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International Evidence on Convergence and Openness

Georgios E. Chortareas[1], Evangelia Desli[2] and Theodore Pelagidis[3]*

Abstract

In this paper we examine for both economic convergence and openness convergence across the global economy and within specific regions. We find that convergence in openness is much more profound than income convergence. Moreover, convergence within regions takes place faster than convergence across the globe. We then examine for the effects of trade openness on income convergence. We use both trade openness indicators based on actual trade volumes as well as indices that rank countries according to trade policy openness. Finally, we consider the effects of such indices on openness convergence. We discuss our results in the context of the regionalism versus globalization debate.

1. Introduction

The existence of a positive relationship between openness and growth is a proposition of almost religious importance to a number of researchers and policymakers. More recently, however, this or-

[1] International Economic Analysis Division, Monetary Analysis, Bank of England, Threadneedle Street, London EC2R 8AH, Email: georgios.chortareas@bankofengland.co.uk

[2] Lloyd's of London, Email: evangelia.desli@lloyds.com.

[3] Department of European Studies, Panteion University of Athens, 136 Syngrou Av., 17671 Athens, Greece, Email: pelagidi@panteion.gr.

* Corresponding author

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thodoxy is being challenged by studies that continuously question the validity of the existent empirical evidence. The evidence is often in disarray and the relevant literature is far from having reached a consensus. For example, Rodriguez and Rodrik (2000) argue that if indeed the evidence for this relationship is so overwhelming then the issue should be considered resolved and consequently the amount of empirical research that continues to be devoted on this topic is paradoxical. In this paper we address some questions pertaining to a particular aspect of this discussion namely, the implications for convergence.

The theoretical underpinnings of the relationship between openness and per capita income convergence can be traced to the factor price equalization theorem. Policies that enhance trade openness are expected to lead to growth convergence and a decline in income dispersion, at least among particular countries and for specific periods. Ben-David (1993) provides empirical evidence supporting this proposition. The following analysis first considers whether convergence in per capita income across countries is matched by convergence in the degree of openness. To answer this question we employ tests of β-convergence to both per capita income and to openness indicators. We obtain evidence as to whether openness convergence takes place faster than income convergence. Applying such tests to openness provides results that feed into the recent discussion about the extent of globalization in the world economy. In addition we examine whether openness convergence takes place faster at the global level or within regions and interpret our results in the context of the globalization-versus-regionalism debate.

We then examine the effects of trade openness on income convergence. Trade openness is conceptualized both as both trade intensity and trade policy openness (degree of trade liberalization). We do so by augmenting the typical convergence tests (as suggested by Barro and Sala-i-Martin 1991, 1992) with variables that capture the effects of trade openness. The first focuses on the role of trade

volumes and the second focuses on the role of liberalized trade policies. Finally, we examine the effects of policy openness on openness convergence itself.

The next section provides a brief literature review. Section 3 describes the data and the econometric methodology and discusses the results of the analysis. Finally, Section 4 concludes.

2. Literature Review

The original work of Barro and Sala-i-Martin on the concept of β-convergence (1991, 1992) has spurred a small industry of studies that examine for income convergence. Obtaining evidence for per capita income convergence, however, has not been an easy task. Typically researchers have been more successful in uncovering evidence of income-per-capita convergence within sets of economies with similar characteristics (e.g., Durlauf and Johnson, 1995) or within regions of a given economy (e.g., Barro and Sala-i-Martin, 1991, 1992). Other authors find evidence of β-convergence across a wider set of economies that do not necessarily hare similar characteristics (e.g., Romer and Weil, 1992), especially when controlling for a number of variables such as investment rates population growth, school enrollment, and so on.

The alleged positive relationship between trade openness and economic growth/development has typically been treated as an article of faith by many researchers and policymakers. Krueger (1997) points to the positive correlation between export growth and GDP growth. A large number of econometric studies employing cross-country evidence find that trade policy openness is associated with faster economic growth (for a summary see, Ben-David et al., 2001). Moreover, openness encourages institutional and policy reform consistent with international standards of sound institutions and policies. Gwartney et al. (2001) provide evidence that countries with persistently high degrees of openness have high per capita income and grow faster than those with persistently low degrees of openness. Greenaway et al,

(2002) emphasize the role of openness and trade liberalization in developing countries. They use a dynamic panel framework and alternative liberalization indicators and find that liberalization affects growth but with a significant lag.

This consensus, however, has been challenged on econometric grounds in general and with reference to the robustness of the cross-country results in particular (e.g., Levine and Renelt, 1992). More recently this relationship is being questioned in broader terms. Rodriguez and Rodrik (2000), for example, provide evidence that single measures of trade barriers tend to not be statistically significant regardless of the samples choice and the conditioning variables used. The results of Rodriguez and Rodrik (2000) are consistent with those of Slaughter (forthcoming). To avoid the perils of "before-and-after" comparisons that characterize many studies Slaughter (forthcoming) employs a difference-in-difference approach. His methodology consists in comparing income convergence patterns before and after trade liberalization for a set of liberalizing countries and a set of randomly chosen control countries. Slaughter's analysis concludes that there is no systematic link between trade liberalization and income convergence. Moreover, he suggests that, on balance, the results of his analysis are more supportive to income divergence rather than convergence due to trade liberalization.

