1. THE STATIONARITY OF CONSUMPTION-INCOME RATIOS: NONLINEAR EVIDENCE IN ASEAN COUNTRIES

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Abstract

The objective of this paper is to investigate the nonstationarity of consumption–income ratios in the ASEAN countries. After establishing that the series follows a nonlinear process, we employ different types of nonstationarity tests including the Wu and Lee (2009) approach in the estimation process. The results show that consumption–income ratio is non-stationary in most of the countries, as suggested by the absolute income hypothesis and the involuntary saving theory. The findings are important because they suggest that government interventions through the fiscal and monetary policies are likely to have enduring impact on the consumption–income ratio in the region.

Keywords: consumption–income ratio; unit root tests; nonlinearity; cross-sectional dependence; ASEAN countries

JEL classification: C12, C32, C33, D12

I. Introduction

The relationship between consumption and income is one of the cornerstones of macroeconomics. In particular, the estimation of the stochastic properties of consumption-income ratio or the average propensity to consume (APC) is an important issue, because it provides evidence for the validity of major consumption theories and also has significant policy implications. A stationary APC implies that the series converges towards a constant in the long run. The life cycle hypothesis of Ando and Modigliani (1963), relative income hypothesis of Duesenberry (1952) and Modigliani (1986) and the permanent income hypothesis of Friedman (1957) have all suggested the incidence of such equilibrium relationship between consumption and income[2]. Similarly, a stationary APC implies that any shock or disturbances to the series will be temporary. Policy makers should not engage in active fiscal and monetary policies to stimulate APC as such efforts might not have long term impact on the series (Nelson

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[2] This result has far reaching implications for modelling and forecasting the economy and for understanding savings behaviour and the business cycle.

and Plosser, 1982). On the other hand, a nonstationary APC implies that the series follows a random walk and thus, does not converge to the steady state. The absolute income hypothesis of Keynes (1936) and involuntary savings theory of Deaton (1991) suggest that the stationarity properties of the series do not fluctuate around a predictable level.

There are empirical papers that have attempted to investigate the stationarity of consumption-income with the earlier set of these studies using the conventional unit root tests such as the ADF test in their estimations (Drobny and Hall 1989; Hall and Patterson, 1992 and Horioka, 1997). Sarantis and Stewart (1999) stimulated the recent interest in the stationarity of consumption-income by using a more sophisticated technique - the Im *et al*. (1997) panel unit root test procedure to examine the stationarity of the series in 20 OECD for the period of 1957-1994. The results yielded strong evidence for the existence of unit root in the series.

Tsionas and Christopoulos (2002) used the data of 14 European Union countries to test the stationarity properties of the consumption−income ratio for the period, 1960-1999. The authors provided evidence for nonstationarity of consumption−income ratio. Cook (2003) probed the nonstationarity of the consumption-income ratio over the period, 1955(1)-2001(3). Using the weighted symmetric and recursive mean adjusted DF tests of Shin and So (2001), strong evidence of the nonstationarity of the UK consumption-income ratio was detected. In another study, Cook (2005) applied the unit root tests of Strazicich and Lee (2003; 2004) to analyze the unit root properties of consumption–income ratio for 20 OECD economies over the period, 1955-1994. Employing the two-break version of the test, the empirical evidence provided support for stationarity in 14 countries, while with the one-break versions of the test, the author provided evidence for stationarity in the remaining six countries.

Romero-Ávila (2008) investigated the existence of a unit root in the consumption-income ratio for a sample of 23 OECD countries over the period, 1960 to 2005. Utilizing a battery of panel unit root tests, the findings suggested that the consumption–income ratios in the OECD countries are generated by a nonstationary stochastic process. Romero-Ávila (2009) examined the stochastic properties of the consumption–income ratio for a sample of 23 OECD countries for the period, 1960–2005. Using the Panel KPSS stationarity test with multiple breaks of Carrion-i-Silvestre *et al*. (2005), the results provided evidence for stationarity of the series.

