FTAs and Income Convergence

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Abstract

The purpose of this paper is to analyze whether FTAs cause the income levels of member economies to converge or diverge. Although previous studies predicted the possibility of convergence among FTA members to a certain degree, they failed to provide definitive evidence. By using the concept of *accelerating convergence*, this study aims to estimate the pure convergence effects of FTAs separate from the conventional notion of income convergence, so-called β-convergence. The neoclassical model of economic growth has been extended to incorporate varying steady states for an open economy framework. Applying the system GMM method to a dynamic panel of data consisting of major FTAs - including the European Union, NAFTA, Mercosur, and AFTA, and encompassing the cases of launching an FTA, expanding membership, or deepening FTA integration - we find considerable evidence for the income convergence effect of FTAs.

Key words: FTA, income convergence, β-convergence, GMM

JEL Classification: F11, F15

1. Introduction

The rapid expansion of free trade agreements (FTAs) has been one of the recent phenomenal developments in the world economy. As FTAs are thought to be critical for the economic benefits of a country, virtually all countries are now engaging in at least one FTA.[1] Many governments and economists, therefore, are interested in examining what effects FTAs might have on the economic growth of member countries.

Most existing FTA research paid attention mainly to the distinction between the effects of trade creation and trade diversion of free trade, or to their welfare implications. However, during the late 1980s and early 1990s, when the Uruguay Round was being negotiated for further multilateral freer trade and, at the same time, when the US-Canada FTA, Mercosur, and the ASEAN FTA were just beginning, research became concerned with a more realistic question of how FTAs affect the income levels of member countries.

Two core questions are raised in this regard. One is related to the question of whether FTAs enhance the economic growth of all member countries or of just a subset of members. The answer to this question is straightforward according to trade theory: Free trade is to engender mutual gains to all parties involved, therefore it is natural to conjecture that all countries grow together. A number of empirical evidence also supports this conjecture.[2] The other is whether the income levels of member countries are converging or diverging due to FTAs. Trade theories offer ambiguous answers depending on the underlying growth model: income levels may converge in a neo-classical growth model, but not necessarily in an endogenous growth model. Empirical research also provides ambiguous results: While most previous studies have shown the possibility of income convergence in closed economy models, Ben-David and Kimhi (2004) and Slaughter (2001) recently show convergence and divergence, respectively, in open economy models. As such, the question remains open to further empirical investigations.

The lack of definitive evidence of whether FTAs cause the income levels of member countries to converge or diverge creates doubts from both developing countries and the world economy. Developing countries are concerned about whether poor countries grow faster than rich ones or whether rich countries become even richer from FTAs. This concern is particularly pertinent, as recently FTA membership has been diversifying from mere north and north to north and south groupings. If developing countries experience relatively lower growth than rich ones, they may face strong domestic protest and may not be able to join any FTAs. This will change the future direction of FTAs of the world as well. If divergent, the growth potential of the world economy will be damaged. The widening income dispersion will eventually slow the current surge toward FTAs, thereby reducing the current rapid liberalization of regional and global trade.

Despite the remarkable proliferation of FTAs in reality, studies that try to identify the relationship between FTAs and the income levels of member countries are lagging far behind. This gap is a significant shortcoming because many governments are currently dealing with many policy questions related to FTAs; for example, does an expansion of membership of or a deepening of integration of an FTA cause the income levels of member countries to converge or diverge? To what extent can the formation of an FTA affect the convergence or divergence of member countries' income levels? The purpose of this paper is to fill the gap.

This paper investigates the so-called convergence hypothesis – namely, poor countries grow faster than rich countries – not in trade liberalization or freer trade, but specifically in FTAs. In doing so, we need to distinguish the income convergence that results from FTAs that we call *accelerating convergence* from the conventional convergence hypothesis, *β-convergence*, that occurs globally due to diminishing marginal returns in neoclassical growth models.[3] We also need to employ an open economy model for FTAs in which the steady state varies due to the international flows of trade and investment across countries.

The paper is organized as follows. In next section, we review existing literature on convergence. This section also explains how income convergence is dealt with in open economy models. In section 3, we explain a new way to measure convergence in FTAs. For this, distinctions are made for the nature of FTAs from the trade liberalization or freer trade in theory. In section 4, we try the empirics of eight cases of FTAs – three cases of the European Union, two cases each for NAFTA and Mercosur, and one case of AFTA – for the tests of accelerating convergence. The model, data, and empirical results are discussed in this section. Section 5 concludes the paper.

2. Review of Theory and Empirical Studies

2.1. Convergence in the Neoclassical Growth Model

Barro (1991) and Barro and Sala-i-Martin (1991, 1992) introduced the notion of convergence, *β-convergence*, in a growth equation derived as a log-linear approximation from the transition path of the neoclassical growth model for a closed economy. In the equation they showed the growth rate of income is negatively related to the initial income levels of countries.

The transitional dynamics of per capita income around the steady state of the closed economy is:

(1) $$\log y_t = e^{-\beta t} \cdot \log y_0 + (1 - e^{-\beta t}) \cdot \log y^*,$$

where the income level at time *t*, y_t, is a weighted average of the initial income level, y_0, and the steady-state income level, y^*, with the weight that contains an exponent of β, with β > 0. The equation shows that future income is related to initial income, steady state income, and β of the economy. The parameter β is to measure the speed of convergence to the steady state and its value depends on the technology and preferences of the economy.

