Quantitative Tests for Income Level Convergence in Asian Countries

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Models in Economics

No subject is terrible if the story is true, if the prose is clean and honest, and if it affirms courage and grace under pressure.

~ attributed to a fictional Ernest Hemingway in Woody Allen's Midnight in Paris

No model is bad if the subject is interesting, the math is clean, the data are honest, and if the model helps to challenge conventional theory.

~ An economist echoing the advice supposedly from Hemingway

Background

- Economies integrate with the purpose of increasing economic growth among its member-countries and protecting regional stability.

- An example is the integration of the countries in Southeast Asia forming the ASEAN.

- Many economists believe that convergence phenomenon in the income levels among less developed and advanced countries will be observed overtime.

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Research Problem

- But to this date it remains unverified whether convergence of income levels among cooperating countries has indeed occured after a long period of time.

- If Solow model holds, then convergence of income level across countries hypothesizing that the income levels of poor economies will tend to grow at faster rates than those of rich economies given technology level is possible to happen (Solow 1956).

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- The convergence of income level across countries has not been well supported in the several decades of empirical researches (e.g., Barro, 1991; Barro and Sala-i-Martin, 2003).

- Also, endogenizing the source (or engine) of growth, such as: – technological progress (Arrow, 1962; and Romer, 1986; 1990; and Lucas, 1988), human capital accumulation (Becker et. al., 1990; and Rebelo, 1991), trade openness (Grossman and Helpman, 1991), R&D (Aghion and Howitt, 1992), government spending (Barro, 1990), and others was attempted to explain the dynamic interaction between capital accumulation and economic growth --the central missing element of the neoclassical growth models.

Objective of the paper

- To re-investigate whether the convergence phenomenon holds for income level in Asian countries for the period over 1975–2015.
- It attempts to evaluate whether economic cooperation among Asian countries, particularly ASEAN member-countries has contributed to the convergence phenomenon of income level applying the traditional methods of σ- and β -convergence.

- The paper also aims to determine the roles of investment, trade openness, human capital accumulation, government expenditure, and population growth in the economic growth of Asian countries.

Literature Review

- The concept of convergence which is sometimes known as the "catch-up effect" is based on the hypothesis that the incomes of poorer economies' will tend to grow at faster rates than those of richer economies.

- As a result, all economies should eventually converge in terms of income level.

Convergence Phenomenon Quantitatively Tested

The convergence phenomenon is possible to be quantitatively tested by applying the traditional methodology of σ convergence and β –convergence.

(1) **σ –convergence** is defined in terms of cross-sectional dispersion of income level across country (Barro and Sala-i-Martin, 2003)
  ◦ convergence is found if dispersion (or inequality) of income level across countries declines overtime.

(2) Absolute β –convergence is based on the Solow (1956)
Model which predicts that poor and rich countries will converge to the same level of income in the steady state with poor countries grow relatively faster than the rich countries.

