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CONVERGENCE HYPOTHESIS: A CROSS COUNTRY ANALYSIS

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Abstract. Convergence debate has been an important topic of economic growth literature. This article aims to investigate convergence at assorted level of disaggregation among a sample of almost 60 countries. It has tested absolute and conditional convergence hypotheses for a set of developed and developing countries by applying pooled least square methodology. The results suggest absolute convergence for countries having similar characteristics and conditional convergence for countries having heterogeneous structures. Disparity level for each country is also calculated with reference to average steady state income. The study has also scrutinized the role of investment, openness and population growth in accelerating the convergence process.

Keywords: Absolute convergence, Conditional convergence, Solow swan growth model, Pooled ordinary least square

JEL classification: C23, F43, C61, O16

I. INTRODUCTION

There has been substantial inquisition into the nature and sources of differences in growth rates across countries and regions over time. This

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was essentially necessitated owing to the considerable potential impact caused by even marginal differences in growth rates, over a long period of time, on the standards of living of people. Convergence, as a phenomenon of diminution in growth rate disparity among different regions, denotes the course by which comparatively poorer regions or countries grow quicker than the rich countries. It can be described as a process of catching up or narrowing down the gap between per capita incomes of less developed and developed countries. It is absolute if all countries accomplish the same level of long-term income growth. It also suggests that the less developed countries grow more rapidly than developed countries resulting in catching up by poorest countries. Conditional convergence, on the other hand, suggests that a country or a region will converge to its own steady state as every country or region has its own distinguished set of endowments.

Convergence hypothesis was initially advocated by Solow (1956) and further refined and developed by Baumol (1986) and Barro and Xavier-Sala-i-Martin (1991). Barro (2000) concluded that absolute convergence can occur only if all countries have same identical inherent features. Conditional convergence, on the other hand, implies that economies with homogeneous features are more likely to experience income convergence irrespective of their preliminary situation. These findings were further proven by Barro and Sala-I-Martin (1992) and Barro (2000). Murphy and Ukpolo (1999) conducted a detailed analysis of conditional convergence hypothesis for African region. Empirical results verified the occurrence of conditional convergence in the region for the period 1960 to 1985. Romer (1986) however raised questions about the validity of convergence hypothesis while presenting his endogenous growth theory.

The absolute and conditional convergence hypotheses have been tested by several researchers using different methodologies and data sets. The outcome appears to have attracted a mixed response from unmitigated rejection by some to ardent acceptance by others. It is in this background that current study is conducted for a set of developed and developing counties to furnish evidence regarding the convergence hypothesis. The analysis is based on latest data sets and is expected to improve understanding of convergence process in various developed and developing countries. An important contribution of this research work is

the calculation of disparity intensity for each country which helps to find out how far away a country is from the average steady state. Besides, the study has also investigated the role of investment, population growth and openness in convergence process. The empirical findings are expected to help policy makers in devising relevant policies in this regard.

II. LITERATURE REVIEW

Abramovitz (1986) and Baumol (1986) conducted maiden empirical analysis of the convergence premise using Maddison's (1982) dataset. Abramovitz (1986) authenticated the convergence hypothesis by employing relative variance and rank correlation coefficient. Baumol (1986) estimated a simple regression equation to show the strong inverse association among the growth rate of Gross Domestic Product and its preliminary value. Delong (1988) in his analysis, nonetheless, concluded no income convergence rather divergence by using the same data set. Baumol and Wolff (1988) verified convergence hypothesis for a set of developed countries by applying piecewise linear and quadratic regression. Dowrick and Nguyen (1989) established the existence of income convergence for developed countries by using parameter stability test. The study commended increase in total factor productivity (TFP) as the basis of income convergence.

Barro and Sala-i-Martin (1990) studied absolute convergence for the United States of America. Barro (1991) tested the convergence hypothesis for a comprehensive data set consisting of 98 countries and rejected the absolute convergence hypothesis. The analysis also recommended that main factor causing income diversion was disparity regarding human capital stocks possessed by various countries.

Paci and Pigliaru (1997) rejected the convergence hypothesis for European region. The study was conducted for 109 regions of 12 European countries for the decade of 1980s. It also analyzed the trend of labor productivity convergence in sample countries. The results suggested that labor productivity in these countries was converging at the rate of 1.2%. Blomstrom and Wolf (1994) found that in most of the world economies labor productivity rates were experiencing convergence. The study also concluded no convergence for manufacturing sectors in these countries.

