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The sustainability of trade accounts of the ASEAN-5 countries

Abstract

Purpose- The present study is intended to analyze the sustainability of the trade deficits in the ASEAN-5 countries using panel framework during the period from 1965 to 2011.

Design/methodology/approach- We applied a battery of first and second generation panel unit root tests and Pedroni's (1999), Kao and Chiang's (1998), Westerlund (2007), and Di-Iorio and Fachin (2011) cointegration tests to achieve our objective.

Findings- We found the evidence of sustainable trade deficit in ASEAN-5 countries while utilizing panel unit root tests as well as panel cointegration testes.

Research implications- Our findings have important macroeconomic policies implication for ASEAN-5 countries that these policies had been effective in leading exports and imports to long run steady state equilibrium relationship among the ASEAN-5 countries.

Originality/value- The main contribution of the paper is to show that the macroeconomic policies of ASEAN-5 countries had been effective in leading exports and imports to long run steady state equilibrium relationship. To our best knowledge, in this area this is the first study in the panel framework for ASEAN countries.

Paper type Research Note

Keywords: Exports, Imports, trade accounts sustainability, ASEAN-5

JEL Code: C22, F13, F14, F35

1. Introduction

The behaviour of the trade (current account) deficit, particularly in an open economy, is an indicator of macroeconomic stability. Hence, for such an economy, one important aspect of inter-temporal plans is the time path of the current accounts, which measures changes in national net indebtedness. Problems that arise in an open economy are not caused by rising imports but are due to the mismatch between export and import growth. Therefore, the stationarity of current accounts is important for two reasons. First, a stationary current account is consistent with the accumulation and sustainability of external debts (which indicates that there is no incentive for a country to default on its international debts) as well as an indicator of potential exchange rate realignment. Second, the stationarity of current accounts agrees with the implication of the modern inter-temporal model of current account, and hence supports its validity (Obstfeld and Rogoff, 1996, p. 90). However, Bohn (2007) argues that a stationary current account balance is sufficient but not necessary for the sustainability of external debts. The time-series properties of the current account and the long-run relationship between imports and exports are nonetheless informative. In the face of short-run turbulence, governments have interest in whether or not, and in what way, a current account deficit is likely to correct towards a more stable level.

In this regard, Husted (1992) shows that under the null hypothesis that the economy satisfies its inter-temporal budget constraint, we expect that exports and imports have a cointegrating relation with cointegrating vector (1,-1), granted that they are I(1). Thus, the fact that the trade balances are stationary is the necessary condition to satisfy the economy's inter-temporal budget constraints. There are two sets of studies based on the application of the tests either in time series or panel framework. One set applies conventional unit root tests – such as ADF PP and KPSS – on the current/trade account whereas second set applies cointegration test between exports and imports and tests the restriction of the cointegrating vector (1, -1). The focus of the second approach is to test for the long-run relationship between exports and imports. Such a relationship would imply that the two series would never drift too far apart. Noteworthy studies in this area are Husted's (1992), Bahmani-Oskooee and Rhee (1997), Fountas and Wu (1999), Arize (2002), Irandoust and Ericsson (2004), Narayan and Narayan (2005), Holmes (2006), Upender (2007), Erbaykal and Karaca (2008), Konya and Singh (2008), Hamori (2009), Konya (2009), Tiwari (2011), Tiwari and Pandey (2011), Yin and Hamori (2011), Greenidge et al. (2011), Tiwari (2012), and Tiwari (2013).

For the Association of Southeast Asian Nations (ASEAN), the question of current account sustainability is unambiguously of primary interest. Formed from its predecessor, the Association of Southeast Asia (ASA) in 1967, the ASEAN was originally an association of five countries – the ASEAN-5 – namely, Indonesia, Malaysia, Philippines, Singapore, and Thailand. They are the major economies of the existing ASEAN-10. Although the group encourages cooperation on many fronts, economic cooperation is one of the principal factors that brought them together. Trade flows in the group are of interest especially in recent time when the region is collectively and individually forging trade ties with the rest of the world particularly the US and the European Union (EU). Recently, for instance, the US-ASEAN Expanded Economic Engagement (E3) initiative was launched in November 2012 to promote closer economic ties between the ASEAN countries and the United States. The E3 initiative is potentially aimed at promoting trade flows between the group and the US. While the formation of the E3 initiative is glamorously welcome, the EU-ASEAN ties have been meeting with a string of bottlenecks especially in the service exports that is the core of the EU's export sector (Robles, 2013). The ensuing policy incoherence will ultimately tell on trade balance in the group, hence warranting a close examination of the current account sustainability. However, the findings are far from conclusive on the subject of current account sustainability in ASEAN markets and indeed the dearth of relevant literature in this area is of concern. This is what we plan to bridge in the literature. We achieve this in a panel framework given the proximity and the integration effects (Pesaran, 2004) in the ASEAN countries. Until now such a framework has been missing in the literature on the ASEAN countries generally and on the ASEAN-5 considered in this study in particular.

