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by

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Abstract

The founder members of the Association of Southeast Asian Nations (ASEAN-5) – Malaysia, Indonesia, Thailand, the Philippines and Singapore – increasingly adopted outward-oriented policies in trade and investment by enforcing reforms in the mid-1980s. This paper investigates the existence of endogenously determined structural breaks of the trade and income per capita by using historical time series data during the period from 1970 to 2003 for the ASEAN-5 by applying an Innovational Outliner (IO) model in the presence of a potential structural break. We find that significant structural breaks occurred for trade per capita in the mid-1980s, which coincides with the recession in the region. We also find that significant structural breaks occurred for Gross National Income (GNI) per capita in 1997, which coincides with the Asian crisis. The Philippines experienced structural breaks in 1985, which coincides with a recession.

JEL: C32, F15, O40

Key words: Trade and GDP per capita, IO model, structural break

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1. Introduction

The empirical testing of the export-GDP nexus has produced mixed results. Ahmad and Harnhirun (1995) estimate the long-run behavioural relationship between exports of the Association of Southeast Asian Nations (ASEAN) globally and economic growth of the ASEAN countries for the years 1966 to 1990 and concludes that an export-GDP connection exists in Singapore but not in the other ASEAN member countries. Lewer and Van den Berg (2003) examine the existing empirical literature on the trade-growth nexus and conclude that a one percentage point increase in the growth of exports is associated with a one fifth percentage point increase in economic growth. The majority of studies identify a cross-country positive association between per capita growth and outward orientation. Rodriguez and Rodrik (2000) criticise the robustness and methodological nature of these studies and conclude that the relationship between trade policy and economic growth still remains very much an open question. To avoid some of the above methodological problems, for example, the problem of endogeneity of relations, Lee, Ricci and Rigobon (2004) apply the identification through heteroscedasticity methodology to estimate the effect of openness on growth while properly controlling for the effect of growth on openness and obtain a positive effect.

Our paper investigates the existence of endogenously determined structural breaks of the trade and income per capita by using historical time series data over the last three decades for the founder members of ASEAN – Malaysia, Indonesia, Thailand, the Philippines and Singapore, referred to as ASEAN-5 from hereon. This paper may not be considered a substitute for the available literature on the trade-GDP nexus, which shows a causal relationship between increased trade and income, but instead intends to show structural breaks in the data series which can then be associated with policy changes. The outward orientation of the ASEAN-5 countries at the regional and global level was a notable feature before and after the Asian crisis and is highlighted in the next section. Section 3 discusses the methodology applied, which incorporates the unit root test in the presence of potential structural change by applying Innovational Outlier models (IO). Section 4 analyses the results, and the final section draws our conclusions.

2. Outward orientation, economic reforms and economic crisis: ASEAN-5

Outward orientation may be associated with trade and investment liberalisation, flexible convertible currency, microeconomic reforms and macroeconomic stability. It is likely that combined current and capital account liberalisations create market-based adverse consequences by influencing exchange rates and interest rates. In this sense, current and capital account liberalisations in the ASEAN-5 countries were gradual in the mid-1980s. By adopting fixed exchange rates regimes, ASEAN countries had stable exchange rates and higher savings interest rates to promote growth by partially liberalising foreign trade and investment. The impact of trade liberalisation (current account) on productivity growth and trade performance remains a contentious issue in the literature and has generated mixed results. Surveys indicate that trade liberalisation policies stimulate productivity gains and trade growth (Jayanthakumaran, 2004; Santos-Paulino and Thirlwall, 2004). Some studies have cast doubt on the role of trade liberalisation and argue that increases in openness are associated with relatively small scale efficiency gains (Tybout and Westbrook, 1994). Ocampo and Taylor (1998: p.1543) argue that the good productivity performance of the Asian economies has been associated with their outward orientation, but definitely not with a liberal trade regime.