The relationship between trade and growth/development has been considered in the context of two main specifications. The first focuses on the effects of actual trade volumes in economic growth (e.g., Frankel and Romer, 1999). The second examines the role of trade policies on growth, focusing on the role of trade barriers and the degree of trade regime liberalization (e.g., Rodriguez and Rodrik 2000). The two aspects are qualitatively different since the last reflects policy decisions while the former reflects structural aspects of the economy as well (such as changes in world demand and supply conditions, transportation costs, etc.). A relatively unexplored, dimension of this discussion, however, seems to be the relationship

between openness and income convergence. The effect of openness on long-run growth is theoretically established in endogenous growth models (see for example, Aghion and Howitt, 1998). In such models openness may affect not only the domestic rate of foreign technologies adoption but the rate of domestic innovation as well. Thus, globalization gives rise to international knowledge spillovers that improve the pool of domestic resources. While the above arguments focus on the implications of openness on innovation, Chortareas and Desli (1999) examine the implications of openness for productive efficiency finding that more open economies operate closer to their production possibilities frontiers.

In the following sections we examine the degree of convergence in income and in openness and the effects of trade openness and trade policies on those aspects of convergence.

3. Data and Econometric Methodology

3.1 Data

The data we use are mainly from the Penn World Tables Mark 5.6.[4] We use per capita income in constant dollars adjusted for changes in the terms of trade. The openness index is defined as exports plus imports and is represented as percentage of the per capita income. The sample covers the period 1950 to 1992 and 152 countries. Due to the large number of missing observations in the early years of the sample, we also provide estimation results for the period 1960 to 1992. We find that the estimates of the convergence rates in the two samples, 1950-1992 and 1960-1992 are in general similar but when we have to choose one of the two we find the 1960-1992 sample more reliable. We also divide the sample in four sub-periods, with each of them corresponding to a decade. This allows every decade to experience a different convergence rate. Fi-

[4] Details on the construction of the Tables are provided in Summers and Heston (1991).

nally, we restrict the convergence rate to be the same across all decades by jointly estimating the four decades.

The only series that is not from the Penn World Tables is the index we use to proxy for openness in trade policies. In particular, we use the "Trade Openness Index" (TOI) from Gwartney et al (2001) published at the Economic Freedom of the World (EFW) Annual Report that measures the degree to which policies interfere with exchange. More specifically, the TOI consists of four major components: tariff rates, black-market exchange premiums, capital movement restrictions, and the actual trade sector size compared to the expected trade sector size. The index is available for seven periods (or years), namely, 1980-1982, 1985-1987, 1990-1992, 1995-1997, 1998, 1980-1998, and 1998. In the present paper we use the periods that overlap with our data sample. That is, we use the index for 1980-1982, 1985-1987, 1990-1992, as well as an average of them. While the Penn World Table covers 152 countries, this exercise is constrained by the number of countries contained in the EFW data set, which is ninety countries.

3.2 Convergence in per capita income and openness

We test for convergence in per-capital income (y) using the typical β-convergence specifications of Barro and Sala-i-Martin (1991, 1992). That is,

$$\frac{1}{T}\ln(y_{it}/y_{it-T}) = \alpha_y - \frac{\left[1-e^{\beta_y T}\right]}{T}\ln(y_{it-T}) + u_{it} \qquad (1)$$

where y_{it} and y_{it-T} are country i's per capita income at time t and at time t-T, respectively, α_y is the intercept, β_y is the rate of convergence parameter, and u_{it} is the disturbance term. A negative value of β_y implies convergence and a smaller (i.e., greater in absolute value) value of β_y indicates a faster convergence rate. The literature that examines for the role of trade openness and/or trade policies

on income growth typically controls for a number of relevant country characteristics. Studies that focus on the convergence process, however, tend to ignore such controls. Since the present paper focuses on the issues of convergence we do not consider further control variables.

We first consider global income convergence and as the results reported in Table 1 show this does not obtain. In particular, the β-coefficient is not statistically significant (and has the wrong sign) in the cross-sectional regression. The same picture emerges when we consider various sub-periods. When we consider a panel data specification that imposes the same β-coefficient for all periods the convergence coefficient appears statistically significant but displays a positive sign that indicates divergence in per capita income rather than converge for the global sample. The pooled estimate that covers all four sub-periods imposes the same convergence coefficient to all sub-periods and summarizes their results.