The structure of the paper is as follows. The following section presents in brief review of literature. The third section presents a basic model of trade sustainability and fourth section presents the data and methodology. Fifth section presents results of our empirical analysis and the final section concludes and gives policy implications.

2. Related literature

Husted (1992) in his pioneering work using quarterly US trade data (1967-1989) shows that exports and imports are cointegrated, and submits that the existence of cointegration between exports and imports implies that countries do not violate their IBC. This finding lends support to the effectiveness of macroeconomic policies in restoring long-run equilibrium. However, for the US economy Fountas and Wu (1999) find no evidence of cointegration between exports and imports during 1967-1994 and conclude that US current account deficit is not sustainable. Bahmani-Oskooee and Rhee (1997) lend support to cointegration with positive coefficient on exports for the Korean economy using quarterly data on exports and imports. Arize (2002) examines the question of current account sustainability using quarterly data from

1973 to 1998 on 50 countries including OCED and developing ones. He finds cointegration for 35 out of 50 countries; and for 31 out of 35 countries, he finds export coefficients to be positive. Irandoust and Ericsson (2004) expand on Husted's (1992) analysis by focusing on six countries (namely the US, Germany, the UK, France, Sweden and Italy) for the period 1971-1997. They find evidence of cointegrating relationship between exports and imports in Germany, the US and Sweden. Hence, authors conclude that these countries do not violate their intertemporal budget constraints and that trade imbalances are short-run phenomena sustainable in the long run.

Narayan and Narayan (2005) apply the bounds testing approach to cointegration to investigate a long-run relationship between exports and imports for 22 least developed countries (LDCs). They find that exports and imports are cointegrated only for six out of 22 countries, with a coefficient of exports less than one. In examining sustainability of current account deficit of 11 OECD countries from 1980 to 2002, Holmes (2006) finds that six of 11 countries (Australia, Belgium, Canada, Japan, the UK and the USA) exhibit sustainability in current account, while France, Germany, Italy, Norway and Spain do not. Upender (2007) shows that India's nominal exports and imports are cointegrated by employing data for the period 1949-1950 to 2004-2005. Erbaykal and Karaca (2008) establish the existence of a cointegrated relationship between exports and imports suggesting that trade deficits are only short-run phenomena and, therefore, sustainable in the long run.

Konya and Singh (2008) apply one-time structural break (1992-1993) to India's exports and imports series from 1949-1950 to 2004-2005, but do not find evidence of cointegration. They choose the structural break exogenously assuming that the switch from a fixed to floating exchange rate regime in March 1993 would have some impact. Hamori (2009) examine the sustainability of the trade accounts of the G-7 countries by analysing the long-run equilibrium between exports and imports. He find that trade accounts are not sustainable for the G-7 countries; thus, he recommends that some appropriate policies must be implemented to prevent trade imbalances from increasing. Holmes and Panagiotidis (2009) conduct an investigation into the extent of cointegration between imports and exports and asymmetries in the adjustment of the US current account over the study period 1960Q4-2007Q2. They find evidence in favour of cointegration through the application of the standard Johansen's methodology. However, utilising the trace test procedure recursively, they identify two distinct regimes according to whether or not imports and exports are cointegrated. With their non-linear cointegration and asymmetric adjustment analysis, they conclude that adjustment towards long-run equilibrium is primarily driven by US exports responding to current account deficits. Greenidge et al. (2011) investigate the sustainability of the current account deficit in Barbados over the period 1960-2006. The authors find that the current account of Barbados is sustainable and that deviations from long-run equilibrium between real exports and imports are corrected in the short-run with imports making the adjustment. Tiwari (2011) examines the long-run relationship between exports and imports for China and India using monthly data from January 1992 to February 2010. He endogenously determines structural breaks in unit root and cointegration and finds that trade deficit is sustainable in India but not in China. Yin and Hamori (2011) use nonstationary time series approach to test for the sustainability of the current account deficits in China over the period 1982-2009. They find that, despite the cointegrating relationship between imports and exports in China, the inter-temporal external constraints may be violated. Thus, they conclude that the trade balance surplus experienced over the past several years cannot be sustainable in the future.

Tiwari and Pandey (2011) examine Indian data from April 1984 to March 2009 and find long-run relationship between exports and imports in all the cases (i.e. by using different dates of structural breaks). In another study, Tiwari (2012) uses disaggregated Indian data at level from 1970 to 2007 and allows for endogenous determination of structural breaks in the unit root and exogenous structural breaks for cointegration. In this novel approach, he specifically tests for long-run sustainability in the current account deficit in India using oil and non-oil exports and imports. He finds strong evidence of long-run relationship between non-oil exports and imports, but not for oil exports and imports. He also finds long-run unsustainable trade deficits for oil and long-run sustainable trade deficits for non-oil commodities. Tiwari (2013) examines the long-run sustainability of trade deficits for the ASEAN-5 economies, viz., Indonesia, Malaysia, the Philippines, Myanmar and Thailand, in the presence of structural breaks. He finds that there is a long run relation between exports and imports for Indonesia, Myanmar and Thailand, and finds sustainable long-run trade deficit only for Myanmar.

