

English Language and Economic Growth: Cross-Country Empirical Evidence

Chew Ging LEE

Nottingham University Business School

The University of Nottingham Malaysia Campus

Jalan Broga

43500 Semenyih

Selangor Darul Ehsan

Malaysia

Tel: +603 8924 8259

Fax: +603 8924 8019

E-mail: Lee.Cheung-Ging@nottingham.edu.my

Abstract

This paper addresses the effect of English proficiency on economic growth empirically with Barro-type cross-sectional growth regression. The level of English proficiency can be viewed as part of human capital. This paper suggests that the ability to absorb knowledge is positively related to the level of English proficiency. Therefore, countries with higher level of English proficiency among the fraction of its population are likely to grow faster. The empirical results provide evidence of positive correlation between initial English proficiency and economic growth only for the countries in the Asia and Europe. The spectacular growth of Asian countries can be attributed to the heavy investment in the creation of human capital that fosters English-speaking culture and promotes a climate of the use of English. An increase in English proficiency will directly accelerate the knowledge absorptive capabilities of workers. A similar argument can be applied to European economies.

Keywords: English Language, Economic Growth

JEL classification: O10, O15

INTRODUCTION

It is generally recognized that the accumulation of knowledge has positive effects on economic growth, in particular, knowledge creation through the firms' research and development activities (e.g., Romer, 1990; Grossmann and Helpman, 1991; Aghion and Howitt, 1992; Jones, 1995). At a given point of time, the stock of knowledge available to an economy is just a subset of existing stock of knowledge. New ideas and insights created by a developed economy may not be aware by others, although Keller (2002) suggests that increasing economic integration and the advent of new means of telecommunication ensure that people in all countries have access to the same stock of knowledge. This is because the rate of diffusion of new knowledge to an economy depends heavily on the economy's absorptive capabilities and the existence of international knowledge spillovers (e.g. Coe and Helpman, 1995; Coe et al., 1997; Falvey et al., 2002; Falvey et al., 2004). Therefore, the production, diffusion and absorption of knowledge determine the volume of knowledge that is available to an economy.

It is widely accepted that majority of new knowledge is created by developed countries in which English has enjoyed a special status. It is also recognized that developing countries enjoy efficiency gains if they adopt the knowledge created in developed countries (e.g. Caselli and Coleman, 2000; Caselli and Coleman, 2001; Hall and Jones, 1999). Crystal (2003, chapter 4) has provided a lengthy discussion on the growth of the influence of English language and the evidence of the importance of English language in the modern society. Since knowledge itself is largely intangible, it is difficult to quantify the stock of knowledge. If the number of internationally accepted journals and published papers can be used as a proxy for the stock of knowledge, we can

conclude easily that English has become an effective means of getting access to knowledge. This is because English language has been an important medium of academic publications. For instance, German Economic Review, the official publication of the German Economic Association (Verein für Socialpolitik), and Spanish Economic Review, the official publication of the Spanish Economic Association (Asociación Española de Economía), are published in English. After 49 volumes with the majority of articles in German, the Konjunkturpolitik was relaunched as Applied Economics Quarterly at the beginning of 2003, and now publishes exclusively in English.

Now, let us focus on the impact of English on daily activities. Machineries usually come with instructions or manuals in English. Without a basic understanding of English, workers are generally unable to use these machineries in productive activities. Keller (2002) indicates that the language of communication among R&D engineers in Germany and Italy could be English in the manufacturing industry level. Based on these examples, we cannot deny that individuals are more likely to be in touch with new knowledge if they have learned English.

I do not deny the importance of other languages. But, I stress the importance of English language as the international language of communication because knowledge is gained either by experience, learning and perception or through association and reasoning. Sometimes, important creations and discoveries of countries where English has no special status are published in a local language. But, to enable the created knowledge to reach much further around the world and to obtain a higher recognition, they would have been translated into English. Further, I do not imply that all workers in a country must master English. What I would like to stress is that in a country a fraction of workers must be

fluent in English. This group of workers will gain access to the new knowledge and then they can translate the learned knowledge into the local language to allow the learned knowledge to reach a wider audience.

