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Chan-Hyun Sohn, Korea Institute for International Economic Policy and Yokohama National University

Hongshik Lee, Korea Institute for International Economic Policy

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Center for International Trade Studies, Faculty of Economics

Yokohama National University

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Chan-Hyun Sohn*
and
Hongshik Lee**

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* Senior Fellow, Korea Institute for International Economic Policy (KIEP) and Visiting Professor, Yokohama National University; chsohn@kiep.go.kr

** Research Fellow, Korea Institute for International Economic Policy (KIEP); hslee@kiep.go.kr

Abstract

The purpose of this paper is to analyze whether the formation of an FTA will cause the economic levels of its member economies to converge or diverge. Although previous studies predicted, to a certain degree, the possibility of economic convergence among FTA members, they failed to provide reliable research methods or concrete conclusions. By introducing the concept of "accelerating convergence," this study tries to estimate economic convergence to analyze the pure effects of an FTA on economic-level convergence among its members. The model of economic growth developed by Barro and Sala-i-Martin (1995) has been extended for this purpose, and by employing the panel data analysis of major FTAs including EU, NAFTA, Mercosur and AFTA, we provide considerable evidence on accelerated convergence.

Key words: FTA, Convergence, Income level, Dynamic panel estimation

JEL Classification: F11, F15

1. Introduction

Free trade agreements (FTAs) have become an increasing phenomenon in the recent world economy. It is generally recognized that the formation of such an agreement is critical for economic benefits. Given this direct implication, it is not surprising that analyses and hypotheses concerning FTAs have a long history in economics. From the classical economists to the Vinerian, particular attention has been given to the economic models of distinction between trade creation and trade diversion. The current trade and growth debate also hinges on FTAs. It becomes of critical importance for what effects FTAs might have on their member economies.

Despite the considerable attention given to FTAs, there are few empirical studies that relate FTAs with the economic levels of its member countries. This gap is a significant shortcoming because investigating the links between each FTA member country opens up crucial questions, for example: how is the formation, expansion or deepening of FTAs related to the economic levels of their member countries? To what extent can the formation of FTAs converge or diverge member countries? The purpose of this paper is to fill this gap in the research and provide a framework for the empirical study of whether FTAs converge or diverge the economic levels of member countries.

From a theoretical point of view, there are two types of convergence. One is conventional convergence as advocated and studied by economists from as early as Solow (1956) to Mankiw, Romer and Weil (1992) in the 1990s. This type of convergence is here called “global convergence,” because it occurs globally due to such factors as technological development and lowered transportation costs. On the other hand, “accelerating convergence” is the type of economic convergence that results from

the formation of FTAs. It is “accelerating” in the sense that the rate of convergence is higher after the formation of FTAs. The central aim of this paper is to find evidence of this accelerating convergence.

Using the growth model of Barro and Sala-i-Martin (1995), this paper will per form a dynamic panel estimation of existing FTAs data on EU, NAFTA, Mercosur and AFTA to show that the economic levels of FTA member countries actually converge. If so, this result will support the proposition of the economic convergence among FTA members.

The paper is organized as follows. In next section, we review the existing literature on convergence. This section also explains how we measure the new convergence. In section 3, we examine whether FTAs cause the economic levels of member countries to converge or diverge. The empirical models used in this paper and their results are discussed in this section. Section 4 provides a summary and conclusion.

2. Review of Existing Literature

2.1. Economic Convergence

Although studies on the economic convergence of FTA member countries could provide important insights into the dynamic nature of FTAs, there have been few such empirical studies. Due to the lack of existing studies, this section instead reviews previous research on related topics such as the estimation of convergence.

Barro and Sala-i-Martin (1995) used neoclassical and endogenous growth models to argue that in a regional economy, the economic levels of countries should

converge over time. Sala-i-Martin (1994) also shows with empirical evidence from the regional economic data that the economic levels of the states in the United States and the prefectures in Japan have indeed converged. At the country-level, the economic levels of selected countries, such as the United States, Canada, Australia, Japan and some EU countries, are also shown to converge. Here, a regional economy is not defined by membership in an FTA but by geographical proximity or similarity of economic structures, and for estimation of economic levels, Gross Regional Product or per capita GDP was used.

