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UNIVERSITI PUTRA MALAYSIA

IMPACTS OF ECONOMIC FREEDOM AND LANGUAGE ON TECHNOLOGY TRANSFER IN DEVELOPING COUNTRIES

TEE CHEE LIP

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IMPACTS OF ECONOMIC FREEDOM AND LANGUAGE ON TECHNOLOGY TRANSFER IN DEVELOPING COUNTRIES

By

TEE CHEE LIP

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

IMPACTS OF ECONOMIC FREEDOM AND LANGUAGE ON TECHNOLOGY TRANSFER IN DEVELOPING COUNTRIES

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TEE CHEE LIP

May 2016

Chairman :   Assoc. Prof. Wan Azman Saini Wan Ngah, PhD
Faculty   :   Economics and Management

This dissertation consists of three empirical exercises, all of which are assessments of issues related to the transfer of technology in developing countries.

The first objective of this dissertation is to examine the role of economic freedom in moderating research and development (R&D) spillovers from developed to developing countries. Two channels are analyzed, namely import and international student flows. The empirical results based on generalized method-of-moment system estimation using data from a panel of 75 developing countries show that spillover effects through import and international student flow are significant, but the latter channel appear to be more important in term of magnitude. This finding is consistent with view that technology diffusion via human capital mobility should not be underestimated. More importantly, the finding reveals that countries with higher level of economic freedom benefit more from R&D spillovers. This provides further support to the idea that successful knowledge acquisition requires that host countries have the ability to absorb and internalise new technology (i.e. absorptive capacity).

The second objective is to investigate the influence of technology transfer on innovation activity in developing countries. The Extreme-Bound-Analysis (EBA) approach is applied to data from 58 developing countries over the 1996 - 2011 period. The result reveals that human capital is a robust determinant of innovation activity. Meanwhile, the impact of foreign technology inflow is found to be different depending on the variables used in the analysis. Specifically, the results indicate that import of machinery and equipment affects domestic innovation activity positively but total import, import of manufactured goods, and FDI inflows appear to be fragile determinants of innovation activity in developing countries. Accordingly, the results suggest that import of machinery and equipment is expected promote productivity through its impact on domestic innovation activity.

Finally, the third objective is to evaluate whether proficiency in English language will enhance the spillover effects from foreign direct investment. This objective is motivated by previous studies which show that countries with mutual language enjoy lower trade cost and increased trade volume. Nevertheless, common native language between countries is not common and studies suggest that English language is widely used in international activity. In order to test this hypothesis, a threshold regression is employed using data from 61 developing countries over the 1976-2013 period. The findings reveal that host country with greater level of English proficiency benefit more from the foreign direct investment (FDI) inflows. Obviously, language plays an important role in the transfer of technology via FDI. This also suggests that the proficiency English language is an important part of the host country's absorptive capacity.

The overall findings indicate the significance of absorptive capacity in technology transfer (i.e. economic freedom and English language proficiency) as it could enhance the benefit gain by host country. Besides, technology transfer does not only benefit economic performance through enhance productivity among developing countries, but it also stimulate domestic innovation effort, which in turn contribute to growth in the long run.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KESAN KEBEBASAN EKONOMI AND BAHASA KE ATAS PEMINDAHAN TEKNOLOGI DI NEGARA SEDANG MEMBANGUN

Oleh

TEE CHEE LIP

May 2016

Pengerusi : **Prof. Madya Wan Azman Saini Wan Ngah, PhD**
Fakulti : **Ekonomi dan Pengurusan**

Disertasi ini mengandungi tiga objektif, di mana kesemuanya adalah penilaian empirikal isu yang berkaitan dengan pemindahan teknologi di negara sedang membangun.

Objektif pertama disertasi ini adalah untuk mengkaji pengaruh kebebasan ekonomi ke atas kesan limbahan aktiviti penyelidikan and pembangunan (R&D) daripada negara membangun ke negara sedang membangun. Dua saluran limbahan dikaji iaitu import and aliran pelajar antarabangsa.. Hasil empirikal yang berdasarkan kaedah pengangaran momen teritlak dalam bentuk sistem (*generalized method-of-moment system estimator*) yang menggunakan data 75 negara sedang membangun menunjukkan bahawa kedua-dua saluran iaitu import dan aliran pelajar antarabangsa adalah signifikan, namun saluran kedua adalah lebih penting dari segi saiz kesannya. Penemuan kajian ini adalah selari dengan pandangan yang menyatakan bahawa kepentingan mobiliti modal insan dalam penyebaran teknologi tidak patut dipandang rendah. Selain itu, hasil kajian ini juga mencadangkan bahawa negara yang mempunyai kebebasan ekonomi yang lebih tinggi akan mendapat manfaat yang lebih besar daripada limbahan kesan penyelidikan dan pembangunan. Ini menyokong pandangan bahawa pengambilalihan ilmu pengetahuan memerlukan keupayaan menyerap dan menggunapakai teknologi baru.

Objektif kedua ialah untuk menguji penentu aktiviti inovasi di negara sedang membangun. Kaedah "*Extreme-Bounds-Analysis*" (EBA) digunakan pada data 58 negara sedang membangun bagi tempoh 1996-2011. Hasil penyelidikan ini mendedahkan bahawa modal insan adalah penentu teguh aktiviti inovasi. Pada masa yang sama, kesan aliran masuk teknologi asing adalah berbeza bergantung pada pembolehubah yang digunakan. Hasil penyelidikan menunjukkan bahawa import jentera dan peralatan akan mempengaruhi aktiviti inovasi secara positif tetapi jumlah import, import barangan pembuatan, dan aliran masuk FDI merupakan penentu yang rapuh.

Akhirnya, objektif ketiga kertas kerja ini adalah untuk mengkaji bahawa adakah tahap penguasaan bahasa Inggeris akan meningkatkan perolehan manfaat dari pelaburan langsung asing. Objektif ini didorong oleh bukti empirical lepas

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yang mendedahkan bahawa negara yang mempunyai bahasa yang sama akan menikmati kos dagangan yang lebih rendah dan kuantiti dagangan yang lebih tinggi. Namun, penggunaan bahasa yang sama di antara negara adalah kurang dan bahasa Inggeris biasanya digunakan sabagai bahasa perantaraan kerana ia mempunyai kos yang lebih rendah berbanding dengan bahasa lain. Untuk menguji hipotesis ini, model "threshold" digunakan untuk 61 negara sedang membangun bagi tempoh 1976-2013. Keputusan menunjukkan bahawa negara dengan tahap penguasaan bahasa Inggeris yang lebih baik akan mendapat lebih banyak manfaat dari pelaburan langsung asing. Ia menunjukkan bahawa bahasa adalah penting dalam pemindahan teknologi di mana tahap penguasaan bahasa Inggeris adalah sebahagian daripada keupayaan penyerapan sebuah negara dalam pemindahan teknologi.

