BIBLIOGRAPHIC INFORMATION

Title	Trading Systems and Convergence Hypothesis: Evidence from ASEAN-5 Countries
Source	International Research Journal of Finance & Economics; 2006 Issue 5, p52-63, 12p
Author 1	Onwuka, Kevin Odulukwe
Author 2	Baharumshah, Ahmad Zubaidi
Author 3	Habibullah, Muzafar Shah
Publication/Conference	NA
Edition	NA
Document Type	Article
CPI Primary Subject	Foreign Relations and Treaties
CPI Secondary Subject	ASEAN; Economic Indicator ; ;
Geographic Terms	ASEAN;

Abstract
The issue of convergence is an ongoing debate. How the world trading systems (multilateral and regional trade arrangements) affect the speed of convergence of GDP per worker and total factor productivity (TFP) is an unaddressed issue in the literature. Hence, the objective of this paper is to examine the impact of multilateral and regional trading systems on the speed of convergence drawing sample from five ASEAN countries, over the 1976 to 2000.

International Research Journal of Finance and Economics
ISSN 1450-2887 Issue 5 (2006)

http://www.eurojournals.com/finance.htm

Trading Systems and Convergence Hypothesis: Evidence from ASEAN-5 Countries

Kevin Odulukwe Onwuka
Department of Economics, Faculty of Economics and Administrative Sciences
Yaşar Universitesi, Kazim Dirik Mah. 364 Sokak No. 5, 35500
Bornova Izmir Turkey
E-mail: odulukwe@yahoo.com
Tel. + 90 232 461 4111 (ext 348); Fax: +90 232 4614121

Ahmad Zubaidi Baharumshah
Department of Economics, Faculty of Economics and Management
Universiti Putra Malaysia, 43400, UPM, Serdang, Selangor
Malaysia

Muzafar Shah Habibullah
Department of Economics, Faculty of Economics and Management
Universiti Putra Malaysia, 43400, UPM, Serdang, Selangor
Malaysia

Abstract

The issue of convergence is an ongoing debate. How the world trading systems (multilateral and regional trade arrangements) affect the speed of convergence of GDP per worker and total factor productivity (TFP) is an unaddressed issue in the literature. Hence, the objective of this paper is to examine the impact of multilateral and regional trading systems on the speed of convergence drawing sample from five ASEAN countries, over the 1976 to 2000. We employed fixed effect estimation technique. The main results are: First, there is evidence of unconditional and conditional $\beta-$ convergences in ASEAN-5 economies. Second, while the multilateral trading system influences the speed of convergence in GDP per worker after controlling for commodity crisis, Asian financial crisis and political violence, the effect of regional trading system is inconclusive. Third, multilateral trading system does not have any impact on the speed of convergence in total factor productivity; the effect of regional trading system remains also inconclusive. Thus following multilateral trading systems, ASEAN economies will converge to similar long run GDP per worker level but not total factor productivity, while following regional trading system leads to them to converge in total factor productivity.

Key words: Trading systems, convergence hypothesis, GDP per worker and total factor productivity.
JEL Classification: F13, F15, P45

1. Introduction

The debate over convergence is an ongoing one. A pool of economic literature has dealt with the issue of convergence of real income per capita, starting with Baumol (1986) and extending through Barro and Sala-i-Martin (1992), Barro *et al*. (1995) and Mankiw, Romer, and Weil (1992). In addition, Miller and Upahdhyay (1997) tested the convergence of GDP per worker and total factor productivity using a panel data of 83 countries that included both developed and developing countries with measures of trade orientation as independent variables. Most of these studies aimed at explaining the cross-country differences in output levels and growth rates with Solow-style growth model in which countries have identical exogenous rate of technological change. The exercise is one of pushing the simple model of capital accumulation to its logical limit, adding only a second type model when the estimated factor share for physical capital seems too large. Bernard and Jones (1996) examined the role of technology in convergence and concluded that differences in technologies across countries had important implications for the convergence or lack of thereof, of labour productivity in OECD economies.

Almost lacking in the empirical literature is the role of trade relations in convergence hypothesis. In such trade-based economies differences in growth rates and total factor productivity stem from differences in trade relations (multilateral and regional) or trade policies adopted. Since the time of Uruguay Round of talks on GATT (General Agreement on Trade and Tariff), there is considerable increase in number of trade relations among the developing countries as well as developed nations. The countries like Japan and South Korea, with long standing policy multilateral trading system are now involved in bilateral trade relations. For example, Japan has signed trade agreement with Singapore. As the regional economic integration is expanding in scope and dimension, the question then is, would these regional grouping lead to the member nation to converge to one another or catch up with the developed nations. Engelbrecht and Kelsen (1999) attempted this question with APEC economies and found that $\sigma-$convergence and β-convergence occurred amongst them over the period studied. This study used a binary openness variable like the Sachs and Warner (1995), where one denotes openness and zero restrictive trade policy. Trade relation choices are assumed away in explaining relative output level and growth rate and hence convergence. This study analyses the neoclassical convergence concepts with respect to ASEAN and trading systems identified in these economies over the period 1976 – 2000, using panel data. The present study attempts to construct regional openness variables. Accordingly, openness ought to raise the steady-state level of output and increase the speed of convergence (Sachs and Warner, 1995).