In general, previous studies show that the economic levels of countries in regional economies converge. Barro and Sala-i-Martin (1995) argues that globally, economic levels have actually diverged, but in regional economies there is significant convergence. The EU European Commission (1996) shows that Greece, Ireland, Portugal and Spain have generally shown rapid economic convergence. On the other hand, Ben-David (1993) shows that in the EEC, the dispersion of per capita GDP of member countries have decreased through economic integration and various free trade measures of the member countries. Slaughter (1997) took the approach of considering per capita income as a factor of production such as labor and capital, and proved that the economic levels of Denmark, Ireland and the U.K. converged after the joined the EU. However, Slaughter's analysis does not include a comparison of global and accelerating convergences in the pre- and post-EU periods, so it cannot show the pure effect of joining in the EU.

2.2. β-Convergence

Barro and Sala-i-Martin (1995)'s definition of convergence is used here. They distinguish as convergence two concepts: β-convergence and σ-convergence. β-Convergence is said to exist in a cross-section of economies if there is a negative relation between the growth rate of income per capita and the initial level of income.[1] In short, there is β-convergence if poorer countries grow faster than the richer ones. This phenomenon is illustrated in Figure 1 (a).

[Insert Figure 1 here]

The solid lines show the movement of per capita GDP of countries A, B and C. Over time, the gap between the lines narrows, because the slopes of B and C are steeper than that of A – that is, countries B and C grow at a faster rate than country A.

A mathematical account of β-convergence by Barro and Sala-i-Martin (1995) is shown as follows. The per capita real income obtained by the Ramsey model at the steady state is:

$$\log\left[\hat{y}(t)\right] = e^{-\beta t} \cdot \log\left[\hat{y}(0)\right] + (1 - e^{-\beta t}) \cdot \log(\hat{y}^{*}) \tag{1}$$

where β>0 represents β convergence and $\log\left[\hat{y}(t)\right]$ is the weighted average of the initial level of per capita income $\left[\hat{y}(0)\right]$ and steady state per capita income $\log\left[\hat{y}^{*}\right]$.

The weight of initial level per capita income decreases at the rate β. The average rate of growth using (1) is:

$$(2) \qquad (1/T)\cdot\log\left[y(T)/y(0)\right] = x + (1-e^{-\beta T})/T \cdot \log\left[\hat{y}^{*}/\hat{y}(0)\right]$$

where x is the growth rate at the steady state, β the rate of convergence and T the time period. This equation shows the negative relation between the growth rate of per capita income and the initial level of income at two points of time T and 0. Applying equation (2) to discrete time and including random disturbance we obtain equation (3).

$$(3) \qquad \log(y_{i,t}/y_{i,t-1}) = a - (1-e^{-\beta})\cdot\log(y_{i,t-1}) + u_{i,t}$$

where $a = x + (1-e^{-\beta})\cdot\log(\hat{y}_i^{*}) + x\cdot(t-1)$ and $\log\left[\hat{y}_i^{*}\right]$ is the steady state value of $\log\left[\hat{y}\right]$. Also the random variable $u_{i,t}$ has the mean 0 and variance σ_{ut}^2 with distribution independent of $\log(y_{i,t-1})$, u_{ji} and the lagged disturbances.

An alternative definition is σ-convergence, which describes the phenomenon in which the dispersion of real per capita income across groups of economies tends to fall over time. For the purpose of this paper, we focus only on β-convergence. This is because it deals with the rate of convergence, which is more relevant to the aim of this paper. Thus, it is not necessary to go into σ-convergence in detail. Suffice it to say that β-convergence is a necessary but not a sufficient condition for σ-convergence.[2]

2.3. New Measure of Convergence

Although there have been some studies on the convergence effect of the FTAs, they have failed to reach concrete conclusions, because they did not distinguish between accelerating and global convergence. In other words, although they found evidence of economic convergence, they failed to reach concrete conclusions on the 'pure' effect of the FTAs on convergence. This is because they did not distinguish accelerating convergence, convergence from FTAs and converge from global convergence, arising from the global interdependence of countries, such as cross-border technology spillovers or trans-border human resource movements. In other words, although the negative sign of β was obtained, it was unclear whether it indicated the existence of global convergence or accelerating convergence or a combination of the two. To make the argument clear, consider Figure 1.

