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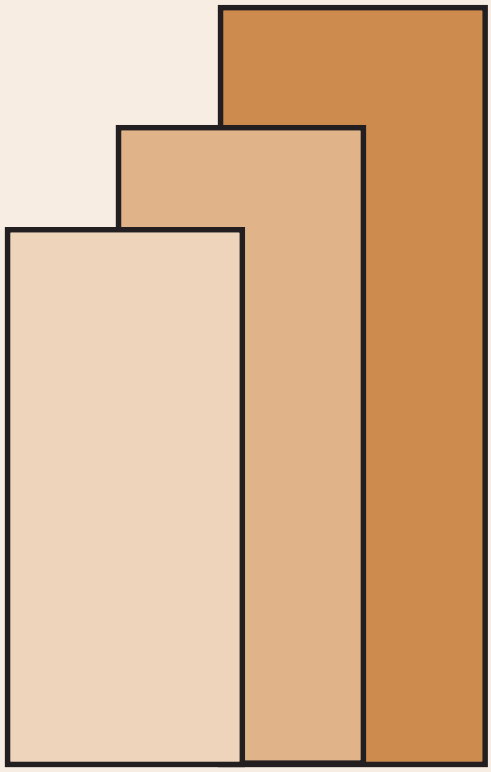
Regional Cooperation in Education: Issues for Developing Countries in the Asia-Pacific

Josef T. Yap

DISCUSSION PAPER SERIES NO. 2012-15



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Regional Cooperation in Education: Issues for Developing Countries in the Asia-Pacific

Josef T. Yap[*]

Abstract

Human capital development is important for economic growth. The main channel by which human capital can be enhanced is education, which is characterized by the issues of availability, access and quality. Domestic reforms can be complemented by regional cooperation in education. The main mechanisms for regional cooperation are: People Exchange, Transnational Education, Information Exchange, Regulatory Reform, and Development Partnerships. The main argument in this paper is that the relevant mechanism for a particular economy—including what should be prioritized—depends on its position in the development ladder and history with regard to education attainment. The experience of Malaysia and the Philippines with regard to these mechanisms and education in general are compared with the expectation that other developing countries can draw lessons from this comparison. Malaysia's high economic growth in the past three decades has enabled it to implement an effective program in transnational education while the Philippines has failed to exploit its competency in the English language largely due to its poor record with regard to infrastructure development. What would be useful for the Philippines is to harness regional cooperation in order to effect regulatory reform. In particular, accreditation of colleges and universities in the Philippines is still voluntary while Malaysia has opened its universities to international standards. A long-run goal would be a regional agreement on education standards somewhat akin to a Free Trade Agreement. Meanwhile, developing countries can benefit from existing institutions like the ASEAN Universities Network and the ASEAN Quality Assurance Network in order to improve the quality of their education systems.

Keywords: Human capital, education, regional cooperation, transnational education, regulatory reform, accreditation

Introduction

The role of education in economic development is widely acknowledged. Hanushek and Woessmann (2008) list three mechanisms through which education impacts on economic growth:

> "First, just as in the micro perspective, education increases the human capital inherent in the labor force, which increases labor productivity and thus transitional growth towards a higher equilibrium level of output,,, Second, education may increase the innovative capacity of the economy, and the new knowledge on new technologies, products and processes promotes growth… Third, education may facilitate the diffusion and transmission of knowledge needed to understand and process new information and to implement successfully new technologies devised by others, which again promotes economic growth"

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The second and third items highlight the importance of an adequate education system in a rapidly evolving economic environment. Continuous technological progress and the process of globalization has accelerated the pace of job destruction, creation, and churning (Paqueo, et al. 2012). This has resulted in "skill gaps" in the Philippines (di Gropello, et al. 2010), an experience likely shared by other developing economies. These gaps are created when there is a significant difference between the type of skills demanded in the labor market and the type of skills possessed by the labor force. Education has a prominent role in shaping these skills.

Many elements characterize the nature of the education system. In general, these aspects can be categorized into either of three categories: availability, access, and quality. In turn availability, access and quality are affected by factors such as resources allocated to the education sector, the institutional framework which includes governance issues, culture which includes the environment at home, and public infrastructure. This paper looks at how regional cooperation can improve availability, access to and the quality of education.

Regional Cooperation in Education

A useful reference for understanding the issues involved in regional cooperation in education, particularly for East Asia, is McKenzie, et al. (2008). They give a practical definition of regional cooperation in education:[1]

> "Educational cooperation in the broadest sense occurs whenever two or more parties work together to achieve an educational objective. In international education cooperation, two or more of the parties working together are from different countries. International partners working together towards an educational objective may be:
>
> a) Playing similar roles – e.g. two countries cooperating on an exchange program; or
> b) In a purchaser-provider relationship (i.e. trade in educational services); or
> c) In a donor-recipient relationship (i.e. development assistance)."

Regional cooperation in education should be guided by certain goals and objectives. These will be the basis for specific programs. The study of McKenzie, et al. proposed the following objectives for regional cooperation in East Asia:

> "1. To build communities among the peoples of the East Asia Summit (EAS) countries, notably through:
>
> - Increasing the mobility of students, teachers and researchers in the area;
> - The appreciation of one another's heritage and history; and
> - The learning of other languages.
>
> 2. To create competitive advantage for the EAS region by:
>
> - Promoting excellence at all levels of education through the exchange of information on good practice, and by bench-marking; and

[1] McKenzie, et al (2008), page 25.

- Enlarging choice in tertiary education and in the labor market through measures to facilitate the movement of students, staff and tertiary-qualified personnel across national borders, and by enlarging access for tertiary education providers to national markets.

3. To reduce disparities in educational opportunity within and between countries in order to:

- Facilitate access to basic and non-formal education and promote high standards through networking and institutional collaboration; and
- Promote tertiary education and training in home countries, especially in the fields of science and technology, as a means to economic development."

These objectives are consistent with the elements of availability, access, and quality mentioned earlier. In particular the desire to promote tertiary education in the fields of science and technology dovetails with the issue on skill gaps and churning in the labor market. Regional cooperation can therefore complement reforms at the domestic level. The major mechanisms for regional cooperation are listed in Table 1.

Institutional mechanisms for regional cooperation in education are fairly advanced in the Asia-Pacific region. These can be classified as regional cooperation *per se*—which is largely government-driven—and universities cooperation (Sugimara 2012). Both types of regional cooperation exist at different levels.

The main argument of this paper is that the role of regional cooperation in a particular country and the viable mechanisms will largely depend on its position in the development ladder and the status of its education sector. In the next section an attempt is made to classify selected countries in the Asia-Pacific along these two dimensions. Broad analysis will be attempted with special attention on the Philippines.