The paper is organised as follows. The next section discusses model specification, estimation procedure, problems and data. The empirical result is presented in section three. Section four discuses the implications of the results obtained and section five gives the conclusion.

2. Model Specification and Data

We begin our investigation whether multilateral and regional trading systems increase the speed of convergence of GDP per worker and total factor productivity per worker by specifying a basic model framework. For this purpose we follow the model of Mankiw *et al.* (1992).

$$Y_t = AH_t^{\sigma} L_t^{\beta} K_t^{i-\sigma-\beta} \qquad [1]$$

where Y_t = output of final consumers good, A = exogenous state of environment or shifter parameter, H_t = human capital, L_t = amount of labour and K_t = physical capital.

Dividing the equation (1) by the labour force (L) expresses the output, the capital stock and human capital on a per worker basis.

$$y_t = Ah_t^{\sigma} k_t^{1-\sigma-\beta} L_t^{\sigma+\beta(1-\sigma-\beta)} \qquad [2]$$

where y_t is real GDP per worker, k_t is the physical capital per worker, h_t is the human capital per worker. This production function displays a constant return to scale. Rewriting equation (2) in natural logarithm and with error term yields the following estimating equation:

$$Iny_{it} = InA + \sigma Inh_{it} + (1-\sigma-\beta)Ink_{it} + e_t \quad [3]$$

The test of constant return to scale involves whether the coefficient of InL is equal to zero, which we assume to be constant. We extend equation (3) to include the measures of the trading systems as follows;

$$\ln y_{it} = \alpha_0 + \sigma \ln h_{it} + \theta \ln FDI_{it} + \phi Z_{it} + e_t \quad [4]$$

where FDI captures the physical capital stock (k_{it}), Z_{it} is the measures of the trading systems, and other control variables and $\theta = (1-\sigma-\beta)$. Other variables are as defined before.

Tests of convergence are performed on real GDP per worker and total factor productivity per worker. The tests for convergence of total factor productivity have implication regarding the spread, adoption and convergence of technological advances and the argument about whether technology is a "public or a private good". If technology is a "public good" it can speedily transit international boundaries, then leading to convergence of total factor productivity.

Two types of convergence exist in the literature - β-convergence and σ-convergence. Convergence of the β-type considers whether the growth rates of countries exhibit a negative correlation with the level of real GDP per worker. That is, β-convergence implies that countries with low real GDP per worker possess more potential for faster growth rates than countries with high real GDP per worker. Convergence of the σ-type considers whether the dispersion of the real GDP per worker diminishes over time. That is, σ -convergence implies that the distribution of real GDP per worker across countries gets tighter over time, thus reducing some measure of dispersion.

For empirical test of convergence, we consider only β -convergence which falls under two categories – unconditional and conditional convergence. Unconditional convergence means that each country moves toward the same steady state of real GDP per worker. Conditional convergence suggests that each country possesses its own steady state real GDP per worker to which it is converging. The steady state in each country is conditioned on the state of its economy. For example, the Solow (1956) growth model implies that the steady state real GDP per worker across countries depends on the saving and population growth rates in each country.

To test for unconditional convergence we estimate the following equation, which approximate the transitional growth process in the neoclassical growth model[1]

$$g_{yt} = Iny_t - Iny_{t-1} = \alpha + \beta_y Iny_{t-1} + \varepsilon_{yt} \quad [5]$$

where g_{yt} is the growth rate of real GDP per worker from $(t-1)$ to t, approximated by logarithm difference, y_{t-1} is the level of real GDP per worker in $(t-1)$, β_y indicates the rate of convergence and it is expected to be negative. A positive sign on the coefficient estimate of log y_{t-1} will indicate divergence and ε_{yt} is the random error that is normally and independently distributed with mean equal to zero and constant variance.

To test for conditional β -convergence we estimate Eq. (4) as follows:

$$g_{it} = \alpha_0 + \beta \ln y_{it-1} + \sigma \ln h_{it} + \theta \ln FDI_{it} + \phi Z_{it} + e_t \quad [6]$$

On a priori we expect $\beta < 0, \sigma > 0$ $\theta > 0$ and $\phi > 0$. A negative coefficient estimate for log y_{t-1} is interpreted as evidence of convergence. Equation (6) is less restrictive and is loosely based on economic theory in the sense that this specification is consistent with a variety of extended versions of the neoclassical growth model (see Barro and Sala-i- Martin, 1995; Caselli *et al*., 1996; Engelbrecht and Kelsen, 1999).