From equation (1), the average growth rate of per capita income over an interval *T* is approximated by:

(2) $$(1/T) \cdot \log(y_{it} / y_{i,t-T}) = x_i^* + (1 - e^{-\beta T}) / T \cdot \log(y_i^* / y_{i,t-T}),$$

where the average growth rate of per capita income of country *i* during the period from *t-T* to *t*, that is the left side of equation, depends on the ratio, $y_i^* / y_{i,t-T}$, in addition to the steady state growth rate of the economy, x_i^*. In the neoclassical growth model, all countries are supposed to have the same steady state growth path, although it still allows for different levels of per capita incomes depending on the characteristics of each country.[4] Thus, for a given x_i^* and y_i^*, the income growth rate is higher, the lower the initial income level of the economy, $y_{i,t-T}$, that was y_0 in equation (1). This relationship represents exactly what is meant by convergence, that is *β-convergence*, in literature, namely that poor countries grow faster than rich ones, or that the income gap between the rich and poor countries narrows.[5]

This proposition is a direct outcome of the underlying hypothesis - namely, the diminishing marginal productivity of capital - of the growth model. The reason is simple: Rich countries are meant to be more capital abundant. As capital accumulates, capital productivity falls to make further capital accumulation less productive. Thus the growth rate of per capita income slows down as countries become richer.

Applying equation (2) to discrete time and including random disturbances, Barro and Sala-i-Martin (1991, 1992) again provide the following equation for empirical tests:

(3) $$(1/T)\cdot\log(y_{it}/y_{i,t-T}) = a_i - \beta_1 \log y_{i,t-T} + u_{it},$$

where $a_i = x_i^* + (1-e^{-\beta T})/T \cdot \log y_i^*$ *and* $\beta_1 = (1-e^{-\beta T})/T$.

The equation is linear with respect to a_i and the log of initial income level, $\log y_{i,t-T}$, but the estimation coefficient β_1 remains non-linear in β and T. When conditioning variables for a_i, such as population growth rate, savings rate, and so forth, of each country, are included in the estimation, the coefficient β_1 reflects the so-called *conditional* β-convergence rate; on the other hand, if a_i becomes a fixed value a that implies all countries have a same steady state growth path, x^* and y^*, the coefficient β_1 measures an *absolute* convergence rate. Conditioning variables become of significance in empirical research, as it is to delineate any idiosyncratic difference in the income growth rates of countries in measuring β-convergence rate.

2.2. Empirical Studies of β-Convergence

The convergence hypothesis found strong empirical support. Barro and Sala-i-Martin (1991) showed evidence of convergence. Using data for 47 US states from 1880 to 1988, they showed that the per capita income and product in poor states tended to grow faster than in rich states. They extended their empirical tests to 73 regions of Western Europe since 1950, and found the process of convergence within European countries to be similar in many respects to that of the United States. Barro (1991) also provided evidence of convergence from the empirics of 98 countries for the period 1960–1985. He found that the growth rate of real per capita GDP was negatively related to the initial level of real per capita GDP. Thus the empirical results showed β-convergence such that the poor countries tended to grow faster than the rich countries. Mankiw, Romer and Weil (1992) showed the evidence that indicated that, holding population growth and capital accumulation constant, countries converge at about the rate their model predicts. Later, Sala-i-Martin (1996) also confirmed the fact that the income levels of the US states and the prefectures in Japan have indeed converged. At the country level, the per capita GDP of selected countries, such as the US, Canada, Australia, Japan, and some European Union countries are also shown to converge.

However, Barro and Sala-i-Martin (1992) extended their own previous works and found again clear evidence of convergence in 48 US states, but very weak evidence of β-convergence across countries. They found evidence of β-convergence only in a limited case from a sample of 98 countries from 1960 to 1985. They noticed that cross-country convergence results would be similar if they held constant a set of variables that proxy for differences in steady state characteristics. Thus they concluded that only the standard neoclassical growth model with exogenous technological progress and a closed economy could predict β-convergence.

The evidence of β-convergence has been further questioned in subsequent works. Bernard and Jones (1996) provided some evidence that cross-country productivity levels had been either not converging or actually diverging. Easterly and Levine (2001) pointed out a divergence in the absolute levels of per capita income across countries: the rich have grown richer, and some of the poorest countries have become even poorer.

2.3. Trade Liberalization and Income Convergence

Since the initial works by Barro and Sala-i-Martin, convergence research has been directed toward three fronts: one is the debate on the effectiveness of the neoclassical model as opposed to the endogenous growth model.[6] The other was to measure the speed of adjustment, β, more precisely.[7] The last, but not least, was to incorporate trade into the growth model so as to answer the question, "Does trade liberalization cause per capita income convergence across countries?"

Slaughter (1997) gave the criticism that the previous evidence of β-convergence occurred only within a closed economy framework and most research analyzing cross-country income convergence has totally ignored international trade. Indeed, most papers analyze convergence either in a neoclassical growth or in an endogenous growth framework in which countries are independent. There are no international linkages that could contribute to the convergence process.

Empirical evidence for trade liberalization and income convergence is mixed. Ben-David (1993) found a reduction in the dispersion of per capita income among liberalizing countries during several episodes of trade liberalization in the European Community. Sachs and Warner (1995) divided countries into two groups: open and closed trade regime countries. They found evidence of convergence within the open group, but not within the closed trade regime. The finding implies that trade leads to income convergence across countries. Similar results were also found in Ben-David (1996). Grouping countries according to their major trading partners tended to display a significant per capita income convergence within the group, compared to different groupings. Recently Ben-David and Kimhi (2004) showed that increased trade, particularly exports, from poorer countries to the rich ones raises the speed of the income convergence. The common conclusion of all those studies is that increased trade volumes arising from a freer trade regime caused income convergence.