Liao *et al*. (2011) adopted the series specific panel unit root test of Breuer *et al*. (SURADF test) to test for the mean-reverting behavior of the consumption-income ratio for the panel of 24 OECD countries. It was found that the consumption-income ratios in 22 OECD countries exhibited mean-reverting behavior. Similarly, Fallahi (2012) probed the stationarity of consumption–income ratio (APC) for 23 OECD countries over the period, 1950–2007. The results showed that the APC is nonstationary in most of the countries. Elmi and Ranjbar (2013) utilized a flexible Fourier stationary test of Becker *et al*. (2006) to examine the mean reversion of consumption–income ratio in 16 OECD countries from 1960 to 2010. The authors showed that the mean reversion hypothesis is not rejected for 75% of the sample. Cerrato *et al*. (2013) examined the nonstationarity of APC in 24 OECD and 33 non-OECD countries over the period 1951–2003. Applying nonlinear and linear panel unit root tests that account for cross-sectional dependence, the study provide evidence for nonstationarity in majority of the cases (65%) with slightly fewer OECD countries' (61%) series exhibiting a unit root than non-OECD countries (68%).

The extant empirical literature on consumption-income series is characterized by mixed results. However, one unique feature of these foregoing empirical papers is that they are focused on developed countries. This was partly because of developed countries' domination of global consumption and income. However, such share is declining. The share of non-OECD countries in the global real GDP rose from 10% in 1970 to 36% in 2015. The portion of non-OECD in the global household final consumption expenditure increased from 18% in 1970 to 32% in 2015 (World Bank, 2016).

The two known studies devoted to the developing countries are the works of Gomes and Franchini (2009) and Gozgor (2013). Gomes and Franchini (2009) analyzed the stochastic properties consumption-income ratio in 10 South American countries for the period 1951 to 2003. The ADF test showed that the null hypothesis of unit root is rejected in Argentina, Paraguay, Chile and Peru. Upon the application of unit root test with structural breaks, only Uruguay was found to be nonstationary. Gozgor (2013) used the panel unit root test of Pesaran (2007) to examine the order of integration of consumption-income ratios in eleven central and eastern European (CEE) countries. With the exception of Croatia and Slovenia, the study found strong evidence for mean-reversion in the consumption-income series of the selected CEE countries.

The foregoing studies indicate that there is limited number of papers on developing countries and none on the countries in the Association of South-East Asian Nations (ASEAN). The issues of nonlinearity, cross-sectional dependency and small sample sizes have not been adequately treated in the existing papers. Consequently, most of the results generated from the previous studies will likely have little relevance to the developing countries. Besides, the results provided by the previous studies especially the ones based on linear might not be reliable. Generally, linear approaches may suffer from power problem when applied to series characterized by a nonlinear data generating process (Kapetanios *et al*., 2003). The adjustments of consumption (especially durable consumption) are likely to follow nonlinear dimension rather than linear one. Moreover, the failure to examine contemporaneous correlations in the series will bias the results toward rejecting the joint unit-root hypothesis (O'Connell, 1998)[3]. Besides, as the international real business cycle literature has demonstrated, there appears to be strong linkages between macroeconomic aggregates – including consumption – among countries (Romero-Ávila, 2008).

Therefore, we are motivated in this study to examine the APC of 10 ASEAN countries, for the period, 1970-2015. The bloc is dominated by developing countries that have experienced surge in both consumption and income (World Bank, 2016). Although the APC in the bloc has not been stable, the region's volume of consumption is steadily gaining momentum both in absolute and relative terms. The volume of household consumption has increased almost 10-fold from US$81 billion (2010 prices) in 1970 to US$864 billion (2010 prices) in 2015 (United Nations, 2016).

There are several reasons for the continuous increase of consumption in the region, including large population size, increasing number of members of middle class and rising equity prices. In 2015, ASEAN achieved population growth rate of 1.17%; thereby

[3] *Only Cerrato* et al. *(2013) have applied a related method.*

reaching 632 million or 8.61% of the global population (United Nations, 2016). Large numbers of individuals and households are joining the middle class and purchasing middle-class goods and services for the first time (Estrada *et al*., 2011). Secondly, we introduce the Wu and Lee (2009) unit root test into the stationarity of consumption-income ratio literature. The test provides for many of the econometrics shortfalls in the previous papers including nonlinearity and cross-sectional dependency.