The ASEAN-5 countries agreed in 1967 to promote cooperation in economic, social and cultural areas and to promote regional peace and stability.[1] Since then, two different intra-ASEAN economic policy interventions, mainly reducing controls in foreign trade, have heavily influenced the ASEAN-5. First, the Bali Summit in 1976 adopted preferential tariff agreements (PTAs), which represented the first major commitment on the part of member countries towards a joint effort to liberalise intra-ASEAN trade. Second, to enhance the economic benefits of the region, the ASEAN countries initiated the ASEAN Free Trade Area (AFTA) at the Fourth ASEAN Summit in Singapore in January 1992, which laid out a comprehensive programme of regional tariff reductions, to be completed in stages through to 2008. Evidence shows

[1] The ASEAN-6 emerged by incorporating Brunei on 7 January, 1984. The ASEAN-10 countries emerged by incorporating Burma, Cambodia, Laos and Vietnam in the 1990s. Our research focuses on the ASEAN-5 founding nations mainly because of the availability of continuous data.

that the above measures taken by the ASEAN-5 countries increased intra-trade flows (Jayanthakumaran and Sanidas, 2005).

Adverse external shocks had struck the ASEAN-5 nations, notably the oil price increases of the early 1970s and 1986. The following external factors triggered off the recession in the mid-1980s: the 1979 oil crisis, the slow-down of the US economy, the yen appreciation following the Plaza Agreement to depreciate the US dollar, and lower external demand for electronics. Internal factors such as rising costs and a slow-down in tourism and other industries aggravated the recession. Following the severe recession of the mid-1980s, and the steady fall in the price of oil, important structural adjustments and economic reforms were initiated by the ASEAN-5 countries at their own pace (Ariff, 1994). The extent of economic reforms varied between these countries and over time but trade liberalisation as the bottom-line of all reform exercises remained the same (Table 1). Controls on trade, finance, tax and foreign direct investment were gradually reduced during the second half of the 1980s. Deregulation has been an important component of the reform agenda. Sound macro-economic policy characterised by fiscal discipline, adequate incentives for saving and investment, and an outward-oriented trade and investment policy were present during the same time. The Philippines was exceptional in that it experienced political instability and poor economic management in the late 1980s and early 1990s (Leipziger, 1997).

Table 1: Indicators of Trade Policy Reforms of ASEAN-5

Policy	Philippines*			Indonesia*			Malaysia**			Thailand**			Singapore**		
	1985	1991	1995	1982	1985	1991	1986	1988	2000	1986	1989	2000	1986	1989	2000
Average tariff rate (%)															
unweighted	28	27	21	37	27	20	10.8	14.5	9.3	31.7	38.5	16.6	0.8	0.4	0
import weighted	18	19	15	22	13	10	n.a.	9.4	6.0	n.a.	33.0	10.1	n.a.	1.1	0
Import licensing (% coverage)															
unweighted	35	5	1	n.a	32	10	n.a.			n.a.			n.a.		
import weighted	33	13	1	n.a	43	13	n.a.			n.a.			n.a.		

Note: n.a. = not available. Source: * Leipziger (1997), ** World Bank (2002).

ASEAN countries experienced gradual reforms and achieved positive performances in trade and investment growth. The reform measures taken by the ASEAN countries outside the ASEAN framework promoted trade flows in the second half of the 1980s

(Ariff, 1994; Tan, 2004). The recovery of the US economy in 1987 raised the demand for ASEAN products (Tan, 2004). Indonesia, Malaysia and Thailand became the world's largest capital importers in the 1990s (Baharumshah, Lau, and Fountas, 2003). As ASEAN-5 currencies were tied to a basket of currencies, primarily to the US dollar, Japanese Foreign Direct Investment (FDI) in the ASEAN countries accelerated with the appreciation of the yen (Tan, 2004). Stable macroeconomic indicators such as small fiscal deficits, stable exchange rates, high saving rates and a highly regarded work force were present in most of these countries (Leipziger, 1997).