Slaughter (2001), however, found opposite results. Utilizing the difference-in-differences method, he compared the convergence patterns of the liberalizing countries before and after liberalization with the convergence pattern of control countries before and after liberalization. If trade liberalization causes convergence, then the movement to freer trade should *accelerate* convergence relative to what the rate would be absent liberalization. The empirical results showed no strong, systematic link between trade liberalization and convergence. In fact he rather found trade liberalization diverges incomes among liberalizers.

All these results, however, cannot be directly compared to the various results on β-convergence, as shown in the previous section 2.2. In fact, both Ben-David and Slaughter used an alternative definition of convergence, known as σ-convergence, which describes the phenomenon in which the dispersion of real per capita income across countries tends to fall over time. On the other hand, all other previous papers, including Barro and Sala-i-Martin, used β-convergence, which describes the case where the per capita incomes of poor countries grow faster than those of rich countries. Barro and Sala-i-Martin (1991, 1992) show that although the two convergences are closely related each other β-convergence need not imply σ-convergence.

3. Income Convergence in FTAs

3.1. Towards a New Measure of Convergence in FTAs

Do FTAs cause income convergence among member countries? To answer the question, distinguishing the *pure* FTA effects of income convergence from the β-convergence effects of income convergence remains of critical importance. Income convergence may come either from FTAs, as a form of trade liberalization, or simply from β-convergence, or from a combination of the two. Most previous studies failed to single out the pure FTA effect on income convergence from β-convergence in that they did not carefully identify the two different convergences. To make the argument clear, consider Figure 1.[8]

[Insert Figure 1 here]

In Figure 1(a), the solid lines show the hypothetical movement of the per capita income of countries *A*, *B*, and *C*. The intercepts of the lines represent the initial income levels of the countries. Over time, the gap among three lines narrows, as the slopes of the lines are: slope *A* < slope *B* < slope *C*. Thus the growth rates of the countries are *A* < *B* < *C*. The figure depicts β-convergence: there is a negative relationship between the growth rate of per capita income and the initial level of income; or the per capita incomes of poorer countries tend to grow faster than the richer ones.[9]

On the other hand, Figure 1(b) depicts the convergence that arises from an FTA. Note the shifts in the solid lines of countries *B* and *C* at time *T* = *FTA* when the FTA is formed.[10] 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 accelerated, thus we call it *accelerating convergence*. Therefore, accelerating convergence extracts the pure convergence effect of the FTA separate from the conventional measure of income convergence, that is β-convergence. As a result, accelerating convergence could directly answer to the question of whether FTAs cause income convergence or not.

The estimation of accelerating convergence requires an empirical model in which international trade is incorporated into the growth equation. Many previous studies showed empirical evidence of income convergence, but their underlying estimation models treated trade liberalization rather exogenously. Ventura (1997), Slaughter (1997), and Ben-David and Loewy (1998) tried to develop an open economy model that addresses the link between trade and income convergence.

The core aspect of the model is to endogenize trade into the growth equation. The earlier assumptions on the steady state values, x_i^* and y_i^*, as in equations (2) and (3) are no longer fixed, but become varying over time. While they explored the theoretical foundation of the model, they seemed to fail in deriving empirical models that used β-convergence; as seen in the previous section, both Slaughter (2001) and Ben-David and Kimhi (2004) used σ-convergence instead of β-convergence.

3.2. Towards a New Empirics in FTAs

Real-world trade liberalization tends to differ from the typical treatment it receives in theory. As such, FTAs are different from free trade. In theory, FTAs are a synonym for free trade and treated as a one-time change in trade policy, but in reality FTAs are more important as a process. FTAs are different each other by their processes, although their goal of free trade among member countries remains same.

The GATT formally allows FTAs for major deviations from the most-favored-nation (MFN) principle. The GATT, however, mandates that the countries involved should abide by the implementing rules for tariff elimination. According to the tradition of the GATT, member countries are subject to total tariff elimination for substantially all trade, usually within a 10-year period.[11]

The 10-year continuous reduction of tariffs engenders two different perspectives for the measure of convergence, specifically for *accelerating convergence*: One is that the model needs to address the long-run growth implications of trade liberalization by endogenizing the steady-state impact of the 10 years of continued tariff reductions. Therefore, convergence should be examined for whole time period or at least at multiple points in time rather than just at a single point. In short, it means the model needs to incorporate varying steady state growth paths for the countries.

The other is that, for the measure of the effect of FTAs, a 10-year time span would be most appropriate for empirical tests: FTAs may have lagging effects beyond 10 years, but it is natural to assume the FTAs effects will be exhausted by that point. An extension of time span beyond the 10 years may involve other convergence factors, thereby contaminating the measure of accelerating convergence. Thus, in empirical tests, having two equal-length time periods for the pre-FTA regime and the post-FTA regime is desirable. The symmetric 10-year time periods for both pre-FTA and post-FTA may eliminate a number of unnecessary econometric complications.

4. Analysis of Income Convergence

4.1. The Model

Making use of the initial works of Barro and Sala-i-Martin and following the spirit of existing works on the empirics of income convergence literature, we begin with a basic specification, which is equal to equation (3):

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

where $\dot{y}_{it}$ is the log difference of the per capita income of country *i* at time *t*, y_{it-1} is the income of country *i* in the previous period, *t-1*, and X_{it} is the vector of conditioning variables. u_i is an individual country fixed effect, η_t is a time effect, and ε_{it} is an error term.

This equation is a simple derivation from equation (3) with T=1. Nonetheless, it could serve as an open economy model with a varying steady state. The use of y_{it-1} as the initial income is to endogenize varying steady state growth rate, x^*_{it}, and varying steady state income level, y^*_{it} in an open economy. This set up of the model is a precise reflection of what we have discussed in the previous section: Namely, convergence should be examined for whole time series rather than just a single point, i.e., an average from initial year to end year.

