Analyzing the Sustainability of Current Account in ASEAN Countries: Test of Intertemporal Borrowing Constraints

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ABSTRACT: The objective of this paper is to investigate the sustainability of current account imbalances by using the data of five ASEAN countries, namely, Indonesia, Malaysia, Philippines, Singapore and Thailand over the 1981-2008 periods. Sustainability of current account for ASEAN countries is analyzed under intertemporal borrowing constraint (IBC) approach by performing an empirical analysis of Pedroni (1999) panel cointegration between exports and imports plus net transfer payments plus net interest payments. The empirical results of panel cointegration test show that these variables are cointegrated for whole period and two sub-periods. To find regression coefficient we use panel FMOLS and DOLS estimators. It is found that the coefficient is not significantly equal to one but very close to one. The overall results provide evidence in favour of the sustainability of the current account for five ASEAN countries as a group.

Keywords: panel data unit-root test; current account; solvency
JEL Classifications: C23; F30; F32

1. Introduction

The sustainability of current account has been receiving increasing attention from economist. Since current account represents an indicator of a country's economic performance, it is an important barometer to both policymakers and investors. As Fountas and Wu (1999) stated that short-run current account deficits may not be considered bad, as they may reflect reallocation of capital to the country where capital is more productive. However persistent payment imbalances can have serious effect. One of them is that they might increase interest rates to attract foreign capital to sustain an increasing current account deficit. Other effect is that these measures impose an excessive burden on future generations as the accumulation of larger debt will imply increasing interest payments and thus lower future standards of living.

The importance of the current account is witnessed by its widespread use in early warning indicators of currency crises (Jahangir et al., 2000; Edwards, 2001). Large and persistent external imbalances are often assumed to lead to financial /currency crises. For example, the currency crises in Chile and Mexico (early 1980s), the UK and Nordic countries (late 1980s), Mexico and Argentina (mid 1990s), East Asian countries (late 1990s) and more recently in Turkey (2001) are often associated with large and persistent current account deficits.

While high and persistent current account deficits could be a sign of unsustainability, there is no agreement of what constitutes a high or persistent current account deficit. Milesi-Ferretti and Razin (1996) have argued that excess of 5% current account deficit to GDP ratio is large and unsustainable, although countries with larger deficits have not always experienced crises. While some countries have suffered a crisis following only a few years of high current account deficits, other countries have faced a high current account deficit for over a decade without a crisis.

In the empirical literature on current account sustainability there have been basically two main approaches. Both approaches suggest possible techniques to test the sustainability of a current account under intertemporal borrowing constraint (IBC) approach. The first approach is based on the univariate time series properties of the current account; the second approach is based on the long-run relationship between exports and imports (bivariate approach). In this paper we followed second approach.

The question of sustainability of current account has been studied in recent years by a large literature. Unit root and cointegration tests have provided useful tools in gaining insight into the long-run implications of current account. S Husted (1992), Wickens and Uctum (1993), Ahmed and Rogers (1995), Milesi-Ferretti and Razin (1996), Jyh-Lin Wu, Stilianos Fountas, and Show-Lin Chen (1996), Paul Cashin and John McDermott (1998), Fountas and Wu (1999), Ho-Don Yan (1999), Nicholas Apergis, Constantinos Katrakilidis, and Nicholas Tabakis (2000), Jyh-Lin Wu (2000), Wu et al., (2001), Arize (2002), Baharumshah et al. (2003), Irandoust and Ericsson (2004), Narayan and Narayan (2005), Onel and Utkulu (2006), Kalyoncu (2005,2006), Azgun and Ozdemir (2008), Kónya (2009), Sohrabji (2010), Kalyoncu and Ozturk (2010), Binatlı and Sohrabji (2012) are examples of these large literature.

In this study we investigate sustainability of current account imbalances by using the data of five ASEAN countries, namely, Indonesia, Malaysia, Philippines, Singapore and Thailand. The remainder of the paper is organized as follows. Section 2 defines the analytical framework. Section 3 explains econometric methodology. Section 4 describes data and presents empirical results. Section 5 concludes.

