

**A Dynamic Analysis of Economic Liberalizations and
Income Convergence in East Asia:
A Difference-in-Differences Approach***

Seyed Komail Tayebi**

This paper examines how economic liberalizations cause per capita income convergence across East Asian countries. It relies on the fact that most countries in the region are well-known in making attempts toward liberalizing strategies over the recent decades. The analysis focuses on before and after Asian liberalizations, which realized mostly in 1980s and 1990s. The paper examines how pre- and post-liberalizations in the region affect the rate of income convergence. To explore these changes, this study relies on a dynamic analysis and uses a 'difference-in-differences' (DID) approach which compares the convergence rates among the liberalizing and non-liberalizing countries before and after liberalizations.

Using annual time-series data over 1970-2005 for all countries around the world, including East Asian countries, from the *Penn World Tables*, we obtain reliable results, which are quite supportive of a positive relationship between trade and financial liberalizations and income convergence. In fact, much of the evidence suggests that such liberalizations converge incomes among the countries. These results also suggest certain directions that further research might take in order to shed more light on this important issue.

JEL Classification: C23, C52, F15, F36

Keywords: income convergence, economic liberalizations, East Asia,
difference-in-differences (DID) approach

* Received July 1, 2008. Accepted June 10, 2009.

** Associate Professor of International Economics, Department of Economics, University of Isfahan, Iran, E-mail: komail@econ.ui.ac.ir, komail38@yahoo.com

1. INTRODUCTION

Do economic liberalizations in East Asia cause per capita income convergence across countries? This paper offers empirical evidence on this question based on a specific dynamic analysis. To identify the effect of economic liberalization (either trade or capital) on the world income dispersion, we use a ‘difference in differences’ (DID) methodology which compares the convergence pattern among all the liberalizing countries before and after a liberalization with the convergence pattern among control countries (non-liberalizing ones) before and after the liberalization. In each case we identify the liberalizing countries’ role as the estimated difference in differences of convergence rates pre- and post-liberalization between the two groups of countries: those are East Asian countries and those are not.

As Slaughter (2001) discusses, the few existing empirical studies focusing on trade and income convergence attempt to identify trade’s effect mainly through a single comparison of two groups of countries. All these studies argue that their single comparisons may or may not support the hypothesis that economic liberalization (e.g., trade liberalization) converges incomes. The difference-in-differences approach is explicitly designed to overcome the potential ambiguities of the single-difference studies.

The rest of the paper is organized as follows. Next section provides a conceptual discussion on financial liberalization, while section 3 discusses the relationship between trade and convergence. Section 4 explains the method that we use to test for convergence, namely based on the approach of difference-in-differences. It firstly reviews the concept of DID, and then specifies a theoretical framework to analyze dynamically the relationship between income convergence and the WTO membership. Our empirical results are summarized and discussed in section 5, and the last section provides the research conclusion.

2. A CONCEPTUAL DISCUSSION ON FINANCIAL LIBERALIZATION

The determinants of capital flows are manifold, ranging from business-cycle fluctuations and volatile fiscal policies to long-term growth (Lueth, 2008). When countries liberalize their capital markets, the costs of capital to industrial firms are reduced. As shown by Henry (2003), this effect is theoretically based on two mechanisms. First, investors can improve the diversification of their assets after liberalization by investing in other countries, which thereby lowers their required risk premium on the stock of national firms. This effect works through the standard observation that the returns volatility on a national market is higher than the covariance between the national and world returns. Second, firms can after liberalization attain funding at the lowest interest rates internationally rather than only the lowest rates nationally.

At the empirical level, Henry (2000) gives ample evidence that financial liberalization actually reduces the capital costs of industrial firms. Moreover, he shows that this has significantly positive effects on the level of investment, trade and of output growth. The main result is that growth in value added is unrelated to all the investigated dimensions of financial liberalization and integration. However, both growth in the number of establishments and output is higher when financial markets are liberalized given that countries have reached a relatively high level of financial development.