$$GGDP_{it} = c + \beta_1 \log (PGDP)_{it} + \varepsilon_{it}. \qquad (1)$$

– Using available cross-country data and applying cross-section analysis, Barro (1991) found that the estimated coefficients of initial income demonstrated negative and statistically significant in the determination of average growth rate, suggesting the presence of absolute β– convergence.
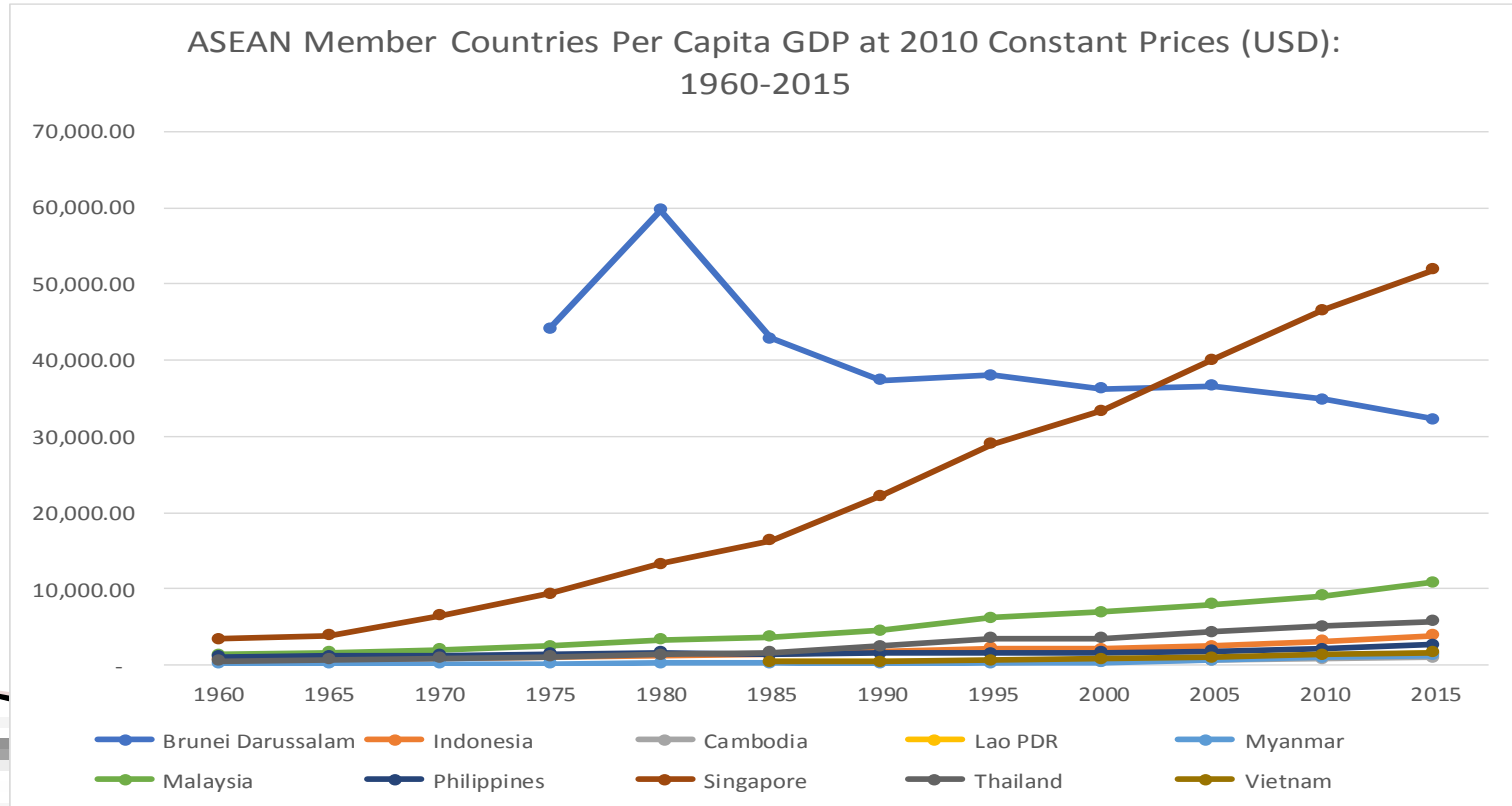
(3) Conditional –convergence