Similarly we specify the regression for the total factor productivity as follows:

$$g_{tfpt} = Intfp_t - Intfp_{t-1} = \alpha + \beta_{tfp} Intfp_{t-1} + \varepsilon_{tfpt} \quad [7]$$

[1] See Engelbrecht and Kelsen, 1999 and Sala-i-Martin, 1996 for more detail on transitional growth process in the neoclassical growth model.

where tfp is the total factor productivity. The same construction of variables for the growth rates and lagged logarithms hold as described for real GDP per worker. For the conditional convergence, the regression is represented as:

$$g_{tfpit} = \alpha + \beta \ln tfp_{it-1} + \sigma \ln h_{it} + \theta \ln FDI_{it} + \phi Z_{it} + e_t \quad [8]$$

The data for this study was obtained from various sources, Asia Development database, International Monetary Fund database, and International Labour Organisation database. Wage rate was extrapolated from the GDP per capita. The measures of trading systems used are average tariff, (import tariff revenue over import volume), Dollar's exchange rate distortion index, and imports plus exports over GDP. Participation in regional trading arrangements is captured by a dummy variable which takes the value of zero before 1978 and thereafter one. The growth rate and levels of real GDP per worker are calculated using the average levels of real GDP per worker in each year. The growth rate for the test calculates g_{yt} as logarithm difference between real GDP per worker in year t and year *t-1*. The total factor productivity growth is derived from the estimates of equation (3) as residual ($TFP = Iny_{it} - \hat{\sigma} Inh_{it} - \hat{\theta} Ink_{it}$).The GLS fixed effects estimation technique is used to estimate the parameters.

3. Result and Discussions

3.1. σ-Convergence

The inquiry into whether the ASEAN economies exhibit convergences begins with the analysis of σ - convergence of the log GDP growth rate per worker and total factor productivity (TFP). The results of this inquiry are presented in Table 1 and are standard deviations calculated over the five-year period for each country and ASEAN.

Table 1: σ -convergence of Real GDP per worker and Total factor Productivity

	Year	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN
σ_y	1976-1980	0.1600	2.3595	0.0526	2.7533	1.9263	1.4503
	1981-1985	0.4083	0.1318	0.6850	0.2500	0.3504	0.3651
	1986-1990	0.6114	0.3097	0.0992	0.2558	0.5192	0.3591
	1991-1995	0.0529	0.1842	0.1035	0.2571	0.3221	0.1840
	1996-2000	3.0404	0.3235	1.9804	0.0826	0.5282	1.1910

	Year	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN
σ_y	1977-1980	0.0080	0.0111	0.0042	0.0026	0.0017	0.0055
	1981-1985	0.0132	0.0041	0.0059	0.0039	0.0039	0.0062
	1986-1990	0.0179	0.0057	0.0058	0.0014	0.0020	0.0066
	1991-1995	0.0119	0.0050	0.0029	0.0021	0.0053	0.0054
	1996-2000	0.0363	0.0090	0.0037	0.0018	0.0047	0.0111

Our results show slight σ -convergence among the ASEAN economies in GDP per worker between 1976 and 1995, with σ decreasing from 1.4503 to 0.1840 and diverge between 1996 and 2000 periods. This result is similar to that obtained for OECD and APEC economies (see Sala-I-Martin, 1996; and Engelbrecht and Kelsen, 1999). The increase in standard deviation or divergence in 1996 and 2000 period may be caused by the Asia financial crisis but not reaching the level of dispersion in the period 1976 and 1980 and this will be accounted for in the conditional convergence test. In the four sub-periods, σ declines consistently to 0.1840 in 1995, as a number of ASEAN countries experienced unprecedented growth rate and were moving towards the middle-income category. During this period, ASEAN countries, especially Malaysia, Indonesia and Thailand doubled

their per capita GDP levels. For TFP there is no consistent pattern of dispersion indicating a clear σ-convergence in TFP among ASEAN economies. The standard deviation increases from 0.0055 to 0.0066 between 1977 to 1990 periods and declines between 1991 and 1995 period.

The σ -convergence in GDP per worker among the ASEAN economies has two implications. First, it shows that income inequality among workers in ASEAN is decreasing over time. That is income of a grade (A) worker will be the same in all ASEAN countries in the long run. Secondly, it indicates the presence of unconditional convergence, i.e. poor economies are actually catching up with richer economies.

3.2. Unconditional $\beta-$ convergence

The unconditional $\beta-$ convergence predicts that due to neoclassical assumption of diminishing returns to capital, poorer economies with lower initial stocks of capital will grow faster than richer economies with larger initial stocks of capital and that all economies converge to the same steady state. In this section, we first analyse the relationship between GDP per worker in 1976 and growth rate in 1976-2000 graphically and the results are displayed in figures 1 and 2.

Figure 1 analyses the existence of unconditional $\beta-$ convergence across the ASEAN-5 economies. On the horizontal axis is the log of GDP per worker in 1976. On the vertical axis is the growth rate between 1976 and 2000. The figure shows that the relation between growth rate and initial level of GDP per worker is negative suggesting that the lower the initial stock of capital the higher the growth rate per worker. In addition Figure 2 shows the existence of unconditional convergence of total factor productivity across ASEAN-5 countries between 1977 and 2000.