Figure 1(a) depicts, as mentioned in the earlier section, global convergence. The rate of per capita GDP growth is higher for poorer countries, thus the gap between the three lines narrows. On the other hand Figure 1(b) depicts accelerating convergence. Note the shifts in the solid lines of countries B and C when they meet the vertical line T-FTA. T is the year when the FTA is formed. After T, the slopes of lines B and C grow steeper, becoming B' and C'. As is clear from the figure, the rate of convergence is now faster – thus accelerating convergence.

Barro and Sala-i-Martin (1995) use equation (3) to estimate β-convergence. However their use of the equation is confined to the analysis of regional economies in a single country such as states in the United States or prefectures in Japan, and countries with very similar economic structures such as the EU. This is because the method

cannot control for country-specific irregularities whose effects might be wrongly captured when estimating the growth rate or β. Thus, their method cannot be used for the panel data analysis of this paper unless it is properly modified.

Instead, this paper extends the equation (3) by adding some neoclassical growth variables, and uses the growth equation developed by Barro and Sala-i-Martin (1995, Chapter 12) to estimate β. This is to say that our model is a hybrid one, combining the neoclassical and endogenous models. Various country-specific differences are controlled for, including changes in factor inputs, changes in government policies, changes in labor productivity and the degree of country openness.

3. Analysis on Economic Convergence

3.1. The Model

In this section, we present a formal model to estimate the effect of the formation of an FTA on the economic levels of its member countries. We make use of the neoclassical growth model containing endogenous growth factors.[3] The real per capita GDP growth is related to two groups of variables: initial levels of state variables and control or explanatory variables.

Following the spirit of existing work on the empirics of economic growth, we begin with a basic specification:

(4) $$\dot{y}_{it} = \alpha + \beta \ln y_{it-1} + \gamma X_{it} + u_i + \eta_t + \varepsilon_{it}$$

where $\dot{y}_{it}$ is the log difference of per capita GDP of country *i* in period *t*. Although there are many other variables that can represent the economic level, we only use $\dot{y}_{it}$. We put the initial level of real per capita national income for the initial level variable, y_{it-1}. X_{it} is the vector of conditioning variables, u_i is an individual country fixed effect and η_t is a time effect. For the explanatory variables, we used the ratio of government expenditure to real GDP, GOV; the ratio of real gross domestic investment to real GDP, INV; the productivity of labor, Y/L[4]; and the openness of an economy, OPEN.[5] The labor productivity, Y/L is used instead of capital-labor ratio since the available data on capital stocks seems unreliable.[6] OPEN proxies for the country's exposure to external trade while INV and GOV proxy for the production input level and the government fiscal policy respectively. The endogenous growth factors, such as human capital and technology, are all contained in the y_{it-1} term. The β coefficient shows the rate of β-convergence. A negative β implies the presence of global β-convergence and if it is positive, the economies are actually diverging.

To capture the effect of "accelerating convergence," the dummy variable FTA is added to form the complete estimation equation:

$$\dot{y}_{it} = \alpha + \beta_1 \ln y_{it-1} + \beta_2 \, FTA * \ln y_{it-1} + \gamma \, X_{it} + u_i + \eta_t + \varepsilon_{it} \tag{5}$$

The dummy variable FTA is formed as follows. We first divide the sample into two groups: pre-FTA and post FTA and then the dummy variable equals 1 if FTA is formed in year t (if post-FTA) and 0 if not in year t (if pre-FTA). If the coefficient β_2 is statistically significant – that is, significantly different from 0 – and negative in sign,

there is accelerating convergence effect. Thus β_2 is here named the "accelerating factor."