To date, as far as I know no study in economic growth has investigated the effect of English on growth either empirically or theoretically. A small number of studies have considered the importance of language for spillovers (e.g. Caselli and Coleman, 2001; Keller, 2002). Caselli and Coleman (2001) investigate the determinants of computer-technology adoption with a large sample of countries between 1970 and 1990. They find that the fraction of the population speaking English is statistically insignificant. Keller (2002) finds that language skills are important for international technology diffusion. He shows that speaking the same language facilitates the diffusion of technology. Hall and Jones (1999) argue that the differences in output per worker across countries can be explained by the differences in social infrastructure which is partially determined by language. They show that the fraction of the population speaking one of the five primary Western European languages: English, French, German, Portuguese and Spanish explains the variation of social infrastructure. This variable also explains the variation of natural logarithm of output per worker. But, the fraction of the population speaking English is insignificant in these two equations.

The intention of this paper is to fill existing gap with empirical evidence. This paper is organized as follows. Next section describes the data. Subsequently, empirical models on the relationship between the level of English proficiency and economic growth are presented. The last section concludes with implications for policy and future research.

DATA

In this study, I combine data from three data sources: Sorensen and Whitta-Jacobsen (2005, table A, 390-393), TOEFL Test and Score Data Summaries: 1993-1994 and 1995-1996 Editions (www.ets.org), and Barro and Lee (2000). The description of variables and their sources are summarized in Table 1.

TABLE 1. DESCRIPTION OF VARIABLES AND THEIR SOURCES

Variable	Explanation	Source
GROWTH	Average annual growth rate of real GDP per worker from 1960-2000.	Sorensen and Whitta-Jacobsen, (2005, Table A, p. 390-393)
INVEST	Average investment rate in physical capital (investment share of GDP) from 1960-2000.	Sorensen and Whitta-Jacobsen, (2005, Table A, p. 390-393)
GDP60	Real GDP per worker in 1960	Sorensen and Whitta-Jacobsen, (2005, Table A, p. 390-393)
ENGLISH93	TOEFL total score mean of examinees who took TOEFL from July 1993 through June 1995.	TOEFL Test and Score Data Summary 1995-96 Edition
ENGLISH91	TOEFL total score mean of examinees who took TOEFL from July 1991 through June 1993.	TOEFL Test and Score Data Summary 1993-94 Edition
ASIA	1 if a country is classified as Asia or Middle East, 0 otherwise by TOEFL.	TOEFL Test and Score Data Summary 1995-96 Edition
AFRICA	1 if a country is classified as Africa, 0 otherwise by TOEFL.	TOEFL Test and Score Data Summary 1995-96 Edition
EUROPE	1 if a country is classified as Europe, 0 otherwise by TOEFL.	TOEFL Test and Score Data Summary 1995-96 Edition
SCHOOL60	Average schooling years in the group of	Barro and Lee (2000)

the population aged 15 and above in year
1960.

Initially, the fraction of the population speaking English compiled by Hall and Jones (1999) which has been used by Caselli and Coleman (2001) is intended to be used as the proxy for English proficiency. However, after a careful study on this data, I believe that this data is not suitable for this study. Firstly, there are only 35 countries with positive values, others take a value equal to zero. Secondly, this data contains only information about the fraction of population who use English as the "first" language. Thirdly, the reliability of this data has been questioned. For instance, the value for Singapore is 0.089, Sri Lanka 0.009, Philippines 0, India 0 and Malaysia 0 in Hall and Jones (1999). But, English language has been widely used in the commercial sector of the above-mentioned five countries. English language is also taught as a compulsory subject at least at high school level in these five countries. Lastly, the data of Hall and Jones does not provide a measure of English proficiency for the fraction of population who know English.

To determine the suitability of a variable as the proxy for English proficiency, we probably have to go through a heated debate similar to the case for the proxies for human capital and environmental pollution. Based on the illustration in Introduction, it is anticipated that the rate of absorption of knowledge of an economy would be greater, the larger the size of population who have better command of English. A proxy that can capture these two dimensions: the fraction of population who know English and the level of English proficiency of this group of individuals, has to be identified. Currently, there

is no single source of data can capture these two dimensions. After a careful consideration, the mean score of TOEFL examinees is used as the proxy for English proficiency of the fraction of population who can speak English. I have to accept that the mean score of TOEFL examinees is not a perfect proxy required by this study. It does not fully capture the fraction of population who can speak English because TOEFL exams are taken by those who plan to live, work or study abroad, particularly in the US, UK, Canada, Australia and New Zealand. Therefore, only a small fraction of the individuals in a country enroll in TOEFL exams.