The Asian economic crisis of 1997-1998 was a collective shock and non-comparable event in the region's post-war economic history (Haggard, 2000). In the process of globalisation, the financial markets were becoming highly integrated in the 1990s and foreign investors targeted higher returns by short-term lending, ignoring the potential risks. Unlike the previous adverse shocks, the magnitude of the Asian economic crisis of 1997-1998 was quite high due to greater integration with the rest of the world. Measures such as trade and investment liberalisation, and financial liberalisation[2] without having adequate institutional strength made the region more vulnerable to a speculative attack. Thailand's short-term debt was 78 percent of its foreign exchange reserve in 1995. The short-term portfolio foreign investment was nearly four times higher than long-term foreign investment in Thailand (Tan, 2004). Several external events adversely influenced the competitiveness of ASEAN countries. A pegged exchange regime, a weak banking system, highly leveraged borrowers and the attitudes of its neighbours initiated the crisis in Thailand, which then spread to Indonesia, Malaysia, the Philippines and Singapore.

In the process of restructuring, ASEAN-5 initiated and implemented wide-ranging regulatory and institutional reforms. The extent of reforms varied among the member countries: Singapore implemented a range of internal reforms; Thailand and Indonesia underwent considerable political, institutional and regulatory reforms; the Philippines continued with on-going reforms after the Asian crisis; and Malaysia initiated some degree of reform of its banking system. The demand for world electronic products

[2] Haggard (2000: pp.32-38) outlines the nature and extent of financial liberalisation in Indonesia, Thailand and Malaysia during the late 1980s and 1990s.

appeared to have peaked in 2000. Thompson and Poon (2000) demonstrate significant correlations between the expectations of reforms and improvements in the ASEAN investment environment. The Asian crisis in 1997 did not damage but rather stimulated trade flows inside and outside the ASEAN framework (Elliot and Ikemoto, 2004; Jayanthakumaran and Sanidas, 2005). Elliot and Ikemoto argue that one effect of the Asian crisis was to generate a stronger desire to source imports from within the region.

Table 2: Trade per capita and GNI per capita of ASEAN-5 Countries

Year	Indonesia		Malaysia		Philippines		Singapore		Thailand	
	Trade*	GNI**	Trade*	GNI**	Trade*	GNI**	Trade*	GNI**	Trade*	GNI**
1970	0.0017	80	0.028	400	0.006	230	0.193	950	0.005	210
1980	0.022	500	0.173	1830	0.029	690	1.79	4830	0.033	720
1985	0.017	530	0.176	1940	0.018	530	1.79	6850	0.031	810
1986	0.016	530	0.152	1890	0.018	560	1.75	7130	0.034	850
1987	0.017	520	0.184	1970	0.022	620	2.20	7940	0.046	970
1988	0.019	540	0.219	2140	0.027	680	2.92	9410	0.067	1190
1989	0.022	570	0.269	2240	0.031	720	3.21	10530	0.083	1350
1990	0.027	620	0.322	2380	0.035	740	3.72	11840	0.100	1520
1995	0.045	1010	0.735	4030	0.067	1040	6.88	23210	0.217	2760
1996	0.047	1120	0.742	4480	0.078	1190	6.98	25110	0.217	3010
1997	0.048	1120	0.728	4600	0.088	1240	6.78	27130	0.202	2770
1998	0.037	670	0.593	3630	0.083	1080	5.39	23500	0.162	2110
1999	0.035	590	0.657	3370	0.092	1040	5.71	22930	0.180	2000
2000	0.046	570	0.774	3390	0.100	1030	6.77	23000	0.215	2010
2003	0.043	810	0.732	3880	0.093	1080	6.40	21230	0.252	2190

Notes: *Trade per capita in percentage (export+import)/population (computed), **GNI per capita in US$. Source: World Bank, DX Database (2005)

Table 2 shows trade and income per capita of the ASEAN-5 countries for selected years. There was a slight reduction in trade and income in 1986 due to the recession. One can observe a steady growth in trade and income per capita for each of those countries since 1986. Increased trade can be associated with economic reforms that were undertaken after the recession and with positive external demand conditions. The Asian crisis adversely affected trade and income from 1997 to 1999. Since then the ASEAN-5 countries' economies have been on a recovery path. However, as noted in Table 2, the pre-crisis level of income per capita was still high.

