North American Journal of Economics and Finance 46 (2018) 249–260

Contents lists available at ScienceDirect

North American Journal of Economics and Finance

journal homepage: www.elsevier.com/locate/najef

Capital market integration in ASEAN: A non-stationary panel data analysis

Kenneth S. Chan[a], Vinh Q.T. Dang[b,*], Jennifer T. Lai[c]

[a] McMaster University, Canada
[b] Nanjing University of Finance and Economics, China
[c] Guangdong University of Foreign Studies, China

ARTICLE INFO

JEL classification:
F31
F32
F36

Keywords:
ASEAN
Capital market integration
Saving-investment correlation
Capital mobility
Panel cointegration

ABSTRACT

Motivated by the establishment of ASEAN Economic Community (AEC) at the end of 2015, we examine saving-investment relationship in various subgroups of ASEAN to assess their capital market integration. The results from second generation panel unit-root and cointegration tests that account for cross-sectional dependence as well as estimates of long-run saving-retention rate provide some evidence of market integration in ASEAN. The analysis of short-run dynamics suggests that capital mobility in ASEAN during 1980–2014 appears similar to that in OECD countries during 1970–1999. More importantly, across different panel estimators and subgroups of membership, there is considerable heterogeneity among the member countries. The saving-investment association is very weak, thereby implying very high capital mobility, in more developed members such as Singapore, Malaysia, and Brunei; the association is very strong, implying very low capital mobility, for much less developed members such as Laos, Myanmar, and Cambodia. The results call for renewed effort to develop capital markets in less developed nations and integrate them with the rest of the membership in ASEAN. In this paper, we also address several major shortcomings of the original Feldstein-Horioka framework.

1. Introduction

The Association of Southeast Asian Nations (ASEAN) is emerging as an important regional political and economic entity. Formed in 1967 by Indonesia, Malaysia, the Philippines, Singapore, and Thailand, its membership was expanded to include Brunei (1984), Vietnam (1995), Cambodia (1999), Laos (1997), and Myanmar (1997). ASEAN Free Trade Area (AFTA), signed in 1992 under Common Effective Preferential Tariff (CEPT) scheme, was the first trade bloc in Asia. In 2003, leaders of the member states committed to an ambitious goal of establishing ASEAN Economic Community (AEC), which came into effect at the end of 2015.

Our research is motivated by the establishment of AEC and the paucity of studies on economic integration in ASEAN. Unlike the formation of the European Economic Community (EEC) and, later, Economic and Monetary Union (EMU), AEC has received little attention from policy makers outside the membership and scant academic research.[1] With a (combined) population of more than 600 million people, which is larger than that in the 28-member European Union (EU), GDP of $2.6 trillion, and annual trade of $2.3 trillion, ASEAN has the potential to become a key player on the global stage if full economic integration is achieved.

In this paper, we follow Feldstein and Horioka (FH, 1980) approach and examine saving-investment relationship to assess capital market integration in ASEAN. Capital market integration is an important ingredient for a successful economic community since it

* Corresponding author at: School of Economics, Nanjing University of Finance and Economics, China.
E-mail address: dang.vinh@outlook.com (V.Q.T. Dang).

[1] An exception is Dang and Yang (2016) who use panel data of 131 retail prices of consumer goods and services to examine market integration in ASEAN.

https://doi.org/10.1016/j.najef.2018.04.010

Available online 14 May 2018

helps channel funds to where they are most productive, thereby fostering integration in goods, services, and labor markets and consequently economic efficiency. Moreover, the extent of capital mobility has direct bearing on whether and how quickly shocks are transmitted across countries, which in turn affect the effectiveness of domestic economic policies, including responses to external shocks. We test whether there is cointegration relationship between saving and investment in various subgroups of ASEAN to find out capital market of which country is more or less integrated with the rest of the group. Moreover, we also estimate long-run saving-retention coefficient and short-run dynamics for these groups as well as for individual members to gauge the degree of capital mobility.

Our paper contains the following contributions. First, our focus is capital market integration in ASEAN; and our data sample includes all ten members of ASEAN. Although the original five members have been included along with other East Asian countries in Eng and Habibullah (2007), Guillaumin (2009), Kim, Kim, and Wang (2007), and Kim, Oh, and Jeong (2005), no study has examined data from the new five members (Brunei, Cambodia, Laos, Myanmar, and Vietnam). Our paper is the first study of the full membership of ASEAN using FH (1980) framework. Moreover, unlike EU where most members have similar level of economic development, there is large economic disparity in ASEAN membership, particularly between the original and new members. Therefore, it is important to see how well capital markets of the new members are integrated with the rest.

The high saving-investment correlation presented in FH (1980) remains one of the major puzzles in international macroeconomics (Obsfeld & Rogoff, 2000) and an active research topic (Blanchard and Giavazzi, 2002; Chan, Dang, Jiang, & Yan, 2011, Chan, Dang, Lai, & Yan, 2011; Ford & Horioka, 2016; Guillaumin, 2009; Kim, Kim, & Wang, 2007; Kim, Oh, & Jeong, 2005; Ma & Li, 2016; Mark, Ogaki, & Sul, 2005). Our second contribution is to address several important deficiencies in the original Feldstein-Horioka framework. Specifically, we tackle the conceptual issue of current account solvency constraint raised by Coakley, Kulasi, and Smith (1996). In so doing, we also examine short-run dynamics in the saving-investment relationship, a feature that is neglected in most empirical studies.

Moreover, instead of using pure cross-sectional data as in original FH study or pure time-series data for individual countries as in many subsequent studies, we exploit the panel structure of the data to address issues related to estimation efficiency and test power, raised by, for example, Ho (2002). In our estimation, country heterogeneity is also fully taken into consideration to account for its potential effects on the saving-investment correlation (Corbin, 2001; Taylor, 2002).

Most notably, we perform recent second-generation panel unit-root and cointegration tests to account for correlation among cross-section units (countries here). As ignoring cross-section dependence in the data results in misleading inferences and therefore policy implications, explicitly accounting for this data feature is an important contribution in itself. In addition, these advanced techniques can accommodate common third factors, such as productivity shocks, that give rise to high correlation between saving and investment (Baxter & Crucini, 1993; Obstfeld, 1995).[2]

In Section 2, we discuss the methodology. The empirical results are reported in Section 3. We offer some concluding remarks in Section 4.

2. Methodology

The literature on evaluating economic integration can be broadly classified into price-based and quantity-based measures. Price-based studies on financial integration usually examine co-variation of asset prices across countries or test international parity conditions such as interest rate parities. For ASEAN, this approach is not feasible because reliable and consistent time-series data on market-based asset prices or key interest rates are not available for all members. For example, in a study by Phylaktis and Ravazzolo (2002), who analyze co-movement of equity prices to evaluate financial integration in Pacific-Basin countries, only the original five members of ASEAN are included.