2. Analytical Framework for Testing

Husted (1992) present a theoretical framework to test for sustainability based on Hakkio and Rush's (1991) procedure. Husted's approach began by noting that an open economy faces the following budget constraint for each period *t:*

$$C_t = Y_t + B_t^f - I_t - (1 + r_t)B_t^f \tag{1}$$

where C_t is current consumption (public and private) in period *t*, Y_t is the output in period *t*, I_t is investment in period *t* , r_t is the one period world interest rate, B_t^f is the size of international borrowing which could be positive or negative.

Since this budget constraint must hold for every time period, the period by period budget constraint can be added up to form the intertemporal budget constraint is given by

$$B_t^f = \sum_{i=1}^{\infty} \mu_i \left[Y_{t+i} - C_{t+i} - I_{t+i} \right] + \lim_{i \to \infty} \mu_i B_t^f \tag{2}$$

where $TB_t = X_t - M_t = Y_t - C_t - I_t$. Here TB denotes trade balance.

Therefore the economy's budget constraint can be expressed as

$$B_t^f = \sum_{i=1}^{\infty} \mu_i \left[TB_{t+i} \right] + \lim_{t \to \infty} \mu_i B_i^f \tag{3}$$

Equation (3) says that when the last term (limit term) equals zero, the amount that a country borrows (lends) in international market equals the present value of the future trade surpluses (deficits). If, for example, the current stock of foreign debt is bigger than the present value of future trade balances, then the country's debt is in a "bubble" and thus the current account is not sustainable.

In order to derive a testable model, Husted (1992) makes several assumptions following Hakkio and Rush (1991). Assuming that the world interest rate is stationary with unconditional mean *r* and making further manipulation equation (3) may be expressed as

$$M_t + rB_{t-1}^f = X_t + \sum_{i=0}^{\infty} \frac{\Delta X_{t+i} - \Delta Z_{t+i}}{(1+r)^{i-1}} + \lim_{i \to \infty} \frac{B_{t+i}^f}{(1+r)^{i-1}} \tag{4}$$

where $Z_t = M_t + (r_t - r)B_{t-1}^f$. Now, subtracting X_t and then multiplying both sides of the later equation by minus 1, we get

$$CA_t = X_t - M_t - rB_{t-1}^f = \sum_{i=0}^{\infty} \frac{\Delta Z_{t+i} - \Delta X_{t+i}}{(1+r)^{i-1}} - \lim_{i\to\infty} \frac{B_{t+i}^f}{(1+r)^{i-1}} \tag{5}$$

Assumed that X and Z are both I(1) processes, equation (5) becomes

$$X_t = \alpha + MM_t - \lim_{i\to\infty} \frac{B_{t+i}^f}{(1+r)^{i+1}} + \varepsilon_t \tag{6}$$

where $MM_t = M_t + r_t B_{t-1}^f$.

Assuming that the second term in (6) equals zero, then (6) can be written as a simple regression equation

$$X_t = \alpha + bMM_t + \varepsilon_t \tag{7}$$

Under the null hypothesis that the economy is satisfying its intertemporal budget constraint, b should be equal to 1 (b=1) and ε_t sould be stationary. In other words, as shown by Hakkio and Rush, if X and MM are I(1), then under the null, they are cointegrated.

In this study we follow Husted (1992) model. In the empirical analysis we estimated $X_t = \alpha + bMM_t + \varepsilon_t$ co-integration regression. In this equation, X is exports of goods and services and MM is imports of goods and services plus net transfer payments and net interest payments.

The empirical results may allow establishing several conclusions related to the sustainability of the current account:
- if there is no co-integration the current account is not sustainable;
- if there is co-integration with b = 1, the current account is sustainable,
- if there is co-integration, with b < 1, economies exports growing lower than economy's imports, and the current account may not be sustainable.

As Hakkio and Rush (1991) demonstrate in the context of government finance also if *MM* and *X* are non stationary variables in level, the condition 0 < b < 1 is a sufficient condition for the budget constraint to be obeyed. However, when X and MM are expressed as a percentage of GDP or in per capita terms, it is necessary to have b = 1.