Data

Education attainment is measured using data from Barro and Lee (2010). Four variables are examined more closely. The data are available for 146 economies for five year segments over the period 1950-2010.

1. Average years of schooling attained in population
2. Percentage of Complete Secondary Schooling Attained in Population
3. Percentage of Tertiary Schooling Attained in Population
4. Percentage of Complete Tertiary Schooling Attained in Population

The limitations of data on school attainment are recognized by experts. This is the reason why there have been efforts to measure cognitive skills (Hanushek and Woessmann, 2008). Unfortunately, there is not enough data on cognitive skills to conduct the type of analysis required in this paper.

Processing of data was initiated by graphing the initial level of the variable in a particular year against the change in the variable for the period starting with the first year until 2010. For example, Figure 1 shows the graph for average years of schooling attained in the population, with 1975 as the initial year.

The graph in Figure 1 clearly indicates that there is convergence among countries in terms of average years of schooling. In other words, the higher the initial level in 1975, the lower the average growth rate over the period 1975-2010. The year 1975 was arbitrarily chosen.[2]

The mean for each variable is calculated and the values are used to divide the graph into four quadrants. Following Fagerberg, et al (2007), the quadrants are defined as follows:

Quadrant 1: Losing Momentum	Quadrant 2: Moving Ahead
Quadrant 3: Falling Further Behind	Quadrant 4: Catching Up

Figure 2 shows the same graph as Figure 1 with selected Asia-Pacific economies being highlighted. These are Australia, Canada, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, the Philippines, Singapore, Taiwan, Thailand, USA, and Viet Nam. In Figure 2, the Philippines and most of the other economies are in the "Losing Momentum" quadrant.

Since regional cooperation in education deals more with higher education, the more important variable would be "Percentage of Complete Tertiary Schooling Attained in Population." The graph for this variable for the selected economies is shown in Figure 3.

The graph in Figure 3 is then juxtaposed with per capita GDP growth (in 2005 PPP$). The behavior of the latter variable is shown in Figure 4. Figures 3 and 4 are then consolidated to form Table 2.

Table 2 shows that since 1975, China, Indonesia, Malaysia, Thailand and Viet Nam have been catching up in terms of both per capita GDP growth and education attainment as measured by Percentage of Complete Tertiary Schooling Attained. The table also shows that the Philippines manifests the development puzzle that it has been associated with. Despite a relatively high education attainment, the Philippines has fallen further behind in terms of economic growth.

Opportunities for Regional Cooperation

Economies in the Asia-Pacific apply the mechanisms listed in Table 1 in different ways. McKenzie et al (2008) conducted a survey for the EAS countries in order to determine how the various mechanisms are applied. The results for three countries are shown in Appendix 1. This section discusses some of the mechanisms in the context of Table 2.

People exchange remains the primary mechanism for regional cooperation in education, especially for developing countries. The top destinations of foreign students are the US, United Kingdom, Australia, Germany, Japan and Canada. Four of these countries are in the

[2] Using the years 1960 and 1985 as the initial period does not change the pattern.

Asia-Pacific region. More scholarships and exchange programs can be made available for developing countries as part of expanding regional cooperation. However, the share of international scholarships for academics has to be increased to improve the teaching and research abilities in developing countries.

In the past two decades or so, Singapore, Hong Kong, China and Malaysia have enhanced their roles as hubs of higher education. These economies are all described as "catching up" in terms of Percentage of Complete Tertiary Schooling Attained in Population (Table 2). Apparently the efforts of establishing the economies as knowledge centers contributed to the catch-up process in education attainment.

In the case of Singapore and Malaysia, their role as education hubs was accomplished by partnering with prestigious universities abroad and encouraging faculty to relocate to these countries. Meanwhile, the Hong Kong government allowed countries to provide courses in Hong Kong in order to build local capacity (Santiago, 2006). Having more hubs, particularly middle-income countries, will make education abroad more accessible and affordable for lower income countries.

In theory, the Philippines can also attract more foreign students especially with the competency of the population in the English language. The likelihood of being a hub will increase if schools focus on niche courses where the Philippines can claim excellence: nursing, dentistry, medicine, care-giving, language education, and information technology (Santiago, 2006). Unfortunately there are constraints to this prospect, the main ones being laws that limit foreign ownership and poor physical infrastructure. The latter is reflected in the poor economic growth performance (Figure 4, Table 2) where the Philippines is described as "falling further behind". Foreign students expect good facilities in a country that for many of them should be more advanced than theirs. At present, these facilities are lacking.

Transnational education involves the other three of the four modes of trade in education services. The three modes are cross-border supply, commercial presence, and presence of natural persons. Countries usually resort to transnational education if domestic capacity is constrained. Such was the case in Malaysia which opened its doors to foreign institutions beginning in 1996 after realizing it may not be able to educate over five percent of its population on its own (Santiago, 2006 citing Lenn, 2000). The catch-up process of Malaysia in terms of economic growth which gained momentum in the 1980s allowed it to allocate resources to transnational education. In turns, this increased the access of Malaysians to tertiary education enabling economic growth to be sustained. [3]

Transnational education is not a relevant mechanism for the Philippines for two reasons. One, the access to tertiary education in the Philippines is relatively high although it is classified as "losing momentum" in terms of Percentage of Complete Tertiary Schooling Attained in Population (Table 2). Two, transnational education will increase the cost of education. Since economic performance in the Philippines is "falling further behind" leading to slower growth in real per capita income, the increased cost of education will reduce accessibility. An alternative is to use commercial presence of foreign schools as a channel to improve the attractiveness of the Philippines as a knowledge center. However, as pointed out earlier, laws that limit foreign ownership will discourage possible foreign partners.

[3] The four different measures of education attainment were each used as an explanatory variable in an economic growth model. Only the variable 'Percentage of Complete Secondary Schooling Attained in Population' turned out to have a significant positive coefficient. The empirical model and results are discussed in Appendix 2. The implication is that basic education, particularly at the secondary level is more important to generate higher economic growth. Resources then can be channeled to tertiary education to sustain this growth.

What would be relevant for the Philippines is regional cooperation that would facilitate regulatory reform. Foremost among these reforms is the establishment of a credible accreditation system. Quality assurance is necessary to increase access of local students to universities abroad and employment opportunities in other countries. Paqueo, et al (2012) describe the accreditation system in the Philippines as follows:[4]

> "The Philippine system of accreditation is voluntary, consistent with the preferred culture of self-regulation. Accreditation is done at the program rather than institutional level. Today, there are five accrediting institutions with three catering to private institutions and two to public institutions. While in theory, Higher Education Institutions can have their programs accredited by any of the agencies, in practice, the agencies usually cater to their own constituents. Despite the long history of accreditation in the country, less than 20 percent of the HEIs have accredited programs. Relative to the 20,000 registered programs documented in Tayag and Calimlim (2003), this means only 7 percent of the programs are accredited. That four-fifths of the programs are not submitted for accreditation speaks a lot about the quality of the programs."