Quantity-based measures, on the other hand, consist of saving-investment correlation, current account dynamics, consumption correlations, and the magnitude and dynamics of international capital flows. In this paper, we analyze saving-investment relationship based on Feldstein and Horioka (1980) framework to gauge capital market integration as time-series data on these variables are most readily available for ASEAN countries.

Feldstein and Horioka, in a seminal paper published in *Economic Journal* in 1980, estimate the following cross-section regression of national investment (I) on saving (S), both expressed as proportions of GDP (Y) and averaged over 1960–1974, of 16 OECD countries ($i = 1, 2, \ldots 16$):

$$(I/Y)_i = \lambda + \beta(S/Y)_i + u_i \tag{1}$$

According to FH (1980), the coefficient on saving, β, also known as the saving-retention rate, measures the association between domestic investment and saving, thereby capturing the degree of international capital mobility. When capital accounts are closed, domestic saving must be exclusively financed by domestic investment as capital cannot flow from one country to another in the form of international lending. In other words, in financial autarky (where each country's financial market is completely segregated from that of another country), estimate of investment-saving correlation β is expected to be high and close to unity. On the other hand, in the world of completely integrated capital markets, capital would freely flow to where it generates the highest return; domestic investment can be easily financed by international funds and consequently would not depend on domestic saving. In this latter case,

[2] Note that as none of ASEAN members is large, the estimation results from our data sample are not likely to be subject to the "large country bias", a concern brought forth in Baxter and Crucini (1993) and Murphy (1984), either.

estimate of investment-saving correlation β is expected to be low and close to zero.

In FH's (1980) cross-section regression, β is estimated in the range of 0.87–0.91. Their estimated range of saving-retention rate was then interpreted as an indication of low capital mobility among the countries in the sample. This interpretation was contradictory to a widely-held perception that financial markets, at least in the sampled OECD countries, were highly integrated with increasingly large cross-border capital flows. The investment-saving correlation remains a puzzle as many subsequent studies confirm high value of its estimates.[3]

To explain the puzzle, some critics point to the econometric techniques used in FH (1980); averaging data over a long period of time to use them in cross-section regressions results in significant loss of information and misleading inferences (Ho, 2002).[4] Some subsequent studies switch to time-series data. However, pure time-series regression also has its drawbacks, including spurious relationship between investment and saving when they are integrated of order 1 and low power of univariate unit root test. Krol (1996) is one of the first studies that employ panel data to remedy these estimation deficiencies; applying a fixed-effect panel regression to the same OECD countries as in FH (1980), Krol (1996) finds a much smaller saving-retention coefficient, indicating very high capital mobility.

The study of FH (1980) has stimulated a large body of empirical literature on saving investment correlation and international capital mobility (Coakley et al., 1998). Indeed, the findings in FH (1980) and in many subsequent replication studies have been deemed one of six major puzzle in international macroeconomics (Obsfeld & Rogoff, 2000). The saving-investment regression framework has continued to be used to measure capital mobility and market integration because of its intuitive simplicity and better data availability of saving and investment (as opposed to financial variables), particularly for developing countries. Chan, Dang, Jiang, et al. (2011) show that FH framework is consistent with consumption smoothing approach to measuring capital mobility in China. Recent studies also include Chan, Dang, Lai, et al. (2011), Ford and Horioka (2016), Guillaumin (2009), Ma and Li (2016), Mark, Ogaki, and Sul (2005), Blanchard and Giavazzi (2002), to name just a few.

In this paper, we also adopt this saving-investment correlation framework. We, however, employ panel data and recent advances in panel data econometrics to avoid the data and estimation issues noted above, thereby obtaining a more accurate and efficient estimation of the investment-saving relationship in ASEAN. In panel data structure, the FH (1980) regression can be expressed as:

$$(I/Y)_{it} = \lambda_i + \beta_i (S/Y)_{it} + u_{it}, \tag{2}$$

where $(I/Y)_{it}$ and $(S/Y)_{it}$ denote investment and saving rate in country i at time t; λ_i is country-specific effect. According to FH (1980), the relationship between investment and saving is represented by the saving-retention rate β.

The first step in the analysis is to check the stationarity property of the data series. Univariate unit root tests, such as augmented Dickey-Fuller (ADF) test, suffer from low power, particularly for short data series, and result in high non-rejection rate of the null hypothesis of unit root. To utilize full information in the data set and thereby improve the power of the test, we adopt panel unit-root tests for our data. Early commonly-used tests such as Levin Lin, and Chu (LLC) (2002) and Im, Pesaran, and Shin (IPS) (2003), also referred to as first-generation tests, assume data are cross-sectionally independent (Breitung & Pesaran, 2008).

Many countries in the ASEAN, besides being located closely in a small area in the tropics, share similar history of colonialism, languages, religion, and ethnicity. These countries are also likely to be exposed to common external economic and political shocks; or shocks in one country can be propagated quickly to others as in the case of the 1997 Asian financial crisis. Hence, the assumption of cross-section independence may not be applicable to our data. Empirical and simulation studies have shown that the first-generation panel unit-root tests exhibit severe size distortion if cross-section dependence exists in the data (Breitung & Das, 2005; Gengenback, Palm, & Urbain, 2010; O'Connell, 1998).

Since erroneous assumption of cross-section independence can produce misleading inferences, we formally test if this feature is present in our data sample with Pesaran (2004) cross-section dependence (CD) test. It is based on an average of pairwise correlation coefficients of OLS residuals from individual (country i) ADF regressions in the panel for each data series x:

$$\Delta x_{it} = \varphi_i x_{it-1} + a_i D_{it} + \sum_{\tau} \gamma_{i\tau} \Delta x_{it-\tau} + \varepsilon_{it}, \tag{3}$$

where D_{it} represents a vector of deterministic variables. Pesaran (2004) CD test statistic is calculated as:

$$CD = \sqrt{\frac{2T}{K(K-1)}} \left(\sum_{i=1}^{K-1} \sum_{j=k+1}^{K} \hat{\pi}_{ij} \right), \tag{4}$$

where $\hat{\pi}_{ij} = \sum_{t=1}^{T} \hat{\varepsilon}_{it}\hat{\varepsilon}_{jt} / (\sum_{t=1}^{T} \hat{\varepsilon}_{it}^2)^{1/2} (\sum_{t=1}^{T} \hat{\varepsilon}_{jt}^2)^{1/2}$; K and T are cross-section and time dimensions of the panel. Under the null hypothesis of no cross-section dependence, $CD \sim N(0,1)$.[5]

Pesaran (2007) proposes a panel unit-root test that accounts for cross-section dependence. He suggests augmenting the ADF regressions in IPS (2003) with the lagged cross-sectional mean and its first-difference means to capture cross-section dependence that arises in a single factor model:

[3] Coakley Kulasi, and Smith (1998) is a comprehensive survey of these studies.