– However, if the characteristics of each country are allowed, then the analysis should be modified. That is, each country has different steady state positions and parameters, such as investment, human capital accumulation, trade openness, population growth rate, and other policy.
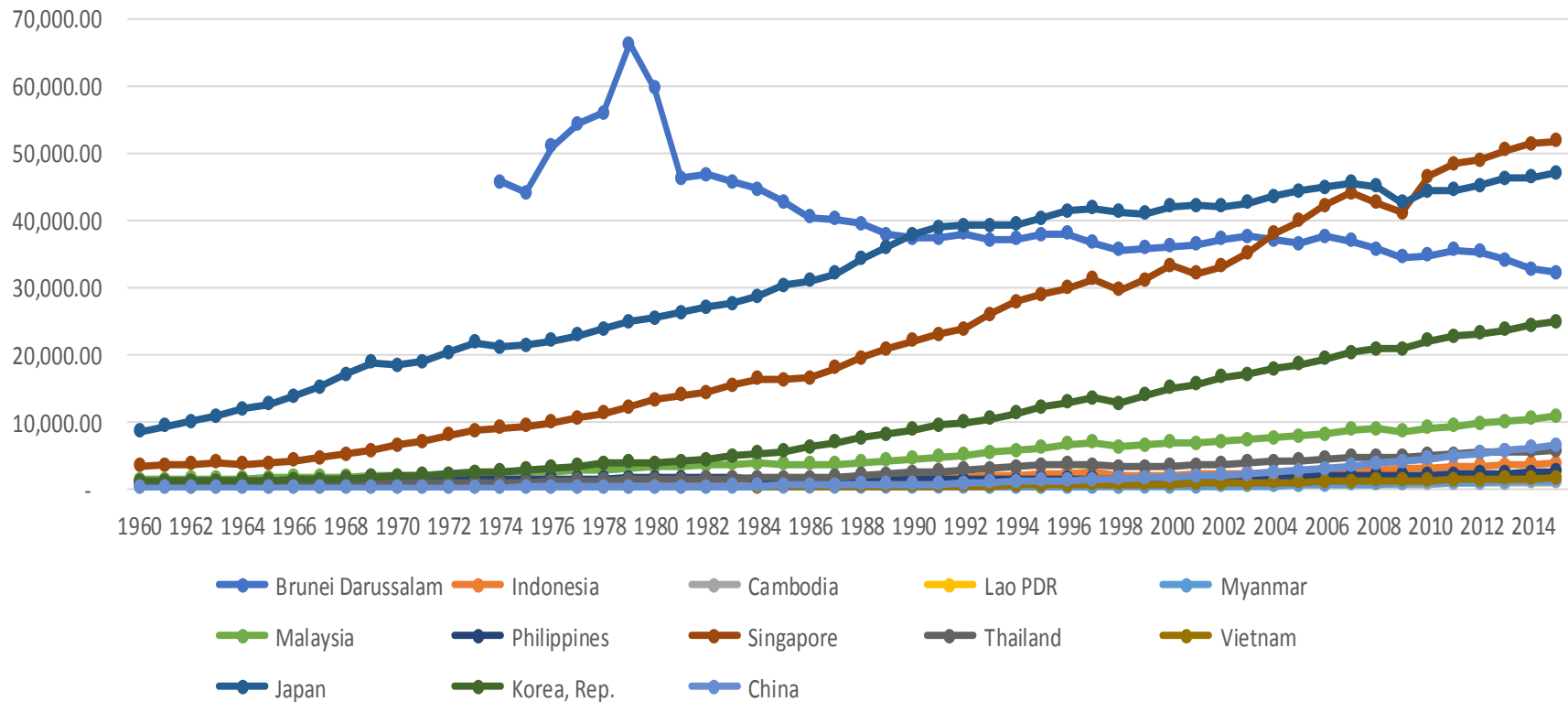
– **Conditional β – convergence** accommodates the idea that as an economy grows faster, the further it is from its own steady state value.

$$GGDP_{it} = c + \beta_1 \log (PGDP)_{it} + \sum_{j=1}^{5} \gamma_{ijt} X_{it} + \varepsilon_{it}. \tag{2}$$
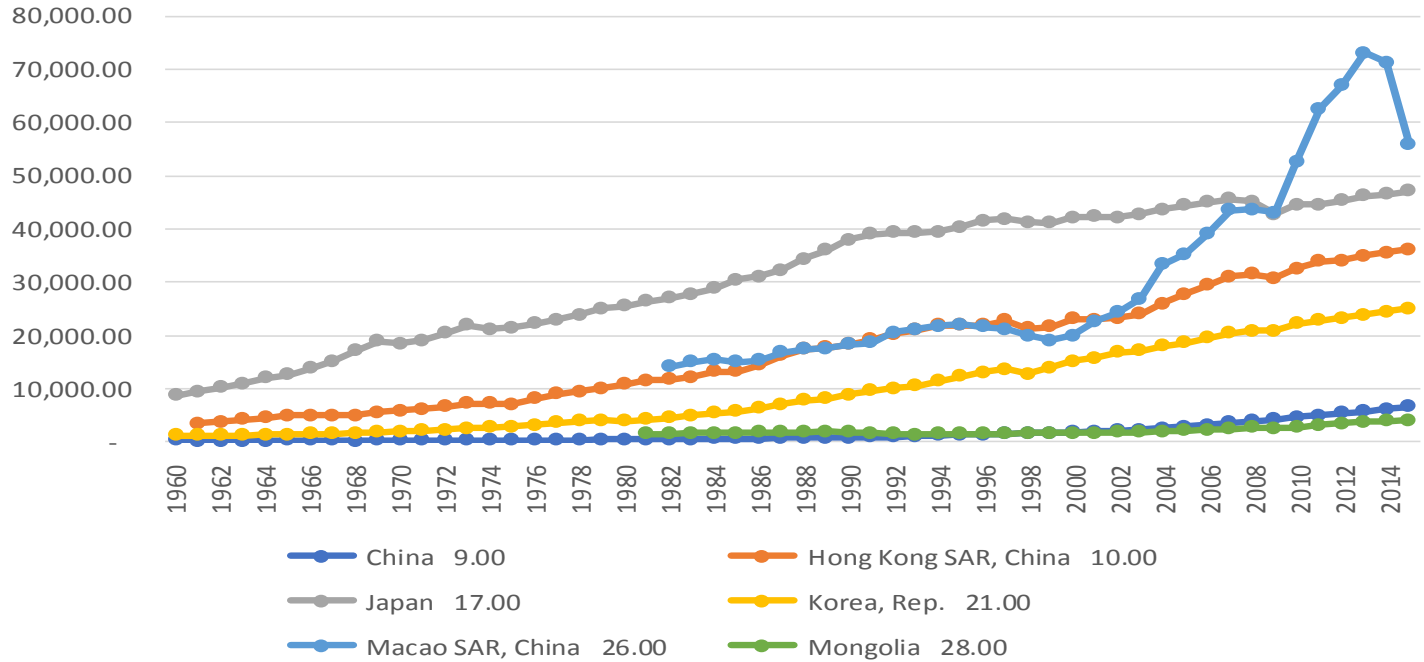
Findings