Figure 1: Convergence of GDP rate per worker

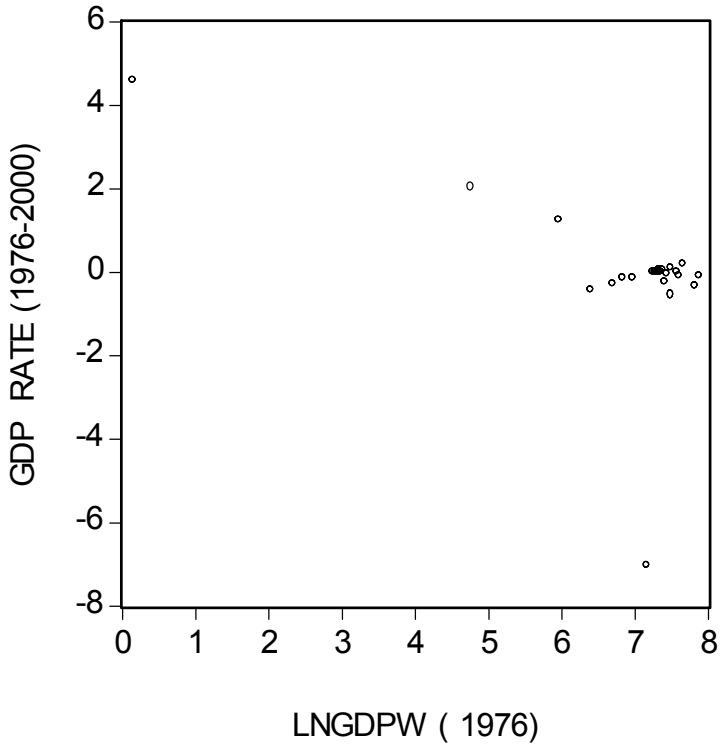
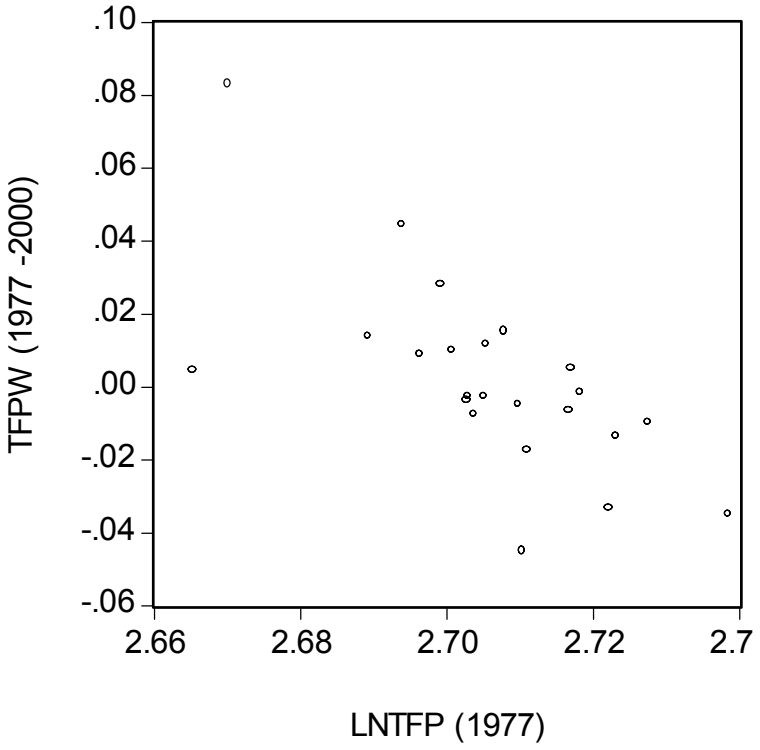


Figure 2: Convergence of TFP growth rates



In the estimation of $\beta-$convergence coefficient, we use Pooled Least Squares (PLS), Generalised Least Squares (GLS) and GLS with country dummy variables (GLSDV) to allow for fixed effects. This GLS estimator takes account of cross-section heteroskedasticity and time-series autocorrelation and the use of country dummy variables permits differences in individual economies production functions to enter the model.