The number of TOEFL examinees also varies considerably from one country to another. The number of TOEFL examinees may reflect the amount of resources allocated in the provision of English teaching and also the fraction of population who have some competence in English language. The mean score of TOEFL examinees may reflect the average proficiency level of the mentioned group of individuals. Creating a new variable by allowing the mean score of TOEFL examinees to interact with the data of Hall and Jones has been avoided because this only generates a sample with 35 positive values. Although there are limitations associated with the mean score of TOEFL examinees, it currently provides, possibly, the only widely available measure for English proficiency.

English language TOEFL Test and Score Data Summary: 1993-1994 Edition provides the earliest available information on TOEFL scores. The number of examinees for TOEFL Test and Score Data Summary varies from one country to another. For instance, in 1993-1994 Edition among the countries where score means are reported, the lowest number of examinees is 34 and highest is 260513. Since average can be distorted by outliers, countries with low number of examinees are excluded. Only countries with at

least 1000 examinees are included. The cut-off point of at least 1000 examinees is chosen arbitrary. A higher cut-off point is avoided so that a reasonable sample size can be maintained.

Crystal (2003, pp. 62-65) identifies seventy five economies in which English has held or continues to hold a special status as either the primary language or second language. These economies include New Zealand, United States, Singapore and others. In these countries, the use of English is high among the general population. Therefore, this group of countries has been omitted from this study because TOEFL is designed to measure the English proficiency of people whose native language is not English. Further, this group of countries is the main creators of knowledge. High percentage of knowledge is transmitted from these countries to others. Putting these data sources together, the total number of usable observations is only 43 economies, as reported in Table 2.

TABLE 2. ECONOMIES INCLUDED IN THIS STUDY

Argentina	Dominican Republic	Israel	Portugal
Austria	Ecuador	Italy	Romania
Belgium	Egypt	Japan	Spain
Bolivia	El Salvador	Jordan	Sweden
Brazil	Ethiopia	Korea	Switzerland
Chile	Finland	Mexico	Syria
China	France	Morocco	Taiwan, China
Colombia	Greece	Netherlands	Thailand
Costa Rica	Guatemala	Norway	Turkey
Cyprus	Indonesia	Panama	Venezuela
Denmark	Iran	Peru	

In the earlier cross-country studies related to human capital, it has been observed that the empirical results are highly sensitive to the choices of proxy and the types of dataset been used. Therefore, in this study, I have used ENGLISH91 and ENGLISH93 to represent the initial English proficiency level and to check whether there are significant changes in the findings when different year data is used. Given the discussed problems related to TOEFL Test and Score Data Summaries, ENGLISH91 and ENGLISH93 may not be perfect proxies for the initial proficiency level.

Dummy variables are created for different regions based on the classifications of TOEFL Test and Score Data Summaries. I have grouped the countries under the classifications of Middle East and Asia regions into a single regional dummy, ASIA, because there are only four countries classified under Middle East region and traditionally the countries under these two TOEFL classifications are classified as Asian countries by atlas. All regional dummies are not used as intercept dummies which are the common approach in existing empirical studies (e.g., Barro, 1991, 1997; Easterly and Levine, 1995; Feng, 2003). They will be used as slope dummies to interact with either ENGLISH91 or ENGLISH93.

RESULTS

Cross-sectional regression is utilized in this study. GROWTH is the dependent variable. Endogeneity problem may arise in this research due to the reverse causality between economic growth and English proficiency. For instance, economic growth leads to increased demand for English speaking employees and thus to higher English proficiency. To tackle this issue, initial English proficiency is used as an independent variable.