3. Methodology

Unit Root Test in the presence of structural change

As is well known, the issue of structural change, and its consequential implications for structural breaks, in macroeconomic time series data must be robustly addressed in order to ensure non-spurious results of unit root tests of such data. There can, of course, be many reasons for structural change, and including such diverse circumstances as economic crises, policy changes or regime shifts. For this reason it is extremely important to test the null hypothesis of structural stability against the alternative of a one-time structural break. If potential structural changes are not allowed for in the specification of an econometric model but are, in fact, present, the results may be spurious because they can be biased towards the erroneous non-rejection of the non-stationarity hypothesis (Perron 1989; Perron 1997; Leybourne and Newbold; 2003; Pahlavani, Valadkhani and Worthington, 2005).

It is essential to test for the existence of a unit root when using time-series data for model estimation. Failure to do so means that the standard asymptotic distribution theory does not apply, resulting in model misspecification, coefficient bias and spurious estimation inferences (Campbell and Perron, 1991; Afandi, 2005). Perron (1989) introduced a way to determine the existence of a structural break in a series which appears to be non-stationary. He presented evidence that most economic time-series are trending stationary if one allows a single change in intercept. In his research he found that many of the variables that had previously been judged to be non-stationary were actually stationary.

It should be noted, however, that Perron's (1989) procedures assume the break point to be known a priori, and that subsequent studies, e.g. Zivot and Andrews (1992), Perron and Vogelsang (1992) and Perron (1997) have criticised the exogenous determination of the break dates. These authors have extended Perron's model by incorporating an endogenous break point into the model specifications. According to Zivot and Andrews (1992), using the endogenously determined structural breaks favours the rejection of the unit root hypothesis in some cases and weakens it in others (Pahlavani, 2005).

Perron and Vogelsang (1992) employ a similar methodology to that used by Zivot and Andrews. They propose a class of test statistics which allows for two alternative forms of change: the Additive Outlier (AO) model, which is best suited for series exhibiting a sudden change in the mean, and the Innovational Outlier (IO) model, which permits that changes take effect gradually over time.

Innovational Outlier models

According to Perron and Vogelsang (1992), the (IO) model tests whether the change in the level occurs gradually, that is, whether there is a transition period. Based on this method, the (IO) model is estimated by the equation below:

$$x_t = \mu + \theta DU_t + \delta D(T_b)_t + \alpha x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t \qquad (1)$$

$$x_t = \mu + \theta DU_t + \gamma DT_t + \delta D(T_b)_t + \alpha x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t \qquad (2)$$

Where x_t is the variable being tested and Tb is the time of the break, and DU_t is equal to one if (t > Tb), and zero otherwise, $D(T_b)_t$ =1 if (t=Tb+1), and zero otherwise and finally DT_t is equal to (t > Tb) t and zero otherwise. The null hypothesis of the unit root is rejected if the t-statistic for α is sufficiently large (in absolute value). The above equations are estimated sequentially for each break year (Tb=k+2,..,T-1), where T is the number of observations. The time of the break that is chosen is the one which minimises the t-statistic for α =1. The lag length is data-determined from general to specific, and the break date is assumed to be unknown and is endogenously determined by the data generating process. The null hypothesis of the unit root is rejected in favour of an alternative of stationarity around the time of the break (Tb) if the t-statistic for α is larger in absolute value than the appropriate critical values.

4. Empirical findings

Taking advantage of the Perron and Vogelsang model (1992), we identify the years in which a structural break occurs. For our empirical estimation, first, the least restrictive model, which takes into account the existence of a potential break in both intercept and slope (equation 2), is estimated. If the empirical result for the variable under

investigation is significant at the 10 percent or higher level, then the results are reported. If the result based on (equation 2) is not significant, then the first model, which considers the existence of a potential break in intercept only (equation 1), is estimated and reported. The empirical results are reported in Table 3. The results are then analysed to explain the reason(s) for the breaks. We apply the method of endogenously determining the appropriate lag length. A data-dependent method for selecting the value of lag length *K* is applied in this research. According to Ng and Perron (cited in Ben-David and Papell, 1998: 562), it is better to use the data-dependent method rather than making an a priori choice of a fixed *K*. Ng and Perron suggest starting with an upper bound of *Kmax*. *K* is considered as *Kmax* if the last lag included in the model is significant, and K is reduced by one if the last lag that we included in the model is not significant. Following Lumsdaine and Papell (1997), we consider the maximum (*Kmax*) equal to eight and if the coefficient on the eighth lag is significant based on a t-test (i.e., at least 1.645 in absolute value), then we let *K=Kmax*. If not, *K* is reduced by one until significance is reached. Otherwise *K* is equal to zero.