The literature on the real effects of financial liberalization and integration is relatively large. In a widely cited study, Rodrik (1998) finds no effect of liberalized capital accounts, either on per capita GDP growth rates or the investment to GDP ratio. But Quinn (1997) and Edwards (2001) find positive growth effects. Edwards qualifies his finding by noting that a certain level of economic development must be reached before an open capital account has positive growth effects. The argument between Rodrik and Edwards is discussed by Arteta *et al.* (2001), who argue that it is largely due to the use of different indicators of capital account liberalization. While

Rodrik uses the IMF binary indicator, Edwards uses a multi-level index of Quinn (1997) which, according to Arteta *et al.*, also seems to be the more comprehensive of the two. More recently, Edison *et al.* (2002) use a similar set of indicators of international financial liberalization and integration, and fail to find any effects on aggregate economic growth, whereas Eichengreen (2003) finds that there may be both positive or negative growth effects of capital account liberalization depending on whether one controls for the occurrence of financial crises or other country-specific features.

Another branch of the literature focuses on the effects on capital constraints and growth by liberalizing equity markets. Bekaert *et al.* (2005) find a temporary increase in per capita growth rates following equity market liberalization. Also Harrison and Guo (2004) combine firm level and macroeconomic data and find that foreign direct investments ease firms' credit constraints, while capital account restrictions make these constraints more severe. Overall, economic literature stresses the positive effects of FDI on the receiving economy. One important reason is the long-term scope of such investment.

According to Fischer (1998), at a theoretical level, capital account liberalization would lead to global economic efficiency, allocation of world savings to those who are able to use them most productively, and would thereby increase social welfare. Citizens of countries with free capital movements would be able to diversify their portfolios and thereby increase their risk-adjusted rates of return. It would enable corporations in these countries to raise capital in international markets at a lower cost. It is suggested, moreover, that such liberalization leads to further development of a country's financial system which in turn is thought to enhance productivity in the real economy by facilitating transactions and by better allocation of resources. Some argue that free capital movements will help increase world welfare through another channel, namely transferring resources from ageing populations and lower rates of return in advanced countries to younger populations and higher rates of return in newly industrializing economies. Such resource transfers will be Pareto optimal as both rich and poor countries

would gain.

However, a large literature on the appropriate sequencing of financial liberalization also suggests that early lifting of controls on the capital account may destabilize the economy. McKinnon (1993), for example, maintains that capital account liberalization should come at the end of the reform sequence, following domestic financial liberalization, bank reform, and trade liberalization. Tayebi and Arbabian (2006) emphasize on removal of trade barriers for implementing financial liberalization. In this view, liberalization of the capital account should not be undertaken until the end of the process; freeing up capital flows prematurely before domestic and trade liberalization could lead to economic instability.

2.1. Financial Liberalization and Convergence

Privatizations of state-controlled banking systems and relaxations of capital account restrictions are generally accepted as integral aspects of economic development. Economists have long advocated the removal of capital controls as a stabilizing factor of the development process to improve efficiency and return economies from distorted factor prices to production frontiers. Empirically, however, financial liberalizations have become associated with capital flow reversals, where initial capital inflows at the onset are subsequently offset by capital outflows resulting in higher levels of accumulated indebtedness (Bacchetta and van Wincoop, 1998; Eicher *et al.*, 2000).

Eicher and Hull (2004) investigate how capital flow reversals caused by financial liberalizations affect the speed of convergence of an economy. Central to the analysis is the investigation of how openness (access to international capital markets) mediates the effects of financial liberalizations on the speed of convergence as the removal of capital account distortions induces the economy to transition to a new growth path. They follow the Eicher and Turnovsky (1999) approach in which the open economy is rooted in the class of growth models that has been shown to best replicate the long

run performance of industrialized nations. Eicher and Hull (2004) conclude that opening capital markets to the outside world and reducing distortions that detract from foreign investment are shown to increase capital inflows and the level of indebtedness of a country. In addition, liberalizations are shown to allow for a longer and smoother transition, which reduces the output shocks. They show that financial liberalizations reduce short run convergence speeds, implying that open economies should experience significantly smaller swings in output but also longer transitions to the new equilibrium.

