-Statistic
Constant	0.006*	3.429
$\Delta \ln NEER_t$	0.477*	9.326
ECM_{t-1}	-0.203*	-5.620
Note: * denotes the significant at 1per cent level respectively.		

Table-4: Diagnostic Tests for $\ln REER_t$ as Dependent Variables

	F-version		LM-version	
	Statistics	P- Value	Statistics	P- Value
A: Serial Correlation	F(4, 79)=1.798	0.137	$\chi 2$ (4)=7.178	0.127
B: Functional Form	F(1, 82)= 1.510	0.223	$\chi 2$ (1)=1.555	0.212
C: Normality	N/A		$\chi 2$ (2)=69.393	0.000
D: Heteroscedasticity	F(1, 84)= 0.745	0.390	$\chi 2$ (1)=0.756	0.384

Table-5: The VECM Granger Causality Analysis

Variables	Short-run		Long-run
	ΔlnREER $_{t-1}$	ΔlnNEER $_{t-1}$	ECT$_{t-1}$
ΔlnREER	-	6.455* [0.013]	-0.136** [0.022]
ΔlnNEER	51.705* [0.000]	-	-0.012*** [0.077]

Note: *, ** and *** denote the significant at 1, 5 and 10%levels respectively

Table 5 reports the results of Granger causality. The Table-5 shows that the estimates of ECM_{t-1} are statistically significant with negative signs at 1% level. The statistical significance of ECM_{t-1} indicates the shock exposed by the system converging to long-run equilibrium path. In long run, we find that the causality direction is from $\ln NEER_t$ to $\ln REER_t$ and same is true from the opposite side. The feedback effect exists between $\ln REER_t$ and $\ln REER_t$ in short run. This finding suggests that devaluation of nominal effective exchange rate leads to devaluation of real effective exchange rate in long run as well as in short run.

4. Conclusion and Recommendations

The relation between nominal and real effective exchange rates is crucial for improving the trade balance. Therefore, we investigate this relation in Laos. The empirical evidence shows that the causality runs from nominal devaluation to real devaluation and vice versa in short run and long run. This evidence implies that devaluation of nominal exchange rate leads to devaluation of real exchange rate in Laos. This direction is crucial for policy makers in order to better formulate the exchange-rate policy that improves the trade balance. Since Laos has suffered from a trade balance and the monetary authority has adapted the manage-floating exchange-rate regime (Kyophilavong, 2010), devaluation of nominal exchange rate might be considered in order to improve the trade balance in short-and-long runs. But as Laos imports most of its materials, the side effect from devaluation, namely inflationary effects, should also be considered.

Acknowledgement

The authors are grateful to the anonymous referees of the journal for their extremely useful suggestions to improve the quality of the paper. Usual disclaimers apply.

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