INVESTIGATION OF REAL GDP PER CAPITA CONVERGENCE IN REGIONAL ECONOMIC INTEGRATIONS

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Investigation of Real GDP Per Capita Convergence in Regional Economic Integrations

Bölgesel Ekonomik Bütünleşme Anlaşmalarında Kişi Başı Reel Gelir Yakınsaması İncelemesi

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ABSTRACT

The regionalism phenomenon has received a lot of interest from economics literature. On the one hand, some of the scholars argued that regional integration agreements are beneficial in leading trade creation effect, increased market size, increased investment by attracting foreign direct investment, reforms in domestic policy etc. On the other hand, some of the scholars took opposing position by pointing out potential results of trade diversion, less sovereignty, employment shift etc. This study aims to investigate whether being a member of regional economic integration agreement foster per-capita income convergence among the participant countries. 23 multilateral regional economic integration agreements (RIAs) which are notified to World Trade Organization (WTO) and more than 100 countries that joined to these agreements are studied. In order to examine the potential effect of regional integration agreements on per capita income convergence among member countries, the series of deviations of each country from regional integration agreement average are constructed out of real GDP per capita in 2005 USD figures, which are obtained from World Bank and United Nations Statistics Division. The period of study spans from the establishment year of RIA to 2013. Any change in membership status of the RIA considered is taken account by performing separate tests on the members of the RIA before and after the change. By applying first and second generation panel unit root tests on each deviation series from RIA average, the existence of convergence in country per capita income is judged and the following conclusions are reached: There is significant evidence in favor of convergence for Caribbean Community, Economic Cooperation Organization, Economic Community of West African States, European Free Trade Association, Gulf Cooperation Council, Central European Free Trade Agreement, Euroasian Economic Community, Latin American Integration Association, South African Development Community, and West African Economic and Monetary Union .

ÖZET

Bölgeselleşme olgusu ekonomi literatüründe oldukça ilgi çekmiştir. Bazı ekonomistler bir yandan bölgesel bütünleşme anlaşmalarının ticareti ve doğrudan yabancı yatırımları arttırıcı, pazar genişletici, yerel politikaları iyileştirici olumlu etkilerine işaret ederken bazı ekonomistler de öte yandan ticareti saptırıcı, istihdamı ve egemenliği azaltıcı gibi olumsuz sonuçları vurgulamaktadır. Bu çalışmanın amacı bölgesel ekonomik entegrasyon anlaşmalarının üye ülkeler arasında kişi başı gelir bazında bir yakınsamaya yol açıp açmadığını incelemektir. Diğer bir deyişle, "Bölgesel ekonomik işbirliği anlaşmalarına müdahil kişi başı milli gelir bazında başlangıçta görece fakir olan ülkeler aynı entegrasyon anlaşmasında yer alan zengin ülkelerin kişi başı milli gelirlerine yaklaşmış mıdır?" sorusuna yanıt aranmaktadır. Bu amaçla Dünya Ticaret Örgütü'ne (WTO) bildirilmiş 23 çok uluslu bölgesel ekonomik işbirliği anlaşması ve bu anlaşmalara dahil olan 100'den fazla ülkeye ait -2005 yılı sabit USD fiyatlarıyla- reel kişi başı milli gelir değerleri Dünya Bankası ve Birleşmiş Milletler İstatistik Bölümü'nden elde edilmiştir. Çalışma süresi bölgesel ekonomik işbirliği anlaşmasının kuruluş yılından 2013 yılına kadar olan süreyi kapsamaktadır. Ülkelerin bölgesel ekonomik işbirliği anlaşmasına üyelik durumu değiştiğinde bu durum değişimden önce ve değişimden sonra olmak üzere çalışmada göz önünde bulundurulmuştur. Bölgesel anlaşma içindeki her ülke kişi başı milli gelirinin bölgesel anlaşma ortalamalarından farkı alınarak fark serisi oluşturulmuş ve bu fark serisine uygun birinci ve ikinci nesil panel birim kök testleri uygulanarak şu sonuçlar elde edilmiştir: Yakınsamanın lehine anlamlı bulgular Karayip Topluluğu, Batı Afrika Devletleri Ekonomik Topluluğu, Körfez İşbirliği Konseyi, Orta Avrupa Serbest Ticaret Anlaşması, Avrupa Serbest Ticaret Birliği, Avrasya Ekonomik Topluluğu, Latin Amerika Entegrasyon Birliği, Güney Afrika Kalkınma Topluluğu, Ekonomik İşbirliği Organizasyonu ve Batı Afrika Ekonomik ve Parasal Birliği için bulunmuştur.

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ANDEAN: Customs Union comprising of South American countries of Bolivia, Colombia, Ecuador and Peru

APTA: Asia – Pacific Trade Agreement

ASEAN: Association of Southeast Asian Nations

CACM: Central American Common Market

CARICOM: Caribbean Community and Common Market

CEFTA: Central European Free Trade Agreement

CEMAC: Monetary and Economic Community of Central Africa

COMESA: Common Market for Eastern and Southern Africa

EAC: East African Community

EAEC: Eurasian Economic Community

ECO: Economic Cooperation Organization

ECOWAS: Economic Community of West African States

EFTA: European Free Trade Association

EU: European Union

GCC: Gulf Cooperation Council

LAIA: Latin American Integration Association

MERCOSUR: Southern Common Market

NAFTA: North American Free Trade Agreement

PAFTA: Pan – Arab Free Trade Agreement

PICTA: Pacific Island Countries Trade Agreements

SACU: Southern African Customs Union

SADC: Southern African Development Community

WAEMU: West African Economic and Monetary Union

LLC: Levin, Lin, Chu (2002) Panel Unit Root Test

IPS: Im, Pesaran, Shin (2003) Panel Unit Root Test

HT: Harris Tsavalis (1999) Panel Unit Root Test

SURADF: Seemingly Unrelated Augmented Dickey Fuller (2001) Panel Unit Root Test

RIA: Regional Integration Agreement

FTA: Free Trade Agreement

CU: Customs Union

PSA: Partial Scope Agreement

WTO: World Trade Organization

CET: Common External Tariff

1.INTRODUCTION

Since 1990s regional economic integration agreements have become more and more intensified across the world - from North America to Latin America, from Europe to Asia and in Africa. Not only a large number of developing countries are part of one or more than one agreements, but also most of developed countries are part of such agreements. Due to the prevalence of them, regional economic integrations between countries and their economic impacts have been receiving a lot of interest from various academics. Existence of convergence in per capita incomes of countries taking part in regional economic integration agreements is one of the most questioned subjects in economics literature. Not surprisingly, empirical evidence is conflicted. While some of the empirical studies find evidence for convergence: Ben David (1993), Karras (1997), Holmes (2005), Cuaresma, Grünwald, Silgoner (2008), Hammouda, Karingi, Njuguna, and Jallab (2009), Carmignani (2007); some of the empirical studies report the opposite: Karras (1997), Cuestas, Monfort, Ordóñez (2012), Slaughter (1998).

Balassa (1961) identifies regional economic integration stages as Free Trade Agreements, Customs Unions, Common Markets, Economic Unions, and Total Integration. In this process, barriers to trade between countries diminishes and integration deepens from Free Trade Agreements to Total Integration. *Free Trade Agreements* abolish tariffs and quotas between participant countries, yet each participant impose their own tariff towards third party countries. *Customs Unions* impose common external tariff (CET) towards third party countries in addition to abolition of tariffs and quotas between members. *Common Markets* allow free movement of factors of production alongside the properties of customs unions. Economic Unions aim to synchronize economic policies (it mostly refers to monetary policy and fiscal policy) of joint countries besides the properties of common markets. Finally, *Total Integration* refers to the unification of monetary, fiscal and social policies between member countries.

In this study, existence of convergence in per capita incomes of participant countries in 23 regional economic integration agreements is evaluated via applying Panel Unit Root Test technique on the series of deviations of each country's real GDP per capita in 2005 USD figures from regional integration agreement average. Based on Balassa's (1961) typology of regional integration agreements, this paper dwells on WTO classification such that: Partial Scope Agreements, Free Trade Agreements and Customs Unions. First Generation Panel Unit Root Tests yield that convergence performances of Caribbean Community (CARICOM) for the period of 2002-2013 to which Haiti joined, and Economic Community of West African States (ECOWAS) for the period of 2000-2013, from which Mauritania left and Cabo Verde - which is the extreme country in terms of per capita income- was dropped were significant. Furthermore, Second Generation Panel Unit Root Tests lead that real GDP per capita series of the following countries do revert to RIA average Oman among Gulf Cooperation Council (GCC); Poland and Czech Republic among Central European Free Trade Agreement (CEFTA); Russia and Tajikistan among Euroasian Economic Community (EAEC); Denmark and United Kingdom among European Free Trade Agreement (EFTA) for the period of 1960-2013 before which Iceland joins and Denmark and UK leave; Austria among EFTA for the period of 1986-2013 during which Finland joins; Uruguay and Panama among Latin American Integration Association (LAIA); Malawi among South African Development Community (SADC) for the period of 1990-2013 during which Namibia joins; Turkey and Uzbekistan among Economic Cooperation Organization (ECO) for the period of 1992-2013 during which Afghanistan, Azerbaijan, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan and Uzbekistan join; Guinea Bissau among West African Economic and Monetary Union for the period of 1997-2013 during which Mali and Guinea Bissau join.

In addition to the evaluation of real income per capita convergence among member countries in various multilateral regional integration agreements, regional integration agreements in which divergence is found are re-analyzed by excluding the deviation series related to countries behaving extremely with respect to the rest over the period of study. These countries are: China in APTA; Cabo Verde in ECOWAS2; Luxembourg in EU1; Greece, Ireland and Luxembourg in EU3; Singapore in ASEAN1; Brunei Darussalam in ASEAN2; Trinidad & Tobago and Antigua & Barbuda in CARICOM2; and United Arab Emirates, Syrian Arab Republic, Libya and Yemen in PAFTA. The repetition of analysis by excluding outlier countries from the RIAs has led to the outcome that there is significant evidence in favor of convergence among ECOWAS2 member countries when Cabo Verde is not included, and among EU3 member countries when Greece, Ireland and Luxembourg are not considered.

This study aims to contribute to the literature in two ways. Firstly, it updates the information related to test of convergence hypothesis in regional integration agreement setting by panel unit root testing technique. Secondly, a wide range of panel unit root tests are considered and the most appropriate ones are employed in this study which is unique in terms of this property.

The remainder of this paper is organized as follows: The next section reviews the literature about concepts of convergence, and it is considered in a regional integration agreement setting in the same section. Data and Methodology is explained in Section 3. Main results and Conclusion are presented in Section 4 and Section 5, respectively.

2. LITERATURE REVIEW

2.1. The Convergence Concept

The concept of convergence is the central issue in this study. For this reason, it is important to have primary knowledge about initial classical studies and the ramifications which represent slightly different approach on it. In the following subsections, the initial understandings of convergence concept by scholars is firstly introduced, then alternative approaches to the concept is presented.

2.1.1. Unconditional Convergence and Conditional Convergence

The notion of unconditional (absolute) convergence is about faster growing of poor countries with respect to richer ones. In empirical literature, it is put forth in the form of the relationship between average income growth rate and initial income per capita regressions Baumol (1986), Kormendi and Meguire (1985), Barro and Sala-i-Martin (1992), Mankiw, Romer and Weil (1992), Sala-i-Martin (1996). Because the existence (or absence) of convergence is concluded based on the sign and significance of the coefficient of initial income per capita variable (β), the name β - convergence is coined to the literature. If β is estimated as significantly negative in average income growth rate – initial income per capita regression then existence of convergence is reached.

At this point, an important distinction between unconditional β - convergence and conditional β - convergence should be stated. It can be easily derived from Solow model. Assume a Cobb-Douglas labor augmenting production function at time t:

$$Y_t = K_t^{\alpha}(A_t L_t)^{1-\alpha}$$

(where Y represents output, K represents capital, L represents labor which is assumed to coincide with population, A represents technology roughly, α represents the capital share in total output and $0<\alpha<1$) Assuming that δ is the constant depreciation rate of physical capital, s is the saving rate which is a constant fraction of income in every period t, and n and g are the constant growth rates of population and technology respectively, the physical capital per effective worker is given by $k = \frac{K}{AL}$ and the output per effective worker is given by $y = \frac{Y}{AL}$. Accordingly, physical capital per effective worker evolves as follows:

$$\Delta k_t = sy_t - (n + g + \delta)k_t$$

$$\Delta k_t = sk_t^{\alpha} - (n + g + \delta)k_t$$

Steady-state value of physical capital per effective worker (k*) is given by:

$$k^* = [\frac{s}{n + g + \delta}]^{\frac{1}{1-\alpha}}$$

It implies that steady-state value of physical capital per effective worker is positively affected by saving rate and negatively affected by population growth, depreciation and rate of technology growth.

Steady-state value of income per effective worker (y*) is given by:

$$y^* = A_0 e^{gt}[\frac{s}{n + g + \delta}]^{\frac{\alpha}{1-\alpha}}$$

Steady-state value of income per effective worker is affected by saving rate, initial technology level, technology growth rate, population growth, depreciation rate and share of capital in output.

Based on the above theoretical specification, the difference between unconditional β - convergence and conditional β - convergence can be understood. Unconditional β - convergence implies all the variables that determine steady-state value of per capita income are the same for all countries considered. This implication feeds the average income growth rate – initial income per capita regression in terms of significant negative estimate of β even no other explanatory variable is controlled for. In contrast, conditional β - convergence implies that saving rate, , initial technology level, technology growth rate, population growth, depreciation rate and share of capital in output are country-specific variables so that addition of them are required as explanatory variables besides initial income variable in the right hand side of the regression. In this case if estimated β is significantly negative then the existence of conditional convergence is concluded. Mankiw et al. (1992) is the initial empirical study that is derived from above theoretical framework. In this influential study, using natural logarithm of per capita income between 1960-1985 the authors firstly test for unconditional convergence in a sample of non-oil countries, in another sample of excluding small countries (intermediate countries) and in another sample of OECD countries. According to the first test, the results confirm significant evidence for unconditional convergence for OECD countries whereas there is no significant evidence for unconditional convergence among the former two samples of countries.

Having the first results implied by unconditional convergence test, the results for the tests of conditional convergence is also reported in Mankiw et al. (1992). The addition of natural logarithm of investment to GDP ratio and natural logarithm of sum of population growth, technology growth and depreciation rate yield significant negative estimates of β which leads to the inference of existence of conditional convergence among three samples of countries. In the final step, in addition to initial income per capita variable, natural logarithm of investment to GDP ratio and natural logarithm of sum of population growth, technology growth and depreciation rate, the human capital variable which is proxied by percentage of working age population that is enrolled in secondary school is included. The results of final regression produced significant negative estimates of β which again leads to the inference of existence of conditional convergence among three samples of countries.

The work of Barro and Sala-i-Martin (1992) is another leading formal study on convergence regression. In this study the specification for convergence regression is based on theoretical framework of Cass (1965) and Koopmans (1965)' household utility maximization version of neoclassical growth model. Utilizing from growth rate of real GDP per capita of 98 countries between 1960-1985 as dependent variable and logarithm of 1960 per capita GDP as independent variable in addition to the variables of primary and secondary school enrollment rates in 1960, the average ratio of government consumption spending, except defense and education, to GDP between 1970-1985, some variables that reflects political instability and average deviation from unity of the Summers-Heston (1988) PPP ratio for investment in 1960, they report evidence in favor of conditional convergence.

The contribution by Kormendi and Meguire (1985) differs from the above empirical studies in that while they search the relationship between average growth rate and initial income they consider some more determinants. For example, average population growth rate, standard deviation of real output growth, the standard deviation of money supply shocks, average money supply growth, average growth of government spending to income ratio, average growth of exports to income ratio, and average growth rate of inflation. 47 countries between 1950-1977 is the interest of the study and it is found that growth of population and standard deviation of real output growth positively affect average growth rate whereas initial real income per capita and monetary variance negatively affect it. Therefore, it can be said that Kormendi and Meguire (1985) confirms the suggestions of neoclassical growth theory.

While estimating parameter β in average growth rate – initial income regression had received a lot of interest from scholars, Evans (1997) takes a prudential approach. In this work, he showed that judgment of convergence in accordance to β is valid under, in his terms, *incredible* conditions. Such conditions are: "the dynamical structures of the economies have identical first-order autoregressive representations; every economy affects every other economy completely symmetrically; and the vector of variables control for all permanent cross-economy differences." (Evans and Karras 1996b, p.1)

2.1.2 σ - Convergence

The concept of σ - convergence appear in the literature as follows: If the dispersion of real per capita income of countries decline over time then these countries are said to converge in σ sense. Sala-i-Martin (1996) puts this phenomenon with mathematical terms in a sensible way: Let σ_t be the standard deviation of logarithm of incomes across countries at time *t*, if

$$\sigma_{t+T} < \sigma_t$$

then the interested countries are said to converge. That is if the measured standard deviation of logarithm of per capita incomes of countries at time *t* is greater than the measured standard deviation of logarithm of per capita incomes of countries after *T* period passes.

Some researchers in the literature put themselves against Barro (1991) regression, that is: cross-section regression tests of convergence hypothesis and judging the existence (or non-existence) of convergence according to sign and significance of β. Quah (1993a) is one of them who puts emphasis on spread of incomes of countries rather than negative β from the average income growth rate – initial income per capita regression. Similarly, in a communication paper Friedman (1992) points the possibility of misinterpretation of β from such a regression due to possibility of having measurement error in regressors. By developing an analogy between Galton's Fallacy of regression and growth rate – initial income level regressions, Quah (1993a) shows that a negative β reflects, in fact, the nonexistence of convergence. In his words: "…Widely used initial level regressions… shed no light on convergence in the sense of notion of poorer countries eventually catching up with richer countries." (Quah 1993a, p.4)

Sala-i-Martin (1996) disagrees with what Quah (1993a) puts. According to Sala-i-Martin (1996) both concepts of σ - convergence and β - convergence deserves empirical investigation. Moreover he asserts that although the concepts of σ - convergence and β - convergence are not the same, they are related and he formally derives this relationship in his work.

2.1.3. Time Series Approach to the Concept of Convergence

The relationship between usual β - convergence and time series approach can be summarized as:

The equation of interest is the standard Dickey-Fuller regression with drift term and a linear trend.

$$y_t = \mu - \beta g t + (1+\beta) y_{t-1} + \varepsilon_t$$

(where y_t and y_{t-1} represent income per capita at time *t* and *t-1* respectively, μ is the systematic change in one period to another, *t* is the linear trend, and ε is the *iid* error term.) In this context, in order to say that convergence exists (1+β) must be less than one: that is β has to be negative. In other words, one is interested in testing whether the null hypothesis of (1+β) is equal to one.

If the null hypothesis can not be rejected, then this implies β=0 can not be rejected. This conclusion in turn implies one can not reject the hypothesis that there is no convergence.

Quah (1990) and Evans and Karras (1996) are the initial studies that utilized from time series analysis to test the existence of convergence across countries. Quah (1990) analyzed income per capita deviations from US for 114 countries between 1970-1985. Islam (2003) "Noting both large N and T, Quah develops and applies inference theory appropriate for 'random field data' and rejects the null of unit root" Quah (cited in Islam 2003)[1]. Regarding to this study, it is also mentioned in Islam (2003) that by including no country-specific intercept the null hypothesis of no unit root is rejected that is the conclusion of evidence for nonexistence of unconditional convergence across the countries. Evans and Karras (1996a) criticizes Quah (1990) in that the alternative hypothesis of his work is absolute convergence by proposing an evidence that if convergence exists then it is conditional. In addition to that, Evans and Karras (1996b) views the weakness of standard Dickey-Fuller test because of its limited power and poor size properties, and uses a modified version of the unit root test proposed by Levin and Lin (1993) together with a pooled data of US states including state specific intercept term. They conclude evidence in favor of conditional convergence since they reject the null hypothesis of unit root. Similar results are obtained in another study of Evans and Karras (1996a). By applying unit root test analysis to pooled deviations from the average, the authors examined the existence of convergence across 54 countries between 1950-1990, and reported strong evidence for the rejection of null hypothesis of unit root implying existence of conditional convergence across countries, which is in line with predictions of neoclassical growth model and therefore in contrast to endogenous growth models.

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[1] Islam, N. (2003), "What have We Learnt from the Convergence Debate?", Journal of Economic Surveys, 17, 309-362.

Bernard and Durlauf (1995) considers the concept of convergence in a dynamic and stochastic environment. Their work examined annual logarithm of real per capita income of 15 OECD countries between 1900-1987 by means of multivariate tests for convergence and cointegration developed by Philips and Ouliaris (1988) and Johansen (1988), and reported rejection of convergence. Although not converging, it is found that there is cointegration across those OECD countries over the period of study implying that the existence of common long-run elements that jointly determine income growth of the economies considered.

2.2. The Notion of Convergence in a Regional Integration Agreement Setting

So far, a strand of literature on convergence across countries has been presented in order to give the reader some prior knowledge about the issue. In the following section, the literature on convergence concept in a regional integration agreement setting with various methodologies, and in the one after, the same literature with Panel Unit Root methodology, which is also the focus of current study will be introduced.

2.2.1. Empirical Studies on Convergence within a Regional Integration

To our knowledge, Ben David (1993) is the first study which points out that most of the convergence confirmed by several studies has existed in post-war period which is also the period of growing trade liberalization. In this study, European Economic Community (EEC) countries are examined in order to see the link between freer trade and income disparity. By utilizing from standard deviations of member countries' incomes and then with the help of unit root test, the author indicates emphatic evidence for the convergence of incomes among EEC during postwar period.

The second contribution to this branch of literature is by Karras (1997). The investigation of this study covers three regional integration experiences: Association of

Southeast Asian Nations (ASEAN), European Union (EU), and Latin American Free Trade Area (LAFTA, then named as LAIA). The conventional regression fit of average growth rate-initial income per capita for each regional grouping reveals that unconditional β - convergence is nonexistent in ASEAN over 1960-1990 period, and unconditional β - convergence exists for EU over 1950-1990 and mildly for LAFTA over 1950-1990 Karras (1997). In addition to estimation of β in an average growth rate – initial income regression, cross country income variances for each regional groupings over the period of study are examined. This examination is consistent with the results from conventional regression fit. In other words, the cross-country income variance in ASEAN has increased while it has decreased in EU and LAFTA over the period of study Karras (1997). Carmignani (2007) provides similar results related to ASEAN and LAIA by using panel unit root methodology. In contrast to findings of Karras (1997) and Carmignani (2007) related to ASEAN, Ismail (2008) finds that there is evidence of convergence after expansion from five to ten members. However, the results from Ismail (2008) are consistent with those of Karras (1997) only before the expansion of ASEAN, that is : there is neither β - convergence nor σ - convergence among five initial member countries.

Related to Latin American regional integration experiences, specifically Latin American Integration Association (LAIA) and Central American Common Market (CACM), Holmes (2005) is another study that questions whether income convergence is achieved among joining countries. This study covers sixteen Latin American countries over the period of 1960-2000, and uses principal components and cointegration analysis. It reports that there exists strong long-run convergence among CACM member countries over the period of 1960-2000, yet existence of convergence among LAIA member countries can be pronounced weakly over the period of 1981-2000 Holmes (2005). Furthermore, the latter finding from Holmes (2005) is consistent with the finding from Karras (1997) and Carmignani (2007) that is convergence weakly exists for LAIA countries.

Cuaresma, Grünwald, Silgoner (2011) is one of the recent studies focuses on the European Union experience, and it reports not only poor countries' catching up with rich ones since 1960s but also growth enhancing effect of duration of membership in EU. The former finding of Cuaresma et al. (2011) corroborates the findings of Karras (1997) related to EU.