The equation provides a big benefit as well. For example, in extreme case of 'leapfrogging' where income reversal occurs as a poor country become richer, the model properly deals with the situation by flipping the countries according to their new income levels. For a 20-year time period of empirical research (10 years each for pre- and post-FTA situations), using conventional models with the initial value, y_0, and simply assuming no leapfrogging do not properly reflect reality. The model can also avoid well known errors-in-variable problem, particularly which is contained in the initial income level, y_0. Most of all, the model is dynamic in nature, dealing with full time series across all countries involved.

For the conditioning variable, X_{it}, we follow the tradition. We use the population growth rate, POP; the ratio of real gross domestic investment to real GDP, INV; the ratio of government expenditure to real GDP, GOV; and the openness of an economy, OPEN.[12] OPEN proxies for the country's exposure to international trade and investment, whereas INV proxies for the production factor input level or capital accumulation and GOV for the extent of government fiscal policy.

The coefficient β shows the rate of β-convergence. A negative value of β implies the presence of β-convergence and if it is positive, the income levels of countries are actually diverging.

To capture the effect of *accelerating convergence*, the dummy variable FTA is added in an interaction term as following:

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

For the dummy variable FTA, we first divide the sample into two groups, pre-FTA and post FTA, and then the dummy variable equals 1 if the FTA is formed in year *t* (if post-FTA) and 0 if not in year *t* (if pre-FTA).

The coefficient of the interaction term, β_2, measures accelerating convergence while β_1 measures conventional β-convergence. As in Figure 1, the rate of income convergence is β_1 in pre-FTA time, but it increases to ($\beta_1 + \beta_2$) in the post-FTA period. If the coefficient β_2 is statistically significant and negative in sign, there is evidence for the accelerating convergence effect.

In actual estimation of the equation, it is well known that in the growth context the initial level of income is usually correlated with the growth variable, thereby generating an endogeneity problem. The model is not an exception. Letting the initial income level be y_{it-1} and applying it over whole time period call for more careful empirics for the estimation. For the estimation of equation (3), Barro and Sala-i-Martin (1992, p.232) noted, "The full time series for y_{it} potentially provides more information about the coefficient β. For a smaller value of T, however, the error term in equation […] represents an average of shocks over a shorter interval. Therefore, the estimates become more sensitive to the specification of the error process. In particular, if there is serial persistence in the error term, then the correlation between the error term in time T […] and the initial income […] is likely to be negligible for large T but substantial for small T." As such, our model where T is the shortest, that is T=1, also suffer from an endogeneity problem.

Another problem in the estimation of the model is that this specification cannot control for unobserved country-specific effects. Because 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.[13]

A dynamic panel estimation method, known as the system GMM method, is well accepted for its capacity to control for both the endogeneity problem and the unobserved country-specific effects problem. As a result, the GMM method has been widely used in similar empirical studies and continues to be popular in research. Thus we are also following the method in the estimation.

As suggested by Arellano and Bond (1991) and Blundell and Bond (1998), the lagged endogeneity can be corrected for by first differentiating and using the second and third lags as instruments, and, at the same time, the issue of unobserved country specific effects can also be addressed by differentiating the data to eliminate the fixed effect, u_i.

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

Even though unobserved country fixed effects are eliminated by the first differentiation, a problem remains. Unless the idiosyncratic error follows a random walk, this specification generates transformed errors in a moving average structure that is correlated with the differenced lagged dependent variable. However, this problem can be solved again by using an instrument variable. Under the assumption of serially uncorrelated level residuals, values of Δy lagged two periods or more qualify as instruments in the first-differenced system. (Appendix shows the detailed application of GMM method). We estimate the equation with instrumental variables in the Generalized Method of Moments (GMM) context.

4.2. The Data

All data was obtained from the Penn World Tables (PWT version 6.1). PWT provides the most appropriate dataset available, because all its values, such as the level of GDP, were in constant US dollar terms. The data covers up to the year 2004. All regressions utilize 20 years of time span for estimations, 10 years before and after the time of FTAs. The only exception is the customs union case of Mercosur, for which 2005 data is not available.

The FTAs under analysis of this paper are the European Union, NAFTA, AFTA, and Mercosur. The EU is further divided into EU-6, EU-9, and EU-12 for a more detailed analysis. EEC (here we call it EU-6) was formed in 1958 by six founding member countries; the Netherlands, Luxembourg, Belgium, France, Italy, and Germany. Three countries, the United Kingdom, Denmark, and Ireland, were added to form EU-9 in 1973. Spain and Portugal then joined in 1985 to form EU-12: however, Greece, which joined the European Union in 1981, is excluded from our analysis. NAFTA was initially the Canada and US Free Trade Agreement (CUSFTA) in 1989, then Mexico joined to form NAFTA in 1994. AFTA, officially launched in 1992, but practically effective from 1994, is the loosest among all the FTAs examined in this study. Only five of the AFTA member countries—the Philippines, Malaysia, Indonesia, Thailand and Singapore—are examined in the analysis due to a lack of data for the smaller countries. Mercosur, consisting of Argentina, Brazil, Paraguay, and Uruguay, started as an FTA in 1991; it later developed into a customs union (CU) in 1995.

The above eight cases of FTAs consist of three different types: Launching, forming, or joining an FTA; expansion of membership of an FTA; and deepening of trade integration of an FTA. It is plausible to regard the degree of FTA effects on the accelerating factor as different depending on whether the FTAs are launched, expanded, or deepened. EU-6, CUSFTA, Mercosur, and AFTA are examples of FTA launches, EU-9, EU-12, and NAFTA are examples of expansion, and the transformation of Mercosur from an FTA into a CU is an example of the deepening of integration.