[4] Other studies suggest that the high investment-saving correlation is the results of government's current account targeting with fiscal and monetary policies (Bayoumi, 1990), large country bias (Murphy, 1984), or common third factors such as productivity shocks (Baxter & Crucini, 1993; Obstfeld, 1995)

[5] Pesaran CD test is valid under a variety of models, including stationary and unit root dynamic heterogenous panels or panels containing multiple structural breaks. It also has satisfactory performance for small data panels such as those with cross-section and time series dimensions of $K = 5$ and $T = 10$.

$$\Delta x_{it} = \varrho_i x_{it-1} + c_i \overline{x}_{t-1} + a_i D_{it} + \sum_{\tau} \delta_{i\tau} \Delta \overline{x}_{it-\tau} + \sum_{\tau} \gamma_{i\tau} \Delta x_{it-\tau} + \varepsilon_{it}, \tag{5}$$

The t-statistics on the coefficient of the lagged value x_{it-1} (called CADF) are averaged across the units to obtain CIPS statistic, which is used to test if each data series contains a unit root:

$$CIPS = \frac{1}{K} \sum_{i=1}^{K} CADF_i, \tag{6}$$

The next step is to test if investment and saving are cointegrated. We apply error-correction based panel test developed by Westerlund (2007). The model can be written as:

$$(I/Y)_{it} = \delta_i' d_t + \psi_i [(I/Y)_{it-1} - \beta_i (S/Y)_{it-1}] + \sum_{\tau} \varphi_{i\tau} \Delta (I/Y)_{it-\tau} + \sum_{\tau} \gamma_{i\tau} \Delta (S/Y)_{it-\tau} + \upsilon_{it} \tag{7}$$

where d_t contains the deterministic components. The parameter ψ_i is the error correction term; $\psi_i < 0$ if investment and saving are cointegrated and $\psi_i = 0$ if they are not. Westerlund (2007) proposes two pairs of test statistics. In the first pair, called group-mean test statistics G_τ and G_α, the null hypothesis of no cointegration H_0: $\psi_i = 0$ for all i is tested against an alternative hypothesis ${H_1}^G$: $\psi_i < 0$ for at least one i. In the second pair, called panel test statistics P_τ and P_α, the alternative hypothesis is ${H_1}^P$: $\psi_i = \psi < 0$ for all i. Cross-sectional dependence is explicitly accounted for by bootstrapping of the residuals. We perform 1000 bootstrap replications and present the bootstrapped p-values for all four test statistics in addition to asymptotic p-values in the results.

Finally, if there is evidence of cointegration between investment and saving in a particular panel of member countries from the above test, we then gauge the degree of capital mobility by estimating the saving retention coefficient β for the whole panel and its individual member countries. To this end, we use Pesaran (2006) common correlated effects (CCE) estimator. This estimator is particularly apt for our data sample as it can account for unobserved common factors (for example, regional spillover effects or global shocks such as the 2008 financial crisis) that give rise to cross-section dependence. The regression specification between investment and saving is augmented with their cross-section means as follows:

$$(I/Y)_{it} = \lambda_i + \beta_i (S/Y)_{it} + \mu_1 \overline{(I/Y)_t} + \mu_2 \overline{(S/Y)_t} + \mu_{it}, \tag{8}$$

Another plausible explanation of close relationship between investment and saving found in FH (1980) and subsequent replication studies is that it reflects a solvency constraint, instead of low capital mobility, as an open economy cannot run current account deficits indefinitely. Therefore, when investment and saving are $I(1)$ processes, the inter-temporal budget constraint implies that they are cointegrated and the saving-retention rate is equal to 1; the current account is then stationary. In this case, the magnitude of the saving-investment association, β, estimated by the above procedure may not be informative of long-run capital mobility (Coakley et al., 1996).

Jansen (1998, 1996a, 1996b) suggest examining both short- and long-run dynamics of the saving-investment relationship to evaluate international capital mobility since the former may reflect different phenomena from those that give rise to long-run saving-retention coefficient. Built on this suggestion, Eng and Habibullah (2007) and Pelgrin and Schich (2004) consider the long-run investment-saving relationship as an artifact of the solvency constraint and focus on short-run dynamics to assess capital mobility. In particular, in these studies, the speed of an economy's adjustment to short-run shocks or deviations from the long run cointegrating relationship between investment and saving, captured by the error-correction term, is used as a measure of capital mobility (Jansen, 1998, 1996a, 1996b).

This notion can be illustrated using a simplified version of the error correction model in Eq. (6):[6]

$$\Delta (I/Y)_{it} = \delta_i + \psi_i [(I/Y)_{it-1} - \beta_i (S/Y)_{it-1}] + \gamma_i \Delta (S/Y)_{it-1} + \upsilon_{it} \tag{9}$$

from which the steady-state equilibrium for country i is defined as

$$\delta_i + \psi_i [(I/Y)_{it-1} - \beta_i (S/Y)_{it-1}] = 0 \tag{10}$$

If investment and saving are cointegrated with the saving-retention rate β being unity, then the current account, $(S-I)_i/Y_i$, would be stationary around the long run value $(\delta/\psi)_i$. The close association between investment and saving is dictated by the solvency constraint and no inference about capital mobility can be obtained. On the other hand, if investment and saving are cointegrated but the saving-retention rate β is statistically different from unity, then the current account is non-stationary, $(S-I)_i/Y_i = (\delta/\psi)_i + (1-\beta_i)(S/Y)_i$. In this case, the coefficient of the error correction term, ψ_i, is an indicator of capital mobility. More specifically, the lower the value of the error correction term, ψ_i, the higher capital mobility is because the slow speed of adjustment allows investment and saving to deviate from the long-run solvency constraint for a longer period of time.

We follow Eng and Habibullah (2007) and Pelgrin and Schich (2004) and rely on mean group (MG) (Pesaran & Smith, 1995) and pool mean group (PMG) (Pesaran, Shin, & Smith, 1999) estimators. Both cross-section and time-series dimensions of data are combined in a panel autogressive distributive lag model that can be re-written into the error correction model in Eq. (8). The estimation yields the following results for the whole panel:

[6] This discussion is based on Pelgrin and Schich (2004).

Table 1
Summary.