Cuestas, Monfort, Ordóñez (2012) is the next recent study related to EU. Unlike Karras (1997) and Cuaresma et al. (2008), Cuestas et al. (2012) asserts the existence of club convergence in EU, which is equivalent to income divergence. According to this study, there are two convergence clubs that have their own steady states. The first convergence club includes all Eastern European countries and Greece whereas Western countries minus Greece constitutes the second convergence club. Moreover, the cluster analysis yields the result of existence of two convergence clubs in Eastern European countries. The main factor which determines these clubs is whether or not belonging to euro zone Cuestas et al. (2012).

Venables (1999) is the next study, which considers the relationship between regional integration agreements and income convergence among member countries in a much broader view. The implications from this study are: Free Trade Agreements (FTAs) tend to lead to divergence if it is between low-income countries whereas they tend to lead to convergence if it is between high-income countries. Moreover, the results suggest that north-south FTAs are much better than south-south FTAs for developing countries because joining to an FTA that is between north-south countries is instrumental in increasing the possibility of convergence with high-income member countries in that FTA. The example RIAs for the above conclusion are also provided in the study, such that EU is an RIA between high and low-income countries and it seems that they experienced convergence. More specifically; Ireland, Spain and Portugal were stated to make a significant performance in closing the gap with high-income members of EU. The RIAs that were stated to experience divergence are East African Common Market (EAC), Central American Common Market (CACM) and the Economic Community of West

African States (ECOWAS). EAC is an interesting example among three RIAs and its story has an important connection with the main argument of this article. Uganda and Tanzania claimed that Kenya having all the benefits of East African Common Market since Kenya has become the major producer and exporter of the manufactures to two comparatively less developed partners. Not surprisingly, the common market collapsed in 1977. Based on this event and the fact that Kenya is the country whose comparative advantage is much closer to the world average among the other member countries, Venables (1999)[2] argues that: "…countries with comparative advantage closer to the world average do better in an FTA than do countries with more extreme comparative advantage." (Venables 1999, p.8)

The study of Hammouda, Karingi, Njuguna, and Jallab (2009) is the first study such that it is very much comprehensive in African experience of regional integration. Southern African Development Community (SADC), Common Market for Eastern and Southern Africa (COMESA), the Economic Community of West African States (ECOWAS), the Central African Monetary and Economic Community (CEMAC), and the West African Economic and Monetary Union (WAEMU or French abbreviation: UEMOA,) are the regional integration agreements considered in this work. For SADC, COMESA and the ECOWAS, the panel estimation of β indicates some evidence of income convergence while the β is not estimated for CEMAC and WAEMU due to lack of data. Besides, income disparity among member countries in each RIA, which is calculated as income deviation of each country from the RIA mean, implies that countries in SADC, COMESA and ECOWAS are not converging; that is income disparity among member countries are increasing over the period of study Hammouda et al. (2009). The finding of existence of convergence in β sense yet non-existence of it in σ

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[2] Venables, A. (1999), "Regional Integration Agreements A Force for Convergence or Divergence?" Washington, D.C, The World Bank:8.

sense is consistent with theoretical expressions or is at least empirical justification of them that are in the work of Sala-i-Martin (1996). For CEMAC the calculated income disparity is decreasing while remaining quite high during the period study, and for WAEMU the income dispersion implies a strong propensity for income convergence Hammouda et al. (2009).

Slaughter (1998) is an exceptional study in the above ones and it provides contrary evidence that there is no link between trade liberalization and convergence. This study examines four trade liberalizations in the post-war period, specifically European Economic Community (EEC), European Free Trade Area (EFTA), liberalization between EEC and EFTA, and Kennedy Round of General Agreement on Tariffs and Trade (GATT). The difference in difference estimations methodology yields the conclusion that the only effect of trade liberalization is the income divergence among the liberalizers not the convergence Slaughter (1998).

2.2.2. Panel Unit Root Approach to Convergence Concept within a Regional Integration

There are several studies which investigated convergence hypothesis in a stochastic framework (Bernard and Durlauf (1995); Evans (1996); Evans and Karras (1996a); Evans and Karras (1996b); Hall, Robertson and Wickens (1997); Evans (1998); Montuenga – Gomez (2002)). Following the definition of convergence in such a framework Carmignani (2007); Guetat and Serranito (2007); and Charles, Darné and Hoarau (2012) applies panel unit root methodology in order to investigate the link between regional integration agreements and convergence hypothesis.

The alternative definition in Bernard and Durlauf (1995) establishes convergence in output as follows:

Given existing information, countries $p=1 \dots n$ converge if the long-term output expectations for all countries are the same at a fixed time t:

$$\lim_{k\to\infty} E\left(y_{1,t+k} - y_{p,t+k} \middle| \Omega_t\right) = 0 \quad \forall p \neq 1$$

This definition requires testing whether $y_{1,t+k} - y_{p,t+k}$ is a mean zero stationary process. The judgment of conditional convergence is done accordingly.

In this context, Evans and Karras (1996) and Evans (1998) proposed a new test which depends on panel unit root methodology in order to test for convergence hypothesis. Conditional convergence implies each economy converges to its own steady state, any deviation from steady state is transient. However, if deviations from steady state is persistent then economies are said to diverge. In view of Evans and Karras (1996) and Evans (1998), this requires the deviations of each economy from cross-country mean of $\overline{y}_t$ to tend to constant values as *k* tends to infinity.

$$\lim_{k\to\infty} E_t\left(y_{1,t+k} - \overline{y}_{p,t+k}\right) = \mu_p$$

(where μ_p is the level of p's economy parallel growth path) If $(y_{p,t+k} - \overline{y}_{t+k})$ are stationary then the above equation holds. Unconditional convergence is concluded if $\mu_p = 0\ \forall p$ while $\mu_p \neq 0$ *for some p* implies conditional convergence that is each economy converges to its own parallel growth path. This argument is equivalent to test whether the value of parameter ρ is equal to zero in the following equation (Evans (1998), Evans and Karras (1996)):

$$\Delta\left(y_{p,t} - \overline{y}_t\right) = \mu_p + \rho_p\left(y_{p,t-1} - \overline{y}_{t-1}\right) + \sum_{k=1}^{K} \varphi_{pk}\, \Delta\left(y_{p,t-k} - \overline{y}_{t-k}\right) + u_{p,t}$$

(where p=1,…n and t=1,…T and $u_{p,t}$ is assumed to be uncorrelated across economies and μ_p is the country specific fixed effect for country p.) If $\rho_p < 0$ then $\left(y_{p,t} - \overline{y}_t\right)$ will be stationary and it will be nonstationary if $\rho_p=0$. In stationarity case $y_{p,t}$ reverts to a common trend which is stated to be well measured by $\overline{y}_t$ Evans (1998).

Carmignani (2007) is a noteworthy advocate of above approach in examining the relationship between regional economic integration and income convergence. The examination covers twenty-eight regional integration initiatives and the period of study is determined according to the date of establishment of each regional integration agreement. By employing panel unit root tests proposed by Levin, Lin, and Chu (2002) and Im, Pesaran and Shin (2003) the following findings are reached: There is no conditional convergence among regional integration agreements of ANDEAN, ASEAN CEMAC, CIS, COMESA (before Swaziland joins), EAEC, LAIA, EEA, EU10, and EU12. In contrast, evidence is in favor of the following regional integration agreements: CACM, CARICOM, CBI, CEFTA, COMESA (after Swaziland joins), ECOWAS, MERCOSUR, SACU, SADC1, SADC2, WAEMU, UMA, APEC1, APEC2, NAFTA, EU15 Carmignani (2007).

The work by Charles, Darné and Hoarau (2012) is another contribution to this strand of literature. This study is specific to COMESA countries. Similar to Carmignani (2007), by utilizing from panel unit root testing techniques, no evidence was reported for the period of 1950-2003. The further application of economic development criterion reveals that there were two absolute convergence clubs among COMESA, that is one for the more developed countries and the other for the rest of less developed ones.

3. DATA and METHODOLOGY

3.1. Data

The data consists of GDP per capita figures in constant 2005 USD and it covers 23 regional integration agreements (RIAs) that are notified to World Trade Organization (WTO), and it is related to more than 100 countries that are involved in these agreements. Out of 23 regional integration agreements, 12 of them are customs unions (CUs), 8 of them are Free Trade Agreements (FTAs) and 3 of them are Partial Scope Agreements (PSAs). This classification is based on the definition by World Trade Organization and the study covers only multilateral regional integration agreements not the bilateral ones. Therefore, trade agreements between two countries are out of scope of this study.

The main source of data is the World Development Indicators of the World Bank, that keeps track of development indicators collected from officially recognized international sources. The United Nations Statistics Division is also utilized when encountered with missing data over the period of study.

In this study sample period spans from the founding year of each regional integration agreement to 2013. Following Carmignani (2007); when membership of an RIA changes over time, the tests are separately performed on the members of the RIA before and after the change. For example, Economic Cooperation Organization (ECO) was founded in 1985 by Iran, Pakistan and Turkey. In 1992; Afghanistan, Azerbaijan, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan joined to ECO. Consequently, there are two sample periods considered for ECO: *ECO-1* is for the period of 1985-2013 with initial countries and *ECO-2* is for period of 1992-2013 with initial countries plus new-joiners. Therefore, the numbers after the abbreviations of regional integration agreements' names stand for the changes in the membership of the RIA considered, sample period and member countries change accordingly[3]. Furthermore, the RIAs that are held after 2004 is out of scope of this study, since this would be too short period of time to investigate convergence dynamics between countries.

3.2. Methodology

In previous sections the researches studying income per capita convergence in the context of regional integration agreements were presented. These researches in fact any research studying convergence hypothesis have many options in terms of methodology, and the results from different studies employing different methods are mostly inconclusive. In this study, following Carmignani (2007) panel unit root test methods employed in order to examine convergence dynamics among countries after they join to a regional integration agreement. By panel unit root method we will benefit from both time and cross-section dimension of data in testing and avoid poor size and power properties of time series unit root testing that are previously pointed by some studies[4]. In addition to avoidance of drawbacks of time series unit root testing, we will utilize from several types of unit root testing in a panel setting.

The first step in panel unit root testing is to determine whether the series of interest is cross-sectional dependent or not. Pesaran's (2004) cross-sectional dependence (CD) test helps to determine cross-sectional dependence[5]. If the series is concluded to be cross-sectional independent, then first generation panel unit root tests will be applicable. On the contrary, if the series is found to be cross-sectional dependent, then second generation panel unit root tests will be appropriate. First generation tests include Levin, Lin and Chu (2002); Im, Pesaran and Shin

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[3] See Part B in Appendix for a detailed information about membership in RIAs and period of study.

[4] Time series unit root testing is criticized because of power and size properties by Schwert (1989), Agiakloghou and Newbold (1992), DeJong, Nankervis, Savin and Whiteman(1992a,1992b).

[5] For a detailed information about Pesaran (2004) CD test: Pesaran, M.H. (2004) "General Diagnostic Tests for Cross Section Dependence in Panels" , CESifo Working Papers, 1229.

(2003); Harris, Tzavalis (1999); Hadri (2000); Choi (2001) and Maddala and Wu (1999). Although it seems many, there are some key differences between these tests, and depending on the relative lengths of cross-section dimension and time dimension the choice of the test changes. Second Generation tests include Choi (2002); Philips and Sul (2002); Bai and Ng (2004); Moon and Perron (2004); Pesaran (2007) and SURADF test by Breuer, McNown, and Wallace (2001). Hence in this study while we proceed in panel unit root application, we will consider cross-sectional dependence (and independence) of the series and then based on the relative cross-section and time dimensions of each regional integration agreement group, we will choose the most appropriate test. Therefore, the contribution of this study to this branch of literature is two-fold. First, it provides recent information related to test of convergence hypothesis in the context of regional integration agreement by means of panel unit root testing. Second, a wide range of panel unit root tests are considered and employed in this study which is unique in terms of this property.

3.2.1. First Generation Panel Unit Root Tests

If a series is concluded to be cross-sectional independent based on the result of Pesaran's (2004) CD test, then first generation panel unit root tests should be employed. Some of the first generation panel unit tests assume a common autoregressive parameter for all panels. Depending on this assumption first generation panel unit root tests can be classified in two groups: The first group of tests, which assume a common autoregressive parameter, are Levin, Lin and Chu (2002), Breitung (2000), Harris and Tsavalis (1999), and Hadri (2000). On the contrary, the second group of tests do not make an assumption of a common autoregressive parameter across panels. These include Im, Pesaran and Shin (2003), Fisher ADF (Maddala and Wu, 1999) and Fisher Philips and Perron (Choi, 2001). In the following subsections a brief introduction about first generation unit root tests and key differences between them will be presented.[6]

3.2.1.1. Levin, Lin and Chu (2002) Panel Unit Root Test

Levin, Lin and Chu (LLC hereafter) (2002) assumes a common autoregressive parameter across panels. The model for LLC (2002) is as follows:

$$\Delta Y_{it} = \rho Y_{i,t-1} + \alpha_{mi} d_{mt} + \sum_{j=1}^{p} \theta_{ij} \Delta Y_{i,t-j} + \varepsilon_{it} \quad m=1,2,3$$

(where $\mathbf{d_{mt}}$ represents the vector of deterministic variables.) One is interested in testing the null hypothesis of each individual time series contains a unit root against the alternative that each time series is stationary. This is equivalent to the formulation of hypotheses of LLC (2002) as follows:

$$H_0: \rho_i = \rho = 0$$

$$H_1: \rho_i = \rho < 0$$

LLC (2002) calculates the adjusted t-statistic, which is shown to have normal distribution by means of Monte Carlo simulations:

$$t_{\rho}^{*} = \frac{t_{\rho} - N\tilde{T}\hat{S}_N \widehat{\sigma}_{\tilde{\varepsilon}}^{-2} \widehat{\sigma}(\widehat{\rho}) \mu_{m\tilde{T}}^{*}}{\sigma_{m\tilde{T}}^{*}}$$

The conventional t-statistic, which has a standard normal distribution, is computed as:

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[6] The information related to the tests presented here is for the justification of use of them case by case. A detailed information can be found in related articles as well as various textbooks.

$$t_\rho = \frac{\hat{\rho}}{\hat{\sigma}(\hat{\rho})}$$

LLC (2002) suggested the use of this test on panels of size with N between 10 and 250 and T between 25 and 250. Furthermore, LLC test without deterministic variables, which are panel specific intercepts or time trends, requires asymptotically $\sqrt{N}/_T \longrightarrow 0$, which is equivalent to say that time dimension of data set grows more slowly than the cross-sectional dimension. LLC (2002) remind that this is appropriate in datasets of microeconomic applications. If the model is supposed to have deterministic variables, then this requires asymptotically $N/_T \rightarrow 0$ in order adjusted t-statistic t_ρ^* to have standard normal distribution. This is equivalent to say that time dimension grows faster than the cross-sectional dimension. LLC (2002) state the last situation as more appropriate for datasets in macroeconomic applications. In the former case, LLC (2002) suggest using the conventional t-statistic whereas they suggest using the adjusted t-statistic for the latter case.

3.2.1.2. Breitung (2000) Panel Unit Root Test

The testing procedure of Breitung (2000) panel unit root test is similar to LLC (2002) except that not only deterministic term is not included but also that the data is adjusted before regression is fitted so that bias adjustment, which is claimed LLC's adjusted t-statistic suffer from low power by Breitung (2000). Firstly, ΔY_{it} is regressed on $\Delta Y_{i,t-j}$ (j=1,...,p) and residuals are obtained: $\hat{e}_{it}$. Then, $Y_{i,t-1}$ is runned on $\Delta Y_{i,t-j}$ (j=1,...,p) and residuals are obtained: $\hat{v}_{i,t-1}$. These residuals are adjusted (like LLC) in order to correct for differences in variances across *i* such that:

$$\tilde{e}_{it} = {\hat{e}_{it}}/{\hat{\sigma}_{\varepsilon_i}} \quad \text{and} \quad \tilde{v}_{it} = {\hat{v}_{i,t-1}}/{\hat{\sigma}_{\varepsilon_i}}$$

Thirdly, forward orthogonalization transformation is applied to the residuals such that obtain u_{it}^{*}. Finally, the following pooled regression is runned and test statistic is obtained, which has standard $N(0,1)$ distribution in the limit. Asymptotically, it is required that $T \rightarrow \infty$ followed by $N \rightarrow \infty$.

$$e_{it}^{*} = \rho v_{i,t-1}^{*} + \varepsilon_{it}^{*}$$

Similar to LLC (2002), in Breitung (2000) test, one is interested in testing the null hypothesis of each individual time series contains a unit root against the alternative that each time series is stationary. This is equivalent to the formulation of hypotheses of Breitung (2000) as follows:

$$H_0: \rho_i = \rho = 0$$

$$H_1: \rho_i = \rho < 0$$

3.2.1.3 Harris and Tsavalis (1999) Panel Unit Root Test

Harris and Tsavalis (HT hereafter) (1999) showed that the assumption of time dimension tends to infinity much faster than cross-sectional dimension does leads to undersized and low power tests. Therefore, this test is designed for the situation that time dimension of panel data is small relatively to cross-section dimension. A common autoregressive parameter (like LLC and Breitung) is also assumed in this test.

The HT (1999) test statistic is derived from the following regression model:

$$Y_{it} = \rho Y_{i,t-1} + \alpha_{mi} d_{mt} + \varepsilon_{it}$$

(where $\mathbf{d_{mt}}$ represents the vector of deterministic variables.) In HT (1999), it is assumed that disturbance term is independent and identically distributed (i.i.d.) and normal with homoscedastic variance across panels.

Similar to LLC (2002) and Breitung (2000), HT (1999) tests the null hypothesis of the null hypothesis of each individual time series contains a unit root against the alternative that each time series is stationary. Note that the test uses Y_{it} instead of ΔY_{it}, consequently this is equivalent to the formulation of null hypothesis of HT (1999) as follows:

$$H_0: \rho_i = \rho = 1$$

3.2.1.4. Hadri (2000) LM Test

Hadri (2000) LM Test differs from the previously discussed tests in its formulation of null and alternative hypotheses. In this test, one is interested in testing the null hypothesis of no unit root in any of the series in the panel against the alternative hypothesis that at least one panel contains unit root. Asymptotically, Hadri (2000) LM test requires $T \to \infty$ followed by $N \to \infty$.

The following two regression models are considered in Hadri (2000) test:

$$Y_{it} = r_{it} + \varepsilon_{it} \quad i=1... N; \quad t=1,\ldots,T$$

$$Y_{it} = r_{it} + \beta_i t + u_{it} \quad i=1...N; \quad t=1,\ldots,T$$

(where $r_{it} = r_{i,t-1} + u_{it}$ is a random walk process. ε_{it} and u_{it} are zero mean i.i.d. normally distributed errors: $\varepsilon_{it} \sim IIN(0, \sigma_\varepsilon^2)$ and $u_{it} \sim IIN(0, \sigma_u^2)$) If the variance of u_{it} were equal to zero, then r_{it} would be equal to a constant. This would imply that Y_{it} were trend stationary. Based on this argument, the null and alternative hypotheses of Hadri (2000) LM test can be stated as follows:

$$H_0: \lambda = \frac{\sigma_u^2}{\sigma_\varepsilon^2} = 0$$

$$H_1: \lambda > 0$$

3.2.1.5. Im, Pesaran and Shin (2003) Panel Unit Root Test

Im, Pesaran and Shin (IPS hereafter) (2003) is one of first generation panel unit root tests which relaxes the assumption of common autoregressive parameter across panels. This test not only abandons common autoregressive parameters assumption, but it is also applicable to unbalanced panel data sets yet there can not be gaps within a panel.

IPS (2003) suggest a standardized t-bar test statistic which is produced from averaging Augmented Dickey-Fuller statistics across panels. Similar to LLC (2002), the regression model is as follows:

$$\Delta Y_{it} = \rho_i Y_{i,t-1} + \alpha_{mi} d_{mt} + \sum_{j=1}^{p} \theta_{ij} \Delta Y_{i,t-j} + \varepsilon_{it} \quad m=1,2,3$$

In contrast to LLC (2002), ρ_i is allowed to vary across panels. The null hypothesis is that each series in the panels contains unit root, and the alternative hypothesis is that some (but not all) of the individual series have unit root. Therefore, the hypotheses of IPS (2003) can be expressed as:

$$H_0: \rho_i = 0 \text{ for all } i$$

$$H_1: \begin{cases} \rho_i < 0 \; for \; i = 1,2,\dots,N_1 \\ \rho_i = 0 \; for \; i = N_1 + 1, \dots, N \end{cases}$$

The test statistic of IPS (2003) is defined as t-bar which is appropriate when cross-section and time dimensions are fixed. It is formulated as:

$$\bar{t} = \frac{1}{N}\sum_{i=!}^{N} t_{\rho_i}$$

3.2.1.6. Fisher ADF (Maddala and Wu, 1999) and Fisher Philips and Perron (Choi, 2001) Panel Unit Root Tests

Fisher type panel unit root tests combine p-values instead of t-statistics from separate unit root tests performed on each panel. Like IPS (2003), Fisher type panel unit root tests relax the assumption of common autoregressive parameter. The null hypothesis of Fisher type tests is that all panels contain a unit root. For a finite number of panels, the alternative hypothesis is given by at least one panel is stationary. Maddala and Wu (1999) and Choi (2001) proposed Fisher type test denoting p_i as the p-value from the relevant test on i^{th} panel. For a finite number of panels as $T_i \rightarrow \infty$, P statistic which is distributed by $\mathcal{X}^2$ with 2N degrees of freedom is given by:

$$P = -2\sum_{i=!}^{N} \ln{(p_i)}$$

Other test statistics are suitable when number of panels are finite or infinite:

$$Z = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \Phi^{-1}(p_i)$$

(where $\Phi^{-1}(.)$ is the inverse standard normal cumulative distribution function.) Z-statistic is normally distributed with zero mean and variance of unity.

$$L = \sum_{i=1}^{N} \ln\left(\frac{p_i}{1-p_i}\right)$$

(where $\ln\left(\frac{p_i}{1-p_i}\right)$ has logistic distribution with zero mean and variance of $\frac{\pi^2}{3}$) Finally,

$$P_m = -\frac{1}{\sqrt{N}} \sum_{i=1}^{N} \{\ln(p_i) + 1\}$$

(where P_m is normally distributed with zero mean and variance of unity.)

3.2.2. Second Generation Panel Unit Root Tests

If a series is concluded to be cross-sectional dependent based on the result of Pesaran's (2004) CD test, then second generation panel unit root tests should be employed. In this study, "seemingly unrelated regressions augmented Dickey-Fuller (SURADF hereafter)" panel unit root (second generation) test proposed by Breuer, McNown, and Wallace (2001) is primarily employed because of the following properties special to this test. First of all, SURADF (2001) test allows us to conclude which series is (or are) nonstationary specifically. This is done by testing separate null hypothesis of unit root against the alternative of stationarity for each panel member. Secondly, seemingly unrelated regression estimation is superior to single equation Dickey-Fuller tests due to that it accounts for the contemporaneous cross-correlation of error terms. Thirdly, like second type of first generation tests, SURADF test allows autoregressive coefficient to vary across panels.

The system of augmented Dickey-Fuller regressions to be estimated by seemingly unrelated regressions is given by:

$$\Delta Y_{1,t} = \alpha_1 + (\rho_1 - 1)Y_{1,t-1} + \sum_{i=1} \delta_i \Delta Y_{1,t-i} + u_{1,t}$$

$$\Delta Y_{2,t} = \alpha_2 + (\rho_2 - 1)Y_{2,t-1} + \sum_{i=1} \delta_i \Delta Y_{2,t-i} + u_{2,t}$$

$$\ldots$$

$$\Delta Y_{N,t} = \alpha_N + (\rho_N - 1)Y_{N,t-1} + \sum_{i=1} \delta_i \Delta Y_{N,t-i} + u_{N,t}$$

In the above system of equations ρ_i stands for the autoregressive coefficient for i^{th} series and it will be estimated by seemingly unrelated regression method. Then, the significance of $(\rho_i - 1)$ will be tested through simulated critical values.