However, in this paper, we apply a battery of panel unit root tests as well as panel cointegration tests. This is because by applying the panel unit root and cointegration tests, we can perform both time series and cross-sectional analyses without limiting their power due to a small sample size. While a large number of countries have been analyzed, to the best of our knowledge, there has been no empirical investigation of the behavior of trade account balance of ASEAN-5 countries in the panel framework. Based on the panel unit root and cointegration tests, we find that exports and imports are cointegrated and the cointegrating coefficient is significantly different from zero, but not significantly different from one. These findings imply that the current account deficits among ASEAN-5 countries are sustainable.

3. Basic Model

Based on Husted (1992), Arize (2002) and Irandoust and Ericsson (2004), we examine the intertemporal budget constraint and analyze the dynamics of the trade balance. Following Hakkio and Rush (1991), Husted (1992) provides a simple framework that implies a long-run relationship between exports and imports. The individual current-period budget constraint is:

$$B_t = C_t + I_t - Y_t + (1+r_t)B_{t-1} = -\zeta_t + (1+r_t)B_{t-1} \qquad \textbf{(1)}$$

where, C_t, I_t, Y_t, B_t and r_t are current consumption, investment, output, international borrowing, and a one-period interest rate respectively. $\zeta_t = Y_t - C_t - I_t (\equiv EX_t - M_t)$ and $(1+r_t)B_{t-1}$ is the initial debt size. We can rewrite Eq. (1) recursively to obtain the intertemporal budget constraint. First, note that Eq. (1) can be written as

$$B_t = (1+r)B_{t-1} - \zeta_t + (r_t - r)B_{t-1}$$

where $r = E_t r_t = E_t r_{t+1}$. The third term $\eta_t = (r_t - r)B_{t-1}$ represents the deviation of stochastic interest rate valued debt repayment from the constant interest rate valued debt repayment and can be treated as random error. Next, we recursively update Eq. (1), arriving at the following intertemporal budget constraint. Taking expectation we obtain the following:

$$(1+r)B_{t-1} = -\sum_{i=0}^{\infty} E_t \frac{\zeta_{t+i}}{(1+r)^i} + \lim_{i\to\infty} E_t\left[(1+r)^{-i} B_{t+i}\right]$$

Following Ahmed and Rogers (1995), we difference the intertemporal budget constraint above using the fact that Eq. (1) implies $B_t - B_{t-1} = (1+r_t)B_{t-1} - (1+r_{t-1})B_{t-2} = r_t B_{t-1} - \zeta_t$ to obtain:

$$rB_{t-1} - \zeta_{t-1} - E_t \sum_{i=0}^{\infty} \frac{\Delta\zeta_{t+i}}{(1+r)^i} = \lim_{i\to\infty} \Delta E_t[(1+r)^{-i} B_{t+i}].$$

In this case, the transversality condition guarantees that $\lim_{i\to\infty} \Delta E_t[(1+r)^{-i} B_{t+i}] = 0$**. The term** $E_t \sum_{i=0}^{\infty} \Delta\zeta_{t+i} / (1+r)^i$ **will be stationary if imports and exports are both I(1) variables. Thus,** $rB_{t-1} - \zeta_{t-1}$ **will be stationary. Defining** $IM_t = M_t + rB_t$**, we arrive at the Husted (1992) testable model:**

$$EX_t = \beta_0 + \beta_1 IM_t + u_t \qquad (2)$$

where EX_t, IM_t and u_t are the exports of goods and services, the imports of goods and services plus net interest payments and net transfer payments and disturbance at time t, respectively. Under the null hypothesis, for an economy that satisfies its intertemporal budget constraint (i.e., for a sustainable current account deficit), it is expected that $\beta_1 = 1$ and u_t is a stationary process. In other words, if exports and imports are integrated of order one, i.e., I(1), then under the null hypothesis, they are cointegrated with a cointegrating vector (1, -1).