Country	Year of accession	GDP (mils, PPP $)	GDP per capita (PPP $)	Sample period	Investment (% of GDP)	Saving (% of GDP)
Indonesia	1967	2,842,247	11,126	1980–2014	28.034	31.264
Malaysia	1967	815,646	26,315	1980–2014	28.488	37.874
Philippines	1967	741,031	7254	1980–2014	21.473	17.387
Singapore	1967	471,877	85,253	1980–2014	32.953	47.802
Thailand	1967	1,108,111	16,097	1980–2014	29.729	30.596
Brunei	1984	33,219	79,587	1989–2014	26.637	47.530
Cambodia	1999	54,205	3487	1993–2014	25.093	15.518
Laos	1997	37,322	5309	2000–2014	21.012	11.851
Myanmar	1997	283,532	5469	1980–2004	13.437	11.421
Vietnam	1995	552,298	6024	1986–2014	26.753	19.975

Note: GDP figures are obtained from International Monetary Fund for 2015.

$$\beta_{MG} = 1/K \sum_{\tau} \beta_i, \psi_{MG} = 1/K \sum_{\tau} \psi_i, \gamma_{MG} = 1/K \sum_{\tau} \gamma_i$$
$$\beta_{PMG} = \beta_i \ \forall \ i, \psi_{PMG} = 1/K \sum_{\tau} \psi_i, \gamma_{PMG} = 1/K \sum_{\tau} \gamma_i$$

The MG estimator allows heterogeneity in the intercept, slope coefficient, and error variance across cross-sectional units. The PMG estimator considers heterogeneity in the intercept, short-run coefficients, and error variance but restricts the long-run coefficient to be the same across units. The MG estimator is less restrictive; it is efficient and consistent if the restriction assumed in the PMG estimator is not valid but inefficient when the restriction holds. Hausmen's test is used to test the validity of the restriction.

We employ this approach for two reasons. First, by using the same MG and PMG estimation methods, we can directly compare our results with those in Eng and Habibullah (2007) and Pelgrin and Schich (2004) for easy interpretation. Second, this approach sidesteps the conceptual problems of panel unit root and cointegration testing, providing a complementary analysis to above Westerlund (2007) cointegration test.[7] We will let all the estimation results collectively shape our interpretation and conclusion.

3. Results

Data on saving and investment (as percentage of GDP) for all ten members of ASEAN are obtained from the World Development Indicators published by the World Bank. The sample period covers 1980–2014 for the five original members (Indonesia, Malaysia, the Philippines, Singapore, and Thailand), 1989–2014 for Brunei, 1993–2014 for Cambodia, 2000–2014 for Laos, 1980–2004 for Myanmar, and 1986–2014 for Vietnam.

Values of investment and saving averaged over the sample period for each country are shown in Table 1. GDP and per capita GDP in purchasing power parity figures, obtained from International Monetary Fund for the year of 2015, are also presented. There is a large development gap among the members, as the highest per capita GDP (Singapore) is almost 25 times the lowest one (Cambodia). The saving rate in more developed members such as Singapore, Brunei, and Malaysia are much higher than that in less developed ones; although these richer members also invest proportionally more, the investment falls significantly short of the saving. Over the sample period, the gap between saving and investment is largest for Singapore and smallest for Thailand.

3.1. Long-run relationship

Besides examining the complete 10-member ASEAN (called ASEAN10) panel, we apply unit-root and cointegration tests to various subgroups to see which country is more or less financially integrated with the rest of the membership. We start with the group of five original members (ASEAN5) and add one new member to this group at a time. Depending on the results of cointegration tests, we repeat the analysis to further groupings of the member countries.

The results of Pesaran (2004) cross-section dependence (CD) test for ASEAN5, ASEAN5 + Brunei, ASEAN5 + Cambodia, ASEAN5 + Laos, ASEAN5 + Myanmar, ASEAN5 + Vietnam, and ASEAN10 panels are shown in Table 2. The CD statistic is significant at 1 percent level for both investment and saving series, suggesting very high correlation across countries. Except one case, the estimated correlation ranges between 0.370 and 0.600. We will therefore use panel unit-root and cointegration tests that explicitly account for this important data feature.

We perform Pesaran (2007) panel unit-root test and report the results with one-lag length in Table 3. For data in levels, the test is performed with a constant and a linear trend included in the vector of deterministic terms in Eq. (3) to account for increasing saving and investment rates over the sample period for all member countries. First-differenced data are tested without a linear trend. In each cell, $Z[t\text{-bar}]$ statistic is shown, followed by its p-value. For investment series, the null hypothesis of unit root is not rejected for level data whereas it is rejected at 1 percent significant level for first-differenced data in all panels. Investment is therefore considered as $I(1)$ process. Results for saving series are similar, except that the null hypothesis of unit-root is rejected for level data at 5 percent

[7] The MG and PMG estimators have good size properties in the presence of either $I(0)$ or $I(1)$ errors (Coakley, Fuertes, & Smith, 2001).

Table 2
Pesaran (2004) cross-section dependence (CD) test.

	Investment		Saving	
	CD statistic	Correlation	CD statistic	Correlation
ASEAN5	6.80[c]	0.370	5.41[c]	0.435
	(0.000)		(0.000)	
ASEAN5 + Brunei	11.53[c]	0.460	4.54[c]	0.590
	(0.000)		(0.000)	
ASEAN5 + Cambodia	5.58[c]	0.425	2.82[c]	0.082
	(0.000)		(0.005)	
ASEAN5 + Laos	7.30[c]	0.397	6.18[c]	0.600
	(0.000)		(0.000)	
ASEAN5 + Myanmar	10.52[c]	0.380	5.79[c]	0.515
	(0.000)		(0.000)	
ASEAN5 + Vietnam	5.61[c]	0.406	4.82[c]	0.592
	(0.000)		(0.000)	
ASEAN10	4.50[c]	0.403	6.61[c]	0.489
	(0.000)		(0.000)	

Note: Under the null hypothesis of cross-section independence, the CD test statistic follows standard normal distribution. [a, b] and [c] denote statistical significance at 10, 5, and 1 percent levels, respectively.

Table 3
Pesaran (2007) panel unit root test; number of lags = 1; null hypothesis: unit root.