Table 2: Unconditional $\beta-$ convergence

	Pooled Least Squares	**Pooled GLS**	**GLSDV (fixed Effects)**
β_y (GDP growth rate)	-0.2935 [-3.180]	-0.2935 [-3.194]	-0.2968 [-3.226]
$\overline{R}$	0.081	0.081	0.083
Cross-sections	5	5	5
No. of observations	115	115	115

	Pooled Least Squares	**Pooled GLS**	**GLSDV (fixed Effects)**
β_{tfp} (Total factor productivity)	-0.1160 [-1.167]	-0.1094 [-5.377]	-0.1057 [-4.510]
$\overline{R}$			
0.012	0.203	0.158	
Cross-sections	5	5	5
No. of observations	110	110	110

Note: Cross-section weights (PCSE) standard errors & covariance t-stat in brackets

Table 2 reports regression estimates of the speed of unconditional convergence. The parameter estimates of lagged log of real GDP per worker growth rate and total factor productivity are consistently negative and statistically significant except in the Pooled Least Square estimator for total factor productivity, providing unambiguous support for the existence of unconditional $\beta-$ convergence in ASEAN-5 economies under investigation. The results indicate that the ASEAN-5 real

GDP growth rate per worker converges at the speed of 29.35 percent a year, and total factor productivity at the speed of 11 percent a year. From the Table 4, the results suggest, since our measure of total factor productivity captures the technological character of the production process, more evidence of convergence of technology than real GDP per worker. Also it indicates that technology is a public good. According to Miller and Upadhyay (1997), the convergence in total factor productivity indicates that the public-good nature of technology dominates any private-good dimension. It is clear from the result that technology that flows from the innovators to the ASEAN-5 countries is being adopted at the same rate or ASEAN-5 economies share similar technology. The test allows the cross-country rates to respond to changes in its level of real GDP per worker. As shown by the results, the ASEAN-5 economies will experience rapid growth in accordance with the convergence hypothesis. And too, ASEAN economies have a similar steady-state and the cross-country income inequality is disappearing (i.e. income inequality is narrowing over time). Our results conform to consensus view in the literature that $\beta-$convergence occurs among the relatively homogenous countries. Since ASEAN economies are more or less homogenous, the result here is not surprising. Similar results are found among the OECD and European Union economies and regions within such economies (see Barro, 1991; Barro and Sala-i-Martin, 1992, 1993; Mankiw *et al*, 1992 and Sala-i-Martin, 1996).

3.3. Conditional $\beta-$ Convergence

In this sub-section we look at the conditional $\beta-$ convergence, which asserts that only once the determinants of an economy's steady-state growth level are controlled for will the economy converge to its individual steady-state and the trading systems affect the speed of convergence. That is whether the trading systems will aid growth rate to decline and go to zero as the capital stock increases. In order to assess this hypothesis we make the following assumptions: a) countries that are similar in all respect except for initial level of output per capita are expected to converge to the same steady state level of output per capita and hence to one another; b) the equilibrium rate of growth in the poorer country depends on the cost of imitation, and on its initial stock of knowledge. If the costs of imitation are lower than the cost of innovation, the poorer country will grow faster than the advanced one, and there will be a tendency to converge; c) the cost of imitation is linked to the degree of openness, in the sense that more open countries have greater ability to capture new ideas being developed in the rest of the world (see Obstfeld and Rogoff, 1996).

For conditional $\beta-$ convergence we estimate Eqs (6) and (8). The results of tests are presented in Tables 3. Column (1) presents the results of the core variables of the model namely foreign direct investments, human capital and wage rate. While column (2) presents the results with multilateral trading system variables and column (5) reports the results for regional trading system. As can be seen the coefficient of the lagged of log of real GDP per worker is negative in all columns and significant at 1% level implying that conditional $\beta-$ convergence exists in ASEAN-5 economies.

Table 3: Conditional $\beta -$ convergence of GDP per Worker growth rate and trading systems

	Dependent Variable: GDP growth rate per worker (g_{yt})				
	1	**2**	**3**	**4**	**5**
GDPW (-1)	0.3068***	-0.4875 ***	-0.4808***	-0.3088***	-0.3405***
	[-4.682]	[-10.396]	[-21.96]	[-4.080]	[-4.901]
FDI	0.5170***	-0.1379***	-0.1403***	-0.5281***	-0.5454***
	[-6.374]	[-12.203]	[-20.002]	[-5.554]	[-5.391]
EDEX	1.2891***	0.4196***	0.4009***	1.2852***	1.2060***
	[14.997]	[3.614]	[5.540]	[11.054]	[8.883]
NSAV	1.3025***	0.4118***	0.4215***	1.2074**	1.2971**
	[3.204]	[10.023]	[10.351]	[2.265]	[2.095]
WAG	0.8423***	0.9669***	0.9696***	0.8791***	0.8811***
	[15.047]	[18.447]	[21.481]	[13.140]	[13.073]
OPEN		0.3135**	0.2898**		
		[2.614]	[2.006]		
DSTORT		0.7959*	1.0150**		
		[1.701]	[2.506]		
AVTA		0.1477	0.1224**		
		[1.038]	[2.611]		
ROPEN				0.0730	0.5156*
				[0.473]	[1.827]
RDSTORT				-0.2266	-0.2727
				[-0.810]	[-0.862]
RTA				0.2571***	0.2683***
				[4.097]	[4.121]
FCC			-0.1192*		-0.4172***
			[-1.994]		[-3.064]
RLO			0.0480		-0.2659*
			[0.868]		[-1.757]
$\overline{R}$	0.72	0.84	0.84	0.70	0.68
Observations	115	100	100	92	92

***1%, ** 5% and * 10% are significance level respectively. Cross-section weights (PCSE) standard errors & covariance t-stat in brackets. GDPW = log of GDP per worker, FDI = log of FDI, NSAV = log initial GDP, EDEX = log of EDEX, WAG = log of WAG, OPEN = trade share, DSTORT = exchange rate distortion, , AVTA = average tariff, ROPEN = regional trade share, RDSTOT = regional exchange rate distortion, RTA = dummy for participation in regional trade arrangements, FCC = dummy variable for commodity and Asia financial crises and RLO = rule of law and order (this is used to capture effect of political, religious violence in Indonesia and Philippines.