Johnson (2000) analyzed income convergence across the United States for the period 1929-1993. The analysis was performed using the per capita personal income in each state relative to the United States average by applying the nonparametric methodology proposed by Quah (1996). The study however, found no empirical evidence of divergence in the cross-state income distribution. Esteban (2000) studied Regional convergence in Europe using shift-share analysis and concluded that regional specialization had a very trivial role in regional convergence. The analysis suggested policy measures to bridge the gap between developed and underdeveloped countries based on improvement of infrastructures and human capital.

Cole and Neumayer (2003) analyzed the absolute convergence hypothesis for 110 countries for the time period 1960-96 based on population weighted per capita GDP. Knack (1996) analyzed the factors influencing the speed and convergence ability of a country and concluded quality of institutions as an imperative factor in building up the convergence potential of a country. Mankiw et al. (1992), conducted comprehensive empirical analysis of conditional convergence based on cross-section data. The study was primarily based on the empirical test of various versions of Solow growth model.

Nonneman and Vanhoudt (1996) tested convergence hypothesis for a set of OECD countries. The analysis established strong empirical support for convergence among the homogeneous countries. Cho and Graham (1996) resolved that most of the poor economies typically exceed their steady state levels and consequently approach their steady state from above. Murthy and Ukpolo (1999) conducted empirical analysis of convergence phenomenon for African region. The study assessed conditional convergence by utilizing Solow model. The study concluded that African economies were converging at an overall rate of 1.7% and this sluggish convergence was ascribed to the structural problems in the region. Dobson and Ramlogan (2002) rejected conditional convergence hypothesis for Latin American region. The study was based on cross-section data from various Latin- American countries.

Karras (2010) inspected convergence hypothesis for various regions. Levine and Renelt (1992) utilized extreme-bounds analysis (EBA) to

empirically analyze the conditional convergence hypothesis. The results suggested occurrence of conditional convergence for the period 1960-89.

Andrés et al. (1996) analyzed convergence hypothesis for OECD region by including inflation rate, exports growth and public-sector expenditure in their model. However, the analysis did not recommend any notable alteration to prevailing evidence on convergence in these countries. Milanovic (2003) tested convergence hypothesis for a sample of 17 rich countries and found that per capita income of these countries did not converge during the per-war era of 1870-1913.However there was a strong evidence for convergence in the inter-war period. Evans and Kim (2005) utilized dynamic random variable model to investigate convergence in Asian countries and concluded that Asian economies converged at a rate of 2%. Ismail (2008) assessed convergence hypothesis for ASEAN countries. The study utilized the pooled mean group estimator (PMGE) and found evidence for both absolute and conditional convergence. Masron and Yusop (2008), however established that convergence among ASEAN countries was subject to the extent of economic openness. The study also highlighted the role of external shocks in producing income deviance among these countries.

Ferreira (2000) and Azzoni (2001) tested convergence hypothesis for Brazil and established strong empirical support for conditional convergence in Brazil. The coefficients estimated by Ferreira (2000) were higher in 1970s as compared to future time periods. Azzoni (2001) on the basis of his findings did not support convergence before 1970. The study proposed a swift income convergence after 1970. Many other studies provided support for conditional β-convergence. Nagaraj et al. (1998) Michelis et al. (2004) and Kim (2005) examined regional convergence in India, Greece and South Korea respectively. The results concluded a higher convergence in the Korean and Indian region as compared to Greek regions. Jones (2002) applied parallel time-series technique to analyze convergence hypothesis for the Economic Community of West African States.

McCaskey (2002) analyzed convergence for a set of Sub-Saharan African countries. The study also evaluated convergence in these countries regarding government share of GDP, capital per worker, openness of economy and standards of living. The results however did

not support any noteworthy convergence trends for the region. Weeks and Yudong (2003) analyzed conditional Income convergence hypothesis for various provinces of China based on the neo-classical growth model framework. The analysis suggested a methodical income deviation during the reform period as the seaside provinces were lagging behind the interior provinces regarding technological progress.