Hasil penyelidikan ini menunjukkan kepentingan keupayaan menyerap (iaitu kebebasan ekonomi dan penguasaan bahasa Inggeris) dalam pemindahan teknologi dimana negara akan mendapat lebih banyak manfaat dengan tahap keupayaan menyerap yang lebih tinggi. Selain itu, kertas kerja ini juga mendapati bahawa pemindahan teknologi bukan sahaja mendorong pertumbuhan ekonomi dengan mempengaruhi produktiviti, tetapi ia juga akan menrangsangkan aktiviti innovasi yang akhirkan menyumbang kepeda pertumbuhan ekonomi.

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I certify that a Thesis Examination Committee has met on 06 May 2016 to conduct the final examination of Tee Chee Lip on his thesis entitled "Impacts of Economic Freedom and Language on Technology Transfer in Developing Countries" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

Members of the Thesis Examination Committee were as follows:

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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Date:

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Declaration by graduate student

I hereby confirm that:
- this thesis is my original work;
- quotations, illustrations and citations have been duly referenced;
- this thesis has not been submitted previously or concurrently for any other degree at any other institutions;
- intellectual property from the thesis and copyright of thesis are fully-owned by Universiti Putra Malaysia, as according to the Universiti Putra Malaysia (Research) Rules 2012;
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Signature: _____ Date: _____

Name and Matric No.: Tee Chee Lip, GS29902

Declaration by Members of Supervisory Committee

This is to confirm that:
- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature: Name of Chairman of Supervisory Committee:	Associate Professor Dr. Wan Azman Saini Wan Ngah
Signature: Name of Member of Supervisory Committee:	Associate Professor Dr. Normaz Wana Ismail
Signature: Name of Member of Supervisory Committee:	Dr. Saifuzzaman Ibrahim

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LIST OF ABBREVIATIONS

EBA	Extreme Bound Analysis
FDI	Foreign Direct Investment
G7	Group of Seven
GERD	Gross Domestic Expenditure on Research and Development
GDP	Gross Domestic Product
GMM	Generalised Method of Moment
ITT	Information Technology and Telecommunication Equipment
MNC	Multinational Corporation
OECD	Organisation of Economic Co-Operation and Development
R&D	Research and Development
TFP	Total Factor Productivity
TOEFL	Test of English as a Foreign Language
UK	United Kingdom
UN Comtrade	United Nations Commodity Trade Statistics Database
UNCTADStat	United Nations Conference on Trade and Development Statistical Database
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States of America
WDI	World Development Indicators
WIPO	World Intellectual Property Organization

CHAPTER ONE

INTRODUCTION

1.1   Overview of the Study

Understanding why some countries grow faster than the others has become one of the important issues in economic analysis. Over the years, economists have tried to examine the causes of growth and inquired on the policies which are necessary in order to maintain and promote output growth and the literature on this subject (both theoretical and empirical) is filled with a lot of controversies. Nevertheless, recent studies unveil more than sixty different variables that contribute to our understanding of long-term growth performance (Durlauf *et al.*, 2005; Sala-i-Martin, 1997).

It has been widely recognized that factor accumulation alone cannot adequately explain differences in growth performance across countries. In recent literature, productivity differences appear to be one of the key explanations, and technology plays a key role in determining productivity (Easterly and Levine, 2001; Hall and Jones, 1999). The neoclassical model assumes that technological progress is exogenous and output growth is driven mainly by improvement in capital-labor ratio. However, recent endogenous growth models have provided novel ways of dealing with technological progress (Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992). This model incorporated a new concept of human capital, the skills and knowledge that make workers more productive. Moreover, the model views innovation efforts, such as investment in research and development (R&D) activity, as a major source of productivity growth that allows countries to sustain growth in the long run.

Although the new growth models have highlighted investment in R&D as a major source of productivity improvements, only a handful of rich countries are responsible for the most of the world's total R&D investment. As shown in figure 1.1, the main source of global R&D investment is the high income countries, where they contribute 72.6 percent and 69.3 percent of global R&D investment in 2011 and 2013, respectively. Furthermore, the Group of Seven (G7)[1] is responsible for most of the investment (see figure 1.2). Specifically, this group contributes approximately 53.9 percent and 51.9 percent of the world Gross Domestic Expenditure in Research and Development (GERD) in year 2011 and 2013, respectively.

This observation suggests that less developed countries that lags behind the technology frontier and hardly invests in R&D may increase their productivity by interacting with R&D leaders. This "international R&D spillovers" imply that host countries could benefit from R&D activity done by foreign countries. They could enhance their knowledge base and productivity directly via learning of new

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[1] The G7 group consists for seven leading OECD countries namely, Canada, France, Germany, Italy, Japan, United Kingdom and United States.

