SPATIAL DISTRIBUTION OF HIGHLY SKILLED DIASPORA OF ASEAN-5: DETERMINANTS AND ENGAGEMENT STRATEGIES

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SPATIAL DISTRIBUTION OF HIGHLY SKILLED DIASPORA OF ASEAN-5: DETERMINANTS AND ENGAGEMENT STRATEGIES

By

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ABSTRACT

Spatial distribution of highly skilled diaspora of ASEAN-5: Determinants and engagement strategies

Fok Kuk Fai

The study aims to examine the spatial distribution and diaspora networks of highly skilled diasporas (HSDs), and the capabilities of ASEAN-5 (Indonesia, Malaysia, the Philippines, Singapore and Thailand) to engage their HSDs for the economic development of home countries. The originality of this study is to develop an analytical framework which assesses quantitatively the two important aspects of the diaspora engagement efforts, namely the potential diaspora resources of HSDs, and the access to such resources through diaspora networks. The analytical framework integrates two parts of analysis, PART I and PART II. PART I employs an augmented gravity model to empirically study the macro-determinants for the spatial distribution of the HSDs from ASEAN-5, with the purpose of identifying the potential diaspora resources. PART II extends the empirical results from PART I, employing social network analysis (SNA) to investigate how ASEAN-5 could leverage on their positions and connectivity in the global diaspora network to harness the diaspora resources. The study discovered the heterogeneity in the migratory motives and diaspora resources of the HSDs from ASEAN-5. Thailand and the Philippines possess the strongest positions and connectivity in the global diaspora network relative to other ASEAN-5 countries. The HSDs from

Thailand, the Philippines and Malaysia are able to play relatively active roles of transnational entrepreneurs and builders of diaspora knowledge networks (DKNs) for their home countries. This study advocated that ASEAN-5 should establish a collaborative platform to pool together the expertise, knowledge and networks of their HSDs. The limitation of the study is that it focuses mainly on the macro-level analysis due to the unavailability of micro-level data to investigate the potential contributions of the HSDs according to their expertise, industries and business units. It is recommended for ASEAN-5 to collect and compile micro-level data in this aspect for future study.

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In the past two decades, my working experience ranges from being a project feasibility analyst and contract administrator of a housing developer, the general manager and chief editor of a business magazine, the executive secretary of an economic think tank, and then the executive secretary of an engineering and technology think tank. Although I have not served in academia, I am always passionate about upgrading and renewing the knowledge of my specialisation, i.e. economics and econometrics. It is not really that a postgraduate degree can enhance my job capability and employability, but rather because of my aspiration to utilise knowledge to contribute to society and economic research.

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This is the starting point from which I have been led to the completion of this PhD thesis.

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APPROVAL SHEET

This thesis entitled "**SPATIAL DISTRIBUTION OF HIGHLY SKILLED DIASPORA OF ASEAN-5: DETERMINANTS AND ENGAGEMENT STRATEGIES**" was prepared by FOK KUK FAI and submitted as partial fulfillment of the requirements for the Doctor of Philosophy at Universiti Tunku Abdul Rahman.

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SUBMISSION OF FINAL YEAR THESIS

It is hereby certified that ***Fok Kuk Fai*** (ID No: ***11UKD04560***) has completed this final year thesis entitled "*SPATIAL DISTRIBUTION OF HIGHLY SKILLED DIASPORA OF ASEAN-5: MACRO-DETERMINANTS AND ENGAGEMENT STRATEGIES*" under the supervision of Prof. Dr. Cheng Ming Yu (Supervisor) from the Department of Economics, Faculty of Accountancy and Management, and Assoc. Prof. Dr Tan Hoi Piew (Co-Supervisor) from the Department of International Business, Faculty of Accountancy and Management.

I understand that University will upload softcopy of my final year thesis in pdf format into UTAR Institutional Repository, which may be made accessible to UTAR community and public.

Yours truly,

(Fok Kuk Fai)

*Delete whichever not applicable

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

Name ____________________________

Date 8 April 2020

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LIST OF ABBREVIATIONS/NOTATION/GLOSSARY OF TERMS

ADBI	Asian Development Bank Institute
AEC	ASEAN Economic Community
AFTA	ASEAN Free Trade Area
ASEAN	Association of Southeast Asian Nations
ASEAN-5	Indonesia, Malaysia, the Philippines, Singapore and Thailand
BGN	Brain Gain Network
C_D	Degree centrality
C'_D	Normalised degree centrality
C'_C	Normalised closeness centrality
C'_E	Normalised eigenvector centrality
C'_B	Normalised betweenness centrality
DKN	Diaspora knowledge network
DKNs	Diaspora knowledge networks
EU	European Union
FDI	Foreign direct investment
FTAs	Free trade agreements
HSDs	Highly skilled diasporas
IDN	Indonesia
INSEAD	Institut Européen d'Administration des Affaires (European Institute of Business Administration)
ISCED	International Standard Classification of Education
IOM	International Organisation for Migration
ILO	International Labour Organisation
ℓ	Geodesic distance or shortest path between nodes
MP3EI	Master Plan for Acceleration of Indonesia Economic Development
MPI	Migration Policy Institute
MYS	Malaysia
OECD	Organisation for Economic Co-operation and Development
OFWs	Overseas Filipino Workers
OLS	Ordinary lease square

PCTC	Philippines-Canada Trade Council
PHL	Philippines
PPML	Poisson *pseudo* maximum likelihood
RTA	Regional trade agreement
SGP	Singapore
SNA	Social network analysis
S&T	Science and Technology
THA	Thailand
UN	United Nations
UNESCO	The United Nations Educational, Scientific and Cultural Organisation
VIF	Variance inflation factor
WIPO	World Intellectual Property Organisation
4IR	Fourth Industrial Revolution

CHAPTER ONE

INTRODUCTION

1.1 Background: From Brain Drain to Diaspora Engagement

In 1963, the British Royal Society used the term ‘brain drain’ to describe the emigration of scientists and technologists from United Kingdom to the United States and Canada (Dainton et al., 1963; Fan and Li, 2018). They attributed the talent exodus to better career opportunities abroad. The Royal Society warned that the procrastination of government action in overcoming the issue would adversely affect the national productivity and economic growth (Oldfield et al., 1963; Balmer, Godwin & Gregory, 2009; Tyson 2011).

The term ‘brain drain’ was eminent in the 1970s-80s to refer to the permanent or long term emigration of highly skilled labours or talent from home countries (Chaichian, 2011; Organisation for Economic Cooperation and Development [OECD], 2016, p. 28). The brain drain notion suggested that the emigration of skilled workers, particularly from the developing countries, resulted in the depletion of human capital and other negative externalities, such as growth retardation, sluggish technological development and declining national competitiveness (Bhagwati and Hamada, 1974; Docquier, Lohest & Marfouk, 2007; Susantono, 2015). The persistent talent outflows also contributed to the widening technological and income gaps between developing and developed countries (King, 2012).

Many countries have responded to the brain drain problem with policies of attracting their overseas talents to go home. The examples for such return option include the *huiguo fuwu* programme (return and serve the motherland) of China in the early 1990s (Faist, 2008; Cheng, 2016; Xiang, 2005, 2016), the Brain Gain Programme launched by the Malaysian government in 2006 (Economic Planning Unit, 2006, p. 32; World Bank, 2011, p. 115; Hoo, Zainal and Chai, 2014), as well as the efforts of Taiwan and South Korea in returning talents in information and communication technology (ICT) from Silicon Valley in the 1970s and 1980s (Saxenian, 2002; OECD, 2008b, p. 44; Hugo, 2010; Hoo, Zainal and Chai, 2014).

However, a paradigm shift has taken place since the 1990s. The focus has shifted from brain drain to the positive externalities or developmental contribution of highly skilled diasporas (HSDs) to their home countries (Gamlen, 2005, 2014; Sinatti and Horst, 2015). The diasporas are defined as people who live outside their countries of origin or home countries (World Bank, 2015, p. 12), while the highly skilled diasporas (HSDs) are defined as emigrants or diasporas aged 25 and above (+25) with tertiary education or equivalent professional qualification (Docquier and Rapoport, 2009; Beine, Docquier and Ozden, 2011a; World Bank, 2011, p. 85; Ataselim, 2014; Artuc, Docquier, Ozden and Parsons, 2015; Fok, Cheng and Tan, 2018).

The paradigm shift has instigated the formulation and implementation of diaspora engagement policy in many countries since the 1990s. Diaspora engagement policy, which is also called diaspora option refers to the policy, strategy and initiatives to involve HSDs in the economic development of the countries of origin (Keusch and Schuster, 2012; Gamlen, 2014; Ho, Hickey and Yeoh, 2015; Cheng, 2016). Contrary to the conventional thinking that highly skilled emigration is brain drain or human capital flight, the diaspora engagement advocates that it may be more beneficial for HSDs to stay overseas than returning home physically and permanently (Hoo, Zainal and Chai, 2014; Cheng, 2016). The paradigm shift was motivated by four major developments in the global economy, namely the rise of Silicon Valley in 1970s, the reorganisation of the global production network, the impacts of international mobility of talent on knowledge creation and diffusion, and the diaspora transnationalism.

1.1.1 The Emergence of Silicon Valley in 1970s

The Silicon Valley emerged as the global centre of innovation and technological development since the 1970s. It attracted scientists, engineers and technopreneurs from all over the world, particularly from East Asia, South Asia, Southeast Asia, Latin America and the Caribbean (Saxenian, 2006; Sabel and Saxenian, 2008; Elo, 2015; Shin and Moon, 2018). Many of them sustained active linkages with their home countries through family ties, kinship, business networks, scientific collaboration and diaspora oriented organisations. These transnational linkages are generally termed as diaspora networks (Kuznetov and Sabel, 2006; Meyer, 2007; Grossman, 2010; OECD, 2016, p. 188, 205). Through the diaspora networks, the HSDs channel the skills, knowledge, innovative ideas, technological know-how and entrepreneurial opportunities from Silicon Valley or other technological clusters to the developing countries (Patterson, 2006; Rapoport, 2017; Gelb and Krishnan, 2018). The HSDs also assume the role of development agent which mediates the technological collaborations and entrepreneurial activities between developed countries and their country of origin. Economists and social scientists used the term 'brain circulation' to describe these transnational interactions and exchanges, implying a two way flows of knowledge, expertise and economic opportunities between destination and home countries. The brain circulation notion argued that the HSDs can benefit their country of origin through diaspora network even without their physical and long term return (Saxenian, 2006; Tung 2008; Docquier and Rapoport, 2012; OECD, 2016, p. 206).

Taiwan, India and China had also implemented policies to facilitate the technological and business exchanges between their HSDs in Silicon Valley and the academia, professionals or entrepreneurs in the homelands. The Chinese government had changed the objective of its diaspora policy from *'Huiguo Fuwu'* (return and serve the motherland) to *'Weiguo Fuwu'* (serve the motherland) in the late 1990s, to encourage Chinese HSDs in Silicon Valley and other technological hubs in advanced countries to interact and collaborate with their counterparts in China (Hugo, 2012; Xiang, 2005, 2016).

1.1.2 The Reorganisation of the Global Production Network

Before the 1980s, the major industries in the world, particularly the IT industry were dominated by vertically integrated corporations. The vertically integrated industrial organisation is characterised by its hierarchical structure which internalises most of the important components of the production process (Saxenian, 2001a; Kuznetsov and Sabel, 2008; Helfat, 2015). The headquarters set the corporate goals and subdivide them into smaller job functions, which are dedicated to the subordinates through a top-down approach.

The rapid globalisation process, the advancement in ICT and the reduced transportation cost had contributed to the decentralisation of large corporations in the 1980s. The decentralisation process gave rise to a more fragmented and flexible industrial structure, comprised of specialised producers and service providers scattered across countries but interconnected through the global supply network (Saxenian, 2001a; Kuznetsov and Sabel, 2008; Brandts and Cooper, 2015). The HSDs, who are strategically positioned in the technological hubs and nodes of the global supply chain are engaged by their home countries to capture new knowledge and expertise, to search for innovative solutions and to form cross border business networks (Ionescu, 2006; Kuznetsov and Sabel, 2006; Newland and Tanaka, 2010; Gamlen, Cummings and Vaaler (2017).

1.1.3 The International Mobility, Knowledge Creation and Diffusion

Knowledge is recognised as one of the important production factors which stimulate economic growth of a country (Daugeliene and Marcinkeviciene, 2009; Royal Society, 2011, p. 31; Mckenzie, 2017). Two prominent economists, Romer (1986) and Lucas (1988) showed that the accumulation of knowledge is the key driver for the growth of national economy in the long run. Lucas (1988) further suggested that the interactions of talent from different parts of the world can stimulate the learning and creation of new knowledge.

Since the 2000s, various international organisations and scholars have argued for greater international mobility of highly skilled individuals, in order to promote interactions between talented people from diversified expertise and socio-cultural backgrounds (Gamlen, 2005, p. 7; OECD, 2008b, p. 47; Oettl and Agrawal, 2008; World Bank, 2011, p. 131; Vandor and Franke, 2016). The interactions between HSDs and talents from other countries will create new knowledge and innovative solutions. The HSDs are also instrumental in fostering the interconnectivity of the global technological hubs, and linking the global technological hubs to the industries in their home countries (OECD, 2008, p. 18-22; Royal Society, 2011, p. 27; Ho and Boyle, 2015).

1.1.4 The Diaspora Transnationalism and the Fourth Industrial Revolution (4IR)

The transnational livelihoods of the diasporas have been observed and widely investigated by social scientists and international organisations since the 1990s. Even after they have migrated to other countries, the HSDs maintained multiple social networks with their home countries. These diaspora linkages are found in the form of informal linkages, such as kinship, family ties, friendships and hometown relations and formal connections, such as business networks, co-workers, scientific collaboration and virtual networks supported by the diaspora oriented organisations (Faist, 2015; de Jong and Dannecker, 2018).

The HSDs are also flexile in their occupations, careers, geographical locations, cultural identity and relationship with home and destination countries (Faist, 2010; Bagwell, 2015). Such characteristics make HSDs susceptible to different working environments, economic conditions as well as challenges of multiculturalism and multilingualism. Thus, the HSDs are able to play an active role as network builder between countries or geographical regions (Faist, 2010; Mckenzie, 2017).

The interest and enthusiasm of the governments and international organisations in the developmental role of HSDs continued to intensify in 2010s (International Organisation for Migration [IOM], 2011, p. 105; Sinatti and Horst, 2015). The prominent engineer and economist, and founder of the

World Economic Forum, Klaus Schwab (Schwab, 2015; 2016) purported that the Fourth Industrial Revolution (4IR) is unfolding at a global scale. The 4IR is characterised by the fusion of digital technologies, internet of the things (IoT) and the traditional industries at an exponential rate (Davies, 2015; McKinsey Digital, 2015; Xu, David and Kim, 2018). Consequently, the economic activities are increasingly digitalised and interconnected (Koch, Kuge, Geissbauer and Schrauf, 2014).

The 4IR is altering the way how highly skilled persons work and interact with one another. The international migration of highly skilled persons, both physically and virtually, will continue with a strong momentum due to the global competition for talent, as well as a more flexible, contractual and temporary nature of jobs under 4IR (Mckenzie, 2017; Fink and Gentile, 2019). The transnationalism and flexibility of HSDs match the demand of the home countries for a more heterogeneous talent pool, which is essential for industrial transformation and technological progress under 4IR. The HSDs connect their home countries to the knowledge and economic opportunities generated by the 4IR process in the advanced countries (Mckenzie, 2017; Commonwealth Secretariat, 2018).

The above four developments show that HSDs have played an increasingly important role in channelling flows of knowledge, innovative ideas and economic opportunities between destination and home countries. Such flows are defined as the diaspora resources, which have the potential to contribute to the economic development of the home countries (Ionescu, 2006,

p. 40; African Diaspora Policy Centre, 2011; Docquier and Rapoport, 2012; Trotz and Mullings, 2013; Hoo, Zainal and Chai, 2014; Fok, Cheng and Tan, 2018).

Economists and international organisations widely acknowledge that HSDs are the global links to facilitate their home countries to absorb heterogeneous diaspora resources from different parts of the world (Yap, 1994; Xiang, 2005; OECD, 2012, p. 27, 95, 230; Elo, 2015; Kerr, Kerr, Ozden and Parsons, 2016, 2017). Under the 4IR, the global competition for talent will be escalating. Thus, international migration of highly skilled persons imposes greater challenges for countries to mobilise their talented people, who disperse extensively across the world (Danchev and Porter, 2018).

1.2 Diaspora Engagement Strategy

The transnational diaspora network is increasingly recognised as an important conduit for developing countries to transfer skills, knowledge, innovative ideas and economic opportunities from developed countries or emerging economies (Saxenian, 2003; Tung, 2008; Cheng, 2015; Elo, 2015). The notion has contributed to the rise of ‘diaspora option’ or ‘diaspora engagement’ as the national strategy to generate brain circulation between HSDs and their country of origin or homeland (OECD, 2008b, p. 54; Tung, 2008; Zweig, Chung and Han, 2008; Royal Society, 2011, p. 27; Kennedy and Lyes, 2015; Cheng, 2016; Kone and Ozden, 2017). The diaspora engagement could be defined as strategic attempts to mobilise HSDs as developmental partners of the home countries or ancestral homelands (Zweig, Fung and Han, 2008; Agunias and Newland, 2012, p. 9; Gamlen, 2014; Ho, Hickey and Yeoh, 2015; Sinatti and Horst, 2015).

The diaspora engagement reconceptualises brain drains as the human capital stored overseas. The HSDs are not viewed as permanent exodus but as talent pool which can be tapped by the country of origin or ancestral homeland (Ionescu, 2006, p. 7; Law, Genc and Bryant, 2009, p. 22; IMD World Competition Center, 2014, p. 11; Gamlen, 2014; Ho and Boyle, 2015; Ho, Hickey and Yeoh, 2015). Thus, the global links possessed by HSDs are considered to be more important than their physical return to home countries (Xiang, 2005; Elo, 2015; Kerr, Kerr, Ozden and Parsons, 2016).

The diaspora engagement has become an integral part of the development policy of many countries to promote technological progress and industrial transformation. A better understanding on the HSDs, particularly their spatial distribution, their migration motives, their potentiality as agents of development and their transnational networks is crucial to formulate a focused strategy for diaspora engagement initiatives (Agunias and Newland, 2012, p. 26; Larner, 2015).

1.3 Diaspora Engagement of ASEAN-5

While addressing the opening of the 2nd Congress of Indonesia Diaspora in Jakarta on 19 August 2013, the then Indonesian president, Susilo

Bambang Yudhoyono stated that Indonesian diaspora communities dispersing over the world were the ‘national asset’. He urged for the active involvement of Indonesian diasporas in the Master Plan for Acceleration of Indonesia Economic Development (MP3E1), which involved a total investment sum of USD 400 billion (Antaranews.com, 2013). The Congress was also concluded with the establishment of the Indonesian Diaspora Network (IDN), a web-based civil society organisation promoted by the Indonesian government. The objective of IDN is to interconnect the Indonesian diasporas for contributing to the socio-economic development of Indonesia (Indonesian Diaspora Network, 2018).