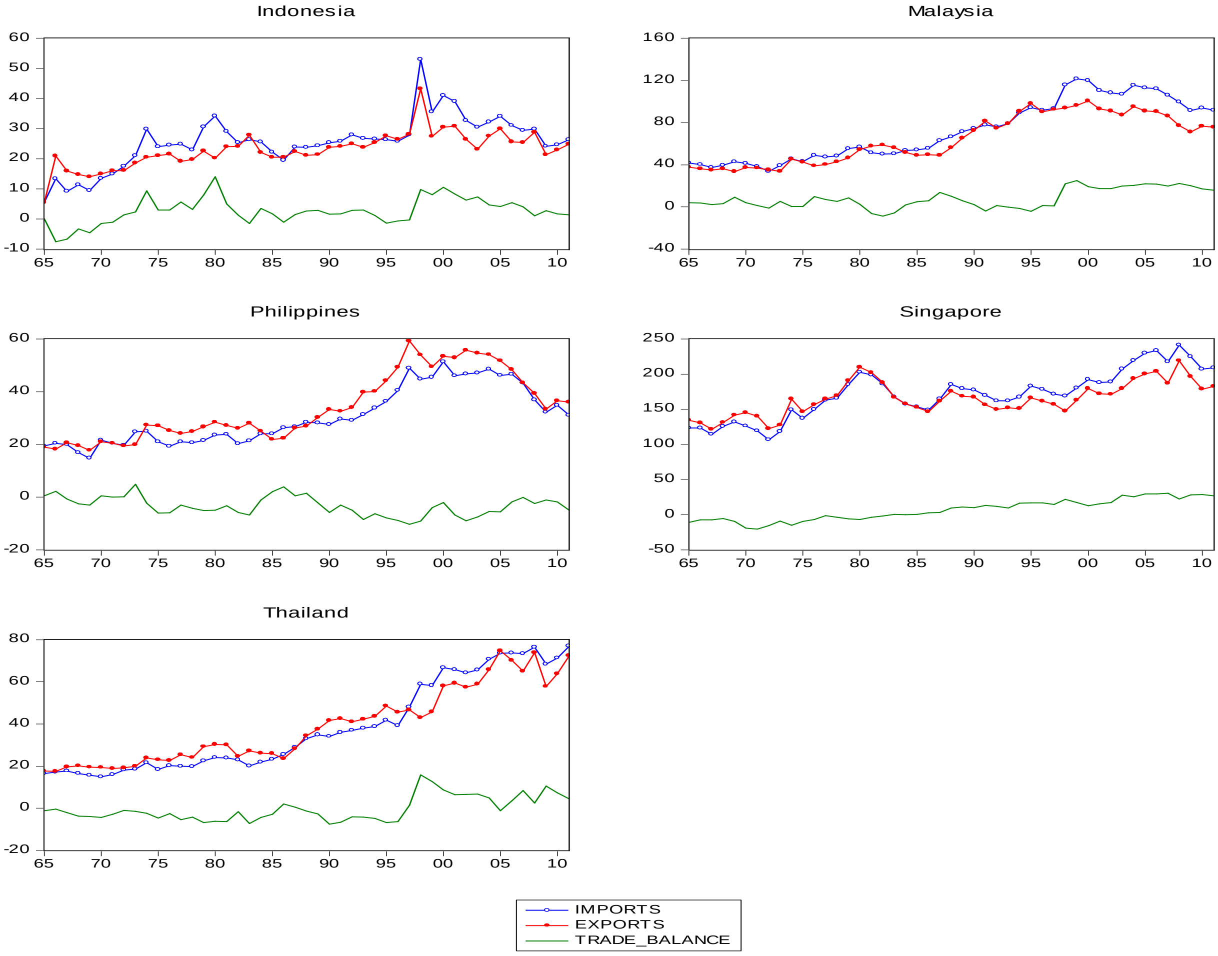
4. Data and Methodology

4.1 Data

We include five countries in our sample: Indonesia, Malaysia, Philippines, Singapore, and Thailand. The annual data from 1965 to 2011 are used in our empirical analysis. Our measure of exports includes exports of goods and services and our measure of imports includes imports of goods and services and expressed in million United States (US) dollar values. Both exports and imports are measured as a percentage of Gross Domestic Product (GDP). All data, obtained from official website of World Bank, were extracted on 27 June, 2013.

Figure 1 shows the movements of the exports, imports and trade balances of the ASEAN-5 countries. **This figure indicates that trade imbalances generally tend to hover around the zero line, suggesting trade balance, for all the countries. However, towards the end of the sample period, we observe that trade imbalances have shown up and have been expanding for both Malaysia and Singapore.**

Figure 1: Exports, Imports and Trade balance



4.2 Methodology

4.2.1 Panel unit root tests

The first thing we do in this section is to perform unit root tests on exports and imports. We divide these tests into two groups, namely, ‘first generation unit root test’ and ‘second generation unit’ root tests. The first generation of panel unit root tests employed in this study includes the LLC test (Levin, Lin and Chu, 2002), the IPS test (Im, Pesaran and Shin, 2003) and the MW test (Maddala and Wu, 1999). The second generation tests are the MP test (Moon and Perron, 2004), Pesaran test (Pesaran, 2007) and Choi test (Choi, 2006). While the first generation assumes cross-sectional independence, second generation tests are robust to cross-sectional dependence and are more powerful than the first generation tests (Hurlin, 2004)[1].

4.2.2 Panel cointegration tests

Provided both exports and imports are nonstationary in level and stationary in first difference i.e., they are I(1) variables, our next step is to perform cointegration tests between exports and imports. The trade account (or trade balance) is defined by the following equation:

$$TB_t = EX_t - IM_t = (1 \quad -1)\begin{pmatrix} EX_t \\ IM_t \end{pmatrix} \tag{3}$$

where TB_t, EX_t, and IM_t represent the trade balance, exports and imports at time *t*, respectively. Consequently, if exports and imports have a cointegrating relationship with cointegrating vector (1,-1), then the linear combination of EX_t and IM_t in Eq. (3) and hence trade balance becomes a stationary. Thus, it follows that testing for a cointegrating relationship between exports and imports under this constraint is effectively the same as testing for unit roots in trade accounts. To further ascertain the robustness of the empirical results, we also apply alternative cointegration tests developed by Pedroni (1999), Kao and Chiang (1998), Westerlund (2007), and Di-Iorio and Fachin (2011).