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technology or indirectly by examining the products developed by R&D leaders (Coe and Helpman, 1995). Some recent studies show that countries benefit significantly from international spillovers (Klenow and Rodriguez-Clare, 2005) and in fact the major source of productivity growth in many countries actually came from abroad (Keller, 2004). Technology is embodied in capital and intermediate goods and the direct import of these is one of the possible channels of transmission (Grossman and Helpman, 1991; Caselli and Wilson, 2004; Eaton and Kortum, 2001). The theory also emphasizes foreign direct investment (FDI) (Findlay, 1978; Wang and Blomstrom, 1992) as an important channel to gain access to technology available at the world frontier. Multinational corporates (MNCs) have been linked to superior technologies, patents, trade secrets, brand names, management techniques and marketing strategies (Dunning, 1993) and responsible for a substantial part of the global R&D and among the most advanced technology firms. They carry superior technology and arguably exist because of its proprietary firm-specific advantages (Eapen, 2012). One of the reasons why MNCs involve in FDI is that they want reduce production cost. One way to achieve this is by setting up a production line in the region with lower wage and material cost (Grossman and Helpman, 1991). Since knowledge cannot be completely internalized, it may thus spill over to local firms once MNCs have established local subsidiaries.
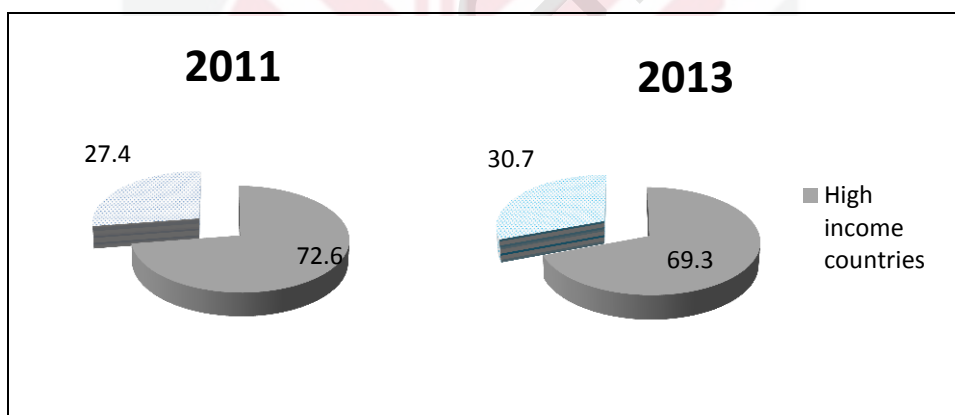
Figure 1.1: Share of Global Gross Domestic Expenditure on Research and Development for High Income Countries and Other Countries.
(Source: UNESCO Science Report 2015)

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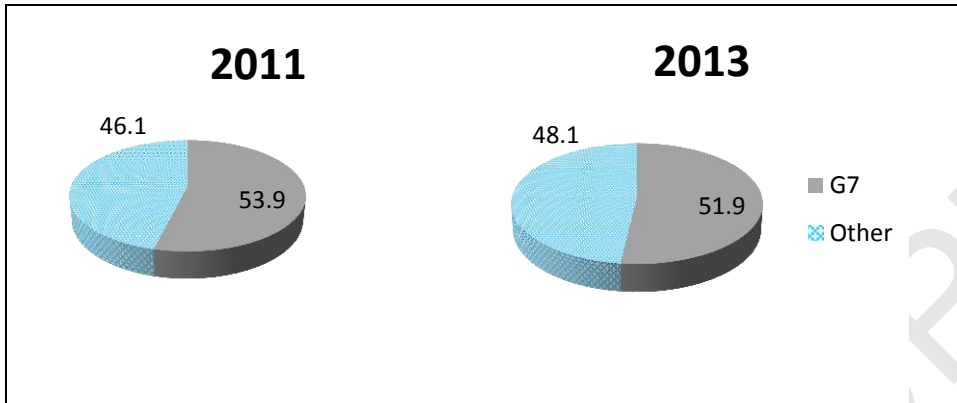
Figure 1.2: **Share of Gross Domestic Expenditure on Research and Development for the G7 and Other Countries.**
(Source: UNESCO Science Report 2015)

Given that MNCs have tremendous benefits to offer, many countries have lifted a lot of restrictions imposed on free flow of FDI. In many countries, FDI is viewed as one of the important ingredients for development strategy. FDI serves as an important channel for them to tap technology available at the world frontier. Therefore, policies are designed accordingly in order to attract FDI inflows. Table 1.1 shows a summary of the changes in national investment policies made by countries from 1991 to 2012. Generally, most countries continue to liberalize and promote foreign investment as a means to support economic growth and development. For instance, an average of 102 changes in FDI regulation was made during 1991 to 2012. Of these changes, 84% were made favorable to FDI. In addition, various incentives both tax incentives and subsidies are provided to MNCs.

Table 1.1: Changes in national investment policies, 1991 – 2012

Item	Annual Average					
	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011	2012
Number of countries that introduced changes	50	67	62	53	44	53
Number of regulatory changes	97	140	126	96	67	86
Liberalization/ promotion	95	130	108	71	52	61
Restriction/ regulation	2	10	14	24	15	20
Neutral/ indeterminate	0	0	4	1	0	5

Sources: UNCTAD (2005, 2013)

The table also reveals that although the economic condition is surrounded by slow growth, turmoil in financial markets and higher uncertainty during the past few years, investment policy measures undertaken by many countries generally continue to be favorable to foreign investors. For instance, a total of 53 countries adopted 86 policy measures affecting FDI in 2012. Of these changes, 61 were related to investment liberalization, promotion and facilitation, while only 20 restrictive policies were implemented. Similar patterns can be observed for other periods which suggest that countries are eager to attract more FDI.

As a result of a policy changes that encourages more investment by MNCs, FDI inflows into both developed and developing countries have shown an increasing trends over the past few decades (see figure 1.3). The increasing trend of FDI inflow is especially obvious in developing countries. FDI flows into developing countries and transition countries have increased from around 3.8 billion dollar in 1970 to around 690 billion dollar in 2010. For the first time in history, FDI inflow to developing and transition countries accounted for more than half of the global FDI inflow in 2010. Over the periods, the average growth of global FDI is 13% per year with the highest growth rate of 55% was recorded in 1999. In fact, the performance of FDI is much better than the performance of the world's output growth which recorded only 2.67% per year (UNCTAD, 2013).

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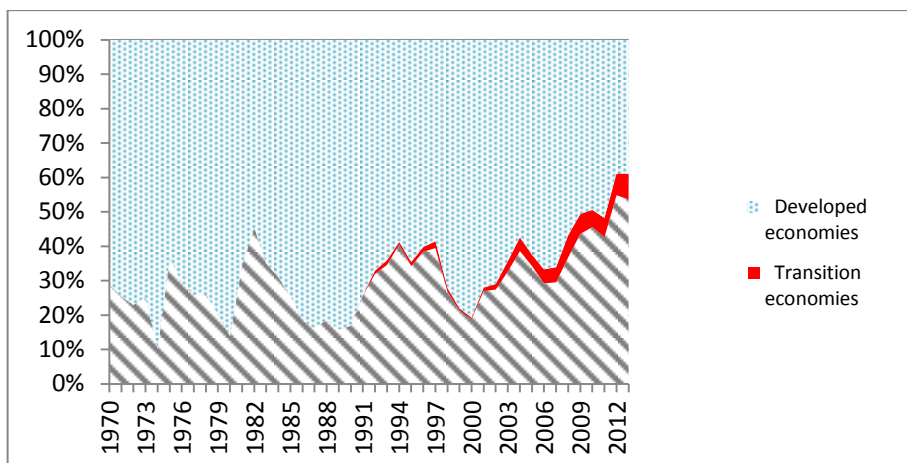
Figure 1.3: Foreign Direct Investment Inflow Ratio in Developed, Developing and Transition Countries