Furthermore, I do not use panel data estimation methods, which are commonly used in the estimation growth equation, for instance the works of Baldacci et al. (2008) and Caselli et al. (1996), because it is not possible to obtain long enough data for the mean score of TOEFL of each selected country. New TOEFL tests have been developed over the last decade. Initially, TOEFL test is paper-based. In 1998, computer-based TOEFL test was introduced. Subsequently, the Internet-based TOEFL test was developed in September 2005. With the introduction of Internet-based TOEFL test, computer-based TOEFL test was discontinued in September 2006. Currently paper-based TOEFL test is offered on a limited basis to support the Internet-based TOEFL testing network. The maximum score of each test is different. For instance, the maximum score of Internet-based TOEFL test is 120, paper-based TOEFL test is 677 and computer-based TOEFL test is 300. Mean scores of TOEFL obtained from the TOEFL Test and Score Data Summaries: 1993-1994 and 1995-1996 Editions were computed from paper-based TOEFL test. With the introduction of computer-based TOEFL test and subsequently Internet-based TOEFL test, the number of examinees in paper-based TOEFL test dropped dramatically.

The regression results are reported in Tables 3, 4 and 5. It has been noted that, in the existing empirical studies, the significance of one independent variable can be affected by the choices of data and groups of independent variables used (e.g., Levine and Renelt, 1992; Sala-i-Martin, 1997). Equation (1) is the base model which captures common control variables observed in the literature and the proxy for initial English proficiency is only introduced in the remaining equations. I use only 2 control variables (INVEST and GDP60) to keep the regression models simple and to prevent the debate on

the suitability of other variables. INVEST and GDP60 are both statistically significant at 1% level for all equations reported in Table 3. They come with the expected sign. These results are consistent with previous studies.

ENGLISH91 and ENGLISH93 are statistically insignificant in Equation (2) and Equation (3), respectively. But, they have the expected positive sign. The lack of significance of the coefficient of either ENGLISH91 or ENGLISH93 warrants some careful analysis. At this stage, it is premature to conclude that English proficiency has no impact on economic growth because it is assumed that the effects of English proficiency are homogeneous across continents. Whether English proficiency has an effect on economic growth is a problem of specification of model. To overcome this problem, I introduce slope regional dummies into Equation (4) and Equation (5). ENGLISH91 and ENGLISH93 are still statistically insignificant. The signs for both of them are different. ENGLISH91 has a negative sign which against the argument that the level of English proficiency has a positive effect on economic growth. Among the slope regional dummies, only ASIA and EUROPE are significant. There are only 3 countries associated with AFRICA. The low number of observations in AFRICA may be the reason why this slope dummy is statistically insignificant. Comparing Equation (4) and Equation (5), each regional dummy has same sign and similar magnitude. Based on F-test, ENGLISH91 and ENGLISH91xAFRICA are jointly insignificant even at 10% level in Equation (4). ENGLISH93 and ENGLISH93xAFRICA of Equation (5) are also jointly insignificant at 10% level. Therefore, these jointly insignificant variables are omitted to estimate Equation (6) and Equation (7).

TABLE 3. REGRESSION RESULTS: GROWTH AS DEPENDENT VARIABLE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
INTERCEPT	9.98x10 ⁻³ (3.84x10 ⁻³) ^b	5.69x10 ⁻³ (0.0292)	4.71x10 ⁻³ (0.0306)	0.0135 (0.0265)	8.64x10 ⁻³ (0.0265)	0.0137 (3.76x10 ⁻³) ^a	0.0137 (3.76x10 ⁻³) ^a
GDP60	-1.26x10 ⁻⁶ (1.86x10 ⁻⁷) ^a	-1.29x10 ⁻⁶ (2.33x10 ⁻⁷) ^a	-1.29x10 ⁻⁶ (2.25x10 ⁻⁷) ^a	-1.19x10 ⁻⁶ (1.73x10 ⁻⁷) ^a	-1.19x10 ⁻⁶ (1.67x10 ⁻⁷) ^a	-1.22x10 ⁻⁶ (1.41x10 ⁻⁷) ^a	-1.22x10 ⁻⁶ (1.40x10 ⁻⁷) ^a
INVEST	0.1400 (0.0170) ^a	0.1397 (0.0171) ^a	0.1397 (0.0171) ^a	0.0783 (0.0223) ^a	0.0787 (0.0221) ^a	0.0728 (0.0218) ^a	0.0727 (0.0217) ^a
ENGLISH91		8.52x10 ⁻⁶ (5.58x10 ⁻⁵)		-3.11x10 ⁻⁶ (4.79x10 ⁻⁵)			
ENGLISH93			1.04x10 ⁻⁵ (5.76x10 ⁻⁵)		6.00x10 ⁻⁶ (4.66x10 ⁻⁵)		
ENGLISH91x AFRICA				8.47x10 ⁻⁶ (1.13x10 ⁻⁵)			
ENGLISH93x AFRICA					8.89x10 ⁻⁶ (1.13x10 ⁻⁵)		
ENGLISH91x ASIA				2.93x10 ⁻⁵ (8.70x10 ⁻⁶) ^a		2.84x10 ⁻⁵ (8.90x10 ⁻⁶) ^a	
ENGLISH93x ASIA					2.94x10 ⁻⁵ (8.52x10 ⁻⁶) ^a		2.82x10 ⁻⁵ (8.79x10 ⁻⁶) ^a