The remainder of the paper is organized as follows. Section 2 illustrates the data and methodology adopted in this paper. Section 3 provides the empirical findings and finally, Section 4 presents the conclusions of the study as well as policy implications.

II. Data and Methodology

The empirical analysis includes 10 ASEAN countries which are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. Generated from the United Nations Statistics Database, the data are for the period, 1970-2015. A visual plot of the real consumption in ASEAN countries is usually the first step in the analysis of any time series. The graphical representation of the data under this study is presented in Figure 1, where it is shown that the real consumption level is actually rising in relative and absolute terms. However, the consumption-income ratio in the region has not maintained a stable trend (Figure 2). Whilst there is heterogeneity in the underlying trend across countries the majority of the nations seem to experience declining APC. The failure to achieve a constant APC is a sign of nonstationary of the series (Cerrato *et al*., 2013)

Figure 1

Real Consumption in the ASEAN countries

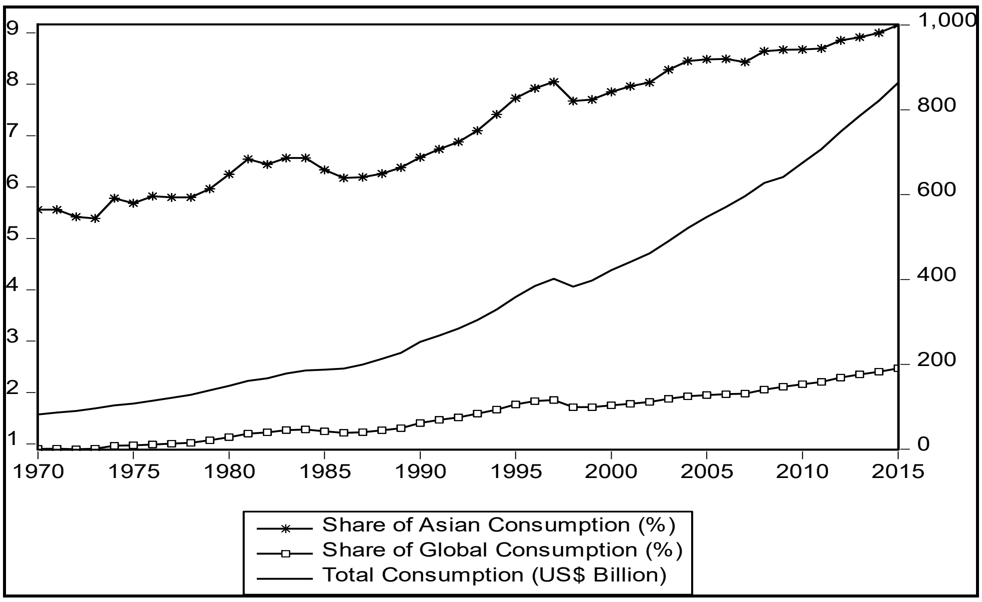
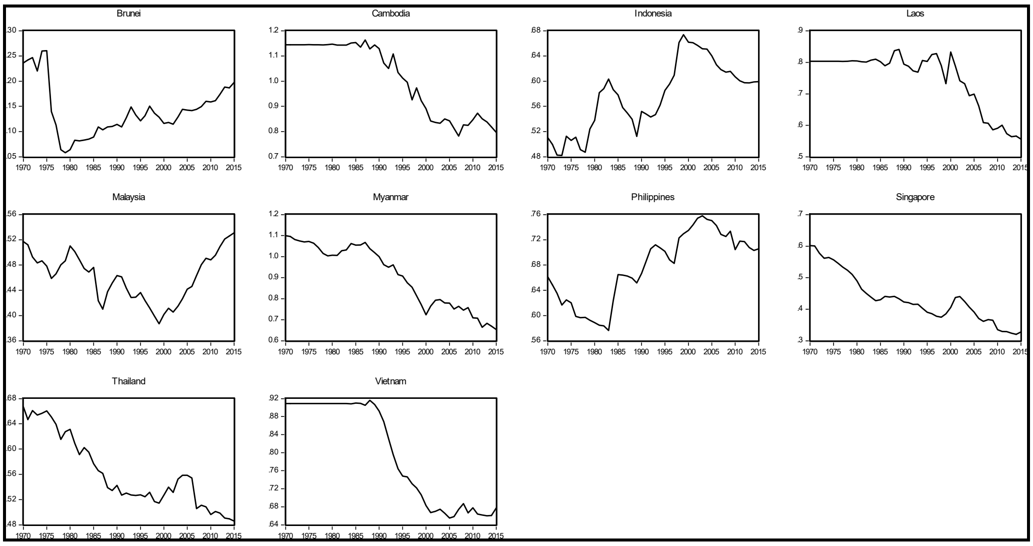