As mentioned above, obtaining evidence for income convergence within groups of countries with dissimilar characteristics is quite difficult and thus, the results of Table 1 should not come as a surprise. To control for the possible effects of regional clusters in the world economy we include regional dummies that modify equation (1) as follows

$$\frac{1}{T}\ln(y_{it}/y_{it-T}) = \alpha_y - \frac{\left[1-e^{\beta_y T}\right]}{T}\ln(y_{it-T}) + d_1 R_1 + d_2 R_2 + d_3 R_3 + \varepsilon_{it} \qquad (1a)$$

where R_1, R_2, and R_3 are dummies for Asia and Australia, Americas, and Africa respectively.

The results from estimating equation (1a) are provided in Table 2. The convergence coefficient (β) displays, on balance, a negative sign, which implies convergence. This coefficient, however, is statistically significant only in the in the panel regressions and not in the cross-country regressions. Thus, taking into account the re-

gional characteristics improves the evidence for the presence of a convergence process.

To examine more closely the existence of income convergence within regions we break the sample into four such regions, namely, the Americas, Africa, Australasia, and Europe. The results from this exercise are summarized in Table 3. The signs of the convergence coefficients that result from the cross-sectional analysis are consistently statistically significant only for Europe. They display a negative sign implying convergence (with the exception of the 1980-1992 period). The only other statistically significant convergence coefficients are those for Africa during 1950-1960 and for the Americas during 1980-1992. The convergence coefficients from the panel specification are also negative (with the exception of Australasia) but again the only statistically significant coefficient is that of Europe. Thus, we obtain clear and strong evidence of per capita income convergence only within Europe. This result is consistent with earlier empirical findings as well as with Kleincnecht and Wengel's (1998) argument for the dominance of "Europeanisation" over globalization.

While a voluminous literature is available on income convergence, few attempts to consider convergence in openness exist. We apply tests for convergence in openness to consider whether the increase of international trade flows has been predominantly a global or regional phenomenon. This exercise permits us to compare the speed of income convergence to that of openness convergence as well as considering the relative speed of convergence in openness within and across regions of the world.

Our econometric specification for β-convergence of trade openness (op) is,

$$\frac{1}{T}\ln(op_{it}/op_{it-T}) = {}_{op} - \frac{\left[1-e^{\beta_{op}T}\right]}{T} op \ln(\quad y_{it-T}) + {}_{it} \qquad (2)$$

where op_{it} and op_{it-T} are country i's percentage of openness at time t and at time t-T, respectively, α_{op} is the intercept and β_{op} is the rate of convergence parameter. Again, a negative value of β_{op} implies convergence and a smaller (greater in absolute value) value of β_{op} corresponds to a faster convergence rate v_{it} is the disturbance term.

We can further modify equation (2) to allow for the presence of regional dummies as:

$$\frac{1}{T}\ln(op_{it}/op_{it-T}) = \alpha_{op} - \frac{\left[1-e^{\beta_{op}T}\right]}{T}op_{it-T} + \delta_1 R_1 + \delta_2 R_2 + \delta_3 R_3 + \varepsilon_{it} \quad (2a)$$

where R_1, R_2, and R_3 are the dummies for Asia and Australia, the Americas, and Africa respectively.

The results from equations (2) and (2a) are reported in Tables 4 and 5 respectively. The tests (and the corresponding Tables) are constructed symmetrically to those of income convergence. In contrast to the results for income convergence, we find strong evidence for openness convergence in the global economy. Both the cross-country and the panel tests show that openness convergence takes place at the global level. That is, the convergence coefficients are statistically significant and negative. Moreover, this result holds both when we control for regional effects by including regional dummies and when we do not do so. Unlike the results pertaining to income convergence, the importance of the regional dummies is less profound and in most cases they are not statistically significant.

When we perform the same tests for income and openness convergence for each region separately some clear patterns emerge. The results from estimating equations (1) and (2) for each separate region are given in Tables 3 and 6 respectively. As Table 3 shows, per capita income convergence occurs only in Europe where the convergence coefficient displays always a negative sign. This result obtains for all but one sub-period and well when we pool the cross-country data for

all sub-periods. Income convergence also occurs in Africa but only for the 1950-1960 sub-period.

Turning to the openness convergence results for each separate region (Table 6), Europe stands out again as the region with the strongest evidence of convergence. This result holds not only for the full sample but for all sub-periods considered as well. The results for openness convergence within the other regions, however, are much stronger as compared to those of income convergence. Openness convergence seems to occur within Africa. During some sub-periods evidence for convergence is displayed in the Americas (sub-period 1960-1992, and Asia and Australasia (sub-period 1960-1992, and 1970-1980). The pooled regression results, provided in the last row of Table 6, summarize the findings when we impose the same convergence coefficient for all periods within one given region. The countries of the three economic regions tend to converge to the same degree of openness within the regions of Europe, Africa, and Australasia.