Another study by Evans and Kim (2011) empirically supported convergence hypothesis and confirmed the existence of income convergence among 13 Asian countries by utilizing the panel stationarity test by Carron-Silvestre et al. (2005). Nahar and Inder (2002) evaluated trend regressions for output gap and squared demeaned output from the USA and used the resultant average slopes for the test of absolute convergence for OECD countries. All countries except Germany, Iceland and Norway showed high convergence tendency towards their average income for the period 1950-98.

III. DATA DESCRIPTION AND METHODOLOGY

Present study has tested convergence hypothesis for 18 developed and 42 developing countries. (The countries are randomly selected and a list of these countries is provided in appendix 1). All the data for present study is taken from Alan Heston, Robert Summers and Bettina Aten Penn World Table version 7.11. Following is a brief description of the variables used in this study:

- Real GDP per capita (constant prices) is a measure of value of goods and services produced in an economy excluding the impact of increase in price level.
- Investment share of PPP converted GDP per capita at 2005 constant prices.
- Population. (In thousands).
- Openness (at 2005 constant prices (%))

[1] http:// pwt.sas.upenn.edu/php_site/pwt_index.php.

To analyze the hypothesis of absolute and conditional convergence Pooled Least Squares with time dummies and cross-section weights (PCSE) standard errors is used.

EMPIRICAL RESULTS

Absolute Convergence

The absolute convergence hypothesis is tested twice firstly for the set of 18 developed countries and secondly for the overall set of 60 countries. The hypothesis tested in both cases is

H_0: $\alpha \geq 0$ (there is no absolute convergence)

H_A: $\alpha < 0$ (there is absolute convergence)

The null hypothesis states that growth rate of GDP does not depend on the preliminary level of GDP per capita. The alternative hypothesis however, designates that growth rates and initial GDP per capita are inversely associated and hence, convergence occurs. To test the hypothesis following model is estimated.

$$\Delta \ln (Y_{i,t}) = a - \bar{\alpha} \ln (Y_{i,t-1}) + \theta_t + \varepsilon_{i,t} \qquad [1]$$

Where $\Delta \ln (Y_{i,t})$ is the GDP per capita growth rate of the country i at time $_t$, a is the intercept, θt is the time fixed time effects and $\alpha = \left(\frac{1 - e^{\beta t}}{T} \right)$ where β is the annual speed of convergence. A significant negative value for $\bar{\alpha}$ implies absolute beta convergence, while a positive value implies non-convergence. Following table provides the estimation of above model for both data sets.

TABLE 1

Absolute Convergence (1970-2010)

Variables/Regression	Developed countries	Full sample
Constant	0.20867 (7.33734) *****	-0.00799 (-0.84634)
ln Y (-1)	-0.01866 (-6.40767)	0.00339 (3.16200)
Fixed Effects (period)		
1970	0.00391	0.01029
1980	-0.00066	0.00604
1990	0.00334	-0.00894
2000	0.00429	-0.00726
2010	-0.00273	0.00085
R^2	0.56212	0.41398
Adj. R^2	0.53476	0.37828

*t-values are provided in the parenthesis

Refereeing to the second column of table 1 the estimated coefficient of $\bar{\alpha}$ for developed countries, is -0.01866, which is highly significant and therefore leads to the refutation of null hypothesis. This result is in line with the forecasts of neoclassical growth model and advocates that absolute convergence exists among developed countries. The estimated coefficient implies that a 1% increase in initial per capita income will lead to 1.866% increase in growth rate. The negative coefficient indicates that the difference among these homogeneous countries tends to reduce as each economy approaches the steady state.

The model is re estimated for the full sample consisting of 18 developed and 42 developing countries. (*The results are summarized in column 3 of Table 1*). The estimated coefficient associated with log of real GDP per capita is 0.00339 which is positive and significant (t-value =3.162). It means that there is inadequate indication to discard the null

hypothesis. It can be concluded that absolute convergence does not exist for the whole sample due to heterogeneous and varied structure of economies among developed and less developed countries. The phenomenon can be ascribed to divergences between the countries and consequently their steady states are different. The fixed effect (period) of 1970 to 1980 is positive while it is negative for the period 1990 and 2000. Hence the results indicate the absence of absolute convergence for of output per capita for the combined sample.