Figure 2

APC in the ASEAN countries



For a more formal investigation, we employ the Panel SURKSS test of Wu and Lee (2009) to investigate the stationarity of consumption-income in 10 ASEAN countries. The estimation method combines the nonlinear unit test of Kapetanios *et al*. (2003) or KSS and the Panel SURADF test of Breuer *et al*. (2001). The test is powerful as it provides for possible existence of cross-sectional dependence and nonlinearity in the series. As such, this nonlinear panel unit-root test is more powerful to the Breuer *et al*. (2001) when the data is nonlinear (Wu and Lee, 2009). As against conventional panel-based unit-root tests that are incompetent of distinguishing between I(0) and I(1) series in a panel setting, Panel SURKSS tests examine a separate unit-root null hypothesis for each and every individual panel member. In so doing, they clearly recognize how many and which panel members are stationary. Consistent with Kapetanios *et al*. (2003), the Panel SURKSS test is based on determining the existence of nonstationarity against a nonlinear but globally stationary exponential smooth transition autoregressive (ESTAR) process. The model is given by:

$$\Delta X_t = \gamma X_{t-1}(1 - \exp\{-\theta X_{t-1}^2\}) + \varepsilon_t \qquad (1)$$

where: X_t is the series, ε_t is the error term which is assumed to satisfy the classical assumptions, θ is the transition parameter of the ESTAR model and dictates the speed of transition. The null hypothesis $H_O : \theta = 0$ can then be tested against the alternative of an ESTAR process. Due to the fact that the parameter γ cannot be identified under the null, KSS used a first-order Taylor approximation for $(1 - \exp\{-\theta X_{t-1}^2\})$ by adopting the following auxiliary regression:

$$\Delta X_t = \chi + \delta X_{t-1}^3 + \sum_{i=1}^{k} b_i \Delta X_{t-i} + \varepsilon_t \qquad t = 1, 2, ...T \qquad (2)$$

In this framework, the null hypothesis is expressed as $\delta = 0$ (nonstationarity), against the alternative hypothesis, which is expressed as $\delta < 0$ (nonlinear ESTAR stationarity). The system of the KSS equations under consideration is:

$$\begin{aligned} \Delta X_{1,t} &= \alpha_1 + \beta_1 X_{1,t-1}^3 + \sum_{j=1}^{k1} \theta_{1,j} \Delta X_{1,t-j} + \varepsilon_{1,t} \\ \Delta X_{2,t} &= \alpha_2 + \beta_2 X_{2,t-1}^3 + \sum_{j=1}^{k2} \theta_{2,j} \Delta X_{2,t-j} + \varepsilon_{2,t} \\ \Delta X_{N,t} &= \alpha_N + \beta_N X_{N,t-1}^3 + \sum_{j=1}^{kN} \theta_{N,j} \Delta X_{N,t-j} + \varepsilon_{N,t} \end{aligned} \qquad (3)$$