Consider the following fixed-effect panel regression,

$$EX_{i,t} = \alpha_i + \beta_i IM_{i,t} + u_{i,t},\ i = 1,\ldots,N\ ;\ t = 1,\ldots,T \tag{4}$$

where $IM_{i,t} = IM_{i,t-1} + e_{i,t}; \{EX_{i,t}, IM_{i,t}\}$ are independent across cross-sectional units and $\varepsilon_{i,t} = (e_{i,t}, u_{i,t})'$ is a linear process that satisfies the assumptions in Pedroni (1999), and Kao and Chiang (1998). Furthermore, *i* is the index of cross-section dimension and *t* is index of time dimension, and α_i and β_i are respectively time invariant country-specific intercept and the slope coefficients that vary across countries. Pedroni (1999) derives the asymptotic distribution and explores the small sample performances of seven different statistics. Of these seven statistics, four are based on pooling along what is commonly referred to as the 'withindimension', and three on pooling along what is commonly referred to as the 'between-dimension'. Pedroni (1999) describes the former and latter as 'panel cointegration statistics' and 'group mean panel cointegration statistics', respectively. Kao (1999) presents DF and ADF types of cointegration tests in the panel data. Kao and Chiang (1998) derive limiting distributions for the ordinary least square (OLS), fully modified (FM) and dynamic ordinary least square (DOLS) estimators in a cointegrated regression and then show that they are asymptotically normal.

However, most of the panel and time series tests are based on the assumption that the long-run parameters for the variables in their levels are equal to the short-run parameters for the variables in their differences referred to as a problem of a common-factor restriction (see Banerjee et al., 1998; Kremers et al., 1992) and which can cause a significant loss of power for residual-based cointegration tests. In order to overcome this problem, Westerlund (2007) develops four new panel cointegration tests that are based on structural rather than residual dynamics and, therefore, do not impose any common-factor restriction. The idea is to test the null hypothesis of no cointegration by inferring whether the error-correction term in a conditional panel error-correction model is equal to zero. The new tests are all normally distributed and are general enough to accommodate unit-specific short-run dynamics, unit-specific trend and slope parameters, and cross-sectional dependence. Two statistics are designed to test the alternative hypothesis that the panel is cointegrated as a whole known as panel tests (denoted as Pt and Pa), while the other two statistics, known as group-mean tests and denoted by Gt and Ga, test the alternative that at least one unit is cointegrated[2].

4.2.3 Panel cointegration testing via residual based bootstrap

The basic problem we address in this section is that the error terms for country *i*, $u_{i,t}$, in Eq. (4) though may be identically and independently distributed for all *t*, that is, $u_{i,t} \sim iid(0,\sigma_{ui}^2)$, they could be cross-sectionally correlated. Bootstrap panel cointegration testing through residual re-sampling has become a standard approach to assessing country-specific critical values while dealing with a panel data structure and can be adapted to address the cross-sectional dependence problem. Earlier novel applications can be found in Paparoditis and Politis (2001, 2003), Di Iorio and Fachin (2011), and Westerlund and Edgerton (2007). Di-Iorio and Fachin (2011) show that the Residual-based Stationarity Bootstrap (RSB) test proposed by Parker et al. (2006) is helpful in generating stationary pseudo series, which, for our purpose, has a clear advantage over the block bootstrap panel unit root test also shown to be asymptotically valid (Palm et al., 2011). It should be noted that the RSB itself is a block bootstrap and so preserves autocorrelation structure embedded in the data set. This allows us in our application to re-sample by chaining blocks of observations starting at random locations (Di-Iorio and Fachin, 2011), the approach that contrasts with the block bootstrap typically of fixed block length. To proceed, we fit the Engle-Granger cointegration model given in Eq. (5).We test for the null of no cross-sectional dependency given by $H_0 : \text{cov}(u_{i,t}, u_{j,t}) = 0$ for all t and $i \neq j$ against the alternative hypothesis given by $H_1 : \text{cov}(u_{i,t}, u_{j,t}) \neq 0$ for some pairs $i \neq j$. We model the error term, $u_{i,t}$ in (4) for country i at period t as an AR(1) process given by

$$u_{i,t} = \rho_i u_{i,t-1} + \varepsilon_{i,t} \qquad (5)$$

Testing for cointegration between our variables therefore amounts to establishing that the estimated autoregressive coefficient ρ_i in Eq. (5) is less than unit. In other words, these variables are said to be cointegrated for unit i if there exists β_i such that $u_{i,t}$ is stationary. It should be observed that stationarity of $\varepsilon_{i,t}$ does not imply the existence of cointegration as $\varepsilon_{i,t}$ is always stationary (Di-Iorio and Fachin, 2011). Next, we employ the residual-based bootstrap to account for cross-sectional dependence. We achieve this by applying the re-sampling procedure discussed above to the entire cross-sections at the same time and thus preserving the cross-sectional correlations. More precisely in step 2 of the algorithm in Appendix I, we apply the re-sampling technique on the $N \times T$ matrix of residuals $\hat{\varepsilon}_{i,t}$ to produce $\boldsymbol{\varepsilon} = [\hat{\varepsilon}_1, \ldots, \hat{\varepsilon}_N]$, where $\hat{\varepsilon}_i = [\hat{\varepsilon}_{1i}, \ldots, \hat{\varepsilon}_{Ni}]$.The procedure for re-sampling is given in Appendix.