3. TRADE AND INCOME CONVERGENCE

In the literature of convergence, Mankiw *et al.* (1992) argue that, based on the Solow model, convergence should not be expected since countries usually exhibit different savings and population growth rates, hence, they reach different steady state paths. Convergence can be expected only if differences between savings and population growth rates are controlled for as they do in their augmented Solow model where they also include accumulation of human and physical capital. They find convergence at roughly the rate that the model predicts for the OECD countries but could not find a tendency for poor countries to grow faster on average than rich countries. A contemporary study by Barro and Sala-i-Martin (1992) finds convergence for a sample of ninety eight countries from 1960 to 1985. This study is based on the standard neoclassical growth model with exogenous technological progress and a closed economy. They also find that when technologies are the same, introducing a global capital market increases convergence for output but slows down income convergence.

In a previous study, Baumol (1986) finds evidence of convergence on the average rate of productivity growth among sixteen industrialized market economies in the period 1870-1979. He also performs a more comprehensive study using data on output per capita covering the period 1950-1980 for

seventy-two countries, and concludes that the same sixteen countries analyzed before show convergence, as well as a second group of planned economies, even a third one comprising intermediate economies, although convergence in these last two groups is not so pronounced.

Now trade liberalization emphasized by the WTO can influence each of the three basic determinants of national income as just written: factor prices, factor quantities, and production technology (Slaughter, 2001). First, the factor-price-equalization (FPE) theorem is usually defined as the set of endowment points among countries for which, given certain assumptions about technology and tastes, free trade entails not only equal goods prices across countries but also equal prices for non-tradable factors as well.

Many studies have examined whether or not trade liberalization tends to bring factor prices closer together. Samuelson (1971) shows that in the standard specific-factors framework freer trade very likely generates convergence. In contrast, Stiglitz (1970) finds the opposite when two countries have different rates of time preferences: freer trade tends to diverge factor prices. Deardorff (1986) presents a two-country, two-factor, four-good Heckscher-Ohlin model in which freer trade converges product prices but actually diverges factor prices. Leamer and Levinsohn's (1996) survey distinguishes the outcome of FPE from the process of wage convergence, and notes that lower trade barriers do not necessarily converge factor prices.

We may consider here a country's per capita income (y) is distributed to two factors of production, labor (L) and capital (K),

$$y = \frac{Y}{L} = \frac{wL + rK}{L} = w + r \cdot \frac{k}{L}, \quad (1)$$

where w and r are the respective national real factor prices for labor and capital. This set-up assumes that the total value of gross domestic output accrues to L and K and that for each factor there is one national market.

There is also a long history of extending static Heckscher-Ohlin models to allow factor accumulation over time. In some ways trade under WTO (or

trade liberalization) converges endowments of L and K but in other ways it diverges them. One important way that trade can converge endowments is by reducing perceived investment risk in poorer countries. Lane (1997) formalizes a model in which trade agreements signal reduced investment riskiness in countries-particularly in poorer countries which tends to be more risky initially. Post-liberalization capital accumulates more rapidly in now-less-risky poorer countries, and all else equal this tends to converge income across countries by raising (K/L) toward richer-country levels.

In contrast, there are at least two important ways for trade liberalization to work in the opposite direction. One is through Stolper-Samuelson effects on capital rentals. Baldwin (1992) formalizes how liberalization can generate 'dynamic' gains from trade for a country relatively well endowed with capital by raising its r (through the usual Stolper-Samuelson effect) and thus accelerating investment. For a country relatively poorly endowed with capital, dynamic losses from trade can result as liberalization lowers r and thus slows investment. The cross-country implication of these dynamic adjustments is divergence of relative endowments: capital-rich countries invest more while capital-poor countries invest less.

Another way freer trade can diverge cross-country endowments is by inhibiting the onset of diminishing marginal returns to investment. In a closed economy capital accumulation slows because of investment's diminishing marginal physical productivity. But with free trade, FPE implies that a country faces constant marginal returns to investment. In an open economy investment changes the national output mix as predicted by the Rybczynski theorem instead of reducing r .

There is also a good deal of international evidence that income convergence occurs amongst economies that are similar in a number of crucial respects, including educational standards, access to technology, openness to trade and general macroeconomic stability (Barry, 2000). Thus OECD and EU countries have generally converged since the 1950s, with poorer countries growing faster than richer ones. The same has been found to be true of US states, Japanese prefectures, and East Asia and EU regions.