The N null and alternative hypotheses are tested individually:

$$\begin{aligned} H_0^1 &: \beta_1 = 0; H_A^1 : \beta_1 < 0 \\ H_0^2 &: \beta_2 = 0; H_A^2 : \beta_2 < 0 \\ H_0^N &: \beta_N = 0; H_A^N : \beta_N < 0 \end{aligned}$$

The test statistics are computed from the SUR equations (3), while critical values are derived through Monte Carlos simulations as the test has nonstandard distributions. The generated 10%, 5% and 1% critical values from the simulations exercise are based on 46 observations for each panel with the experiment replicated 5000 times.

III. Results and Interpretation

Many unit root tests are known to be less reliable in the presence of cross-sectional dependence and nonlinearity. Thus, we begin the analysis by examining the existence of cross-sectional dependency among the series with the Breusch and Pagan (1980) and Pesaran (2004) cross-sectional dependence tests[4]. According to the test statistics given in Table 1, the null hypothesis of independence across the cross-sections is rejected at the 1% level of significance, which indicates strong evidence of cross-sectional dependence. The study further considers the nonlinearity of the series by using the test of Teräsvirta (1994)[5]. Reported in Table 2, the linearity test results show that the APC follows nonlinear process in all the economies. Given the existence of cross-sectional dependence and nonlinear process in the series, there is the need to utilize a unit root test, which provides for cross-sectional dependence as well as nonlinearity such as the Wu and Lee (2009) nonstationarity test.

For confirmatory purpose, we initially report a battery of conventional unit root tests-including the Maddala and Wu (1999), Breuer *et al*. (2001), Kapetanios *et al*. (2003), Becker *et al.* (2006), Pesaran (2007), Cerato *et al.* (2009), Sollis (2009) and Kruse (2011) in Table 3. The ADF-Fisher and PP-Fisher test statistics of Maddala and Wu (1999) panel unit root tests suggest that we cannot reject the null hypothesis of

[4] *For the details of these tests, see Pesaran (2004).*
[5] *For the details of this test, see Terasvirta (1994).*

nonstationarity of the series[6]. Using the Breuer *et al*. (2001) method, we are not able to reject the null of stationarity in seven ASEAN countries. The results further show that we can not reject the null hypothesis in Indonesia and Philippines at 5% significance level, and Malaysia at 10% significance level. Using the Kapetanios *et al*. (2003) method, we cannot reject the null hypothesis in eight ASEAN countries. The countries for which the null hypothesis of non-stationarity can be rejected are Brunei at 1% significance level and Indonesia at 10% significance level. Furthermore, we use test of Becker *et al.* (2006) - with a null of stationarity- to examine the stationarity of the series[7]. We can reject the null hypothesis of stationarity in nine countries. The result for Singapore indicate that we cannot reject the null hypothesis in the country at 5% level.

Next, we introduce two unit root tests that provide for cross sectional dependence in the estimation process- Pesaran (2007) and Cerato *et al*. (2009). In the Cerato *et al*. (2009), there is additional provisions for nonlinearity in the series. Using the Pesaran (2007) test, we can reject the null hypothesis of non-stationarity in all the individual country series as well as the panel series. Subjecting the series to the Cerato *et al*. (2009) test, the null of nonstationarity is achieved in only eight countries with the exception of Brunei and Singapore. The null hypothesis is rejected at the panel-level. We further conduct robustness exercise by subjecting the series to the Sollis (2009) and Kruse (2011) unit root tests, which are improvements on the Kapetanios *et al*. (2003) test. Similar to the results of Pesaran (2007) test, there is no evidence for stationarity of the series in all the series, whilst using Sollis (2009). Malaysia and Indonesia are the only countries, which show evidence for stationairty of the series, whilst using Kruse (2011) test. From the foregoing findings, there is substantial evidence for non-stationarity of the series. However, these unit root tests are likely to be less reliable in the presence of cross-sectional dependence and nonlinearity. With the expection of the Cerato *et al*. (2009), none of these studies have simulataneously provided for nonlinearity and cross-sectional dependence.