In addition to SURADF second generation panel unit root test proposed by Breuer, McNown, and Wallace (2001), Pesaran's CADF (2003) second generation panel unit root test is employed in the cases where the country deviation series is cross-sectional dependent but the data matrix is not positive definite. Whenever the data matrix is not positive definite, SURADF (2001) test becomes inapplicable.

3.2.3 The Model for Testing

In order to examine convergence hypothesis in regional integration agreements, appropriate panel unit root tests are applied to the series of real GDP per capita deviations from regional integration agreement average following Carmignani (2007)[7]. Specifically, by letting natural logarithm of real GDP per capita in country *i* at some time *t* (let Y_{it} represent this series)

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[7] Carmignani, F. (2007), "A Note on Income Convergence Effects in Regional Integration Agreements", Economics Letters, 94: 361-366. Convergence is defined as a situation where the series of deviations from regional integration agreement average evolves into a stationary process.

the average of natural logarithm of real GDP per capita in each RIA at that time t (let $\overline{Y}_t$ represent this series) is taken. This can be illustrated according to the formula:

$$\frac{1}{N}\sum_{t=1}^{T}\sum_{i=1}^{N} Y_{it}$$

Once the series of averages are obtained, the series of deviations of each country i from RIA average are constructed according to the formula:

$$\widetilde{\mathrm{Y}}_{\mathrm{t}} = \mathrm{Y}_{\mathrm{it}} - \frac{1}{\mathrm{N}}\sum_{\mathrm{t}=1}^{\mathrm{T}}\sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{Y}_{\mathrm{it}} \quad t=1,\ldots,T$$

Before proceeding to the application of panel unit root tests to the series of deviations from regional integration agreement average, cross-sectional dependency of the series is checked via Pesaran's (2004) CD test. If the series is found cross-sectional independent, then first generation panel unit root tests are applied whereas if it is cross-sectional dependent, then second generation panel unit root tests, specifically SURADF (2001) test is applied. In the case where the series of deviation from RIA average is found cross-sectional independent, the most appropriate first generation panel unit root test is decided according to relative dimensions of cross-section dimension and time dimension[8]. In the case where the series of deviation from RIA averages is found cross-sectional dependent, the most appropriate second generation panel unit root test is SURADF (2001) test for this study, since for all of RIAs which suit well to second generation type, the cross-sectional dimension is smaller than the time dimension.

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[8] In section 3.2.1 the asymptotics required for each of the first generation panel unit root tests are briefly mentioned.

4. RESULTS

4.1. Graphical Examination

Before proceeding to the results of formal panel unit root tests, evolution of real income per capita figures is plotted in order to visually detect existence of time trend in the series over the course of regional integration agreement. Visual inspection reveals that there exists time trend in the series of real income per capita in constant 2005 USD figures[9]. This elementary finding leads that the average series will be probably trended so do the deviation series.

4.2. Cross-Sectional Dependence Test Results

Cross-sectional dependence is tested via Stata13 software and the results are presented separately for each type of regional integration agreement in the tables below.

Table 1 shows the summary results of Pesaran's (2004) CD test for customs union agreements. According to the results cross-sectional independence implied by the null hypothesis of the test can be rejected for the following customs union deviation series of agreements at 5% significance level: ANDEAN1, ANDEAN2, CACM, CARICOM1, COMESA, EAC, EU2, EU4, GCC, MERCOSUR, SACU1, SACU2, WAEMU1, and WAEMU2. In contrast to this result, the null hypothesis of cross-sectional independence can not be rejected at 5% significance level for the deviation series of agreements of CARICOM2, CEMAC, ECOWAS1, ECOWAS2, EU1, and EU3. These results imply that the deviation series of agreements of ANDEAN1, ANDEAN2, CACM, CARICOM1, COMESA, EAC, EU2, EU4, GCC, MERCOSUR, SACU1, SACU2, WAEMU1, and WAEMU2 are cross-sectional dependent and this situation requires to run SURADF (2001) test on these series. On the

[9] These graphs are provided in Part A of Appendix.

contrary, the deviation series of agreements of CARICOM2, CEMAC, ECOWAS1, ECOWAS2, EU1, and EU3 are concluded to be cross-sectional independent and this case requires the application of first generation panel unit root test on these series.

Table 1. Pesaran's (2004) Cross-Sectional Dependence Test Results for Customs Unions Agreements

CU NAME	***CD TEST STATISTIC***
ANDEAN1	-4,19* (0,000)
ANDEAN2	-4,32* (0,000)
CACM	-2,98* (0,003)
CARICOM1	-2,10** (0,036)
CARICOM2	-1,91*** (0,056)
CEMAC	-1,79*** (0,074)
COMESA1	-2,73* (0,006)
EAC	-3,77* (0,000)
ECOWAS1	-1,50 (0,133)
ECOWAS2	-0,51 (0,611)
EU1	1,40 (0,163)
EU2	2,46** (0,014)
EU3	-0,30 (0,768)
EU4	-2,07** (0,039)
GCC	-3,56* (0,000)
MERCOSUR	-3,47* (0,001)
SACU1	-4,79* (0,000)
SACU2	-3,62* (0,000)
WAEMU1	-4,48* (0,000)
WAEMU2	-2,69* (0,007)

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis.

Table 2 summarizes the results of Pesaran's (2004) CD test for free trade agreements. The results imply that the null hypothesis of cross-sectional independence of free trade agreements deviation series can be rejected at 5% significance level for the following: ASEAN3, SADC1, SADC2, SADC3, CEFTA, PICTA, NAFTA, EAEC, EFTA1, EFTA2, EFTA3, and EFTA4. This situation requires to run SURADF (2001) test on these series. Conversely, the null hypothesis of cross-sectional independence can not be rejected at 5% significance level for the following free trade agreement deviation series: ASEAN1, ASEAN2, and PAFTA. Cross sectional independence implied by Pesaran's (2004) CD test for ASEAN1, ASEAN2, and PAFTA requires to run first generation panel unit root test on them.

Table 2. Pesaran's (2004) Cross-Sectional Dependence Test Results for Free Trade Agreements

FTA NAME	CD TEST STATISTIC
ASEAN1	0,96 (0,338)
ASEAN2	-1,70*** (0,089)
ASEAN3	-2,67* (0,008)
SADC1	-4,15* (0,000)
SADC2	-2,31** (0,021)
SADC3	-2,18** (0,029)
CEFTA	-2,94* (0,003)
PAFTA	-1,63 (0,104)
PICTA	-2,60* (0,009)
NAFTA	-2,99* (0,003)
EAEC	-2,52** (0,012)
EFTA1	5,37* (0,000)
EFTA2	3,77*

	(0,000)
EFTA3	-3,41* (0,001)
EFTA4	-3,55* (0,000)

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis.

Table 3. Pesaran's (2004) Cross-Sectional Dependence Test Results for Partial Scope Agreements

PSA NAME	CD TEST STATISTIC
APTA	0,33 (0,743)
ECO1	-4,48* (0,000)
ECO2	-2,42** (0,015)
LAIA	36,89* (0,000)

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis.

Finally, Table 3 presents the results of Pesaran's (2004) CD test for preferential trade agreements. According to the results, the null hypothesis of cross-sectional independence can be rejected for the following partial scope agreements deviation series at 5% significance level: ECO1, ECO2, and LAIA. Therefore, the deviation series of agreements of ECO1, ECO2, and LAIA requires to apply SURADF (2001) test. Contrarily, the null hypothesis of cross-sectional independence can not be rejected for the deviation series of partial scope agreement of APTA, requiring to run first generation panel unit root tests.

4.3. First Generation Panel Unit Root Test Results

4.3.1 Test Results for Customs Union Agreements

4.3.1.1 Test Results for CARICOM2

Table 4 summarizes the appropriate panel unit root test results for the deviation from CARICOM2 average series, where both the number panels and number of time periods are fixed and small[10]. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[11], the tests are run with time trend.

Firstly, Im, Pesaran and Shin (2003) test results are reported in Table 4. The t-bar test statistic is calculated by averaging the test statistics from separate ADF regressions, and IPS (2003) suggests use of it when both number of panels and the number of time periods are fixed. t-bar statistic is equal to -2.1923 and the corresponding critical value at 5% significance level equals -2.570. The comparison of test statistic with critical value at 5% significance yields the no rejection of null hypothesis of each series in the panels contains unit root. Next to t-bar test statistic in Table 4, $Z_{\tilde{t}}$-bar test statistic, which has a standard normal distribution, is reported. This statistic is calculated by standardizing the test statistic from employing error variances as regressors in the entire model. It is calculated to be -1.3163 and the corresponding p-value is equal to 0.0940. Again, since p-value of the test statistic is larger than 5% significance level, the null hypothesis of each series in the panels contains unit root can not be rejected. Therefore, there is significant evidence at 5% level that the deviation from CARICOM2 average series is nonstationary based on IPS (2003) test.

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[10] Although the most appropriate test is IPS (2003) for CARICOM2 deviation series since that both number of panels and number of time periods are fixed, the other type of tests are also considered. These are the tests whose asymptotics require number of time periods and number of panels tend to infinity sequentially.

[11] See Figure 4 in Part A of Appendix.

Table 4. Panel Unit Root Test Results for Deviation Series of CARICOM2 N=11; T=12

IPS (2003) with Time Trend

t-bar		Z-t-tilde-bar	
-2.1923		-1.3163***	
[-2.570]		(0.0940)	
Fisher Type with time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
35.8684**	0.0527	-0.4085	2.0907**
(0,0314)	(0,521)	(0.3422)	(0.0183)
Breitung (2000) with Time Trend			
ƛ- Statistic			
1.5042			
(0.9337)			
Hadri (2000) with Time Trend			
Z-Statistic			
10.4824*			
0.0000			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

Secondly, Fisher ADF (Maddala and Wu, 1999) test results are reported in Table 4. Out of four test statistics only inverse chi-square (P) and modified inverse chi-square (Pm) test statistics are significant at 5% significance level. This implies rejection of null hypothesis of all panels contain a unit root. Therefore, according to Fisher ADF test, there is at least one panel that is stationary among the deviation series from CARICOM2 average. Although the rest of the test statistics of Fisher ADF test lead to the conclusion of no rejection of the null, for CARICOM2 case inverse chi-square (P) statistic is considered in drawing conclusion because Maddala and Wu (1999) recommends use of P statistic when number of panels are finite. Based on Fisher ADF test, there is at least one deviation series from CARICOM2 average that is stationary. This result leads to conclude that at least one deviation series from CARICOM2 average among CARICOM2 member countries reverts to some constant, implying existence of convergence is possible.

Thirdly and finally, Breitung (2000) and Hadri (2000) test results are provided in the bottom panel of Table 4. Breitung (2000) test statistic is calculated to be 1.5042 and the corresponding p-value is equal to 0.9337. This implies that null hypothesis of each individual time series contains a unit root can not be rejected. Hadri (2000) test statistic and corresponding p-value are calculated to be 10.4824 and 0. This implies that the null hypothesis of all panels are stationary can be rejected at even at 1% significance level. Therefore, the alternative hypothesis of some panels contain unit roots will be valid.

To sum, four convenient first generation panel unit root tests are applied to the deviation series of CARICOM2 agreement and it is concluded that the deviation from CARICOM2 average series is nonstationary. Among the four tests only Fisher ADF test leaded to conclude that existence of convergence might be possible over the period of 2002-2013.

In addition to above panel unit root procedure applied to CARICOM2 deviation series, the same analysis is proceeded by removing the data related to outlier countries from the deviation series from CARICOM2 average. Graphical examination of countries in CARICOM2 agreement reveals that Trinidad & Tobago and Antigua & Barbuda are separated from the others as having substantial volatility in their income per capita over the period of study. When they are removed, the number of panels in CARICOM2 decreases from 11 to 9 and number of time period remains the same. Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -1.84 and the corresponding p-value is equal to 0.066. This result clearly implies that the null hypothesis of cross-section independence can not be rejected at 5% significance level, and this requires further application of appropriate first generation panel unit root tests.

Table 5 presents the summary results obtained from panel unit root tests on CARICOM2 deviation series without Trinidad & Tobago and Antigua & Barbuda , which are the countries having substantial volatility in their income per capita over the period of study. According to all the tests, the deviation series of CARICOM2 without outlier countries from CARICOM2 average is found nonstationary, leading to the conclusion of no evidence for convergence even when outlier countries are excluded.

Table 5. Panel Unit Root Test Results for Deviation Series of CARICOM2 without Trinidad &Tobago and Antigua & Barbuda

IPS (2003) with Time Trend			
t-bar		Z-t-tilde bar	
-1.9345		-0.6486	
[-2.66]		(0.2583)	
Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
24.4218	1.0629	0.7348	1.0703
(0.1417)	(0.8561)	(0.7670)	(0.1422)
Breitung (2000) with Time Trend			
ƛ- Statistic			
1.5219			
(0.9360)			
Hadri (2000) with Time Trend			
Z-Statistic			
8.5821*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

4.3.1.2 Test Results for CEMAC

Table 6 summarizes the appropriate panel unit root test results for the deviation from CEMAC average series where the number of panels and the number of time periods are assumed to be fixed[12]. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[13], the tests are run with time trend.

Table 6. Panel Unit Root Test Results for Deviation Series of CEMAC N=6; T=15

IPS (2003) with Time Trend			
t-bar		Z-t-tilde-bar	
-0.8535		2.1082	
[-2.760]		(0.9825)	
Fisher Type with time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
1.8542	2.7815	2.8661	-2.071
(0.9996)	(0.9973)	(0.9962)	(0.9808)
Breitung (2000) with Time Trend			
ƛ- Statistic			
4.2313			
(1.0000)			
Hadri (2000) with Time Trend			
Z-Statistic			
11.237*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

Firstly, Im, Pesaran and Shin (2003) test results are reported in Table 6. The comparison of t-bar statistic and critical value at 5% significance level yields the conclusion that the null hypothesis of each series in the panels contains unit root can not be rejected. Next to t-bar test statistic in Table 6, $Z_{\tilde{t}}$-bar test statistic, which has a standard normal distribution, is reported. It is calculated to be 2.1082 and the corresponding p-value is equal to 0.9825. Again, since p-

[12] Similar to the procedure for CARICOM2, although the most appropriate test is IPS (2003) for CEMAC deviation series since that both number of panels and number of time periods are fixed, the other type of tests are also considered. These are the tests whose asymptotics require number of time periods and number of panels tend to infinity sequentially.

[13] See Figure 8 in Part A of Appendix.

value of the test statistic is larger than 5% significance level, the null hypothesis of each series in the panels contains unit root can not be rejected. Therefore, there is significant evidence at 5% level that the deviation from CEMAC average series is nonstationary based on IPS (2003) test.

In addition to IPS (2003), Fisher ADF test results are provided in Table 6. All four test statistics have p-values such that they are greater than 5% significance level. This implies there is significant evidence at 5% level that the null hypothesis of all panels contain a unit root can not be rejected. Therefore, similar to IPS (2003) implication, there is significant evidence at 5% level that the deviation from CEMAC average series is nonstationary based on Fisher ADF test.

Finally, Breitung (2000) and Hadri (2000) test results are also presented in Table 6. Test statistic in Breitung (2000) test has a p-value of unity implying no rejection of the null hypothesis of each individual time series contains a unit root. Hadri (2000) test statistic has a p-value of 0 implying that there is significant evidence even at 1% level that the null hypothesis of all panels are stationary can be rejected. Therefore, the alternative hypothesis of some panels contain unit roots will be valid. Evidence of unit root implies that there is no convergence among CEMAC member countries.

4.3.1.3 Test Results for ECOWAS1

Table 7 summarizes the appropriate panel unit root test results for the deviation series of ECOWAS1, where the number of panels is 14 and number of time periods is equal to 39. This situation suits well the recommendation of LLC (2002) in that they suggest the use of their test for moderate size such that panels are between 10 and 250, and time period is between 25 and 250. Therefore, LLC (2002) is considered in addition to other panel unit root tests. Similar to others, graphical examination reveals existence of time trend in real GDP per capita figures of ECOWAS1 countries[14] but this time it is milder than that of other RIA member countries.

At the beginning of Table 7 there exists summary results of LLC (2002) test. The bias-adjusted test statistic of LLC (2002) is equal to -1.0671 and corresponding p-value is equal to 0.143. Based on this, the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level. This result implies that there is evidence for the deviation series from ECOWAS1 average is nonstationary leading to the conclusion of nonexistence of convergence among member countries.

Table 7. Panel Unit Root Test Results for Deviation Series of ECOWAS1 N=14; T=39

LLC(2002) with Time Trend			
Adjusted t-statistic (t*)			
-1.0671			
(0.143)			
Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
33.8843	-0.7951	-0.7843	0.7863
(0.2047)	(0.2133)	(0.2177)	(0.2158)
Breitung (2000) with Time Trend			
λ- Statistic			
0.5034			
(0.6927)			
Hadri (2000) with Time Trend			
Z-Statistic			
38.4642*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

[14] See Figure 9 in Part A of Appendix.

In addition to LLC (2002), test results of Fisher ADF and Breitung (2000) are given in Table 7. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Finally, Hadri (2000) test is applied to the series of deviations from ECOWAS1 average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

To sum, four appropriate first generation panel unit root tests are applied to the deviation series of ECOWAS1 and it is concluded that the deviation from ECOWAS1 average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among ECOWAS1 member countries over the period of 1975-2013.

4.3.1.4 Test Results for ECOWAS2

Table 8 summarizes the appropriate panel unit root test results for the deviation from ECOWAS2 average series, where both the number panels and number of time periods are assumed to be fixed.[17] First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures, the tests are run with time trend.[18]

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[17] Similar to the procedure for CARICOM2 and CEMAC, although the most appropriate test is IPS (2003) for ECOWAS2 deviation series since that both number of panels and number of time periods are fixed, the other type of tests are also considered. These are the tests whose asymptotics require number of time periods and number of panels tend to infinity sequentially.

[18] See Figure 10 in Part A of Appendix

Table 8. Panel Unit Root Test Results for Deviation Series of ECOWAS2 N=13; T=14

IPS (2003) with Time Trend			
t-bar		Z-t-tilde bar	
-1.9988		-1.2268	
[-2.570]		(0.1100)	
Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
27.0128	0.8258	0.8899	0.1404
(0.4087)	(0.7955)	(0.8117)	(0.4442)
Breitung (2000) with Time Trend			
ƛ- Statistic			
1.9555			
(0.9747)			
Hadri (2000) with Time Trend			
Z-Statistic			
9.4836*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

Firstly, Im, Pesaran and Shin (2003) test results are reported in Table 8. The t-bar test statistic is calculated by averaging the test statistics from separate ADF regressions, and IPS (2003) suggests use of it when both number of panels and the number of time periods are fixed. t-bar statistic is equal to -1.9988 and the corresponding critical value at 5% significance level equals -2.570. The comparison of test statistic with critical value at 5% significance yields the no rejection of null hypothesis of each series in the panels contains unit root. Next to t-bar test statistic in Table 8, $Z_{\tilde{t}}$-bar test statistic, which has a standard normal distribution, is reported. This statistic is calculated by standardizing the test statistic from employing error variances as regressors in the entire model. It is calculated to be -1.2268 and the corresponding p-value is equal to 0.1100. Again, since p-value of the test statistic is larger than 5% significance level, the null hypothesis of each series in the panels contains unit root can not be rejected. Therefore, there is significant evidence at 5% level that the deviation from ECOWAS2 average series is nonstationary based on IPS (2003) test.

In addition to IPS (2003), test results of Fisher ADF and Breitung (2000) are given in Table 8. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Finally, Hadri (2000) test is applied to the series of deviations from ECOWAS2 average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

To sum, four appropriate first generation panel unit root tests are applied to the deviation series of ECOWAS2 and it is concluded that the deviation from ECOWAS2 average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among ECOWAS2 member countries over the period of 2000-2013.

In addition to above panel unit root procedure applied to ECOWAS2 deviation series, the same analysis is proceeded by removing the data related to leader country from the deviation series from ECOWAS2 average. Graphical examination of countries in ECOWAS2 agreement reveals that Cabo Verde is distinguished from the others as having the highest real income per capita over the period of study. When it is removed, the number of panels in ECOWAS2 decreases from 13 to 12 and number of time period remains the same. Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -0.26 and the corresponding p-value is equal to 0.796. This result clearly implies that the null hypothesis of cross-section independency can not be rejected at 5% significance level, and this requires further application of appropriate first generation panel unit root tests.

Table 9 presents the summary results obtained from panel unit root tests on ECOWAS2 deviation series without Cabo Verde, which is the country having the best performance among the others over the period of study. As the number of panels and the number of time periods are fixed and small, the most appropriate test is decided to be IPS (2003) for this case. The results implied by the t-bar test statistic on the one hand, implies that the null hypothesis of each series in the panels contains unit root can not be rejected at 5% significance level. On the other hand, $Z_{\tilde{t}}$-bar test statistic implies the rejection of the null hypothesis of each series in the panels contain unit root at 5% significance level. Therefore, it will be concluded that there is significant evidence in favor of conditional convergence among ECOWAS2 members when Cabo Verde is not considered. There may be several reasons underlying this situation, yet one of the explanations could be that the existence of convergence when the outlier country is excluded may be because of geographical and cultural familiarities between the remaining countries not only because of regional integration agreement came into force. In the case of ECOWAS, Cabo Verde differs from the other members not only in real income per capita but also it is geographically different from rest of them. (i.e. it is an island country, it is not located in African continent.)

Table 9. Panel Unit Root Test Results for Deviation Series of ECOWAS2 without Cabo Verde

IPS (2003) with Time Trend	
t-bar	Z-t-tilde bar
-2.2494	-1.8478**
[-2.57]	(0.0323)

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

4.3.1.5 Test Results for EU1

Table 10 summarizes the appropriate panel unit root test results for the deviation from EU1 average series. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[19], the tests are run with time trend.

Firstly, test results of Fisher ADF and Breitung (2000) are given in Table 10. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Finally, Hadri (2000) test is applied to the series of deviations from EU1 average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

Table 10. Panel Unit Root Test Results for Deviation Series of EU1 N=6; T=44

Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
3.7235 (0.9879)	2.937 (0.9983)	3.2199 (0.9986)	-1.6894 (0.9544)
Breitung (2000) with Time Trend			
λ- Statistic			
3.6433 (0.9999)			
Hadri (2000) with Time Trend			
Z-Statistic			
32.9529* (0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

[19] See Figure 17 in Part A of Appendix.

To sum, three appropriate first generation panel unit root tests are applied to the deviation series of EU1 and it is concluded that the deviation from EU1 average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among EU1 member countries over the period of 1970-2013.

In addition to above panel unit root procedure applied to EU1 deviation series, the same analysis is proceeded by removing the data related to leader country from the deviation series from EU1 average. Graphical examination of countries in EU1 agreement reveals that Luxembourg is distinguished from the others as having the highest real income per capita over the period of study. When Luxembourg is removed, the number of panels in EU1 decreases from 6 to 5 and number of panels remains the same. Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -4.78 and the corresponding p-value is equal to 0. This result clearly implies that the null hypothesis of cross-section independency can be rejected at 5% significance level. As a result, the alternative of existence of cross-section dependency will be valid, and this requires application of SURADF (2001) test.

4.3.1.6. Test Results for EU3

Table 11 summarizes the appropriate panel unit root test results for the deviation from EU3 average series First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[20], the tests are run with time trend. The number of panels is equal to 11, and the number of time periods is equal to 28 for EU3 series. This situation suits well the recommendation of LLC (2002) in that they suggest the use of their test for moderate size such

[20] See Figure 19 in Part A of Appendix.

that panels are between 10 and 250, and time period is between 25 and 250. Therefore, LLC (2002) is considered in addition to other panel unit root tests.

At the beginning of Table 11 there exists summary results of LLC (2002) test. The bias-adjusted test statistic of LLC (2002) is equal to 0.3007 and corresponding p-value is equal to 0.6182. Based on this, the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level. This result implies that there is evidence for the deviation series from EU3 average is nonstationary leading to the conclusion of nonexistence of convergence among member countries.