ASEAN Member Countries Per Capita GDP at 2010 Constant Prices (USD): 1960-2015
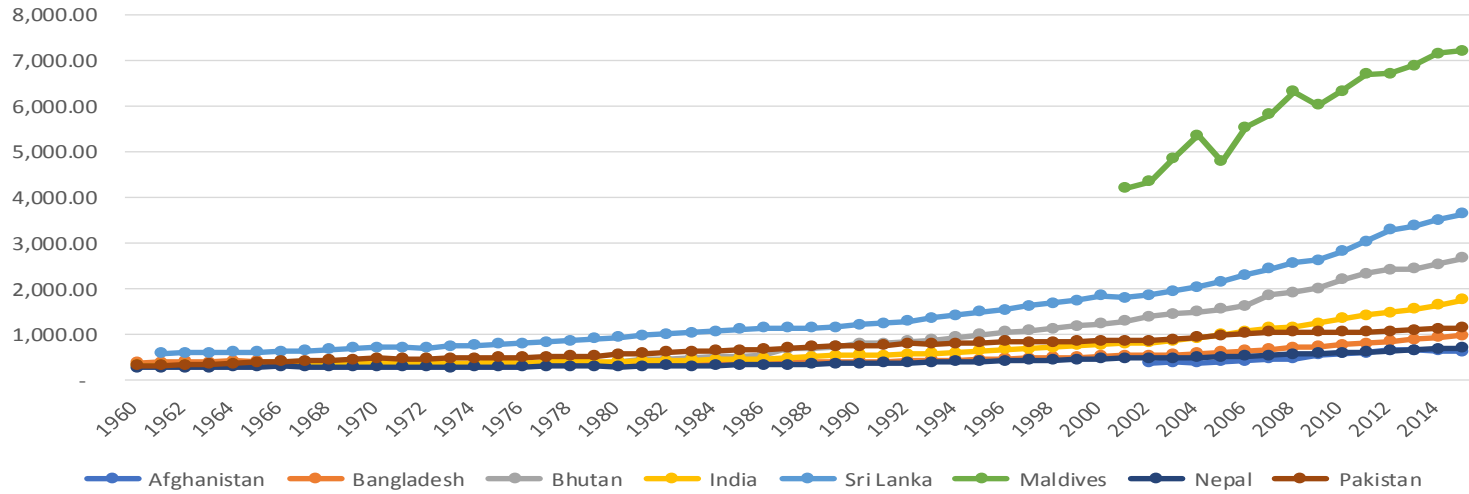
ASEAN + 3: Per Capita GDP at 2010 Constant Prices (USD)