3. Methodology
3.1. Panel Unit Root and Panel Cointegration

In this paper, current account sustainability in the five countries is studied by testing the existence of co-integration between exports and imports plus net transfer payments and net interest payments. Co-integration analysis developed in the mid-80s introduced the idea that even if underlying time series are non-stationary, linear combinations of these series might be stationary. Therefore, before employing panel co-integration techniques, it is essential to verify that all variables are integrated of order one in levels. In recent years some tests for unit root within panels are developed in the literature. Levin and Lin (1992, 1993), Im et al. (1997), Maddala and Wu (1999), Kao (1999) and Quah (1994) have developed panel unit root tests. In this study Im, Pesaran and Shin (hereafter IPS) tests are used. The IPS test is more important because it is appropriate for a heterogeneous regressive root under an alternative hypothesis. We briefly describe the IPS model: Suppose that there is a group of N series, X_{it}, which have the following time-series representation:

$$\Delta X_{it} = \alpha_i + \beta_i X_{it-1} + \sum_{j=1}^{w_{ij}} \delta_{ij} \Delta X_{it-j} + \varepsilon_{it}, \quad i = 1,....,N \text{ and } t = 1,.....,T. \tag{8}$$

The IPS test examines the null hypothesis:

$H_0 : \beta_1 = \beta_2 = ... = \beta_N = 0,$ against

$H_a : \beta_i < 0, \text{ for some } i.$

The IPS statistic is defined as:

$$\bar{z} = \sqrt{N}\left[\bar{t} - E(\bar{t})\right] / \sqrt{Var(\bar{t})}, \tag{9}$$

where $\bar{t} = (1/N)\sum_{i=1}^{N} t_i$. t_i is the t statistics of $\hat{\beta}_i = 0$, $E(\bar{t})$ and $Var(\bar{t})$ are the mean and variance of $\bar{t}$, respectively.

In recent years some tests for unit root within panels are developed in the literature. Pedroni (1995, 1999, 2000), Phillips and Moon (1999), Kao (1999) and Kao and Chiang (2000) have developed panel cointegration test. This paper uses the panel cointegration test of Pedroni (1999) to research the relationship between X and MM. The equation for the panel cointegration tests for Pedroni (1999) is as follows:

$$X_{it} = \alpha_i + \delta_t + \beta_i MM_{it} + \varepsilon_{it}, \quad i = 1,....,N \text{ and } t = 1,.....,T. \tag{10}$$

This formulation allows the investigation of heterogeneous panels, in which heterogeneous slope coefficients (β_i), fixed effects (α_i) and individual specific deterministic trends (δ_i) are permitted.

This framework provides cointegration tests for both heterogeneous and homogenous panels with seven regressors based on seven residual-based statistics. Pedroni proposes these residual based tests for the null of no cointegration. Rejection of the null hypothesis means that the variables under consideration are cointegrated.

3.2. The between-group panel FMOLS and DOLS estimators

To estimate the cointegration vector we will examine two panel cointegration estimators: the between group fully modified OLS (FMOLS) and dynamic OLS (DOLS). Pedroni (2000, 2001) suggested two methods to apply fully modified method to panel cointegration for FMOLS. One of them is the within-group (or pooled) panel FMOLS estimator and the between-group (group mean) FMOLS estimator. In this study between-group FMOLS estimator will be used.

Between group FMOLS estimators for equation (10) can be written as:

$$\hat{\beta}^*_{GMF} = N^{-1}\sum_{1}^{N}\left[\sum_{t=1}^{T}(MM_{it} - \overline{MM_i})^2\right]^{-1}\left[\sum_{t=1}^{T}(MM_{it} - \overline{MM_i})X_{it}^* - T\hat{\gamma}_i\right]$$