The above results constitute some new empirical evidence on the relative speed of market integration at the regional and global level. One can use such results to address the question of whether globalization or regionalism appears to be the dominant force that characterizes today's increased cross-border trade flows. Note that the convergence coefficient of the pooled regressions covering the global sample is close to -0.017 (Tables 4 and 5). This is lower in absolute value than the convergence coefficients in Europe and Africa but higher than the corresponding coefficients in the Americas and Australasia. That means that convergence takes place faster within the first regional blocks as compared to convergence across the globe. We find the result for Australasia unsatisfactory and we suspect that it obtains because constructed in the Penn World Tables the Asia region is constructed in such a way that covers many heterogeneous sub-sets of economies (extending from Japan to the Middle East).

By examining for convergence in openness and using the above interpretation we contribute to the discussion of whether nations tend to trade globally or they tend to confine their exchanges within their relatively close neighbors (see also Chortareas and Pelagidis, 2000). Of course, the processes of globalization and regionalism are not mutually exclusive and cannot be viewed in isolation from each other. Globalization possibly implies stronger ties at the regional level. In addition, trading blocks exist to encourage trade within specific regions and the hope is that the resulting externalities to the rest of the world will take the form of trade creation.

A number of authors view the development of stronger regional ties/arrangements as an impediment to multilateralism. Such arguments typically rely on political economy considerations (e.g., Grossman and Helpman, 1995). More recently new interpretations of regionalism emerged viewing it as a coordination failure resulting to Pareto-inferior outcomes (e.g., McLaren, 2002). Other authors, however, view regionalism as a stage en route to a multilateral process, and therefore not as being inconsistent with globalization (e.g., Baldwin 1995, Ethier 1998). For such a discussion to be meaningful, however, a sober assessment of the extent of regionalism versus globalization is required. Employing convergence tests allows us to obtain some indication as to whether trade integration takes place faster at the regional or the global level. Put it differently, we test whether the tendency of countries to become more open is more profound within their regions or at a global level.

3.3 Openness in trade volumes, trade liberalization and convergence

In this sub-section we examine the effects of trade openness on per capita income convergence in the global sample. To consider whether trade openness enhances the convergence process we augment the per capita income convergence equation with the

growth of openness as an additional explanatory variable according to the model

$$\frac{1}{T}\ln(y_{it}/y_{it-T}) = {}_{y} - \frac{\left[1-e^{\beta_y T}\right]}{T}{}_{y}\ln({}_{it-T}) + \frac{1}{T}\gamma\ln(op_{it}/op_{it-T}) + d_1R_1 + d_2R_2 + d_3R_3 + u_{it} \quad (3)$$

where R_1, R_2, and R_3 are again dummies for Asia and Australia, Americas, and Africa respectively. As we have seen in the previous sub-section a convergence model with regional dummies displays a better performance.

Non-linear least squares estimation produces inconsistent estimates when some of the explanatory variables are endogenous. Since the growth rate of openness in equations (2) and (3) is endogenous, and therefore possibly dependent on the error terms, we employ two-stage least squares to obtain consistent estimators (Pagan and Ullah, 1999). Thus, we estimate equation (3) along with equation (2) using non-linear two-stage least squares with the exogenous variables as the instruments. In applying the two-stage least squares method we first replace the growth rate of openness in equation (3) with the estimated variable from equation (2), which is purged of the stochastic element, and then perform a least squares estimation. The results from specification (3) are provided in Table 7. We have considered specifications focusing on both the global sample without regional dummies as well as separate regions of the world economy but since the results are consistent with those of Table 7 and the earlier discussion of the paper we do not report them here. Although the role of openness, defined as trade volumes, affects positively the growth of per capital income when we consider the pooled sample, it is not statistically significant. Moreover, the evidence for β-convergence in per capita income remains scant. Use of alternative lag specifications provided similar results.

The emerging question is whether one should consider only the effects of the trade intensities -as reflected in the openness meas-

ure used above- on the income convergence (or divergence) process or policy openness measures as well. To address this question we use the "Trade Openness Index" provided by the EFA data set (as described in section 3.1). Unfortunately this index is not available for the full data span of the World Pen Tables and we have to confine our focus only at the period 1980-1992 which represents the overlap of the two data sets. We report three different scores of the TOI corresponding to the beginning, middle, and end of this period. We have considered all those indices as well as an average of them but since the results are similar we report only the most representative, i.e., those that correspond to the middle period of 1985-1987.

Thus, we first consider a model that includes both the trade volumes openness measure and the policy-based openness measure as follows:

$$\frac{1}{T}\ln(y_{it}/y_{it-T}) = \alpha_y - \frac{\left[1-e^{\beta_y T}\right]}{T}\ln(y_{it-T}) + \frac{1}{T}\gamma\ln(op_{it}/op_{it-T}) + \frac{1}{T}\delta_y TOI_i + u_{it} \quad (4)$$

where all variables are defined as above. The results of this exercise are provided in Table 8 and show that both the growth of the trade-volume-openness measure and the policy-base-openness measure are statistically significant and display the expected positive sign. The convergence coefficient, however, remains not significant as in the previous income convergence regressions.