ENGLISH91x				2.62x10 ⁻⁵		2.62x10 ⁻⁵	
EUROPE				(6.38x10 ⁻⁶) ^a		(5.46x10 ⁻⁶) ^a	
ENGLISH93x					2.56x10 ⁻⁵		2.60x10 ⁻⁵
EUROPE					(6.17x10 ⁻⁶) ^a		(5.42x10 ⁻⁶) ^a
\overline{R}^2	0.5598	0.5487	0.5488	0.6992	0.6994	0.7096	0.7096

^a Statistically significant at the 1% level in a two-tailed test.

^b Statistically significant at the 5% level in a two-tailed test.

^c Statistically significant at the 10% level in a two-tailed test.

Standard errors are in the parentheses and are constructed from White's (1980) heteroskedasticity-consistent covariance matrix.

In Equation (6) and Equation (7), all left-hand side variables are significant at 1% level. The coefficient of each left-hand side variable for these two equations have similar magnitude. Both these final equations also have \bar{R}^2 of slightly above 0.7. All the earlier equations have \bar{R}^2 lower than both these two final equations reported in Table 3. Interaction terms between ASIA and either ENGLISH91 or ENGLISH93 are significant at 1% level as reported. Same conclusion also applies to interaction terms between EUROPE and either ENGLISH91 or ENGLISH93. This implies that the level of English proficiency has a positive impact on the economic growth of Asian and European economies only. The economies in other regions do not enjoy the positive effects of English language on growth probably due to internal factors, such as political instability, market distortion, policy uncertainty and lack of political freedom. These internal factors may disrupt market activities and threaten the effective use of human capital.

To keep the models simple, the regression models obtained in Table 3 have only two control variables: INVEST and GDP60. These regression models are lack of a general education variable which may lead to misspecification of model. Further, some researchers may suggest that the results in Table 3 are obtained because the English language variable has acted as a proxy for general education. To check whether the results of English language variable are robust to the inclusion of other common independent variables and to prevent the misspecification of model, initial average years of schooling, SCHOOL60, is introduced in the regression models reported in Table 4. Recognizing that the interaction of the dummy variable associated with African countries and initial English proficiency is insignificant in the earlier results and there are only

three African countries in this sample, ENGLISH91xAFRICA and ENGLISH93xAFRICA are omitted.