4.3. Estimation Results

The regression results for the FTAs are reported in tables 1 to 4. The Sagan tests of all regression result in satisfactory values: This means that there are no endogeneity or fixed effect problems in the GMM estimation. Most of all, all the estimations seem very robust and the results are quite compatible with other income convergence studies. The estimated coefficients of all eight regressions turn out to be very stable in their magnitudes. It is of surprise to see the robustness of estimated coefficient of each variable in such a diverse composition of member countries in terms of their stages of development, national income levels, and geographical differences.

Consistently throughout the regression in all eight cases of FTAs, the sign of the coefficient for the initial income level $\log(y_{t-1})$, β_1, is negative and very significant. This means that there exist strong β-convergences in all FTAs and in all three cases of launching, expansion, and deepening. In particular the coefficient β_1 ranges from 0.2 to 0.6, which is equivalent to 0.011 and 0.045 respectively in terms of the conventional measure of β-convergence.[14] Considering that the estimate of β by Barro and Sala-i-Martin (1991, 1992) and other research was about 0.02, our results more or less coincide with previous research. In addition, the coefficient for the population growth rate, POP, turns out to be fairly stable around 0.3, which was again found to be similar to the argument of Mankiw, Romer, and Weil (1992).

The regression results of the European Union in Table 1 show a negative $\beta_{2,}$ with particularly high significance for EU-9 and EU-12.

[Insert Table 1 here]

In other words, accelerated convergence was observed in the cases of European Union in its membership expansion to EU-9 and EU-12. Although the launch effect was rather weak, as implied by the weak significance of the estimate of β_2 in EU-6, the expansion effects seem to be very strong. An intercept dummy is added for the regression of membership expansion, EU-9 and EU-12, in order to capture the difference in their absolute levels of per capita incomes. The estimating equation for this particular case is:

$$(7)\quad \Delta \dot{y}_{it} = \gamma\ FTA + \beta_1 \Delta\ \ln y_{it-1} + \beta_2\ FTA * \Delta \ln y_{it-1} + \gamma\ \Delta X_{it} + \Delta u_{it}.$$

Note that the dummy variable is added to the equation as an intercept dummy, $\gamma\ FTA$. For example, 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.[15]

[Table 2 is here]

Table 2 shows the regression results of NAFTA. CUSFTA also shows weak evidence of accelerating convergence, that is a negative sign for coefficient for β_2 but with a weak significance. On the other hand, NAFTA exhibits moderate evidence of accelerating convergence.

NAFTA in the sample of 1984–2004 shows a very unstable regression result. The result would probably come from the fact that, regardless of its entry into NAFTA, Mexico experienced severe output falls due to the 1994 currency shock during the examining period.[16] For this reason, in the regression we excluded outliers, the years 1994 and 1995 during which the country was most severely hit by the crisis. In the NAFTA regression, we added the intercept dummy thus used estimate equation (7), because the initial income level of Mexico was quite low compared to the United States and Canada.[17] The coefficient β_2 becomes more significant in NAFTA than CUSFTA. This may indicate that, consistent with the EU case, expansion of FTA membership strengthens the accelerating convergence effect.

As in Table 3, Mercosur shows a similar result to NAFTA. While Mercosur-FTA shows weak evidence of accelerating convergence, Mercosur-CU exhibits otherwise strong convergence through a significant, negative coefficient for β_2.

[Insert Table 3 here]

The result implies that the deepening of integration, from Mercosur-FTA to Mercosur-CU, has expedited the speed of accelerating convergence of member countries. This result may be accounted for by two characteristics of Latin America. First, the economic situation of most of the Mercosur countries was very unstable during the early 1990s. This probably weakened the accelerating convergence effect of Mercosur-FTA, or added econometric distortions into the estimation, thereby making the Mercosur-FTA data less comparable with the data of other FTAs. Second, Mercosur was initially not such an integrated FTA. Trade and economic integration between member countries was rather loose. It was only when neighboring FTAs, such as NAFTA, started to pose competitive pressure or economic threat to the region. In response, Mercosur deepened its economic 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. Recognizing that AFTA has officially launched in 1992 but become practically effective from 1994, we tested for the time span of 1984-2004, instead of 1982-2002. Both time periods did not show any strong or moderate evidence of accelerating convergence. They only show the coefficient β_2 in a negative sign with weak statistical significance.

[Insert Table 4]

This result may reflect the fact that AFTA is not a strict FTA but a very loose economic cooperation body - it is the loosest of all FTAs examined in this study. Nonetheless AFTA also exhibits evidence of accelerating convergence, although it is not statistically significant.

Other variables also show rather robust results regardless of the FTAs. The population growth rate and investments significantly enhance the per capita income of the countries. The two variables have high *t*-values in all eight cases, indicating that the neoclassical growth model is appropriate for the measure of convergence as shown in Mankiw, Romer and Weil (1992). In addition, the significant β-convergences in all eight estimations with high *t*-values also confirms legitimacy of the neoclassical growth model in measuring our accelerating convergences.

It is interesting to see that trade openness does not contribute consistently in its magnitude, although it affects positively to the income growth of member countries in all FTAs. The effects are more or less strong in the cases of NAFTA, AFTA, CUSFTA and EU-9. Government expenditure has insignificant impacts in all cases. The signs of coefficient are ambiguous. This result is inconsistent with the findings of Barro (1991), which implies that government consumption introduces distortions, thereby retarding the income growth of countries.

[Insert Figure 2 here]

Figure 2 summarizes the characteristics and magnitudes of our *accelerating convergence*, coefficients β_2 for the FTAs. Although the number of cases is not enough, we may derive the following observations: One is that the expansion of membership lowers the rate of accelerating convergence, as in cases of EU-9, EU-12, and NAFTA. The other is that deepening of integration seems to increase the rate of accelerating convergence, as in the customs union case of Mercosur. Another is that new FTAs may not facilitate strong accelerating convergence from the beginning as expected. All launching cases - EU-6, CUSFTA, Mercosur as an FTA, and AFTA - show very weak accelerating convergence, although the sign of the coefficient β_2 remains right and in a negative.