One reason for the lethargic economic growth despite the relatively high level of tertiary education is the poor quality of the colleges and universities in the Philippines.

The Malaysian case provides a useful counterpoint to that of the Philippines:[5]

> "… countries like Malaysia chose to link its accreditation system with those of other Asian countries, and are aiming to fortify the function of domestic quality assurance in this international competition by referring to the standards of the Australian Universities Quality Agency, the New Zealand Qualifications Authority, the office for National Education Standards and Quality Assessment in Thailand and the University Association Quality Assurance Network in Singapore. Malaysia is also characteristic in its development of an international quality assurance network, collaborating with AQAN, the ASEAN QA network; on the one hand, while on the other hand it is beginning to actively participate in the Association of Quality Assurance Agencies of the Islamic World (AQAAIW) since Malaysian society is an Islamic one.
>
> Such participation in and collaboration with international networks is a new trend that emerged from the advancement of globalization in higher education, and it is a national strategy that aims to match Malaysian higher education policy to not only domestic needs but also to international standards so as to seek more versatility in its international higher education. Amidst the transnational movement of international higher education, the issue of quality assurance is an indispensable aspect for human resource development and the establishment of a solid education program for this purpose. Transnational programs are effective in attracting international students for many reasons, including economic reasonableness, efficiency, and ease of degree acquisition, and an effective method for governments to

[4] Paqueo, et al. (2012), page 59.

[5] Sugimura (2012), page 93. Compared to the Philippines, it was easier and natural for Malaysia to pursue a more 'globalized' strategy in higher education because it shares the same educational culture, tradition and governance system inherent among its major partners, which are members of the Commonwealth of Nations. This facilitates mobility of students, faculty, and systems.

> enhance their higher education. However, without guarantees for the credibility and validity of such degrees and qualifications, the incentives for these programs would soon lose their appeal."

The approach of Malaysia resolves the "dilemma of establishing quality assurance based on international standards while maintaining national governance within the country and the autonomy of higher education agencies." (Sugimura, 2012). In the case of the Philippines, the agency for higher education does not even impose mandatory accreditation.

The ASEAN Quality Assurance Network was organized in 2008 in order to promote collaboration among QA-related agencies in individual ASEAN countries. At present, the Philippines has not fully acceded to AQAN. One proposal is for the collaboration to be formalized into an agreement to achieve certain standards in the education sector within a prescribed time. This can be called the ASEAN Education Agreement which hopefully will have an impact similar to free trade agreements. FTAs give leverage to policy makers in implementing domestic reforms. They can readily argue that the reforms are necessary to meet international agreements.

In the meantime that the ASEAN Education Agreement is being considered, the ASEAN Universities Network can be strengthened and expanded. One possible option is for the AUN to participate in the Coursera program or establish a similar system and dovetail it with an open university. However, this will likely cover only a few schools in most member countries which will not be enough to create a critical mass in order to make mandatory accreditation the norm.

Countries can also pursue bilateral mutual recognition agreements. The MRAs should include quality assurance on the part of both countries. Even if the standards are not as the same level as in higher-income countries, there will be pressure on some of the higher educational institutions in the lower income countries to improve their programs and facilities to gain accreditation.

Table 1: Types of International Education Cooperation	
1. People Exchange	The oldest form of educational collaboration. It entails a direct personal exchange. It involves international exchanges of students, teachers, researchers and administrators through scholarships, study visits, curriculum projects and research collaborations. This form of cooperation includes the mechanisms and networks which facilitate people exchange as well as the exchanges themselves.
2. Transnational Education	This can involve educational institutions or centers jointly provided and funded by several countries, or the establishment of campuses in other countries, often in association with a local partner. It also includes the supply of distance education across national borders.
3. Information Exchange	Information exchange is a key source of successful collaboration in education, often involving the establishment of information clearing houses. Examples include the OECD's Education at a Glance, first published in 1992 and now the principal source book for comparative indicators of educational participation and performance in OECD countries, and a stimulus to ongoing international data collection efforts: and, in the EAS area the Southeast Asian Ministers of Education Organization (SEAMEO) Regional Centers and the ASEAN University Network. Other examples include IT platforms such as the European Union's Information Network on Education in Europe (EURYDICE).
4. Regulatory Reform	The enabling, administrative framework that makes other forms of educational exchange possible. Examples include multilateral arrangements for quality assurance recognizing qualifications and allowing credit transfer (e.g., the Bologna Process, and the Lisbon Convention in Europe) and the establishment of cross-country quality assurance mechanisms (e.g., the European Network for Quality Assurance in Higher Education, or ENQA, set up in 1999). Regulatory reform can help smooth the flow of students and qualified personnel between countries. Such agreements and frameworks are essential for creating a single market for education and for qualified manpower in a given region
5. Development Partnerships	In a development partnership two or more countries enter into a systematic relationship, often within the framework of a memorandum of Understanding, to enhance education in a less developed country through the cooperation of a more developed partner. This project is mainly concerned with technical, rather than financial, assistance.
Source: Table 3.1 of McKenZie, et al (2008), page 28. The table is copied in full.	