The incumbent government under the leadership of President Joko Widodo had further launched the “diaspora card” in 2017. The objective of the diaspora card is to facilitate the involvement of diasporas in the economic development of Indonesia. The “diaspora card” entitles the holders to special treatments such as long term multiple entry VISAs, property ownership and establishment of business (Setijadi, 2017; Kosasih, 2019). The Ministry of Foreign Affairs of Indonesia also sought to amend the citizenship law in order to allow dual citizenship for overseas Indonesians (Setijadi, 2017; Anya, 2019).

Indonesia, Malaysia, Philippines, Singapore and Thailand are member countries of the Association of Southeast Asian Nations (ASEAN) (these five countries are called as ASEAN-5 hereinafter). Compared to the other four countries, Indonesia is a latecomer to undertake diaspora engagement initiatives (Harijanti, Dewansyah, Abdurahman and Dramanda, 2018). The recent gesture of Indonesian government to reach out to diasporas signify a big step towards a more aggressive and comprehensive diaspora engagement policy. It is motivated by the pressing needs of Indonesia to capitalise on its overseas talent, in order to overcome the domestic shortage of highly skilled and professional workers (Setijadi, 2017).

Malaysia started its efforts in engaging HSDs with the launching of ‘brain gain’ programme by the Ministry of Science Technology and Innovation (MOSTI) in 1995. Its objective was to attract Malaysia’s scientists and technical experts living overseas to return to Malaysia. However, the programme had ended in 2004 due to low number of applications and returnees (Hoo, Zainal and Chai, 2014). In 2011, the Talent Corporation was established under the Prime Minister Department of Malaysia. It aimed to implement more effective strategy and programmes in engaging the HSDs for the economic transformation of Malaysia (Talent Corporation Malaysia, 2012; 2018, p. 12). One of the missions of Talent Corporation is to link the Malaysian diasporas with the industries and career opportunities in Malaysia (World Bank, 2015, p. 12).

The ‘Reverse Brain Drain Programme’ (RBD) of Thailand was established in 1997 by the Ministry of Science and Technology under the National Science and Technology Development Agency (NSTDA). The RBD plays a similar role as the Malaysia’s Brain Gain Programme, i.e. to return overseas professionals and talents. However, the RDB also promotes Thai talents abroad to contribute to the economic development of Thailand, especially in the science and technology sectors (Tanpipat, 2015; Salmi and Salmi, 2017). The diaspora engagement initiatives of RDB include arranging overseas Thai professionals to conduct lectures and workshops in Thailand, as well as encouraging universities and government agencies to undertake joint research projects with Thai researchers living abroad (Bhumiratana, Songkasiri, Commins and Grimley, 2009; Agunias and Newland, 2012, pp. 171-172; Salmi and Salmi, 2017).

The attitude of Singapore government to HSDs has undergone a few major stages. In the 1980s, the senior officials of Singapore government always expressed their anger and frustration on the depletion of human capital caused by talent outflows (Yap, 1994). Starting from the 1990s, Singapore has implemented the 'open door policy' to encourage the inflows of expatriate talents or highly skilled foreigners, in order to fill the gap in human capital shortage (Rikvin, 2012). Since the 2000s, Singapore government has reoriented their diaspora engagement strategy, which takes a more positive stance on the roles of HSDs in contributing to the national development agendas. The new strategy emphasises Singaporean HSDs as the global links for the businesses in Singapore. It recognises the potential roles of overseas talents in promoting the inflows of foreign direct investments (FDIs), exploring overseas markets for Singaporean companies and facilitating knowledge exchanges between Singapore and other advanced economies (Saha, 2009; National Population and Talent Division, 2013, p. 25; Ho and Boyle, 2015).

The Philippines is the pioneer among ASEAN-5 to recognise the instrumental role of HSDs in expediting knowledge transfers, foreign direct investments (FDIs) and entrepreneurship development of the home countries (OECD, 2017, p. 58). The Philippines government is often lauded as a model for comprehensive and institutionalised diaspora engagement (Migration Policy Institute [MPI], 2014; Asis, 2017). Starting as early as the 1980s, a number of knowledge transfer activities through HSDs have been mediated by diaspora organisations and national driven programmes. One of the most successful governmental efforts is the *Balik* Scientist Programme under the Department of Science and Technology (DOST). It began in 1993 and continues until today (Opiniano and Castro, 2006; Asis, 2017; Caunan, 2017). The mission of *Balik* Scientist Programme is to tap the expertise of overseas Filipinos through short-term or long term assignment contracts. Since its inception, the programme has benefited a wide range of industries and technological fields, including hazardous waste management, photovoltaic technology, geothermal energy, fishery, food industry, irrigation systems and others (Opiniano and Castro, 2006; Caunan, 2017).

Another prominent initiative of the Philippines diaspora engagement is the establishment of the Commission on Filipinos Overseas (CFO) with the President Office. It is a government agency which provides protection and assistance to the Philippines emigrants. At the same time, it also actively involves in promoting the knowledge and business networks between overseas Filipinos, especially the HSDs in United States, with the research institutions, universities and companies in the Philippines (MPI, 2014; OECD, 2017, p. 58).

In addition, the professional and entrepreneurial diasporas of the Philippines in United States, Canada and Australia have also established various types of diaspora organisations to transfer technical know-how and knowledge to their homeland (Opiniano and Castro, 2006; Camroux, 2008; MPI, 2014; Meulen, 2016). The outstanding examples include the Brain Gain Network (BGN), a business network of professional engineers, scientists and organisations, which reconnect HSDs with their counterparts in the Philippines (Brain Gain Network [BGN], 2019); the Philippines-Canada Trade Council (PCTC), which promote the business networking between Canada and the Philippines (Philippines Canada Trade Council [PCTC], 2019); the Massachusetts Institute of Technology-Philippine Emerging Start-ups Open (MIT-PESO), which transfers HSDs' knowledge and expertise to the Philippines (Barrett, 2019); and PhilDev based in California, which endeavours to channel the scientific knowledge, business and technical experience and venture capital from Silicon Valley to the young technopreneurs in the Philippines (Opiniano and Castro, 2006; MPI, 2014; Sorensen, 2014, p. 52; Philippines Development Foundation, 2019).

This study focuses on the HSDs and the diaspora engagement initiatives of the ASEAN-5. The five countries were selected was based on the following backgrounds: Firstly, as ASEAN-5 are relatively well-performing economies in the ASEAN region, the ASEAN-5 may benefit from their HSDs in the development of home countries. Secondly, the ASEAN-5 countries possess a large number of HSDs distributing across the world, particularly in the developed and emerging economies. This implies that the ASEAN-5 could benefit from the knowledge, innovations and economic opportunities from heterogeneous sources if the HSDs were closely connected with the industries, research institutions, governmental development agencies and other stakeholders in the home countries. Thirdly, all ASEAN-5 have implemented their respective diaspora engagement initiatives. A study on ASEAN-5 would generate insight useful for the policy making in managing diaspora originated from the region.

1.4 The Current Status of International Migration of Highly Skilled Persons

The United Nations defines international migrant stock as the total number of international migrants residing in a given country at a given point in times (2016, p. 4; 2017a, pp. 15-16; 2017b, p. 3). Thus, the international migrant stock is a static measure for the total number of emigrants, i.e. total diasporas who live outside of their countries of origin at a given time, regardless of their age groups and education levels (United Nations, 2017a, pp. 15-16).

United Nations (2013a, 2016, 2017b) showed that international migrant stock had increased steadily from 1990 to 2015 (See Table 1.1). There were 245 million people living outside their country of origin in 2015, a 57.6% increase from the total number in 1990. The diasporas constituted 2.9% of the world population in 1990 and rose to 3.3% in 2015.

Table 1.1: International Migrants (million)

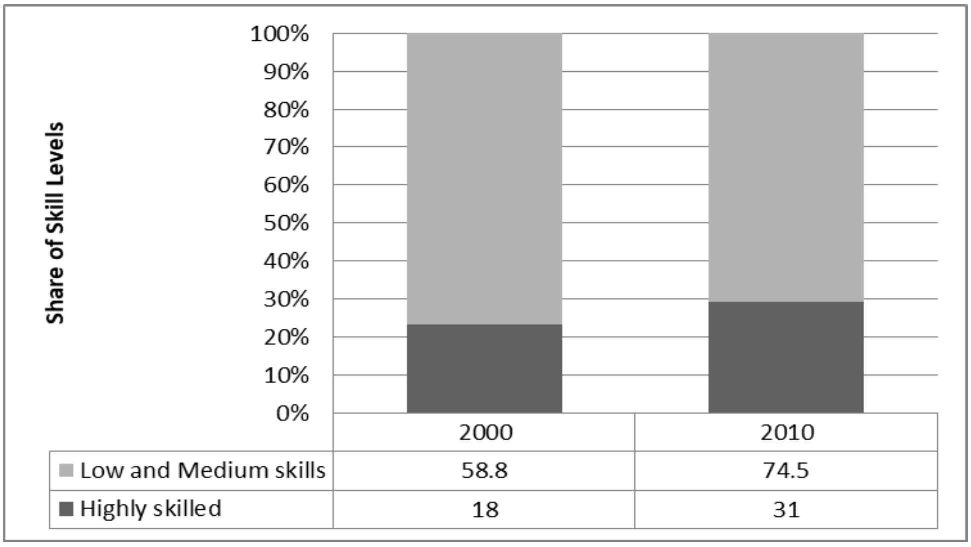
	Year				
	1990 (Million)	2000 (Million)	2010 (Million)	2013 (Million)	2015 (Million)
World	154.2	174.5	220.7	231.5	243.7
Development Status					
Developed region	82.3	103.4	129.7	135.6	140.5
Developing region	71.9	71.1	91	95.9	103.2
Continents					
Africa	15.6	15.6	17.1	18.6	20.6
Asia	49.9	50.4	67.8	70.8	75.1
Europe	49	56.2	69.2	72.4	76.1
Latin America and the Caribbean	7.1	6.5	8.1	8.5	9.2
Northern America	27.8	40.4	51.2	53.1	54.5
Oceania	4.7	5.4	7.3	7.9	8.1

Sources: United Nations (2013a, 2016, 2017b)

The world economy is increasingly integrated and interconnected, However, economists predicted that the developmental gap between countries may persist due to the exponential advancement of technology in developed countries under the 4IR (Schwab, 2015; OECD, 2016, p. 64-65). Table 1.1 shows that developed regions had attracted more international migrants than developing regions.

The acute competition among developed countries and emerging economies for talent and professional workers, particularly those in the ICT industries and R&D sectors, has driven the cross-border migration of highly skilled people (OECD, 2008b, p. 16; Widmaier and Dumont, 2011; OECD, 2016, p. 257; Mckenzie, 2017). Furthermore, many advanced countries, particularly the European Union (EU) have implemented immigration policies which encouraged highly skilled immigrants (OECD, 2016, p. 115). Consequently, the share of highly skilled immigrants to the total immigrants in

OECD countries had increased from 23.4% in 2000 to 29.4% in 2010 (Figure 1.1).



Source: OECD DIOC-E (3.0) and OECD DIOC 2010/11

Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (World Bank, 2011, p. 85; Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77; Fok, Cheng and Tan, 2018).).

Figure 1.1: International Migrants (aged +25*) in OECD Countries According to Skill Levels (Million)

Table 1.2 shows that the United States was the top destination country, which hosted approximately one third of the international highly skilled emigrants in 2000 and 2010. Other major receiving countries were either advanced countries or high-growth economies, indicating that the highly skilled emigrants were concentrating in destination countries which offered better job and career opportunities (OECD, 2013; OECD, 2016, p. 88).

Table 1.2: The Top Destinations for the International Highly Skilled Migrants (Aged +25*) in 2000 and 2010

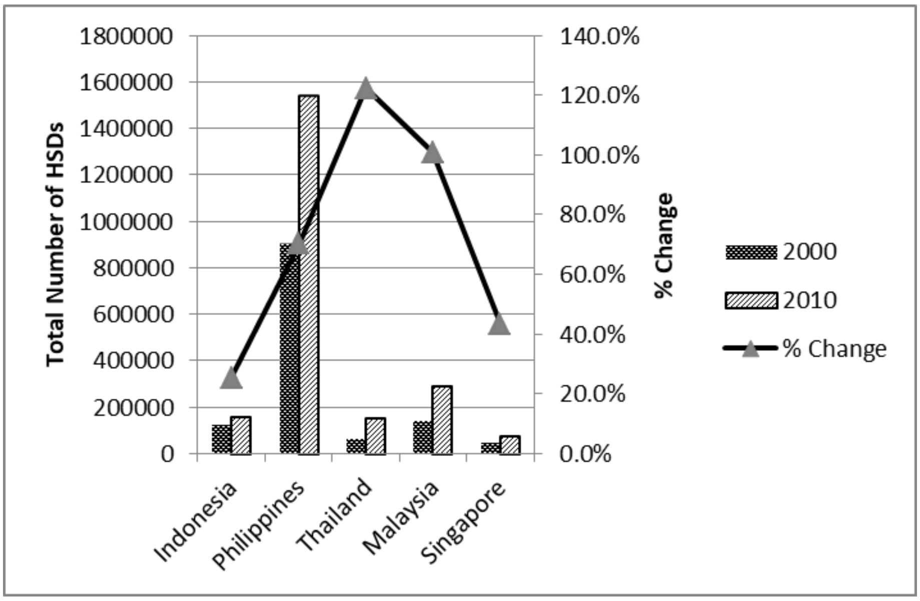
2010			2000		
Country	Number	Share of Total	Country	Number	Share of International Migrant Stock
United State	11326405	31.8%	United State	7768934	30.5%
Canada	3516010	9.9%	Russia	2249942	8.8%
Great Britain	3444701	9.7%	Ukraine	2116467	8.3%
Russia	2992317	8.4%	Germany	1970394	7.7%
Germany	1995999	5.6%	Canada	1938770	7.6%
Australia	1788436	5.0%	Great Britain	1256128	4.9%
France	1603304	4.5%	France	961807	3.8%
Spain	1189510	3.3%	Australia	872999	3.4%
Israel	775328	2.2%	Israel	682117	2.7%
Italy	577051	1.6%	Spain	372580	1.5%
Switzerland	560225	1.6%	Switzerland	280711	1.1%
New Zealand	424572	1.2%	Netherlands	265830	1.0%
Netherlands	400378	1.1%	Hong Kong	258905	1.0%
Turkey	340637	1.0%	Japan	257721	1.0%
Sweden	337935	0.9%	Belarus	248941	1.0%
Belarus	252525	0.7%	Italy	241126	0.9%
Ireland	249251	0.7%	Philippines	216749	0.9%
Kazakhstan	246554	0.7%	Sweden	197730	0.8%
Belgium	226994	0.6%	Belgium	181649	0.7%
Thailand	223026	0.6%	India	168015	0.7%
Others	3172265	8.9%	Others	2953475	11.6%

Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (World Bank, 2011, p. 85; Artuc, Docquier, Ozden and Parsons, 2015; Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77; Fok, Cheng and Tan, 2018).

The international emigration of highly skilled or tertiary educated persons, particularly those from the developing to developed regions is expected to increase in the coming years until 2030 (OECD, 2016, p. 20). Effective engagement of HSDs is becoming more important, in order to mobilise diaspora resources and networks for the economic development of home countries, particularly the developing nations.

1.5 The Spatial Distribution of the HSDs of ASEAN-5

Figure 1.2 shows that all ASEAN-5 experienced substantial increase in the sizes of their HSDs during the period of 2000-2010. It is more obvious for Malaysia and Thailand, where the increments were more than 100%. The ASEAN-5 is an interesting group with respect to their development levels. It includes two lower middle income countries, namely Indonesia and Philippines; two upper middle income countries, i.e. Thailand and Malaysia; and one high income country, Singapore (World Bank, 2018).



Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (World Bank, 2011, p. 85; Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77; Fok, Cheng and Tan, 2018).

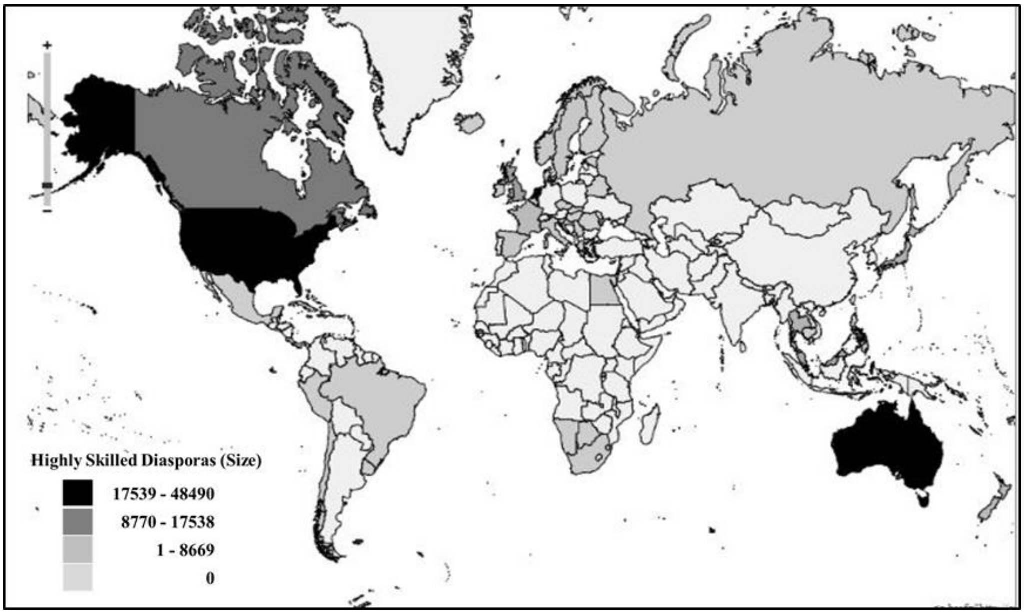
Figure 1.2 The Sizes of HSDs (Aged +25*) of ASEAN-5 in 2000 and 2010

Figure 1.2 places the ASEAN-5 on the x-axis from left to right according to their levels of per capita GDP, with Singapore having the highest per capita GDP at the right end. As a result, the percentage changes of the HSDs form a shape resembling an inverted U-curve. This pattern conforms to the empirically testified migration-development relationship, which shows how the international migration of highly skilled persons is influenced by the development level of the country of origin (Docquier and Rapoport, 2007; OECD, 2008, p. 60; Czaika and de Haas, 2014; OECD, 2016, p. 31, de Haas et al., 2018). When a country is in a less developed stage, the international mobility of the highly skilled persons may be restricted by their financial capability and skill mobility. When the country achieves a higher level of economic development, there will be more highly skilled persons who are financially capable to move abroad and employable in the international labour market. However, when the country reaches the developed stage, the emigration growth rate may slow down due to improved job and career prospect in the home country (King and Collyer, 2016; de Haas et al., 2018; Idu, 2019). Thus, *ceteris paribus*, the sizes of the HSDs of Indonesia, Philippines and Thailand are expected to grow in the near future. Conversely, the growth rates of the HSDs of Malaysia and Singapore are likely to slow down.