TABLE 4. REGRESSION RESULTS: GROWTH AS DEPENDENT VARIABLE

	(8)	(9)	(10)	(11)	(12)
INTERCEPT	0.0115 (0.0047) ^b	0.0109 (0.0333)	0.0107 (0.0354)	0.0338 (0.0321)	0.0295 (0.0332)
GDP60	-1.32x10 ⁻⁶ (2.4x10 ⁻⁷) ^a	-1.33x10 ⁻⁶ (2.5x10 ⁻⁷) ^a	-1.33x10 ⁻⁶ (2.43x10 ⁻⁷) ^a	-1.24x10 ⁻⁶ (1.95x10 ⁻⁷) ^a	-1.25x10 ⁻⁶ (1.91x10 ⁻⁷) ^a
INVEST	0.1273 (0.0296) ^a	0.1273 (0.0309) ^a	0.1273 (0.0311) ^a	0.0542 (0.0352)	0.0550 (0.0354)
SCHOOL60	4.5x10 ⁻⁴ (1.1x10 ⁻³)	4.4x10 ⁻⁴ (1.2x10 ⁻³)	4.4x10 ⁻⁴ (1.2x10 ⁻³)	6.6x10 ⁻⁴ (1.0x10 ⁻³)	6.2x10 ⁻⁴ (1.1x10 ⁻³)
ENGLISH91		1.05x10 ⁻⁶ (6.18x10 ⁻⁵)		-3.57x10 ⁻⁵ (5.6x10 ⁻⁵)	
ENGLISH93			1.46x10 ⁻⁶ (6.5x10 ⁻⁶)		-2.73x10 ⁻⁵ (5.72x10 ⁻⁵)
ENGLISH91x ASIA				2.77x10 ⁻⁵ (8.57x10 ⁻⁶) ^a	
ENGLISH93x ASIA					2.78x10 ⁻⁵ (8.44x10 ⁻⁶) ^a
ENGLISH91x EUROPE				2.87x10 ⁻⁵ (6.99x10 ⁻⁶) ^a	
ENGLISH93x EUROPE					2.82x10 ⁻⁵ (6.82x10 ⁻⁶) ^a
\overline{R}^2	0.5429	0.5302	0.5302	0.7007	0.6998

^a Statistically significant at the 1% level in a two-tailed test.

^b Statistically significant at the 5% level in a two-tailed test.

^c Statistically significant at the 10% level in a two-tailed test.

Standard errors are in the parentheses and are constructed from White's (1980) heteroskedasticity-consistent covariance matrix.

Equation (8) is the base model reported in Table 4 with the addition of SCHOOL60 but without initial English proficiency and the interaction terms of dummy variables. The results associated with GDP60 and INVEST are similar to those obtained from Equation (1). SCHOOL60 is statistically insignificant but its estimated coefficient has the expected positive sign. The proxies for initial English proficiency are introduced in Equations (9) and (10). SCHOOL60 is still statistically insignificant. The results for other independent variables are similar to those obtained from Equations (2) and (3). Interaction terms, ASIAxENGLISH91 and EUROPExENGLISH91, are introduced into Equation (9) for the estimation of Equation (11). To estimate Equation (12), interaction terms, ASIAxENGLISH93 and EUROPExENGLISH93, are added to Equation (10). In both Equations (11) and (12), INVEST becomes statistically insignificant. Initial English proficiency variable in both equations is statistically insignificant with negative sign. The interaction terms of initial English proficiency with either ASIA or EUROPE are statistically significant at 1% level with sign and magnitude similar to the earlier estimated equations.

Table 4 has produced surprising results indicating that initial schooling is not correlated with economic growth. Further, investment becomes statistically insignificant when the interaction terms between initial English proficiency and regional dummy variables have been introduced as additional independent variables. Instead of analyzing the effects of initial English proficiency and initial schooling separately, I have allowed these two variables to interact to obtain a new proxy for initial human capital: ENGLISH91xSCHOOL60 or ENGLISH93xSCHOOL60. Table 5 provides the results of the estimated models where this new proxy for initial human capital has been introduced

as an independent variable. Equations (13) and (14) are the base models with 3 independent variables: GDP60, INVEST and either ENGLISH91xSCHOOL60 or ENGLISH93xSCHOOL60. All these independent variables are significant at 1% level, except ENGLISH91xSCHOOL60 in Equation (13) and ENGLISH93xSCHOOL60 in Equation (14). These two new proxies for initial human capital are allowed to interact with ASIA and EUROPE dummy variables in the estimation of Equations (15) and (16). In both equations, all independent variables are statistically significant at least at 5% level. All these independent variables have the expected signs with the exception of the estimated coefficient of either ENGLISH91xSCHOOL60 or ENGLISH93xSCHOOL60. The negative estimated coefficient of the initial human capital in each estimated equation implies that for Latin American and African countries, this initial human capital and economic growth are negatively correlated. However, for Asian and European countries the initial human capital is positively correlated with economic growth because in absolute value the estimated coefficient of ENGLISH91xSCHOOL60 is smaller than that of either ENGLISH91xSCHOOL60xASIA or ENGLISH91xSCHOOL60xEUROPE and the estimated coefficient of ENGLISH93xSCHOOL60 is smaller than that of either ENGLISH93xSCHOOL60xASIA or ENGLISH93xSCHOOL60xEUROPE.