Figure 1: Average Years of Schooling, 1975 Level vs. Change during 1975-2010

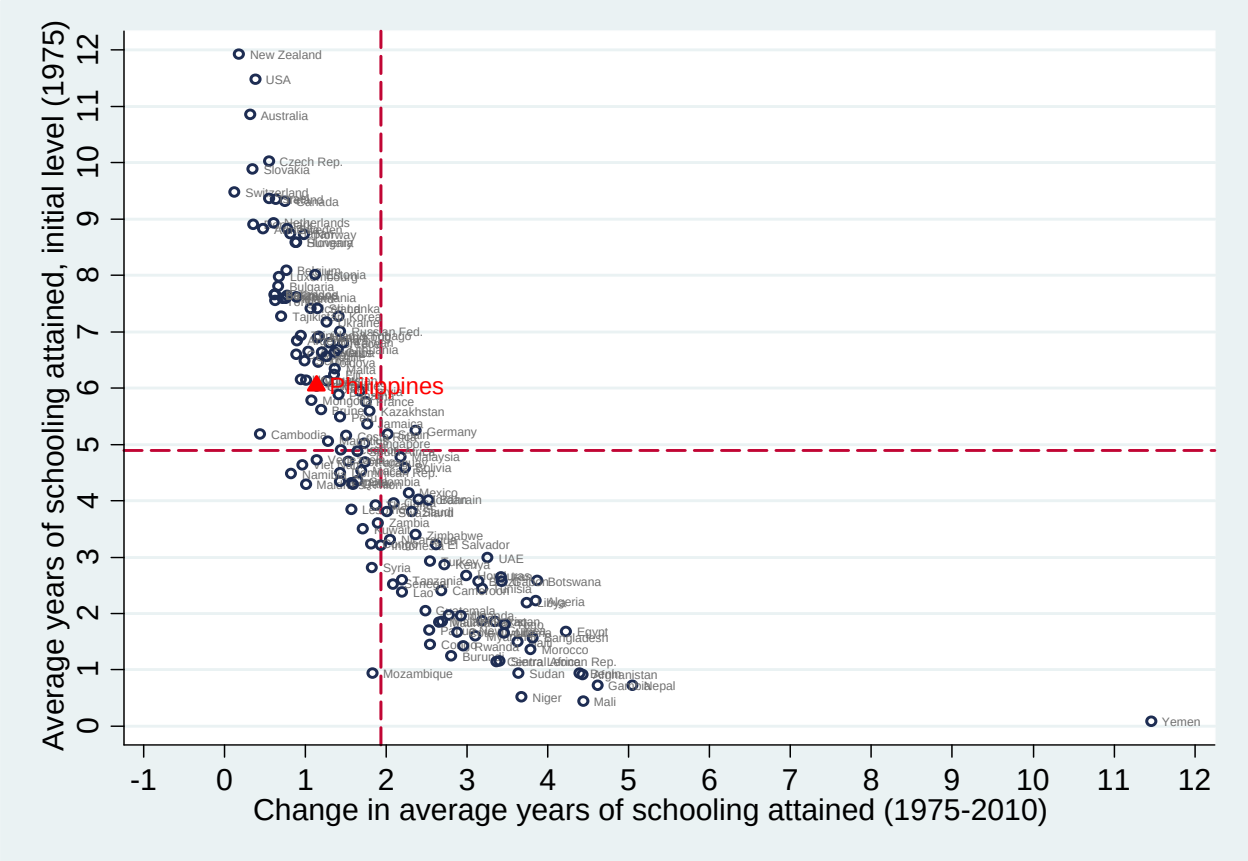

Figure 2: Data in Figure 1 but Highlighting Selected Asia-Pacific Economies

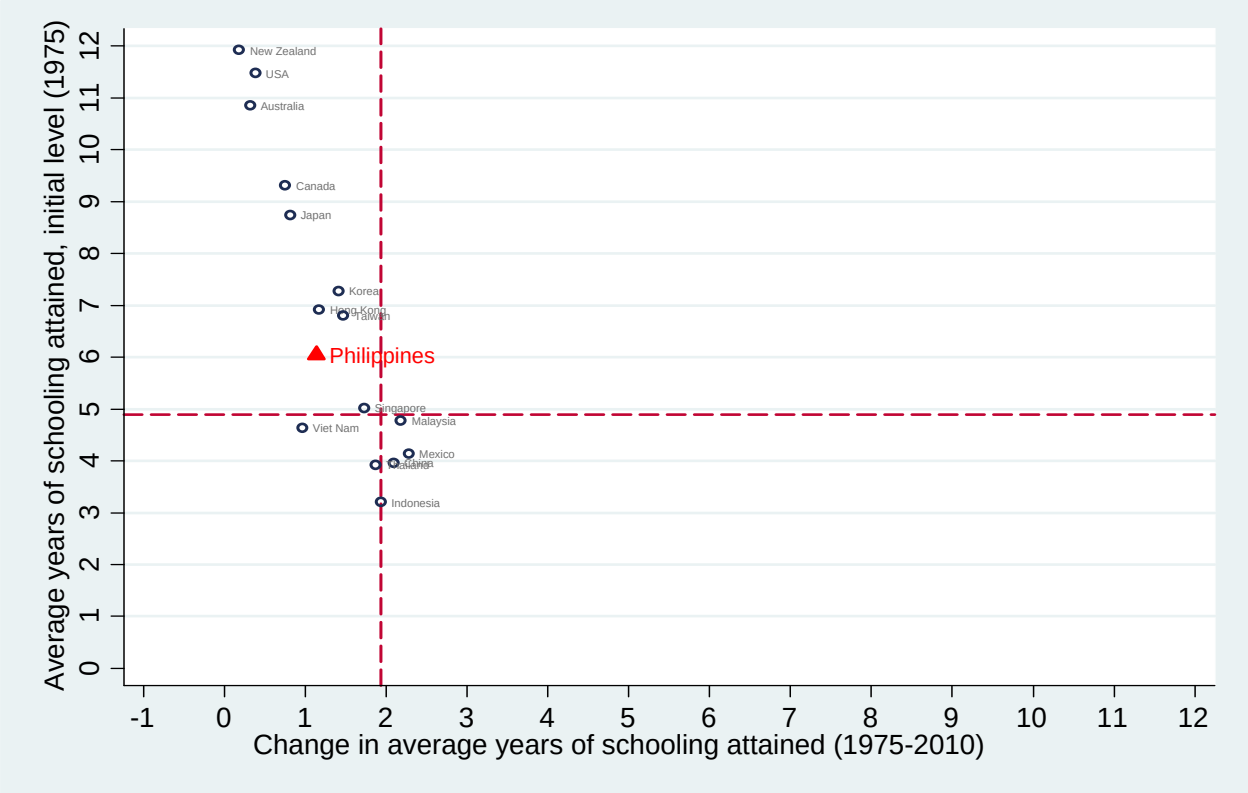

Figure 3: Percentage of Complete Tertiary Schooling Attained, 1975 level vs. Change during 1975-2010