The Philippines has accumulated an enormous size of HSDs abroad. This is largely caused by the Out-migration Policy implemented since the 1970s, which encouraged Filipinos, including many highly skilled and professional persons to work abroad as contractual workers. The purposes of the policy are to alleviate the pressure of labour oversupply and to earn foreign reserves from the remittances sent home by the overseas Filipinos (Alburo and

Abella 2002, p. 19; Asian Development Bank Institute [ADBI], 2014, p. 7-9; Castro-Palaganas et al., 2017).

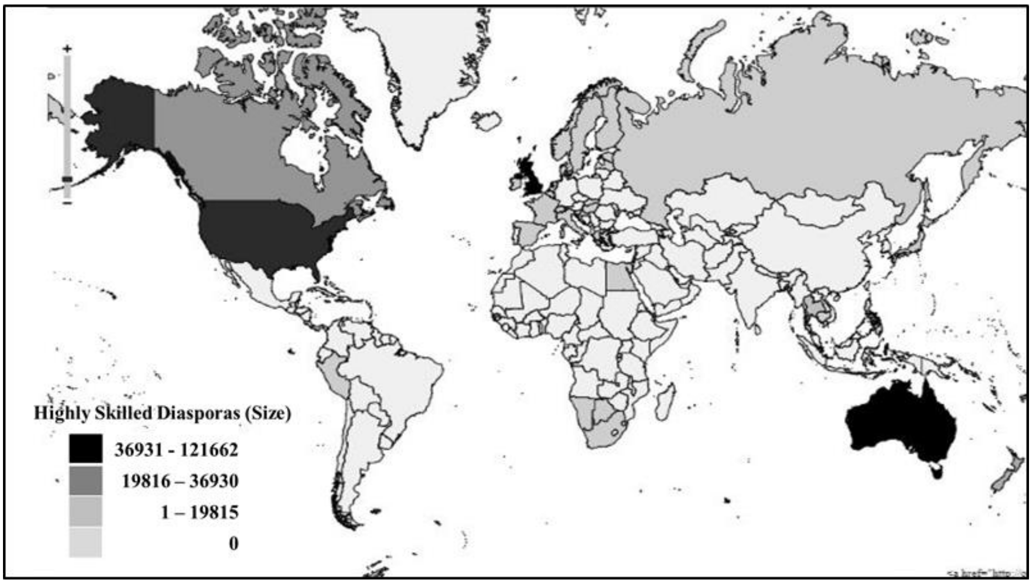
Figure 1.3, 1.4, 1.5, 1.6 and 1.7 map the spatial distribution of the HSDs from ASEAN-5 in 2010 according to their destination countries or regions. Apart from a few major destinations such as the United States, Australia, United Kingdom, Canada and ASEAN-5 counterparts, the HSDs of ASEAN-5 were also found in other countries across Europe, Asia, South America and Africa. The extensive distributions of the HSDs indicate that ASEAN-5 are linked to heterogeneous economic resources located at different parts of the world.



Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD

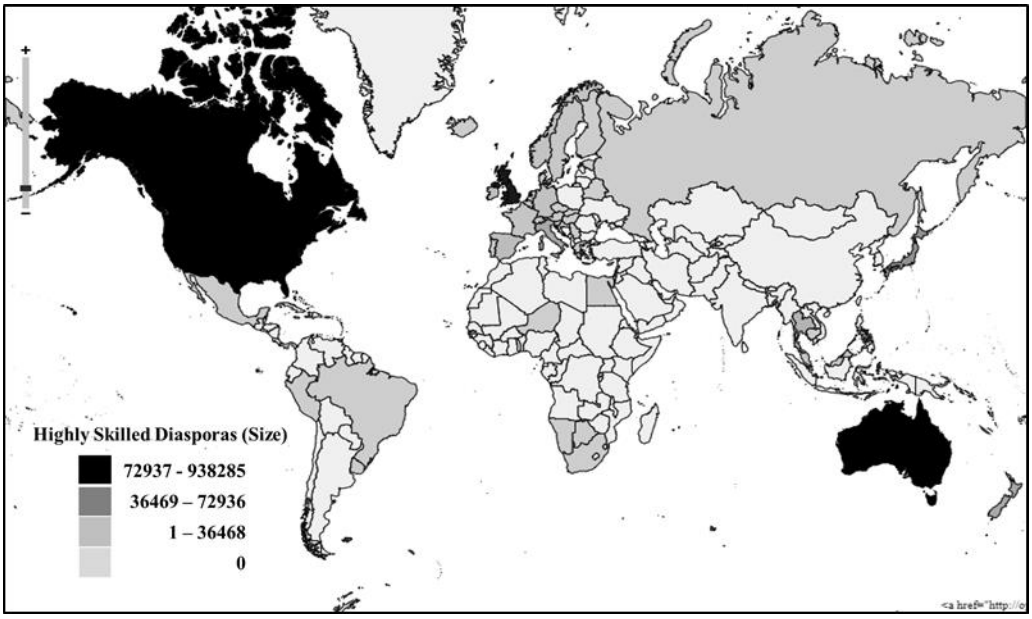
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77).

Figure 1.3: The Global Distribution of the HSDs (+25*) of Indonesia, 2010



Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77).

Figure 1.4: The Global Distribution of the HSDs (+25*) of Malaysia, 2010



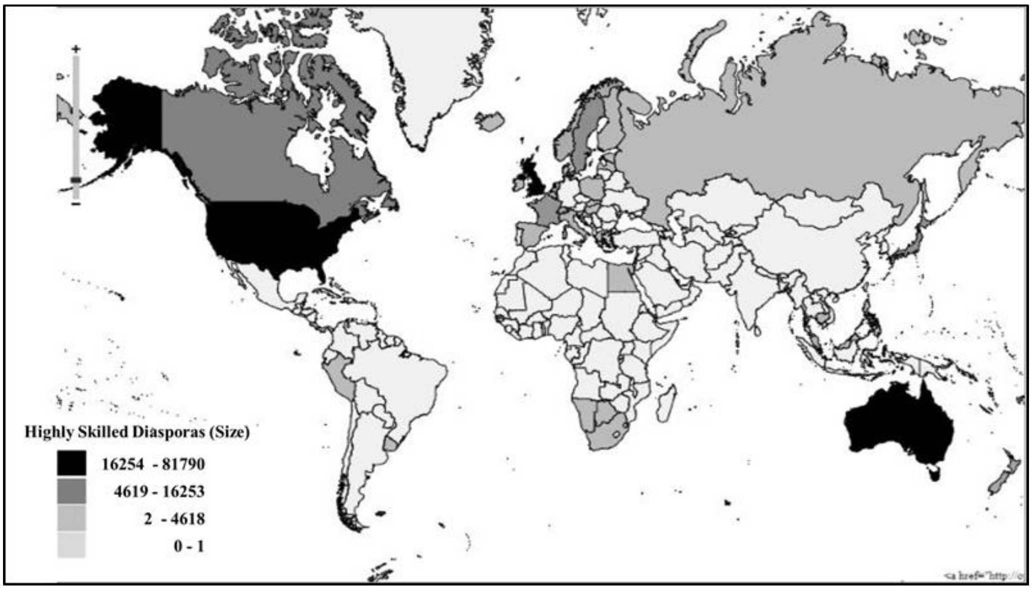
Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77).

Figure 1.5: The Global Distribution of the HSDs (+25*)

of Philippines, 2010

Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77).

Figure 1.6: The Global Distribution of the HSDs (+25*) of Singapore, 2010



Source: DIOC-E (Release 3.0) and DIOC 2010 (Release 1.0), OECD
Note*: The highly skilled migrants of aged +25 include those who are economically active in the destination countries but exclude students (below 25) who temporarily stay abroad for educational purpose (Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77).

Figure 1.7: The Global Distribution of the HSDs (+25*) of Thailand, 2010

1.6 ASEAN Economic Community and the Fourth Industrial Revolution (4IR)

The ASEAN member states have entered into a new era of the ASEAN Economic Community (AEC) since 2015. The primary goal of AEC is to integrate the ASEAN countries into a single market, in order to achieve a more sustainable development across ASEAN region (ASEAN Secretariat, 2015, p. 6). One of the core elements of the AEC is the intra–regional mobility of skilled labours and professional service providers. The AEC has established collaborative frameworks, such as the Mutual Recognition Agreements (MRAs) to promote the free movement of highly skilled persons among ASEAN countries. The objective of the MRAs is to promote interactions and collaborations between talents so as to nurture the innovation activities in ASEAN countries (ASEAN Secretariat, 2015, p. 10-11; Sugiyarto and Agunias, 2014; Chen and Wong, 2015; Jurje and Lavenex, 2015).

The AEC also encounters the challenges and opportunities brought by the 4IR, which includes the digitalisation of production process and business operation, the integration of different types of technologies and a highly interconnected world driven by internet networks, big data analytics and artificial intelligence (Di, 2016; Menon and Fink, 2017). The AEC should embrace the 4IR to transform the regional economy, in order to promote innovation-led economic growth and synchronise to the evolution of global value chains (Ministry of Industry and International Trade Malaysia [MITI], 2016; Menon and Fink, 2017).

The highly skilled persons of ASEAN-5 are increasingly mobile. Their movements are not confined to the ASEAN region but venturing into many developed and emerging economies around the world. They have also maintained strong social, cultural and economic linkages with their home countries. ASEAN-5 should collaborate on mobilising their overseas talents to transmit knowledge, technology and business opportunities from countries outside the ASEAN region, particularly the developed economies. The HSDs could be engaged to develop ASEAN-5 into the regional hubs for knowledge exchanges and commercial activities (Performance Management and Delivery Unit [PEMANDU], 2015, p. 158-173; PricewaterhouseCoopers [PWC], 2015). The HSDs are also instrumental in connecting ASEAN-5 to the international network of scientific hubs, which is essential for the knowledge creation and diffusion activities under the 4IR (Darsono, 2017; Salmi and Salmi, 2017).

1.7 Research Problems

The ASEAN-5 countries have implemented a number of measures and programme to engage their HSDs for the economic development of home countries. There are two important focuses related to the diaspora engagements initiatives of ASEAN-5: firstly, the diaspora resources to be harnessed from destination countries through the HSDs (Kotarumalos, 2013; Hoo, Zainal and Chai, 2014; Ho and Boyle, 2015; Tanpipat, 2015; Meulen, 2016; Fok, Cheng and Tan, 2018). Secondly, the networks formed by HSDs which could facilitate the transfers of diaspora resources from destinations to home countries (Chen and Wong, 2015; Darsono, 2017; Setijadi, 2017).

However, there is a lack of systematic approach to evaluate the potential outcomes of the above two aspects, which are essential to assess the effectiveness of the diaspora engagement initiatives (World Bank, 2015, p. 71; Ho and Boyle, 2015).

To fill the knowledge gap, it is crucial to understand the macro-determinants which influenced the spatial distribution of the HSDs from ASEAN-5. The macro-determinants reflect the HSDs' migratory motives and expectations, which relate to the overseas economic resources pursued by the HSDs, as well as the types of diasporic linkages with their home countries. The heterogeneous types of diaspora linkages are partly responsible for the formation of various diaspora associations, organisations, networks and initiatives to represent the diverse interests, resources and social capital of diasporas (Ionescu, 2006, p. 27; Globerman and Shapiro 2008; de Haas, 2010a, 2010b; King, 2012; Docquier, Peri and Ruyssen, 2014; Epstein and Heizier, 2015; Gheasi and Nijkamp, 2017; Fok, Cheng and Tan, 2018).

In addition, from the perspective of network sociology and social network analysis (SNA) (Meyer, 2007; Tranos, Gheasi and Nijkamp, 2012; Danchev and Porter, 2018; Windzio, 2018), the international migration of highly skilled persons generate the locus of spatial movements, which also forms diaspora links interconnecting the countries at different parts of the world. The global network is called the world migration network (Danchev and Porter, 2018; Windzio, 2018) or the global diaspora network (Clemens, Ozden and Rapoport, 2014). This study adopts the term 'global diaspora network' in order to highlight the role of HSDs as diasporas living in destinations but maintaining strong economic linkages with their countries of origin (Kennedy and Lyes, 2015, p. 10).

The ASEAN-5 countries are also among the nodes located or embedded in the global diaspora network. They are connected with other countries (or other nodes) through the spatial distribution of their HSDs. The positions and connectivity in the global diaspora network can influence the capabilities of ASEAN-5 to harness the overseas knowledge, innovative ideas and business opportunities through their diaspora networks (Xiang, 2005; Meyer, 2007; Royal Society, 2011; Ho and Boyle, 2015; Epstein and Heizier, 2016; Rapoport, 2016, 2018).

Thus, a better understanding on the potential development roles of the HSDs can be achieved through the investigation of the driving forces for their spatial distribution, their diaspora resources and the connectivity of ASEAN-5 in the global diaspora network. The knowledge is crucial to formulate diaspora engagement strategies which are mutually beneficial to the career development of HSDs and the economic development of their home countries.

1.8 Research Questions

The study aims to address the following research questions:

i. What are the macro-determinants of the spatial distribution of the HSDs of ASEAN-5?

ii. What are the migratory motives and expectations of HSDs from ASEAN-5, and how

iii. What are the potential diaspora resources to be tapped by ASEAN-5?

iv. How do the spatial distributions of the HSDs influence the potential economic linkages between destination countries and ASEAN-5?

v. What are the characteristics of the network positions of ASEAN-5 in the global diaspora network?

vi. How do the network positions of ASEAN-5 affect their capacity in tapping the potential economic resources of HSDs?

vii. How can ASEAN-5 leverage on their HSDs to mediate the flows of knowledge and economic opportunities circulating through the global diaspora network?

viii. How do the network positions and connectivity of ASEAN-5 influence the developmental roles of the HSDs for their home countries?

ix. How to identify the targeted destination countries to strengthen the diaspora linkages so as to optimise the outcomes of diaspora engagement initiatives?

1.9 Objectives of the Research

The general objective of this research is to examine how the spatial distributions and diaspora networks of HSDs could influence the capabilities of ASEAN-5 to engage diasporas in the economic development. The specific objectives are:

1) to investigate the macro-determinants for the spatial distribution of the HSDs of ASEAN-5, in order to understand the migratory motives and expectations, as well as the associated diaspora resources of the HSDs;

2) to investigate how the positions of ASEAN-5 in the global diaspora network can facilitate the transmission and mediation of diaspora resources, namely the knowledge and economic opportunities from their HSDs; and

3) to recommend diaspora engagement strategies for the ASEAN-5.

1.10 Definition of Terms

The important terms used throughout the study are stated and defined as follows.

1.10.1 International Migrant Stock

The international migrant stock is defined as the total number of persons who live outside of their countries of origin at a given time, regardless of their age groups and education levels (United Nations, 2016, 2017a, 2017b).

1.10.2 Highly Skilled Persons or Population

The highly skilled persons or population are defined as the individuals or population aged 25 and above (+25) with at least tertiary education or equivalent professional qualification. The age group of 25 and above (+25) excludes students or youths who are not economically active (Arslan et al., 2014, pp. 10-11; Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77).

1.10.3 Highly Skilled Emigrants/Highly Skilled Diasporas (HSDs)

HSDs refer to the tertiary educated individuals or population aged 25 and above (+25) and living out of their home countries. The age group of 25 and above (+25) exclude students who temporarily stay abroad for educational purpose (World Bank, 2011, p. 85; Ataselim, 2014; Artuc, Docquier, Ozden and Parsons, 2015; Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016, p. 20; OECD, 2017, p. 77; Fok, Cheng and Tan, 2018).

1.10.4 Diaspora Resources

Diaspora resources are defined as the economic resources which can be harnessed or mobilised by home countries through their HSDs, including overseas markets, knowledge, innovations and international trade opportunities (Gamlen, 2005; Aqunias and Newland, 2012, pp. 24-25; 146; Trotz and Mullings, 2013; Ataselim, 2014; Gamlen, 2014; Acharya, 2017; Fok, Cheng and Tan, 2018).

1.10.5 Diaspora Engagement

Diaspora engagement is defined as national efforts dedicated to outreach and engage HSDs for the economic development of home countries

(Agunias and Newland, 2012, p. 9; Lee and Saxenian, 2013; Ataselim, 2014; Gamlen, 2014; Ho and Boyle, 2015; Kennedy and Lyes, 2015, p. 10; Sinatti and Horst, 2015; Cheng, 2016, pp. 13-15; Gamlen, Cummings and Vaaler, 2017).

1.10.6 Transnationalism

In international migration and diaspora studies, transnationalism or transnational phenomenon refers to the phenomenon of diaspora or HSDs to establish connections between destination and home countries through sustained, long-distanced and border crossing processes, practices, activities and social networks (International Organisation for Migration [IOM], 2010; Faist, 2010, p. 13; Glick Schiller, 2010, 2013; Faist, 2014; Hoo, Zainal and Chai, 2014; Bilecen, Gamper and Lubbers, 2018; Verdery, Mouw, Edelblute and Chavez, 2018).

1.10.7 Global Diaspora Network

Global diaspora network is defined as the locus of migration movements which links countries in the world (Clemens, Ozden and Rapoport, 2014; Danchev and Porter, 2018; Windzio, 2018).

1.10.8 Positional Advantages

Positional advantage is a concept adopted from the social network analysis (SNA). In this study, it refers to the capabilities of ASEAN-5 to gain access to diaspora resources, as conferred by their positions and connectivity in the global diaspora network (Hanneman and Riddle, 2005; Ryall and Sorenson, 2007; Scott, 2012, p. 25; Badi and Diamantidou, 2017; Antinyan, Horvath and Jia, 2019).

1.10.9 Centrality

Centrality is a concept of social network analysis (SNA) which refers to the importance or prominence of a focal node's position relative to other nodes in a network (Prell, 2012, p. 96; Yang, Keller and Zhen, 2017, p. 61; Zhang and Luo, 2017; Borgatti, Everetti and Johnson. 2018, p. 190; Iacobucci, McBride, Popovich and Rouziou, 2018). This study employs centrality concept to measure the positional advantages of a given country relative to other countries in the global diaspora network, in terms of its capabilities to gain access and mobilise the flows of diaspora resources, such as knowledge and economic opportunities.

1.11 Research Strategy

The research is based on the secondary data on the international migration of highly skilled persons between countries. It employs an interdisciplinary approach which integrates knowledge from different fields to solve the research problems. The knowledge fields involved in the research include the neo-classical economic framework on the developmental impacts of HSDs, the social scientists' studies on diaspora transnationalism, the economic theories on the international migration of highly skilled persons, the diaspora engagement strategy and the social network analysis (SNA). The research is carried out in two major parts.