The results of Wu and Lee (2009) nonstationarity test are presented in Table 4. Conforming to the test statistics of earlier results, it is observed that the null of nonstationarity can be rejected in Brunei and Indonesia at 1% significance level. In order to strengthen the validity of the results, we re-examine the stationarity of APC by using the data from Penn World Tables (version 8.0)[8]. Similar to the foregoing results, the estimations provide evidence for nonstationarity of APC in all the ASEAN economies (Table 5). This means that APC in most of the countries are nonstationary.

The results tend to support the absolute income hypothesis of Keynes (1936) and involuntary savings theory of Deaton (1991), which have suggested that the series do not fluctuate around a predictable level. Our results appear to be consistent with the findings of Sarantis and Stewart (1999), Tsionas and Christopoulos (2002), Romero-Ávila (2008), Fallahi (2012), Cerrato *et al*. (2013). In particular, Cerrato *et al*. (2013)

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[6] *ADF implies augmented Dickey-Fuller and PP means Philips-Perron.*

[7] *The F-stat reported in Becker* et al. *(2006) suggests that the null hypothesis of linearity can be rejected in most of the countries. Becker et al. (2006) has warned against relying on the F-statistics, when the null hypothesis of stationarity is rejected. Thus, we stick with the Teräsvirta (1994) to decide on the existence of non(linearity).*

[8] *The data spans from 1970-2014.*

have included both Philippines and Thailand in their sample concluded the nonstationarity of APC in these two countries. Despite using different dataset, we are also unable to reject the null hypothesis of stationarity for Philipines, with eight of the nine methods adopted in this study. We are unable to reject the null hypothesis of stationarity with all the methods adopted in this paper for case of Thailand. One of the main differences between the present study and the previous studies is that we have been able to use several methods to arrive at the conclusion that nonstationarity is prevalent in a particular region of the world – the ASEAN countries.

Table 1

Cross-sectional Dependence Test

Test	Statistic
Breusch-Pagan (1980)	819.943*** (0.000)
Pesaran LM (2004)	81.686*** (0.000)
Pesaran CD (2004)	3.799*** (0.000)

***denotes statistical significance at the 1% level. () is the p-value. The selection of the optimal lag length is based on Akaike Information Criterion. LM is langrage multiplier and CD is cross-sectional dependence

Table 2

Teräsvirta (1994) Linearity Test

Country	Panel B: Linearity test	
	F-stat	d
Brunei	19.097***(1)	5
Cambodia	6.988***(1)	3
Indonesia	3.387***(1)	5
Laos	7.254***(1)	2
Malaysia	4.869***(1)	8
Myanmar	2.368**(3)	2
Philippines	2.118*(2)	1
Singapore	4.935***(1)	2
Thailand	2.998**(1)	1
Vietnam	9.032***(2)	2

*, ** and *** indicate significance at 10%, 5% and 1% levels respectively. The maximum lag is set at 8,, while () is the optimal lag. The selection of the optimal lag length is based on Akaike Information Criterion, d is the delay parameter