In addition to LLC (2002), test results of Fisher ADF and Breitung (2000) are given in Table 11. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Table 11. Panel Unit Root Test Results for Deviation Series of EU3 N=12; T=28

LLC(2002) with Time Trend			
Adjusted t-statistic (t*)			
0.3007			
(0.6182)			
Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
24.502	0.3676	0.3649	0.0725
(0.4332)	(0.6434)	(0.6416)	(0.4711)
Breitung (2000) with Time Trend			
λ- Statistic			
5.8994			
(1.0000)			
Hadri (2000) with Time Trend			
Z-Statistic			
29.4390*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

Finally, Hadri (2000) test is applied to the series of deviations from EU3 average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

To sum, four appropriate first generation panel unit root tests are applied to the deviation series of EU3 and it is concluded that the deviation from EU3 average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among EU3 member countries over the period of 1986-2013.

In addition to above panel unit root procedure applied to EU3 deviation series, the same analysis is proceeded by removing the data related to outlier countries from the deviation series from EU3 average. Graphical examination of countries in EU3 agreement reveals that similar to EU1, Luxembourg is distinguished from the others as having the highest real income per capita over the period of study. Besides Luxembourg, Greece and Ireland have experienced sharp business cycle contractions over the period of study. Therefore, these countries are removed as well. Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -3.36 and the corresponding p-value is equal to 0.001. This result clearly implies that the null hypothesis of cross-section independency can be rejected at 5% significance level. As a result, the alternative of existence of cross-section dependency will be valid, and this requires application of SURADF (2001) test.

4.3.2. Test Results for Free Trade Agreements

4.3.2.1. Test Results for ASEAN1

Table 12 summarizes the appropriate panel unit root test results for the deviation from ASEAN1 average series. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[21], the tests are run with time trend.

Firstly, test results of Fisher ADF and Breitung (2000) are given in Table 12. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Table 12. Panel Unit Root Test Results for Deviation Series of ASEAN1 N=5; T=47

Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
4.7283 (0.9086)	1.7332 (0.9585)	1.9428 (0.9691)	-1.1788 (0.8808)
Breitung (2000) with Time Trend			
λ- Statistic			
2.9693 (0.9985)			
Hadri (2000) with Time Trend			
Z-Statistic			
35.891* (0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

Finally, Hadri (2000) test is applied to the series of deviations from ASEAN1 average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected

[21] See Figure 26 in Part A of Appendix.

even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

In a nutshell, three appropriate first generation panel unit root tests are applied to the deviation series of ASEAN1 and it is concluded that the deviation from ASEAN1 average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among ASEAN1 member countries over the period of 1967-2013.

In addition to above panel unit root procedure applied to ASEAN1 deviation series, the same analysis is proceeded by removing the data related to leader country from the deviation series from ASEAN1 average. Graphical examination of countries in ASEAN1 agreement reveals that Singapore is distinguished from the others as having the highest real income per capita over the period of study. When it is is removed, the number of panels in ASEAN1 decreases from 5 to 4 and number of time periods remains the same. Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -0.78 and the corresponding p-value is equal to 0.436 This result clearly implies that the null hypothesis of cross-section independency can not be rejected at 5% significance level. As a result, further application of appropriate first generation panel unit root tests is required.

Firstly, test results of Fisher ADF and Breitung (2000) are given in Table 13. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Finally, Hadri (2000) test is applied to the series of deviations from ASEAN1 average –without Singapore- and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary. Therefore, there is significant evidence against convergence in ASEAN1 member countries even when the outlier country of Singapore is not considered.

Table 13. Panel Unit Root Test Results for Deviation Series of ASEAN1 without Singapore N=4; T=47

Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
1.0709 (0.9978)	3.3881 (0.9996)	3.7174 (0.9995)	-1.7323 (0.9584)
Breitung (2000) with Time Trend			
ƛ- Statistic			
2.4070 (0.9920)			
Hadri (2000) with Time Trend			
Z-Statistic			
30.9511* (0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

4.3.2.2. Test Results for ASEAN2

Table 14 summarizes the appropriate panel unit root test results for the deviation from ASEAN2 average series. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[22], the tests are run with time trend.

Firstly, test results of Fisher ADF and Breitung (2000) are given in Table 14. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a

[22] See Figure 27 in Part A of Appendix.

similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

Table 14. Panel Unit Root Test Results for Deviation Series of ASEAN2 N=6; T=30

Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
4.937 (0.9601)	1.5831 (0.9433)	1.5296 (0.9323)	-1.4417 (0.9253)
Breitung (2000) with Time Trend			
λ- Statistic			
2.1360 (0.9837)			
Hadri (2000) with Time Trend			
Z-Statistic			
25.3884* (0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

Finally, Hadri (2000) test is applied to the series of deviations from ASEAN2 average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

To sum, three appropriate first generation panel unit root tests are applied to the deviation series of ASEAN2 and it is concluded that the deviation from ASEAN2 average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among ASEAN2 member countries over the period of 1984-2013.

In addition to above panel unit root procedure applied to ASEAN2 deviation series, the same analysis is proceeded by removing the data related to outlier country from the deviation series from ASEAN2 average. Graphical examination of countries in ASEAN2 agreement reveals that Brunei Darussalam is separated from the others as have experienced significant decrease in real income per capita over the period of study. When it is removed, the number of panels in ASEAN2 decreases from 6 to 5 and number of time period remains the same.

Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -2.13 and the corresponding p-value is equal to 0.033 This result clearly implies that the null hypothesis of no cross-section dependency can be rejected at 5% significance level, and this requires application of SURADF (2001) test.

4.3.2.3. Test Results for PAFTA

Table 15 summarizes the appropriate panel unit root test results for the deviation from PAFTA average series. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[23], the tests are run with time trend.

Firstly, Im, Pesaran and Shin (2003) test results are reported in Table 15. The comparison of t-bar statistic and critical value at 5% significance level yields the conclusion that the null hypothesis of each series in the panels contains unit root can not be rejected. Next to t-bar test statistic in Table 15, $Z_{\tilde{t}}$-bar test statistic, which has a standard normal distribution, is reported. It is calculated to be -1.5518 and the corresponding p-value is equal to 0.0604. Again, since p-value of the test statistic is larger than 5% significance level, the null hypothesis of each series in the panels contains unit root can not be rejected. Therefore, there is significant evidence at 5% level that the deviation from PAFTA average series is nonstationary based on IPS (2003) test.

In addition to IPS (2003), test results of Fisher ADF and Breitung (2000) are given in Table 15. All four statistics of Fisher ADF test imply that the null hypothesis of all panels contain a unit root can not be rejected (corresponding p-values are such that: $p > 0.05$). Breitung (2000) leads to a similar outcome such that the null hypothesis of each individual time series contains a unit root can not be rejected at 5% significance level ($p > 0.05$).

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[23] See Figure 25 in Part A of Appendix.

Finally, Hadri (2000) test is applied to the series of deviations from PAFTA average and based on the p-value of 0, the null hypothesis of all panels are stationary can be rejected even at 1% significance level ($p < 0.01$). So, based on Hadri (2000), there is at least one panel that is nonstationary.

Table 15. Panel Unit Root Test Results for Deviation Series of PAFTA N=16; T=16

IPS (2003) with Time Trend			
t-bar		Z-t-tilde-bar	
-1.984		-1.5518***	
[-2.49]		(0.0604)	
Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
38.6889	-0.0444	-0.1609	0.8361
(0.1932)	(0.4823)	(0.4363)	(0.2015)
Breitung (2000) with Time Trend			
λ- Statistic			
1.3914			
(0.9179)			
Hadri (2000) with Time Trend			
Z-Statistic			
10.3929*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

In a nutshell, four appropriate first generation panel unit root tests are applied to the deviation series of PAFTA and it is concluded that the deviation from PAFTA average series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among PAFTA member countries over the period of 1998-2013.

In addition to above panel unit root procedure applied to PAFTA deviation series, the same analysis is proceeded by removing the data related to outlier countries from the deviation series from PAFTA average. Graphical examination of countries in PAFTA agreement reveals that United Arab Emirates, Libya, Syrian Arab Republic and Yemen are separated from the other member countries in that they have experienced decline in their real income per capita while the rest of the countries remain steady. Conventionally, Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -1.63 and the corresponding p-value is equal to 0.103 This result clearly implies that the null hypothesis of no cross-section dependency can not be rejected at 5% significance level. Therefore, the application of appropriate first generation panel unit root tests is required.

Table 16 summarizes the results obtained from IPS (2003), Fisher type, Breitung (2000) and Hadri (2000) tests. According to all the tests, the deviation series of PAFTA without outlier countries from PAFTA average is found nonstationary, leading to the conclusion of no evidence for convergence even when outlier countries are excluded.

Table 16. Panel Unit Root Test Results for Deviation Series of PAFTA without United Arab Emirates, Libya, Syrian Arab Republic, and Yemen

IPS (2003) with Time Trend			
t-bar		Z-t-tilde bar	
-1.6578		-0.5910	
[-2.55]		(0.2773)	
Fisher Type with Time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
10.6245	2.4384	2.4090	-1.9306
(0.9914)	(0.9926)	(0.9906)	(0.9732)
Breitung (2000) with Time Trend			
λ- Statistic			
1.3025			
(0.9036)			
Hadri (2000) with Time Trend			
Z-Statistic			
11.6451*			
(0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

4.3.3. Test Results for Partial Scope Agreements

4.3.3.1. Test Results for APTA

Table 17 summarizes the appropriate panel unit root test results for the deviation series of APTA, where the number of panels is fixed and number of time periods tends to infinity. First of all, because time trend is observed in real GDP per capita in constant 2005 USD figures[24], the tests are run with time trend.

Firstly, Fisher ADF (Maddala and Wu, 1999) test results are reported in Table 17. All four test statistics have p-values such that they are greater than 5% significance level. This implies there is significant evidence at 5% level that the null hypothesis of all panels contain a unit root can not be rejected. This leads to the conclusion of no convergence among APTA member countries.

Secondly, Breitung (2000) and Hadri (2000) panel unit root test results are provided in Table 17. Both Breitung (2000) and Hadri (2000) require the condition that time dimension is larger than cross-section dimension, and this asymptotic requirement is met in the case of APTA where there are 38 time periods and 7 cross-section units. Breitung test statistic and related p-value are calculated to be 3.4996 and 0.9998. This implies that null hypothesis of each individual time series contains a unit root can not be rejected. Hadri (2000) test statistic and corresponding p-value are calculated to be 38.0098 and 0. This implies that the null hypothesis of all panels are stationary can be rejected even at 1% significance level. Therefore, the alternative hypothesis of some panels contain unit roots will be valid.

To sum, three convenient first generation panel unit root tests are applied to the deviation series of APTA agreement and it is concluded that the deviation from APTA average

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[24] See Figure 37 in Part A of Appendix.

series is nonstationary. These results leads to the conclusion that there is significant evidence for nonexistence of convergence among APTA member countries over the period of 1976-2013.

Table 17. Panel Unit Root Test Results for Deviation Series of APTA N=7; T=38

Fisher Type with time Trend			
Inverse Chi-square (P)	Inverse Normal (Z)	Inverse Logit (L*)	Modified Inverse Chi-square (Pm)
7.4065 (0.9179)	1.6516 (0.9507)	1.7952 (0.9592)	-1.246 (0.8936)
Breitung (2000) with Time Trend			
ƛ- Statistic			
3.4996 (0.9998)			
Hadri (2000) with Time Trend			
Z-Statistic			
38.0098* (0.0000)			

Note: * refers to significance at 1%, ** refers to significance at 5%, and *** refers to significance at 10%. Corresponding p-values are in parenthesis and critical values are in brackets.

In addition to above panel unit root procedure applied to APTA deviation series, the same analysis is proceeded by removing the data related to outlier country from the deviation series from APTA average. Graphical examination of countries in APTA agreement reveals that China is distinguished from the others as having experienced significant increment in its real income per capita over the period of study(i.e. its real income per capita line has the steepest slope among the other member countries). When China is removed, the number of panels in APTA decreases from 7 to 6 and number of time periods remains the same. Pesaran's (2004) CD test is applied to the new series and it yields that CD test statistic is calculated as -2.55 and the corresponding p-value is equal to 0.011 This result clearly implies that the null hypothesis of no cross-section dependency can be rejected at 5% significance level. As a result, the alternative of existence of cross-section dependency will be valid, and this requires application of SURADF (2001) test.

4.4. Second Generation Test Results

4.4.1. Test Results for Customs Union Agreements

4.4.1.1. Test Results for ANDEAN1

Table 18 presents the summary results of SURADF (2001) test on deviation series of ANDEAN1, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from ANDEAN1 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated.

Table 18. SURADF (2001) Test Results for Deviation Series of ANDEAN1

SURADF (2001) with Time Trend	Test Statistic	Result
Bolivia	-2.524 [-4.316]	NS
Colombia	-1.721 [-4.636]	NS
Ecuador	-3.698 [-4.650]	NS
Peru	-2.166 [-4.369]	NS
Chile	-2.893 [-5.015]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from ANDEAN1 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

4.4.1.2. Test Results for ANDEAN2

Table 19 presents the summary results of SURADF (2001) test on deviation series of ANDEAN2, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from ANDEAN2 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from ANDEAN2 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

Table 19. SURADF (2001) Test Results for Deviation Series of ANDEAN2

SURADF (2001) with Time Trend	Test Statistic	Result
Bolivia	-2.976 [-4.690]	NS
Colombia	-1.243 [-4.929]	NS
Ecuador	-3.779 [-4.972]	NS
Venezuela	-2.647 [-4.844]	NS
Peru	-2.092 [-5.386]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.1.3. Test Results for CACM

Table 20 presents the summary results of SURADF (2001) test on deviation series of CACM, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from CACM average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated.

Table 20. SURADF (2001) Test Results for Deviation Series of CACM

SURADF (2001) with Time Trend	Test Statistic	Result
Guatemala	-2.913 [-4.566]	NS
Honduras	-1.981 [-4.579]	NS
El Salvador	-3.487 [-4.644]	NS
Nicaragua	-2.584 [-5.846]	NS
Costa Rica	-3.270 [-4.690]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from CACM average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

4.4.1.4. Test Results for CARICOM1

Table 21 presents the summary results of SURADF (2001) test on deviation series of CARICOM1, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from CARICOM1 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from CARICOM1 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

Table 21. SURADF (2001) Test Results for Deviation Series of CARICOM1

SURADF (2001) with Time Trend	Test Statistic	Result
Antigua and Barbuda	-2.836 [-5.566]	NS
Barbados	-3.500 [-4.870]	NS
Belize	-3.777 [-5.112]	NS
Dominica	-1.543 [-5.535]	NS
Grenada	-2.992 [-5.303]	NS
Guyana	-2.901 [-5.134]	NS
St. Kitts and Nevis	-2.064 [-4.97]	NS
St. Lucia	-1.951 [-5.685]	NS
St. Vincent and Grenadines	-3.485 [-4.954]	NS
Trinidad and Tobago	-2.201 [-5.069]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.1.5. Test Results for COMESA

Table 22 presents the summary results of PESCADF (2003) test for COMESA deviation series. Differing from others, SURADF (2001) test is not applied to COMESA deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of COMESA is nonstationary. This further leads to the conclusion that there is no convergence among COMESA countries.

Table 22. PESCADF (2003) Test Results for Deviation Series of COMESA

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-1.728	2.548
[-2.670]	(0.995)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.1.6. Test Results for EAC

Table 23 presents the summary results of SURADF (2001) test on deviation series of EAC[25], where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from EAC average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated.

Table 23. SURADF (2001) Test Results for Deviation Series of EAC

SURADF (2001) with Time Trend	Test Statistic	Result
Burundi	-3.191 [-5.610]	NS
Kenya	-3.436 [-5.865]	NS
Rwanda	-4.219 [-5.824]	NS
Uganda	-1.897 [-5.046]	NS
Tanzania	-2.368 [-4.913]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel

[25] Although EAC was established in 1967, the start of the agreement is taken as 1988 due to lack of data for Uganda and Tanzania for the period of 1967-1987.

member can not be rejected. Therefore, the deviation series of Burundi, Kenya, Rwanda, Uganda and Tanzania from EAC average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries over the period of 1988-2013.

4.4.1.7. Test Results for EU2

Table 24 presents the summary results of SURADF (2001) test on deviation series of EU2, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from EU2 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated.

Table 24. SURADF (2001) Test Results for Deviation Series of EU2

SURADF (2001) with Time Trend	Test Statistic	Result
Belgium	-0.8289 [-5.569]	NS
France	-1.861 [-5.276]	NS
Germany	-2.010 [-5.013]	NS
Italy	-4.326 [-5.408]	NS
Luxembourg	-3.443 [-5.606]	NS
Netherlands	-4.653 [-5.455]	NS
Denmark	-4.936 [-5.859]	NS
Greece	-2.495 [-6.378]	NS
Ireland	-2.049 [-5.514]	NS
United Kingdom	-3.641 [-5.298]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Belgium, France, Germany, Italy, Luxembourg, Netherlands, Denmark, Greece, Ireland and UK from EU2 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

4.4.1.8. Test Results for EU4

Table 25 presents the summary results of PESCADF (2003) test for EU4 deviation series. Similar to COMESA, SURADF (2001) test is not applied to EU4 deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of EU4 is nonstationary. This further leads to the conclusion that there is no convergence among EU4 countries.

Table 25. PESCADF (2003) Test Results for Deviation Series of EU4

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-1.019	4.882
[-2.78]	(1.000)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.1.9. Test Results for GCC

Table 26 presents the summary results of SURADF (2001) test on deviation series of GCC, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from GCC average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Oman (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Bahrain, Kuwait, Qatar, Saudi Arabia and United Arab Emirates from GCC average for each individual country is concluded to be nonstationary. However, as the test statistic of the deviation series of Oman does fall into the rejection area (i.e. -5.246 < -5.130), the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Oman from GCC average is concluded to be stationary.

Table 26. SURADF (2001) Test Results for Deviation Series of GCC

SURADF (2001) with Time Trend	Test Statistic	Result
Bahrain	-2.026 [-5.627]	NS
Kuwait	-4.654 [-5.863]	NS
Oman	-5.246** [-5.130]	S
Qatar	-2.188 [-4.632]	NS
Saudi Arabia	-1.889 [-4.992]	NS
United Arab Emirates	-2.299 [-5.25]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.1.10. Test Results for MERCOSUR

Table 27 presents the summary results of PESCADF (2003) test for MERCOSUR deviation series. Similar to COMESA and EU4, SURADF (2001) test is not applied to MERCOSUR deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series.

Table 27. PESCADF (2003) Test Results for Deviation Series of MERCOSUR

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar

-2.177	0.286
[-2.86]	(0.613)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

According to the results in Table 27, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of MERCOSUR is nonstationary. This further leads to the conclusion that there is no convergence among MERCOSUR countries.

4.4.1.11. Test Results for SACU1

Table 28 presents the summary results of PESCADF (2003) test for SACU1 deviation series. SURADF (2001) test is not applied to SACU1 deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of SACU1 is nonstationary. This further leads to the conclusion that there is no convergence among SACU1 countries.

Table 28. PESCADF (2003) Test Results for Deviation Series of SACU1

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-1.249	2.48
[-2.84]	(0.993)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.1.12. Test Results for SACU2

Table 29 presents the summary results of SURADF (2001) test on deviation series of SACU2, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from SACU2 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from SACU2 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

Table 29. SURADF (2001) Test Results for Deviation Series of SACU2

SURADF (2001) with Time Trend	Test Statistic	Result
Botswana	-3.850 [-4.675]	NS
Lesotho	-2.597 [-5.135]	NS
Namibia	-3.893 [-5.486]	NS
S.Africa	-2.061 [-5.181]	NS
Swaziland	-1.122 [-5.982]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.1.13. Test Results for WAEMU1

Table 30 presents the summary results of SURADF (2001) test on deviation series of WAEMU1, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from WAEMU1 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from WAEMU1 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

Table 30. SURADF (2001) Test Results for Deviation Series of WAEMU1

SURADF (2001) with Time Trend	Test Statistic	Result
Burkina Faso	-3.161 [-4.725]	NS
Benin	-2.849 [-4.762]	NS
Cote d'Ivoire	-3.400 [-4.685]	NS
Mali	-4.023 [-5.217]	NS
Niger	-4.067 [-5.167]	NS
Senegal	-3.611 [-5.313]	NS
Togo	-4.128 [-5.896]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.1.14. Test Results for WAEMU2

Table 31 presents the summary results of SURADF (2001) test on deviation series of WAEMU2, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from WAEMU2 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Guinea Bissau (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Burkina Faso, Benin, Cote d'Ivoire, Mali, Niger, Senegal, Togo and Guinea Bissau from WAEMU2 average for each individual country is concluded to be nonstationary. However, as the test statistic of the deviation series of Guinea Bissau does fall into the rejection area (i.e. -4.413 < -0.0006416), the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Guinea Bissau from WAEMU2 average is concluded to be stationary. This further implies that the deviation series of Guinea Bissau reverts to WAEMU2 average.

Table 31. SURADF (2001) Test Results for Deviation Series of WAEMU2

SURADF (2001) with Time Trend	Test Statistic	Result
Burkina Faso	-4.965 [-8.694]	NS
Benin	-7.040 [-7.207]	NS
Cote d'Ivoire	-2.902 [-31.04]	NS
Mali	1.814 [-8.569]	NS
Niger	0.8560 [-8.981]	NS
Senegal	-0.5147 [-8.201]	NS
Togo	-0.4792 [-8.407]	NS
Guinea Bissau	-4.413** [-0.0006416]	S

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.2. Test Results for Free Trade Agreements

4.4.2.1. Test Results for ASEAN3

Table 32 presents the summary results of PESCADF (2003) test for ASEAN3 deviation series. SURADF (2001) test is not applied to ASEAN3 deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of ASEAN3 is nonstationary. This further leads to the conclusion that there is no convergence among ASEAN3 countries.

Table 32. PESCADF (2003) Test Results for Deviation Series of ASEAN3

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-1.026	1.883
[-2.37]	(0.97)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.2.2. Test Results for CEFTA

Table 33 presents the summary results of SURADF (2001) test on deviation series of CEFTA[26], where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Poland and Czech Republic (i.e. each of them is

[26] The membership status of CEFTA changes in 2006, but this change is not considered due to very short time period between 2006-2013.

greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Slovenia, Slovak Republic, and Hungary from CEFTA average for each individual country is concluded to be nonstationary. However, as the test statistics of the deviation series of Poland and Czech Republic do fall into the rejection area, the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Poland and Czech Republic from CEFTA average is concluded to be stationary.

Table. 33 SURADF (2001) Test Results for Deviation Series of CEFTA

SURADF (2001) with Time Trend	Test Statistic	Result
Slovenia	1.891 [-5.512]	NS
Slovak Republic	-2.593 [-6.867]	NS
Poland	-5.103** [1.385]	S
Czech Republic	-5.237** [-1.989]	S
Hungary	-3.629 [-4.601]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.2.3. Test Results for EAEC

Table 34 presents the summary results of SURADF (2001) test on deviation series of EAEC, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Russia and Tajikistan (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Belarus, Kazakhstan, and Kyrgyz Republic from EAEC average for each individual country is concluded to be nonstationary.

However, as the test statistics of the deviation series of Russia be rejected at 5% significance level. Therefore, the deviation series of Russia and Tajikistan from EAEC average is concluded to be stationary.

Table. 34 SURADF (2001) Test Results for Deviation Series of EAEC

SURADF (2001) with Time Trend	Test Statistic	Result
Belarus	3.374 [-12.55]	NS
Kazakhstan	-4.227 [-6.297]	NS
Russia	-2.406** [-0.6197]	S
Kyrgyz Republic	-7.707 [-15.48]	NS
Tajikistan	-5.776** [-0.3131]	S

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.2.4. Test Results for EFTA1

Table 35 presents the summary results of SURADF (2001) test on deviation series of EFTA1, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Denmark and United Kingdom (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Austria, Norway, Portugal, Sweden and Switzerland from EFTA1 average for each individual country is concluded to be nonstationary. However, as the test statistics of the deviation series of Denmark and United Kingdom do fall into the rejection area, the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Denmark and United Kingdom from EFTA1 average is concluded to be stationary.