The first part (hereinafter called as PART I) examines the macro-determinants of the spatial distribution of the HSDs of ASEAN-5. Based on the theoretical framework of gravity model (Globerman and Shapiro 2008; Beine, Bertoli and Fernández-Huertas, 2016; Moraga,Ramos, 2016), the macro-determinants composed of six categories: the development gaps between destination countries and ASEAN-5; the economic opportunities in destination countries; the network effects of the existing diasporas; the economic linkages with destination countries, the employment conditions in the destination countries, as well as the geographical, historical and cultural proximity between ASEAN-5 and the destination countries. The investigation of the macro-determinants will provide insights into the motives and expectations of the HSDs to migrate and dwell in a certain destination country. The findings of the macro-determinants will lead to the identification of potential diaspora resources useful for the economic development in ASEAN-5.

The second part of the research (hereinafter called as PART II) establishes ASEAN-5 as nodes in the global diaspora network formed by the highly skilled emigration between countries. The social network analysis method (SNA) is employed to explore: firstly, how ASEAN-5 network positions influence their capabilities to capture the diaspora resources, such as knowledge and economic opportunities from heterogeneous sources of destination countries; and secondly, how ASEAN-5 can leverage on their HSDs to mediate, re-create and disseminate diaspora resources between countries.

By combining the findings of both PART I and PART II, this study explores the potential developmental roles played by the HSDs of ASEAN-5 for their home countries. Such developmental roles include the entrepreneurship which facilitates the integration of home countries into global market; the diaspora networks which transfer the economic opportunities, technology and innovative solutions from developed economies; and promotion of international trades between destination and home countries. Based on the understanding of the potential development roles of the HSDs, this study recommends strategies to engage HSDs more actively and effectively for the economic development of ASEAN-5.

1.12 Contribution to Knowledge

A comprehensive and reliable dataset on the educational or skill levels of international migrants was not available until the publication of DIOC-E

2000 (Release 3.0) in 2010 and DIOC-E 2010 (Release 1.0) in 2017 by the OECD (Dumont, Spielvogel and Widmaier, 2010; Arslan, Dumont, Kone, Özden, Parsons and Xenogiani, 2016). Prior to this, apart from some surveys on the characteristics and migratory motives, there was a lack of quantitative studies on the determinants of the highly skilled emigration from ASEAN-5.

The study attempts to fill the gap by developing an analytical framework which integrates the quantitative studies from two different academic fields, namely the empirical study based on econometric analysis; and the network study based on social network analysis (SNA). The econometric analysis investigates the macro-determinants for the spatial distribution of HSDs from ASEAN-5. The major contribution of the empirical study is to develop a systematic approach to identify the potential diaspora resources of ASEAN-5.

The network study based on SNA further investigates how the diaspora resources can be engaged in the economic development of ASEAN-5. This is accomplished by examining the positions and connectivity of ASEAN-5 in the global diaspora network.

Thus, this study contributes to introduce an interdisciplinary and holistic approach to investigate the diaspora resources and potential developmental roles of the HSDs for their home countries. The innovative approach emphasises on strengthening the flows of knowledge and economic opportunities between ASEAN-5 and other countries through their overseas talents. The study is especially crucial for connecting ASEAN-5 to the exponential progress of 4IR in the developed and emerging economies (Menon and Fink, 2017; Fink and Gentile, 2019).

1.13 Organisation of the Study

Chapter Two reviewed the literature from five related fields. Firstly, it is the neo-classical microeconomic theories on the positive externalities caused by highly skilled emigrants to their home countries. The neo-classical framework is the standard model widely used in economic analysis. The framework is built on the rational choices of economic agents and general equilibrium of the economic system (de Haas, 2014; O'Reilly, 2015; Ehrlich and Kim, 2015; King and Collyer, 2016; Malecki, 2017). The neo-classical economics postulates that the factors which drives the international migration are reciprocal to HSDs' developmental impacts to their home countries (Wickramasinghe and Wimalaratana, 2016; Gheasi and Nijkamp, 2017). The second field discussed in Chapter Two relates to the macro-determinants of the spatial distribution of HSDs. A few types of theoretical frameworks on international migration were discussed. These include neo-classical framework, the push and pull model, the transition migration theory and the gravity model of migration. Justification was provided to support that the gravity equation was the most popular and adequate theoretical framework for the empirical study of international migration. The review also justified that the Poisson Pseudo Maximum Likelihood (PPML) is able to produce robust estimators for the empirical model based on gravity equation. The literature of related empirical studies was reviewed in order to identify the explanatory variables for the model specification.

The third academic field is the social science literature on the transitional phenomenon of diasporas, particularly the transnational linkages through which diasporas participated in the economic development of their home countries (Faist, 2014; 2015). The review highlights three notable transnational networks through which HSDs can contribute to the development of their home countries, i.e. diaspora knowledge network (DKN) (Cheng, 2016), transnational entrepreneurship (Bagwell, 2015) and diaspora search network (Kuznetsov, 2019). The literature of social scientists further supports the notions that the developmental roles of HSDs to their home countries are associated with their migratory motives and expectations.

The fourth type of the knowledge discussed in the Chapter Two is the diaspora engagement policy. The discussion showed that the knowledge on the characteristics of HSDs, particularly their expectations and interests are crucial in achieving a mutually beneficial or win-win diaspora engagement strategy. The literature review also revealed that the knowledge on the diaspora network is important in promoting the knowledge diffusion from HSDs to their home countries.

The final part of Chapter Two discussed the application of social network analysis (SNA) to study the knowledge network and diaspora links. From SNA perspective, the global diaspora network is formed by diaspora links which are also the information conduits between countries. The positions and connectivity of a home country in the global diaspora network affects its capacity in capturing the knowledge and economic opportunities transmitting between countries. The review argued that knowledge on the diaspora network of ASEAN-5 can contribute to the formulation of strategy which captures or mobilises their diaspora resources.

Chapter Three explained the research methodology of the study. The analytical framework of the research synthesises two parts of studies, i.e. PART I and PART II. PART I was the econometric analysis of the macro-determinants of the spatial distribution of the HSDs of ASEAN-5. PART II was the social network analysis (SNA) on the positions and connectivity of ASEAN-5 in the global diaspora network.

PART I presented the model specification, which was built based on the gravity model of international migration. There were six categories of macro-determinants to be investigated, which were the development gaps between destination and home countries; the diaspora network effects; the economic opportunities in destination country; the economic linkages between destination and home countries, the labour market condition in destination country and the control variables for geographical, historical and cultural proximity between destination and home countries.

PART II deliberated on how to utilise the findings from the PART I to recommend diaspora engagement strategies for the ASEAN-5. It designed an exploratory study based on the flow model of SNA (Borgatti, Mahra, Brass and Labianca 2009; Borgatti, Everett and Johnson, 2013, p. 7; Elo, 2015; Malecki, 2017). There were two network dimensions to be investigated. The first network dimension is the positions of ASEAN-5 in the global diaspora network. A family of centrality metrics was used to measure the relative capacity of ASEAN-5 in capturing the flows of knowledge and economic opportunities between countries. The second network dimension is the ego-network of the individual ASEAN-5 country, i.e. the destination countries directly linked (or adjacent) to the individual ASEAN-5 country and the interconnection between them. The brokerage measures are used to explore how ASEAN-5 can mediate the flows of knowledge and economic opportunities between countries in their respective ego-network.

The analysis was carried out and the results are presented in Chapter 4. The analysis of PART I discusses significant estimators and findings for each ASEAN-5 country, the elasticity (or relative importance) of the significant determinants, and the comparison of elasticity magnitudes across ASEAN-5. Explanation was provided for the estimated outcomes and how they were interpreted as potential diaspora resources to be managed by ASEAN-5 home countries.

The analysis of PART II extended the outcomes of PART I. The centrality metrics evaluates and compares the positional advantages of ASEAN-5 in capturing the diaspora resources circulating in the global diaspora network of 2010. The brokerage analysis identifies the destination countries which are highly interconnected with each ASEAN-5 country, and the potential diaspora resources which can be mediated and disseminated by ASEAN-5 between other countries.

Chapter Five concludes the study, which summarises the major research outcomes and proposes potential diaspora engagement strategies of ASEAN-5. The contribution of the study to knowledge field, policy thinking and future study are discussed.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

de Haas' studies on migration and development have derived two major conclusions (2010a, 2010b, 2011, 2014a, 2014b): Firstly, the factors which drive international migration are reciprocally related to the emigrants' economic impacts on their country of origin or sending country. This implies that a better understanding on the macro-determinants of international migration will provide useful insights to promote economically beneficial interaction, exchanges and flows between highly skilled diasporas (HSDs) and their home country (de Haas et al., 2018).

Secondly, de Haas (2010a, 2011, 2014b) and Castles, de Haas and Miller (2014, p. 27) suggested that international migration studies should be interdisciplinary in order to investigate the interplay between various aspects of the migration-development interactions. The analytical framework established for international migration study or diaspora study should integrate the different types of study approaches so as to better understand the problems and to find appropriate solutions.

Thus, this chapter reviews literature from five main aspects pertinent to the research on international migration of highly skilled people and their economic linkages or developmental impacts to the home country. The first part reviews the neo-classical theoretical framework on the migration-development interaction, which reveals the reciprocity between the developmental factors driving the international migration of highly skilled persons and their potential contribution to the economic development of home countries. The second aspect of the literature examines the macro-determinants of international migration of highly skilled people. The review is critical to establish the analytical framework for this research. The focus will be on the neo-classical framework, push-pull model, transition migration theory and gravity model.

The third aspect is the social scientists' studies on the transnational phenomenon of diasporas and their linkages to home countries, such as diaspora knowledge networks (DKNs), transnational entrepreneurship and diaspora search networks. The review aims to identify the transnational networks for HSDs to contribute to the economic development of their home country. The review strengthens the conviction that the types of diaspora linkages and the economic interaction between HSDs and their home country are reciprocally related to the economic opportunities and resources pursued by them in destination countries.

The fourth aspect of the review discusses the contemporary thinking of the diaspora engagement policy. A better understanding on the characteristics of HSDs, such as the macro-determinants of their spatial movements between countries would be important in formulating effective diaspora engagement strategy. The review also highlights the gaps in the contemporary diaspora engagement strategy, which largely ignore the positions and connectivity of home country in the global diaspora network.

The last aspect of the literature review discusses how the centrality measures and brokerage analysis of social network analysis (SNA) can be used to investigate scientific collaboration, knowledge networks and global diaspora network. The literature review shows that the application of SNA can contribute to the formulation of informed strategy for diaspora engagement.

2.2 Neo-classical Growth Model and the Interaction between Migration and Development

The neo-classical growth model on the migration-development interaction has undergone various stages of evolution since the 1960s. The changes are mainly caused by different notions on the avenues through which the migrant or diaspora externalities impact the home country.

2.2.1 Pessimistic Views from the 1960s until Early 1990s

Grubel and Scott's cosmopolitan model (1966) investigated the international migration of highly educated people through a framework of international labour market, which operates under perfect market mechanism and perfect information. At general equilibrium level, the shortage of highly skilled labours in developed countries is satisfied by the immigration of highly skilled persons from developing countries. The developing countries, in turn, receive capital inflows from the developed countries at the equilibrium level. Hence, Grubel and Scott (1966) predicted that the international mobility of highly educated persons is beneficial for both destination and home countries.

However, the optimism of Grubel and Scott (1966) was quickly replaced by the pessimistic view in the 1970s, as a result of the counter example provided mainly by Harris and Todaro (1970) and Bhagwati and Hamada (1974). Harris and Todaro's model (1970) showed that higher incomes and better job prospects abroad will drive the continuous emigration of highly skilled persons, draining the precious human capital from the industrial transformation and modernisation process of low income countries. Bhagwati and Hamada (1974) criticised that the cosmopolitan model of Grubel and Scott (1966) is contradictory to the reality by assuming perfect information and flexible prices in the international labour market. Bhagwati and Hamada's growth model (1974) showed that the emigration of highly skilled people results in higher wages for both highly skilled and low skilled labours in home country through emulation of overseas wages. Consequently, international migration generate detrimental impacts on home economy, in terms of rising unemployment, truncation of innovative human resources, drop in income per capita and the waste of national investment on education. The critics of neo-classical school on the unrestricted international migration went on until early 1990s (Haque and Kim, 1994).

2.2.2 The Emergence of Optimism after Mid-1990s

Three seminal works paved the way for the emergence of optimistic notions on highly skilled emigration after mid-1990s. They are Stark and Bloom (1985), Lucas (1988) and Romer (1990). Stark and Bloom (1985) advocated the ‘new economics of labour migration’ or NELM, stating that an emigrant’s migratory decision is a contractual arrangement with his or her left behind family members, in order to maximise the family’s income portfolio. The contractual arrangement is a kind of linkage which will not only channel financial remittance back home, but also facilitate further migration by mitigating the adaptation costs and employment risks in destination countries. NELM pioneered the academic attempt to explore the role of diasporas in generating positive externalities to their country of origin. It shows that the diasporas can contribute to alleviate the developmental problems in home country, which previously cause them to emigrate. The financial remittances of diaspora contribute to enhance the household incomes as well as raising the standard of living in their home country.

Lucas (1988) pioneered by incorporating human capital accumulation process into the neo-classical growth model. He defined human capital as skill level which increases an individual’s productivity. By establishing human capital accumulation as the engine of growth, his model arrived at two significant conclusions: Firstly, the difference in the income per capita gap across countries is attributed to the different levels of human capital accumulation; and secondly, the difference in human capital accumulation, in turn, is driven by the different exposures to technological progress and learning by doing process. The learning by doing is operated through the interaction between individuals or groups of people. Lucas (1988) elaborated that such interactions include the collaborative research projects or joint business ventures between highly skilled emigrants and their associates or partners in the home country. In the growth model of Romer (1990), the human capital accumulation is endogenised as spill over effects from the innovation activities of monopolistic firms. He showed that the openness to international mobility of human capital is critical for developing countries to benefit from the knowledge accumulation and technological innovation.

2.2.3 New Brain Drain Literature

Romer's theoretical framework (1990) is often modified and extended by economists to argue for the positive externalities of highly skilled emigration on the economic development of home country. The renewed optimism on the highly skilled emigration is also called the 'new brain drain literature' (Brinkerhoff, 2006; Shin and Moon, 2018), which has emerged since the second half of the 1990s and immediately attract academic attention until to-date. The new brain drain literature is founded on the rational choice framework of individual migrants (O'Reilly, 2015). Based on this framework, economists study the mechanism which drives the international migration, the networks formed between destination and home countries, the role of national government in strengthening such networks and the channels through which the diasporas could contribute to the economic development of their home countries (Ehrlich and Kim, 2015; Rapoport, 2016, 2018; Bahar and Rapoport, 2018;)

2.2.3.1 Probabilistic Model of International Migration

The central argument of the new brain drain literature is that decision to emigrate by highly skilled persons is in fact a national choice based on migration prospect. The migration prospect refers to the highly skilled emigrants' *ex-ante* anticipation on the probability or likelihood to obtain overseas employment opportunities and higher expected income. The model developed based on this perspective is generalised as probabilistic migration model (Docquier and Rapoport, 2012; de Haas, 2014b; King and Collyer, 2016).

Mountford (1997), Stark, Helmenstein and Prskawetz (1997), Dos Santos and Postel-Vinay (2003), Clemens (2015), Kouni (2016), Fan and Li (2018) and Idu (2019) show that the migration prospect also incentivises those remained in home countries to invest on human capital, such as higher education and skill training. Vidal (1998), Beine, Docquier and Rapoport (2001), Docquier and Rapoport (2012) and Fan and Li (2018) further show that the human capital accumulation stimulated by migration can contribute to extricate the home country from the underdevelopment trap.

Stark, Helmenstein and Prskawetz (1997), de Haas (2010a), Docquier and Rapoport (2012), Freguglia, Goncalves and Silva (2014) and Kerr, Kerr, Ozden and Parsons (2017) elucidated that the migration prospect could be viewed as the propensity to emigrate, which indicates the likelihood to emigrate. The migration propensity to emigrate differs with respect to the skilled levels of population. The highly skilled people tend to have a higher propensity to emigrate as they are relatively mobile and adaptive to new working environment, accessible to greater employment opportunities and welcome by the selective immigration policy of destination countries.

2.2.3.2 Highly Skilled Emigrants and Economic Linkages to Home Countries

The probabilistic model is a paradigm change in neo-classical literature on the developmental impacts of highly skilled migration. It shows that international migration of highly skilled people is not necessarily detrimental but beneficial to the economic development of the home countries. The human capital accumulation induced by the highly skilled emigrants implies the existence of economic linkage between HSDs and their home countries (Clemens, 2015; Kouni, 2016; Fan and Li, 2018; Idu, 2019). The positive externalities of HSDs on their home countries corroborate the arguments of Czaika and de Haas (2014), de Haas (2010a, 2010b, 2011, 2014a, 2014b) and de Haas et al. (2018) on the reciprocal relationship between migration and development.

2.2.3.3 Diaspora Networks and the Economic Development of Home Countries

Hoon and Quan (2003) constructed a theoretical model to explain how the networks with the HSDs in Silicon Valley had contributed to the rise of ICT industry in Taiwan since the 1970s. They incorporated policy parameters in the endogenous growth model driven by knowledge accumulation. The policy parameters indicate the efforts of public and private institutions in home country to strengthen the networks with diasporas residing in developed countries. The stronger the diaspora networks, the higher the intensity of knowledge spill over from developed countries, which stimulate rapid knowledge accumulation in the developing countries. The economic catching up of developing countries would eventually induce the returning of emigrant talents, bringing with them the new skills and knowledge which further accelerate the technological convergence with the developed countries. Hoon and Quan (2003) highlighted that the national efforts in strengthening the diaspora networks are essential in knowledge transfers from developed countries.

Docquier and Rapoport (2012) modelled the economic dynamics of the home country which is driven by the interaction between international labour market and its investment decision on human capital. Their model is a meaningful contribution to the literature as it describes how HSDs can influence the balanced growth path of the home country through diaspora networks. Apart from the conventional inducement to human capital accumulation, their model showed the knowledge spill over facilitated by diaspora networks bridging destination and home countries (Rapoport, 2016; 2017).

Docquier and Rapoport (2012) and Rapoport (2016, 2017) identified two major channels through which HSDs living in advanced countries could positively impact the economic trajectory of the home country. The first channel is driven by two effects, i.e. the conventional incentive effect of migration prospect p on human capital accumulation and the technological spill over through diaspora network. The latter is facilitated by the technological linkages between HSDs residing abroad and the population remaining in the home country.