To check whether commodity crisis of 1985 and financial crisis of 1997/1998 lead to divergence among the ASEAN countries, we include a dummy variable (FCC) to capture this effect, which takes the value of one in 19985, 1997- 1998. We also consider in the analysis the political violence in some of the countries (like Indonesia and Philippines) and use data on rule of law and order from the International Country Risk Guide[2]. The results are presented in columns (3) and (5) for multilateral and regional trading systems respectively. In all there is evidence of convergence of real GDP per worker.

The estimated speed of convergence without the measures of multilateral trading system is 30.7 percent (column 1), while it increases to approximately 48 percent when we control for measures of multilateral trading system (column 2). Controlling for commodity and Asia financial crises and political violence in Indonesia and Philippine does not change estimated speed of convergence (column 3). However it increases the t-ratios of the multilateral trading system variables and improves their role in the speed of convergence. The coefficients of measures of multilateral trading system, OPEN (trade share), DSTORT (exchange rate distortion) AVTA (average tariff) are positive and are at least significant at 10% level, except AVTA. The coefficient of OPEN conforms to theory and most of empirical literatures while the coefficients of exchange rate distortion and average tariff contradict the

[2] The data has 0 – 6 scales, 6 = les risk. This study considers 0 – 4 high risk and 5 –6 less risk and assign 1 to 0-4 scale and 0 to 5-6 scale.

theoretical expectation (see Dollar, 1992; and Ghura and Grennes, 1993). However the result does show the importance of stable exchange rate in economic growth during the liberalisation era as emphasised by Michaely *et al*. (1991). This study argues that countries with more volatile real exchange rate experience poorer overall economic performance than those that maintain a more stable real exchange rate. Exchange rate stability appears to attract investment as volatility in exchange rate deters investors, limits the amount of capital inflows, discourages savings and thus decreases productivity and GDP. Considering the fact that most ASEAN countries have pegged exchange rate the results are not surprising. Also tariff imposition in ASEAN is for revenue generation, not for protection of local industries or to induce industrialisation. The commodity and Asian financial crises (FCC) negatively affect the growth rate in ASEAN economies while the political violence (RLO) does not affect it. Their effect on the speed of convergence is slight (see Column 3).

In the case of regional trade system the regional trade share (ROPEN) and participation in regional trade arrangement (RTA) positively affect the growth rate and thus the speed of convergence in ASEAN economies (column 4). The coefficient of exchange rate distortion has negative sign and is not significant. Controlling for commodity crisis and Asian financial crisis increases the speed of convergence from 30 to 34 percent and it increases the t-ratios of regional trading system variables. The coefficients of commodity crisis and Asian financial crisis and political violence carry a negative signs and are significant.

In both multilateral and regional trading systems, the important factors that affect the economic growth and thus the speed of convergence in ASEAN countries are FDI, national gross savings, and human capital and wage rate. The coefficients of these factors are positive except FDI, and are statistically significant at least at 5 percent level. The negative sign on FDI coefficient does not conform to theory, which expects FDI to increase the rate of convergence. Barro (1997) and Engelbrecht and Kelsen (1999) obtained similar results for investment. This, Barro (1997) attributed to reverse causation, (that is growth causes investment). In comparison with unconditional convergence (29.35 percent, Table 2) it is seen that, apart from the fundamental factors that influence economic growth, trading systems either multilateral or regional affects the speed of convergence but the importance regional trading system is less conclusive.

Table4: Conditional $\beta -$ convergence of Total factor productivity and trading systems