Conditional Convergence

The notion of conditional convergence can be described as the relationship between the growth rate and the gap between the actual levels of GDP versus its own steady state. The neoclassical model envisages conditional convergence whereby countries tend to converge to their own steady states owing to their particular country-specific features, such as level of technology, openness, investment, population and rule of law. Mankiw et al (1992) and Barro and Sala-i-Martin (1995) keeping in view the heterogeneity of various economies advocated the conditional convergence hypothesis. In current section following hypothesis is tested to examine the occurrence of conditional convergence.

H_0: $\alpha \geq 0$ (there is no conditional convergence)

H_A: $\alpha < 0$ (there is conditional convergence)

To test the conditional convergence hypothesis, following model is estimated

$$\Delta \ln (Y_{i,t}) = a - \alpha \ln (Y_{i,t-1}) ++ \Upsilon_t + \theta_t + u_{i,t} \qquad [2]$$

Where $\Delta \ln (Y_{i,t})$ is the GDP per capita growth rate of the country i at time t, a is the intercept, θ_t is the time fixed time effects, Υ_t are the country fixed effects and $\alpha = \left(\frac{1 - e^{\beta t}}{T} \right)$ where β is the annual speed of convergence. The estimation results are provided in Table 2. The estimated coefficient value for log of real GDP is -0.021470, which is highly significant. (t-value is -4.25713). Therefore, the hypothesis of conditional convergence is accepted for the overall sample countries.

TABLE 2

Conditional Convergence for 60 Countries (1970-2010)

Variables/Regression	Full sample
Constant	0.19858 (4.73866) *****
ln Y (-1)	-0.02147 (-4.25713)
Fixed Effects (period)	
1970	-0.00128
1980	0.00164
1990	-0.00697
2000	-0.00209
2010	0.00870
R^2	0.57502
Adj. R^2	0.45305

*t-values are provided in the parenthesis.

Next step is to find the annual speed of convergence. We have $\alpha = \left(\frac{1-e^{\beta t}}{T}\right)$ where α is the estimated coefficient, β^2 is the annual speed of convergence and T is the number of years per period. By substituting the calculated value, we have

$$(1 - e\text{-}\beta*10)/10 = -0.021470$$

$$1 - e\text{-}\beta*10 = 0.21470$$

$$e\text{-}\beta*10 = 0.7853$$

By taking logarithm of both sides we get

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[2] $\beta = -\frac{1}{10} ln\,(1 + \alpha)$

$\beta = 0.02418$ (*Annual speed of convergence*)

Half-life computation formula $(0.69/\beta)$[3] can be utilized to find the distance from steady state. The results propose that it will take about 25 to 28 years to fill half the original distance from the steady state, which some people in the present generation can also witness. This conclusion upgrades the existing empirical evidence which contends that, the time required for substantial convergence is approximately many generations.

Disparity Level for each Country

Current section provides disparity level for each country based on demeaned values. To find the income disparity, the log GDP per capita data for the whole set of 60 countries is altered by taking deviations from their cross section mean. This practice is similar to introducing time dummies. The fixed effect is expelled from the model and the estimation is used to approximate the individual income effects. Following model is estimated to calculate income disparity.

$$D_{yit} = - \beta_{yit\ -1} + \gamma_i + \varepsilon_{it} \qquad [3]$$

Where yit is $\ln\left(\frac{yit}{\bar{y}t}\right)$ and $\bar{y}t$ is the mean of yit across the country *i* at time *t*. The inverse association among the time-demeaned preliminary GDP per capita and the average growth rate are tested. (*For details see Appendix II).* The estimated value of β is -0.22278. It advocates conditional convergence for each country and indicates a "provisional dynamics" by each country to their corresponding steady states. The positive coefficient value for a country suggests that the country is growing quicker as paralleled to the sample mean, while a negative coefficient suggests a parting from the sample mean; hence, such country is far behind the other countries.

The empirical results also suggest that countries have diverse steady state which is revealed by a different intercept value for each country. The results show that most developing economies have negative constants and 26 out of 50 countries have significant coefficients. All the

[3] Half-life computation formula is helps to estimate the time needed by a country to reach steady state and is given by $t = - \ln (0.5) / \beta$

developed countries have positive and significant constants. The next logical step is to compute income disparity for each country which aids to assess income disparities and variances in living standards. The disparity for each country is computed as follows:

$$Dsi = \frac{yi}{\beta}$$

Where D_{si} is the disparity level for each country and is obtained by dividing estimated fixed effect of each country by its estimated coefficient of regression equation. Income disparities abet to understand the relative position of a country with regard to its steady state position. It also provides the information as to how promptly a country will approach its steady state.