The second channel of diaspora externalities is also driven by two effects. Firstly, the increase in p induces more investment in human capital, which increases the skill levels of the population and thus alleviates the risk of doing business with the home country. Secondly, the higher p results in larger size of HSDs, who form stronger networks with the highly skilled persons in the home country. The stronger diaspora networks contribute to reducing the risk premiums for doing business with the home country.

Docquier and Rapoport's contribution (Docquier and Rapoport, 2012; Rapoport, 2016, 2017, 2018) is to show that the diaspora networks offer potential solutions for the developmental problems of the country of origin, such as shortage of human capital, low innovation capability, slow adoption of new technology and weak connection to the global supply chain (World Bank, 2011, p. 134-137; Kone and Ozden, 2017). More importantly, their model further corroborates that the developmental impacts or externalities of HSDs are closely related to the developmental gaps which previously drive their emigration.

Bénassy and Brezis (2013) endogenise the highly skilled emigration with the innovation activities and profit maximisation process of firms in the home country. They found that other than the inducement of human capital accumulation, the HSDs can benefit their home country through cross border knowledge spill overs and other economic activities engaged with the home country. Based on their findings, Bénassy and Brezis (2013) suggested that policy makers should play an active role to reconnect and engage the HSDs, in order to facilitate the economic interactions between HSDs and the home country.

2.2.4 Empirical Evidences on the Developmental Impacts of HSDs

The theoretical findings as discussed above are substantiated by empirical studies on the various types of developmental impacts of HSDs, such as the human capital accumulation, international trades, investment and technological innovation.

2.2.4.1 Inducement on Human Capital Formation

Beine, Docquier and Rapoport (2001, 2003, 2008), Docquier (2014) and Rapoport (2016, 2017, 2018) found evidence that HSDs could contribute significantly to the human capital accumulation of developing countries, especially those with large population size, such as China, India, Pakistan and Brazil. A small increase in the migration prospect in these populous countries tends to induce a relatively large investment in human capital, as compared to less populous countries. Similarly, Gibson and Mckenzie (2014) and Rapoport (2017) provided empirical evidences that international migration of highly skilled persons have induced higher human capital formation in countries of origin, regardless of their development levels.

2.2.4.2 Contribution to the Bilateral Trades and Cross-Border Investments of Home Countries

Gould (1994) and Head and Ries (1998) have showed that the HSDs living in US and Canada had significantly contributed to the bilateral trades of their country of origin. They explained that the immigrants' familiarity with the overseas markets empowered them to facilitate the international trades between destination and home countries.

The studies of Rauch and Trindade (2002) focused on the wide dispersion of Chinese diasporas around the world. They discovered strong evidence for the instrumental role of Chinese diasporas in promoting trades between destination and home countries. Rauch and Trindade (2002) posited that Chinese diasporas are the nodes interconnecting the countries in the world. Such networks are information conduits to facilitate overseas Chinese entrepreneurs in identifying and capturing business opportunities around the world. The meta-analysis conducted by Genc, Gheasi, Nijkamp and Poot (2012) based on 48 previous studies further substantiated the positive impacts of international migration on both export and import between destination and home countries. Ratha, Mohapatra and Scheja (2011), Genc (2014) and Rapoport (2016, 2017; 2018) also found empirical evidences that diasporas are instrumental in reducing the business costs for the bilateral trades between their destination and home countries, particularly in international trades between developing countries and advanced economies.

Docquier and Lodigiani (2006) investigated the impacts of migrant networks in promoting cross border investment. They estimated two models, a cross section model based on data of 114 countries for the period 1990-2000, and a panel model covering 83 countries and four periods of five years. Both empirical models showed that the HSDs have contributed significantly to the investment in home countries. In addition, Murat and Pistoresi (2009) showed that the emigrants of Italy had significantly promoted both inward and outward foreign direct investments (FDIs) of their home country. The study of Rapoport (2016, 2017, 2018), Gheasi and Nijkamp (2017) and Kone and Ozden (2017) further demonstrated that highly skilled immigrants in advanced countries had positive and significant impacts on the FDI inflows of their countries of origin.

2.2.4.3 Impacts on the Knowledge Flows and Innovation Activities of Home Countries

Agrawal, Kapur, Mchale and Oettl (2011) and Docquier and Rapoport (2012), Clemens (2015) and Kone and Ozden (2017) investigated the linkages between emigrant Indian innovators and the innovation and invention activities in home country. They noted that India have benefited significantly from the knowledge spill over through diaspora network.

Gibson and McKenzie (2014) found that highly skilled emigrants from New Zealand, Papua New Guinea and Tonga had become more productive in scientific output than those who stayed in the home countries. In addition, the highly skilled emigrants had transferred knowledge and innovation outcomes between their destination and home countries. Similarly, Ratha, Mohapatra and Scheja (2011), Gibson and McKenzie (2014), Breschi (2015), King and Collyer (2016), Kone and Ozden (2017), Rapoport (2016, 2018) had also found evidences for diasporas serving as links to channel overseas knowledge which improved the business performance and technology of their home countries.

2.2.5 Summary

The neo-classical models on the migration-development interaction show that the developmental factors driving the international migration of HSDs are reciprocal to their developmental contribution to home countries.

Such positive externalities, which include access to overseas markets, international trade opportunities and technological know-how, are channelled through diaspora networks forged by the HSDs between destination and home countries. The neo-classical economists also stated that the national efforts in engaging the HSDs can increase the economic and technological transfers through the diaspora networks. The reciprocity in the migration-development interaction shows that it is essential to study the driving forces for the spatial distribution of HSDs, in order to identify the diaspora resources which can be tapped by home countries.

2.3 The Macro-determinants of the Spatial Distribution of HSDs

This section reviews the literature on the macro determinants of the spatial distribution of HSDs. A better understanding on the distributional patterns of highly skilled emigrants is vital in understanding the potential diaspora resources. The section discusses important theoretical frameworks which are pertinent to the construction of the empirical model used in the study, particularly the dependent and independent variables to be included in the empirical model, and the estimation methods to be used.

The review is based on the framework of push-pull model, neo-classical microeconomic theories and gravity model for migration. The review also discusses the transition migration theory of de Haas (2010a, 2010b, 2014b; de Haas et al., 2018), as it would provide meaningful insights for the direction of the empirical study and the interpretation of the estimation outcomes.

2.3.1 Push-Pull Model

Lee's push-pull model (1966) is influential in studying the driving forces of migration. The analytical framework indicates that migration occurs because of i) pull factors in the destination area, ii) push factors from the area of origin, iii) intervening obstacles between the destination and origin, mainly the geographical distance and transportation costs and iv) personal factors of the migrants. Lee argued that in every location, there are factors which attract people to it, push people from it or retain people in it, which are labelled as plus (+), minus (-) or zero (o) effect respectively. Lee stated that migration will takes place between the two areas if the plus factors are more than the minus factors. However, de Haas (2010b, 2018) criticised that the push-pull model is not a structural framework to study migration. It is just a juxtaposition of the already known facts about international migration. The push-pull model also has its methodological issue as it does not differentiate between macro or micro level factors. In empirical study based on econometric model, the inclusion of both macro and micro level determinants might result in reverse causality and endogeneity problem.

Nevertheless, the push-pull model provides some meaningful insights on the patterns of international migration of highly skilled individuals. It shows that cross border migration happens as long as the attractiveness, such as job opportunities and career prospects in destination country are higher than the country of origin. Hence, it corrects the misconception that highly skilled emigration happened mostly from poor to rich countries. In fact, it could occur between any two countries regardless of their development levels (Czaika and de Haas, 2014; de Haas, 2010a, 2010b, 2011; de Haas et al., 2018).

2.3.2 Neo-classical Theory of International Migration

The root of the neo–classical framework can be traced back to Ravenstein' works (1885) concerning the spatial movement of people between regions and towns in the England in ninetieth century. He pioneered in formulating the laws of migration, which stated that the major causes for the spatial movement of people are difference in geographical, demographical and economic factors, for examples, the geographical distance, travelling costs, population sizes, commercial activities, urbanisation and advancement in transport technology (de Haas, 2010a; 2014; O'Reilly, 2015; Gheasi and Nijkamp, 2017). Ravenstein (1885) also insightfully showed that migration movements are highly patterned and clustered at destinations with large population or higher level of industrial activities. He also advocated that advancement in transport technology promotes migration (Czaika and de Haas, 2014; O'Reilly, 2015).

The contemporary neo-classical framework, which is an extension of the work of Harris and Todaro (1970) is more refined and comprehensive than Ravenstein's work (1885). It is developed based on the equilibrium analysis, which shows that the development gaps between countries, such as difference in wages or incomes, employment opportunities, living standards and technology caused disequilibrium in the international labour market. The country with a higher ratio of highly skilled workers to capital has lower average wages and lesser career opportunities, which induce talent outflows to capital intensive countries. The equilibrium framework has strong influence on the policy formulation until the 2000s. It is believed that the improvement in the economic conditions will stop or reverse the exodus of highly skilled workers from home countries (Massey, Arango, Hugo, Kouaouci, Pellegrino and Taylor, 1993; de Haas, 2005, 2014).

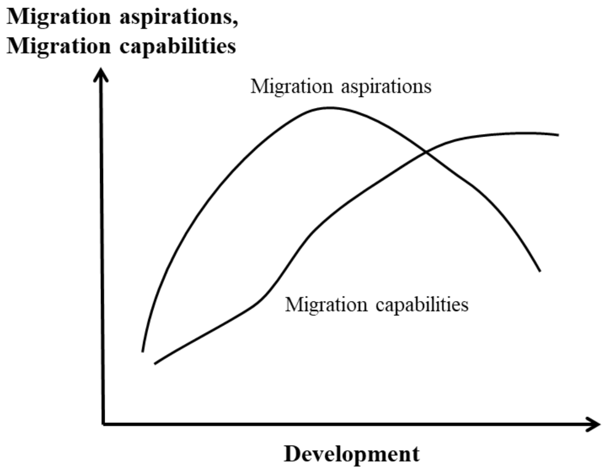
de Haas (2010a, 2010b, 2014) pointed out that the reciprocal relationship between causes and impacts of highly skilled emigration is often overlooked by researchers of both economic and social sciences. The study on the causes and impacts of highly skilled emigration is often perceived as two fragmented and unrelated fields. Some policy makers and economists tend to assume that highly skilled emigration could be stopped or alleviated if the economic conditions are improved (de Haas et al., 2018). However, de Haas (2010a, 2010b, 2014), Keusch and Schuster (2012) and de Haas et al. (2018) criticised this view by showing that international migration can increase with the development status of the home country.

2.3.3 Transition Migration Theory

de Haas (2010a, 2010b, 2011, 2014) constructed the transition migration framework to further his argument on the reciprocal relationship between migration and development (de Haas et al., 2018). He argued from a interdisciplinary viewpoint in order to obtain holistic insights from the different aspects of migration-development interaction. His conceptual framework is a synthesis of neo-classical framework, push-pull model, transnational framework of diaspora study and Zelinsky's (1971) spatio-temporal process of human mobility (de Haas, 2010a, 2010b, 2011, 2014).

According to de Haas (2010a, 2010b, 2011, 2014), the highly skilled emigration is one of the processes of economic evolution. The highly skilled persons' decision to emigrate is affected by two factors, namely migration aspirations and migration capabilities, both are functional to the development process of the home country. The former is the highly skilled individual's willingness and desire to migrate, and expectation for overseas career opportunities. The latter is his or her capabilities to emigrate, including financial resources, international mobility and adaption to the foreign environment.

As shown in Figure 2.1 below, when the economic development of the home country is moving up from a very low level, the migration aspirations and migration capabilities increase simultaneously. The increase in the migration capabilities is caused by better education and higher incomes. In addition, the population will receive more information about income levels and career opportunities abroad, either through various types of media or the social networks connected to their overseas diasporas. This contributes to higher aspiration for migration. When the development level of the home country continues to advance further, the migration capabilities continue to increase but at a decreasing rate due to the effects of diminishing marginal return. However, as the gap of economic opportunities between destinations and the home country is narrowing, the migration aspirations of the population eventually decline.

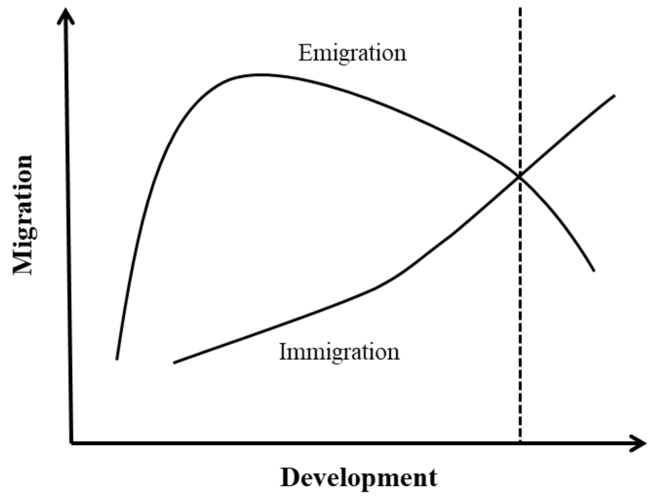


Sources: de Haas (2010a, 2010b, 2011)

Figure 2.1: Migration Aspirations and Capabilities

The interaction of these two effects resulted in a 'migration hump' phenomenon, which is graphically depicted as an inverted U-shape relation between migration and development (See Figure 2.2 below). Figure 2.2 describes that initially the highly skilled emigration increases with the development level in the home country. The growing size of HSDs abroad can further stimulate the economic development of the home country through their positive externalities. However, after the home country passes through a certain level of development, the opportunities in home country are higher than those available aboard. This is when the international migration reaches its peak and starts decreasing. The existence of migration hump in developing countries was empirically observed by Martin (2000), Widgren and Martin

(2003), International Organisation for Migration (2003, p. 148; 2014, p. 37), Czaika and de Haas (2014), de Haas (2014) and King and Collyer (2016).



sSources: de Haas (2010a, 2010b, 2011)

Figure 2.2: Migration Hump

As stated by de Haas (2010a, 2010b, 2011, 2014), the migration transition theory is a conceptual framework which is not yet truly developed and formalised. However, de Haas had pointed out that the empirical study based on the neo-classical model must avoid falling into the wrong perception that international migration occurs only between poor country and developed or rich nation. The international migration is an integral part of the development process and it could happen at all development levels of the home country. Hence, de Haas had purported an important insight which is relevant to this study: the international migration of highly skilled individuals is not only driven by the development differentials such as income gap and technological gap, but also the gap in the job or career opportunities between destination and home countries. Another important insight of de Haas (2011) is that the migration flows tend to spatially concentrating along the migration corridors or pathways between destination and home countries. The existence of such patterned migratory flows was also confirmed by Engbersen, Bakker, Erdal and Bilgili (2014) and Artuc, Docquier, Özden and Parsons (2015). It is important to differentiate between factors which caused the highly skilled emigration and those which determine the spatial distribution of the HSDs. These two kinds of studies are different as the former tries to answer what caused the highly skilled individuals to emigrate; the latter is to investigate the factors which make them to choose a particular destination. The difference in the concepts will have different impacts on the choice of empirical model and dependent variables.

2.3.4 Gravity Model of International Migration

2.3.4.1 The Origin of Gravity Model

The gravity model is commonly used in the empirical studies for international trades, international migration and other types of economic flows between geographical regions (Anderson and Wincoop, 2003; Starck, 2012; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Rapoport, 2016). Its origin can be traced back to the law of universal gravitation in physics, which was developed by Isaac Newton (Starck 2012; Rodrigue, Comtois and Slack, 2013, p. 343-344; OECD, 2016, p. 248; Poot, Alimi, Cameron and Mare, 2016; Ramos, 2016; Ramos and Suriñach, 2017; Draženović, Kunovac and Pripužić, 2018). In physics, the gravitational force F_{ij} which attracts two bodies to one another is described in the following equation:

$$F_{ij} = G\frac{M_i M_j}{d_{ij}^2} \tag{2.5}$$

F_{ij} is proportional to the product of the masses M_i and M_j of the two bodies, and inversely proportional to the square of the distance between them. G is a gravitational constant which is empirically calibrated (Rodrigue, Comtois and Slack, 2013, p. 343-344; Ramos, 2016).

2.3.4.2 Adoption of Gravity Model in International Economics

The gravity equation has been adopted and modified by economists, and widely applied in the studies of international economics (Greenwood, 2005; Starck, 2012; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Anderson, 2016; Draženović, Kunovac and Pripužić, 2018). Its functional relation resembles the bilateral movements of goods, capital and factor of productions between countries. The gravity equation used in the empirical study of international migration takes the following nonlinear or multiplicative form (Greenwood, 2005; Lewer and van den Berg, 2008; Starck, 2012; Anderson, 2016; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016):

$$M_{jk} = \alpha\frac{(P_j \cdot P_k)^{\beta_1}}{d_{jk}^{\beta_2}}\eta_{jk} \tag{2.6}$$

Equation (2.6) relates the number of migrants originated from country j to country k as proportional to the product of the population sizes of the two countries, i.e. P_j and P_k and inversely proportional to the geographical distance d between them. The geographical distance is an approximation for the migration costs between the two countries. The α, β_1 and β_2 are unknown parameters to be estimated empirically, whereas the η_{jk} is an error term assumed to be independent of the explanatory variables. As the gravity equation is a multiplicative model with constant elasticity, the coefficients of β_1 and β_2 also represent the elasticity.

2.3.4.3 Economic Foundation of Gravity Model and Concept of Multilateral Resistance

The gravity equation (2.6) is capable of producing high goodness of fit for data in the empirical studies of international economics. This advantage is always highlighted in literature but its theoretical foundation had been overlooked for the past few decades until early 2000s (Starck, 2012; Poot, Alimi, Cameron and Mare, 2016). The effort to construct a theoretical foundation for the economic application of gravity equation began with Anderson (1979), which was further developed by Anderson and van Wincoop (2003, 2004), then improved by Bertoli and Fernández-Huertas Moraga (2013) and Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016) and Anderson (2011, 2016), The theoretical foundation of gravity model as built by Anderson (1979, 2011, 2016) and Anderson and van Wincoop (2003, 2004) was based on the general equilibrium framework of microeconomics. Anderson and van Wincoop (2003, 2004) and Anderson (2016) criticised that the traditional gravity equation was wrongly specified as it did not take into account the multilateral resistance terms. The concept of multilateral resistance could be explained as follows: a potential emigrant from country *j*, in this case a highly skilled labour, chooses his/her migratory destination from a set of potential destination countries. The potential migrant's utility function is composed of the 1) attractiveness of the alternative destination countries, such as market opportunities and development levels; and 2) his/her individual specific preference. Thus, the objective of the potential emigrant is to maximise his/her utility function by choosing a country *k* from the alternative destinations. At aggregate level, it can be described as country *j* sends emigrants to country *k* after considering the expected returns from all other destinations, which is called the outward resistance. Conversely, the destination country *k* pulls immigrants from country *j* if its attractiveness exceeds other destination countries, which is called as inward resistance (Shepherd, 2013). By aggregating the individual emigrant's utility function and each country's demand for immigrant labours respectively, Anderson and van Wincoop (2003, 2004) constructed the aggregate labour supply and demand functions. The general equilibrium of the aggregate supply and demand functions produces a new function of M_{jk} which could be generalised to resemble the gravity equation (2.6). Anderson and van Wincoop (2003, 2004) and Anderson (2016) called their gravity equation as the structural gravity equation, in order to differentiate it from the traditional gravity equation which does not take into account the influence of multilateral resistance terms, both outward and inward resistance (Santos Silva and Tenreyro, 2006; Arvis and Shepherd, 2013; Shepherd, 2013; Bertoli and Fernández-Huertas Moraga, 2013; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016).