Table 3

Alternative Unit Root Tests

Country	Maddala and Wu (1999)		Breuer et al. (2001)				Kapetanios et al. (2003) test	Becker et al. (2006)	Pesaran (2007)	Cerato et al. (2009)	Sollis (2009)	Kruse (2011)
	ADF-Fisher T-stat	PP-Fisher T-stat	T-stat	Critical values			T-stat	T-stat	T-stat	T-stat	T-stat	Tau-stat
				1%	5%	10%						
Panel	10.835 (1)	7.887 (1)	-	-	-	-	-	-	-1.927 (1)	-2.922*** (2)	-	
Brunei			-1.762 (1)	-2.979	-2.187	-1.814	-4.153*** (3)	0.113*** (1) [1] (22.581***] {0.058}	-1.297 (1)	–3.526*** (4)	8.452 (3)	17.324*** (3)
Cambodia			-0.112 (1)	-3.613	-2.882	-2.561	-0.189 (1)	0.095*** (1) [1] (70.196***] {0.032}	-2.452 (1)	-2.391 (1)	0.154 (1)	1.329 (1)
Indonesia			-1.995** (1)	-2.623	-1.808	-1.413	-2.709* (3)	0.208*** (1) [2] (17.013**] {0.031}	-2.088 (1)	-2.545 (1)	4.535 (3)	9.102* (3)
Laos			0.344 (1)	-3.051	-2.233	-1.836	0.514 (1)	0.065** (1) [1] (87.755***] {0.026}	-1.404 (1)	-1.412 (1)	0.759 (1)	4.876 (1)
Malaysia			-1.670* (1)	-2.612	-1.821	-1.451	-0.872 (2)	0.067** (1) [1] (68.428***] {0.015}	-1.528 (1)	-0.327 (2)	0.0701 (2)	1.197 (2)
Myanmar			0.408 (1)	-5.327	-2.013	-1672	-0.366 (1)	0.385*** (1) [2] (21.049***] {0.044}	-1.866 (3)	-1.960 (2)	0.510 (1)	2.280 (1)
Philippines			-2.003** (1)	-2.517	-1.806	-1.417	-1.516 (2)	0.064** (1) [1] (57.441***] {0.012}	0.661 (5)	-1.579 (1)	1.175 (2)	2.260 (2)
Singapore			-1.615 (1)	-2.865	-2.144	-1.757	-1.151 (3)	0.047 (1) [1] (46.341***] {0.012}	-2.577 (3)	-2.873* (8)	0.671 (3)	1.305 (3)

Country	Maddala and Wu (1999)		Breuer et al. (2001)				Kapetanios et al. (2003) test	Becker et al. (2006)	Pesaran (2007)	Cerato et al. (2009)	Sollis (2009)	Kruse (2011)
	ADF-Fisher T-stat	PP-Fisher T-stat	T-stat	Critical values			T-stat	T-stat	T-stat	T-stat	T-stat	Tau-stat
				1%	5%	10%						
Thailand			-0.935 (1)	-2.714	-1.991	-1.619	-0.881 (1)	0.165*** (1) [1] (31.595***] {0.010}	-2.459 (4)	-1.317 (1)	0.474 (1)	1.300 (1)
Vietnam			-0.479 (1)	-3.597	-2.952	-2.617	-1.450 (2)	0.097*** (1) [1] (84.407***] {0.016}	-0.600 (3)	-0.378 (1)	0.870 (1)	2.092 (1)

, ** and * indicate significance at 10%, 5% and 1% levels respectively. The critical values for the KSS test are -3.48 -2.93 and -2.66 at 1, 5 and 10% significance level, respectively. The critical values for the individual CADF test of Pesaran (2007) test are -4.49, -3.78 and -3.44 at 1, 5 and 10% significance level, respectively. CADF implies Cross-sectional augmented Dickey-Fuller The critical values for the panel CADF test of Pesaran (2007) test are -3.06, -2.84 and -2.73. at 1, 5 and 10% significance level, respectively. The critical values for the individual CADF test of Cerato et al. (2009) test are -3.81 -3.11 and -2.78 at 1, 5 and 10% significance level, respectively. The critical values for the panel CADF test of Cerato et al. (2009) test are -2.36 -2.16 and -2.05 at 1, 5 and 10% significance level, respectively The critical values for the Sollis (2009) test are 6.891 4.886, 4.173, 4.009 at 1, 5 and 10% significance level, respectively while the values for Kruse (2011) test are 13.75 10.17, 8.60 at 1, 5 and 10% significance level, respectively. The lag structures for each equation in Breuer et al. (2001) is based on the approach adopted by Perron (1989). . For uniformity sake, the regressions in each test include constant and trend. The Akaike Information Criterion (AIC) is used to select the optimal lag in the other tests. In KSS, Kruse (2011) and Sollis (2009), we used the demeaned or non-zero means variant of these tests. The maximum lag is set at 8, while () is the optimal lag. [] is the number of single frequency. (] is the f-statistics and {} is the sum of square residuals.*