Finally, we explore the effects of trade policy openness on trade-volume openness convergence. In other words, we examine whether the convergence in openness that we established in the previous section is enhanced by policy measures (trade liberalization). To test this we use the openness convergence equation (2) augmented by the trade openness index (TOI) as:

$$\frac{1}{T}\ln(op_{it}/op_{it-T}) = \alpha_{op} - \frac{\left[1-e^{\beta_{op}T}\right]}{T}\ln(op_{it-T}) + \frac{1}{T}\delta TOI_{op} \quad \nu_i + \varepsilon_{it}, \quad (5)$$

As previously, we estimate equations (4) and (5) together using non-linear two-stage least squares with the exogenous variables as instruments to capture the stochastic nature of the growth rate of openness in equation (5). Table 9 provides the results of regression (5). The convergence in openness result we identified in the previous section remains intact but at the same time the role of the policy openness index is positive and statistically significant. That is, the trade-policy openness index (TOI) enhances the actual openness convergence process. This implies that trade liberalization measures improve the process of openness convergence.

4. Conclusion

A large volume of empirical evidence has led to a conventional wisdom that trade openness and economic growth is positively associated. This set of evidence, however, has not remained unchallenged. The present paper contributes to this discussion by providing evidence on some relatively neglected aspects of this debate. In particular, we focus on the implications of trade openness for per capita income convergence. In addition, we examine for convergence in openness convergence across the global economy and within specific regions of it. We find that convergence in openness is more evident than income convergence. Moreover, convergence within regions takes place faster than convergence across the globe. We then examine for the effects of trade openness on income convergence. We use both trade openness indicators based on actual trade volumes as well as indices that rank countries according to trade policy openness. Finally, we consider the effects of such indices on openness convergence. We discuss our results in the context of the regionalism versus globalization debate. Further research could focus on the implications of trade openness for productive efficiency as well as on how alternative institutional frameworks affect those relationships.

References

Aghion, P. and P. Howitt, (1998), *Endogenous Growth Theory*, MIT Press, Massachusetts.

Baldwin, R.E., (1995), "A Domino Theory of Regionalism," in R.E. Baldwin, P. Haaparanda, and J. Kiander, eds., *Expanding Membership in the European Union* (Cambridge, UK: Cambridge University Press), pp. 25-48.

Barro, R. and X. Sala-i-Martin, (1991), ¨Convergence across States and Regions,¨ *Brookings Papers on Economic Activity*, no.1, 107-82.

Barro, R. and X. Sala-i-Martin, (1992), ¨Convergence,¨ *Journal of Political Economy*, no.100, 223-51.

Ben-David, D., (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics* 108.

Ben-David, D., H. Nordström, and L. A. Winters, (2000), *Trade, Income Disparity and Poverty*, World Trade Organization Special Studies No. 5.

Chortareas, G. and Pelagidis (2000), "Trade Flows: A Facet of Regionalism or Glabalisation?", *Forthcoming, Cambridge Journal of Economics.*

Chortareas, G. and E. Desli, (1999), "Openness and Productive Efficiency: Some International Evidence," *mimeo*, *University of Connecticut*.

Durlauf, S. N. and P. A. Johnson, (1995), ¨Multiple Regimes and Cross-Country Growth Regressions,¨ *Journal of Applied Econometrics,* vol. 10, 365-384.

Ethier, W., (1998). "Regionalism in a Multilateral World," *Journal of Political Economy*, no.106, 1214-1245.

Frankel, J. and D. Romer, (1999), "Does Trade Cause Growth?" *American Economic Review* 89, 379-399.

Greenaway, D., W. Morgan, and P. Wright, (2002), "Trade Liberalisation and Growth in Developing Countries," *Journal of Development Economics*, vol. 67, 229-244.

Grossman, G. and E. Helpman, (1995), "The Politics of Free-Trade Agreements," *American Economic Review* 85, 833-850.

Gwartney, J., C. Skipton, and R. Lawson, (2001), "Trade Openness, Income Levels, and Economic Growth, 1980-1998," in Gwartney, J. and R. Lawson, eds., *Economic Freedom of the World 2001 Annual Report* (Fraser Institute), pp. 71-98.

Kleinknecht, A. and J. Wengel, (1998), ¨The Myth of Economic Globalization,¨ *Cambridge Journal of Economics*, vol.22, no.4, 637-47.

Krueger, A.O., (1997), "Trade Policy and Economic Development: How we learn," *American Economic Review* 87, 1-22.