	Investment		Saving	
	Level	Difference	Level	Difference
ASEAN5	0.726	−9.270[c]	−0.478	−8.539[c]
	(0.766)	(0.000)	(0.316)	(0.000)
ASEAN5 + Brunei	−0.038	−9.468[c]	−0.480	−8.613[c]
	(0.485)	(0.000)	(0.316)	(0.000)
ASEAN5 + Cambodia	0.409	−10.217[c]	−0.013	−9.668[c]
	(0.659)	(0.000)	(0.495)	(0.000)
ASEAN5 + Laos	0.595	−9.421[c]	−0.703	−7.867[c]
	(0.724)	(0.000)	(0.241)	(0.000)
ASEAN5 + Myanmar	0.408	−9.688[c]	−0.397	−9.561[c]
	(0.658)	(0.000)	(0.346)	(0.000)
ASEAN5 + Vietnam	0.978	−9.455[c]	−0.364	−9.492[c]
	(0.836)	(0.000)	(0.358)	(0.000)
ASEAN10	0.227	−11.509[c]	−1.754[b]	−10.790[c]
	(0.590)	(0.000)	(0.040)	(0.000)

Note: Contained in each cell is $Z[t\text{-bar}]$ statistic; p-value is included in the parentheses.
a, b, and c denote statistical significance at 10, 5, and 1 percent levels, respectively.

significance level in ASEAN10 panel. Judging from all the panels, we also treat saving as $I(1)$ process. We repeat the test with two-lag length; the results, reported in Table A1 in Appendix, clearly indicate both series contain a unit root. The evidence of investment and saving being $I(1)$ processes presented here is consistent with the findings in the literature for countries in Asia and other parts of the world (Guillaumin, 2009; Ho, 2002; Kim, Oh, et al., 2005).

As both investment and saving are non-stationary, we proceed to test whether there exists a cointegrating relationship between them. Results from Westerlund (2007) group and panel test statistics are reported in Table 4. Due to limited time-series observations for some member countries, the panel error-correction in Eq. (6) is estimated with 1 lag. A constant and a linear trend are also included in the vector of deterministic components. Contained in each cell is the test statistic, followed by two p-values in parentheses. The first p-value is based on asymptotic distribution; the second p-value is robust one-sided p-value based on bootstrapped distribution of the residuals from 1000 replications to account for cross-section correlation.[8]

For ASEAN5 panel, there is no evidence of cointegration between investment and saving as all four test statistics are not significant. When the panel is enlarged to include one new member at a time, the null hypothesis of no cointegration is rejected by group test statistic G_t and G_a at 5 percent and 10 percent significance levels, respectively, for ASEAN5 + Cambodia panel. There is also evidence of cointegration at 10 percent level in ASEAN5 + Myanmar panel by group test statistic G_t. It suggests that there is a long-run relationship between investment and saving in Cambodia and in Myanmar, and that the capital markets in these two countries are less integrated with ASEAN5. There is no evidence of cointegration between investment and saving in ASEAN5 + Brunei,

[8] For consistency, the null hypothesis of no cointegration is imposed when bootstrapped samples are generated.

Table 4
Westerlund (2007) panel cointegration test. Null hypothesis: No cointegration.

	G_t	G_a	P_t	P_a
ASEAN5	−0.680	−0.473	−0.429	−0.984
	(0.248)	(0.318)	(0.334)	(0.163)
	(0.203)	(0.157)	(0.372)	(0.186)
ASEAN5 + Brunei	0.442	−0.422	−0.346	−1.221
	(0.329)	(0.336)	(0.365)	(0.111)
	(0.231)	(0.148)	(0.435)	(0.172)
ASEAN5 + Cambodia	−1.765	−0.999	−0.446	−0.978
	(0.039)[b]	(0.159)	(0.328)	(0.164)
	(0.035)[b]	(0.083)[a]	(0.333)	(0.171)
ASEAN5 + Laos	−0.668	−0.512	−0.460	−1.062
	(0.252)	(0.304)	(0.323)	(0.144)
	(0.198)	(0.162)	(0.368)	(0.183)
ASEAN5 + Myanmar	−1.213	−0.485	−0.468	−0.989
	(0.113)	(0.314)	(0.320)	(0.161)
	(0.097)[a]	(0.161)	(0.339)	(0.192)
ASEAN5 + Vietnam	−0.763	−0.567	−0.558	−1.184
	(0.223)	(0.285)	(0.288)	(0.118)
	(0.173)	(0.156)	(0.331)	(0.153)
ASEAN5 + Brunei + Vietnam	−0.541	−0.517	−0.461	−1.402
	(0.294)	(0.303)	(0.322)	(0.081)
	(0.250)	(0.139)	(0.397)	(0.134)
ASEAN5 + Brunei + Vietnam + Laos	−0.547	−0.550	−0.486	−1.469
	(0.292)	(0.291)	(0.314)	(0.071)[a]
	(0.231)	(0.143)	(0.398)	(0.150)
ASEAN5 + Cambodia + Myanmar	−2.182	−0.989	−0.494	−0.990
	(0.015)[b]	(0.162)	(0.311)	(0.161)
	(0.020)[b]	(0.077)[a]	(0.342)	(0.189)
ASEAN10	−1.834	−1.014	−0.541	−1.499
	(0.033)[b]	(0.155)	(0.294)	(0.067)[a]
	(0.023)[b]	(0.053)[a]	(0.338)	(0.114)

Note: Owing to limited number of time-series observations, we fix the number of lags at 1. For semi-parametric correction, the Bartlett kernel window width is set according to $4(T/100)^{2/9} \approx 2$. Contained in each cell is the test statistic, followed by two p-values in parentheses. The first p-value is based on asymptotic distribution. The second p-value is robust one-sided p-value based on bootstrapped distribution (1000 replications) to account for cross-section correlation.
a, b, and c denote statistical significance at 10, 5, and 1 percent levels, respectively.

ASEAN5 + Laos, ASEAN5 + Vietnam panels, suggesting capital market of these three members are relatively more integrated with ASEAN5.

It is possible that when Cambodia and Myanmar are individually added to ASEAN5 panel, the enlarged cross-sectional dimension results in higher power of the test, leading to the rejection of the null hypothesis of no cointegration as above. To check this possibility, we repeat the cointegration test for the following panels: ASEAN5 + Brunei + Vietnam, ASEAN5 + Brunei + Vietnam + Laos, ASEAN5 + Cambodia + Myanmar, and ASEAN10. The group test statistics G_t and G_a in Table 4 show that the null hypothesis of no cointegration can only be rejected for the last two panels, at 5 percent and 10 percent, respectively. These results collectively indicate that it is Cambodia and Myanmar that give rise to long-run correlation between investment and saving in the panels for which they are members.[9]

Westerlund (2007) dynamic panel error-correction model in Eq. (6) can also accommodate lead order besides lag order. We repeat the cointegration test allowing for maximum 1 lead order while maintain the lag order at 1 to check the robustness of the results in Table 4. Owing to limited time-series observation for Laos, this dynamic specification cannot be applied to any panel in which it is a member. Table A2 in Appendix contain the results for the rest of the panels; they are very similar quantitatively and therefore yield the same qualitative conclusion.

A close examination of economic development and institutions in the less-developed new ASEAN members (Cambodia, Laos, Myanmar, and Vietnam) can be useful to understanding the above results. Among these members, Vietnam was the first to institute

[9] As the anonymous referee points out, despite various groupings of the new members to ASEAN5 for robustness check as shown above, the short data series for Laos can give rise to the results for the panels of which it is part.