Using the sequential approach, the regression equation is run with the values Tb of (2…t-1) for each time series. The values of the t-statistic for variable α are recorded and compared. From this comparison, the break point is then selected by the value of Tb, which minimises the t-statistic on the coefficient α**.** The unit root null hypothesis is rejected in favour of the alternative of stationarity if the t-statistic for α is significant and greater than the critical values tabulated by Perron and Vogelsang (1992). The result of the Innovational Outlier (IO) model is reported in Table 3:

Table 3: Innovational outlier model for endogenously determined breaks

Series	Tb	K	α	$t_{\hat{\alpha}}$	Possible cause of the break
LNGIND	1997	8	0.81	-1.53	Asian crisis
LNTIND	1986	1	0.80	-4.63*	Recession
LNGMA	1997	8	0.78	-4.01	Asian crisis
LNTMA	1986	2	0.83	-4.15	Recession
LNGPHIL	1985	8	0.69	-3.12	Recession
LNTPHIL	1985	7	0.75	-4.26*	Recession
LNGTH	1997	1	0.78	-3.25	Asian crisis
LNTTH	1986	7	0.71	-4.37*	Recession
LNGSNG	1997	2	0.97	-1.74	Asian crisis
LNTSNG	1986	7	0.66	4.73*	Recession

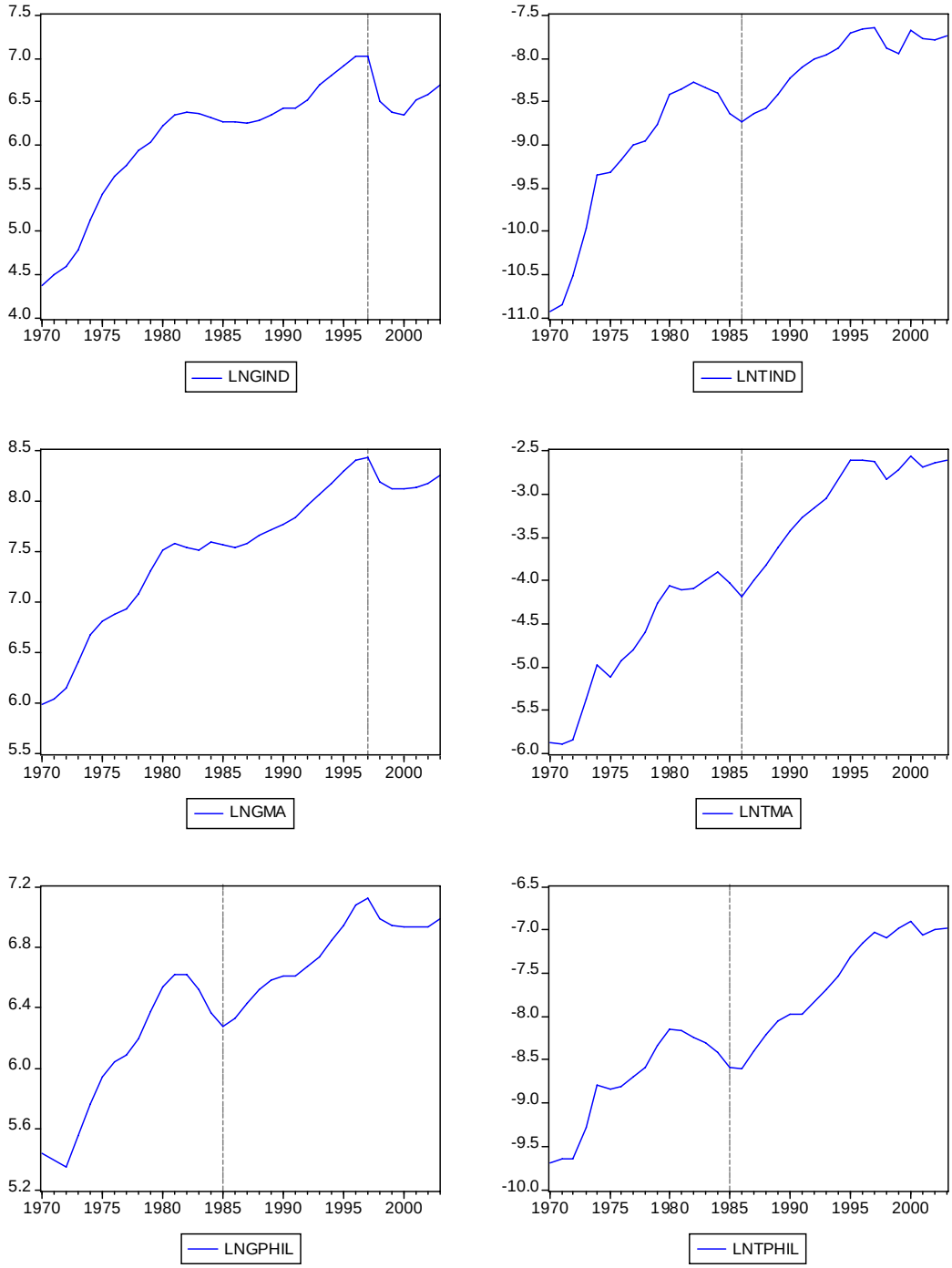
Note: Critical value for T_{α} at 5% is -4.19 (Perron and Vogelsang 1992, p.308). * indicate that the corresponding null is rejected at 5% significant level. LNGIND = GNI per capita in Indonesia, LNGMA = GNI per capita in Malaysia, LNGPHIL = GNI per capita in the Philippines, LNGTH = GNI per capita in Thailand, LNGSNG = GNI per capita in Singapore, LNTIND = trade per capita in Indonesia, LNTMA = trade per capita in Malaysia, LNTPHIL = trade per capita in the Philippines, LNTTH = trade per capita in Thailand, LNTSNG = trade per capita in Singapore.