In summary, economic liberalizations have unclear net effects on cross-country income levels. This leads us to consider financial liberalization or trade liberalization as a program and evaluate its effects on countries worldwide which are liberalizing their economies or not. Thus, in what follows identify liberalization's effect on income convergence by using a difference-in-differences estimation strategy.

4. A DIFFERENCE-IN-DIFFERENCES (DID) FRAMEWORK

Lee (2005) shows that a 'difference-in-difference' (DID) design is an improvement over the before-after program (e.g. the WTO membership of East Asian countries or a financial liberalization strategy in those countries) in which there is a control group that gains the time effect but not the treatment effect.¹⁾ Using the control group, the treatment effect can be identified even if the treatment takes place step by step. In a DID design, the treatment is given only to a certain group of units (countries), and those left out constitute the control group. In fact, a difference-in-differences estimator measures the impact of the program by the difference between participants and non-participants in the before-after difference in outcomes. It uses both pre- and post-program data (t_a and t_b data) on $D=1$ and $D=0$ observations. The equations for two periods, thus concerning the treatment effect in t_a , can be written as

$$Y_{ita} = f(X_{ita}) + D_i \beta_D + \varepsilon_{ita}, \quad (2)$$

and

$$Y_{itb} = f(X_{itb}) + \varepsilon_{itb}. \quad (3)$$

¹⁾ In fact, treatment effect is difference in response between participating and not participating in a program.

Subtracting two equations, the difference-in-differences estimator ($\hat{\beta}_D^{DID}$) applies the least squares method for β_D^{DID} in the following specification:

$$Y_{ita} - Y_{itb} = f(X_{ita}) - f(X_{itb}) + D_i \hat{\beta}_D^{DID} + (\varepsilon_{ita} - \varepsilon_{itb}). \quad (4)$$

The estimator requires that

$$E(\varepsilon_{ita} - \varepsilon_{itb}) = 0, \quad E[(\varepsilon_{ita} - \varepsilon_{itb})D_i] = 0 \quad \text{and}$$

$$E\{[f(X_{ita}) - f(X_{itb})][\varepsilon_{ita} - \varepsilon_{itb}]\} = 0.$$

Treatment effects with general changes in the economy motivate the DID estimator, which compares the before-after change of treated units with the before-after change of untreated units. In this situation, the outcomes of the untreated units as well as the treated units get differenced out in any common trend. The common time trend assumption that justifies the DID estimator is given by:

$$E(Y_{0ta} | D=1) - E(Y_{0tb} | D=1) = E(Y_{0ta} | D=0) - E(Y_{0tb} | D=0). \quad (5)$$

Overall, panel data methods represent a powerful tool when longitudinal data are available on treated and untreated units, when the timing of treatment varies among units, and when the timing of treatment is unrelated to the outcomes, conditional on the included variables. Panel data models constitute the most general version of these estimators. These models apply to data sets with multiple observations over time on many treated and untreated units. A regression is run of the outcome variable of interest on exogenous covariates plus dummy variables for each unit and each time period. The unit dummy variables control for permanent differences in outcomes among units, just as in the simple difference-in-differences model. The time period dummies control for aggregate effects in each period. Panel models require some variation in the timing of the treatment; without such

variation, the treatment effect cannot be distinguished from the aggregate time effects. Thus, a basic panel model has the following general form:

$$Y_{it} = \beta_0 + \beta_D D_{it} + \beta_k X_{kit} + \mu_i + \mu_t + \varepsilon_{it}, \quad (6)$$

where Y_{it} stands for a response variable (outcome) for unit (country) i in time t .²⁾ β_D is the panel data impact estimator, D_{it} is a time-varying indicator for treatment, μ_i is a unit-specific intercept (individual effects), μ_t is a time-period-specific intercept and X_{kit} is a set of k regressors (including time variable).

5. EMPIRICAL RESULTS

As explained previously, the before and after conditions of a response variable (income convergence), which is affected by a treated policy (e.g., the WTO membership of East Asian countries³⁾ or a financial liberalization strategy in those countries) is compared by the DID analysis. More specifically, both groups of the East Asian countries (as a treated group) and other countries around the world (as an untreated group) experience effect of participation and face differences before and after a program. In fact, the rate of differences in income convergence between two groups points out the DID analysis.