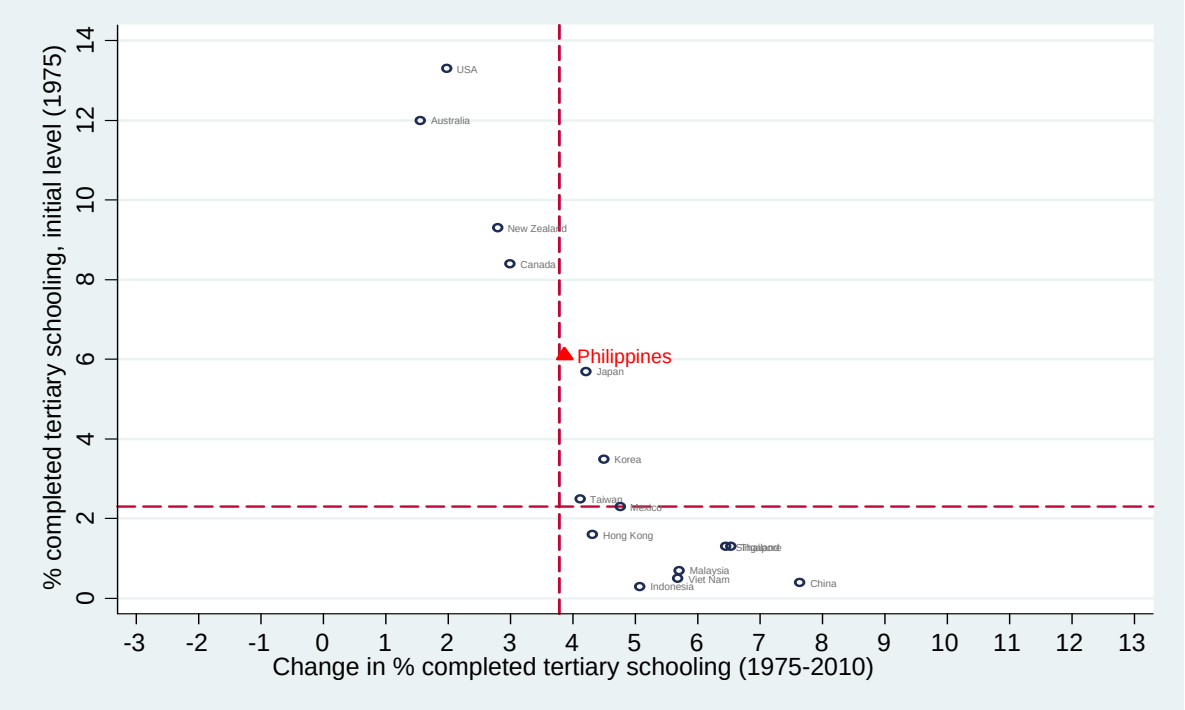

Figure 4: Per Capita GDP in 2005 PPP$, 1975 Level vs. Change during 1975-2009

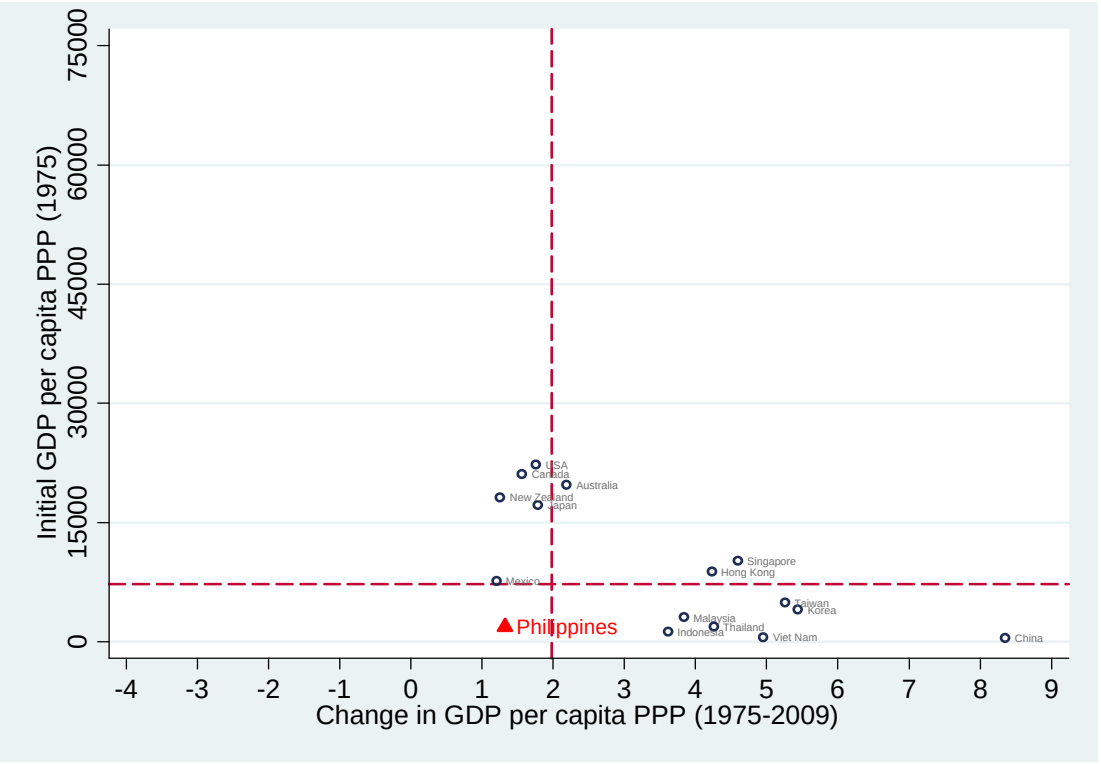

Table 2: Economic Growth and Education Attainment (Percentage of Complete Tertiary Schooling Attained in Population)					
Situation with respect to Education Attainment		**Situation with Respect to Per Capita GDP Growth (2005 PPP$)**			
		Losing Momentum	**Moving Ahead**	**Falling Further Behind**	**Catching Up**
	Losing Momentum	US, New Zealand, Canada	Australia	Philippines	
	Moving Ahead	Japan			Korea, Taiwan
	Falling Further Behind				
	Catching Up		Singapore, Hong Kong	Mexico	China, Indonesia, Malaysia, Thailand, Viet Nam

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Appendix 1: How Mechanisms of International Education Cooperation are Applied in China, Singapore and Thailand

Types of International Education Cooperation, China			
	Schools	Technical and Vocational Education and Training (TVET)	Higher Education
1. People exchange	Major ongoing cooperative projects between China and countries in Asia include the teacher exchange program with Japan and Korea, and the teenager exchange program with Japan. Student exchange agreements with all 16 EAS countries. Large numbers of Chinese students complete their schooling abroad on a self-funded basis	No VET specific data obtained.	China had 358,000 students doing tertiary studies abroad in 2005, and hosted 78,000 foreign students in 2003, over 80% of them from Asia. China plans to triple provision for foreign students by 2020, including from ASEAN. China offers 5000 scholarships at doctoral level.
2. Transnational Education	A number of international schools, notably in development zones.	China has initiated some joint provision with foreign vocational education institutions to promote the development of Chinese vocational education.	By June 2004 there were 164 joint HE programs entitled to award foreign or Hong Kong degrees. Full – fledged international campuses exist, but are not common.
3. Information Exchange	China participates in many multilateral and bilateral forums, and maintains a large, cross-sectoral Institute of Educational Research. Mutual study visits are seen as an important way to learn about foreign education and training systems, and provide information about China's.		
4. Regulatory Reform	The MoE said that for the time being they preferred to approach mutual recognition on a bilateral basis, through free trade agreements. Agreements are in place or in negotiation with Japan, Korea, Thailand, Malaysia and the Philippines.		
5. Development Partnerships	China as a donor for basic education in the CLMV counties. Expanding scholarship program. ASEAN is an area of focus for China's drive to recruit more foreign students.		
Source: Table 6.3 of McKenZie, et al (2008), page 60. The table is copied in full.			