The basic problem faced in the estimation of this model is that this specification cannot control for unobserved country specific effect. Because the unobserved effects tend to persist over time, ignoring unobserved individual effects is serially correlated with the error term, ε_{it}. The difference with respect to the highest level of income in the sample of countries acts as a proxy for country-specific effects in cross sectional regressions and thus the estimates are inconsistent.[7] Moreover, cross-sectional regressions suffer from endogeneity problems. In the growth context, the initial level of income is correlated with the growth variable.

To control for the endogeneity problem and unobserved country-specific effects, we used a dynamic panel data model. The dynamic panel model has been used in the existing empirical studies. The lagged endogeneity can be corrected for by first differencing and using second and third lags as instruments, as suggested by Arellano and Bond (1991), and the issue of unobserved country specific effects can also be addressed by differencing the data to eliminate u_i.

$$\Delta \dot{y}_{it} = \beta_1 \Delta \ln y_{it-1} + \beta_2 \, FTA^* \Delta \ln y_{it-1} + \gamma \, \Delta X_{it} + \Delta \eta_t + \Delta \varepsilon_{it} \quad (6)$$

Even though the unobserved country fixed effects are eliminated, however, a problem still arises. That is unless the idiosyncratic error followed a random walk, this specification necessarily gives the transformed error a moving average structure that is correlated with the differenced lagged dependent variable. This can be overcome by using instrument variables date *t-n* and earlier. We estimate with instrumental variables,

using as instrument the differences in a Generalized Method of Moments (GMM) context.[8]

3.2. The Data

The data have been obtained from the Penn World Tables (PWT version 6.0). It was the most appropriate data set available because the monetary values such as the level of GDP were in constant U.S. dollar terms.

The FTAs under analysis of this paper are the EU, NAFTA, AFTA and Mercosur. The EU is further divided into EU-6, EU-9 and EU-11 for our purposes. EEC (here we call it EU-6) was formed in 1958 by six member countries, the Netherlands, Luxembourg, Belgium, France, Italy and Germany. Three additional countries, the UK, Denmark and Ireland, were added to form EU-9 in 1973. Spain and Portugal then joined in 1985 to form EU-12. Greece, which joined the EU in 1981, is excluded in our analysis (hence) EU-11. NAFTA was started initially as the Canada and U.S. Free Trade Agreement (CUSFTA) in 1989, and Mexico later joined to form NAFTA in 1994. AFTA, officially launched in 1994, is the loosest of all the FTAs examined in this study. Only five of the AFTA member countries – the Philippines, Malaysia, Indonesia, Thailand and Singapore – are examined for the AFTA analysis due to the lack of data on the smaller countries. Mercosur – Brazil, Argentina, Paraguay and Uruguay – started as an FTA in 1991 but later developed into a customs union (CU) in 1995.[9]

The regression results will be analyzed in three dimensions – launch, expansion and deepening. It is plausible to regard the degree of FTA effects on the accelerating factor as different depending on whether the FTAs are launched, expanded (the membership is extended to more countries) or deepened (the member countries are

more integrated).[10]

3.3. Estimation Results

To estimate the econometric model in equation (6), we focus on four major existing FTAs: EU, NAFTA, AFTA and Mercosur. We limited our sample to before and after the FTAs were formed. Estimates for equation (6) are reported in Tables 1 to 4. Consistently throughout the regression of all FTAs, the sign of coefficient of $\ln(y_{t-1})$, β_1, is negative and very significant, implying the existence of global convergence.

The regression results of the EU in Table 1 show negative β_2 with particularly high significance for EU-9 and EU-11.

[Insert Table 1 here]

In other words, accelerated convergence was observed in the EU. Although the launch effect was rather weak, as implied by the weak significance of the EU-6 β_2, the expansion effects seem to be very strong. An intercept dummy was added for the regression of EU-11. Therefore, the estimating equation for this particular case is

$$(7) \qquad \Delta \dot{y}_{it} = \gamma\, FTA + \beta_1 \Delta \ln y_{it-1} + \beta_2\, FTA^* \Delta \ln y_{it-1} + \gamma\, \Delta X_{it} + \Delta \eta_t + \Delta \varepsilon_{it}$$

Note the addition of an intercept dummy $\gamma\, FTA$ in equation (7). Since Spain and Portugal had income levels significantly lower than other EU member countries, there was a need to control for this particularly large difference in the initial income levels.[11]

Regression results of CUSFTA in Table 2 also show negative β_2 with significance.