(Source: United Nations Conference on Trade and Development Statistical Database)

Apart from FDI, international student flows may also help in international technology spillovers (Park, 2004). This idea is based on the argument that advance technology embodies not only in physical capital and intermediate goods, but also in human capital. Therefore improvement in the quality of human capital may have important implications on the productivity of local economy. Since human capital is embodied in people and contains knowledge about new technologies and materials, production methods, or organizational structures, it is natural to expect that the mobility of people across borders will help diffuse knowledge among countries. With the existence of student flows from developing countries to developed countries, foreign students who acquire R&D-induced technological knowledge through education and post-schooling work experience in the country they study may be able to contribute to productivity improvement of their home country upon returning or maintaining close and frequent contact with people back home.

In addition, returnees are expected to bring back new technology, patent, and network that will contribute to spillovers when they set up venture in their home countries and when other domestic firms learn from returnees. At the same time, social capital along with returnee contains relational and structural resource allows access to information and resources that are restricted to others, and therefore facilitate spillovers. Despite returnees leaving the foreign countries they studied or worked, they act as abridge for the latest technology diffusion from the foreign countries where they usually maintain connection with. Returnees also believed to have a greater vision, experience, and ideas other than technological advantages (Filatotchev *et al.*, 2011).

Figure 1.4 illustrates the flow of international students to G7 and other OECD countries.[2] Interestingly, the figure shows that the G7 country appears to be the most popular destinations for students from developing countries to pursue

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[2]This excludes Chile, Estonia, Israel and Slovenia due to data availability.

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their studies. This reinforces the argument that this group is a major player in the generation of new knowledge. Specifically, the figure shows that approximately 70 percent of international students undertake their studies in the G7 country. This indicates the superiority of the G7 countries in R&D activity and knowledge stock.
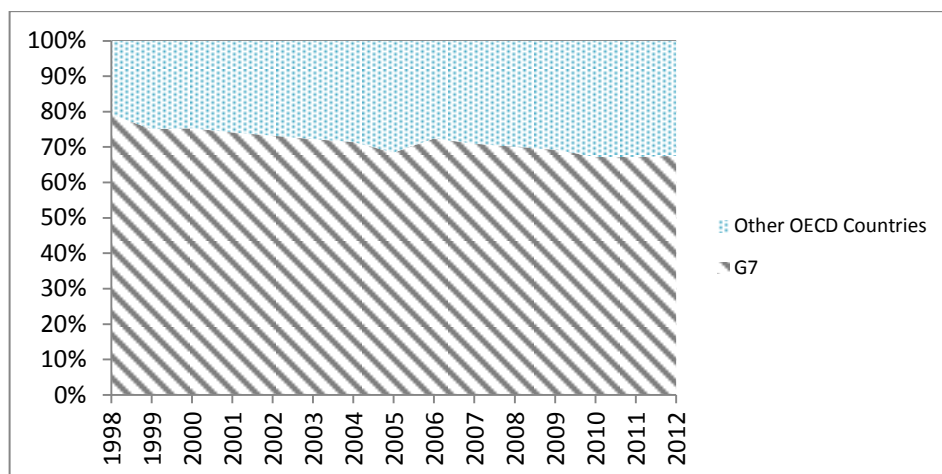
Figure 1.4: Share of International Students Enrolled in OECD Countries
(Source: OECD Education and Training Database)

Recently, many studies have reported that the technology transfers are a complex process and not automatic but contingent on other factors which are widely known as absorptive capacity[3]. This argument is based on the idea that host countries need certain quality to absorb and internalize knowledge generated by others. For instance, Borenstein *et al.* (1998) shows that knowledge spillovers via FDI require the availability of labor that is able to understand and work with the new technology. Meanwhile, Hermes and Lensink (2003), Alfaro et al. (2004, 2010), and Azman-Saini (2010b), find that technology diffusion require well-functioning financial institutions.

1.1.1 The role of Economic Freedom in Economic Development

The importance of economic freedom (i.e. market-based institutions) in economic development has been widely recognized and extensively discussed in the literature. According to the Heritage Foundation (2004), economic freedom can be defined as "the absence of government coercion or constraint on the production, distribution, or consumption of goods and services beyond the extent necessary for citizens to protect and maintain liberty itself". Several studies have shown that this type of institutional setting by transmitting information efficiently, enforcing property rights and contracts and securing

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[3]Cohen and Levinthal (1990) define absorptive capacity as a firm's "ability to recognize the value of new information, assimilate it, and apply it to commercial ends." This concept differs from learning-by-doing, which is the automatic process by which firms become more experienced, and hence, more efficient at current practices. In contrast, absorptive capacity firms may acquire new knowledge developed by others that will enable them to do something in different ways.

competition, will affect the incentives to participate in a market and ensure capital is allocated to the project that yield the highest return and therefore enhance output growth (see for example Justesen, 2008; Sturm and De Haan, 2005; Dawson, 2003; Leertouwer, *et al.*, 2002; Sturm and De Haan, 2001; De Haan and Strum, 2000; De Haan and Siermann, 1998; and Ayal and Karas, 1998, among many others).[4]