Krueger, A.O., (1998), "Why Trade Liberalisation is Good for Growth," *The Economic Journal* 108, 1513-1522.

McLaren, J., (2002), "A Theory of Insidious Regionalism," *The Quarterly Journal of Economics*, vol.117, no.2, 571-607.

Levine, R. and D. Renelt, (1992), "A Sensitivity Analysis of Cross Country Growth Regressions," *American Economic Review* 82, 942-963.

Pagan, A. and A. Ullah, (1999), *Nonparametric Econometrics*, Cambridge University Press, Cambridge, UK.

Rodriguez, F. and D. Rodrik, (2000), "Trade Policy and Economic Growth: A Sceptic's Guide to the Cross-National Evidence," *NBER Working Paper*.

Slaughter, M. J., (forthcoming), "Trade Liberalization and Per Capita Income Convergence: A Difference-in-Differences Analysis," *Journal of International Economics*.

Summers, R. and A. Heston, (1991), "The Penn World Table (Mark 5): An Expanded Set of International comparisons 1950-88," *Quarterly Journal of Economics* 106, 327-368.

Table 1: *Convergence equation for per capita income (equation 1)*

		No Obs	α_y Value	(s.e.)	β_y Value	(s.e.)	R2
50-92	**Global**	51	0.0030	(.0143)	0.0023	(.0017)	0.0339
60-92	**Global**	86	−0.0156	(.0135)	0.0043*	(.0016)	0.0713
50-60	**Global**	60	0.0063	(.0198)	0.0023	(.0026)	0.0134
60-70	**Global**	125	−0.0176	(.0172)	0.0063*	(.0022)	0.0596
70-80	**Global**	133	−0.0046	(.0216)	0.0038	(.0027)	0.0143
80-92	**Global**	91	−0.0559*	(.0175)	0.0073*	(.0020)	0.1198
All Decades Pooled	**Global**	409	−0.0023	(.0108)	0.0032*	(.0014)	0.0124

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 2: *Convergence equation for per capita income with regional dummies (equation 1α)*

		No Obs	α_y Value	(s.e.)	β_y Value	(s.e.)	R2
50-92	**Global**	51	0.0462*	(.0147)	−0.0021	(.0021)	0.0339
60-92	**Global**	86	0.0452*	(.0185)	−0.0020	(.0023)	0.0713
50-60	**Global**	60	0.0674*	(.0222)	−0.0038	(.0028)	0.0134
60-70	**Global**	125	0.0507**	(.0249)	−0.0005	(.0030)	0.0596
70-80	**Global**	133	0.0606**	(.0334)	−0.0034	(.0040)	0.0143
80-92	**Global**	91	−0.0023	(.0251)	0.0020	(.0027)	0.1198
All Decades	**Global**	409	0.0718	(.0149)	−0.0046*	(.0018)	0.0124

Pooled				*			

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 2 Continues: *Convergence equation for per capita income with regional dummies (equation 1α)*

		Dummy Asia & Australia		Dummy Americas		Dummy Africa	
		Value	**(s.e.)**	**Value**	**(s.e.)**	**Value**	**(s.e.)**
50-92	**Global**	-0.0077**	(.0037)	-0.0157*	(.0030)	-0.0185*	(.0045)
60-92	**Global**	-0.0022	(.0048)	-0.0145*	(.0047)	-0.0238*	(.0054)
50-60	**Global**	-0.0153*	(.0063)	-0.0213*	(.0049)	-0.0306*	(.0074)
60-70	**Global**	-0.0109**	(.0065)	-0.0188*	(.0062)	-0.0274*	(.0071)
70-80	**Global**	0.0033	(.0086)	-0.0090	(.0083)	-0.0243*	(.0096)
80-92	**Global**	0.0098	(.0063)	-0.0190*	(.0061)	-0.0208*	(.0074)
All Decades Pooled	**Global**	-0.0038	(.0041)	-0.0185*	(.0039)	-0.0313*	(.0045)

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 3: *Convergence equation for per capita income within regions (equation 1)*

			α_y		β_y		
		No Obs	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**R2**
50-92	**Africa**	7	0.0082	(.0358)	0.0009	(.0050)	0.0056
	Americas	18	0.0005	(.0198)	0.0019	(.0024)	0.0354
	Asia & Australia	9	0.0442	(.0369)	-0.0029	(.0056)	0.0430
	Europe	17	0.1075*	(.0180)	-0.0121*	(.0037)	0.5545
60-92	**Africa**	31	0.0070	(.0354)	0.0002	(.0053)	0.0001
	Americas	18	0.0005	(.0210)	0.0019	(.0026)	0.0313
	Asia & Australia	19	0.0413	(.0387)	-0.0018	(.0055)	0.0066
	Europe	18	0.0909*	(.0144)	-0.0085*	(.0022)	0.5407
50-60	**Africa**	9	0.0906*	(.0271)	-0.0128*	(.0047)	0.5494