For the difference-in-differences specification, let j indicate country group, with $j=1$ for the treated group and $j=0$ for some control (untreated) group. Moreover, r describes two different regimes; if $r=0$ means the period before the program (i.e., before financial liberalization or before the year of the WTO establishment, 1995), whereas $r=1$ denotes the period after the program. D is thus a set of dummy variables denoting these mentioned

²⁾ The response variable (outcome) is here per capita income convergence, which will be defined later.

³⁾ East Asia includes Japan, Korea, Brunei, Taiwan, Hong Kong, Macao, Singapore, Malaysia, China, the Philippines, and Thailand.

cases. Now we estimate equation (7) following Slaughter (2001) and equation (8) as its concept was discussed in the previous section:

$$CG_{kjrt} = \alpha_1 + \alpha_2 D_{kr} + \alpha_3 D_{kj} + \alpha_4 D_{kjr} + \beta_1 t + \beta_2 t D_{1r} + \beta_3 t D_{kj} + \beta_4 t D_{kjr} + u_{kjrt}, \quad (7)$$

where $k = 1, 2$, and CG_{kjrt} (income convergence in the case of financial liberalization in East Asia) is measured by $\log(yc_{it} - myc_{1jrt})^2$, where yc_{it} denotes per capita GDP of all countries worldwide in time t , while myc_{1jrt} is the mean of per capita GDP, in time t , of all the East Asia countries that have liberalized their financial markets since 1985 (Henry 2006). CG_{2jrt} (income convergence in the case of trade liberalization in East Asia after the WTO establishment in 1995) is measured by $\log(yc_{it} - myc_{2jrt})^2$, where yc_{it} is the same as the previous case, while myc_{2jrt} is the mean of per capita GDP, in time t , of all East Asia's WTO membership since 1995). The dichotomous variable D_r equals 1 after the period of the each program and zero otherwise; the dichotomous variable D_j indicates the treated group; the dichotomous D_{jr} variable equals one if both $j=1$ and $r=1$ and zero otherwise; t denotes a time dummy variable for the period under consideration (1970-2004). u_{kjrt} is an error term (whose variance varies by both j and r). For each of the four country-group /regimes, equation (8) estimates a separate intercept term and income convergence rate.

Generally, table 1 draws four cases where case I refers only to the liberalizing countries which are East Asian (or the WTO membership of the East Asian countries). In this case the following equation is estimated:

$$CG_{kjrt} = \alpha_1 + \alpha_3 D_{kj} + \beta_1 t + \beta_3 t D_{kj} + u_{kjrt}. \quad (8)$$

Case II considers the financial liberalization in East Asia after 1985 (or the WTO membership of the East Asian countries after 1995). In this case the model specified in equation (8) is estimated. The condition of pre-financial liberalization before (or pre-WTO membership) is considered in Case III,

Table 1 The Coefficients of Income Convergence Rates in Four Cases

Case	Intercept	Income Convergence Rate
I	$\alpha_1 + \alpha_3$	$\beta_1 + \beta_3$
II	$\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4$	$\beta_1 + \beta_2 + \beta_3 + \beta_4$
III	α_1	β_1
IV	$\alpha_1 + \alpha_2$	$\beta_1 + \beta_2$

$$DID = [(\beta_1 + \beta_2 + \beta_3 + \beta_4) - (\beta_1 + \beta_3)] - [(\beta_1 + \beta_2) - \beta_1] = \beta_4$$

while we estimate the following equation:

$$CG_{kjrt} = \alpha_1 + \beta_1 t + u_{kjrt}. \tag{9}$$

Case IV stands for the post- financial liberalization (post-WTO membership), in which the following regression is estimated:

$$CG_{kjrt} = \alpha_1 + \alpha_2 D_{kr} + \beta_1 t + \beta_2 t D_{kr} + u_{kjrt}. \tag{10}$$

The effect of the financial liberalization (or the WTO membership) on income convergence can be obtained by calculating the “difference in differences” of the estimated rates. The difference in convergence rates within the member group pre- and post- liberalization (membership) is given by B_2 . The similar difference in convergence rates within the control group is given by (B_2+B_4) . The difference in differences is thus given by $(B_2+B_4) - (B_2)=B_4$. Assuming that the only treatment pre- and post- liberalization (WTO membership) between the two groups is participation in the program, B_4 identifies its effect. If the financial liberalization (or the WTO membership) tends to increase (decrease) among the East Asian countries then B_4 is positive (negative).