	Dependent Variable: Total factor productivity growth rate ( )□				
	1	**2**	**3**	**4**	**5**
$tfp(-1)$	0.0440	0.0391	-0.1461***	-0.0742**	-0.1591***
	[1.389]	[0.912]	[-4.504]	[-2.070]	[-3.095]
FDI	-0.0206***	-0.0217***	-0.0076**	-0.2320***	-0.2148***
	[-8.313]	[-6.335]	[-2.462]	[-10.269]	[-9.089]
EDEX	0.0009***	0.0015***	0.0010***	0.0024***	0.0021***
	[3.621]	[3.875]	[3.120]	[7.251]	[5.632]
NSAV	0.0214***	0.0228***	0.0173***	0.0221***	0.0209***
	[9.682]	[7.931]	[7.646]	[8.498]	[7.626]
WAG	0.0012***	0.0016***	0.0020***	0.0032***	0.0033***
	[7.753]	[9.691]	[17.744]	[11.738]	[11.420]
OPEN		-0.0001	0.00003		
		[-0.524]	[0.229]		
DSTORT		0.0044***	-0.0012		
		[2.903]	[-0.906]		
AVTA		-0.0022	-0.0021		
		[-1.121]	[-1.241]		
ROPEN				-0.0001	0.0016
				[-0.279]	[1.476]
RDSTORT				0.0008	0.0006
				[0.878]	[0.622]
RTA				0.2285***	0.2129***
				[9.996]	[8.593]
FCC			-0.0044***		-0.0020***
			[-10.389]		[-3.056]
RLO			0.0002		-0.0012*
			[0.828]		[-1.883]
$\overline{R}$	0.720	0.771	0.903	0.940	0.772
observations	110	80	80	88	88

***1%, ** 5% and * 10% are significance level respectively. Cross-section weights (PCSE) standard errors & covariance t-stat in brackets. tfp = log of total factor productivity, FDI = log of FDI, NSAV = log initial GDP, EDEX = log of EDEX, WAG = log of WAG, OPEN = trade share, DSTORT = exchange rate distortion, , AVTA = average tariff, ROPEN = regional trade share, RDSTOT = regional exchange rate distortion, RTA = dummy for participation in regional trade arrangements, FCC = dummy variable for commodity and Asia financial crises and RLO = rule of law and order (this is used to capture effect of political, religious violence in Indonesia and Philippines

Next we estimate the effect of trading systems on the speed of convergence of total factor productivity. The results of this test are reported in Table 4. The evidence of conditional β-convergence in total factor productivity in ASEAN-5 countries is rather mixed. The convergence hypothesis fails with the core variables (column 1) and when we control for multilateral trading system (column 2). However there is evidence of total factor productivity convergence after controlling for commodity crisis, Asian financial crisis and political violence (column 3). The coefficient of $\ln tfp(-1)$ carries a negative sign and is significant at the 1% level in the multilateral trading systems. The speed of total factor productivity convergence is about 15 percent per year. This is higher than the speed of convergence obtained from the unconditional convergence (10.6 percent, Table 2). No measures of multilateral trading system have any impact on the total factor productivity growth and thus its convergence. The commodity and Asian financial crises affect the total factor productivity growth negatively. Their coefficient carries a negative sign and is significant. This implies that to achieve improvement in total factor productivity growth and catch up with the world leading economies requires a stable economy with less political turmoil and rule of law and order.

In the case of regional trading system, ASEAN economies exhibit convergence in total factor productivity. The coefficient of $\ln tfp(-1)$ carries a negative sign and is significant at least 5% level. Looking at three measures of regional trading system, only participation in regional trade arrangement affects the total factor productivity and thus the speed of convergence of total factor productivity in

ASEAN economies. The regional trade share and exchange rate distortion do not have any effect on the speed of convergence of total factor productivity. Controlling for Commodity and Asian financial crises and political violence increases the speed of convergence in total factor productivity from 7.4% (column4) to 15.9% (column 5). The core variables that influence the speed of the total factor productivity convergence in both trading systems are FDI, national gross savings (NSAV) and wage rate (WAG).

4. Implications of convergence

Our results have some implications. First, the convergence of GDP growth rate per worker and total factor productivity in the sample indicates that the ASEAN-5 countries have similar steady-state and income inequality is disappearing over time. That is they are moving towards similar growth rate over time and there is high growth potential for ASEAN-5 economies. Coincidence of the unconditional convergence and conditional convergence hypothesis shows that ASEAN-5 economies have the same steady-state. Second, for ASEAN countries to catch up with the world economy there is need for integration with world economy and stable economy, as political violence and economic crises will derail the catching up process. Third, ASEAN economies share similar values, preference and technologies. For this reason the growth rate per worker and total factor productivity growth tend towards zero. This conforms to view of Galor (1996) that the countries that are similar in all respects except for their initial level of output per capita are expected to converge to the same steady-state level of output per capita and hence to one another. In addition, the conditional convergence hypothesis is closely related to the notion that each economy is characterized by unique, globally stable steady-state equilibrium. Countries that are identical in their fundamentals and dynamic systems converge to one another regardless of their initial conditions. A look at ASEAN five economies – Malaysia, Indonesia, The Philippines, Singapore and Thailand - reveals that they are similar in their structural characteristics and policies and perhaps pursue similar objectives. Although there are differences in per capita income with Singapore being the highest per capita income country, they tend to converge because of similar structures and policies.

5. Concluding Remark

Our study shows evidence of unconditional and conditional $\beta-$ convergence in GDP per worker growth rate and total factor productivity in ASEAN economies. That is the ASEAN economies are converging to similar steady-state both in growth rate per worker and TFP due to similar structures among them, like access to the same technology market and commodity markets. Multilateral trading system measures have a positive effect on the speed of convergence of GDP per worker growth rate after controlling for commodity and Asian financial crises and political violence in Indonesia and Philippines. The effect of regional trading system (regional trade share and RTA) on the speed of GDP per worker convergence remain inconclusive.