	Americas	22	−0.0071	(.0449)	0.0032	(.0057)	0.0148
	Asia & Australia	10	0.0458	(.0435)	−0.0029	(.0061)	0.0290
	Europe	19	0.0914	(.0412)	−0.0070	(.0055)	0.0934
60-70	**Africa**	47	0.0143	(.0504)	0.0008	(.0075)	0.0003
	Americas	27	0.0247	(.0414)	0.0004	(.0053)	0.0002
	Asia & Australia	27	−0.0046	(.0406)	0.0054	(.0052)	0.0388
	Europe	24	0.1382	(.0217)	−0.0119	(.0030)	0.4494
70-80	**Africa**	50	0.0246	(.0630)	−0.0017	(.0093)	0.0007
	Americas	27	0.0223	(.0557)	0.0003	(.0069)	0.0001
	Asia & Australia	29	0.0331	(.0532)	0.0007	(.0068)	0.0003
	Europe	27	0.1869	(.0267)	−0.0199	(.0038)	0.5762
80-92	**Africa**	32	0.0121	(.0415)	−0.0031	(.0061)	0.0086
	Americas	19	−0.1088	(.0332)	0.0117	(.0035)	0.3668
	Asia & Australia	19	0.0146	(.0407)	0.0011	(.0049)	0.0030
	Europe	21	−0.0256	(.0484)	0.0045	(.0051)	0.0370
All Decades Pooled	**Africa**	138	0.0572	(.0298)	−0.0072	(.0047)	0.0183
	Americas	95	0.0299	(.0269)	−0.0015	(.0035)	0.0021
	Asia & Australia	85	0.0263	(.0231)	0.0010	(.0030)	0.0013
	Europe	91	0.1459	(.0178)	−0.0142	(.0024)	0.3091

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 4: *Convergence equation for openness (equation 2)*

		No Obs	α_{op} Value	(s.e.)	β_{op} Value	(s.e.)	R2
50-92	**Global**	51	0.0431*	(.0075)	−0.0121*	(.0034)	0.3057
60-92	**Global**	86	0.0550*	(.0071)	−0.0152*	(.0030)	0.3314
50-60	**Global**	60	0.0509*	(.0183)	−0.0128*	(.0057)	0.0899
60-70	**Global**	125	0.0477*	(.0146)	−0.0117*	(.0043)	0.0645
70-80	**Global**	133	0.1126*	(.0156)	−0.0241*	(.0051)	0.1788
80-92	**Global**	91	0.0541*	(.0175)	−0.0145*	(.0051)	0.0998
All Decades Pooled	**Global**	409	0.0727*	(.0091)	−0.0170*	(.0028)	0.0978

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 5: *Convergence equation for openness with regional dummies (equation 2a)*

		No Obs	α_{op} Value	(s.e.)	β_{op} Value	(s.e.)	R2
50-92	**Global**	51	0.0517*	(.0073)	−0.0137*	(.0034)	0.4556
60-92	**Global**	86	0.0603*	(.0078)	−0.0160*	(.0032)	0.3667
50-60	**Global**	60	0.0679*	(.0180)	−0.0140*	(.0054)	0.2589
60-70	**Global**	125	0.0573*	(.0152)	−0.0124*	(.0043)	0.1136
70-80	**Global**	133	0.1124*	(.0167)	−0.0236*	(.0051)	0.2050
80-92	**Global**	91	0.0559*	(.0194)	−0.0145*	(.0053)	0.1236
All Decades Pooled	**Global**	409	0.0796*	(.0097)	−0.0177*	(.0028)	0.1124

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 5 Continues: *Convergence equation for openness with regional dummies (equation 2a)*

		Dummy Asia & Australia Value	(s.e.)	Dummy Americas Value	(s.e.)	Dummy Africa Value	(s.e.)
50-92	**Global**	−0.0097*	(.0032)	−0.0078*	(.0027)	−0.0056	(.0045)
60-92	**Global**	−0.0011	(.0037)	−0.0071**	(.0038)	−0.0044	(.0054)
50-60	**Global**	−0.0300*	(.0088)	−0.0166*	(.0071)	−0.0156**	(.0074)

60-70	**Global**	−0.016	(.0079)	−0.0127	(.0079)	−0.0031	(.0071)
		7**					
70-80	**Global**	0.0074	(.0081)	−0.0088	(.0082)	−0.0025	(.0096)
80-92	**Global**	0.0038	(.0073)	−0.0133	(.0074)	−0.0058	(.0074)
All Decades Pooled	**Global**	−0.004	(.0046)	−0.0106*	(.0045)	−0.041	(.0045)
		7					

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 6: *Convergence equation for openness within regions (equation 2)*