In the latest development, Bertoli and Fernández-Huertas Moraga (2013) and Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016) showed that the gravity model for international migration behaviour at macro level can be derived from an individual's migration decision problem, which is described by the random utility model (RUM) (Ramos, 2016). RUM demonstrates how individuals choose their migratory destination in order to maximise their utility (Ramos, 2016). The RUM constructs the utility function of a prospective emigrant from country of origin j in two components, a deterministic component and an individual specific stochastic term. The distributional pattern of the stochastic term influences the prospective emigrant's behaviour in opting for a particular destination country k to maximise his utility. Beine, Bertoli and Fernández-Huertas Moraga (2014) assumed that the stochastic term obeys an independently and identically distributed (idd) Extreme Value Type-1 distribution (McFadden, 1973, 2001; Docquier and Machado, 2015). Based on this construct, they derived a function of migration stock which resembles the gravity equation (2.6).

The micro-economic foundation built by Anderson and van Wincoop (2003, 2004), Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016) and

Anderson (2016) showed that the gravity model in economic study is not merely an analogy to the Newton's law of universal gravitation. Instead, the core equation of the gravity model shows how the attractiveness between countries, such as the difference in economic scales and development levels promotes the spatial movements, and how the costs of international movement, which is approximated by the geographical distance could impede the movements (Ramos, 2016; Poot, Alimi, Cameron and Mare, 2016).

2.3.5 Analytical Framework for the Empirical Studies Based on Gravity Model

Since the 2000s, there has been a rising interest on the macro-determinants of the international migration of highly skilled persons. This is partially due to the availability of more comprehensive and harmonised data on the bilateral migration between countries in the world, especially the information on the education levels of the migrants. The latest of such datasets is DIOC-E 2010 (Release 1.0), compiled by the cooperation between the OECD and the World Bank based on the national census in destination countries. The availability of more reliable dataset has permitted in-depth studies in this field to be carried out.

Another reason for the escalating interest in the international migration of highly skilled persons is the increasing acceptance of augmented gravity model as the appropriate theoretical framework for the empirical study. The gravity equation (2.6) can be augmented by other macro-determinants which influence the international migration of the HSDs (Burger, van Oort and Linders, 2009; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Ramos, 2016; Wajdi, Adioetomo and Mulder, 2017).

2.3.5.1 Population Size and Geographical Distance

Equation (2.6) shows that potential migrants from country *j* are attracted to country *k* by the pull factors in country *k* and expelled by push factors in country *j* (de Haas, 2014b). The pull and push factors of country *j* and *k* are usually approximated by their population sizes P_j and P_k. The underlying economic argument is that the larger the population size in the destination country *k* (i.e. P_k), there are more career and business opportunities to offer to the immigrants. Conversely, the larger the population size in the country of origin *j* (i.e. P_j), especially if it is in the developing stage, the pressure in job market is higher and there are fewer career opportunities for those who do not migrate (Lewer and van den Berg, 2008; Ramos, 2016; Yau and Zhou, 2018).

Equation (2.6) also shows that the attraction forces of economic opportunities in destinations would be discounted or impeded by the geographical distance between destination and home countries. In the gravity model based on microeconomic foundation, i.e. RUM model, the geographical distance represents the negative influence of migration costs on the choice of destinations by HSDs (Beine, Noël and Ragot, 2014; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Ramos, 2016).

2.3.5.2 Existing Diasporas in Destinations and Diaspora Networks

Beine, Docquier and Ozden (2009), Beine, Docquier and Ozden (2011a, 2011b), Docquier and Rapoport (2012) and Beine, Bertoli and Fernández-Huertas Moraga (2014; 2016) stated that the existing diasporas in destination would generate network effects which attract more emigrants from the home countries. According to Beine, Docquier and Ozden (2011a, 2011b) and Beine, Bertoli and Fernández-Huertas Moraga (2014; 2016), the existing diasporas in the destination country may maintain close ties with their home country through family kinship, financial remittance, business linkages, professional and scientific networks. Such linkages serve as information channels for the prospective emigrants in the home countries, providing them the valuable information pertaining to the employment opportunities, career prospects, business intelligence, social environment and living costs in the destination countries (Rapoport, 2016). Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016), Fok, Cheng and Tan (2018) and Van Hear, Bakewell and Long (2018) stated that the existing diasporas could help the highly skilled emigrants to locate career opportunities and reduce business risks. Hence, intuitively, the larger the diaspora size in a given destination country, there will be greater pulling power on the prospective emigrants from the home country.

2.3.5.3 Development Gap

The development gap between countries is recognised by neo-classical economists as one of the major drivers for international migration of highly skilled persons (de Haas, 2014a, 2014b; 2018; Van Hear, Bakewell and Long, 2018). The higher level of development in destinations implies higher average wages and larger economic opportunities to be acquired by highly skilled emigrants from countries of origin (Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016).

In the neo-classical framework of international migration, the development gap is normally represented by the income gap between destination and home country. The most common measurement of income gap in empirical studies is the ratio of GDP per capita between destination and home country (Globerman and Shapiro, 2008; Ramos, 2016; Ramos and Suriñach, 2017; Wajdi, Adioetomo and Mulder, 2017)

2.3.5.4 International Trade Volumes of Destination and Home Countries

According to Globerman and Shapiro (2008), Campaniello (2014) and Jut (2015), the international trades could drive international migration of highly skilled persons between countries. Globerman and Shapiro (2008) stated that the global expansion and networks of the transnational corporations (TNCs) are one of the primary forces driving the highly skilled emigration. The transnational transfer of information, business resources and expertise between the affiliates of TNCs is accompanied by the cross-border deployment of highly skilled workers. Thus, Globerman and Shapiro (2008) suggested that there is a complementarity between the international trades of MNCs and the direction of the highly skilled emigration.

Campaniello (2014) and Jut (2015) explained the complementary relationship between trades and international migration based on the supply and demand for labours between countries. International trade creates development gap between countries. The highly skilled emigrants would choose countries which import substantially from their home countries as migratory destinations. The complementary relationship of migration and international trade exists especially between developing home countries and developed destinations (Campaniello, 2014).

Jut (2015) further elaborated that the trade relationship between two countries will increase the understanding and familiarity of each other's business culture, socio-economic environment and employment market. Thus, a strong trade relationship between countries would facilitate the highly skilled migration by reducing migration and adaptation costs.

2.3.5.5 Innovation Levels of Destination and Home Countries

Globerman and Shapiro (2008), Nica (2015), Ramos and Suriñach (2017) and Simpson (2017) stated that innovation activities in destinations could have positive influence on the highly skilled immigration. The destination countries with high level of innovation activities provide career opportunities in research, development and commercialisation. Similarly, Bhumiratana, Songkasiri, Commins and Grimley (2009), Weng and Chanwong (2016), Caunan (2017) and Darsono (2017) stated that the gap in technological innovation is one of the factors for highly skilled emigration from developing countries to advanced economies.

2.3.5.6 Free Trade Agreement between Destination and Home countries

Economists found that regional trade agreement (RTA) or bilateral free trade agreement (FTA) could have positive influence on the highly skilled emigration between member countries (Otten, 2013; Ramos, 2016). The FTAs will strengthen the economic ties between member countries, which in turn deepen their highly skilled persons' knowledge on each other's socio-economic conditions, business practices and employment opportunities. Thus, FTA can mitigate the migratory costs and uncertainty for highly skilled emigrants (Globerman and Shapiro, 2008; Jut, 2015). In addition, FTAs normally include terms which facilitate the mobility of professional workers between signatory countries (Globerman and Shapiro; Docquier, Peri and Ruyssen, 2014).

2.3.5.7 Colonial Links between Destination and Home countries

The strong historical and economic links usually exist between an independent nation and its former colonising country. The colonial links promote economic cooperation and facilitate highly skilled emigration from developing countries to their former colonising countries (Beine, Bertoli and Fernández-Huertas Moraga, 2016; Ramos, 2016). In empirical studies, the existence of colonial link between destination and home countries is normally represented by a dichotomous dummy variable (Dumont, Spielvogel and Widmaier 2010; Beine, Docquier and Ozden, 2011a; Docquier, Peri and Ruyssen, 2014; Jut 2015).

2.3.5.8 Cultural Proximity between Destination and Home countries

Economists posit that cultural proximity or cultural links could facilitate international migration between countries (Van Hear, Bakewell and Long, 2018). The cultural proximity, such as linguistic affinities, similar traditions and shared social norms would reduce the migration costs and risks for potential highly skilled emigrants (Docquier, Peri and Ruyssen, 2014; Beine, Bertoli and Fernández-Huertas Moraga, 2016; Wajdi, Adioetomo and Mulder, 2017). Dumont, Spielvogel and Widmaier (2010), Otten (2013) and OECD (2016, p. 41) further stated that the HSDs' language proficiency is crucial for them to obtain professional occupations in the destination countries.

2.3.5.9 Immigration Policies of Destination Countries

The influence of immigration policies on the choices of destinations by highly skilled emigrants has been highly debated (de Haas, Natter and Vezzoli, 2015, 2018; de Haas et al., 2018). The main focus of the debate was on how to measure or quantify the impacts of immigration policies implemented by various countries. The absence of a standardised and widely accepted measure has impeded the efforts to compare the impacts of immigration policies on international migration, resulting in the limited number of empirical studies in this aspect (Beine, Bertoli and Fernandez-Huertas Moraga, 2014; de Haas, Natter and Vezzoli, 2015, 2018).

According to de Haas, Natter and Vezzoli (2015, 2018), it is difficult to measure and compare the impacts at a particular point of time due to the diverse and complex nature of immigration policies in different countries. Instead, they studied the evolution of immigration polices based on the DEMIG POLICY dataset published by the International Migration Institute (IMI) (DEMIG, 2015), which tracks the changes in immigration policies for 45 countries between 1990 and 2014. The investigation of de Haas, Natter and Vezzoli (2015, 2018) had produced two significant findings on the evolution and current status of the immigration policies by advanced and emerging economies.

Firstly, de Haas, Natter and Vezzoli (2015, 2018) found that immigration policies in most countries have become less restrictive but more selective since 1945 (de Haas, Natter and Vezzoli, 2015, 2018). The contemporary immigration policies, particularly in advanced countries are more positive or encouraging to the highly skilled immigrants. The relaxation is caused by the escalating global competition for talent (OECD, 2008, p. 127-136; Beine, Docquier and Özden, 2011b; Ghani, 2018). Secondly, de Haas, Natter and Vezzoli (2015, 2018) showed that the existing immigration restrictions such as VISA regimes, border controls, restriction on irregular immigrants and family migrants are mainly aimed at low skilled immigrants, illegal immigrants and asylum seekers.

The above findings can be further elaborated by the empirical studies of Ortega and Peri (2012) and Docquier, Peri and Ruyessen (2014). They investigated how the immigration policies, such as the relaxation of immigration laws and VISA waiver influenced the emigrants' choice of destination countries. Due to the absence of generally accepted measures or indicators for immigration policies, the researchers had to construct *ad hoc* indicators based on their own observations and judgements. Ortega and Peri (2012) measured the impact of the immigration policies of 15 OECD destination countries on the immigrants from 120 countries of origin from 1980 to 2006. They found that a tighter immigration entry requirement did have negative impacts on the immigration flows, regardless of their skill or education levels.

However, in the later study by Docquier, Peri and Ruyssen (2014) based on the highly skilled immigrants to OECD countries in 2000 and 2010; it was found that the immigration policies had insignificant impact on the choice of destination counties. The finding of Docquier, Peri and Ruyssen (2014) has substantiated the claims made by de Haas, Natter and Vezzoli (2015, 2018) that the recent immigration controls implemented by various countries are mainly targeted at the low skilled immigrants, illegal worker, human trafficking, refugees or asylum seekers. Most countries, especially the advanced and emerging economies have open their door to the highly skilled immigrants in order to fill the human capital gap since 2000s (Arslan, Dumont, Kone, Ozden, Parsons and Xenogiani, 2016; Kone and Ozden, 2017).

Thus, based on the literature review, it can be concluded that it is reasonable to exclude immigration policies of destination countries as a determinant for the spatial distribution of the HSDs from ASEAN-5. It is due to the lack of practical and standardised measures for the immigration policies, as well as the fact that such immigration policies are not targeted at highly skilled immigrants. Although immigration policies might be selective for the types of expertise, it is impossible to examine the exact impacts due to the unavailability of HSD dataset based on detailed expertise classification (Arslan, Dumont, Kone, Ozden, Parsons and Xenogiani, 2016).

2.3.6 Econometric Issues and Poisson Pseudo Maximum Likelihood

The seminal work of Santos Silva and Tenreyro (2006) highlighted a critical econometric issue caused by the effects of multilateral resistance in the empirical study of international migration (Anderson, 2016; Beine, Bertoli and Fernández-Huertas Moraga, 2016). Santos Silva and Tenreyro (2006) criticised the conventional practice of transforming gravity equation into a log-linear form and estimating with OLS or Tobit method. They pointed out that there is inherent heteroscedasticity in the international migration data due to the effects of multilateral resistance, which result in reverse endogeneity in the estimated equation.

Santos Silva and Tenreyro (2006) showed that the heteroscedasticity is exacerbated by the problem of Jensen's inequality. The Jensen's inequality implies that $E(\ln y) \neq \ln E(y)$ or the expected value of the logarithm of a random variable is different from the logarithm of its expected value. Assuming that in a gravity equation, the dependent variable y is randomly distributed, the application of log-linear $\ln(y)$ and OLS method will generate a conditional mean of $\ln y$ which is dependent on the probability distribution of y. However, the inherent heteroscedasticity in the distribution of y is confounded by the estimated $\ln y$, until its pattern is unable to be recovered by a robust covariance matrix estimator (Santos Silva and Tenreyro, 2006; Arvis and Shepherd, 2012; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016). Consequently, the log-linear and OLS method would produce biased and inconsistent estimators (Burger, van Oort and Linders, 2009; Shepherd, 2013; Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Wajdi, Adioetomo and Mulder, 2017).

Santos Silva and Tenreyro (2006) suggested that the estimation of a gravity model must be performed using a method which is robust to a wide range of heteroscedasticity problems. They found that the Poisson pseudo maximum likelihood (PPML) can fulfil the requirement of efficient, unbiased and consistent estimators, as long as the conditional mean of the dependent variable y is correctly specified (IHS Markit, 2017, p. 380; Wajdi, Adioetomo and Mulder, 2017). Santos Silva and Tenreyro (2006) showed that the correct specification of the conditional mean is $E\,[y_i/x_i] = \exp(x_i\beta)$ instead of the linear function of $E\,[\ln(y_i/x_i)]$, which causes the problem of Jensen's inequality. Hence, the PPML estimates the gravity equation in the multiplicative or nonlinear form instead of the log-linear function. Given that the conditional mean is correctly specific, the maximum likelihood (ML) method is able to produce consistent estimation for the parameters even if the distribution of errors is incorrectly specified and not normal (Santos Silva and Tenreyro, 2006; Quantitative Micro Software, 2010, p. 289; IHS Markit, 2017, p. 380).

The PPML method is often used for dependent variables measured as count data. This is appropriate for the gravity equation where the dependent variable, such as diaspora stocks and trade flows are either measured in whole numbers or integers or approximated to integers. Santos Silva and Tenreyro (2006), Burger, van Oort and Linders (2009), Bein, Docquier and Ozden (2011), Arvis and Shepherd (2013), Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016), Ramos (2016) and Wajdi, Adioetomo and Mulder (2017) had identified another advantage of PPML over OLS method in handling the gravity equation. In the international migration studies, it is common to have excessive zero values for the dependent variable, which is the diaspora stock M_{jk}. The application of logarithm over zero value generates indefinite value. In order to overcome this problem, the empirical studies based on OLS method usually add a small constant 'one' to the zero value or just truncate all the zero observations. The truncation approach only permits the estimation to be made out of a subset of the original sample size. Thus, the truncation approach risks omitting vital information from the observations and resulted in biased estimators of the parameters. On the other hand, the PPML estimates the gravity equation in multiplicative or non-linear form, hence it retains all zero value observations of the dependent variable.

The empirical studies conducted after Globerman and Shapiro (2008) fell into two main groups based on the augmented gravity model. The first group follows the tradition of Globerman and Shapiro (2008), which mainly estimated the augmented gravity model by log-linearisation and OLS, Panel model or Tobit method. These include the studies of Docquier and Rapoport (2009), Dumont, Spielvogel and Widmaier (2010), Mayda (2010), Ortega and Peri (2012), Docquier, Peri and Ruyssen (2014), Jut (2015) and Ramos and Suriñach (2017).

Another group of studies, which include Beine, Docquier and Ozden (2009, 2011a, 2011b), Bertoli and Fernández-Huertas Moraga (2012, 2013), Campaniello (2014), Artuc, Docquier, Ozden and Parsons (2015), OECD (2016, pp. 107-110; pp. 125-127), Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016), Ramos (2016) and Wajdi, Adioetomo and Mulder (2017) adopted the PPML estimation. Ruther (2012), Abel (2013), Shepherd (2013), Ramos (2016) and Wajdi, Adioetomo and Mulder (2017) asserted that the PPML had emerged as the appropriate estimation method for international migration studies in recent years.

2.3.7 Empirical Studies on the Macro-determinants of International Migration of Highly Skilled Persons

The literature review in this section starts by referring to the empirical study of Globerman and Shapiro (2008), which presented a comprehensive empirical model based on the theoretical framework of neo-classical economists. Globerman and Shapiro (2008) studied the macro-determinants which influenced the bilateral migration of highly skilled people among the 29 OECD countries in 2000. They constructed an augmented gravity equation which reflects the economic opportunities in destinations, economic linkages between countries, migration costs, cultural proximity and overseas employment market. They emphasised that the strength of the augmented gravity equation is its capabilities in modelling the international migration as driven by the economic attractions between countries and deterred by the geographical distance or costs of migration

The augmented gravity model of Globerman and Shapiro (2008) constituted the gravity equation and other four categories of explanatory variables. The first category or (1) is the gap of living standards between the home and destination countries, which include real income per capita and human development index (HDI). The second category or (2) is the economic and employment opportunities in the destinations as represented by the population in destinations and the ratio of unemployment rates. The third category or (3) is the distance between countries which include geographical distance and cultural proximity. The fourth category or (4) is the economic linkages between countries which are represented by the bilateral trade volume and FDI flows. The contribution of Globerman and Shapiro (2008) is to explicitly relate the spatial distribution of the HSDs to better economic opportunities in destination countries. The likelihood of emigration is enhanced by the economic ties and cultural proximity with destination countries but decreased by the geographical distance (Fok, Cheng and Tan, 2018).