TABLE 3

Disparity Level

Country	Disparity level	Country	Disparity level
ARG	-0.49349 (0.1887)[4]	ITA	0.77830 (0.0114)
AUS	0.865293 (0.0041)	KOR	1.04901 (0.0062)
AUT	1.02127 (0.0000)	LAO	-1.63304 (0.0362)
BFA	-3.13021 (0.0000)	LBY	-0.28292 ((0.3914)
BOL	-1.78238 (0.0000)	LUX	1.61706 (0.0002)
BRA	-0.47679 (0.3090)	MEX	-0.25738 (0.4145)
CAF	-3.82938 (0.0000)	MNG	-1.58730 (0.0421)
CHE	1.45656 (0.0000)	MWI	-3.24261 (0.0004)
CHI	-0.81937 (0.3835)	MYS	0.04951 (0.89900)
CHL	-0.38841 (0.3117)	NGA	-2.75662 (0.0000)
CIV	-2.58425 (0.0000)	NLD	0.90727 (0.0014)
COG	-1.89716 (0.0001)	NOR	1.29455 (0.0000)
CRI	-0.44945 (0.1151)	NZL	0.34222 (0.1332)

[4] P-values are provided in the parenthesis,

Country	Disparity level	Country	Disparity level
CYP	0.52998 (0.1151)	PAK	-1.84334 (0.0002)
DNK	0.83288 (0.0045)	PAN	-0.23929 (0.4839)
DOM	-0.41336 (0.2711)	PHL	-1.73919 (0.0001)
DZA	-1.24719 (0.0000)	PRT	0.56243 (0.0333)
EGY	-1.12914 (0.0289)	PRY	-1.40658 (0.0081)
ESP	0.83194 (0.0068)	RWA	-3.22888 (0.0000)
ETH	-3.49429 (0.0000)	SGP	1.71936 (0.0000)
FRA	0.812236 (0.0037)	SOM	-4.19651 (0.0000)
GAB	-0.305952 (0.5603)	TUN	-0.81506 (0.0260)
GER	0.763039 (0.0017)	TUR	-0.43100 (0.0021)
GHA	-2.404614 (0.0000)	TWN	1.33243 (0.0000)
GTM	-1.015935 (0.0099)	UKR	0.84949 (0.0044)
HKG	1.495421 (0.0000)	USA	0.95385 (0.0012)
HND	-1.71680 (0.0000)	VEN	-0.77475 (0.0182)
HTI	-2.84486 (0.0000)	ZAR	-4.81124 (0.0001)
IDN	-1.23601 (0.0249)	ZMB	-2.87346 (0.0002)
IND	-1.62433 (0.0127)	ZWE	-4.03388 (0.0000)

A positive disparity level reflects that a country's steady state level is above the average steady state level while a negative steady state value indicates that the country is below the average steady state level. Table 3 provides the GDP per capita disparity results showing a maximum of 1.72 for Singapore which reflects that Singapore is 172% richer than the average (mean) country. Correspondingly, ZAR has a value of -4.811 which presents that it is 481% poorer than the average country. Pakistan is found to be 184% poorer than the average country. It is evident from the results that all the developed countries are above average steady state level with significant p-values.

IV. CONDITIONAL CONVERGENCE, OPENNESS, INVESTMENT AND POPULATION GROWTH

Fixed effect panel estimation approach is used to estimate regressions (2). Control variables play an important role in testing the conditional convergence hypothesis. The inclusion of control variables aids to understand the effects of various factors on economic growth. In current study, investment to GDP ratio (K), trade openness (O), population growth (P) and Rule of law (R) are taken as control variables. Investment to GDP ratio (K) and trade openness (O) is included because they are important components of aggregate demand and hence have implications for economic growth. Rule of law (R) is used as a policy stability variable. Population growth (P) is included to incorporate social conditions of a country. For Openness and Investment mean values are used to account for instability of these variables arising due to business cycles. It helps to measure the effects of these variables on economic growth. Keeping in view the neoclassical growth model there is an expectation of an inverse relationship among population growth and economic growth and a positive relationship between investment and economic growth. The relationship between openness and economic growth and rule of law and economic growth is also expected to be positive.