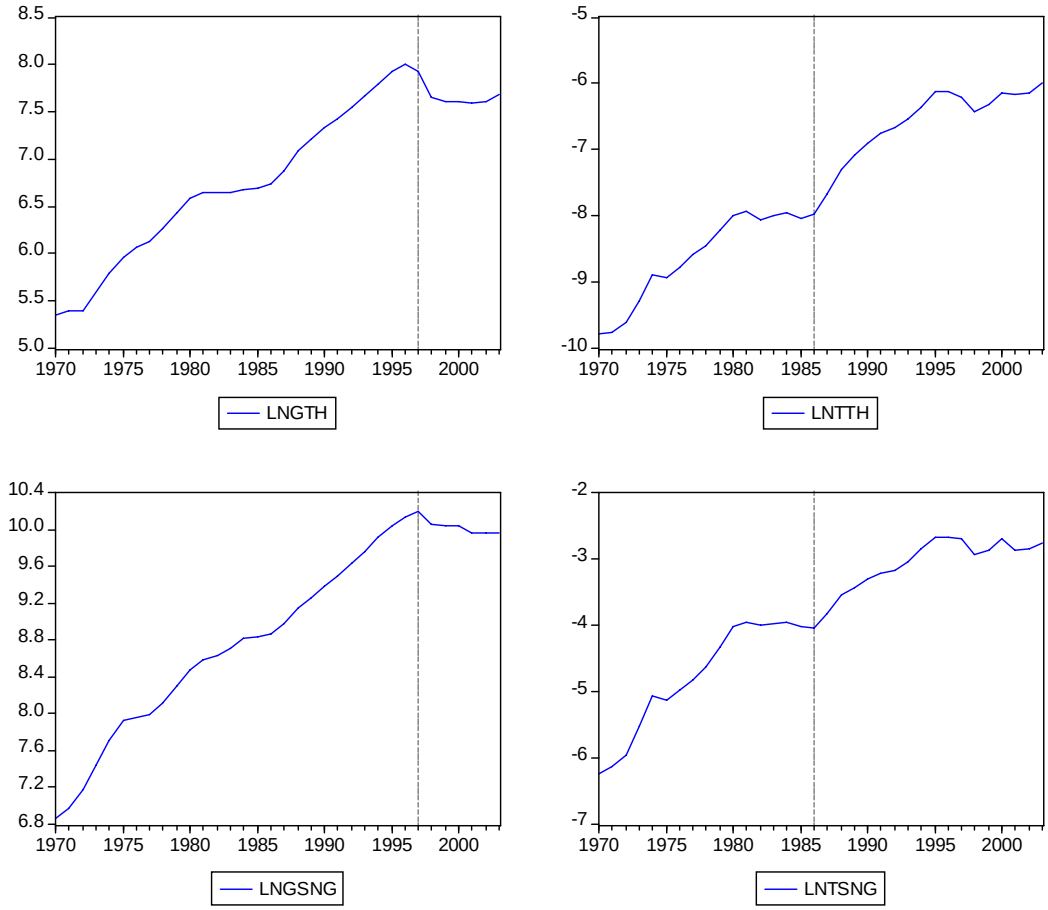
As can be seen from Table 3, the critical values for some of the variables under investigation are higher in absolute value than the t-statistic of $\alpha = 1$ (unit root null hypothesis), which means that the unit root null hypothesis can be rejected for some of the variables under investigation in this study. The dates of the breaks and t-statistics on the coefficients of the dummy variables are also presented in Table 3. Using the IO model proposed by Perron and Vogelsang (1992), the general break dates obtained correspond closely to the expected dates associated with the gradual effects of the recession in 1986 and the economic crisis in 1997.