5. Empirical Analysis

Result of panel unit root tests for exports, imports and trade balance are presented in the Table 1 below.

Table 1: Second Generation Panel Unit Root Tests

Types of test statistic	*Test statistic* **exports**	*Test statistic* **imports**	*Test statistic* **trade balance**
Second-generation panel unit root test on exports			

Moon Perron's (t_a) test (2004)	-1.4780	-5.5359	-8.0981***
Moon Perron's (t_b) test (2004)	-1.0104	-2.2330	-3.8915***
Pesaran's ($CIPS$) test (2007)	-1.4664	-1.5072	-2.5342**
Choi's (P_M) test statistic (2006)	1.2233	0.9592	4.6586***
Choi's (Z) test statistic (2006)	-0.5902	-1.0745	-3.2852***
Choi's (L^*) test statistic (2006)	-0.6899	-1.0381	-3.5080***
Note: (a) Critical values for Moon Perron's (t_a) and (t_b) (2004) tests and Choi's (Z) test statistic (2006) and Choi's (L^*) test statistic (2006) at 1%, 5% and 10% respectively are -2.3263, -1.6449, -1.2816. (b) Critical values for Pesaran's ($CIPS$) test (2007) at 1%, 5% and 10% respectively are -2.5550, -2.3289, -2.2121. (c) Critical values for Choi's (P_M) test statistic (2006) at 1%, 5% and 10% respectively are 2.3263, 1.6449, 1.2816.			
Source: Authors' calculation			

Second column of Table 1 shows the results of the panel unit root tests performed on exports. The Akaike information criterion (AIC) was used to select the number of lags. The first and second-generation panel unit root tests provide similar results i.e., exports has a unit root. Results of panel unit root tests on imports are presented in the third column of Table 1, and in this case too we find that all tests provide the similar results. Hence, we conclude that exports and imports are nonstationary variables in the level form.

Next, we identify the order of integration of the variables and find that both variables are first difference stationary. This implies that both variables are I(1)[3]. Having found that both exports and imports are nonstationary variables in level and stationary in first difference i.e., I(1), we now perform cointegration tests between exports and imports. First we present results of cointegration analysis. Following on Eq. (3), we present results of panel unit root tests on trade balance in the fourth column of Table 1.

As is clear from the fourth column of Table 1, trade balance does not have a unit root in any of the cases (except for the LLC test). This suggests that there is strong evidence of cointegrating relation between exports and imports with cointegrating vector (1,-1). In the next step we adopt cointegration test proposed by Pedroni (1999), Kao and Chiang (1998), and Westerlund (2007) and present results in Table-2 below.

Table 2: Cointegration test

Method	*Test statistic*	*P-Value*
Pedroni Residual Cointegration Test: Trend assumption:- No deterministic trend		
Panel v-Statistic	0.933468	0.1753

Panel rho-Statistic		-2.643536	0.0041
Panel PP-Statistic		-3.026987	0.0012
Panel ADF-Statistic		-3.159300	0.0008
Group rho-Statistic		-3.117431	0.0009
Group PP-Statistic		-4.161164	0.0000
Group ADF-Statistic		-4.464101	0.0000
Kao Residual Cointegration Test: Trend assumption:- No deterministic trend			
ADF		-4.320363	0.0000
Westerlund (2007) cointegration test: lags(1 2) leads(0 1) lrwindow(2) constant trend			
Statistic	Value	Z-Value	P-Value
Gt	-2.710	-0.947	0.172
Ga	-20.114	-2.664	0.004
Pt	-4.860	-0.156	0.438
Pa	-16.171	-2.640	0.004
Source: Authors' calculation			