The estimated coefficient for log of real GDP after inclusion of control variables is is -0.002133 which is insignificant and suggests the absence of conditional convergence. It submits that the control variables are not strong enough to produce a level difference which can lead to income convergence among countries. Hence these factors do not impact the steady state position of countries. All the control variables investment, openness, Rule of law and population growth have expected signs as supported by economic theory. For example, one-unit increase in investment share leads to 0.01 unit increase in GDP growth.

Fourth column of Table 4 presents the results of conditional convergence for18 developed countries by eliminating the fixed effects. Moreover, it also adds the investment, openness and population growth as control variables. The value of the estimated coefficient of log GDP per capita is -0.021339 which is highly significant. The results suggest conditional convergence amongst countries. The coefficients pertaining

to investment and openness are positive but only investment coefficient is found significant. The coefficient of population growth is negative and insignificant. Hence, population growth and openness are not significant determinants.

TABLE 4

Conditional Convergence, Inclusion of Investment, Population Growth and Openness as Control Variables (1970-2010)

Variables/ Regression	Full sample (excluding R)	Full sample (including R)	Developed Countries
Constant	0.02154 (1.58242) *****	0.03546 (2.16584)	0.21345 (6.35026)
ln Y (-1)	-0.002133 (-1.56630)	-0.003937 (-2.15714)	-0.02133 (-6.34711)
Investment (K)	0.001100 (6.60344)	0.00100 (5.82718)	0.000747 (2.91379)
Openness (O)	0.000048 (2.17601)	0.000044 (2.06426)	0.000024 (1.08596)
Population (P)	-0.637353 (-3.75880)	-0.49709 (-2.53132)	-0.025353 (-0.13805)
Rule of Law (R)	----------	0.004130 (1.85864)	----------
Fixed Effects (period)			
1970	0.00993	0.00859	0.00993
1980	0.00475	0.00427	0.00375
1990	-0.00614	-0.00640	0.00433
2000	-0.00603	-0.00553	0.00100
2010	-0.00150	-0.00008	0.00459
R^2	0.31711	0.33756	0.52711
Adj. R^2	0.29753	0.30807	0.49753

*t-values are provided in the parenthesis

Column 2 and 3 summarize the results of regressions pertaining to full sample with and without including rule of law as a control variable respectively. In column 2 estimated coefficient value for log GDP is negative but not significant indicating absence of conditional convergence. The coefficients on population growth, investment and openness have the expected signs as suggested by neo-classical growth

theory and are highly significant. Conditional convergence hypothesis is tested again after including rule of law as a control variable and the results are summarized in column 3 of table 4. The coefficient of log GDP has not only a negative sign but significant as well. Its value is -0.003937 with a t-value of -2.157 indicating conditional convergence. The coefficient on rule of law also has the expected sign and is significant as well. These results put forward that population growth; investment, openness and rule of law are all significant determinants.

V. CONCLUSION

This paper has empirically investigated the convergence hypothesis for a set of developed and developing countries. The study has tested both absolute convergence hypothesis (using beta convergence methodology and conditional convergence hypothesis (by including the appropriate controls). The study has employed the pooled cross-section, time series data set, which offers new insights about the convergence tests for real GDP per capita. Current analysis concludes absolute convergence for countries having homogeneous characteristics and conditional convergence for set of countries having diverse features. The study also calculated the disparity level for each country depicting the expanse of each country from the mean steady state. Investment, openness, population growth and rule of law are important determinants in this regard.