5. Conclusion

The conclusion of this paper is straightforward: FTAs do indeed *cause* income convergence among member countries. As Table 5 shows, all FTAs exhibit evidence of accelerating convergence that measures the *pure* income convergence effect of FTAs, separate from the conventional notion of income convergence, known as β-convergence. The accelerating convergence was found in all eight cases, regardless of the nature of FTAs, namely launching, expanding or deepening of the FTAs.

[Insert Table 5 here]

The conventional β-convergence is also confirmed in all FTAs. The estimated coefficients on β-convergence remain highly significant in all eight cases of estimation. The coefficients turn out to be very stable across the FTAs and their magnitudes are comparable with other research results. It is of surprise to see the robustness of estimation results in such a diverse composition of member countries in terms of their stages of development, national income levels, and geographical distances.

The estimation model generates comparable results for conditioning variables as well. The population growth rate and investments significantly enhance the per capita income of the member countries. The two variables have high *t*-values in all eight cases, indicating that our model that is a version of an open economy with implicitly varying steady state is appropriate for the measure of convergence. Moreover, the significant β-convergences in all eight estimations with high *t*-values also confirms legitimacy of the estimation model. The results are well comparable with the previous results derived from the Barro and Sala-i-Martin or other version of the neoclassical growth model.

The findings of this paper could provide some policy suggestions to the prospective FTAs. For example, we may draw policy implications for an East Asian FTA that is yet to realize; an East Asian FTA will be better if it does not expand membership in a short period of time; the deepening of integration will be of need; and initially the convergence effect of the FTA will be smaller than expected. All these observations, of course, demand further in-depth studies.

Naturally, there are many issues that have not been touched in the paper. Most of all, this study does not explain how the accelerating convergence happens. One possible argument would be that developing countries are more likely to eliminate higher tariffs rates than developed countries, thereby having a larger efficiency gain. The efficiency gain engenders the accelerating convergence; poor countries grow faster in FTAs. Apart from this intuition, we do not have much knowledge for the precise mechanism of the convergence. It is hoped that the results of this study shed renewed light on this topic and lead to further investigation.

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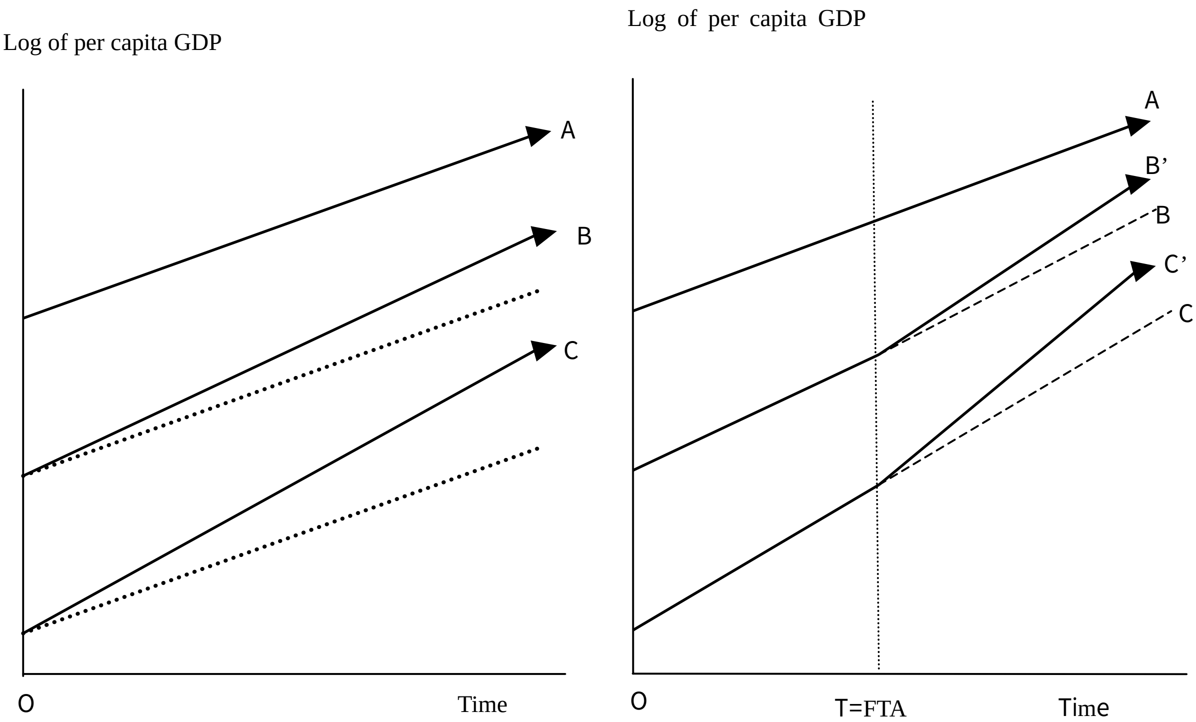
<Figure 1> β-Convergence and Accelerating Convergence