The first of the simple panel cointegration statistics, the '*panel v-statistic*', is a nonparametric variance ratio statistic. The second, the '*panel rho-statistic*', is a panel version of a nonparametric statistic analogous to the familiar (Phillips and Perron, 1988) *rho-statistic*. The third, the '*panel t-statistic* (nonparametric)', is a nonparametric statistic analogous to the Phillips and Perron *t-statistic*. The fourth, the '*panel t-statistic* (parametric)', is a parametric statistic analogous to the familiar ADF *t-statistic*[4]. The other three panel cointegration statistics are based on a group mean approach. The first, the '*group rho-statistic*', is analogous to the Phillips and Perron *rho-statistic*. The last two, the '*group t-statistic* (nonparametric)' and '*group t-statistic* (parametric)', are analogous to the Phillips and Perron *t-statistic* and the ADF *t-statistic*, respectively. Table 2 shows the results of panel cointegration tests performed on exports and imports. It indicates that the null hypothesis of no cointegration is rejected in all seven cases (except one) at the 5% level of significance. Similar findings are reported by ADF-type Kao (1999) test. Thus, it is likely that exports and imports are cointegrated for the ASEAN-5 countries. This result is consistent with one obtained in Table 3. Our results based on Westerlund's (2007) two (particularly Pa and Ga) out of four panel cointegration tests provide evidence to reject the null hypothesis that exports and imports are not cointegrated. In the final step we present results of cointegration test proposed by Di-Iorio and Fachin (2011) with residual based bootstrap approach[5]. In principle, these tests should reject the null even if there is cointegration in only one of the 5 ASEAN countries." Hence, we adopted a country specific bootstrap approach to validate our findings. Our results of residual based bootstrap approach are presented in Table 3.

Table 3: Residual based bootstrap cointegration test statistics

(a) Cross-sectional dependence test				
	LM (Breusch-Pagan, 1980)	CD1 (Pesaran, 2004)	CD2 (Pesaran, 2004)	
	48.7538[0.000]	8.6656[0.000]	4.819[0.000]	
(b) Individual country's cross-sectional-dependence cointegration tests				
Country	Statistics	10%	5%	1%
Dickey-Fuller GLS				
Indonesia	-3.984**	-3.618	-3.837	-4.316
Malaysia	-2.678	-3.001	-3.126	-3.396
Philippines	-3.897***	-3.210	-3.397	-3.758
Singapore	-3.285***	-2.781	-2.824	-2.909
Thailand	-4.071***	-3.304	-3.524	-3.962
Phillips-Perron				
Indonesia	-23.522**	-18.255	-20.970	-26.494
Malaysia	-14.673	-15.451	-16.866	-19.977
Philippines	-27.893***	-16.758	-18.910	-23.077
Singapore	-19.300***	-11.356	-11.773	-12.549
Thailand	-31.876***	-19.526	-22.582	-29.051
Modified Phillips-Perron				
Indonesia	-2.599*	-2.568	-2.763	-3.100
Malaysia	-2.569*	-2.485	-2.607	-2.852
Philippines	-3.471***	-2.582	-2.746	-3.025
Singapore	-2.777***	-2.028	-2.073	-2.159
Thailand	-3.587***	-2.807	-3.032	-3.436
(c) Group cross-sectional-dependence cointegration tests				
	Mean	Median	Max	
Dickey-Fuller GLS				
	-3.583[0.000]	-3.897[0.000]	-4.071[0.039]	
Phillips-Perron				
	-23.453[0.000]	-23.522[0.0002]	-31.876[0.000]	
Modified Phillips-Perron				
	-3.001[0.000]	-2.777[0.0019]	-3.587[0.000]	

Notes: In Panel (a), LM, CD1 and CD2 stand for the Breusch-Pagan (1980) likelihood multiplier test, the first and the second cross-sectional dependence tests of Pesaran (2004) respectively. In Panel (b), ***,** and * refer to 1, 5 and 10% significance levels respectively. The results are based on 10000 re-drawings with replacement. In Panel (c), the p-values are reported in parentheses. The p-values in all cases are based on the 10000 re-drawings computed as the proportion of re-drawings for which the computed statistics (mean, median and maximum of the statistics for the cross-sections) is greater than the bootstrap statistics.

The first set of tests we carry out in this section is cross-sectional dependence tests. We use three (3) tests to confirm if there is cross-sectional dependence. They are the Breusch-Pagan (1980) LM test, the first and the second Pesaran (2004) cross-sectional dependence tests. The results in Panel (a) of Table 3 show that at 1 percent all the three tests indicate the presence of cross-sectional dependence. Based on these results, we proceed to accommodate cross-sectional dependence in our cointegration tests. What we do here is to establish the stationarity property of the data by factoring in the cross-sectional stylized fact common to panel-data structure. Panel (b) of Table 3 reports the country specific cointegration tests between exports and imports. The based on the three (3) statistics reported in this paper, namely, the Dickey-Fuller GLS, the Phillips-Perron (PP) and the Modified Phillips-Perron cointegration tests, trade balance for Philippines, Singapore and Thailand is consistently found to be stationary (that is, imports and exports are cointegrated) at 1 percent significance level, while for Indonesia trade balance is stationary at 5 percent level of significance based on the Dickey-Fuller GLS and the Phillips-Perron (PP) and at 10 percent based on the Modified Phillips-Perron. For Malaysia, trade balance is not stationary at the standard levels of significance using the Dickey-Fuller GLS and the Phillips-Perron (PP) and only marginally stationary at 10 percent. In Panel (c) we report the group statistics (mean, median and maximum) based on the Dickey-Fuller GLS, the Phillips-Perron (PP) and the Modified Phillips-Perron cointegration tests. The mean statistic implies that the rejection of the null hypothesis of no-cointegration against the alternative of cointegration implies that in most of the cross-sections the mass of the distribution should be significantly far from 1. This same interpretation can be given to the median statistic. The max statistic on the other hand requires that the rejection of the null hypothesis of no-cointegration depend on finding cointegration for *all* the cross-sections, meaning that $\rho_i < 1$ in all cases. Based on these statistics, we find that cointegration is found for ASEAN-5 as a group, the associated p values being sufficiently less than 5 percent for all the statistics.