Several recent studies reveal a robust positive relationship between economic freedom and economic performance. Figures 1.5 and 1.6 show the correlation between economic freedom with GDP per capita and economic growth, respectively. Countries are group into four quartiles and they are ranked from "least free" to "most free". Both figures 1.5 and 1.6 show that economies with higher ranking in term of economic freedom perform better than those with lower level of freedom ranking. Specifically, countries that promote economic freedom of economic activities tend to have substantially higher per-capita incomes and grow more rapidly. This observation provides some insights about the nature and characteristics of market-oriented economies and those dominated by government regulation and planning.
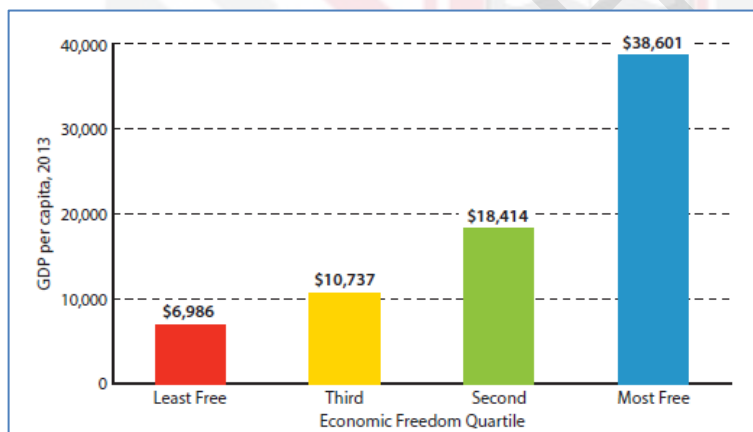
Figure 1.5: Economic Freedom and Income per Capita
(Source: Fraser Institute Annual Report)

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[4] De Haan *et al.* (2006) and Doucouliagos and Ulubasoglu (2006) provide excellent surveys on the evolution of the literature.
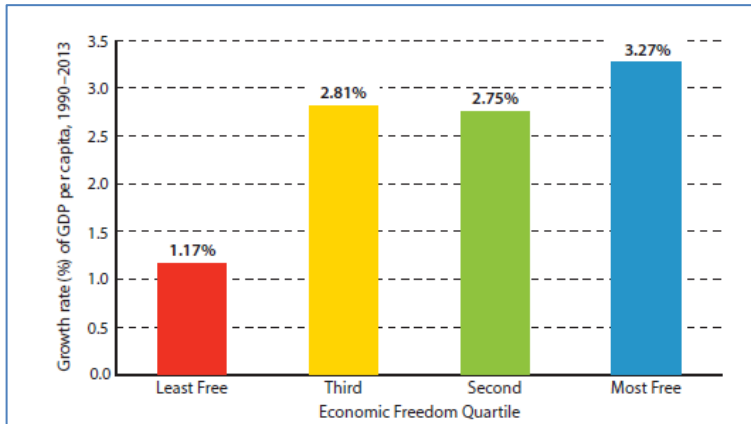
Figure 1.6: Economic Freedom and Economic Growth
(Source: Fraser Institute Annual Report)

Economic freedom should be distinguished from political and civil freedom (Haan and Sturm, 2000). Economic freedom measures the extent of properties protection and the freedom to engage in voluntary transactions while political and civil freedom refer to citizens' freedom to participate in political processes and individual rights to assemble, adopt a religion and to express their views. Thus, economic freedom is different from political and civil freedom where a country with high freedom on the latter does not necessarily adopt a high economic freedom policy. However, the data show that countries that promote economic freedom are associated with high score for political and civil liberty (see Figure 1.7).
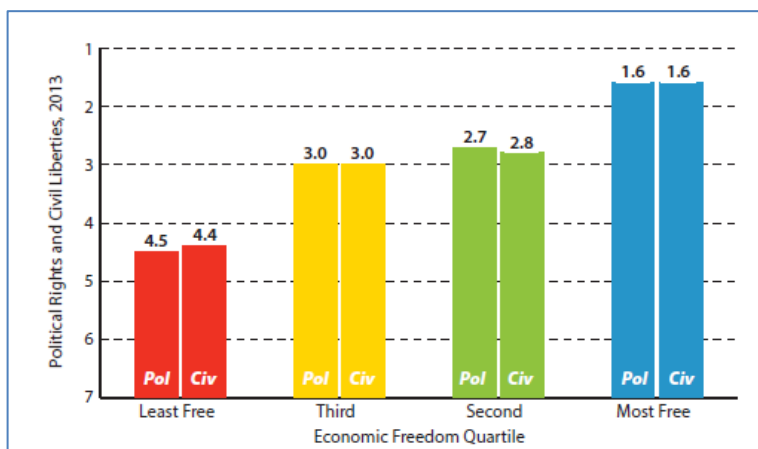
Figure 1.7: Economic Freedom and Political Rights and Civil Liberties
Note: Political rights and civil liberties are measured on a scale from 1 to 7: 1 is highest degree of political rights and civil liberties; 7 = the lowest.

(Source: Fraser Institute Annual Report)

Moreover, economic freedom may also affect the economic performance via its impact on promotion of entrepreneurial system within an economy. As shown in the report of 2016 Index of Economic Freedom (Heritage Foundation, 2016), countries with higher score in economic freedom experience greater entrepreneurship and opportunity (see Figure 1.8). It is suggested that economically freer economy would promote entrepreneurship as people tend to engage in entrepreneurial activity when they have more choices. This in turn would create jobs, investment opportunities, and innovation activities that led to new products and services, leading to better economic performance.

Figure 1.8: Economic Freedom and Entrepreneurial
(Source: 2016 Index of Economic Freedom)

Economic freedom is expected to play important role in technology transfer for several reasons. Rosenberg (1992) has suggested that innovation activities are facing uncertainties, neither the outcome nor the process to achieve goal are predictable. It is therefore cannot be planned in detail and even a failed experiment could be generating valuable information for the future. Thus, any intervention from external force like government on conducting experiments creates constraints for individuals or institutions in involving in innovation activities. Moreover, a free market will encourage innovation as it promises greater return, better quality products and a more efficient production process. When market is extensively regulated or corruption is rampant, it harms the innovation effort. For example, when a new technology is introduced that threatens the incumbent, they will exercise their power (either politically or financially) to restrict the introduction of new technology. Besides, government intervention may improve innovation activity by providing the necessary incentives (such as tax cut) which encourage firms to adopt costly and risky new technology. However, taxation and subsidies policies may also lead to inefficient resource distribution which could lead to disappointment among innovators when they cannot keep what they have earned. Meanwhile, government enterprises usually rely less on consumers for revenue and decision making and therefore they are less dependent on the market's condition. A large share of government enterprises in the market will then lead to imperfect competition and discourage for innovation activity.