East Asia Countries Per Capita GDP at 2010 Constant Prices (USD)
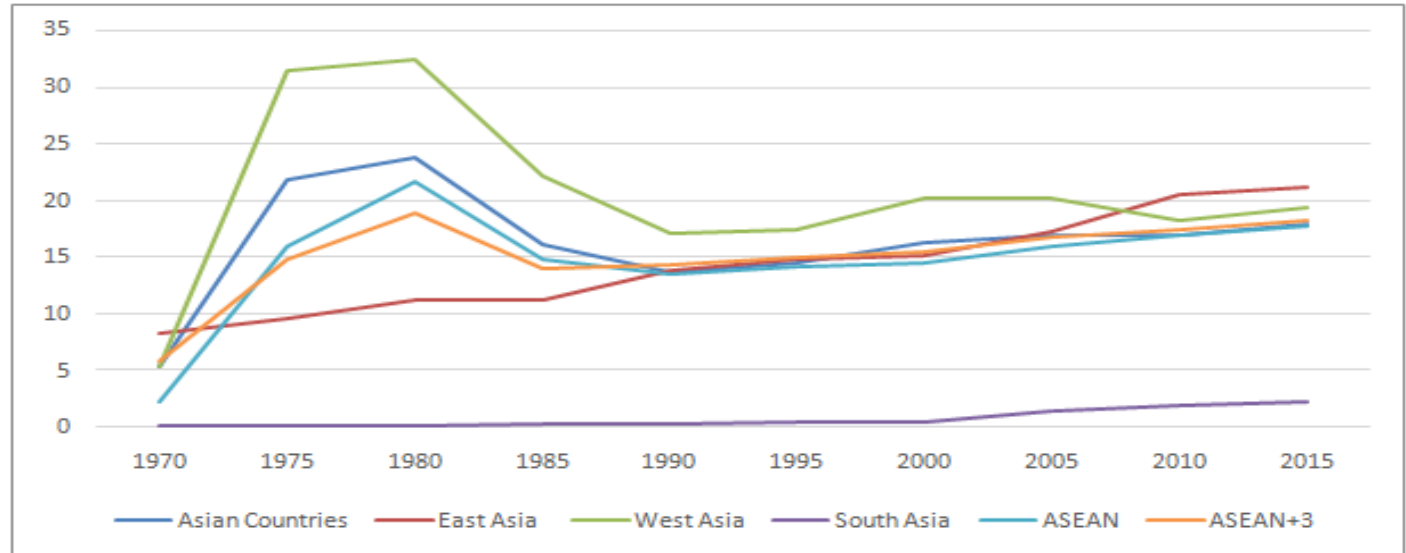
South Asian Countries Per Capita GDP at 2010 Constant Prices (in USD)

Findings (σ–convergence)

Figure 1. Standard deviation of GDP per capita over time

Note: A total of 47 countries are included in the sample for Asian countries. Countries such as North Korea and Syrian Arab Republic were excluded from the list due to data limitations. The countries included in East Asia region are China, Japan, South Korea, Mongolia, plus Hong Kong and Macao. The countries covered for the West Asia group include Armenia, Azerbaijan, Bahrain, Cyprus, Iran, Iraq, Israel, Georgia, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Turkey, UAE, and Yemen. Meanwhile, the countries included in the South Asian group include Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The ASEAN members, on the other hand, include Brunei, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Cambodia, and Vietnam. China, Japan, and S. Korea were added to form ASEAN+3. The remaining countries to complete the list include Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzberkistan and Timor Leste. All Per Capita GDP data were sourced from the World Bank.

Table 1. Standard deviation of GDP per capita (in thousand USD)

	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
Asian Countries	5.29	21.83	**23.78**	16.10	13.62	14.50	16.29	16.85	16.90	17.84
East Asia	8.22	9.46	11.11	11.15	13.86	14.88	15.17	17.26	20.55	21.22
West Asia	5.29	31.50	**32.44**	22.16	17.08	17.44	20.14	20.19	18.27	19.43
South Asia	0.16	0.20	0.23	0.28	0.31	0.40	0.52	1.46	1.94	2.23
ASEAN	2.32	16.02	**21.69**	14.87	13.62	14.16	14.53	15.92	17.00	17.80
ASEAN+3	5.89	14.77	**18.85**	14.02	14.36	15.00	15.51	16.69	17.35	18.22

Note: GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in constant 2010 U.S. dollars. Source: World Bank

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Absolute β-convergence has been observed

Table 2. Estimated results on the absolute β-convergence of income level

Dependent variable: economic growth rate (1970-1979, 1980-1989, 1990-1999, 2000-2009, and 2010-2015)

	Asian countries		ASEAN+3 countries	
	(A) Pooled LS	(B) FE / RE	(C) Pooled LS	(D) FE / RE
Constant	7.80*** (5.04)	8.03*** (5.24)	10.41***(4.04)	9.77*** (4.23)
log (PGDP)	-0.61*** (-3.24)	-0.64*** (-3.46)	-0.79**(-2.34)	-0.71** (-2.53)
R^2	0.68	0.06	0.21	0.11
Observations	183	183	57	57
χ^2 [p-value]	-	2.44 [0.12]	-	0.62 [0.43]
FE /RE Model	-	RE	-	RE

Notes: (i) *t*-statistics are provided in parentheses. (ii) In models using the Pooled LS method, *t*-statistics are based on the White's heteroskedasticity-consistent standard errors and covariance. (iii) (***) and (**): significant at 1 and 5 percent levels, respectively. The selection of FE or RE is determined by the result of the Hausman test.