Types of International Education Cooperation, Singapore			
	Schools	Technical and Vocational Education and Training (TVET)	Higher Education
1. People exchange	Extensive range of school twinning programs and student and staff exchanges with schools in ASEAN and other EAS countries. About 80,000 international students are currently studying in Singapore (all sectors)	VTE institutions in Singapore host regular study visits and sharing sessions with their counterparts from ASEAN and EAS countries	Growing number of overseas students studying in Singapore, and Singapore students studying abroad Singapore universities have ongoing and regular exchanges with universities in other countries, including through MoUs
2. Transnational Education	Not part of survey	Not part of survey	Joint programs with foreign universities in the EAS region.
3. Information Exchange	Participates in a wide range of international research studies e.g. IEA, UNESCO Holds regular bilateral meetings and professional forums with education ministries from ASEAN and EAS countries.	Participation in ASEAN and APEC working groups on skill development and qualification frameworks	Conduct regular sharing, joint research and information exchanges with universities in ASEAN and other EAS countries Active participation in ASEAN Universities Network (AUN)
4. Regulatory Reform	Not part of survey		
5. Development Partnerships	Provision of ASEAN Scholarships Training teachers from countries like Viet Nam and Philippines, including in English language teaching School leadership attachments for principals from developing countries Expertise sharing in the learning and teaching of English and other languages through the SEAMEO Regional English Language.	Provision of VTE training programs for trainers and officials from developing countries	ASEAN scholarships for university study in Singapore Institutional support through AUN and other higher education networks
Source: Table 6.3 of McKenZie, et al (2008), page 70. The table is copied in full.			

Types of International Education Cooperation, Thailand			
	Schools	Technical and Vocational Education and Training (TVET)	Higher Education
1. People exchange	Current national economic and social development plan emphasizes preparation of Thai students for global engagement MoUs on educational cooperation, including exchanges of students, staff and officials with Australia, Cambodia, India, Lao PDR, NZ, Singapore & Viet Nam Increasing use of ICT to facilitate staff and student dialogue across countries Seeking to strengthen language teaching including through expertise from other Countries	Increasing number of bilateral arrangements to strengthen TVET, including by exchanging expertise with industries investing in Thailand and countries with which Thailand has FTAs Developing joint programs in training for tourism and hospitality industries with Philippines and CLMV countries to ensure consistency with international standards and to facilitate labor mobility	Thousands of Thai university students study abroad (including 4000 on Thai government scholarships), and there is an emphasis on attracting more foreign students to study in Thailand Over 700 programs offered in public and private universities using English as medium of instruction Large number of MoUs governing staff and student exchange and joint research projects between Thai and overseas universities
2. Transnational Education	Not part of survey	Not part of survey	Support for foreign universities wishing to establish campuses and partnerships in Thailand
3. Information Exchange	Thailand is an active participant in international research studies e.g. by IEA and OECD Hosts a large number of International conferences and study visits on school priority issues	Strengthening networking arrangements in the region through staff exchanges, joint research projects, and knowledge and management systems	Active participation in ASEAN University Network and other university networks
4. Regulatory	Developing a competency-based training and qualifications systems with		

Reform	assistance from donor countries and multilateral organizations, and seeking to ensure that standards and qualifications are internationally comparable
5. Development Partnerships	Extensive range of development partnerships with ADB, WB and donor countries aimed at building Thai capacity, improving access to education and lifting quality Provides technical assistance and teacher training to developing countries in the region Shares expertise in language training, and in non-formal education with both Thai government and donor support
Source: Table 6.3 of McKenZie, et al (2008), page 71. The table is copied in full.	

Appendix 2: Education Attainment and Economic Growth, an Econometric Growth Model Incorporating an Education Variable[6]

A2.1 Model

The background of this growth model is presented in Park, et al. (2011). Instead of actual gross domestic product (GDP) growth being the dependent variable, the per capita growth rate of potential output is used. The estimated model is as follows:

$$GR_{it} = f\left(\frac{I}{GDP}_{i,t-k}, \widehat{GC}_{i,t-l}, \widehat{REER}_{i,t-m}, \widehat{MS}_{i,t-n}, GR_{US_{JAP_{EU}}}, GDP_{i,0}, TA_{it}\right)$$

GR_{it} is per capita growth rate of economy *i* at time *t*; $I / GDP_{i,\,t-k}$ is the investment-GDP ratio of economy *i* lagged *k* periods; $\widehat{GC}_{i,t-l}$ is government consumption growth y-o-y in real terms for economy *i* lagged *l* periods; $\widehat{REER}_{i,t-m}$ is the year-on-year (y-o-y) percentage in the real effective exchange rate for economy *i* lagged m periods, with positive value indicating an appreciation; $\widehat{MS}_{i,t-n}$ is y-o-y money supply growth in real terms for economy i lagged n periods; $GR_{US_{JAP_{EU}}}$ is the weighted average of the y-o-y real GDP growth rate of the US, Japan, Europe, with weights fixed at 42%, 14%, and 44%, respectively; $GDP_{t,\,0}$ is the per capita income of economy *i* in 1990 in PPP$; and TA_{it} is the level of technological activity for economy *i* as reported in Table A2.1, with the 1995 figure being applied to 1990–1999 and the 2001 figure being applied to 2000–2009.

Table A.2.1: Technological Activity Index

	Rank (out of 117 countries)	Country	1995 Index	Rank (out of 117 countries)	Country	2001 Index
High Innovation	3	Japan	0.949	5	Japan	0.935
	10	Taipei,China	0.89	7	Taipei,China	0.902
	18	Singapore	0.803	12	Singapore	0.875
	24	Korea, Republic of	0.762	20	Korea, Republic of	0.812
Medium-high Innovation	37	Hong Kong, China	0.613	33	Hong Kong, China	0.632
	61	Malaysia	0.401	55	Malaysia	0.446
	63	China, People's Republic of	0.39	58	China, People's Republic of	0.417
	67	Thailand	0.34	61	Thailand	0.361
	76	Philippines	0.264	80	Philippines	0.265
	85	Indonesia	0.203			
Low Innovation				93	Indonesia	0.175

Source: UNCTAD. World Investment Report, 2005

Note: Each component of the Index has equal weights, the Index value being the simple average of the normalized value of the three variables: R&D manpower, patents in the United States and scientific journal articles.