TABLE 5. REGRESSION RESULTS: GROWTH AS DEPENDENT VARIABLE

	(13)	(14)	(15)	(16)
INTERCEPT	0.0116 (4.8x10 ⁻³) ^b	0.0116 (0.0048) ^b	0.0254 (4.6x10 ⁻³) ^a	0.0253 (4.6x10 ⁻³) ^a
GDP60	-1.35x10 ⁻⁶ (2.51x10 ⁻⁷) ^a	-1.35x10 ⁻⁶ (2.5x10 ⁻⁷) ^a	-1.3x10 ⁻⁶ (2.0x10 ⁻⁷) ^a	-1.3x10 ⁻⁶ (1.99x10 ⁻⁷) ^a
INVEST	0.1258 (0.0282) ^a	0.1259 (0.0281) ^a	0.0630 (0.0241) ^b	0.0630 (0.0240) ^b

ENGLISH91x	9.92x10 ⁻⁷		-4.82x10 ⁻⁶	
SCHOOL60	(1.8x10 ⁻⁶)		(2.0x10 ⁻⁶) ^b	
ENGLISH93x		9.7x10 ⁻⁷		-4.77x10 ⁻⁶
SCHOOL60		(1.79x10 ⁻⁶)		(1.98x10 ⁻⁶) ^b
ENGLISH91x			7.44x10 ⁻⁶	
SCHOOL60x			(2.31x10 ⁻⁶) ^a	
ASIA				
ENGLISH93x				7.39x10 ⁻⁶
SCHOOL60x				(2.29x10 ⁻⁶) ^a
ASIA				
ENGLISH91x			6.84x10 ⁻⁶	
SCHOOL60x			(1.67x10 ⁻⁶) ^a	
EUROPE				
ENGLISH93x				6.79x10 ⁻⁶
SCHOOL60x				(1.65x10 ⁻⁶) ^a
EUROPE				
\overline{R}^2	0.5442	0.5441	0.7170	0.7166

^a Statistically significant at the 1% level in a two-tailed test.

^b Statistically significant at the 5% level in a two-tailed test.

^c Statistically significant at the 10% level in a two-tailed test.

Standard errors are in the parentheses and are constructed from White's (1980) heteroskedasticity-consistent covariance matrix.

The empirical results reported in Tables 3, 4 and 5 are unable to find statistically significant correlation between economic growth and the proxy for initial English proficiency if the effects of initial English proficiency are treated homogeneously across continents. With the introduction of interaction terms between continental dummy variables and initial English proficiency into the regression models, statistically significant correlation between economic growth and the proxy for initial English

proficiency can be found for countries in Asia and Europe. Therefore, there is no unanimous evidence to support the positive contribution of English proficiency to economic growth across all countries. English proficiency will have positive impacts on economic growth if the increase in English proficiency is complemented with minimum threshold of physical capital, technology, political stability, good governance and other factors. The improvement in English proficiency without sufficient accumulation of physical capital, technology and social capital will be wasted. This probably explains why English proficiency does not explain the economic growth of the countries outside Asia and Europe. Hence, English proficiency can be seen as a necessary but not sufficient condition for economic growth.

CONCLUSION

The spectacular growth of Asian countries can be attributed to the heavy investment in the creation of human capital that fosters English-speaking culture and promotes a climate of the use of English. An increase in English proficiency will directly accelerate the knowledge absorptive capabilities of workers. A similar argument can be applied to European economies which also enjoy a positive growth rate. This study does not find any evidence about the effects of English language on the economic growth of Latin American and African countries. This indicates that a satisfactory understanding of the effect of English language on economic growth requires an appreciation of how the formation of institutions, stability and certainty can encourage the accumulation of knowledge. It is important not to forget the fact that even if this study is able to find a positive relationship between the proficiency level of English and the growth rate in a

cross-sectional data, establishing this relationship can be very difficult under different empirical framework and different measures for the proficiency level of English.

REFERENCES

Aghion, Philippe and Peter Howitt, “A Model of Growth through Creative Destruction”, *Econometrica*, 1992, Vol. 60, No. 2, pp. 323-351.