Also we could not draw a conclusive statement on the effect of multilateral trading system and regional trade bloc on the speed of convergence of TFP in the ASEAN economies as some of the measures these trading systems are not robust. The effect of trading systems may not be linear, as it is depicted in this study. Their effects on the speed of convergence might be captured in the neoclassical models through their effect on the control variables conditioning the economies steady-states. Although participation in regional trade arrangement indicates that regional integration may leads to convergence in TFP among the group.

The results obtained in this study may not hold in future periods, as there may be unforeseen events that will derail the path of ASEAN growth. There could be changes in variables determining the long-run equilibrium growth rate. These changes may be country-specific or region-specific. For these reasons future research is required to learn how multilateral and regional trading systems advance the catching up process of ASEAN economies to the world economy and among themselves.

Acknowledgement
The authors would like to thank FEP for financial support. The results reported and the views expressed herein do not necessarily reflect those of the Faculty of Economics and Management.

References
[1] ASEAN, 2002. ASEAN Surveillance Coordinating Unit (ASCU) database, (2002), http://www.aseansec.org/macroeconomic/. Accessed on 8 March 2004.
[2] ASEAN, (2002), Statistics of Foreign Direct Investment in ASEAN: Comprehensive Data set, 2002 edition, http://www.aseansec.org/macroeconomic/. Accessed on 8 July 2001.
[3] Asian Development Bank. (2001), Key Indicators of developing Asia and Pacific countries, 2001, http:www.adb.org/statistics/kiasp. Accessed on 8 July 2001.
[4] Barro, R. and X. Sala-i-Martin. (1995), *Economic growth*. McGraw-Hill, Cambridge, MA
[5] Barro, R. J and Sala-i-Martin, X. (1992), Convergence. Journal of Political Economy, vol. 100, pp. 223-251.
[6] Barro, R.J., N. G. Mankiw, and X. Sala-i-Martin. (1995), Capital mobility in neoclassical models of growth. American Economic Review, vol. 85 No.5, pp. 103-115.
[7] Baumol, W. (1986), Productivity growth, convergence and welfare: What the long-run data show. American Economic Review, vol. 76 No. 5, pp. 1072-1085.
[8] Bernard, A.B. and C. I. Jones. (1996), Technology and convergence. The Economic Journal, vol. 106, pp. 1037-1044.
[9] Caselli, F., G. Esquivel and F. Lefort. (1996), Reopening the convergence debate: a new look at cross-country growth empirics. Journal of Economic Growth, vol. 1, pp. 363-389.
[10] Dollar, D. (1992), Outward-oriented developing countries do grow more rapidly: evidence from LDCs, 1976-1985, *Journal of Development and Cultural Change*, vol.40, No. 3, pp. 523-544.
[11] Engelbrecht, H.J and B. K. Kelsen. (1999), Economic Growth and Convergence Amongst the APEC economies 1965-1990. Asian Economic Journal, vol. 13 No.4, pp. 1-17.
[12] Galor, O. (1996), Convergence? Inferences From Theoretical Models. The Economic Journal, vol. 106, pp. 1056-1069.
[13] Ghura, D. and T. J. Grennes (1993), The real exchange rate and macroeconomic performance in Sub-Saharan Africa" *Journal of Development Economics*, vol. 42, No.1, pp. 155-174.
[14] ILO. (2001), ILO Bureau of statistics, http://www.ilo.org/stat/ or http://laborsta.ilo.org/ , Accessed on 24 September 2002.
[15] IMF. (2001), Money Matters: An IMF Exhibit – the importance of Global cooperation
[16] IMF, Direction of Trade Statistics, various issues.
[17] IMF, International Financial Statistics, various issues.
[18] Mankiw, N. G., D. Romer, and D. N. Weil. (1992), A contribution to the empirics of economic growth. Quarterly Journal of Economics, vol. 107, No.2, pp. 407-437.
[19] Michaely, M. M., Papageorgiou, D. and Choksi, A. (1991). Liberalizing Foreign Trade, Vol.7 Lessons of experiences in the developing World. Oxford and Cambridge, M.A. Basil Blackwell.
[20] Miller, S. M. and M. P. Upadhyay. (1997), The effect of trade orientation and human capital on total factor productivity. Working Paper No. 010, Department of Economics, University of Connecticut, Storrs, U.S.A.
[21] Obstfeld, M. and K. Rogoff. (1996), Foundations of International Macroeconomics, Cambridge MIT Press.
[22] Sachs, J. and A. Warner. (1995), Economic reform and the process of global Integration. *Brookings Papers on Economic Activity*, vol. 1, pp. 1-118.
[23] Sala-i-Martin, X. (1996), The classical approach to convergence analysis. The Economic Journal, vol. 106, pp. 1019-1036.