Table. 35 SURADF (2001) Test Results for Deviation Series of EFTA1

SURADF (2001) with Time Trend	Test Statistic	Result
Austria	-2.618 [-4.828]	NS
Denmark	-5.431** [-4.782]	S
Norway	-4.282 [-4.294]	NS
Portugal	-2.978 [-4.571]	NS
Sweden	-2.833 [-4.808]	NS
Switzerland	-2.556 [-4.375]	NS
United Kingdom	-4.629** [-4.373]	S

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.2.5. Test Results for EFTA2

Table 36 presents the summary results of SURADF (2001) test on deviation series of EFTA2, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from EFTA2 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

Table 36. SURADF (2001) Test Results for Deviation Series of EFTA2

SURADF (2001)	Test Statistic	Result
Austria	-2.246 [-4.698]	NS
Norway	-3.432 [-4.407]	NS
Portugal	-2.655 [-4.677]	NS

Sweden	-4.132 [-4.490]	NS
Switzerland	-1.312 [-4.737]	NS
Iceland	-1.831 [-4.441]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.2.6. Test Results for EFTA3

Table 37 presents the summary results of SURADF (2001) test on deviation series of EFTA3, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated.

Table 37. SURADF (2001) Test Results for Deviation Series of EFTA3

SURADF (2001)	Test Statistic	Result
Austria	-5.307** [-5.200]	S
Norway	-4.942 [-5.355]	NS
Sweden	-2.924 [-5.307]	NS
Switzerland	-2.388 [-4.532]	NS
Iceland	-2.828 [-5.848]	NS
Finland	-3.556 [-8.169]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area except for Austria (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Norway, Sweden, Switzerland, Iceland and Finland from EFTA3 average for each individual country is concluded to be nonstationary. However, as the test statistic of the deviation series of Austria does fall into the rejection area (i.e. -5.307 < -5.2), the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Austria from EFTA3 average is concluded to be stationary.

4.4.2.7. Test Results for EFTA4

Table 38 presents the summary results of SURADF (2001) test on deviation series of EFTA4, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated.

Table 38. SURADF (2001) Test Results for Deviation Series of EFTA4

SURADF (2001)	Test Statistic	Result
Austria	-1.923 [-5.383]	NS
Norway	-4.700 [-5.447]	NS
Switzerland	-4.676 [-5.396]	NS
Iceland	-2.813 [-4.537]	NS
Liechtenstein	-2.284 [-6.027]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from EFTA4 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

4.4.2.9. Test Results for NAFTA

Table 39 presents the summary results of PESCADF (2003) test for NAFTA deviation series. SURADF (2001) test is not applied to NAFTA deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of NAFTA is nonstationary. This further leads to the conclusion that there is no convergence among NAFTA countries.

Table 39. PESCADF (2003) Test Results for Deviation Series of NAFTA

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-1.060	2.327
[-2.86]	(0.99)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.2.10. Test Results for PICTA

Table 40 presents the summary results of PESCADF (2003) test for PICTA deviation series. SURADF (2001) test is not applied to PICTA deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of PICTA is nonstationary. This further leads to the conclusion that there is no convergence among PICTA countries.

Table 40. PESCADF (2003) Test Results for Deviation Series of PICTA

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-2.112	0.328
[-2.92]	(0.629)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.2.11. Test Results for SADC1

Table 41 presents the summary results of SURADF (2001) test on deviation series of SADC1, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated.

Table 41. SURADF (2001) Test Results for Deviation Series of SADC1

SURADF (2001)	Test Statistic	Result
Angola	-2.458 [-5.092]	NS
Botswana	-3.916 [-5.538]	NS
Lesotho	-2.066 [-5.309]	NS
Malawi	-4.937 [-5.045]	NS
Mozambique	-3.587 [-5.321]	NS
Swaziland	-1.405 [-5.515]	NS
Zambia	-0.5569 [-5.634]	NS
Zimbabwe	-3.350 [-5.968]	NS
Madagascar	-3.257 [-4.876]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, each deviation series from SADC1 average for each individual country is concluded to be nonstationary. This conclusion leads to the outcome of non-existence of convergence among member countries.

4.4.2.12. Test Results for SADC2

Table 42 presents the summary results of SURADF (2001) test on deviation series of SADC2, where the number of time periods exceeds the number of panels. As stationarity of the series of deviations from SADC2 average for each country can be judged with SURADF (2001) test, test statistics and corresponding critical values at 5% significance level are calculated.

Table 42. SURADF (2001) Test Results for Deviation Series of SADC2

SURADF (2001)	Test Statistic	Result
Angola	-3.071 [-8.49]	NS
Botswana	-2.984 [-7.39]	NS
Lesotho	-3.803 [-6.374]	NS
Malawi	-7.268** [-6.887]	S
Mozambique	-3.26 [-7.221]	NS
Swaziland	-2 [-6.647]	NS
Zambia	-2.776 [-7.171]	NS
Zimbabwe	-3.232 [-8.241]	NS
Madagascar	-3.71 [-8.416]	NS
Namibia	-3.615 [-8.263]	NS

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

Since each test statistic does not fall into the rejection area except for Malawi (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Angola, Botswana, Lesotho, Mozambique, Swaziland, Zambia, Zimbabwe, Madagascar, and Namibia from SADC2 average for each individual country is concluded to be nonstationary. However, as the test statistic of the deviation series of Malawi does fall into the rejection area (i.e. -7.268 < -6.887), the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Malawi from SADC2 average is concluded to be stationary.

4.4.2.13. Test Results for SADC3

Table 43 presents the summary results of PESCADF (2003) test for SADC3 deviation series. SURADF (2001) test is not applied to SADC3 deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of SADC3 is nonstationary. This further leads to the conclusion that there is no convergence among SADC3 countries.

Table 43. PESCADF (2003) Test Results for Deviation Series of SADC3

PESCADF (2003) Test with Time Trend

t-bar	Z-t-bar
-1.873	1.466
[-2.780]	(0.929)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.3. Test Results for Partial Scope Agreements

4.4.3.1 Test Results for ECO1

Table 44 presents the summary results of PESCADF (2003) test for ECO1 deviation series. SURADF (2001) test is not applied to ECO1 deviation series due to the reason that property of positive definiteness is not attained in data matrix. Therefore, PESCADF (2003) test, which is another type of second generation test, is applied to the series. According to the results, t-bar and Z-t-bar test statistics imply that the null hypothesis of unit root in each series can not be rejected at 5% significance level. This leads to the conclusion that each deviation series of ECO1 is nonstationary. This further leads to the conclusion that there is no convergence among SADC3 countries.

Table 44. PESCADF (2003) Test Results for Deviation Series of ECO1

PESCADF (2003) Test with Time Trend	
t-bar	Z-t-bar
-2.695	-0.717
[-2.860]	(0.237)

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%.

4.4.3.2 Test Results for ECO2

Table 45 presents the summary results of SURADF (2001) test on deviation series of ECO2, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Turkey and Uzbekistan (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan and Turkmenistan from ECO2 average for each individual country is concluded to be nonstationary. However, as the test statistics of the deviation series of Turkey and Uzbekistan do fall into the rejection area, the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Turkey and Uzbekistan from ECO2C average is concluded to be stationary.

Table 45. SURADF (2001) Test Results for Deviation Series of ECO2

SURADF (2001)	Test Statistic	Result
Afghanistan	-4.718 [-7.475]	NS
Azerbaijan	-3.454 [-6.72]	NS

Iran	-1.186 [-7.952]	NS
Kazakhstan	-2.928 [-8.916]	NS
Kyrgyz Republic	-6.139 [-7.963]	NS
Pakistan	-4.339 [-7.918]	NS
Tajikistan	-3.7 [-7.162]	NS
Turkey	-7.981** [-7.312]	S
Turkmenistan	-1.112 [-8.513]	NS
Uzbekistan	-6.082** 1.976	S

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.3.3 Test Results for LAIA

Table 46 presents the summary results of SURADF (2001) test on deviation series of LAIA, where the number of time periods exceeds the number of panels. Test statistics and corresponding critical values at 5% significance level are calculated. Since each test statistic does not fall into the rejection area except for Uruguay and Panama (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, the deviation series of Argentina, Bolivia, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Paraguay, Peru and Venezuela from LAIA average for each individual country is concluded to be nonstationary. However, as the test statistics of the deviation series of Uruguay and Panama do fall into the rejection area, the null hypothesis of unit root in the panel can be rejected at 5% significance level. Therefore, the deviation series of Uruguay and Panama from LAIA average is concluded to be stationary.

Table 46. SURADF (2001) Test Results for Deviation Series of LAIA

SURADF (2001)	Test Statistic	Result
Argentina	-7.082 [-7.555]	NS
Bolivia	-6.915 [-7.792]	NS
Brazil	-5.596 [-7.411]	NS
Chile	5.999 [-6.462]	NS
Colombia	0.9118 [-7.382]	NS
Cuba	-3.937 [-7.12]	NS
Ecuador	-2.69 [-6.914]	NS
Mexico	1.070 [-6.426]	NS
Paraguay	-3.18 [-6.144]	NS
Peru	-6.378 [-6.581]	NS
Uruguay	-6.937** [-6.103]	S
Venezuela	-3.094 [-6.959]	NS
Panama	-7.946** [-7.338]	S

Note: Corresponding critical values at 5% significance level are in brackets. ** refers to significance at 5%. *NS* stands for nonstationarity of deviation series, and *S* stands for stationarity of deviation series.

4.4.4. Test Results for Regional Integration Agreements without Outlier Countries

4.4.4.1. Test Results for APTA without China

Table 47 presents the summary results of SURADF (2001) test for APTA deviation series excluding China. Since each test statistic does not fall into the rejection area (i.e. each of them is greater than corresponding critical value), the null hypothesis of unit root for each individual panel member can not be rejected. Therefore, removing the outlier country doesn't change the outcome that lead to the conclusion of nonstationarity of each country deviation series. Nonstationarity of deviation series from regional integration average confirms the initial interpretation of non-existence of convergence among member countries of APTA agreement.

Table 47. SURADF (2001) Test Results for Deviation Series of APTA without China

SURADF (2001) with Time Trend	Test Statistic	Result
Bangladesh	-3.286 [-5.093]	NS
India	-3.32 [-4.484]	NS
Korea	-0.9446 [-4.474]	NS
Lao PDR	-3.307 [-4.503]	NS
Sri Lanka	-2.954 [-4.925]	NS
Mongolia	-1.466 [-5.052]	NS

Note: Corresponding critical values at 5% significance level are in brackets. *NS* stands for nonstationarity of deviation series.

4.4.4.2 Test Results for ASEAN2 without Brunei Darussalam

Table 48 presents the summary results of SURADF (2001) test for ASEAN2 deviation series excluding Brunei Darussalam. Removing the outlier country doesn't change the outcome that lead to the conclusion of nonstationarity of each country deviation series. Nonstationarity of deviation series from regional integration average confirms the initial interpretation of non-existence of convergence among member countries of ASEAN2 agreement, as well.

Table 48. SURADF (2001) Test Results for Deviation Series of ASEAN2 without Brunei Darussalam

SURADF (2001) with Time Trend	Test Statistic	Result
Philippines	-3.648 [-4.404]	NS
Singapore	-2.856 [-4.844]	NS
Thailand	-3.165 [-4.527]	NS
Malaysia	-0.8128	NS

	[-4.693]	
Indonesia	-2.613 [-5.812]	NS

Note: Corresponding critical values at 5% significance level are in brackets. *NS* stands for nonstationarity of deviation series.

4.4.4.3. Test Results for EU1 without Luxembourg

Table 49 presents the summary results of SURADF (2001) test for EU1 deviation series excluding Luxembourg. Removing the outlier country doesn't change the outcome that lead to the conclusion of nonstationarity of each country deviation series. Nonstationarity of deviation series from regional integration average confirms the initial interpretation of non-existence of convergence among member countries of EU1 agreement, as well.

Table 49. SURADF (2001) Test Results for Deviation Series of EU1 without Luxembourg

SURADF (2001) with Time Trend	Test Statistic	Result
Belgium	-1.641 [-4.464]	NS
France	-2.23 [-4.238]	NS
Germany	-2.19 [-4.415]	NS
Italy	0.4881 [-4.272]	NS
Netherlands	-1.839 [-4.705]	NS

Note: Corresponding critical values at 5% significance level are in brackets. *NS* stands for nonstationarity of deviation series.

4.4.4.4. Test Results for EU3 without Luxembourg, Greece and Ireland

Table 50 presents the summary results of SURADF (2001) test for EU3 deviation series excluding Greece and Ireland in addition to Luxembourg. According to the results, the deviation from EU3 average series of Netherlands is found stationary. (i.e. test statistic is less than the corresponding critical value at 5% significance level.) This leads to the conclusion of there is significant evidence in favor of convergence when three outliers of Luxembourg, Greece and Ireland are excluded. There may be several reasons underlying this situation, yet one of the explanations could be that the existence of convergence when the outlier countries are excluded may be because of geographical and cultural familiarities between the remaining countries not only because of regional integration agreement came into force. In the case of EU, Luxembourg differs from the other members as having the world's second highest GDP per capita. It is a developed country with a sophisticated economy. Greece and Ireland are the other standing out outlier countries. Greek economy is characterized by low national savings rate, and this implies reliance of large capital inflows to finance consumption. In contrast to Greece, Ireland has much higher national savings rate yet it has experienced construction boom with a huge expansion of financial activity Gros and Alcidi (2011).

Table 50. SURADF (2001) Test Results for Deviation Series of EU3 without Luxembourg, Greece and Ireland

SURADF (2001) with Time Trend	Test Statistic	Result
Belgium	-1.304	NS
	[-5.558]	
France	-1.040	NS
	[-5.44]	
Germany	-1.085	NS
	[-6.598]	
Italy	0.6414	NS
	[-5.799]	
Netherlands	-6.137**	S
	[-4.936]	
Denmark	-3.863	NS
	[-6.165]	
United Kingdom	-4.871 [-7.007]	NS
Portugal	-3.293	NS
	[-7.005]	
Spain	-1.97	NS
	[-6.654]	

Note: Corresponding critical values at 5% significance level are in brackets. *NS* stands for nonstationarity of deviation series.

5. CONCLUSION

In this paper the hypothesis of income per capita convergence among various multilateral regional integration agreements has been analyzed. The importance of the study stems from its contribution to economic literature in terms of providing the most recent information related to convergence performances within regional integration initiatives.

Using figures of real GDP per capita in 2005 constant USD prices, which is gathered from World Bank and United Nations Statistics Division, the series of real GDP per capita deviations from regional integration agreement average are constructed. Before proceeding to the application of panel unit root test on the series, Pesaran's (2004) Cross-sectional Dependence (CD) Test is applied in order to decide which type of panel unit root tests is appropriate for each series of deviations. Once cross-sectional dependence is found to be nonexistent in each series of deviations, First Generation Panel Unit Root Tests are utilized. It is found that convergence performances of Economic Community of West African States (ECOWAS) for the period of 2000-2013, from which Mauritania left and Cabo Verde - which is the extreme country in terms of per capita income- was dropped and Caribbean Community (CARICOM) for the period of 2002-2013 to which Haiti joined, were significant. When cross-sectional dependence is concluded to be existent in each series of deviations, Second Generation Panel Unit Root Tests, specifically SURADF and Pesaran's CADF Tests are employed. It is reached that convergence performances of the following countries are significant(i.e. real GDP per capita series of the countries revert to the related RIA average): Oman among Gulf Cooperation Council (GCC) for the period of 1981-2013, Poland and Czech Republic among Central European Free Trade Agreement (CEFTA) for the period of 1993-2013, Russia and Tajikistan among Euroasian Economic Community (EAEC) for the period of 2000-2013, Denmark and United Kingdom among European Free Trade Agreement (EFTA) for the period of 1960-2013 before which Iceland joins and Denmark and UK leave, Austria among EFTA for the period of 1986-2013 during which Finland joins, Uruguay and Panama among Latin American Integration Association (LAIA) for the period of 1980-2013, Malawi among South African Development Community (SADC) for the period of 1990-2013 during which Namibia joins, Turkey and Uzbekistan among Economic Cooperation Organization (ECO) for the period of 1992-2013 during which Afghanistan, Azerbaijan, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan and Uzbekistan join, Guinea Bissau among West African Economic and Monetary Union (WAEMU) for the period of 1997-2013 during which Mali and Guinea Bissau join.

The assessment of convergence performances in various multilateral regional integration agreements is also extended to the cases where there is found no convergence yet there are extreme observations in deviation series of some countries. These countries are named as outlier countries in the study. Examples of such countries are China in APTA, Cabo Verde in ECOWAS2, Luxembourg in EU1, and Greece and Ireland in addition to Luxembourg in EU3, Singapore in ASEAN1, Brunei Darussalam in ASEAN2, Trinidad & Tobago and Antigua & Barbuda in CARICOM2, and United Arab Emirates, Syrian Arab Republic, Libya, Yemen in PAFTA. Graphical inspection reveals that these countries are all distinguished from other member states in some way such that their per capita real incomes have been either superior or lower relative to others. Besides, the real per capita income of some of these countries have been quite volatile over the period of study.

Application of first generation tests on ASEAN1 excluding Singapore, and PAFTA without United Arab Emirates, Syrian Arab Republic, Libya, Yemen yields the outcome of nonstationarity of the deviation series meaning no evidence for convergence when the outlier countries are removed. Similarly, excluding Trinidad & Tobago and Antigua & Barbuda from CARICOM2 together with first generation tests lead to no evidence for convergence.

SURADF Test on deviation series of APTA without China, EU1 without Luxembourg and ASEAN2 without Brunei Darussalam confirmed the initial interpretation of nonexistence of convergence among member states of these RIAs.

The only change has occurred in our interpretation of no significant evidence in favor of convergence among member states in ECOWAS2 and EU3 when the outlier countries of Cabo Verde and Greece, Ireland and Luxembourg are removed, respectively. Initially, ECOWAS2 and EU3 deviation series have been found nonstationary by first generation panel unit root tests, which is equivalent to say non-existence of convergence among member countries. However, when outlier countries are excluded, further application of first generation tests and SURADF test on ECOWAS2 and EU3 without their own outliers, significant evidence in favor of convergence is reached.

Overall, this paper elaborates on panel unit root testing tool in determining convergence dynamics within regional integration agreements and provides detailed information for each of them. Some countries do success in catching up of relatively richer ones in the same regional integration agreement whereas some countries do not. A study on why convergence in real income per capita is not attained in some regional integration initiatives could be an interesting avenue for further research.

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APPENDIX

PART A. Graphs for Evolution of Real GDP per capita Figures in RIAs

1. **Customs Unions**

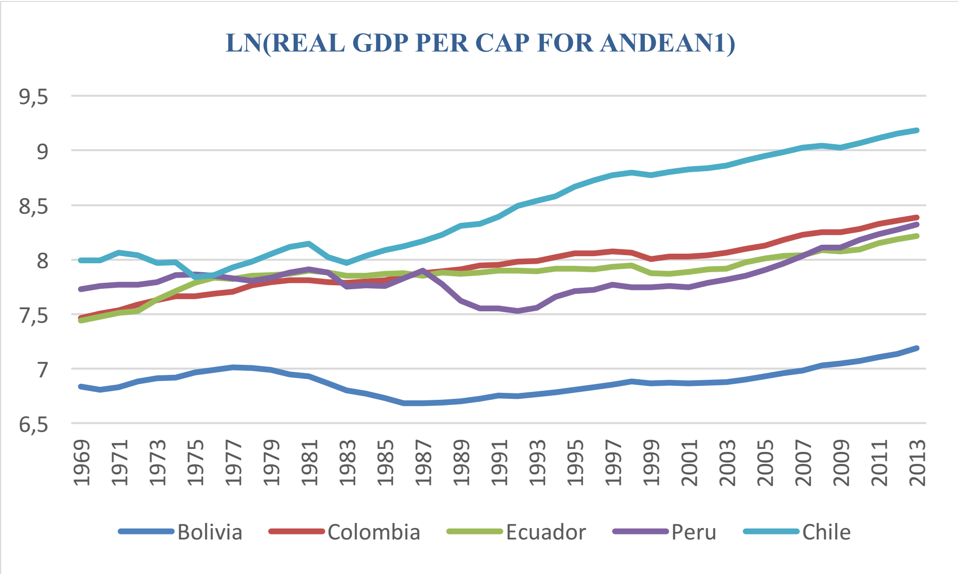

Figure 1. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ANDEAN1 countries.

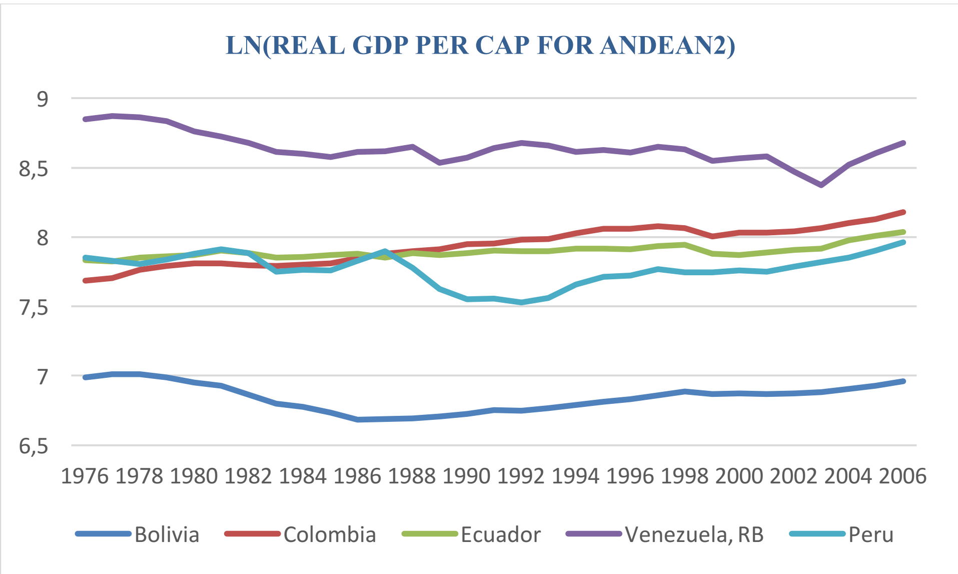

Figure 2. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ANDEAN2 countries.

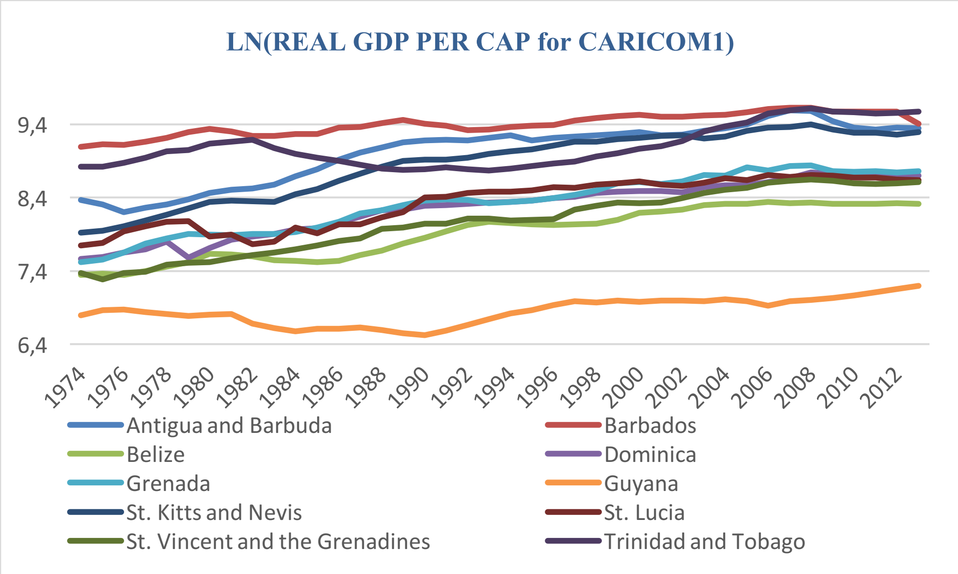

Figure 3. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for CARICOM1 countries.