Table 5
Pesaran (2006) mean group estimate of saving-retention coefficient β.

	ASEAN5 + Cambodia		ASEAN5 + Myanmar		ASEAN5 + Cambodia + Myanmar		ASEAN10	
	β (p-value)	χ^2 test of $\beta = 1$ (p-value)	β (p-value)	χ^2 test of $\beta = 1$ (p-value)	β (p-value)	χ^2 test of $\beta = 1$ (p-value)	β (p-value)	χ^2 test of $\beta = 1$ (p-value)
Average	0.639[c]	82.71[c]	0.747[c]	2.92[a]	0.749[c]	3.55[a]	0.629[c]	4.44[b]
	(0.000)	(0.000)	(0.000)	(0.088)	(0.000)	(0.060)	(0.000)	(0.035)
Indonesia	0.634[c]	3.80[a]	0.741[c]	2.33	0.666[c]	3.06[a]	0.943[c]	0.09
	(0.001)	(0.051)	(0.000)	(0.127)	(0.000)	(0.080)	(0.000)	(0.770)
Malaysia	0.661[c]	21.40[c]	0.822[c]	4.15[b]	0.745[c]	8.93[c]	0.451[c]	14.56[c]
	(0.000)	(0.000)	(0.000)	(0.042)	(0.000)	(0.003)	(0.000)	(0.000)
Philippines	0.616[b]	2.25	0.425	4.38[b]	0.790[c]	0.55	0.707[b]	0.93
	(0.016)	(0.134)	(0.122)	(0.036)	(0.005)	(0.459)	(0.020)	(0.335)
Singapore	0.282	8.10[c]	0.362	4.41[b]	0.210	10.38[c]	0.0145	14.26[c]
	(0.263)	(0.004)	(0.233)	(0.036)	(0.391)	(0.001)	(0.955)	(0.000)
Thailand	0.831[c]	1.52	0.908[c]	0.40	1.013[c]	0.01	1.172[c]	0.85
	(0.000)	(0.217)	(0.000)	(0.525)	(0.000)	(0.925)	(0.000)	(0.358)
Brunei							−0.415[c]	10.13[c]
							(0.005)	(0.001)
Cambodia	0.576[c]	10.20[c]			0.565[c]	10.57[c]	0.571[c]	10.13[c]
	(0.000)	(0.001)			(0.000)	(0.001)	(0.000)	(0.001)
Laos							0.482	2.70
							(0.127)	(0.101)
Myanmar			1.250[c]	3.97[b]	1.185[c]	2.04	1.251[c]	2.45
			(0.000)	(0.046)	(0.000)	(0.153)	(0.000)	(0.117)
Vietnam							0.605[b]	2.76[a]
							(0.011)	(0.097)

a, b, and c denote statistical significance at 10, 5, and 1 percent levels, respectively.

Table 6
Panel results of pool mean group (PMG) and mean group (MG) estimation for ASEAN10.

	Saving retention rate β	Error correction term	Short run coefficient $\Delta(S/Y)$
MG	0.565[b]	−0.356[c]	0.084
	(0.047)	(0.000)	(0.268)
PMG	0.424[c]	−0.286[c]	0.144
	(0.000)	(0.002)	(0.183)
χ^2 of Hausman test	0.23		
	(0.689)		

a, b, and c denote statistical significance at 10, 5, and 1 percent levels, respectively.

economic reforms (1986) and is the most developed in terms of per capita income. It also obtained ASEAN membership before the other members. Sustained high growth and more outward-oriented policies render Vietnam more closely integrated with the economies of the original ASEAN members. Its inclusion in the Trans-Pacific Partnership (TPP), along with more developed ASEAN members Brunei, Malaysia, and Singapore, further demonstrates this potential. Among the three least-developed economies, Laos instituted economic reform relatively early, around the same time as Vietnam, and has sustained high economic growth, among the highest in Asia in the last few years. More importantly, as in Vietnam, political stability has been conducive to Lao's economic development and international relations. In contrast, political instability has hindered economic progress and integration in Cambodia and, particularly, Myanmar. For example, Cambodia has the lowest per capita income in ASEAN. Myanmar's economy was effectively closed to the rest of the world for two decades during 1997–2016 when it faced economic sanctions from the US. This probably explains why the EIU's collection of price data in Myanmar was rescinded after 2004. In addition, Myanmar is the only country in ASEAN that has not adopted Article VIII of the International Monetary Fund Articles of Agreement.[10] In short, our results of the above statistical analysis are consistent with these economic and institutional developments.

We use Pesaran (2006) approach to estimate the saving-retention coefficient β in Eq. (7) for the panels in which there is evidence of cointegration between investment and saving. The results are shown in Table 5. For each panel, the first column contains the estimated values of β for the whole panel as well as individual members; underneath each of these estimates is the p-value obtained from the test of whether β is different from zero. The second column contains χ^2 statistic testing the null hypothesis of $\beta = 1$. The results show that the

[10] Article VIII of the IMF's Articles of Agreement stipulates general obligations of its members on avoidance of restrictive and discriminatory currency practices, convertibility of foreign-held balances, furnishing of information, consultation on international agreements, and collaboration on reserve assets.

Table 7
Individual results of pool mean group (PMG) and mean group (MG) estimation for ASEAN10.

	MG		PMG	
	Error correction term	$\Delta(S/Y)$	Error correction term	$\Delta(S/Y)$
Indonesia	−0.352[c]	0.273	−0.231[b]	0.533[c]
	(0.007)	(0.171)	(0.040)	(0.000)
Malaysia	−0.132	−0.176	−0.044	0.389
	(0.205)	(0.556)	(0.641)	(0.161)
Philippines	−0.311[b]	0.456	−0.302[b]	0.473[a]
	(0.015)	(0.120)	(0.011)	(0.085)
Singapore	−0.070	0.239	−0.095	0.241
	(0.458)	(0.369)	(0.120)	(0.337)
Thailand	−0.164	0.192	−0.191[a]	0.227
	(0.216)	(0.676)	(0.089)	(0.596)
Brunei	−0.152	−0.145	−0.125	−0.154
	(0.430)	(0.415)	(0.111)	(0.323)
Cambodia	−1.039[c]	0.043	−1.032[c]	0.039
	(0.000)	(0.770)	(0.000)	(0.769)
Laos	−0.740[c]	−0.288	−0.516[b]	−0.197
	(0.009)	(0.320)	(0.010)	(0.439)
Myanmar	−0.354[c]	0.282	−0.132	0.649[c]
	(0.008)	(0.249)	(0.151)	(0.001)
Vietnam	−0.247[b]	−0.030	−0.190[b]	0.016
	(0.049)	(0.859)	(0.040)	(0.146)

a, b, and c denote statistical significance at 10, 5, and 1 percent levels, respectively.

average value of the saving-retention coefficient β is smallest (0.629) in ASEAN10 panel and largest (0.749) in ASEAN5 + Cambodia + Myanmar panel; this is consistent with the above discussion of the role of Cambodia and Myanmar in the cointegration test results. The estimated value of β is 0.639 and 0.747 in, respectively, ASEAN5 + Cambodia and ASEAN5 + Myanmar panels. In all four panels, the estimated saving retention rate is statistically different from zero at 1 percent significance level. The null hypothesis of $\beta = 1$ is rejected at 1 percent level in ASEAN5 + Cambodia, at 5 percent in ASEAN10, and at 10 percent in the other two panels.