However, the study of Globerman and Shapiro (2008) did not employ PPML estimation method as recommended by Santo Silva and Tenreyro (2006). Instead, they estimated their empirical model using log-linearisation and OLS, which were unable to produce robust estimators due to the inherent heteroscedasticity in the cross-sectional data (Santos Silva and Tenreyro, 2006; Beine, Bertoli and Fernández-Huertas Moraga, 2016), Ramos 2016; Wajdi, Adioetomo and Mulder, 2017).

Based on the analytical framework of Globerman and Shapiro (2008), the rest of this section will review the empirical findings for important macro-determinants and control variables in the extant literature.

2.3.7.1 Population in Destination and Home Countries

Dumont, Spielvogel and Widmaier (2010) studied the macro-determinants of the international migration in 2000, based on the international migration dataset published by OECD. Their results revealed that the populations in both destination and home countries had strong positive influence (i.e. elasticity larger than 1) on the international migration of highly skilled persons. The study of Beine, Docquier and Ozden (2009, 2011a) also found that the population sizes of OECD destinations had positively influenced the highly skilled immigrants from developing countries in 2000, indicating that the economic opportunities in populous OECD countries were attractive to the HSDs from developing countries. Similarly, Ramos and Suriñach (2017) also discovered that the international migration between European Union (EU) and European neighbouring countries (ENC) were positively influenced by the populations in destination and home countries but hindered by the geographical distance between them.

The study of Campaniello (2014) further showed that the emigrants from the Mediterranean region to EU countries in 1970 to 2000 were driven by the population sizes in their home countries. This implies that the emigrants might face acute competition for employment opportunities in their home countries (Ramos, 2016; Yan and Zhou, 2018).

2. 3.7.2 Geographical Distance

Campaniello (2014) showed that the migratory decision was negatively affected by the geographical distance between EU destinations and the countries of origin. The negative influence of geographical distance was also discovered by Artuc, Docquier, Ozden and Parsons (2015) in their study on international migration of both low skilled and highly skilled persons between countries in 1990 and 2000. However, the negative impact was larger for low skilled than highly skilled emigrants. OECD (2016, p. 127) further confirmed that the international migration of highly skilled persons in 2010 was also influenced by the negative impacts of geographical distance.

2. 3.7.3 Existing Diasporas in Destination Countries

The positive influence of the diaspora network on the spatial distribution of HSDs has been widely examined by the extant literature. Beine, Docquier and Ozden (2009, 2011a) found that the highly skilled immigrants to 30 OECD countries were strongly driven by the existing diasporas stocks from their countries of origin. According to Beine, Docquier and Ozden (2009, 2011a), the existing diasporas in the OECD destinations maintained strong economic ties with their home countries. Such diaspora networks were the channels for the potential emigrants to acquire vital information of the destinations, such as the employment opportunities and business environment. The strong influence of diaspora networks on the subsequent highly skilled emigrants were also shown by Beine, Docquier and Ozden (2011b). Bertoli and Fernandez-Huertas Moraga (2012), Beine, Bertoli and Fernández-Huertas Moraga (2014, 2016), Artuc, Docquier, Özden and Parsons (2015), OECD (2016, pp. 107-110; pp. 125-127) and Ramos (2016) provided further empirical evidences for the strong positive network effects of existing diaspora stocks on the highly skilled emigrants, especially from developing countries to developed countries

2. 3.7.4 Development Gap between Destination and Home Countries

The development gap between destination and home countries is one of the important macro-determinants examined by most empirical studies. The development gap is always represented by the GDP per capita at destination countries or the ratio of GDP per capita between destination and home countries. Dumont, Spielvogel and Widmaier (2010) found that the GDP per capita of destination countries had relatively strong positive influence than other determinants on the international migration of highly skilled persons. Docquier, Peri and Ruyssen (2014) also found that GDP per capita or income level at OECD destination countries had positive influence on the highly skilled immigrants from 2000 to 2010. Ortega and Peri (2012) discovered that the GDP per capita of OECD countries had positive influence on the immigrants from 120 countries of origin, regardless of their skill levels. Similarly, Campaniello (2014), Jut (2015), OECD (2016, p. 125) and Ramos and Suriñach (2017) also discovered that the GDP per capita in developed countries had positive influence on immigrants of all skill levels. Notably, Jut (2015) found that the GDP per capita of Netherlands had stronger positive influence on the immigrants from low income than high income countries. This is further supported by OECD (2016, p. 127), which showed that the highly skilled emigrants from developing countries were more responsive to the ratio of GDP per capita than developed countries. The significance of development gap in the extant literature shows that the economic opportunities in relatively developed countries are the main driver for the highly skilled emigration (Van Hear, Bakewell and Long, 2018).

2. 3.7.5 Bilateral Trades between Destination and Home Countries

Globerman and Shapiro (2008) incorporated international trades between destination and home countries in their augmented gravity equation. Their estimation results showed that international trades had strongly driven the bilateral migration of highly skilled persons between 29 OECD countries in 2000. Globerman and Shapiro (2008) attributed the positive influence of international trade to the global deployment of human resources by multi-national corporations (MNCs). Campaniello (2014) further discovered the complementary effects between bilateral trades and international migration from the developing countries in Mediterranean region to the EU countries from 1970 to 2000. Campaniello (2014) stated that the close trade relationships had deepened the potential emigrants' knowledge on the employment and career opportunities in the EU countries. Jut (2015) investigated the migration flows to the Netherlands from its 181 trading partners in the period of 1998 to 2010. The results showed that the immigrants were attracted to Netherlands by the bilateral trades with their countries of origin. Jut (2015) argued that the bilateral trades strengthened the information flows, which induced immigrants to seek for better career opportunities in the Netherlands.

2. 3.7.6 Innovation Activities in Destination and Home Countries

Driouchi, Trandas-Boboc and Zouag (2010) used the knowledge economy index (KEI) to study the impacts of technological innovation on highly skilled emigration to OECD countries. The KEI was published by World Bank Institute since 1995. It measures whether the environment of a country is conducive for utilising knowledge in economic development (Chen and Dahlman, 2006; World Bank, 2008; Gorji and Alipourian 2011). KEI is an aggregate index calculated from four main groups of measures, which are 1) economic and institutional variables; 2) education and skill of population; 3) information infrastructure and 4) innovation system. Thus, the KEI is not a direct measure of the innovation activities of a country, but an indicator for institutional and structural factors which promote technological innovation. In addition, the study of Driouchi, Trandas-Boboc and Zouag (2010) also found that KEI has no significant influence on international migration of highly skilled persons to OECD countries.

However, after the study of Driouchi, Trandas-Boboc and Zouag (2010), although many economists had emphasised on the importance of innovation activities in attracting highly skilled immigration to advanced countries, there is lack of empirical investigation on its impacts (Elo, 2015; Epstein and Heizier, 2016; Ramos and Suriñach, 2017; Gelb and Krishnan, 2018).

The Global Innovation Index [GII] published jointly by Cornell University, Institut Européen d'Administration des Affaires [INSEAD] and World Intelligent Property Organisation [WIPO] (2019) is a composite index based on an array of indicators, such as political environment, education, infrastructure and research and technology outputs of a country. However, GII, like KEI is also not a direct measure of the innovation activities of a country but the overall environment which influences the innovation level of a country. In addition, the usage of KEI and GII in cross sectional study will encounter the issue of missing data as both indices only cover a limited number of countries.

Hall (2004), Kurtossy (2004), Svensson (2015), Burhan, Singh and Jain (2017), Shambaugh, Nunn and Portman (2017) and Sharma and Tripathi (2017) suggested that the level of innovation activities can be measured by the number of patent applications originated from a given country. According to Svensson (2015), Burhan, Singh and Jain (2017), the patent applications are mainly driven by the motives of intellectual property protection and commercialisation. Thus, the number of patent applications from a given country reflects the actual innovation activities and thus the career opportunities in technological development and applications. This study adopts the above notion and advocates that the ratio of numbers of patent applications between destination and home countries is a more adequate measurement than GII and KEI for the gaps of technology and innovation levels between countries. In the empirical study for the spatial distribution of HSDs, the number of patent applications represents the scale of innovation activities in destination countries as observed by the potential highly skilled emigrants.

2.3.7.7 Free Trade Agreements between Destination and Home Countries

The empirical results of Globerman and Shapiro (2008) showed that regional free trade agreement (RFTA) could be included as a dummy variable if it promotes regional mobility of highly skilled persons. In the study of Docquier, Peri and Ruyssen (2014) on highly skilled emigrants to 30 major destination countries, the free trade agreement (FTA) was estimated with a positive sign but not significant. They posited that FTAs will only become a significant driver for the international migration if it can create more economic opportunities for the potential emigrants. Jut (2015) also found that the immigrants to the Netherlands were not significantly influenced by the FTAs between the Netherlands and their home countries. However, Campaniello (2014) inferred from his empirical results that FTAs did have positive impacts on the emigrants from Mediterranean countries to EU from 1970 to 2000.

Following the interpretation of Globerman and Shapiro (2008) and Docquier, Peri and Ruyssen (2014), the mixed results for the significance of FTAs in the extant literature are depended on whether the FTAs would provide more overseas economic opportunities to potential emigrants.

2.3.7.8 Unemployment Rates in Destination and Home Countries

Unemployment rate in destination countries or the ratio of unemployment rate between destination and home countries are often included as a control variable in the empirical studies. This is to control for the emigration driven by better employment conditions abroad (Van Hear, Bakewell and Long, 2018). Globerman and Shapiro (2008) pioneered in investigating the impact of the ratio of unemployment rates between destination and home countries. They found that the ratio had negative influence on the international migration of highly skilled persons between OECD countries. This finding is further supported by Docquier, Peri and Ruyssen (2014), which showed that an increase in the employment rate in the 30 major destination countries would precipitate highly skilled emigrants from 138 countries of origin for the period between 2000 and 2010. Nica (2015) also showed that unemployment rate in destinations had a negative influence on the labour migration between European countries in 2014. In the latest work of Van Hear, Bakewell and Long (2018), it was found that a rise in the unemployment rates in developing countries would trigger emigration to developed countries.

2.3.7.9 Colonial Link between Destination and Home Countries

Colonial link between destination and home countries is normally represented by a dichotomous dummy variable in the empirical model. Dumont, Spielvogel and Widmaier (2010), Ortega and Peri (2012), Campaniello (2014), Jut (2015), Artuc, Docquier, Ozden and Parsons (2015), and OECD (2016, pp. 126-127) found that colonial links positively influenced the highly skilled emigrants from developing countries to their former colonising countries. Ortega and Peri (2012), Jut (2015) and Artuc, Docquier, Ozden and Parsons (2015) explained that the economic cooperation and historical links attributed to colonial heritage had facilitated the migration flows from developing countries to the former colonial empires.

In the study of Beine, Docquier and Ozden (2009; 2011a) on the immigration to 30 developed countries from 1990 to 2000, the colonial link was estimated with a significantly negative sign. Beine, Docquier and Ozden (2009; 2011a) did not provide clear explanation for the negative influence of colonial link. However, according to Head, Mayer and Ries (2011) and Stack, Ackrill and Bliss (2018), the estimated negative sign for the colonial link in empirical studies could be interpreted as the decreasing influence of the colonial past on the former colonies.

2.3.7.10 Cultural Proximity between Destination and Home Countries

The cultural proximity was included to control for international migration driven by cultural similarity between destination and home countries. The cultural proximity is usually represented by a dummy variable which indicates whether the destination and home countries share a common language (Beine, Noël and Ragot, 2014; OECD, 2016, p. 268). Dumont, Spielvogel and Widmaier (2010) found that the positive influence of common language on the destination choices was higher for highly skilled than low skilled emigrants. Dumont, Spielvogel and Widmaier (2010) explained that the phenomenon was due to the importance of language proficiency for highly skilled occupations. Their notion was further supported by Artuc, Docquier, Özden and Parsons (2015) which showed that the coefficient of common language was higher for highly skilled than low skilled emigrants in 1990 and 2000. In the empirical study of OECD (2016, p. 129) on the international migration in 2010, the cultural proximity was only significant for the emigration of highly skilled but not low skilled persons. In other empirical studies, Mayda (2010), Ortega and Peri (2012), Jut (2015) and Ramos and Suriñach (2017) showed that cultural proximity had positive influence on the total migration from developing countries to European countries.

The review of the extant literature shows that HSDs tend to choose destinations which have cultural affinities with their home countries. However, the practice of representing cultural proximity with a dichotomous dummy variable of common language is criticised by some studies as too simplistic and arbitrary (Otten, 2013; Kirby et al., 2016; Fok, Cheng and Tan, 2018). The dummy variable fails to capture the intricacy and scale of cultural similarity between two countries. This study recommends Eff's (2008) cultural proximity concept which is based on the language phylogeny (Holman, Wichmann, Brown and Eff, 2015; Fok, Cheng and Tan, 2018). Eff's argument is that if the primary language used in a pair of countries is originated from a similar ancestral language, then the two countries may share a common culture root or are influenced by the same culture. Thus, the cultural proximity between two countries could be represented by the scale of linguistic proximity between them. The linguistic proximity w_{jk} between countries j and k is calculated by the following index:

$$w_{jk} = \sum_m \sum_n p_{mj} p_{nk} s_{mn} \tag{2.7}$$

Where $0 < w_{jk} < 1$

where p_{mj} is the proportion of the population in country j speaking language m, p_{nk} is the proportion of the population in country k speaking language n, and s_{mn} is the proximity measure between language m and language n based on the network structure of language phylogeny (Eff, 2008). A relatively high value of w_{jk} implies that the two countries are closely linked by their linguistic proximity, which also implies that they are culturally connected.

2.3.8 Empirical Studies on the Highly Skilled Emigration of ASEAN-5

According to Singapore Polytechnic (2014), a total of 61.5 per cent of Singaporeans aged 15-35 are considering the possibility of living overseas. The primary reasons for Singaporean youth to go overseas are to gain more international exposure and experience for personal growth and career advancement. World Bank's survey (2011, p. 121) on Malaysian HSDs found that the main reasons for emigration include better overseas career prospects, social injustice, higher salaries or staying on after overseas study. The social injustice refers to the exclusion and frustration feelings by the highly skilled ethnic Chinese and Indians of Malaysia towards the race-based affirmative action (Hugo, 2011; Tyson, Jeram, Sivapragasam and Azlan, 2011; World Bank, 2011, p. 121; Sukumaran, 2017).

/1Buchori (2011) found that the highly skilled Indonesians chose to stay abroad in order to acquire overseas skills and experience, which may enhance their employability if returning to the home country later. Another important motive for Indonesian talent to stay overseas is to gain access to comprehensive research and development (R&D) facilities.

Opiniano and Castro (2006) and Migration Policy Institute (2014) highlighted that both the economic opportunities and historical link have attracted continuous flows of highly skilled emigrants from Philippines to US. Similarly, Pholphirul (2011) advocated that the economic opportunities abroad are the main driver for Thai people to leave their home country. He also testified that diasporas had contributed to promote the trades and investment between destination countries and Thailand. Beasley, Hirsch and Rungmanee (2014) surveyed the roles of Thai diasporas in fostering the economic linkage between Australia and Thailand, including the investment of Thailand in the energy industry of Australia, tourism between Thailand and Australia, cultural and food industries and various types of professional services.

However, there is limited study to examine the macro-determinants of the international migration or spatial distribution of HSDs for ASEAN-5. This could be caused by lack of comprehensive dataset on the international bilateral migrant stocks, especially before the publication of DIOC-E 2000 (Release 3.0) in 2010 (OECD, 2010).

Foo's econometric study (2011) on the determinants of Malaysia's highly skilled emigration can be considered an exceptional study. The study was based on the DIOC-E 2000 (Release 3.0) published by the OECD (OECD, 2010). Foo's empirical findings show that emigration rate of highly skilled persons in Malaysia was positively influenced by the income gaps and linguistic proximity with destination countries. The geographical distance between destination countries and Malaysia, which is a proximate of migration and adaptability costs to destination country, significantly reduced the highly skilled emigration from Malaysia.

Foo’s model (2011) is based on the push-pull model of Lee (1966), which is not a comprehensive framework to investigate the driving forces for the spatial movement or distribution of highly skilled emigrants. It could be improved by incorporating the network effects of existing diaspora stocks (Ellerman 2006; Beine, Docquier and Ozden, 2011; Beine, Noel and Ragot, 2014 and Docquier, Peri and Ruyssen, 2014; Bilecen, Gamper and Lubbers, 2018).

Foo admitted that his model is plagued by collinearity between the gaps of income and quality of life, compelling him to drop either one of them in order to estimate another variable significantly. His model also oversimplified cultural proximity between countries by just testing whether English is a major common language. More importantly, by using highly skilled emigration rate as the dependent variable, Foo’s empirical study is unable to provide knowledge on how the determinants affect the spatial distribution of HSDs across destinations. Foo employed the OLS method for estimation, which is inadequate for international migration study due to heteroscedasticity caused by the multilateral resistance (Santos Silva and

Tenreyro, 2006; Beine, Bertoli and Fernández-Huertas Moraga, 2014; Artuc, Docquier, Ozden and Parsons, 2015).

The work of Wajdi, Adioetomo and Mulder (2017) is another study on ASEAN-5 migration. They studied the various factors which influenced the inter-regional migration in Indonesia. Although their study focused on the internal migration of Indonesia, their empirical model, estimation method and findings are insightful for the investigation based on gravity model. Wajdi, Adioetomo and Mulder (2017) employed PPML method to estimate their augmented gravity model. They stated that PPML had become a more acceptable estimation method for augmented gravity model in the recent years. Their study found that the population in both destination and origin regions had positive influence on the inter-regional migration of Indonesia. Wajdi, Adioetomo and Mulder (2017) explained that migrants were attracted to populous destination regions which offered greater economic and employment opportunities. Similarly, the potential emigrants might also be driven out of populous regions which had intense competition for economic and employment opportunities. Wajdi, Adioetomo and Mulder (2017) also showed that the migration movements were deterred by the geographical distance between regions. They found that the existing migrants in destination regions would attract more immigrants, indicating the presence of strong network effects between migrants and their relatives, friends and associates in home regions. More importantly, Wajdi, Adioetomo and Mulder (2017) showed that the development gap, as represented by the GDP per capita ratio was the major driver for the inter-regional migration in Indonesia.