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APPENDIX

TABLE I

Developed Countries		Less Developed Countries	
Sr. No	Name	Sr. No	Name
1	Australia (AUS)	1	Argentina (ARG)
2	Austria (AUT)	2	Algeria (DZA)
3	Cyprus (CYP)	3	Burkina Faso (BFA)
4	Denmark (DNK)	4	Bolivia (BOL)
5	France (FRA)	5	Brazil (BRA)
6	Germany (GER)	6	Central African Republic (CAF)
7	Hong Kong(HKG)	7	China (CHI)
8	Italy(ITA)	8	Chile (CHL)
9	South Korea (KOR)	9	Ivory Coast(CIV)
10	Luxembourg (LUX)	10	Congo (COG)
11	Netherlands (NLD)	11	Costa Rica (CRI)
12	Norway (NOR)	12	Dominican Republic (DOM)
13	New Zealand(NZL)	13	Egypt (EGY)
14	Portugal(PRT)	14	Ethiopia (ETH)
15	Singapore (SGP)	15	Gabon GAB)
16	Spain (ESP)	16	Ghana (GHA)
17	Taiwan (TWN)	17	Guatemala (GTM)
18	United States of America (USA)	18	Honduras (HND)
		19	Haiti (HTI)
		20	Indonesia (IDN)
		21	India (IND
		22	Laos (LAO)
		23	Libya (LBY)
		24	Mexico (MEX)
		25	Mangolia (MNG)
		26	Malawi (MWI)
		27	Malaysia (MYS)
		28	Nigeria (NGA)
		29	Pakistan (PAK)
		30	Panama (PAN)
		31	Philppine (PHL)
		32	Paraguay (PRY)
		33	Rwanda (RWA)
		34	Somalia (SOM)
		35	Tunisia (TUN)
		36	Turkey (TUR)
		37	Tanzania (TAN)
		38	Ukaraine (UKR)
		39	Venezuela (VEN)
		40	Zambia (ZAM)
		41	Zar (ZAR)
		42	Zimbabwe (ZWE)

TABLE II

Conditional Convergence for 60 Countries: Elimination of Dummies and Country Fixed Effects

Variable	Coefficient	Variable	Coefficient
β	**-0.02227 (-4.21741) ***		
ARG	-0.01099 (-1.31827)	ITA	0.01733(2.54988)
AUS	0.01927 (2.90225)	KOR	0.02337 (2.76086)
AUT	0.02275 (4.29858)	LAO	-0.03638 (-2.10708)
BFA	-0.06973 (-4.74153)	LBY	-0.00630 (-0.85869)
BOL	-0.03970 (-5.16401)	LUX	0.03602 (3.77085)
BRA	-0.01062 (-1.01961)	MEX	-0.00573 (-0.81744)
CAF	-0.08531 (0.01357)	MNG	-0.03536 (-2.04365)
CHE	0.01808 (2.15217)	MWI	0.07223 (-3.57556)
CHI	0.01825 (-0.87315)	MYS	0.00110 (0.12711)
CHL	-0.00865 (-1.01388)	NGA	-0.06141 (-404006)
CIV	-0.05757 (-4.52933)	NLD	0.02021 (3.22625)
COG	-0.04226 (-3.88798)	NOR	0.02884 (4.43619)
CRI	-0.01001 (-1.58171)	NZL	0.00762 (1.50682)
CYP	0.01180 (2.55850)	PAK	-0.04106 (-3.73117)
DNK	0.01855 (2.87095)	PAN	-0.00533 (-0.70116)
DOM	-0.00920 (-1.1.317)	PHL	-0.03867 (-4.06938)
DZA	-0.02778 (-5.01872)	PRT	0.01253 (2.14107)
EGY	-0.02515 (-2.19816)	PRY	-0.03133 (-2.67031)
ESP	0.01853 (2.73051)	RWA	-0.07193 (-4.46238)
ETH	-0.07784 (-4.23473)	SGP	0.03830 (5.619490
FRA	0.01809 (2.93458)	SOM	-0.09349 (-5.29444)
GAB	-0.006816 (-0.58332)	TUN	-0.01815 (-2.24052)
GER	0.016399 (3.17821)	TUR	-0.00960 (-3.11125)
GHA	-0.05357 (-4.36265)	TWN	0.02968 (6.33419)
GTM	-0.02263 (-2.60130)	UKR	0.01892 (2.87331)
HKG	0.03331 (7.09104)	USA	0.02126 (-2.377779)
HND	-0.03824 (-4.46037)	VEN	-0.01726 (-2.37779)
HTI	-0.06337(-4.98105)	ZAR	-0.10718 (-4.12406)
IDN	-0.02753 (-2.25851)	ZMB	-0.06401 (-3.78778)
IND	-0.03618 (-2.51059)	ZWE	-0.08986 (-4.83601)

* values in parentheses are t-values