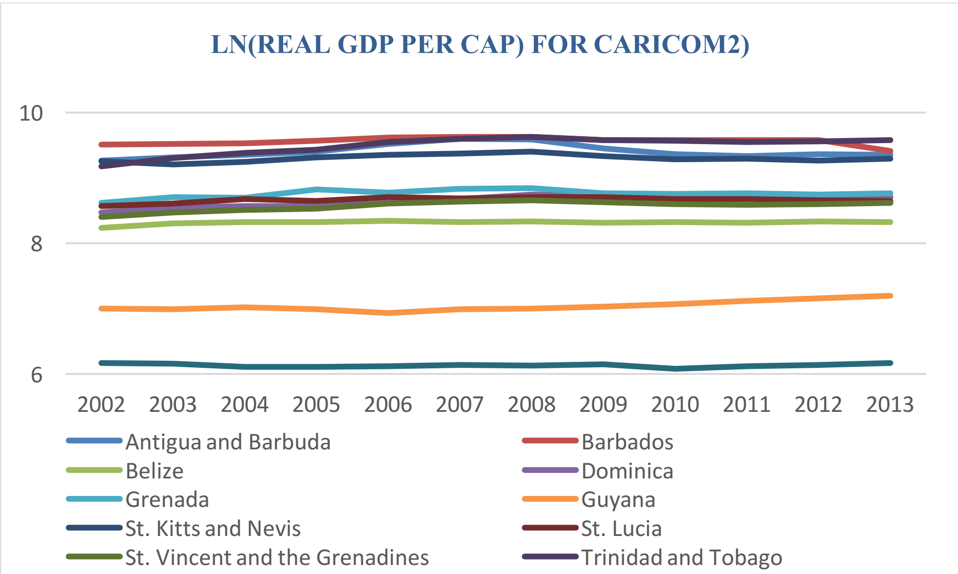

Figure 4. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for CARICOM2 countries.

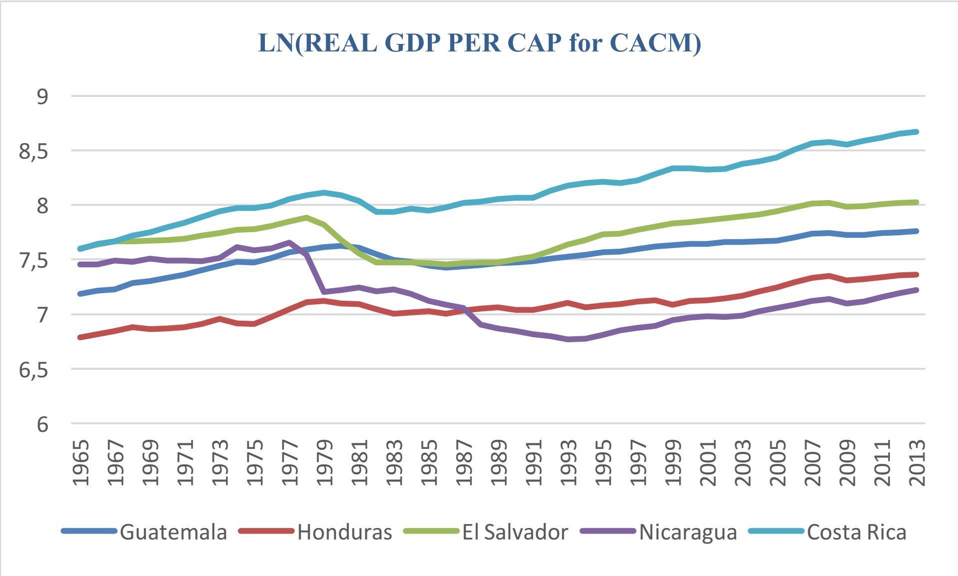

Figure 5. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for CACM countries.

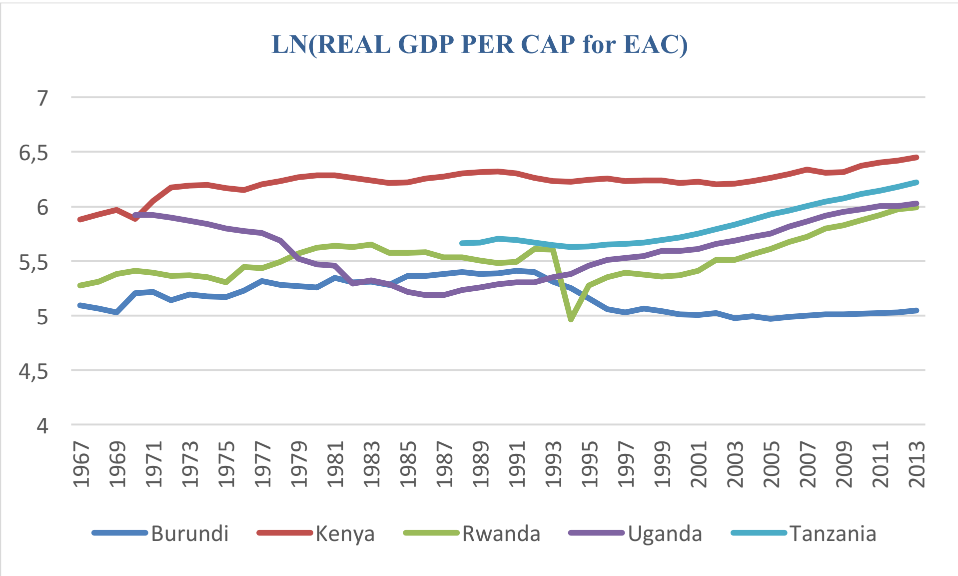

Figure 6. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EAC countries.

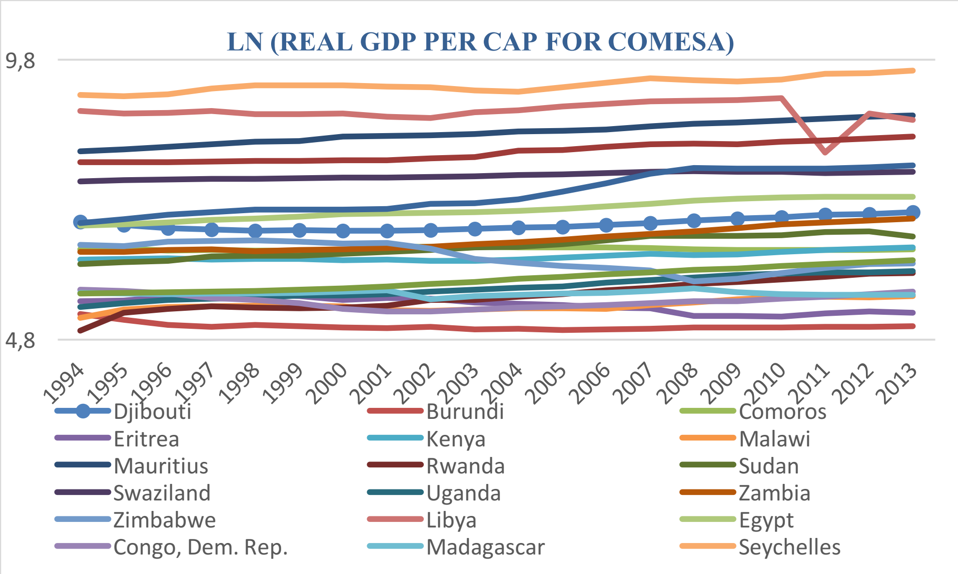

Figure 7. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for COMESA countries.

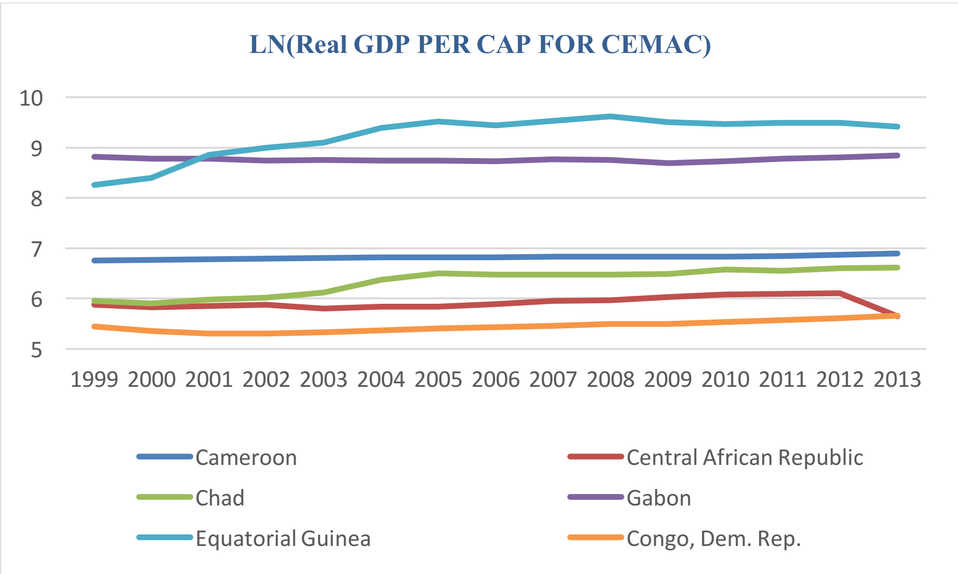

Figure 8. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for CEMAC countries.

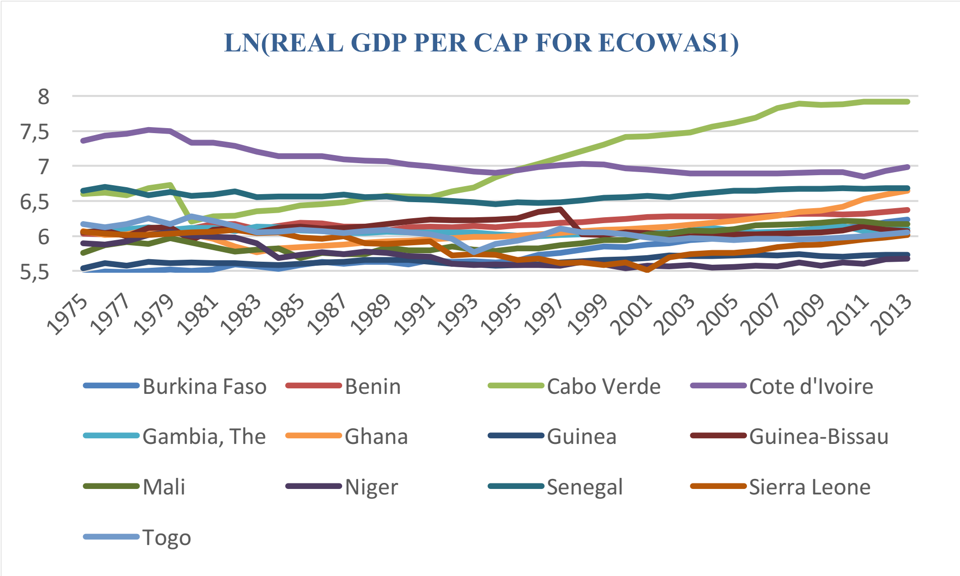

Figure 9. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ECOWAS1 countries.

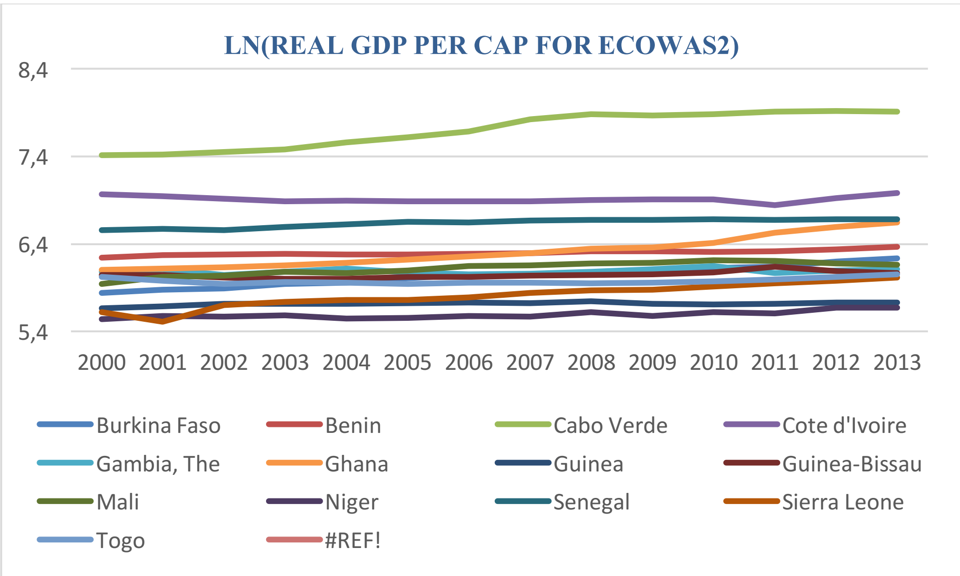

Figure 10. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ECOWAS2 countries.

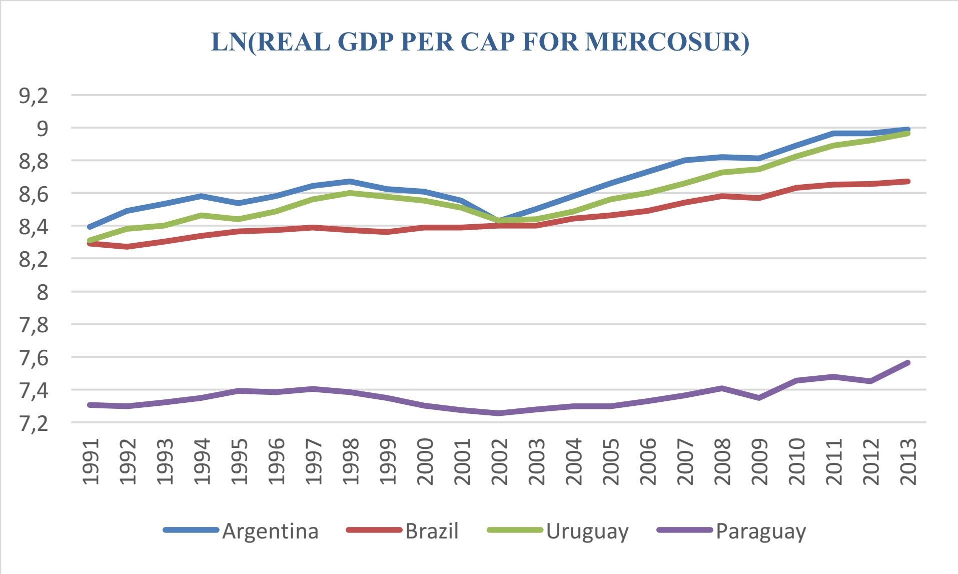

Figure 11. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for MERCOSUR countries.

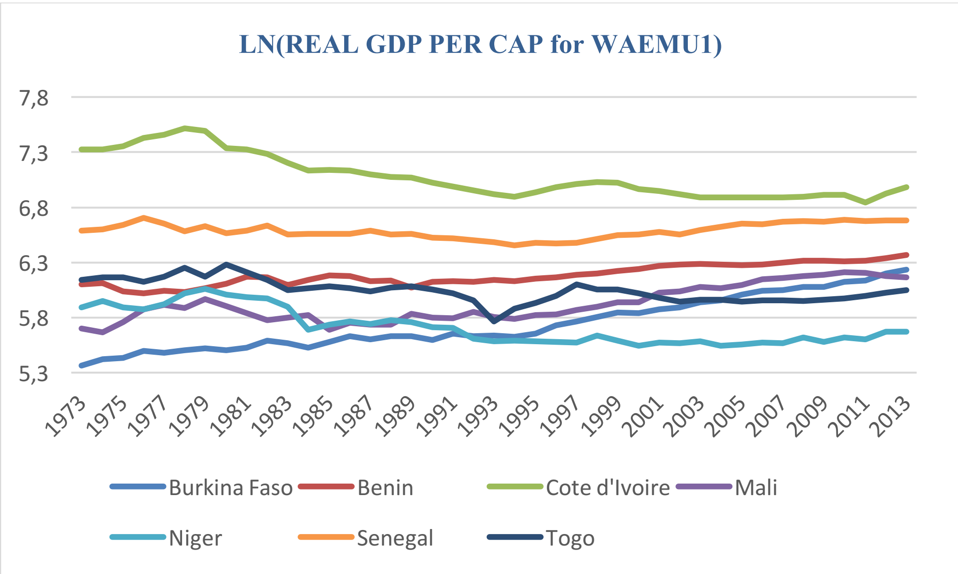

Figure 12. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for WAEMU1 countries.

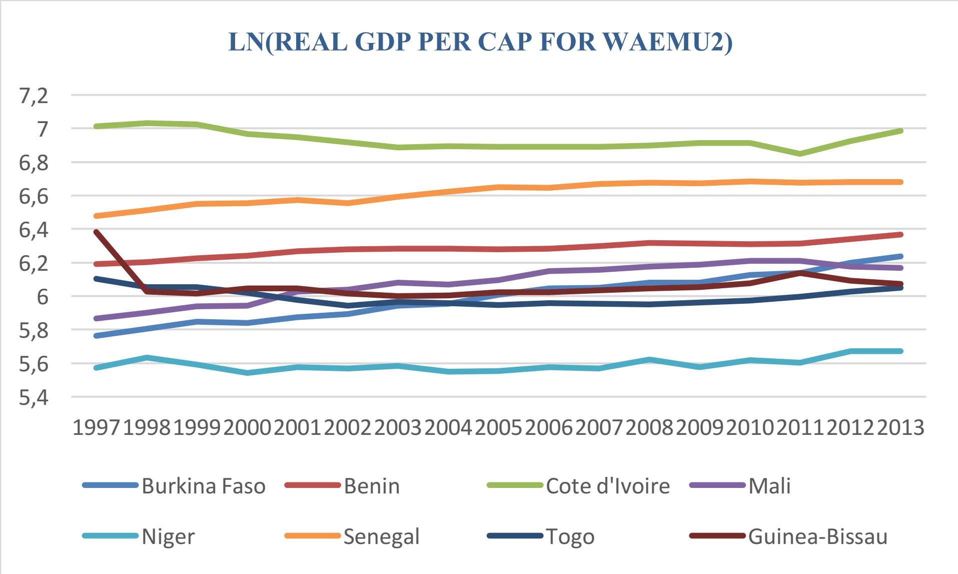

Figure 13. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for WAEMU2 countries.

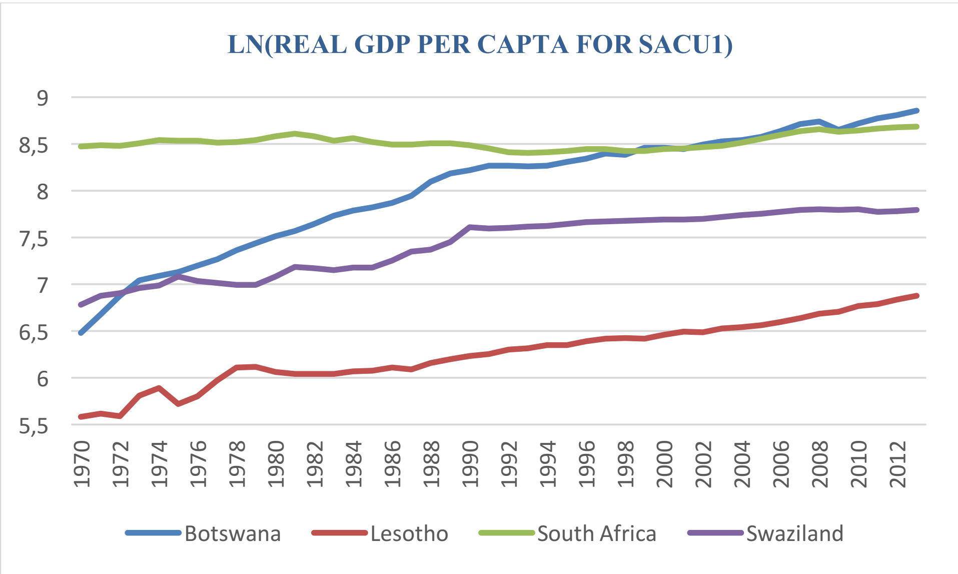

Figure 14. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for SACU1 countries.

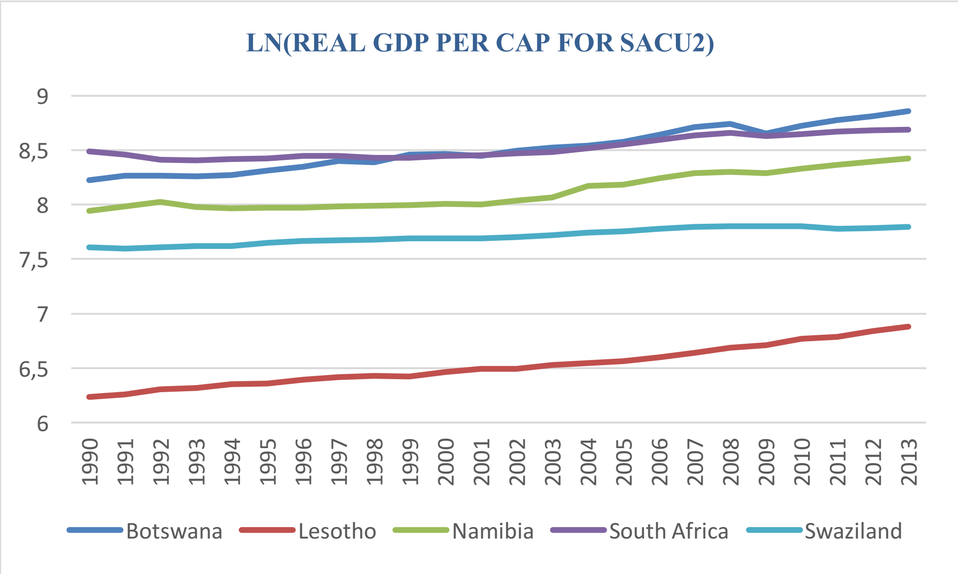

Figure 15. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for SACU2 countries.

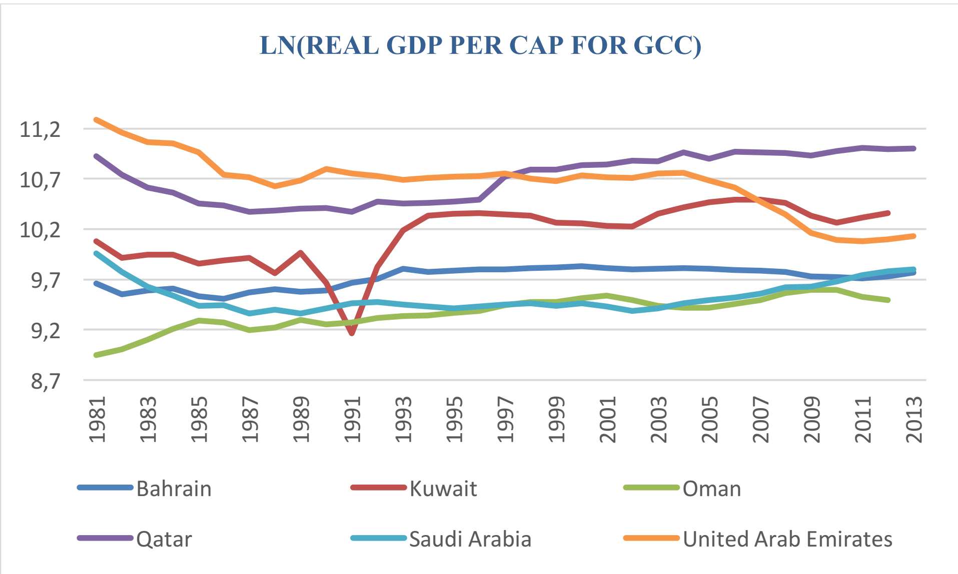

Figure 16. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for GCC countries.