[6] The author is once again indebted to Dr. Jose Ramon G. Albert, Senior Research Fellow at PIDS, for explaining and doing the regression runs. The usual disclaimer still applies.

The growth model is patterned after Park and Lee (2002) since the economy's behavior after the 1997/98 crisis is of interest in this study. The investment-to-GDP ratio indicates the rate at which the capital stock is augmented. Data on the latter variable is not available for all economies hence I/GDP is used instead. Differences in initial conditions could affect future growth rates and also the pattern of adjustment to a crisis. In growth theory, an economy with a lower initial per capita GDP is in a more favorable position for future growth. The fundamental idea is that the gap in existing capital and technology between the current and steady-state levels provides an opportunity for "catching up" via high rates of capital accumulation as well as diffusion of technology from more advanced economies. This is the rationale for the variable GDP_0.

Meanwhile, macroeconomic and structural reform policies implemented by the government for crisis management can influence the behavior of both actual and potential output. Fiscal policy can shore up domestic demand while monetary policy usually plays a crucial role in determining consumption and investment. While the major concern of policymakers would be short-term output growth, implementing appropriate stimulus measures has repercussions on medium- and long-term output growth. For example, if government does not compensate for a sharp drop in private sector demand, there may be a permanent loss of employment.

An important variable in the adjustment process is the exchange rate. The large real exchange rate depreciation in many economies of East Asia after the 1997/98 financial crisis restored their external balance. This helped facilitate a quick recovery in their respective economies. The favorable global environment at the time of the 1997/98 crisis also supported the current account balance through sustained export demand.

Given the importance of technology in endogenous growth models, a variable representing technological activity is included in the model. Unfortunately, there is no measure of technological capability at the country level on a regular basis (Archibugi and Coco, 2005). What is used in the econometric model is a technological activity index reported by the United Nations Conference on Trade and Development (UNCTAD) but only for 2 years. The rankings of the level of technological activity, however, reflect the degree of recovery of the nine economies from the 1997/98 crisis.

A2.2 Estimation Procedure

Since a combination of time series and cross section data is used, a traditional fixed-effects model was estimated in order to determine the optimal number of lags. After this, the possibility of improving the estimation to account for non-stationary and heterogenous behavior was considered. This was done by using the mean-group estimator of Pesaran and Smith (1995) and Pesaran, Shin, and Smith (1998) which involves assuming that given the dependent variable *Y* and explanatory variables, *Xs*, there is a short-run and long-run behavior of the "cointegrating" variables:

$$\Delta y_{it} = \varphi^{*}(y_{i,\,t-1} - \beta x_{i,\,t}) + \sum_{j=1}^{p} \alpha_j \Delta y_{i,\,t-j} + \sum_{j=1}^{q} \gamma_j \Delta x_{i,\,t-j} + \varepsilon_{it},$$

where φ is the error correction speed of adjustment parameter to be estimated; β is a $k \times 1$ vector of parameters; α and γ are parameters to be estimated; x_{it} is a $(1 \times k)$ vector of covariates; and ε_{it} is the error term.

The model was estimated using Stata but results indicated that the log likelihood function was non-concave. One possible reason was that the dependent variable—per capita growth of potential output—or some or all of the covariates are stationary. This was a logical deduction since many of these variables are percent changes thereby inherently involving differencing. Panel unit root tests developed by Im–Pesaran–Shin confirmed this.

This outcome ruled out the Pesaran–Smith model. Instead improvements on the fixed effects model were obtained by testing for cross-sectional dependence, i.e., whether the residuals from the fixed effects model are correlated across entities. The test results indicate the presence of cross sectional dependence and following Hoechle (2007), adjustments are applied by estimating the model with Driscoll–Kraay standard errors. The results are shown in table A2.2

Meanwhile, a standard random-effects model was estimated using generalized least squares taking into account heteroscedasticity and contemporaneous correlation among the variables. The results are shown in table A2.3. Estimates from a random-effects model are generally more efficient than those from a fixed-effects model. However, the latter always yields consistent estimates. Moreover, since choice of the economies in the study is pre-determined, the fixed-effects model is theoretically more appropriate.

A2.3 Data

Quarterly real GDP data series for the nine emerging East Asian economies, Japan, US, and aggregate Europe were constructed for the period from 1980 to 2010. The nine emerging economies are: China, Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand. Data from 1980Q1 to 2009Q2 were sourced from Oxford Economics. Figures from 2009Q3 to 2010Q4 were derived from the quarterly pattern of Oxford Economics forecasts using the annual GDP growth rate forecasts from the Asian Development Outlook Update 2009. Data for the emerging East Asian economies on real private consumption (from 1980–2010), real total fixed investment (from 1980–2010), government consumption expenditures in current prices (from 1980–2009), and money supply (M2 and M3, from 1980-2009) were also sourced from Oxford Economics.[7] All data not seasonally adjusted at the source were adjusted using Eviews 6, X12 Census method. Money supply and government consumption were deflated using consumer price index (CPI) data obtained from Oxford Economics.[8]

Population data used in the model was from the World Economic Outlook Database October 2009 and the Technology Activity Index for 1995 and 2001 was taken from the UNCTAD World Investment Report 2005. Data on the real effective exchange rate was sourced from Bloomberg with the exception of data from China which was obtained from the International Monetary Fund's (IMF) International Finance Statistics database.

A2.4 Results

Estimated coefficients generally conform to expectations and those that do are statistically significant. The main difference from the fixed-effects model (table A2.2) and the random-effects model (table A2.3) is the sign and significance of initial GDP and the variable representing technological activity. These two variables carry the correct sign and are significant in the random-effects model.

[7] However, M3 data for Indonesia and Taiwan are missing while figures for the Philippines from 1982Q1 to 1986Q3 were estimated based on data from the Central Bank of the Philippines.

[8] CPI data for the nine emerging East Asia economies were obtained from Oxford Economics, with the exception of data for Hong Kong which was downloaded from CEIC.

The investment-to-GDP ratio is significant when it is lagged one and four periods. The coefficient of the former carries the expected positive sign while the variable lagged four periods negatively affects growth of per capita GDP, a counter-intuitive result. The combined coefficients, however, yields a net positive impact confirming the role of investment in driving potential output.

The policy variables are also significant, with the fixed-effects model showing significant coefficients for government consumption and money supply when they are lagged two periods. In the case of random-effects, government consumption lagged one period is also significant. This conforms to conventional wisdom that fiscal policy — while normally longer to design and implement — has a quicker impact on economic activity.