Table 4

Wu and Lee (2009) Unit Root Test

Country	SURKSS (*t-stat*)	Critical values		
		1%	5%	10%
Brunei	-3.379*** (1)	-3.091	-2.441	-2.102
Cambodia	0.294 (1)	-3.042	-2.352	-1.994
Indonesia	-3.433*** (1)	-2.877	-2.201	-1.834
Laos	0.491 (1)	-2.810	-2.123	-1.758
Malaysia	-1.187 (1)	-2.621	-1.860	-1.529
Myanmar	0.330 (1)	-2.884	-2.32	-1.858
Philippines	-0.948 (1)	-2.601	-1.910	-1.352
Singapore	-1.097 (1)	-3.281	-2.716	-2.422
Thailand	-0.777 (1)	-3.308	-2.680	-2.342
Vietnam	4.678 (1)	-2.354	-1.632	-1.251

, ** and * indicate significance at 10%, 5% and 1% levels respectively. The lag structures for each equation are based on the approach adopted by Perron (1989). The maximum lag is set at 8,, while () is the optimal lag.*

Table 5

Wu and Lee (2009) Unit Root Test (Penn 8.0 Dataset)

Country	SURKSS (*t-stat*)	Critical values		
		1%	5%	10%
Brunei	0.501 (1)	-3.326	-2.766	-2.462
Cambodia	-0.213 (1)	-3.357	-2.733	-2.457
Indonesia	-3.209 (1)	-2.758	-2.144	-1.772
Laos	0.231 (1)	-3.050	-2.363	-2.018
Malaysia	-0.947 (1)	-2.830	-2.150	-1.794
Myanmar	-0.346 (1)	-3.375	-2.782	-2.493
Philippines	-1.929 (1)	-2.880	-2.140	-1.755
Singapore	-1.144 (1)	-3.341	-2.730	-2.410
Thailand	-1.873 (1)	-2.478	-1.788	-1.427
Vietnam	4.890 (1)	-2.181	-1.546	-1.194

, ** and * indicate significance at 10%, 5% and 1% levels respectively. The lag structures for each equation are based on the approach adopted by Perron (1989). The maximum lag is set at 8, while () is the optimal lag.*

There are many potential explanations for the nonstationarity of the APC in the region. Firstly, the bloc has generally experienced rapid income growth rate. The average growth rate of the annual real GDP of the region was 5.72% for the period, 1970-2016 (World Bank, 2016). In the case of a rising income growth rate, the APC will shift downwards instead of being constant, which is the requirement for stationarity of the APC (Cerrato *et al*. 2013). Secondly, the region has experienced incessant periods of financial crises such as the Asian financial crisis of 1997. Income uncertainty due to these crises would change the precautionary savings and, thereby causing volatility of the APC (Cerato *et al*. 2013). Other factors that might be responsible for shifts in APC and hence the nonstationarity of the series include demographic factors, fiscal variables (Pesaran, Haque and Sharma, 2000) compulsory social security savings schemes (Abeysinghe and Choy, 2004) and inflation (Hon and Yong, 2004). If such events could influence APC, then shocks introduce through the government policies will also have long term impact on APC.

IV. Conclusion

This paper has examined the unit root properties of consumption–income ratio of the 10 ASEAN countries over the period 1970-2015. For this purpose, we have deployed unit root test of Wu and Lee (2009), which provide for both nonlinearity and cross-sectional dependency in the series. The results suggest that the APC in ASEAN countries are nonstationary, which is in agreement with the absolute income hypothesis of Keynes (1936) and the involuntary saving theory of Deaton (1991). The essence of the findings did not change, when the data is further subjected to other unit root tests. We also obtain similar evidence, when an alternative dataset is utilized. The lack of mean reversion implies that policy shocks are likely to have permanent effects on the APC in ASEAN countries. Therefore, government interventions through the fiscal policy and monetary policy are likely to have long-term impact on the APC in the region.

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