[Table 2 is here]

The NAFTA in the sample 1989-2000 shows that the negative sign of β_2 was significantly very weak. This was probably because regardless of its entry into NAFTA, Mexico was experiencing severe output falls from the 1994 currency shock during the examined period.[12] In the hopes of improving the result, the same data set was regressed again, excluding the years 1994 and 1995 when the country was most severely hit by the crisis. Indeed, R-squared improved and β_2 is now significantly negative. In the NAFTA regression, we added the intercept dummy and estimate equation (7) because the initial income level of Mexico was too low compared to the United States and Canada.[13] The magnitude of β_2 has increased from the near-zero of CUSFTA to almost 0.02 NAFTA. This may imply that consistent with the EU case, expansion of the FTA membership strengthens the convergence effect.

Mercosur was initially set up as an FTA in 1991 but transformed to a CU in 1995. Although Mercosur (CU) shows a negative and statistically significant β_2, that of Mercosur (FTA) is positive (see Table 3).

[Insert Table 3 here]

This means that the economic levels of member countries actually diverged. This unexpected result may be accounted for by two characteristics of Latin America. First, the economic situation of most of the countries was very unstable during the early

1990s. Even hyper-inflation was observed in some countries, including Brazil. This probably weakened the FTA convergence effect, or added econometric distortions into the estimation, making the Mercosur (FTA) data incomparable with the data of other FTAs. Second, Mercosur initially was not such an integrated FTA. Trade and economic cooperation between member countries was low. It was only when neighboring FTAs such as NAFTA started to pose economic competition that Mercosur strengthened its integration, thus the FTA effects of convergence appeared relatively late in Mercosur.

Finally, in the AFTA regression in Table 4, β_2 is negative but statistically not so significant.

[Insert Table 4]

This is probably because AFTA is not a strict FTA – it is the loosest of all FTAs examined.

It is interesting to note here that the sign of the coefficient of other variables such as OPEN raises a question. It shows a very volatile trend that is negative in some regressions and positive in others. This paper will leave this problem for further research.

4. Conclusion

According to conventional wisdom on economic growth, the economic levels of FTA member countries should converge. The regression result of this paper supports

this proposition with strong evidence. There is also evidence of accelerating convergence throughout all FTAs except Mercosur (FTA). In other words, there are income convergences among member countries in all cases of the formation of an FTA, the expansion of the FTA membership, or the deepening of the integration. Table 5 summarizes the regression results.

[Insert Table 5 here]

It is hoped that the results of this study will shed new light on this topic and lead to further studies. Naturally, there are many issues untouched. First, although the regression results provide evidence that FTAs do accelerate economic convergence, they do not tell us how this happens, besides possible larger elimination of tariffs by poorer members. For instance, increased technological diffusion or spillover effects, or increased trade between member countries would have improved productivity or increased the income levels of the poorer members. Second, there are yet more ways in which the regression results can be interpreted. One is to look at the composition of member countries: EU-6, EU-9 and CUSFTA are FTAs between generally rich countries while AFTA and Mercosur were between mostly developing countries. EU-11 and NAFTA were, on the other hand, composed of countries with significantly dissimilar income levels (for example, Spain and Portugal in EU-11; and the United States and Mexico in NAFTA). It is intuitive to suppose that FTAs between rich and poor countries would exhibit the strongest accelerated convergence, and although the hypothesis is supported by the EU-11 and NAFTA (excl. 94, 95) analysis results, we obviously need more data for a concrete conclusion. Another way to analyze the regression result is to

look at the intensity of FTAs. The EU was the strictest FTA of all and AFTA the loosest, probably with NAFTA and Mercosur in the middle of the spectrum. It should be interesting to see whether and in what ways the intensity of FTAs influences the rate of convergence.