Baldacci, Emanuele, Benedict Clements, Sanjeev Gupta and Qiang Cui, “Social Spending, Human Capital, and Growth in Developing Countries”, *World Development*, 2008, Vol. 36, No. 8, pp. 1317-1341.

Barro, Robert J., “Economic Growth in a Cross-Section of Countries”, *Quarterly Journal of Economics*, 1991, Vol. 106, No. 2, pp. 407-433.

Barro, Robert J., *Determinants of Economic Growth: A Cross Country Empirical Study*, 1997, Cambridge, MA: MIT Press.

Barro, Robert J., and Lee Jong-Wha, “International Data on Educational Attainment: Updates and Implications”, CID Working Paper No. 42, 2000, Harvard University.

Caselli, Francesco and Wilbur John Coleman II, “The World Technology Frontier”, National Bureau of Economic Research Working Paper no. 7904, 2000, National Bureau of Economic Research.

Caselli, Francesco and Wilbur John Coleman II, “Cross-Country Technology Diffusion: the Case of Computers”, *AEA Papers and Proceedings, American Economic Reviews*, 2001, Vol. 91, No. 2, pp. 328-335.

Caselli, Francesco, Gerardo Esquivel and Fernando Lefort, “Reopening the Convergence Debate: A New Look at Cross-Country Growth Empirics”, *Journal of Economics Growth*, 1996, Vol. 1, No. 3, pp. 363-390.

Crystal, David, *English as a Global Language*, 2003, 2nd ed. Cambridge: Cambridge University Press.

Coe, David T. and Elhanan Helpman, “International R&D-Spillovers.” *European Economic Review*, 1995, Vol. 39, No. 5, pp. 859-887.

Coe, David T., Elhanan Helpman and Alexander W. Hoffmaister, “North-South R&D Spillovers”, *Economic Journal*, 1997, Vol. 107, No. 440 , pp. 134-149.

Easterly, William and Ross Levine, “Africa’s Growth Tragedy: a Retrospective, 1960-89”, Policy Research Working Paper WPS1503, 1995, World Bank, Washington, DC.

Falvey, Rod, Neil Foster, and David Greenaway. 2002. “North-South Trade, Knowledge Spillovers and Growth”, *Journal of Economic Integration*, 2002, Vol. 17, No. 4, pp. 650-670.

Falvey, Rod, Neil Foster and David Greenaway, “Imports, Exports, Knowledge Spillovers and Growth”, *Economics Letters*, 2004, Vol. 85, No. 2, pp. 209-213.

Feng, Yi, *Democracy, Governance, and Economic Performance: Theory and Evidence*, 2003, Cambridge, MA: MIT Press.

Grossmann, Gene M. and Elhanan Helpman, *Innovation and Growth in the Global Economy*, 1991, Cambridge, MA: MIT Press.

Hall, Robert E. and Charles I. Jones, “Why Do Some Countries Produce so Much More Output Per Worker than Others?”, *Quarterly Journal of Economics* , 1999, Vol. 114, No. 1, pp. 83-116.

Jones, Charles I., “R&D-Based Models of Economic Growth.” *Journal of Political Economy*, 1995, Vol. 103, No. 4, pp. 759-784.

Keller, Wolfgang, “Geographic Localization of International Technology Diffusion”, *American Economic Review*, 2002, Vol. 92, No. 1, pp. 120-142.

Levine, Ross, and David Renelt, “A Sensitivity Analysis of Cross-Country Growth Regressions”, *American Economic Review*, 1992, Vol. 82, No. 4, pp. 942-963.

Sorensen, Peter Birch and Hans Jorgen Whitta-Jacobsen, *Introducing Macroeconomics: Growth & Business Cycles*, 2005, McGraw-Hill Companies.

Romer, Paul M., “Endogenous Technological Change”, *Journal of Political Economy*, 1990, Vol. 98, No. 5, S71-S102.

Sala-I-Martin, Xavier X., “I just Ran Two Million Regressions”, *AEA Papers and Proceedings American Economic Review*, 1997, Vol. 87, No. 2, pp. 178-183.

White, Halbert, “A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity”, *Econometrica*, 1980, Vol. 48, No. 2, pp. 817-838.