Other aspects of economic freedom such as good intellectual property protection may also encourage the adoption of new technology as it promise greater return when utilization of new technology is successful. At the same time, good protection will reduce the problem of free riders, since other companies cannot imitate the new technique used without any pay after the technique is proven to be more efficient. Regulation affecting access to credit is also crucial for innovation activity. Difficulties in getting financial support due to barriers could restrict the innovation activity since many firms will face need external financing in adopting new technology. Besides, economic freedom also enhances the ability to searching for appropriate technology which is important in absorbing knowledge externalities (Eapen, 2012). Bjornskov and Foss (2012) suggest that well-functioning legal and property right system will lead to relatively low contracting costs, and it benefits the process of searching, negotiating, and bargaining with the input owner. It is due to the risk of having uncertain profit is lower in a market with well-defined legal system.

Recently, Azman-Saini *et al.* (2010a) find that countries which actively promote freedom of economic activity are more able to absorb and adopt new technologies as well as other benefits associated with FDI inflows. In an economically freer environment, firms are more willing to engage in risky activity such as trying out new ideas and adopting new technologies because many obstacles that limit the efficient diffusion of knowledge have been abolished. It has been widely recognized that this type of institutional setting, by transmitting information efficiently, enforcing property rights and contracts and securing competition, will affect the incentives to participate in a market and ensure that capital is allocated to the project that yield the highest return.

The importance of economic freedom for innovative activity can be illustrated in Figure 1.9. The figure shows a scatter plot between economic freedom index from Fraser Institute and technology transfer (constructed based on suggestion in Coe and Helpman, 1995) among developing countries. Clearly, there is a positive relationship which suggests that R&D spillovers are likely to occur in countries that promote economic freedom. This suggests that it is important to understand the role of economic freedom plays in the process of R&D spillovers.
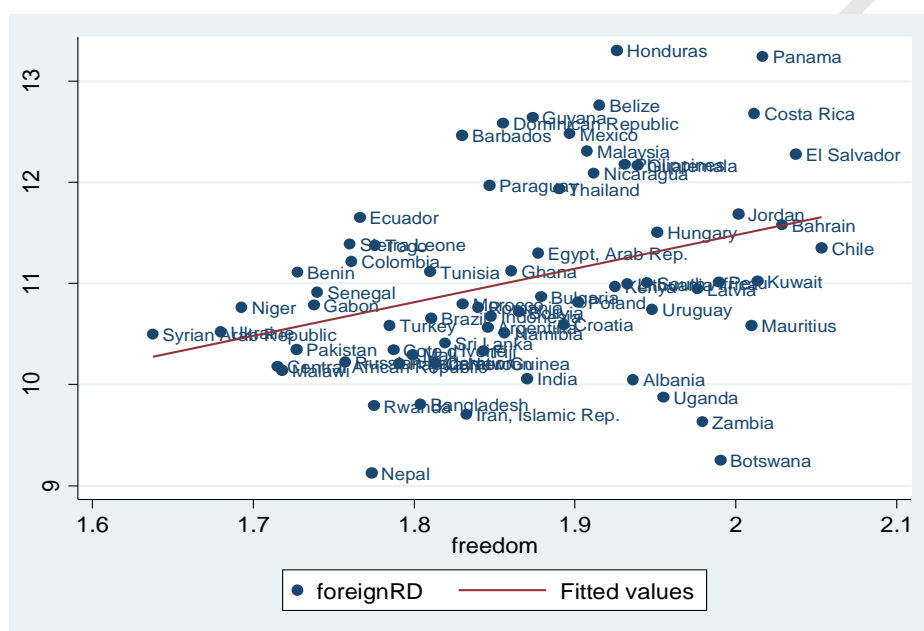
Figure 1.9: Scatter plot between economic freedom and import weighted foreign R&D stocks

1.1.2 Language Proficiency and Economic Activity

Arguably, proficiency in certain language also plays a crucial role in knowledge acquisitions. Several studies suggest that countries that share common native language are able to reduce trade cost. This suggests that countries with common native languages are expected to benefit more from technology transfer as the transaction with the existence of a common native language will be easier when they share a common culture root, literature lore and code of law. Misunderstandings can be avoided and this is expected to enhance the efficiency of communication (Helliwell, 1997). Nevertheless, not every country uses a language which is similar to the one used in technology source country[5]. In such case, the use of *lingua franca*[6] is expected to boost up communication

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[5] There is 7,102 living languages exist among 235 countries in the world (Lewis, Gary, and Charles, 2016).
[6] *Lingua franca* refers to any language used as a medium communication when common native language is absent (Selmier II and Oh, 2012a).

among countries. Among several major languages[7] in the world, English is found to be the main language used in many activities as it possesses lower communication and transaction costs than the alternatives. The language has been commonly practiced as a *lingua franca* by many countries for newspaper publishing, book publishing, international telecommunications, scientific publishing, international trade, mass entertainment, and diplomacy (Northrup, 2013).

This implies that when a common native language between source and host countries is absent, host country would still be able to benefit from foreign technology inflows through mastery of major language that is widely used globally such as English language. This is in line with the current trend where English language is widely used globally in recent decades. For example, English language is used as a main communication language in many regional and international organizations like the Association of Southeast Asian Nations (ASEAN) although English is not native language for most of the member countries. It is also the most widely taught foreign language worldwide although it is not the official language in many countries (Crystal, 2003). According to Lewis, Gary, and Charles (2016), English language is now practiced in more than 110 countries with more than 940 million users worldwide.

Table 1.2 shows countries with highest and lowest English Proficiency Index out of 70 countries included in the report published by the EF Education First. On average, developing countries have a lower score in the index, as shown in Table 1.2 where countries with lowest index are developing countries.

Table 1.2: Ten countries with highest English Proficiency Index and ten countries with lowest English Proficiency Index

Highest Proficiency Index		Lowest Proficiency Index	
1 Sweden	6 Slovenia	61 El Salvador	66 Iraq
2 Netherlands	7 Estonia	62 Thailand	67 Algeria
3 Denmark	8 Luxembourg	63 Qatar	68 Saudi Arabia
4 Norway	9 Poland	64 Mongolia	69 Cambodia
5 Finland	10 Austria	65 Kuwait	70 Libya

Source: EF English Proficiency Index

Figure 1.10 provides some supports to the idea that English proficiency may play similar role as common language when the latter is absent. For instance, Oh *et al.* (2011) suggest that a common native language would enhance FDI inflows and although common native language is absent, it seems that recipient countries could still gain from this relationship supported by a positive relationship between English proficiency (proxy by score from Test of English as a Foreign Language) and FDI inflows for those non-native speaker countries. Hence, it is possible that countries which communicate through *lingua franca* gain similar benefit as those who share a common native language.