The income convergence model (equation (7)), which has been specified by the DID method, is applied to all countries worldwide, both East Asian and non-East Asian countries. Of all 208 countries 129 ones are selected due to data availability on per capita GDP in 2000 constant prices for the period 1970-2004. A key issue here is over the adequacy of the data size and the required numbers of degrees of freedom to generate robust empirical findings, both for the overall time period and for the four individual cases. The model is estimated by the panel fixed or random effects using several tests (F_{Leamer} statistic to test between pooled method and panel fixed effects, Hausman statistic to select between random effects and fixed effects, and Brusch-Pagan LM to test between random effects and OLS) on the final selection. We use panel data on the countries over 1970-2004 obtained from Penn World Tables compiled by Heston *et al.* (2006) at <http://pwt.econ.upenn.edu/>.

To estimate the DID income convergence rate affected by the financial liberalization in East Asia, we consider the pre and post 1985 as the year of liberalization commencement. Table 2 draws the estimated convergence rates on the basis of the DID approach. Case I, which includes only East Asian countries before the liberalization, measures convergence rate ($\hat{\beta}_1 + \hat{\beta}_3$) that equals 0.0301. This rate in case II ($\hat{\beta}_1 + \hat{\beta}_2 + \hat{\beta}_3 + \hat{\beta}_4$), which include liberalizing countries after 1985, is equal to 0.0070. Thus, the difference rate between these two cases is negative and equals -0.0231 in which it means more convergence in income occurs among the East Asian countries since after 1985.

Case III measures the convergence rate ($\hat{\beta}_1$) for non-East Asian countries (control group), which is equal to 0.0299. This rate is calculated by about 0.0237 in case IV, which refers to the involvement of non-East Asians after the liberalization, meaning income dispersion for the control group. But the difference rate between Case III and Case IV is about -0.0062 , a convergence effect. Therefore, the DID convergence rate, which is the rate of difference in differences, is finalized by about -0.0169 . This value reveals the fact that the net and dynamic effect of the financial liberalization in all East Asian countries on income convergence is applicable.

Table 2 Difference-in-Differences in Rates of Income Convergence, Pre- vs. Post- Financial Liberalization in East Asia

Case	Intercept	Convergence Rate
Case I: $CG_{1jrt} = \alpha_1 + \alpha_3 D_{1j} + \beta_1 t + \beta_3 t D_{1j} + u_{1jrt}^1$	6.881	0.0301
Case II: $CG_{1jrt} = \alpha_1 + \alpha_2 D_{1r} + \alpha_3 D_{1j} + \alpha_4 D_{1jr} + \beta_1 t + \beta_2 t D_{1r} + \beta_3 t D_{1j} + \beta_4 t D_{1jr} + u_{1jrt}$	7.041	0.0070
Difference between Case II and Case I: $(\beta_1 + \beta_2 + \beta_3 + \beta_4) - (\beta_1 + \beta_3)$		-0.0231
Case III: $CG_{1jrt} = \alpha_1 + \beta_1 t + u_{1jrt}^2$	6.891	0.0299
Case IV: $CG_{1jrt} = \alpha_1 + \alpha_2 D_{1r} + \beta_1 t + \beta_2 t D_{1r} + u_{1jrt}^3$	7.057	0.0237
Difference between Case IV and Case III: $(\beta_1 + \beta_2) - (\beta_1)$		-0.0062
Difference-in-Differences (DID): $[(\beta_1 + \beta_2 + \beta_3 + \beta_4) - (\beta_1 + \beta_3)] - [(\beta_1 + \beta_2) - (\beta_1)]$ $= \beta_4$ or β_{DID}		-0.0169

Note: Results obtained by Stata 9.2.