The only problematic variable is the real effective exchange rate (*REER*). The expected sign is negative since an undervalued currency is more supportive of economic growth. The coefficient of the percentage change of *REER* is negative and significant when the variable is lagged four periods. However, it is positive and significant when lagged one and two periods. Moreover, combining the coefficients yields a net positive value. Most likely the time period involved does not capture the long-term dynamics of exchange rate behavior and economic growth. Another possible reason is that the percentage change in *REER* does not capture the degree of over-valuation or under-valuation of a particular currency, which is the important concept in explaining economic growth.

Meanwhile, the combined economic growth of industrialized economies yields a positive and significant coefficient. The dummy variable representing the 1997/98 crisis and its aftermath carries a negative coefficient. As mentioned earlier, the fixed-effects model and random-effects model yield contrasting results for the technology variable and the variable representing initial conditions. Nevertheless, this is an indication that both variables are important in explaining the behavior of potential output.

A2.5 Incorporating Education Variables

The four education variables were alternately used as explanatory variables:

1. Average years of schooling attained in population
2. Percentage of Complete Secondary Schooling Attained in Population
3. Percentage of Tertiary Schooling Attained in Population
4. Percentage of Complete Tertiary Schooling Attained in Population

Only the variable “Percentage of Complete Secondary Schooling Attained in Population” (percss) turned out to have a coefficient which is both positive and significantly differently from zero. This result was obtained with both the fixed effects model and random-effects model (Table A2.2 and Table A2.3, respectively). The other variables all had negative and significant coefficients in the random-effects model. In the case of the fixed-effects model the coefficients of the other three education variables were insignificant.[9]

The results suggest that both under-investing and over-investing in education may not be conducive to economic growth. This issue has been discussed extensively in the literature (e.g. Leuven and Oosterbeek, 2011). Secondary education may be the most important for

[9] The empitical results with the other three variables, i.e. Average years of schooling attained in population, Percentage of Tertiary Schooling Attained in Population, and Percentage of Complete Tertiary Schooling Attained in Population, are available from the author upon request.

the first stages of economic growth which is labor-, export- and manufacturing-intensive. Thereafter when a country shifts to services and participates more actively in the global knowledge economy, tertiary education becomes more relevant.

Table A2.2: Regression with Driscoll–Kraay Standard Errors

Regression with Driscoll-Kraay standard errors
Method: Fixed-effects regression
Group variable (i): country
maximum lag: 3

Number of obs = 702
Number of groups = 9
F(17, 8) = 110.49
Prob > F = 0.0000
within R-squared = 0.5126

gr_opc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
I/GDP $_{i,t-1}$	45.35384	11.46494	3.96	0.004	18.91563	71.79205
I/GDP $_{i,t-2}$	2.558463	13.35625	0.19	0.853	-28.2411	33.35802
/GDP $_{i,t-3}$	-11.23754	10.89927	-1.03	0.333	-36.37131	13.89622
/GDP $_{i,t-4}$	-39.48709	10.96346	-3.60	0.007	-64.76887	-14.20531
REER $_{i,t-1}$	.0443743	.0173339	2.56	0.034	.0044022	.0843464
REER $_{i,t-2}$	.05685	.0150587	3.78	0.005	.0221247	.0915754
REER $_{i,t-3}$	-.007433	.0138451	-0.54	0.606	-.03936	.024494
REER $_{i,t-4}$	-.036138	.0092921	-3.89	0.005	-.0575656	-.0147104
MS $_{i,t-1}$	.0369718	.0303929	1.22	0.258	-.0331143	.1070579
MS $_{i,t-2}$	.1165453	.0331243	3.52	0.008	.0401606	.19293
GC $_{i,t-1}$	.0206103	.0172205	1.20	0.266	-.0191003	.060321
GC $_{i,t-2}$	.0424861	.0183827	2.31	0.050	.0000956	.0848766
GR_US_JAP_EU	.8428468	.1482266	5.69	0.000	.5010356	1.184658
TA $_{it}$	-15.82414	14.44306	-1.10	0.305	-49.1299	17.48163
GDP $_{i,0}$	.0013648	.0014705	0.93	0.381	-.0020262	.0047557
crisis	-4.278874	1.100947	-3.89	0.005	-6.817663	-1.740085
percss	.1329489	.0559868	2.37	0.045	.0038431	.2620547
_cons	(omitted)					

Table A2.3: Cross-sectional Time-Series FGLS Regression, Random Effects

Coefficients: generalized least squares
Panels: heteroskedastic
Correlation: no autocorrelation

Estimated covariances	=	9	Number of obs	=	702
Estimated autocorrelations	=	0	Number of groups	=	9
Estimated coefficients	=	18	Time periods	=	78
			Wald chi2(17)	=	974.22
			Prob > chi2	=	0.0000

gr_opc	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
I/GDP $_{i,t-1}$	60.71554	9.470893	6.41	0.000	42.15293	79.27815
I/GDP $_{i,t-2}$	3.785405	13.38624	0.28	0.777	-22.45114	30.02195
/GDP $_{i,t-3}$	-16.61785	13.39878	-1.24	0.215	-42.87897	9.643277
/GDP $_{i,t-4}$	-39.49111	9.509018	-4.15	0.000	-58.12844	-20.85378
REER $_{i,t-1}$	.0506316	.0142002	3.57	0.000	.0227997	.0784635
REER $_{i,t-2}$	.0501694	.0174921	2.87	0.004	.0158855	.0844532
REER $_{i,t-3}$	-.0034381	.0170701	-0.20	0.840	-.0368948	.0300187
REER $_{i,t-4}$	-.0321449	.0140781	-2.28	0.022	-.0597375	-.0045522
MS $_{i,t-1}$	.0352659	.0308183	1.14	0.252	-.0251369	.0956687
MS $_{i,t-2}$	.0869638	.0311603	2.79	0.005	.0258907	.1480369
GC $_{i,t-1}$	.0368791	.0164805	2.24	0.025	.0045779	.0691802
GC $_{i,t-2}$	.0534029	.0163729	3.26	0.001	.0213125	.0854933
GR_US_JAP_EU	.7174441	.0745006	9.63	0.000	.5714257	.8634626
TA $_{it}$	2.518088	.7942365	3.17	0.002	.9614126	4.074762
GDP $_{i,0}$	-.0001177	.0000394	-2.99	0.003	-.0001949	-.0000405
crisis	-3.67022	.3699631	-9.92	0.000	-4.395334	-2.945106
percss	.0336894	.0126837	2.66	0.008	.0088298	.0585491
_cons	-2.587915	.4998966	-5.18	0.000	-3.567694	-1.608135

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