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[7] Major trade languages refer to English, French, Spanish and Arabic (Selmier II and Oh, 2012a).
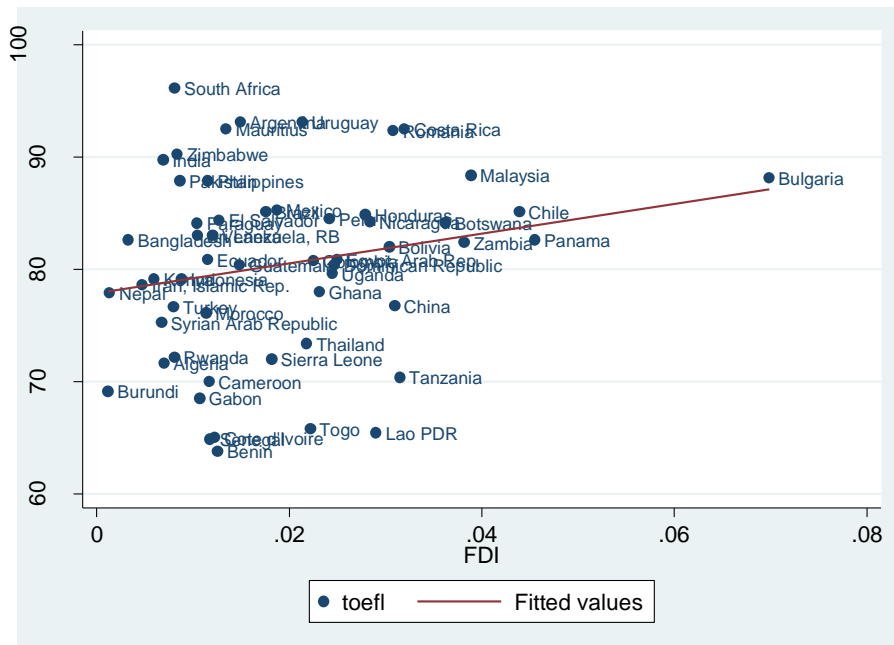
Figure 1.10: Scatter plot for FDI and Economics Growth

This issue is critically important as absorptive capacity of the host countries was found to be important intervening factor in FDI spillovers. For instance, recent literature suggests that the spillovers is non-existence when the host countries do not achieve certain level of quality which is required for the effective transmission of knowledge (e.g. Durham, 2004; Alfaro *et al.*, 2010; Azman-Saini *et al.*, 2010a, 2010b). Thus, it is possible that FDI spillovers will be limited in host countries which do not achieve certain level of English proficiency, as the mastery of this language could substitute the role of common language.

1.1.3 Technology Transfer and Domestic Innovation

Most of the studies on technology inflow have mainly focused on its impact on output growth. However, technology inflow also affects innovation activities in the host countries and it brings two impacts: competition effect and spillovers effect. Firstly, import and existence of MNCs lead to increased competition and domestic firm must choose either to invest more in R&D activity in order to compete (Wang, 2010) or to reduce R&D investment since product differentiation from import and MNCs decreases the product lengths of run (Veugelers and Houte, 1990; Funk, 2003). Secondly, technology inflow contributes to R&D capital stock and encourages domestic R&D investment when foreign technology act as a complement for domestic R&D, but substitution effect is also possible if the adoption of foreign technology is more effective than investing in R&D locally (Veugelers and Houte, 1990; Wang, 2010).

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Furthermore, the influence of technology inflow on domestic firm's production cost may affect local firms' decision on whether to undertake R&D activity. Domestic firm's production cost is reduced when spillovers lead to productivity improvement. However, MNCs presence may exert negative impact as it creates wage spillovers. MNCs are widely known for their generous remuneration and this may force local firm to increase wages in order to stay competitive (Gorg and Strobl, 2003). Since profitability is one of the determinants for firm's R&D investment decision (Un and Cuervi-Cazurra, 2008), domestic R&D will increase in the former case but decrease in the latter case. Another possible effect from MNCs is that they may demand the government to improve the quality of human capital (Qu, Huang, Zhang and Zhao, 2007), which is also one of the major determinant of R&D (Wang, 2010).

1.2   Problem Statement

Ever since Adam Smith published his masterpiece: *An Inquiry into the Nature and Causes of the Wealth of Nations*, understanding economic growth has been one of the important national agenda. Although not everyone agrees with his ideas, the book is arguably the most important book on the subject ever published. Over the years**,** economists have attempted to unveil the causes of growth and inquired on the right policies that countries can implement in order to maintain and promote it. However, explaining why some countries can grow faster than the others is not an easy task, and the literature on this subject is filled with a lot of controversies. Nevertheless several recent studies identify more than sixty different variables that contribute to our understanding of long-term growth performance (Durlauf *et al.*, 2005; Sala-i-Martin, 1997).

Innovation effort such as investment in R&D is highlighted as a major source of productivity improvement. However, only a few countries engage actively in R&D activities and they are responsible for the most of the world's investment in R&D. The variations in R&D investment across countries explain a large part of cross-country differences in productivity, and countries are found to benefit enormously from international spillovers (Klenow and Rodriguez-Clare, 2005). In fact, the major source of productivity growth for many countries are came from abroad (Keller, 2004). This suggests that a less developed country that lags behind the technology frontier and hardly invests in R&D can boost its productivity by interacting with R&D leaders. The theory suggests that new knowledge cannot be completely internalized and may spill over to other countries via several channels. Moreover, globalization in recent decades has enhanced the interaction between countries and indicates the greater opportunity of knowledge transfer activity.

Several studies have examined international spillovers and they mainly focused on two channels: trade (i.e. import) and FDI. It is also known that not all knowledge is embodied in products and spillovers of this type of knowledge require direct contact and communication with the R&D leaders. This suggests that countries which encourage their citizens to acquire knowledge from countries that have accumulated substantial scientific and technological capabilities may grow faster than the others because they have better access to technology available at the world's frontier. Moreover, several studies

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suggest that globalization and the advancement of technology have led to lower transportation and communication costs and this has promoted greater international interaction through disembodied channel. Therefore, the disembodied channel could become at least as important as embodied channel (such as import) (Filatotchev *et al.*, 2011). However, evidence on the role played by disembodied channel in R&D spillovers is extremely limited.