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Table 3. Estimated results on the conditional β-convergence of income level

Dependent variable: economic growth rate (1970-1979, 1980-1989, 1990-1999, 2000-2009, and 2010-2015)

Conditional
β–convergence
could not be
observed

	Asian countries		ASEAN+3 countries	
	(A) Pooled LS	(B) FE / RE	(C) Pooled LS	(D) FE / RE
Constant	6.07***(3.31)	7.21***(3.73)	12.89***(6.83)	8.47***(1.45)
log (PGDP)	-0.21(-0.92)	-0.30(-1.04)	-1.04**(-2.54)	-0.11(-0.13)
GCF	0.06(1.60)	0.04(1.44)	0.10***(3.37)	-0.01(-0.14)
SSE	-0.02(-1.57)	-0.02(-1.30)	-0.03(-1.00)	-0.04(-1.54)
OPEN	0.005(1.68)	0.002(0.49)	0.01**(2.56)	-0.01 (-0.79)
GOV	-0.04(-1.53)	-0.04(-1.38)	0.04(0.41)	-0.03(-0.20)
POPG	-0.66**(-2.15)	-0.60***(-2.93)	-1.24*(-1.79)	-0.59**(-2.17)
R^2	0.21	0.13	0.53	0.84
Observations	122	122	40	40
χ^2 [p-value]	-	8.07 [0.23]	-	14.18 [0.03]
FE /RE Model	-	RE	-	FE

tes: (i) t-statistics are provided in parentheses. (ii) In models using the Pooled LS method, t-statistics are based on the White's heteroskedasticity-consistent standard errors and covariance. (iii) (***), (**), and (*): significant at 1, 5, and 10 percent levels, respectively. The selection of FE or RE is determined by the result of the Hausman test.
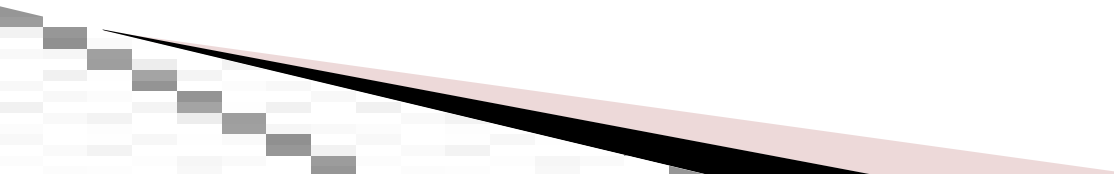
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Summary and Conclusion

- This paper empirically examined whether the convergence of income level holds, based on panel data in 47 Asian countries over the period 1975-2015.

- **σ-Convergence cannot be observed**

- In terms of σ-convergence, the paper found that the per Capita GDP of these 47 countries started to converge (with declining standard deviation) specifically starting in1980s however, it was halted in the mid 1990s changing direction from decreasing to increasing trend (from 1995 and onwards), suggesting that *σ -Convergence* cannot be observed.

Absolute β Convergence was observed

- The findings show that enomic convergence in terms of rate of change of growth of PGDP (*absolute β –Convergence*) was observed.

- Using available cross-country data and applying cross-section analysis, the study found that the estimated coefficients of initial income demonstrated negative and statistically significant in the determination of average growth rate (Table 2), suggesting the presence of absolute β- convergence (consistent with Barro 1991).

Conditional β-convergence cannot be observed

- However, when the characteristics of each country was allowed to play in the model to see if the influences of human capital investments, capital formation, trade, government size, population growth are significant to explain the variability of growth of the Per Capita GDP of these countries, the findings show that except population growth, the estimated coefficients of human capital, capital formation, trade, and government size are statistically insignificant.

- Hence we cannot conclude existence of Conditional β-convergence.

Policy implications and areas for future research

- Emerging countries like the Philippines must take advantage of the benefits of integration by strengthening those factors (capital formation, trade liberalization, human capital, size of government) that promote national growth as well as regional convergence.

- For future research, it is worth investigating the role of the attributes (openness, human capital, capital formation, population, government size, among others) to the growth of per capita income of each of the member countries of ASEAN, ASEAN+3, ASEAN+6. Hence, econometric tests on a per country basis to explain the convergence or divergence of regional economies is worth exploring.

Thank you.