Olaolu Richard Olayeni, and Aviral Kumar Tiwari. 2014. The sustainability of trade accounts of the ASEAN-5 countries. Journal of Chinese Economic and Foreign Trade Studies (forthcoming)

6. Discussion, conclusions and policy implications

The present study examines the nature of long-run relationship between exports and imports for the ASEAN-5 countries namely: Indonesia, Philippines, Thailand, Malaysia, and Singapore. Period studied in the analysis is from 1965 to 2011. As demonstrated earlier by Husted (1992), the trade balance of an economy is a stationary variable when the economy satisfies inter-temporal budget constraints. Husted (1992), Arize (2002) and Irandoust and Ericsson (2004) show that trade deficit is stationary and that in many countries, trade account imbalances will converge to a certain equilibrium over the long run. Our study provides supports to the finding that trade deficit is stationary as we find that exports and imports are cointegrated and trade deficit is stationary. Economic theory suggests that in a well-functioning economy where there are neither permanent productivity shocks nor policy distortions, there is a natural tendency towards cointegration in the trade balance. A violation of these maintained hypotheses will lead to non-cointegration in trade balance. Our results support the view that there is a tendency of trade deficit to converge to zero in the long run in the ASEAN-5 countries. This implies that the economies ASEAN-5 countries are well-functioning in such a way that these economies are able to adjust for technological and policy shocks.

From our analysis, we are able to come-up with few policy implications for ASEAN-5 countries. First, our findings of cointegration indicate that these countries do **not** violate their **intertemporal** budget constraints. Second, the results reveal that, in these countries, the imbalances are temporary and sustainable in the long run. Third, macroeconomic policies (such as fiscal, monetary, and external policies) in ASEAN-5 had been effective in bringing trade balance to converge toward zero in the long run. Fourth, since trade balance follows mean-reverting process, policy analysts can use it to predict the future behaviour and can suggest policy decisions accordingly. Fifth, in the framework of BOP-constrained growth model, ASEAN-5 countries are following “BOP equilibrium growth rate” for long time.

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Olaolu Richard Olayeni, and Aviral Kumar Tiwari. 2014. The sustainability of trade accounts of the ASEAN-5 countries. Journal of Chinese Economic and Foreign Trade Studies (forthcoming)

Notes

1. For a detailed review on the difference between different tests of first and second generation please refer to Hurlin (2010).
2. For elaborate discussion on these test statistics please refer to original work of author.
3. Results of first difference form of the variable will be available upon request to the author.
4. See Table 1 in Pedroni (1999, p. 660).
5. This approach is adopted in response to an anonymous referee of this journal who argued that even if "the panel cointegration tests unanimously reject the null hypothesis of no cointegration, this does not mean that exports and imports are cointegrated in each country".

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Appendix: Residual-based Stationary Bootstrap Procedure

The bootstrap residual re-sampling algorithm proceeds as follows:

1. Estimate Eq. (4) by OLS to obtain the residual series, $\{\hat{u}_{i,t}\}$;
2. Estimate Eq. (5) by OLS to obtain the AR(1) coefficient $\hat{\rho}_i$ and the associated residual series $\{\hat{\varepsilon}_{i,t}\}$, where $\hat{\varepsilon}_{i,t} = \hat{u}_{i,t} - \hat{\rho}_i \hat{u}_{i,t-1}$;
3. Construct the pseudo residuals $\{\ddot{\varepsilon}_{i,t}\}$ by applying the Residual-based Stationary Bootstrap to $\{\hat{\varepsilon}_{i,t}\}$. In order to preserve cross-sectional dependence, we apply the re-sampling algorithm to the entire cross-section;
4. Obtain pseudo residual $\{\ddot{u}_{i,t}\}$ by cumulating $\{\ddot{\varepsilon}_{i,t}\}$ to obey the null hypothesis of no-cointegration;
5. Compute $E\ddot{X}_{i,t} = \hat{\mu}_i + \hat{\beta}_i IM_{i,t} + \ddot{u}_{i,t}$;
6. Estimate the cointegrating regression on the dataset $\{E\ddot{X}_{i,t}, IM_{i,t}\}$: $E\ddot{X}_{i,t} = \ddot{\hat{\mu}}_i + \ddot{\hat{\beta}}_i IM_{i,t} + \ddot{\hat{u}}_{i,t}$;
7. Estimate $\ddot{\rho}_i$ by applying Eq. (5) to the residuals $\{\ddot{u}_{i,t}\}$;

8. Repeat 3-7 B (large enough) times