(a) β-Convergence (b) Accelerating Convergence

<Figure 2> Trends of Accelerating Convergence

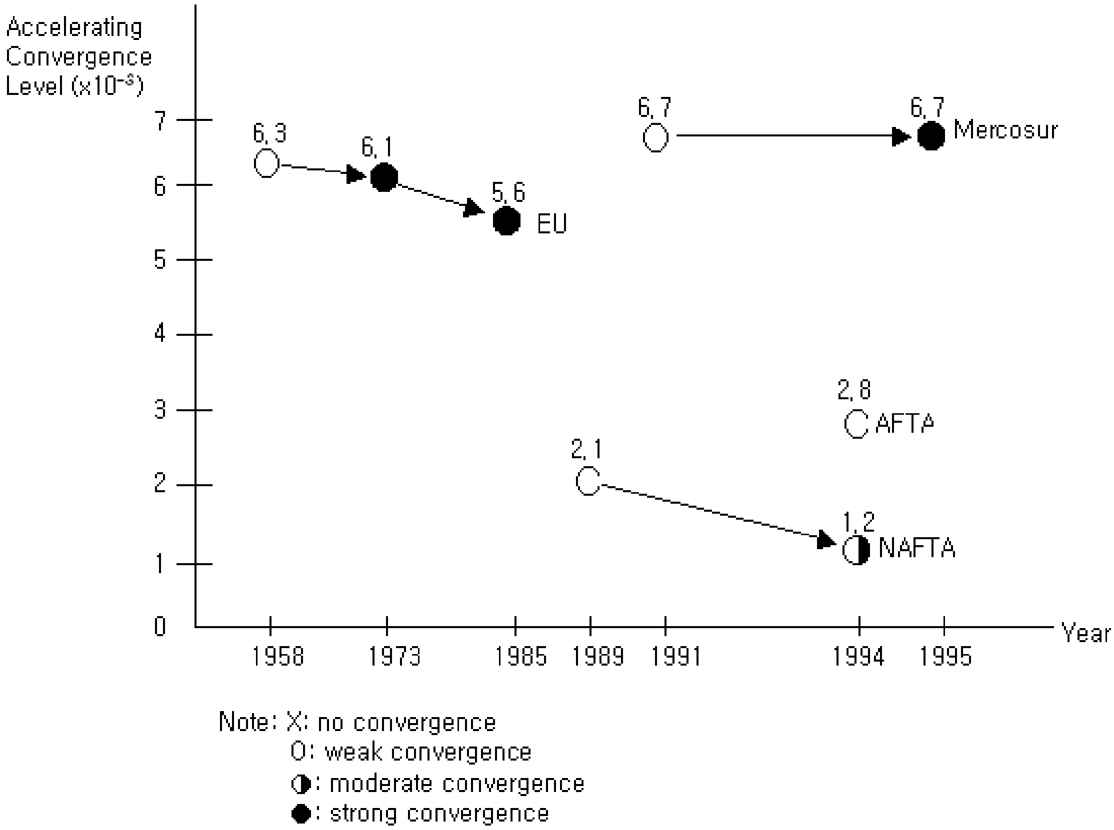


Table 1
European Union

Dependent Variables: Growth Rates of Per Capita GDP

Variable	EU-6 (1948–1968)	EU-9 (1963–1983)	EU-12 (1975–1995)
ln y(t-1)	-0.436	-0.301	-0.202
	(-4.15)***	(-2.65)***	(-2.89)**
FTA * ln y(t-1)	-0.0063	-0.0061	-0.0056
	(-0.79)	(-2.42)***	(-2.08)***
POP	0.309	0.348	0.283
	(2.65)***	(2.29)***	(2.70)***
INV	0.014	0.055	0.029
	(2.41)***	(1.65)*	(4.94)***
GOV	0.109	0.039	-0.0056
	(1.21)	(0.11)	(-0.01)
OPEN	0.132	0.067	0.04
	(0.75)	(1.99)*	(1.08)
m1	-1.78	-1.89	-1.91
m2	-0.61	-0.49	-0.45
Sargan test	34.85 (0.54)	35.38 (0.59)	37.21 (0.59)
Obs	96	158	201

Note: (1) ***, **, and * denote that the coefficients are significant at the 1 percent, 5 percent and 10 percent levels, respectively
(2) m1 and m2 are tests for first-order and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0,1) under the null of no serial correlation.
(3) Sagan is a test of the over-identifying restrictions, asymptotically distributed as under the null of instrument validity.
(4) EU-9 and EU-12 included an intercept dummy as in equation (7).

Table 2
NAFTA

Dependent Variables: Growth Rates of Per Capita GDP

Variable	CUSFTA (1979–1999)	NAFTA (1984–2004)
ln y(t-1)	-0.309	-0.442
	(-2.65)***	(-4.25)***
FTA * ln y(t-1)	-0.0021	-0.0012
	(-0.48)	(-1.93)*
POP	0.3088	0.321
	(2.42)**	(3.15)***
INV	0.0311	0.037
	(0.89)	(1.69)*
GOV	0.0071	-0.0058
	(1.89)*	(-0.55)
OPEN	0.039	0.0805
	(2.42)*	(2.12)**
m1	-1.13	-1.17
m2	-0.59	-0.77
Sargan test	21.67 (0.68)	21.65 (0.62)
Obs.	39	51

Note: (1) NAFTA excludes 1994 and 1995.
(2) NAFTA included an intercept dummy as in equation (7)
(3) For others see notes for table 1.

Table 3
Mercosur

Dependent Variables: Growth Rates of Per Capita GDP

Variable	Mercosur-FTA (1981–2001)	Mercosur-CU (1986–2004)
ln y(t-1)	-0.516	-0.591
	(-3.21)***	(-2.94)***
FTA * ln y(t-1)	-0.0067	-0.0067
	(-0.28)	(-2.21)***
POP	0.35	0.428
	(3.32)***	(5.34)***
INV	0.023	0.021
	(2.00)**	(2.76)***
GOV	0.0024	0.0018
	(0.11)	(0.01)
OPEN	0.018	0.035
	(0.10)	(0.70)
m1	-1.62	-1.62
m2	-0.53	-0.58
Sargan test	33.18 (0.87)	32.19 (0.67)
Obs	82	73

Note: (1) The time span for Mercosur-CU is 1986-2004 because of unavailable 2005 data.
(2) For others, see notes for table 1.