(11)

where $X_{it}^* = (X_{it} - \overline{X}_i) - \dfrac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}}\Delta MM_{it}$ and $\hat{\gamma}_i = +\hat{\Gamma}_{21i} + \hat{\Omega}_{21i}^0 - \dfrac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}}(\hat{\Gamma}_{22i} + \hat{\Omega}_{22i}^0)$. Between dimension

estimator is $\hat{\beta}^*_{GMF} = N^{-1}\sum_{i=1}^{N}\beta^*_{CFM,i}$ where $\beta^*_{CFM,i}$ is conventional FMOLS estimator applied to i^{th}

country of the panel. t-statistics are calculated as $t_{\hat{\beta}^*_{GMF}} = N^{-0.5}\sum_{i=1}^{N}t_{\beta^*_{CFM,i}}$ where

$$t_{\hat{\beta}^*_{CFM,i}} = (\beta^*_{CFM,i} - \beta_o)\left[\Omega_{11i}^{-1}\sum_{t=1}^{T}(MM_{it} - \overline{MM}_{it})^2\right]^{0.5}.$$

Next, we construct the group mean panel dynamic ordinary least square (DOLS) estimator as:

$$\hat{\beta}^*_{DOLS} = N^{-1}\sum_{1}^{N}\left[\sum_{t=1}^{T}Z_{it}Z_{it}'\right]^{-1}\left[\sum_{t=1}^{T}Z_{it}\widetilde{\widetilde{X}}_{it}\right]$$

(12)

where Z_{it} is a $2(K+1)1$ vector of regressors $Z_{it} = MM_{it} - \overline{MM}_{it}, \Delta MM_{it-K}, .., \Delta MM_{it+K}$ and

$\widetilde{\widetilde{X}}_{it} = X_{it} - \overline{X}_{it}$. Between dimension DOLS estimator can be constructed as:

$\hat{\beta}^*_{DOLS} = N^{-1}\sum_{i=1}^{N}\beta^*_{CD,i}$ where $\beta^*_{CD,i}$ is conventional DOLS estimator applied to i^{th} country of the

panel. The associated t-statistics can be constructed as: $t_{\hat{\beta}^*_{DOLS}} = N^{-0.5} \sum_{i=1}^{N} t_{\beta^*_{CD,i}}$ where

$$t_{\beta^*_{CD,i}} = (\beta^*_{CD,i} - \beta_o) \left[\hat{\sigma}_i^{-2} \sum_{t=1}^{T} (MM_{it} - \overline{MM}_{it})^2 \right]^{0.5}$$ and the long-run variance of the residuals from

the DOLS regression $\sigma_i^2 = \lim_{T \to \infty} E\left[T^{-1} (\sum_{t=1}^{T} \mu_{it})^2 \right]$.

4. Data and Empirical Results

4.1. Data

We use annual time series data, and the sample period is begin in 1981 and ends in 2008. The sample consists of Indonesia, Malaysia, Philippines, Singapore and Thailand. All data are taken from the International Monetary Fund's (IMF) International Financial Statistics. Exports (X) include exports of goods and services, while our measure of imports (MM) includes imports of goods and services plus net transfer payments and net interest payments (see Husted, 1992). The consumer price index (CPI) is used as a proxy for the national price level.

4.2. Empirical Results

In the first step, IPS panel unit root tests are applied. The results of panel unit root tests are presented in Table 1 and reported intercept and intercept with a trend both in levels and in first differences. It can be inferred from the Table 1 that the unit root hypothesis cannot be rejected when the variables are taken in levels. However, when the first differences are used, the hypothesis of unit root non-stationary is rejected. These results enable to test the cointegration among variables in I(1) level.

Table 1. Panel Unit Root Test For X and MM, 1981-2008

Variables		Level		First Difference	
		$\overline{z}_{INT}$ *	P**	$\overline{z}_{INT}$ *	P**
X	Individual intercept	2.30413	0.9894	-6.82184	0.0000
	Individual trend and intercept	0.33663	0.6318		
MM	Individual intercept	2.68661	0.9964	-7.25144	0.0000
	Individual trend and intercept	-0.41857	0.3378		

* $\overline{z}_{INT}$ is the test statistic of Im, Pesaran, and Shin (1997)

** Probabilities are computed assuming asymptotic normality

Having established that all variables are integrated of the same order, we proceed with the panel cointegration tests, which allow us to test for long-run relationship. Of the seven tests, the panel v-statistic is a one-sided test where large positive values reject the null hypothesis of no cointegration whereas large negative values for the remaining test statistics reject the null hypothesis of no cointegration. Table 2 shows both the within and between dimension panel cointegration test statistics. With the exception of the group p-statistics, the other six test statistics reject the null hypothesis of no cointegration. Null hypothesis of no cointegration is rejected at the 10% significance level for panel v-statistics, 5% significance level for panel p-statistics, panel PP-statistics, panel ADF-statistics, group PP-statistics and 1% significance level for group ADF statistics. Therefore X and MM series appear to be cointegrated at a reasonable significance level.