Table 3 and the visual inspection of Figure 1 suggest the existence of structural breaks in the trade per capita data series in 1986 in all the countries under review except the Philippines, after which trade per capita accelerated substantially. The above structural breaks coincide with the recession in 1986. The increased trade per capita since then can be associated with structural adjustment programs that were carried out by individual ASEAN countries following the recession. The structural breaks for the GNI per capita series for the above four countries - Malaysia, Indonesia, Thailand, and Singapore - occurred in 1997, which coincided with the Asian crisis. GNI per capita accelerated continuously due to economic reforms and reached a turning point in 1997. The Philippines' record of policy selection and implementation was not strong, especially in the late 1980s and early 1990s, and took a heavy toll on growth.

The structural breaks for both trade per capita and GNI per capita occurred in 1985, which coincided with the recession.

Fig. 1: Plots of the series and endogenously estimated timing of structural breaks





Note: The time (*Tb*) of structural breaks based on the IO model is indicated by the dotted line.

5. Conclusion

This paper has used annual time series data (1970-2003) to determine the most important years when a structural break occurred in the trade and GNI per capita in the ASEAN-5 countries. The Perron and Vogelsang (1992) Innovational Outlier model is adopted to allow the data to determine the single most important structural break in each series. The break dates for each series based on these models are determined on the basis of well-known events such as the recession in 1986 and the Asian crisis in 1997. For Indonesia, Malaysia, Thailand and Singapore structural breaks for trade per capita occurred in 1986. Economic reform policies carried out as part of structural adjustment programs have contributed increases in trade per capita since then. The structural break for GNI per capita for the Philippines occurred in 1985, coinciding with a recession. For Indonesia, Malaysia, Thailand and Singapore structural breaks for GNI per capita occurred in 1997, coinciding with the Asian crisis.

The empirical result based on the Innovational Outlier model provides evidence against the null hypothesis of unit root for some of the variables under investigation. It should be noted that this methodology is one of the most advanced methodologies so far achieved for the examination of a structural break in time series analysis. It is also important to note that these tests are unable to detect the presence of multiple structural breaks. Therefore the possibility exists for other potentially significantly breaks to have occurred in reality for the series under investigation. Using the models proposed by Perron and Vogelsang (1992), only the most significant of such breaks will be detected. Future work in this area, therefore, will need to consider multiple structural breaks.

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