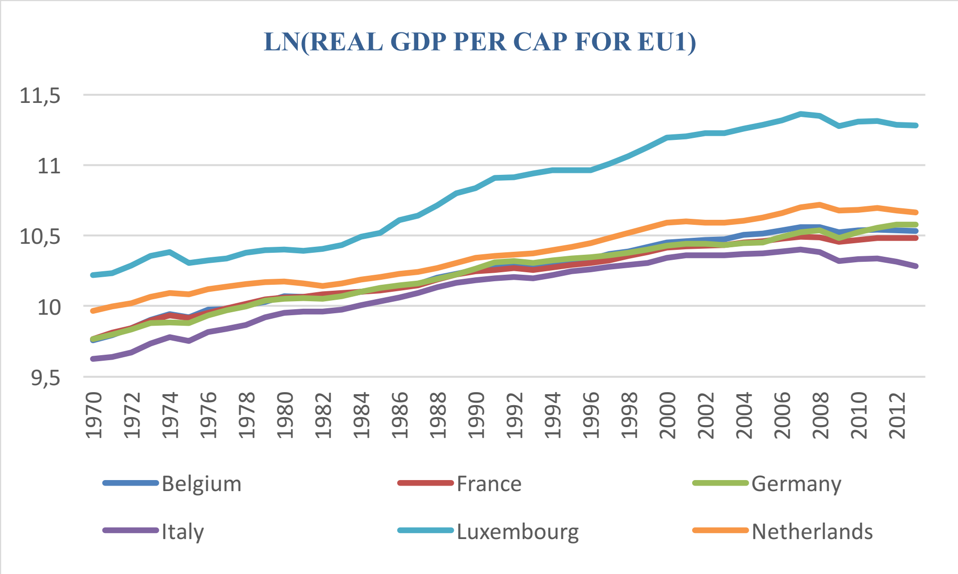

Figure 17. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EU1 countries.

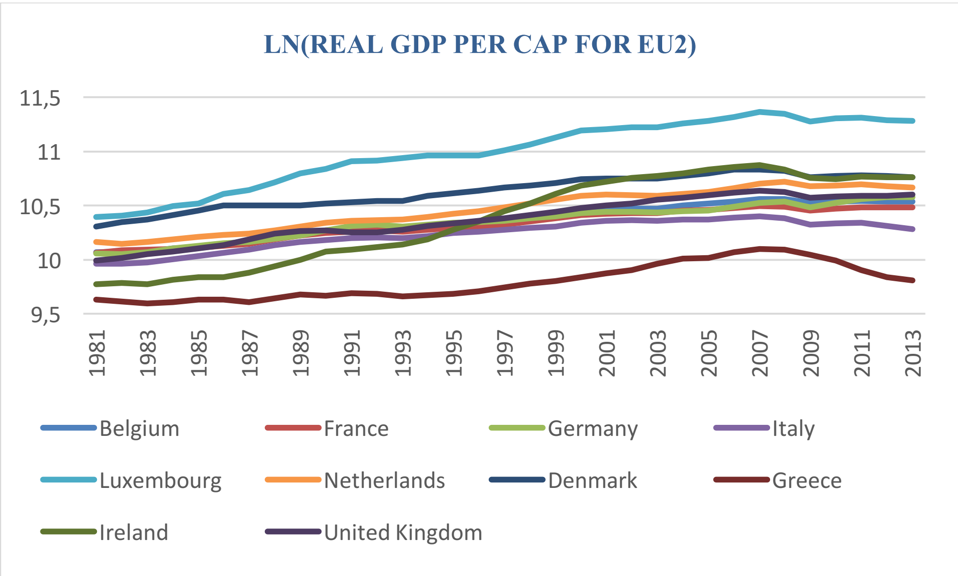

Figure 18. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EU2 countries.

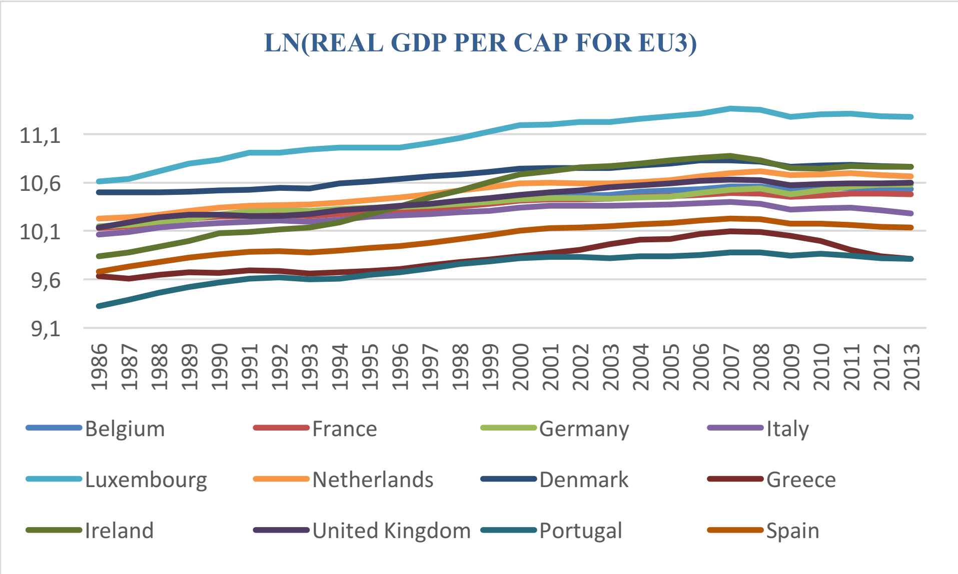

Figure 19. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EU3 countries.

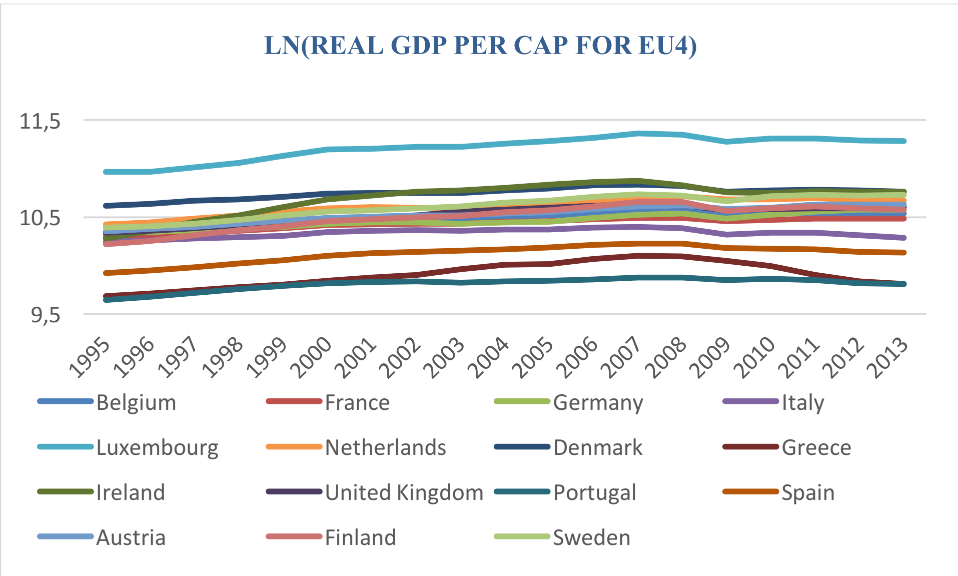

Figure 20. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EU4 countries.

2. Free Trade Agreements

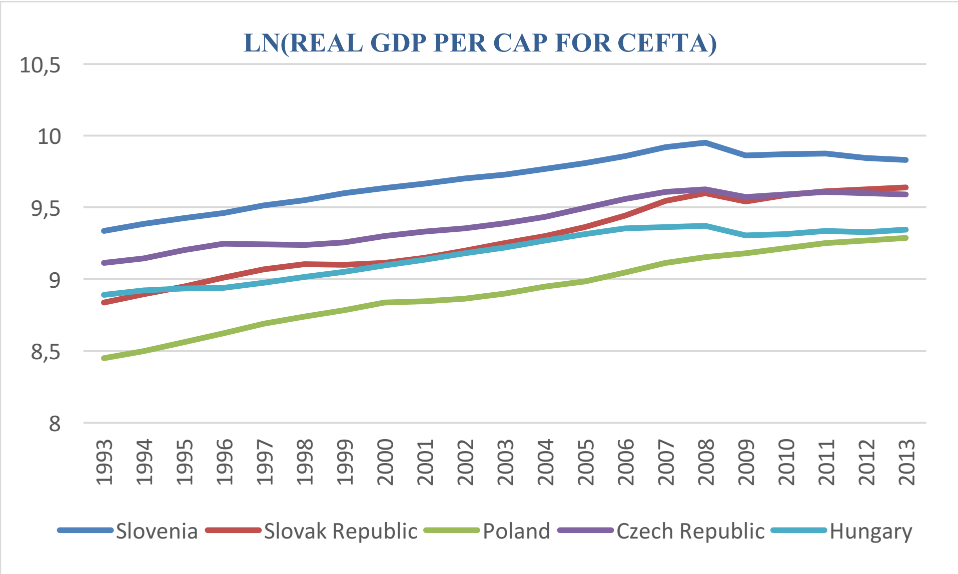

Figure 21. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for CEFTA countries.

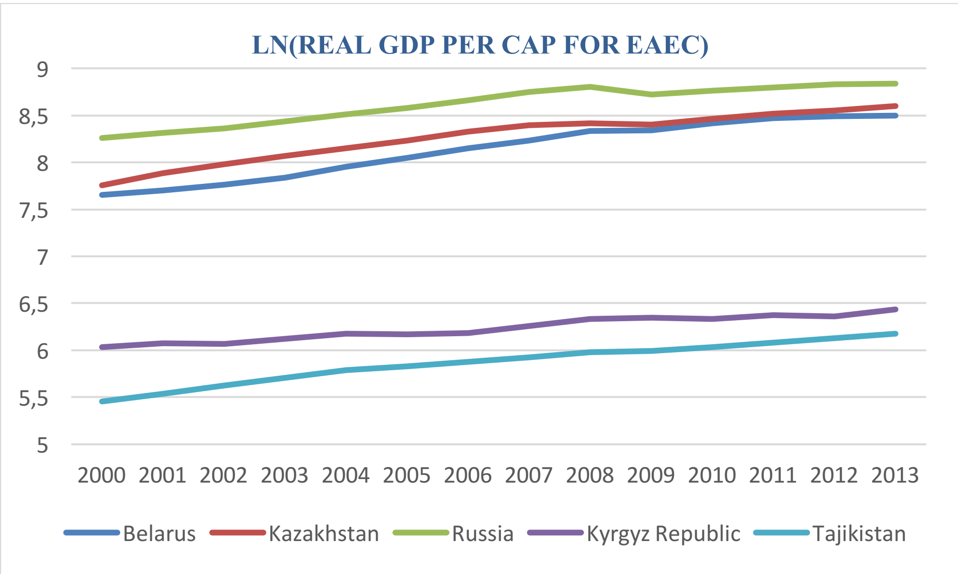

Figure 22. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EAEC countries.

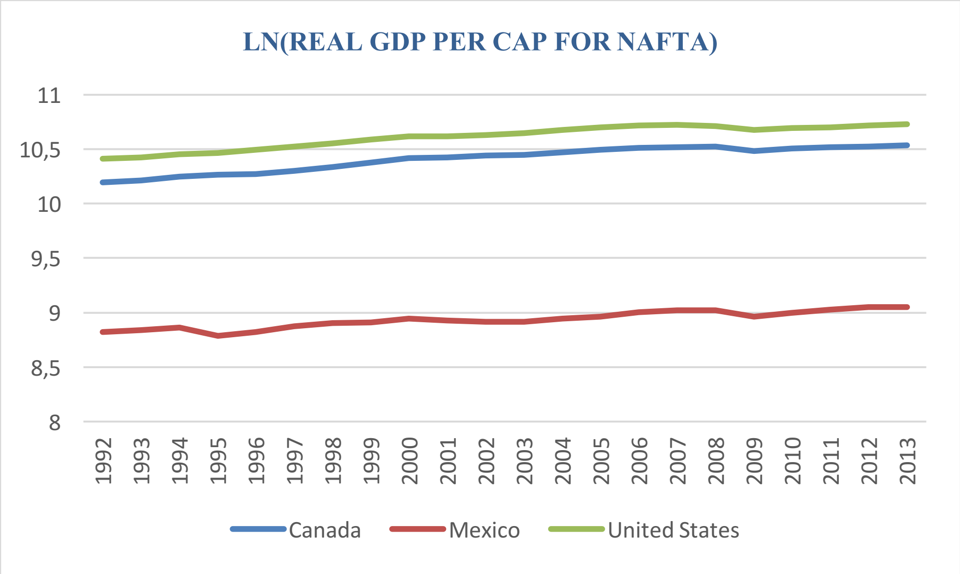

Figure 23. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for NAFTA countries.

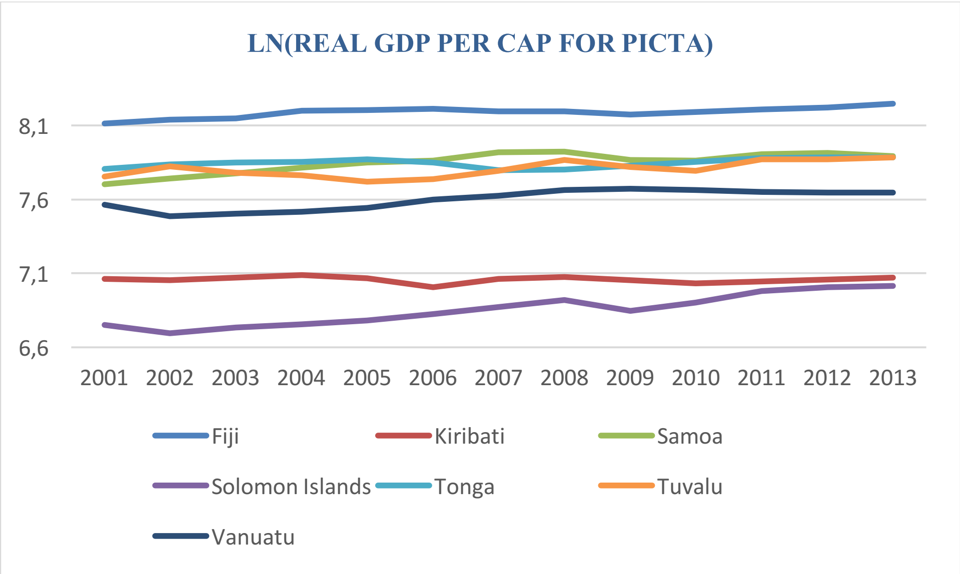

Figure 24. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for PICTA countries.

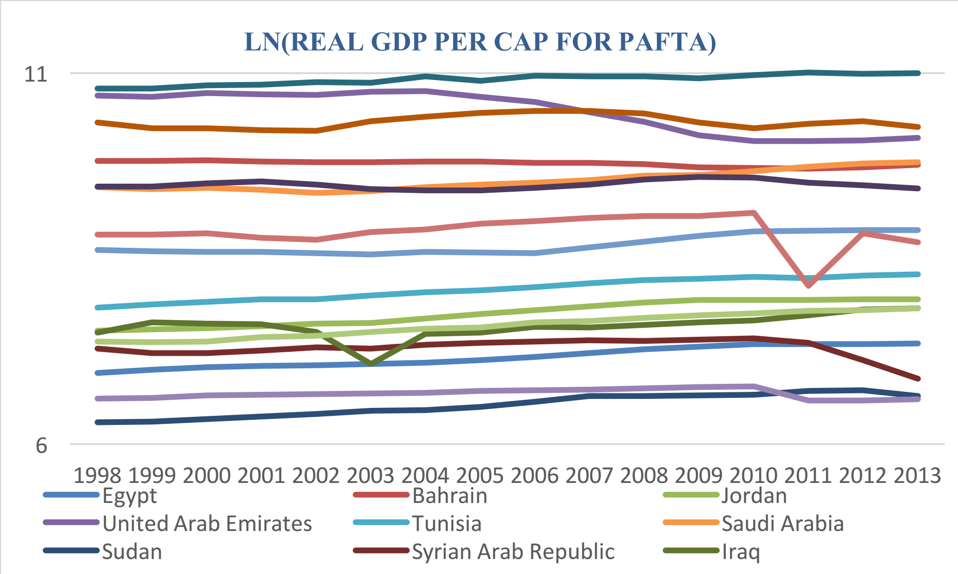

Figure 25. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for PAFTA countries.

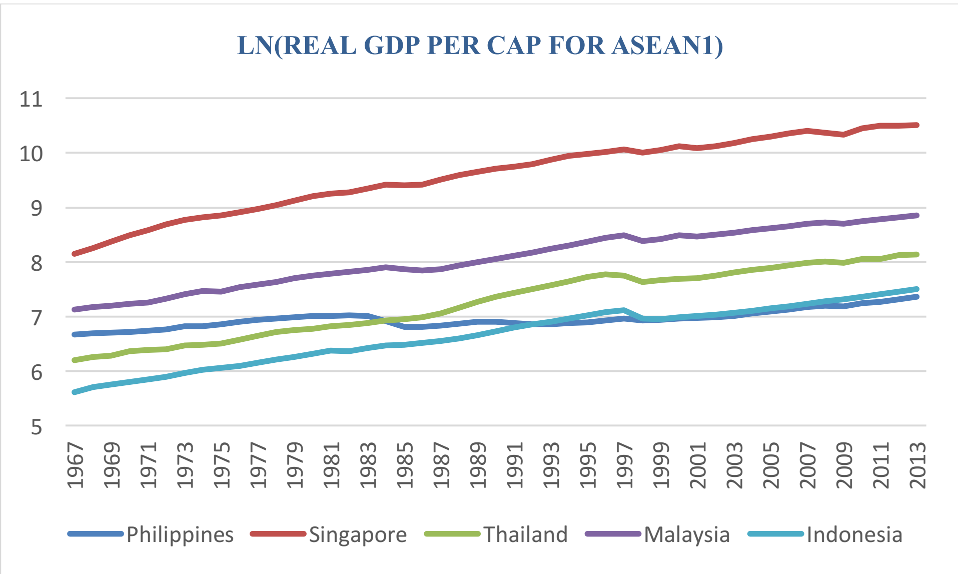

Figure 26. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ASEAN1 countries.

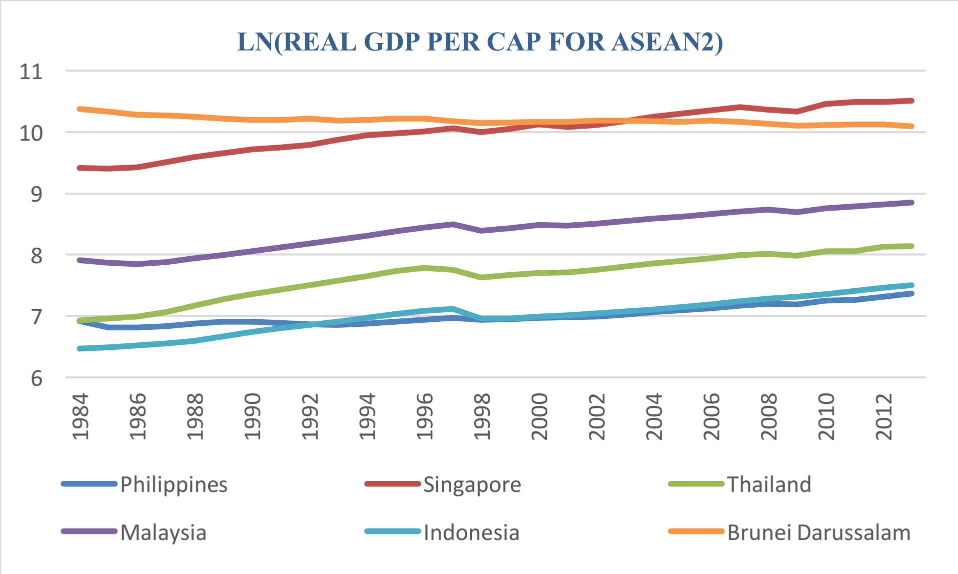

Figure 27. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ASEAN2 countries.

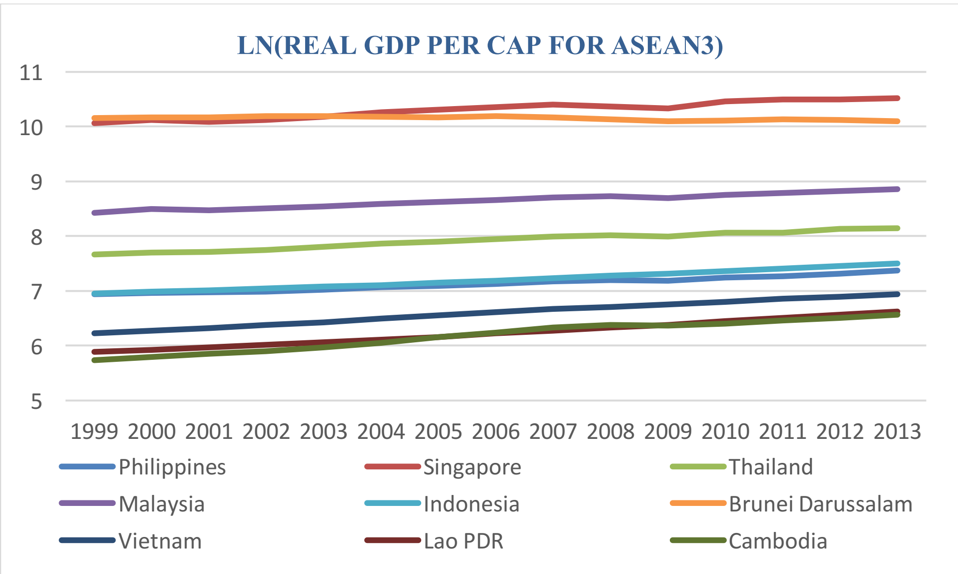

Figure 28. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ASEAN3 countries.

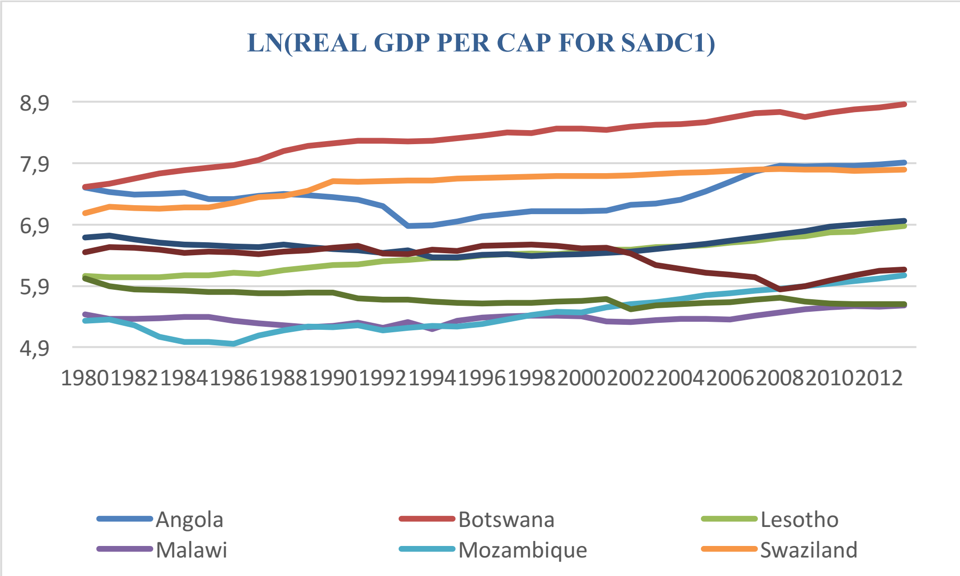

Figure 29. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for SADC1 countries.