Also to estimate the DID income convergence rate affected by the WTO membership of East Asia (as a type of trade liberalization in this region), we consider the pre and post 1995 as the year of the WTO establishment. Table 3 reports the estimated convergence rates on the basis of the DID approach in the case of the WTO membership. Case I, which includes only East Asian countries before the WTO membership, measures convergence rate ($\hat{\beta}_1 + \hat{\beta}_3$) that equals 0.0302. This rate in case II ($\hat{\beta}_1 + \hat{\beta}_2 + \hat{\beta}_3 + \hat{\beta}_4$), which include members after 1995, is equal to 0.049. Thus, the difference rate between these two cases is positive and equals 0.0188 in which it means more divergence in income occurs among the East Asian countries since after 1995.

Table 3 Difference-in-Differences in Rates of Income Convergence, Pre- vs. Post East Asia's WTO Membership

Case	Intercept	Convergence Rate
Case I: $CG_{2jrt} = \alpha_1 + \alpha_3 D_{2j} + \beta_1 t + \beta_3 t D_{2j} + u_{2jrt}^1$	6.871	0.0302
Case II: $CG_{2jrt} = \alpha_1 + \alpha_2 D_{2r} + \alpha_3 D_{2j} + \alpha_4 D_{2jr} + \beta_1 t + \beta_2 t D_{2r} + \beta_3 t D_{2j} + \beta_4 t D_{2jr} + u_{2jrt}$	6.117	0.0490
Difference between Case II and Case I: $(\beta_1 + \beta_2 + \beta_3 + \beta_4) - (\beta_1 + \beta_3)$		0.0188
Case III: $CG_{2jrt} = \alpha_1 + \beta_1 t + u_{2jrt}^2$	6.890	0.0298
Case IV: $CG_{2jrt} = \alpha_1 + \alpha_2 D_{2r} + \beta_1 t + \beta_2 t D_{2r} + u_{2jrt}^3$	7.252	0.0172
Difference between Case IV and Case III: $(\beta_1 + \beta_2) - (\beta_1)$		-0.0126
Difference-in-Differences (DID): $[(\beta_1 + \beta_2 + \beta_3 + \beta_4) - (\beta_1 + \beta_3)] - [(\beta_1 + \beta_2) - (\beta_1)]$ $= \beta_4$ or β_{DID}		0.0314

Note: Results obtained by Stata 9.2.

Case III in table 3 measures the convergence rate ($\hat{\beta}_1$) for non-East Asian countries (control group), which is equal to 0.0298. This rate is calculated by about 0.0172 in case IV, which refers to the involvement of non-East Asians after the WTO establishment, meaning income dispersion for the control group. But the difference rate between Case III and Case IV is about -0.0126, a convergence effect. Therefore, the DID convergence rate, which is the rate of difference in differences, is measured by about 0.0314. This value reveals the fact that the net and dynamic effect of the trade liberalization in all East Asian countries on the world income is divergent rather than that of financial liberalization.

6. CONCLUSION

This research made attempts to identify the 'economic liberalizations' effects on income convergence by using a difference-in-differences estimation strategy. The main empirical result was that the financial liberalization did foster significant, systematic convergence among all countries even though a low rate was achieved. In fact, much of the evidence suggests that financial liberalization in East Asia converges incomes among countries worldwide. The overall results showed that DID convergence rate was finalized by about -0.0169 . This value reveals the fact that the net and dynamic effect of the financial liberalization in East Asia on income convergence is appropriate in order to encourage non-Asian countries to increase their efforts for the advantages of such liberalization. Thus, the main empirical result was that the participation of East Asian countries in the program of financial liberalization did foster significant convergence among all countries even though a low rate was achieved. In fact, much of the evidence suggested that such participation converges incomes among countries worldwide. However, the participation of these countries in the WTO diverges the world income with respect to their average income; a reversal and an unexpected effect. This may imply a trade diversion in the region rather other parts of the world.

Hence, the results obtained by DID approach imply variations in development levels of countries need to be taken into account in order to ensure that some economic liberalization like financial liberalization is effective in achieving the objective of economic development in entrants. It is thus important to consider situations before and after the liberalization program for all countries either participants or non-participants.

Finally, a future research might explore the channels through which liberalization affects income dispersion. With adequate data the difference-in-differences methodology could be applied to these channels as well.

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