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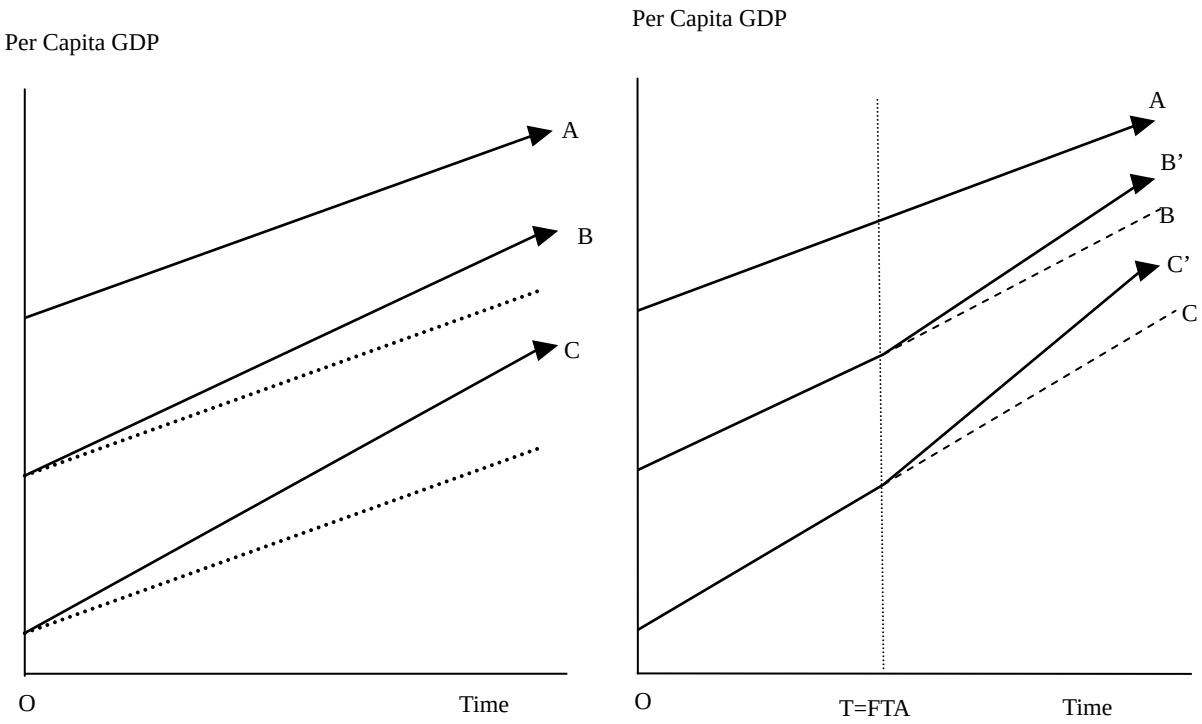
<Figure 1> Global and Accelerating Convergence



(a) Global Convergence β

(b) Accelerating Convergence β'

Table 1
EU

Dependent Variable: Log difference of per capita GDP

Variable	EU-6 (1951 - 1965)	EU-9 (1965 - 1980)	EU-12 (1977 - 1992)
C	0.0007	0.0001	-0.0004
	(1.06)	(0.51)	(-0.90)
ln y(t-1)	-0.763	-0.428	-0.641
	(-5.79)***	(-4.19)***	(-5.55)***
FTA * ln y(t-1)	-0.00012	-0.0003	-0.00012
	(-0.92)	(-2.38)**	(-2.87)***
GOV	0.0016	-0.0028	-0.00023
	(2.74)***	(-1.42)	(-1.44)
INV	-0.00148	-0.00061	-0.00042
	(-3.59)***	(-3.36)***	(-3.43)***
OPEN	-0.0002	-0.00033	0.0003
	(-1.44)	(-0.53)	(0.24)
Y/L	0.7332	0.4397	0.6179
	(5.48)***	(4.35)***	(5.57)***
Obs	60	104	130

Note: ***, **, and * denote that coefficients are significant at 1%, 5% and 10% levels, respectively.