Finally, we estimate the cointegrating vector using two methods: the group-mean FMOLS and DOLS estimators. We consider two cases: with and without common time dummies. Also respective t-statistics for H_o: $\beta_i = 1$ are provided. Table 3 shows the estimate of cointegrating vector by period, using the between-group panel cointegration technique. First, we look at the case of a without time dummy for each period. The group-mean FMOLS estimate of regression coefficient is 1.11 and the

DOLS estimate is 1.08 for the whole period. The coefficient is not significantly equal to one for either method. When we consider two sub-periods (1981-1998 and 1999-2008), Table 3 also shows that the coefficient is not significantly equal to one. The group-mean FMOLS estimate of regression coefficient is 1.07 and the DOLS estimate is 1.02 for 1981-1998 and FMOLS estimate of regression coefficient is 0.97 and the DOLS estimate is 1.06 for 1999-2008.

Table 2. Panel Cointegration Tests, 1981-2008

Within dimension Test statistics		Between dimension Test statistics	
Panel v-statistic	2.0133 (0.0526)	Group p-statistic	-1.5757 (0.1153)
Panel p-statistic	-2.6650 (0.0114)	Group PP-statistic	-2.5097 (0.0171)
Panel PP-statistic	-2.6266 (0.0127)	Group ADF statistic	-2.8055 (0.0078)
Panel ADF statistic	-2.5619 (0.0150)		

Note: the value in parentheses indicates probability values.

Table 3. Panel FMOLS and DOLS Test Results

Period		1981-2008	1981-1998	1999-2008
Without Time Dummies Between	FMOLS	1.11 (8.12)*	1.07 (6.47)*	0.97 (2.20)*
	DOLS	1.08 (23.10)*	1.02 (6.72)*	1.06 (58.18)*
With Time Dummies Between	FMOLS	0.93 (-1.83)*	0.87 (-3.45)*	0.93 (-3.54)*
	DOLS	0.74 (-2.41)*	0.83 (-4.20)*	0.91 (-8.37)*

Note: the value in parentheses indicates t-statistics for $H_o: \beta_i = 1$. * indicate rejection of null hypothesis. Between reports Pedroni (1996) group-mean panel FMOLS and the group-mean panel DOLS introduced in this paper.

We also look at the case of a time dummy for each period. The group-mean FMOLS estimate of regression coefficient is 0.93 and the DOLS estimate is 0.74 for the whole period. When we consider two sub-periods we can see that the coefficient using FMOLS is 0.87 for the period 1981-1998, whereas it is 0.93 for 1999-2008. The DOLS estimate is 0.83 in the first sub-period and 1.06 in the second sub-period. The coefficient is not significantly equal to one for all period and either method.

The presence of cointegration means that there are long run relationship between exports of goods and services and imports of goods and services plus net transfer payments plus net interest payments. The coefficient is not significantly equal to one but very close to one. These results show that the current account of these countries as a panel is sustainable in the long run.

5. Conclusion

There is a growing literature that examines the sustainability of current account. Unit root and cointegration tests have provided useful tools for the sustainability of current account. In the literature various type of unit root and cointegration test are used for individual country or panel country group.

In this study, we use the panel data of export and import for five ASEAN countries using annual data from 1981 to 2008 and also two sub-groups (1981-1998 and 1998-2008). A relationship between export and import is investigated by employing Pedroni (1999) panel cointegration method.

The empirical results of panel cointegration test show that export and import are co-integrated for whole period and two sub-periods. In addition we apply panel FMOLS and DOLS estimators. Panel FMOLS and DOLS test results show that the estimated cointegration factor, β, is close to 1 but not significantly equal to 1. As a general conclusion the finding show that ASEAN countries are likely to be sustainable countries in terms of current account.

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