		No Obs	α_{op} Value	(s.e.)	β_{op} Value	(s.e.)	R2
50-92	**Africa**	7	0.0705**	(.0346)	−0.0294	(.0313)	0.4074
	Americas	18	0.0377**	(.0131)	−0.0107***	(.0021)	0.2498
	Asia & Australia	9	0.0323**	(.0169)	−0.0093	(.0069)	0.2830
	Europe	17	0.0541*	(.0086)	−0.0149*	(.0042)	0.6133
60-92	**Africa**	31	0.0856*	(.0151)	−0.0325*	(.0110)	0.4847
	Americas	18	0.0449*	(.0165)	−0.0123***	(.0069)	0.2288
	Asia & Australia	19	0.0367*	(.0126)	−0.0073***	(.0042)	0.1848
	Europe	18	0.0699*	(.0111)	−0.0205*	(.0055)	0.6375
50-60	**Africa**	9	0.1343*	(.0341)	−0.0453*	(.0150)	0.6753
	Americas	22	0.0320	(.0251)	−0.0079	(.0076)	0.0554
	Asia & Australia	10	0.0220	(.0430)	−0.0090	(.0129)	0.0623
	Europe	19	0.0479	(.0339)	−0.0079	(.0098)	0.0395
60-70	**Africa**	47	0.1118*	(.0253)	−0.0310*	(.0089)	0.2700
	Americas	27	−0.0016	(.0218)	0.0007	(.0057)	0.0007
	Asia & Australia	27	0.0306	(.0421)	−0.0094	(.0122)	0.0252
	Europe	24	0.0479*	(.0119)	−0.0096*	(.0034)	0.2830
70-80	**Africa**	50	0.1464*	(.0416)	−0.0361*	(.0150)	0.1491
	Americas	27	0.0529*	(.0224)	−0.0078	(.0064)	0.0615
	Asia & Australia	29	0.1189*	(.0287)	−0.0233*	(.0095)	0.2199

	Europe	27	0.1293*	(.0231)	−0.0293*	(.0079)	0.4287
80-92	**Africa**	32	0.1226*	(.0405)	−0.0383*	(.0153)	0.2523
	Americas	19	0.0157	(.0416)	−0.0038	(.0113)	0.0069
	Asia & Australia	19	0.0248	(.0259)	−0.0048	(.0067)	0.0319
	Europe	21	0.0747***	(.0380)	−0.0199***	(.0113)	0.1724
All Decades Pooled	**Africa**	138	0.1307*	(.0199)	−0.0360*	(.0072)	0.2105
	Americas	95	0.0247**	(.0145)	−0.0044*	(.0040)	0.0131
	Asia & Australia	85	0.0615*	(.0213)	−0.0135*	(.0063)	0.0590
	Europe	91	0.0827*	(.0136)	−0.0186*	(.0041)	0.2147

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.

Table 7: *Convergence Equation for per capita income with growth of openness as an explanatory variable (equation 3)*

			α_y		β_y		Growth of Openness		
		No Obs	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**R2**
50-92	**Global**	51	−0.0023	(.014)	0.0026	(.0016)	0.3594	(.2538)	0.1519
60-92	**Global**	86	−0.0085	(.0156)	0.0039**	(.0018)	−0.0349	(.2331)	0.1079
50-60	**Global**	60	−0.0008	(.0220)	0.0028	(.0028)	0.4739	(.3261)	0.1299
60-70	**Global**	125	−0.0189	(.0208)	0.0068*	(.0027)	−0.4524	(.3193)	0.0812
70-80	**Global**	133	0.0008	(.0280)	0.0034	(.0031)	−0.0666	(.2087)	0.0356
80-92	**Global**	91	−0.055	(.	0.0072	(.	−0.04	(.	0.08

			7*	0179)	*	0021)	85	3031)	92
All Decades Pooled	**Global**	409	-0.0044	(. 0114)	0.0033 *	(. 0014)	0.0674	(. 1335)	0.0465

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.
Note 3: Openness is estimated as in equation (2).

Table 8: *Convergence equation for per capita income with growth of openness and TOI as explanatory variables (equation 4) - The results refer to the period 1980 – 1992*

	α_y		β_y		Growth of Openness		EFW_TOI (85-87)		
	Value	**(s.e.)**	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**R2**
70	-0.0202	(. 0206)	0.0008	(. 0029)	0.3594 *	(.0974)	0.0497*	(.0148)	0.3734

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.
Note 3: Openness is estimated as in equation (5).

Table 9: *Convergence equation for openness with TOI as explanatory variable (equation 5) - The results refer to the period 1980 – 1992*

	α_y		β_y		EFW_TOI (85-87)		
No Obs	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**Value**	**(s.e.)**	**R2**
70	0.0402*	(.0173)	-0.0143*	(.0055)	0.0287**	(.0143)	0.1152

*Note 1: *5% significance, **10% significance, ***20% significance*
Note 2: The estimation method is non-linear least squares.