Table 4
AFTA

Dependent Variables: Growth Rates of Per Capita GDP	
Variable	AFTA (1984–2004)
ln y(t-1)	-0.295
	(-2.98)***
FTA * ln y(t-1)	-0.0028
	(-0.93)
POP	0.338
	(3.17)***
INV	0.059
	(2.34)***
GOV	-0.0072
	(-0.38)
OPEN	0.0023
	(2.44)***
m1	-1.71
m2	-0.6
Sargan test	29.83 (0.54)
Obs	86

Note: See notes for table 1.

Table 5

Summary of Regression Results

FTAs	Accelerating Convergence
EU-6	Weak convergence
EU-9	Strong convergence
EU-12	Strong convergence
CUSFTA	Weak convergence
NAFTA	Moderate convergence
Mercosur-FTA	Weak convergence
Mercosur-CU	Strong convergence
AFTA	Weak convergence

Notes

[1] The contents of free trade agreements (FTAs) vary widely, although all FTAs aim for 'free trade' by eliminating trade barriers, such as tariffs, quotas, and non-tariff barriers, between members. In recent years, many FTAs have gone beyond the traditional notion of FTAs so as to cover the liberalization of services, investment, and intellectual property rights, or even the harmonization of domestic regulations. Conventional distinctions among free trade area, customs unions, or common markets are becoming less clear. We use the term FTA to represent all of these free trading arrangements.

[2] In recent years, however, Rodriguez and Rodlik (2001) and Baldwin (2003) denied any robust relationship that freer trade enhances economic growth of countries. See Sohn and Lee (2003) for a reference.

[3] The β-convergence is also found in an endogenous growth model when technology-imitating cost of developing countries is cheaper than technology-innovating cost of advanced countries.

[4] For details, see Barro and Sala-i-Martin (1992) and Mankiw, Romer, and Weil (1992).

[5] The initial income level, y_0, affects the income growth rate of the economy, conditioned through the steady-state income level, y*. Thus, countries that are below the steady-state level of income should grow faster, and conversely, countries that are above the steady-state level should grow slower, so as to approach the same steady state. For this reason, the equation is said to predict a *conditional* convergence rather than an *absolute* convergence.

[6] However, Mankiw, Romer, and Weil (1992) experimented with the neoclassical growth model and concluded that the original Solow model, if suitably extended, is enough to explain cross-country differences in growth rates and income convergence. The result made the debate of less significance.

[7] Barro and Sala-i -Martin (1991, 1992) derived the value of β around 0.02 (2 percent) and it became a benchmark in later research that tried to find the true value of β.

[8] The figure was first introduced in Sohn (2002).

[9] Barro and Sala-i-Martin (1991, p.124, Figure 5) presented nearly a same figure for the trend of personal income of four US regions during 1880–1988.

[10] Naturally, line *A* also shifts to the upward, but we keep the line straight to highlight the relative size of shifts of *B* and *C* to *A*.

[11] In GATT 1994 Article XXIV, the possibility of regional trading agreements is delineated. The article says that a group of countries may form a free trade area or customs union provided it adheres to three conditions. First, trade barriers against non-members should not be more restrictive than before. Second, they should remove trade barriers in substantially all trade. Finally, subsequent progress toward trade integration should be expeditious: The length of time for the elimination of tariffs on substantially all trade should not to exceed 10 years.

[12] The equation for openness is (total exports + total imports) / real GDP.

[13] See Casselli, Esquivel, and Lefort (1996) for details.

[14] They are calculated from comparing the coefficients in our estimation equation (4) with equation (3).

[15] The levels of GDP per capita of Spain and Portugal in 1985 when they joined EU were US$8,513 and US$6,473 respectively, compared to, say, US$14,283 in Luxembourg. (Source: PWT 6.1)

[16] The growth rate of Mexico in 1995 was -8.8 percent. (Source: PWT 6.1)

[17] The level of GDP per capita of Mexico in 1994 when participated in NAFTA was US$7,572, compared to US$26,834 in the United States. (Source: PWT 6.1).

[18] This implies the following moment conditions:

$E[y_{it}\Delta u_{it}] = 0 \quad for\ t = 3,...,T$. (1)

But a GMM estimation based on (1) alone can be highly inefficient. In most cases, it is necessary to make use of the explanatory variables as additional instruments. Here the issue of endogeneity due to reverse causality becomes critical. For strictly exogenous explanatory variables both past and future ΔX are valid instruments: $E[\Delta X_{it-s}\Delta u_{it}] = 0 \quad for\ t = 3,...,T$ and all s. (2)

But using (2) for $s < 2$ will lead to inconsistent estimates if reverse causality exists in the sense that $E[X_{ir}v_{it}] \neq 0$ for $r \geq t$. To allow for this possibility, one may assume X to be weakly exogenous, i.e., $E[X_{is}v_{it}] = 0$ for $s < t$, which implies the following subset of (2):

$E[\Delta X_{it-s}\Delta u_{it}] = 0 \quad t = 3,...,T$ and $s \geq 2$. (3)

Equations (1)–(3) imply a set of linear moment conditions to which the standard GMM methodology applies. The consistency of the GMM estimator hinges on the validity of these moment conditions, which in turn depends on maintained hypotheses on the level residuals being serially uncorrelated and the exogeneity of the explanatory variables. It is therefore essential to ensure that these assumptions are justified by conducting specification tests (Arellano and Bond 1991).