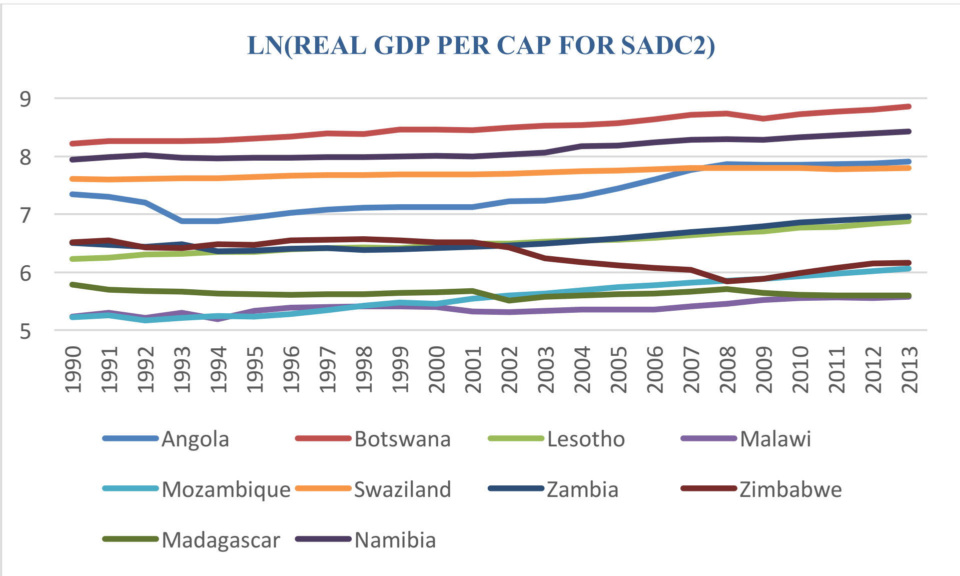

Figure 30. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for SADC2 countries.

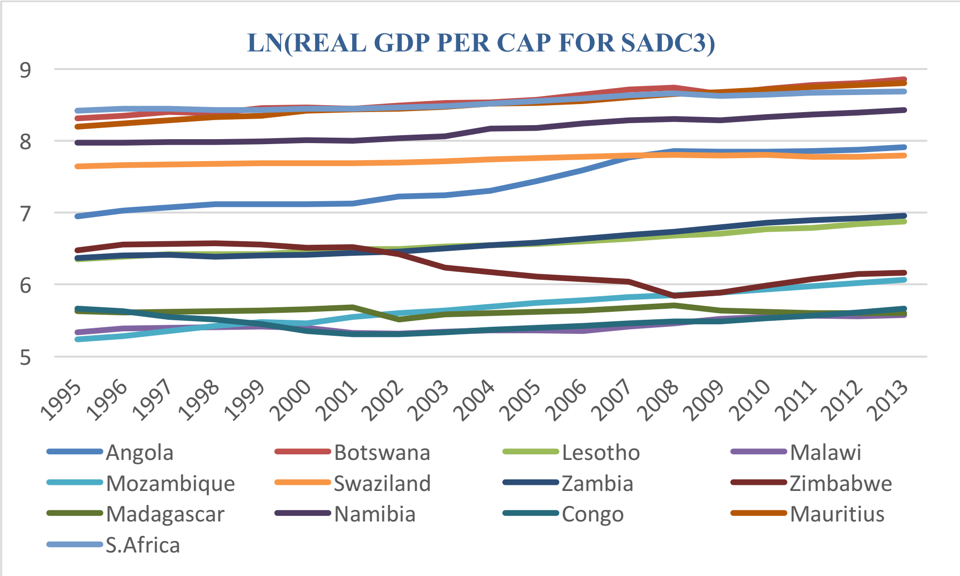

Figure 31. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for SADC3 countries.

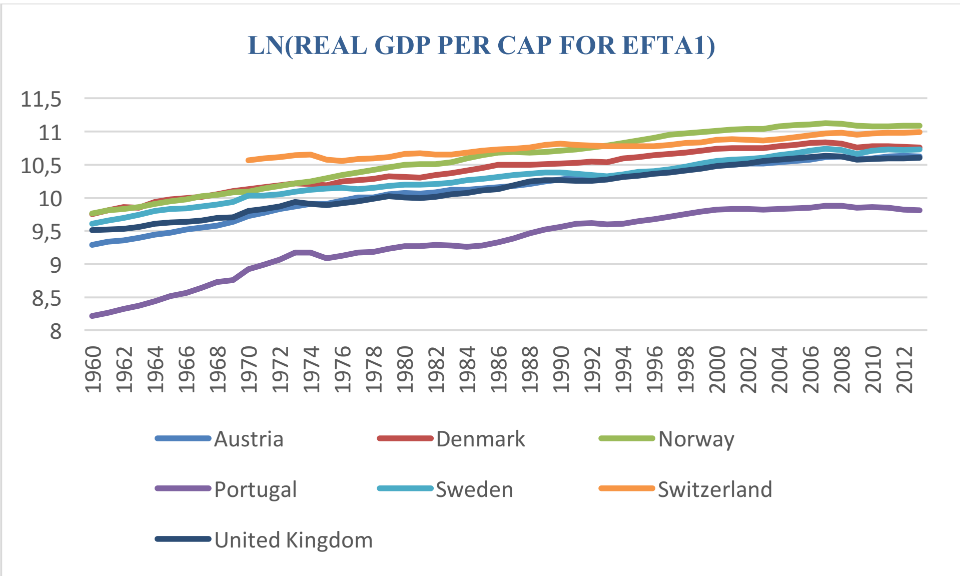

Figure 32. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EFTA1 countries.

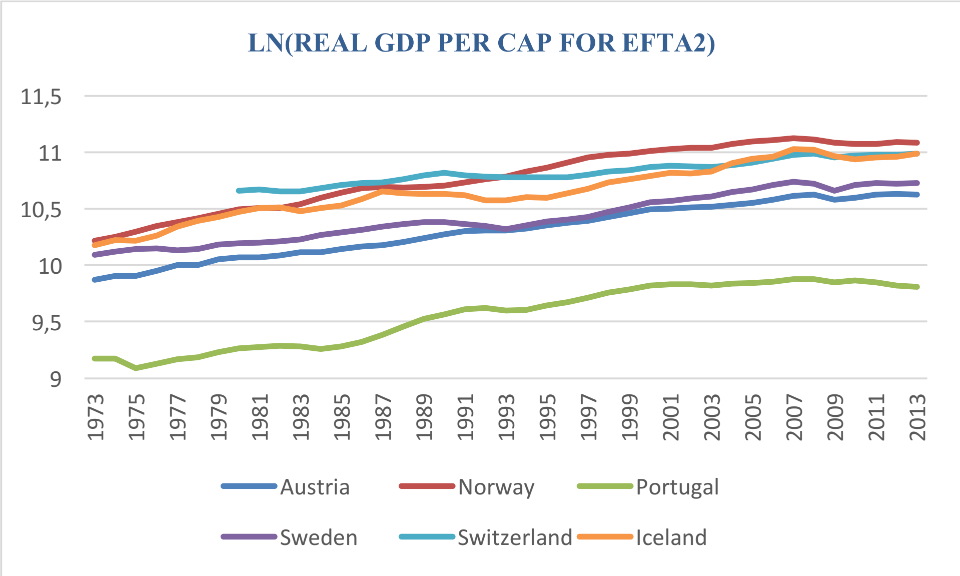

Figure 33. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EFTA2 countries.

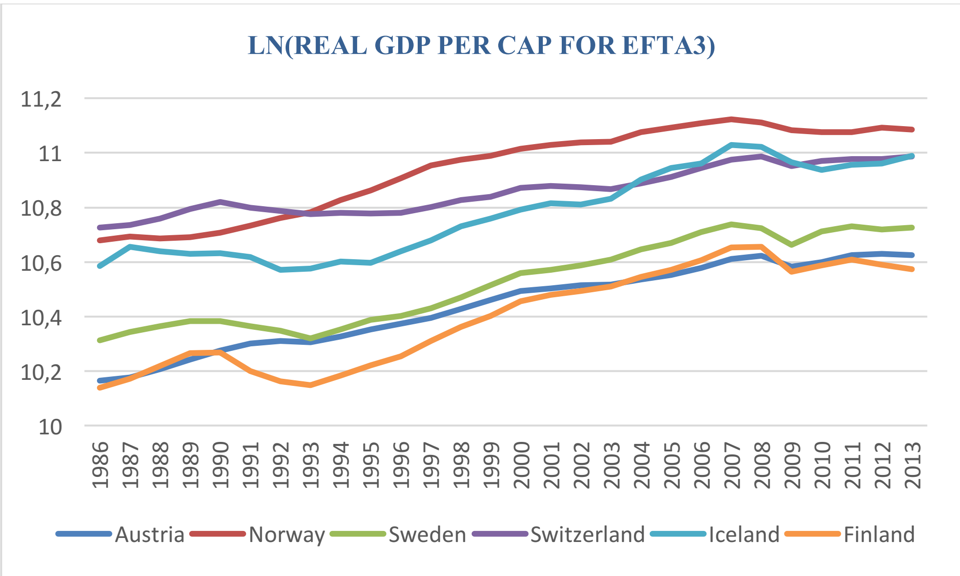

Figure 34. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EFTA3 countries.

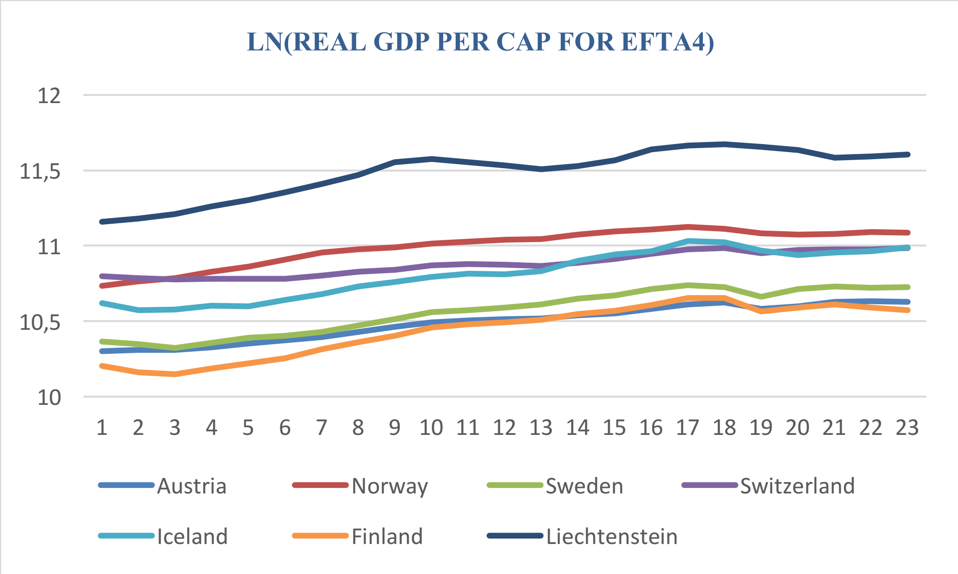

Figure 35. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for EFTA4 countries.

3. Partial Scope Agreements

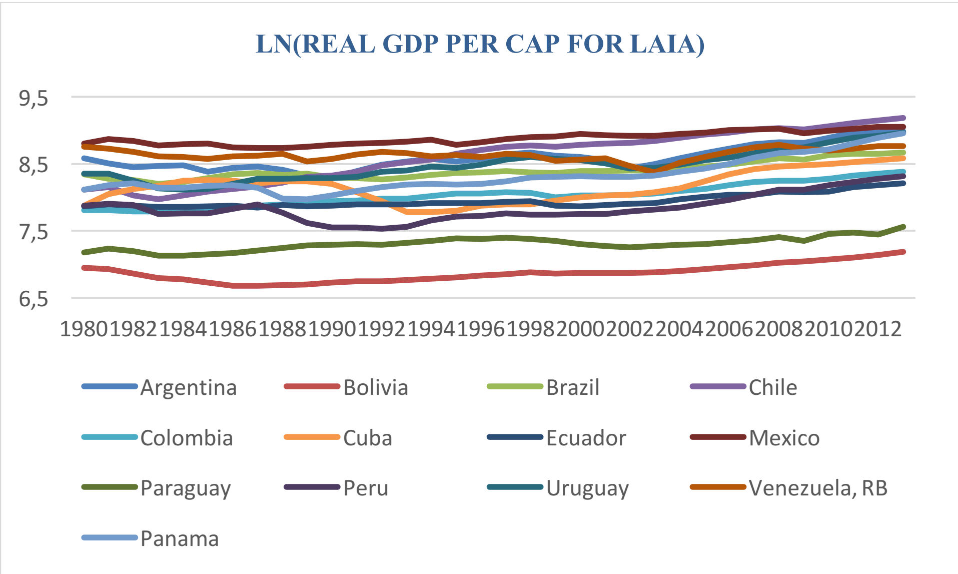

Figure 36. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for LAIA countries.

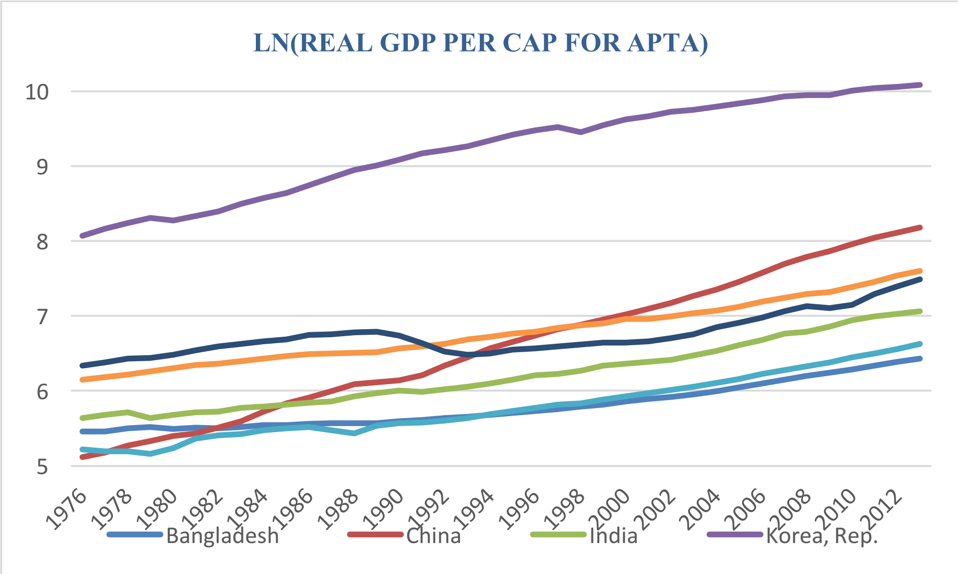

Figure 37. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for APTA countries.

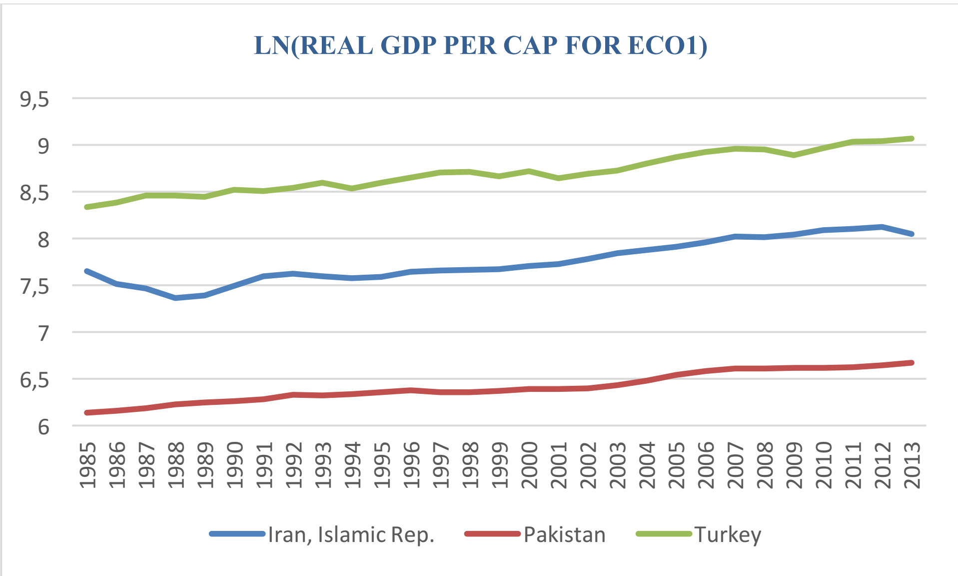

Figure 38. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ECO1 countries.

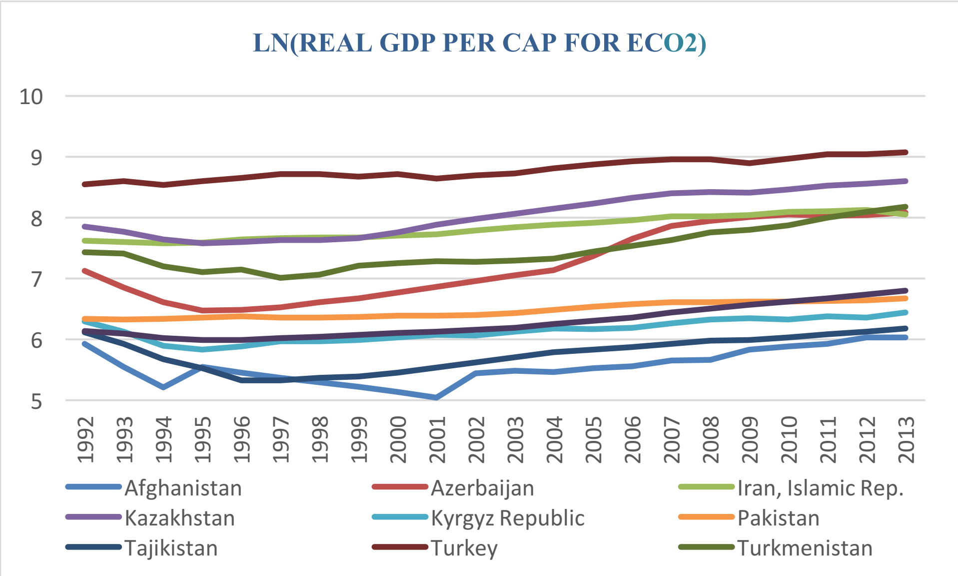

Figure 39. Evolution of natural logarithm (LN) of real GDP per capita in constant 2005 USD for ECO2 countries.

PART B. Changes in Membership Status of RIAs and Period of Study

Regional Economic Integration and Membership	Time Period
CARICOM2 (Antigua Barbuda; Barbados; Belize; Dominica; Grenada; Guyana; St. Kitt and Lewis; St. Lucia; St. Vincent; Trinidad & Tobago; Haiti)	2002-2013
CEMAC (Cameroon; Central African Republic; Chad; Gabon; Equatorial Guinea; Congo Democratic Republic)	1999-2013
ECOWAS1 (Burkina Faso; Benin; Cabo Verde; Cote d'Ivoire; Gambia; Ghana; Guinea; Guinea-Bissau; Mauritania; Mali; Niger; Senegal; Sierra Leone; Togo)	1975-2013
ECOWAS2 (Burkina Faso; Benin; Cabo Verde; Cote d'Ivoire; Gambia; Ghana; Guinea; Guinea-Bissau; Mali; Niger; Senegal; Sierra Leone; Togo)	2000-2013
EU1(Belgium; France; Germany; Italy; Luxembourg; Netherlands)	1970-2013
EU2 (EU1 plus Denmark; Greece; Ireland and UK)	1981-2013
EU3 (EU2 plus Portugal and Spain)	1986-2013
EU4 (EU3 plus Austria; Finland and Sweden)	1995-2013
ASEAN1 (Philippines; Singapore; Thailand; Malaysia and Indonesia)	1967-2013
ASEAN2 (ASEAN1 plus Brunei Darussalam)	1984-2013
ASEAN3 (ASEAN2 plus Vietnam; Lao PDR and Cambodia)	1999-2013
PAFTA (Egypt; Bahrain; Jordan; United Arab Emirates; Tunisia; Saudi Arabia; Sudan; Syrian Arab Republic; Iraq; Oman; Qatar; Kuwait; Lebanon; Libya; Morocco; Yemen	1998-2013
EAC (Burundi; Kenya; Rwanda; Uganda; Tanzania)	1988-2013
GCC (Bahrain; Kuwait; Oman; Qatar; Saudi Arabia; United Arab Emirates)	1981-2013
MERCOSUR (Argentina; Brazil; Uruguay; Paraguay)	1991-2013
SACU1 (Botswana; Lesotho; South Africa; Swaziland)	1970-2013
SACU2 (SACU1 plus Namibia)	1990-2013
WAEMU1 (Burkina Faso; Benin; Cote d'Ivoire; Niger; Senegal; Togo)	1973-2013
WAEMU2 (WAEMU1 plus Mali and Guinea Bissau)	1997-2013
CEFTA (Slovenia; Slovak Republic; Poland; Czech Republic; Hungary)	1993-2013
EAEC (Belarus; Kazakhstan; Russia; Kyrgyz Republic; Tajikistan)	2000-2013
EFTA1 (Austria; Denmark; Norway; Portugal; Sweden; Switzerland; UK	1960-2013
EFTA2 (Austria; Norway; Portugal; Sweden; Switzerland; Iceland)	1973-2013
EFTA3 (Austria; Norway; Sweden; Switzerland; Iceland; Finland)	1986-2013
EFTA4 (Austria; Norway; Switzerland; Iceland; Liechtenstein)	1991-2013
NAFTA (United States; Canada; Mexico)	1992-2013
PICTA (Fiji; Kiribati; Samoa; Solomon Islands; Tonga; Tuvalu; Vanuatu)	2001-2013
SADC1 (Angola; Botswana; Lesotho; Malawi; Mozambique; Swaziland; Zambia; Zimbabwe; Madagascar	1980-2013
SADC2 (SADC1 plus Namibia)	1990-2013
SADC3 (SADC2 plus Congo; Mauritius; South Africa)	1995-2013
ECO1 (Turkey; Iran; Pakistan)	1985-2013

ECO2 (ECO1 plus Afghanistan; Azerbaijan; Iran; Kazakhstan; Kyrgyz Republic; Tajikistan; Turkmenistan; Uzbekistan)	1992-2013
LAIA (Argentina; Bolivia; Brazil; Chile; Colombia; Cuba; Ecuador; Mexico; Paraguay; Peru; Uruguay; Venezuela; Panama)	1980-2013
CARICOM1 (Antigua & Barbuda; Barbuda; Belize; Dominica; Grenada; Guyana; St. Kitts & Lewis; St. Lucia; St. Vincent; Trinidad & Tobago)	1974-2013
ANDEAN1 (Bolivia; Colombia; Ecuador; Peru; Chile)	1969-2013
ANDEAN2 (Bolivia; Colombia; Ecuador; Peru; Venezuela)	1976-2013
CACM (Guatemala; Honduras; El Salvador; Nicaragua; Costa Rica)	1965-2013
COMESA (Djibouti; Burundi; Comoros; Namibia; Eritrea; Kenya; Malawi; Mauritius; Tanzania; Rwanda; Sudan; Swaziland; Uganda; Zambia; Zimbabwe; Libya; Egypt; Congo; Madagascar; Seychelles; Angola)	1994-2013
APTA (Bangladesh; China; India; S.Korea; Lao PDR; Sri Lanka; Mongolia)	1976-2013