Table 2
NAFTA

Dependent Variable: Log difference of per capita GDP

Variable	CUSFTA (1979 - 1999)	NAFTA (1989 - 2000)	NAFTA (1989 - 2000)*
C	0.0039	0.0019	0.0025
	(3.54)***	(1.43)	(0.56)
ln y(t-1)	-0.265	-0.4274	-0.6992
	(-2.05)**	(-2.81)***	(-6.88)***
FTA * ln y(t-1)	-0.00029	-0.00012	-0.00048
	(-1.64)	(-0.77)	(-2.00)**
GOV	-0.00117	-0.005	0.00031
	(-0.61)	(-2.10)**	(0.81)
INV	0.00014	0.00066	-0.00043
	(0.24)	(1.09)	(-1.32)
OPEN	-0.00085	-0.00067	-0.00017
	(-2.19)**	(-1.31)	(-0.58)
Y/L	0.2278	0.3079	0.6798
	(2.14)**	(1.89)*	(7.17)***
Obs	36	27	69

Note: * excluding 1994 and 1995.

Table 3
MERCOSUR

Dependent Variable: Log difference of per capita GDP

Variable	MERCOSUR (FTA) (1982 - 2000)	MERCOSUR (CU) (1989 - 2000)
C	0.0009	0.0136
	(0.49)	(2.22)**
ln y(t-1)	-0.4722	-0.6236
	(-3.34)***	(-2.33)**
FTA * ln y(t-1)	0.00266	-0.0011
	(0.92)	(-2.50)***
GOV	0.00197	0.00558
	(1.00)	(1.59)
INV	0.0052	0.0095
	(1.95)*	(1.36)
OPEN	0.0023	0.002
	(3.94)***	(2.58)***
Y/L	0.3678	0.3712
	(3.26)***	(2.00)**
Obs	64	36

Table 4
AFTA

Dependent Variable: Log difference of per capita GDP	
Variable	AFTA (1986 - 2000)
C	0.0015 (0,68)
ln y(t-1)	-0.0315 (-2.17)**
FTA * ln y(t-1)	-0.0018 (-1.63)
GOV	-0.0029 (-0.58)
INV	-0.0018 (-1.76)*
OPEN	0.0005 (1.36)
Y/L	0.1175 (0.89)
Obs	56

Table 5

Summary of Regression Results

FTAs	Accelerating Convergence
EU-6	Weak evidence
EU-9	Strong evidence
EU-11	Strong evidence
CUSFTA	Moderate evidence
NAFTA	Weak evidence
NAFTA (excl. 94, 95)	Strong evidence
Mercosur (FTA)	No evidence (Weak diverge)
Mercosur (CU)	Strong evidence
AFTA	Moderate evidence

Notes

[1] This is also called “regression to the mean” or simply “catching up.”
[2] The proof is in Sala-i-Martin (1994), pp. 6-7.
[3] A detailed account is set out in Barro and Sala-i-Martin (1995).
[4] The productivity of labor is calculated by dividing real GDP by the labor force.
[5] The equation for openness is (total export + total import)/real GDP.
[6]. Barro and Sala-i-Martin reasoned that the data on physical stock depends on the arbitrary assumptions on depreciation and inaccurate measures of benchmark stocks and investment flows.
[7] See Casselli, Esquivel and Lefort (1996) for details.
[8] See Hsiao (1986) and Arellano and Bond (1991) for more detail.
[9] Unlike FTAs, in Cus, the tariff rate on trade with non-member countries is common in all member countries. In short, the CU is a more integrated or strengthened version of an FTA.
[10] EU-6 is an example of the launch case, EU-9, EU-11 and NAFTA are examples of the expansion case and the transformation of Mercosur from an FTA into a CU is the example of the deepening case.
[11] The levels of GDP per capita of Spain and Portugal in 1992 were US$14,100 and US$12,721 respectively, compared to, say, $US29,193 in Luxembourg. (Source: PWT 6.0)
[12] The growth rate of Mexico in 1995 was -8.8%. (Source: PWT 6.0)
[13] The level of GDP per capita of Mexico in 1998 was US$7,791, compared to US$30,047 in the US. (Source: PWT 6.0).