Arguably, the transfer of technology may not be realized if domestic firms are not able to absorb and internalize new knowledge. Several studies suggest that only countries with better institutional quality (i.e. higher level of economic freedom) are able to benefit from international knowledge spillovers because in such an environment firms are more willing to engage in risky activities like the adoption of new technology. Although the important of absorptive capacity in technology transfer (such as FDI spillovers) has been widely tested in recent literature, there is however lack of evidence in the context of R&D spillovers.

Apart from its impact on output growth via transfer of new technology to local firms, technology inflow may also have important implication on domestic R&D. Inflow of foreign technology is expected to force domestic firms to improve quality, to reduce management inefficiencies, and most importantly, to increase the possibilities of technological progress as well as the rate of R&D investment. At the same time, existence of foreign technology is possible to discourage innovative activities of domestic firms since they could simply adopt foreign technology rather than developed it by themselves. However, little is known about the nature of relationship between technology inflow and domestic R&D activities, especially for developing countries. This information is critically important for policy makers to ensure the right policies are implemented so that host countries can reap the maximum benefit from technology inflow.

FDI has also been pointed out as an important channel for international knowledge spillovers. It is highly regarded as an important source of growth and therefore become a central element of development strategy for many countries (i.e. especially the developing ones). FDI is growth-enhancing because of its positive externalities such as transfer of new technology, the introduction of new processes, management techniques, and technical know-how in the local market, employee training, and international production networks. These expectations have led many countries to provide various incentives (both fiscal and financial) to MNCs and remove policies that restrict free flows of foreign capital. However, the experience of host countries suggests that not all FDI recipients benefit from MNCs' presence.

One possible reason for the failure of host countries to benefit from FDI-generated externalities is because they do not have sufficient absorptive capacity. Previous studies suggested several factors that could strengthen FDI spillovers, including the presence of a common native language. It is suggested that the possession of similar language with the source country will led to lower transaction cost and this is expected to boost FDI inflows. Nevertheless, Lewis, Gary, and Charles, 2016 highlighted a common native language between source and host country is uncommon and communication using *lingua franca* is more likely to occur in the international transactions. Among all, English language is suggested to have a superior ability in fitting this role because it is

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widely used and possess lowest communication and transaction costs than the other languages.

Therefore, it is common for the recipient and source countries communicate using English language when the common native language is absent. In such scenario, English language is expected to play a key role and countries with high level of English language proficiency are expected to gain more. Besides, English language is viewed as an important tool in technology transfer because it is the officially recognized *lingua franca* of international science and technology and it is widely used for scientific communication (i.e. publication of scientific papers). Moreover, many of the world's most powerful MNCs are based in the United States and Great Britain and English language is accepted as international language in business by most countries. With this backdrop, it is natural to expect that the level English language proficiency can make a difference in the way FDI affect output growth.

Nevertheless, the literature on the role of language in knowledge spillovers is limited. One possible reason is the unavailability of the indicator for language proficiency. Without reliable indicator for language proficiency, researchers are not able to examine the impact of English proficiency in economic performance. A recent study by Ku and Zussman (2010) has proposed a solution by utilizing the score from Test of English as a Foreign Language (TOEFL) as this indicator designed to measure the English proficiency of examinees whose native language is not English. Meanwhile, the indicator is well accepted by academic institutions, government agencies as well as sponsors from all around the world. Moreover, its standardization allows the comparison of English proficiency across countries.

1.3   Objectives of the Study

The general objective of this study is to investigate several issues related to transfer of technology which are critical for long term growth performance. Specifically, this study intends to:
1.   Examine the role of economic freedom in moderating R&D spillovers.
2.   Assess the impact of technology inflows on the host country's innovation activity.
3.   Evaluate the role of English language proficiency in moderating the growth-effect of FDI.

1.4   Significance of the Study

The endogenous growth model view technological progress as a major engine for economic growth and investment in R&D appear to be one of the important activities. Since domestic R&D investment may be insufficient to drive technological progress, technology transfer from foreign economy is equally important for the progress of domestic economy. Spillovers through embodied channel may not fully reflect the extent of technology transfer due to legal and economic environment (Filatotchev *et al*., 2011). Therefore, globalization that lead to the abolition trade and financial flow barriers and mobility of human

capital across border has made disembodied channel like international student flow to be important in enhancing knowledge spillovers especially in recent decade. This paper aims to contribute to the literature by analyzing the importance of disembodied channel (i.e. international student flow) which has been ignored in the past.

Meanwhile, although many countries have realized the important of disembodied channel and actively encourage their citizen to study abroad[8], they are less sure about whether domestic country has the ability to absorb and adopt new technology brought by students when they return home. Many studies have highlighted that economic freedom is a crucial element of a nation's absorptive capacity which could make a difference to the way knowledge is transmitted across borders. However, studies on the role of economic freedom in mediating R&D spillovers limited. The paper is expected to provide better insights for policy makers on the role played by economic freedom in mediating knowledge transfer across borders.

The impacts of technology inflows (via import and FDI) on economic growth and productivity have been examined extensively in the literature. However, the impact on other activities such as innovation activity is largely ignored. One important exception is a study by Wang (2010) who examine various determinants of R&D activities for developed countries. Theoretically, technology inflows may exert both positive and negative impacts on domestic R&D investment. This paper examines the impacts of technology inflows (both import and FDI) on domestic innovation activities in developing countries and therefore is able to provide relevant information for policy makers. Thus, the information provided in this study is critically important as it may give a clearer picture on the full impacts of technology inflows on host country.

The impact of FDI flows on economic growth has been widely examined but the finding reveal that the impact is ambiguous. Several recent studies find that the influence from FDI "kick in" only after host country has achieved certain level of absorptive capacity (Durham, 2004; Azman Saini *et al.*, 2010a, 2010b). Although several factors have been highlighted to be important in the growth-effect of FDI, the role of language proficiency is largely neglected in the literature. Due to the unavailability of a common native language for many countries, it is important to know if the *lingua franca* is able to plays similar role to common native language. This paper focuses on testing the role of English language proficiency as a pre-condition for successful spillovers from FDI as it is the most widely use international language. Therefore, this study is expected to highlight a new dimension on the intricate link between FDI and output growth. The findings are expected to provide important input for policymaker in devising not only FDI policies but also education policies related to proficiency in English language.

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[8] Based on OECD Education and Training Database, international student flow into 30 OECD countries rise from 1.3 million in 1998 to 2.5 million in 2010.

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