As for the estimated saving retention coefficient for individual members, we focus on ASEAN10 panel and note the following. The estimated β is smallest for Singapore at 0.0145; and it is not statistically different from zero, suggesting perfect capital mobility. The saving retention coefficient is very high for Myanmar (at 1.251), Thailand (1.172), Indonesia (0.943), and the Philippines (0.707) and is not statistically different from unity. The coefficient lies below unity for the rest of ASEAN members.

3.2. Short-run dynamics

As indicated in Table 1, the investment rate is larger than saving rate for the majority of countries in the sample period. It is not a mere coincidence that the saving retention rate estimated above tends to be smaller for the countries that have current account surplus (Singapore, Malaysia, Brunei) and larger for those that have current account deficit (Myanmar, Philippines, Vietnam) in the sample. As a country cannot run current account deficits indefinitely, high long-run correlation between saving and investment β may reflect the solvency constraint (stationary current account), as discussed in Section 2, and consequently may not be informative about long-run capital mobility (Coakley et al., 1996; Jansen, 1998, 1996a, 1996b). In this section, we turn our attention to short-run dynamics in the saving-investment relationship.

In Table 6, we report the results of the simple panel error correction model in Eq. (8), which is derived from an ARDL (1,1) specification. For simplicity and space reservation, we focus on the full membership, ASEAN10 panel. The error correction term ψ is negative and statistically significant at 1 percent level in both MG and PMG estimation, which indicates the existence of a long-term saving investment relationship and is consistent with the results from Westerlund (2007) panel cointegration test discussed above. It also implies that short-run dynamics of investment is driven by deviations from long-run solvency constraint. The estimated coefficient of the error-correction term ($\psi_{MG} = -0.356$ and $\psi_{PMG} = -0.286$) is statistically different from unity, signaling high capital mobility; these estimates imply half-life adjustment of about two years and three quarters to three years and two quarters.

Moreover, the panel-average long-run saving retention rate is positive and statistically different from both zero and unity; β is 0.565 in MG and 0.424 in PMG estimation. Lastly, the short-run saving retention rate, the coefficient of $\Delta(S/Y)$, is very small at 0.084 (MG) and 0.144 (PMG) and is not different from zero. Although both estimators yield very similar results, χ^2 statistic from Hausman's test does not reject the null hypothesis of valid restriction on the *long-run* coefficient to be same across countries, suggesting PMG estimation is more appropriate. To sum up, the results appear to suggest high capital mobility for ASEAN.

The results for individual countries in ASEAN10 panel are reported in Table 7. The MG and PMG estimates are quite similar and given the outcome of Hausman's test, we focus our discussion on the PMG results. The estimated error correction is negative and statistically different from unity for all except Cambodia. More specifically, it is not statistically different from zero for Singapore ($\psi = -0.095$), Malaysia (−0.044), and Brunei (−0.125), the three countries with highest income and excess saving. Capital mobility

is very high for these countries as current account imbalances can be maintained for a protracted period of time due to very low speed of adjustment to long-run equilibrium. The case of small and statistically insignificant error correction term for Myanmar ($\psi = -0.132$) is an anomaly, attributable to limited time-series data.

For the rest of the membership, the speed of adjustment is fairly small, -0.516 for Lao, -0.231 for Indonesia, and -0.190 for Vietnam. The short-run saving retention rate, $\Delta(S/Y)$, is close to zero for seven countries and statistically different from zero only for Myanmar (0.649), Indonesia (0.533), and the Philippines (0.473). Moreover, these short-run estimates are far below their respective long-run saving retention rate reported in Table 5.

A comparison with results from Pelgrin and Schich (2004), in which the saving-investment relationship is estimated based on a sample of 20 OECD countries over 1970–1999 and on the same ADRL (1,1) specification, is useful. In their paper, the estimated coefficient of the error correction term for the whole panel is -0.36 and -0.33 from MG and PMG estimators, respectively; these values of adjustment speed are very close to those obtained for ASEAN10 in our analysis. Their estimates of the short-run coefficient, $\Delta(S/Y)$, are 0.20 (MG) and 0.22 (PMG); both are statistically different from zero; they are higher than the corresponding values (0.084 and 0.144) in our sample. Their results for individual countries also show a wide range of estimates for the adjustment speed, from -0.14 (not significant) and -0.12 (significant at 10 percent) for Japan and Belgium, respectively, to -0.60 (significant at 5 percent) and -0.48 (significant at 1 percent) for less developed members Greece and Spain, respectively.

4. Concluding remarks

In this paper, we examine capital market integration in ASEAN via Feldstein and Horioka (1980) framework. Instead of using traditional pure cross-section or pure time-series techniques, we use recent advances in the econometrics of non-stationary panel data to not only increase the power of the test but also effectively address several major shortcomings of the original FH methodology.

Analysis of various subgroups and the full membership in ASEAN shows that there is some evidence of market integration in the ASEAN, especially among the original and/or more developed members. A direct comparison with the results in Pelgrin and Schich (2004) suggests that capital mobility in the full ASEAN membership during 1980–2014 is similar to that in OECD countries during 1970–1999. This can be interpreted in two ways: (i) capital mobility in ASEAN, which consists mostly of low and middle income countries, is already *high* since it is comparable, albeit with about one-decade lag, to that among developed countries; or (ii) capital mobility in ASEAN is still *low* because advances in information technology, financial innovations, and deregulations in the past two decades should have spurred greater capital market integration, particularly in light of other cooperation initiatives in ASEAN. Either interpretation is, of course, open to a myriad of qualifications and caveats.

A more meaningful observation from our analysis, however, is that there is a considerable disparity among individual members of ASEAN. Accounting for country heterogeneity in all estimation, we show that the saving-investment association is very weak, thereby implying very high capital mobility, in more developed members such as Singapore, Malaysia, and Brunei. The association is very strong, implying very low capital mobility, for much less developed members such as Laos, Myanmar, and Cambodia.

Under ASEAN Economic Community blueprint, the member states have committed to “transform ASEAN into region with free movement of goods, services, investment, and skilled labor, and freer flow of capital.” With regard to financial integration, ASEAN member states have made notable achievements in the last two decades. For example, Chiang Mai Initiative (CMI), a network of bilateral currency swap arrangements between ASEAN and China, Japan, and South Korea (ASEAN + 3) established in 2000 as a response to the Asian financial crisis of 1997–1998, grew to USD 240-billion multilateral agreement (CMIM) in 2012. Instituted in support of CMIM is ASEAN + 3 Macroeconomic Research Office, a surveillance group that monitors and analyzes regional economies to maintain monetary cooperation and stability in the region. There have also been recent initiatives launched in support of financial integration under AEC blueprint in the areas of (i) financial services liberalization, (ii) capital account liberalization, and (iii) capital market development (ASEAN, 2015). For example, in the area of financial services liberalization, the ASEAN Bank Integration Framework, approved by the member central bank governors in December 2014, aims to establish a more integrated regional banking sector for a network of qualified ASEAN banks by applying the principles of equal access, equal treatment, and equal environment in the banking industry. For capital account liberalization, all member states, except Myanmar, have adopted Article VIII of the IMF Articles of Agreement. And in terms of capital market development, member states have taken steps to develop and integrate bond and equity markets in the Association and present ASEAN as an asset class internationally.

Despite these achievements and initiatives, there are many challenges in harmonizing regulatory frameworks and implementing them across member states. The most serious obstacle is that there are not only considerable disparities between ASEAN5 and the group of five new members, but also among the countries within each group (ADB, 2013). This observation is supported by the data analysis in our paper.

In short, the empirical results in this paper call for renewed effort to develop capital markets in less developed nations and integrate them with the rest of the membership in ASEAN. This can be achieved by unilateral effort of these nations or, better yet, with assistance from and cooperation with more developed members. Greater capital market integration and capital mobility are important in themselves, but they also facilitate greater integration in other markets (labor, goods, and services). Dang and Yang (2016) show integration in retail markets of many goods and services in ASEAN, which is part of the vision of the Economic Community, is very low and has not exhibited any significant improvement in the last two decades.

ASEAN, an important trade bloc with large, young, and dynamic labor force, has committed to the lofty goal of ASEAN Economic Community (AEC). There is a lot more to be done by the members so that the full potential benefits of such a community can be realized. Much more research is also needed to identify policies and reforms that are conducive to a successful formation of AEC. Our paper is a step in that direction.

Acknowledgements

We would like to thank Donald Lien, Kiyotaka Sato, Zhaoyong Zhang, and other participants at 2016 Edith Cowan University – Yokohama National University International Conference on "China's Rise and Regional Integration in East Asia" in Yokohama, Japan for helpful comments on an earlier draft. The remaining errors are ours.

Appendix

See Tables A1 and A2

Table A1
Pesaran (2007) panel unit root test; number of lags = 2; null hypothesis: unit root.

	Investment		Saving	
	Level	Difference	Level	Difference
ASEAN5 (1960–2014)	0.764	−8.918[c]	0.636	−8.734[c]
	(0.777)	(0.000)	(0.738)	(0.000)
ASEAN5 (1980–2014)	1.607	−6.573[c]	1.300	−6.303[c]
	(0.946)	(0.000)	(0.903)	(0.000)
ASEAN5 + Brunei	1.428	−7.760[c]	0.543	−5.932[c]
	(0.928)	(0.000)	(0.707)	(0.000)
ASEAN5 + Cambodia	0.938	−6.871[c]	0.823	−5.738[c]
	(0.826)	(0.000)	(0.795)	(0.000)
ASEAN5 + Laos	1.142	−5.465[c]	1.766	−6.103[c]
	(0.873)	(0.000)	(0.961)	(0.000)
ASEAN5 + Myanmar	0.489	−6.734[c]	1.291	−6.513[c]
	(0.687)	(0.000)	(0.902)	(0.000)
ASEAN5 + Vietnam	1.186	−6.185[c]	0.842	−7.132[c]
	(0.882)	(0.000)	(0.800)	(0.000)
ASEAN10	0.515	−7.494[c]	−0.059	−6.766[c]
	(0.697)	(0.000)	(0.477)	(0.000)

Table A2
Westerlund (2007) panel cointegration test. Null hypothesis: No cointegration; 1 lag and 1 lead.

	G_t	G_a	P_t	P_a
ASEAN5	−0.069	0.893	0.140	−0.007
	(0.473)	(0.814)	(0.555)	(0.497)
	(0.418)	(0.517)	(0.585)	(0.387)
ASEAN5 + Brunei	0.544	1.154	0.624	0.173
	(0.707)	(0.876)	(0.734)	(0.569)
	(0.583)	(0.541)	(0.698)	(0.414)
ASEAN5 + Cambodia	−2.240	0.705	0.232	0.153
	(0.013)[b]	(0.760)	(0.592)	(0.561)
	(0.023)[b]	(0.342)	(0.500)	(0.318)
ASEAN5 + Laos	–	–	–	–
ASEAN5 + Myanmar	−1.510	0.770	0.206	0.121
	(0.066)[a]	(0.779)	(0.581)	(0.548)
	(0.081)[a]	(0.392)	(0.501)	(0.354)
ASEAN5 + Vietnam	0.341	1.061	0.338	0.084
	(0.633)	(0.856)	(0.632)	(0.533)
	(0.503)	(0.531)	(0.577)	(0.344)
ASEAN5 + Brunei + Vietnam	0.877	1.303	0.789	0.252
	(0.810)	(0.904)	(0.785)	(0.599)
	(0.655)	(0.579)	(0.706)	(0.417)
ASEAN5 + Brunei + Vietnam + Laos	–	–	–	–
ASEAN5 + Cambodia + Myanmar	−3.413	0.593	0.279	0.264
	(0.001)[c]	(0.723)	(0.610)	(0.604)
	(0.006)[c]	(0.270)	(0.488)	(0.324)
ASEAN10	–	–	–	–

Note: Owing to limited number of time-series observations, we fix the number of lags at 1 and the number of leads at 1. The specification also includes a linear trend. Results for panel with Laos are not available because the number of observations for Laos is not sufficient to accommodate this specification of leads and lags. For semi-parametric correction, the Bartlett kernel window width is set according to $4(T/100)^{2/9} \approx 2$. Contained in each cell is the test statistic, followed by two *p*-values in parentheses. The first *p*-value is based on asymptotic distribution. The second *p*-value is robust one-sided *p*-value based on bootstrapped distribution (1000 replications) to account for cross-section correlation.

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