2.3.9 Summary

The review found that the gravity model is the most appropriate theoretical framework for the study in international migration. The gravity model describes the spatial movement of the HSDs as driven by the overseas economic opportunities but deterred by the migration costs. In empirical studies, the gravity equation can be augmented to include other macro-determinants and control variables which may influence the spatial distribution of the HSDs. For instances, the diaspora network effects, development gaps, economic linkages between destination and home countries, the cost of migration to the destination countries, the employment conditions in destination countries, as well as the colonial links and cultural proximity between destination and home countries.

The review recommends improvement in the selection of explanatory variables, for instance, to use the number of patent applications to represent the innovation level of countries (Svensson, 2015; Burhan, Singh and Jain, 2017; Sharma and Tripathi, 2017), and language phylogeny to indicate the cultural proximity between countries (Eff, 2008; Holman, Wichmann, Brown and Eff, 2015; Fok, Cheng and Tan, 2018).

The review also found that PPML method can produce robust estimators for the empirical study based on augmented gravity equation. This is because PPML method accounts for the inherent heteroscedasticity in the cross sectional data of international migration.

2.4 Social Science Literature on the Linkages between Diasporas and the Economic Development of the Country of Origin

The optimism of the neo-classical economists on the highly skilled emigration in the 1990s coincided with the social scientists' rising enthusiasm on diaspora studies. While the neo-classical framework theorises the developmental impacts of the HSDs on home economy, it is social science researchers who deepened the understanding on the formations, characteristics, sustainability and functions of diaspora linkages between home and destination countries (King and Collyer, 2016).

An important contribution of the social science literature is to use the concept of transnationalism to describe and study the multidimensional and multidirectional diaspora linkages spanning across countries. The social science researchers employ ICT tools and social network perspectives to investigate the formation and persistence of such cross-border diaspora linkages, as well as the mechanism which facilitates the diffusion of knowledge and business opportunities from destination to country of origin (Wimmer and Schiller, 2002; Morales and Jorba, 2010; Engbersen, Bakker, Erdal and Bilgili, 2014; Faist, 2007, 2015; Ho, Hickey and Yeoh, 2015).

2.4.1 The Extension of Diaspora Concept

The rise of transnationalism as analytical framework is closely associated with the ethnographic literature which extends the definition of the term ‘diaspora’ (Ragazzi, 2014). Safran’s seminal work (1991) purported that diasporas are communities originated from the common homeland and disperse across two or more countries. Although the diasporas live in different geographical locations, they adhere to similar ethnic or national identity, cultural inheritance and social norms. Such adherence sustains their continued concerns and contribution to the socio-economic development in their home country. Cohen (2008) analysed the evolution of the definitions of diasporas for the past two thousand years. He discovered that since the 1970s, the concept of diasporas is no longer confined to describing the historical experience of exile from an ancestral homeland or forced dispersion of particular ethnic communities, such as Jews and Armenians. Instead, the term has been popularised to represent the growing number of population living outside their country of origin. Cohen (2008) posited that diasporas’ endeavours and tensions of integrating into foreign society stimulate their creativeness and adaptability. The country of origin can capitalise on such quality by engaging diasporas in the international business expansion and scientific collaboration. Tsagarousianou (2004) argued that the social ties to home country should be the focus for the study of diaspora phenomenon. He argued that the diaspora phenomenon since mid-late twenty century could be characterised as constellations of networks through which the diasporas play a proactive role in the socio-economic interaction between home and destination country.

In the recent academic debates on international migration and development, the term ‘diaspora’ is often operationalised as people who live outside their country of origin and their descendants who are born in the destination country, regardless of whether they still retain their original nationality or have acquired the citizenship of their destination country (Commission of European Communities, 2005, p. 23; OECD, 2012, p. 16; Ragazzi, 2014; World Bank, 2015, p. 12). Commission of European Communities (2005, p. 23), Faist (2015) and Malecki (2017) describe that diasporas, regardless of their citizenship, are often committed to and interested in the affairs of their country of origin. This is echoed by Brinkerhoff (2006, p. 1), who defines modern diasporas as 'ethnic minority groups of migrant origins residing and acting in the host countries but maintaining strong sentimental and material links with their country of origin – their homelands'.

This study integrates the above notions and views diasporas as migrants who live outside their origin countries, but maintain strong connection with their home countries through family ties, cultural attachment and various types of socio–economic activities or linkages.

2.4.2 Transnationalism and Transnational Livelihood

Glick Schiller, Basch and Blanc-Szanton (1992), Portes, Guarnizo and Landolt (1999) and Faist (1998; 2015) used the concept of transnationalism to investigate the new type of cross-border social relations formed by diasporas between the destination and home country. Transnationalism in diaspora studies generally refers to an array of sustained and long-distanced social relations established by diasporas between destination and home countries

(Vertovec, 2004; International Organisation for Migration [IOM], 2010;; Glick Schiller, 2010, 2013; Engbersen, Bakker, Erdal and Bilgili, 2014; Faist, 2010, p. 13; 2014, 2015; de Jong and Dannecker, 2018).

Glick Schiller, Basch and Blanc-Szanton (1992) advocated studying the transnational phenomenon at a global perspective. The transnationalism is characterised by the fluids or flows channelled by diasporas between home and destination countries or regions, including financial remittances, transfers of new ideas and knowledge, political influence and socio-economic activities. Such cross-border linkages have connected the countries in the world into a single social and economic system.

Faist (1998; 2006; 2010, p. 13; 2015) invented the concept of transnational social spaces to describe the combinations of social, economic, political and religious linkages interlocking diasporic communities and organisations in destination countries with their home country. The transnational social spaces enable diasporas to carry out economic activities and scientific collaboration between two or more countries. Thus, diasporas are no longer perceived as disconnected from their origin countries or isolated from the cultural practices and social norms of the destinations. Instead, they live a transnational livelihood, which potentially connects and synchronises the economic development of the home country with other parts of the world (Parnwell, 2005; Faist, 2015).

2.4.3 The Drivers of Transnationalism and Diasporas as Development Agent

Portes, Guarnizo and Landolt (1999) and Parnwell (2005) posited that the rapid progress in time-space compression technology, such as information and communication technology (ICT) and advanced transportation, has diminished the barrier of distance between countries and metropolitans. This is the pre-requisite for the establishment of transnational, durable and reciprocal linkages between diasporas and their home country.

Glick Schiller, Basch and Blanc-Szanton (1995), Portes (1996), Portes, Guarnizo and Landolt (1999) and Glick Schiller (2013, 2015) advocate that the diaspora transnationalism has been driven by the expansion of global capitalism since the late 1950s. As a strategy to profit maximisation, the transnational corporations from advanced countries and newly industrialised economies reallocated their capitals to developing or least developed countries. The inflows of FDIs and new production methods tend to crowd out the immature local industries, resulting in labour oversupply. Consequently, the development gap and labour market imbalance among countries and regions trigger the outmigration from economically periphery countries to developed nations and regions. The immigrant or diaspora communities are often found to concentrate in cities or regions which are also the nodes for global networks of production, communication and organisations. The diasporas residing in these nodes tend to maintain national allegiance, cultural adherence and socio-economic relationships with their home countries, such as their financial remittance to family members left behind in country of origin.

According to Portes, Guarnizo and Landolt (1999) and Glick Schiller (2010, 2013, 2015) and Faist (2014, 2015), the transnational livelihood is also a strategy for diasporas to overcome the assimilation pressures from the society of the destination country. The diaspora communities face the tensions of adaption to unfamiliar socio-economic and cultural environment. They respond to such challenges by organising into various types of diaspora institutions or cohesive groups, including hometown affiliations, diaspora associations, diaspora oriented professional organisations and business associations, in order to enhance their socio-economic status in destination countries through collective actions and collaborative networks. These institutions are also the potential platforms for diasporas to interact, influence and participate transnationally in the socio-economic, cultural and political affairs of home country.

Faist (2006, 2008, 2010, 2014) and Sinatti and Horst (2015) advocated that the transnational livelihood maintained by diasporas across two or more countries empowers them to be the development agents for their home countries. Faist (2010, 2014) pointed out that the proactive participation of diasporas in the development of their home countries is a kind of grassroots or bottom-up initiatives, in contrast to the conventional top-down approach in the forms of national policy intervention and business deployment of multinational corporations (MNCs). Faist (2008, 2015) adopted Coleman's

(1988) concept of social capital and purported that the diaspora transnational networks embody both bonding and bridging functions. The former sustains the economic and knowledge networks connecting home and destination countries, and the latter facilitates diasporas to transfer financial remittances, human capital, economic opportunities and new knowledge to the home countries.

Similar to the neo-classical economic model for international migration, the analytical framework of the transnationalism shows that the' developmental impacts and economic linkages of diasporas to home countries are reciprocally related to the developmental differentials or gaps with destination countries. Such developmental differentials lead to the different expectations and motives of emigration. Ionescu (2006), Globerman and Shapiro (2008), Engbersen, Bakker, Erdal and Bilgili (2014, p. 257) and Fok, Cheng and Tan (2018) stated that these differences are partly responsible for the formation of various diaspora associations, organisations, networks and initiatives, which represent the diverse interests, resources and social capital of diasporas. Hence, the knowledge on the causes of international migration is vital to better understand the characters of diasporas, which in turn may contribute to the formulation of diaspora engagement policies targeted at their resources (de Haas, 2011; Czaika and de Haas, 2014; Sinatti and Horst, 2015).

2.4.4 Knowledge Creation and Diffusion through HSDs

Saxenian (1999, 2003, 2008, 2011) coined the concept of 'brain circulation' to describe the reciprocal and multi-dimensional transfers of skills, knowledge and economic opportunity facilitated by the diaspora networks (Kone and Ozden, 2017). Xiang (2005) further asserted that the HSDs are instrumental to transfer knowledge from advanced nations to the developing countries. Such transferable knowledge include technology know-how sought after by industries, latest theories and methodology for academic researches, expertise in management practices, corporate finance and international market, as well as international experience critical for the diaspora engagement policy of home countries. As such, he stated that the global links of the HSDs may be more important than the human capital stock in the home country. Balasubrmanyam and Wei (2006) and Aikins and White (2011) supported such view by advocating that the HSDs can play the mediator's role for the flows of knowledge, capital and business opportunities between destination and home countries.

The social science literature on knowledge creation and transmission has provided explanation on how brain circulation or knowledge exchanges could take place between HSDs and their home country. Oettl and Agrawal (2008), Sorenson, Rivkin and Fleming (2006), OECD (2008, p. 21-61) and Breschi (2015) posited that after highly skilled individuals emigrated, they tend to maintain linkages with their home country through former colleagues and associates in previous workplace such as universities, business organisations or public agencies. This is because such linkages are crucial for them to re-establish their professional, academic or business networks, in order to enhance their career prospects in destination countries. The establishment, sustenance and extension of the diaspora networks are vital in bridging knowledge flows between home and destination countries.

Social scientists decompose knowledge into two major components, i.e. explicit or codified knowledge and tacit knowledge (OECD, 2008, p. 22; Tung, 2008; Gibson and Mckenzie, 2014; Rapoport, 2016, 2018). Both explicit and tacit knowledge are vital in the innovation process which requires acquisition, recombination and creation of new knowledge. The explicit knowledge can be codified and transmitted through various channels such as printed materials, academic papers, documentations, operational manuals, formulas, internet transmission, conferences, lectures and other communication methods. However, the tacit knowledge which includes the experience and perception acquired by an individual from his/her participation in a scientific community, is only transferable through his/her repeated interaction, exchanges and collaborations with other individuals (Meyer and Brown, 1999; OECD, 2008, p. 22; Tung, 2008; Ataselim, 2014; Cheng, Heng, Tan and Fok, 2018).

OECD (2008, p. 22), the British Royal Society (2011, p. 36) and (Kerr, Kerr, Ozden and Parsons, 2016) argued that international mobility of highly skilled people promotes exchange of ideas and recombination of tacit knowledge, which is crucial in creating new knowledge and innovative ideas. The international mobility is not confined to the physical movements of highly skilled persons, but also encompassing the repeated and reciprocal interactions between them through ICT enhanced knowledge networks. The OECD (2008, p 18), Gibson and McKenzie (2014) and Rapoport (2016) highlight that the cross-border migration of highly skilled persons influence the direction of international knowledge flows, which is crucial in enhancing the innovation capability and capacity of both home and destination countries.

2.4.5 Three Major Networks for HSDs to Contribute to the Development of Home Country

The sociologists adopted the transnational framework and concepts of knowledge creation and diffusion to investigate the channels or networks for HSDs to contribute to the development of their home countries. The following sub-sections review three major networks as identified and widely studied by social scientists: diaspora knowledge networks (DKNs), transnational entrepreneurship and diaspora search network (Xiang, 2005; Kuznetov and Sabel, 2008; Sabel and Saxenian, 2008; Tung, 2008; Saxenian, 2011; Agunias and Newland, 2012; Bagwell, 2015; Meyer, Miao and Zhao, 2015; Malecki, 2017; Kuznetov, 2019). The knowledge on the three major networks essential to recommend strategy of the diaspora engagement initiatives.

2.4.5.1 Diaspora Knowledge Networks (DKNs)

According to Turner (2003), Meyer and Wattiaux (2006), Meyer (2007, 2011), Meyer, Miao and Zhao (2015) and Malecki (2017), DKNs are associations and professional bodies formed by HSDs who are willing to contribute to the development of their home countries. The DKNs have emerged since 1990s and their memberships are usually exclusively for HSDs from a specific country of origin, ethnic group, cultural affiliation or geographical region.

The original purpose of DKNs is to connect the professional diasporas and emigrant entrepreneurs in order to enhance each other's scientific, professional or business networks. However, Xiang (2005), Meyer and Wattiaux (2006), Charest (2007), Meyer (2007), Sabel and Saxenian (2008), Saxenian (2008), African Diaspora Policy Centre (2011), Chaichian (2011), Trotz and Mullings (2013), Gibson and McKenzie (2014) and Kennedy and Lyes (2015) found abundant evidences that the DKNs organised around the Silicon Valley and other technological clusters in the world have also become the channels for HSDs, namely those from Taiwan, India, Mainland China, Italy, Iran, Ireland, African countries, Caribbean countries and Pacific Island states to transfer knowledge, technological know-how and business opportunities back to their country of origin. Meyer and Wattiaux (2006), Meyer (2007; 2011) and Meyer, Miao and Zhao (2015) argued that these DKNs, augmented by ICT have created social proximity transcending geographical distance between countries, facilitating the diffusion of knowledge with high complexity to home country. The emergence of DKNs shows that the HSDs are distant but accessible human capital through transnational knowledge networks (Marceau, Turpin, Woolley & Hill, 2008; Ho and Boyle, 2015; Malecki, 2017).

Xiang (2005, 2016) studied the mechanism of DKNs through which the Overseas Chinese Professionals (OCPs) interact with their home country with respect to knowledge exchanges and collaborative research projects. He showed that the OCP associations play an important role in maintaining the formal and informal links of Chinese professional diasporas with the societies, institutions and industries in the homeland. Grossman (2010) supported Xiang's notion and used the term 'digital diaspora of China' to describe the overseas Chinese professionals, academics and scientists who diffuse knowledge to their home country via ICT augmented networks.

The notion of DKNs coincides with the Royal Society's observation (2011) of an increasingly interconnected scientific world and the knowledge diffusion through international collaboration. The Royal Society (2011, p. 20), Faist (2010, 2015) and King and Collyer (2016) highlighted that the border-crossing networks of highly skilled diaspora communities are grassroots driven or bottom up efforts which elevate the flows of scientific ideas and knowledge from national to global levels.

The grassroots nature of the DKNs testifies the relevance of the research problem of this study, which highlights that the HSDs' expectation for overseas opportunities and career development is reciprocally related to their potential economic linkages with the home country.

2.4.5.2 Transnational Entrepreneurship

Saxenian (2000, 2001a, 2001b, 2002, 2003, 2006, 2008), Sabel and Saxenian (2008) and Kuznetsov and Sabel (2008) were among the first batch of social scientists who examined the transnational technical and business networks spanning between Taiwan, India and Mainland China and their HSDs in Silicon Valley. They purported that the rise of the Silicon Valley in 1970s – 80s had transformed the global industrial structure from the vertical integration of multinational corporations (MNCs) to the horizontal, decentralized and more fragmented structure organised around networks of increasingly specialised producers. The transformation deepened the global division of labour and created opportunities of business and technological innovation in the formerly peripheral regions.

Saxenian (2002, 2006) coined the term 'transnational entrepreneurship' to describe how the HSDs in Silicon Valley had turned themselves into active developmental agents for their sending country or region. The highly skilled emigrants, on top of their cultural and linguistic affinity with their homelands, have accumulated extensive overseas experience. These advantages enable them to occupy an intermediary position in the global economy, connecting the technological advancement and business innovation in the global technological cores to the economic dynamics in their periphery homelands (Bagwell, 2015; Weng and Chanwong, 2016).

Saxenian (2000, 2001a, 2001b, 2006) observed that the transnational entrepreneurs of Taiwanese origin had organised themselves around various associations and technical bodies. Among them include the Chinese-American Engineers and Scientists Association of Southern California, the North America Taiwanese Engineers' Association (NATEA), the Chinese Institute of Engineers (CIE/USA) established, Asian American Manufacturer Association (AAMS), Monte Jade Science and Technology Association (MJSTA). Through the programmes initiated and networks established by these diaspora professional organisations and business associations, the Taiwanese hi-tech entrepreneurs and engineers in Silicon Valley had help enhancing the technical, managerial and innovation capability of their counterparts in Taiwan since 1970s. By early 1990s, the transnational entrepreneurship linking Hsinchu Science Park and Silicon Valley had successfully shifted the global centre of semiconductor design and manufacturing from other advanced countries to Taiwan. Chen and Ku (2002), Lee and Saxenian (2013) and Shin and Moon (2018) also shows that the personal computer, semiconductor and electronics industries of Taiwan were augmented by the frontier technologies and skills acquired from the Taiwanese engineers and technicians working in the Silicon Valley.

Xiang (2005) investigated how the diaspora entrepreneurs and technologists had extended their transnational network to Mainland China. Since 1990s, the China government had actively promoted the transnational networks between the Chinese technical communities in Silicon Valley and the industries and academia in home country. The China overseas talents, together with the Taiwanese hi-tech transnational entrepreneurs who invested in China’s new centres of innovation, had contributed to the formation of new capitalist dynamics through the triangular networks linking Silicon Valley, Hsinchu Science Based Industrial Park and Shanghai’s Zhangjiang Science Park.

Agrawal, Cockburn and Mchale (2003; 2006), Pandey, Aggarwal, Devane and Kuznetsov (2006), Saxenian (2006), Sabel and Saxenian (2008), Saxenian (2008), Agrawal, Kapur, McHale and Oettl (2011), Kerr, Kerr, Özden and Parsons (2016) and Kone and Ozden (2017) described the technical communities of India in Silicon Valley as one of the most successful examples for HSDs to contribute to the technological development and industrial transformation in home country. The formation of the HSDs of India in Silicon Valley has started since 1960s, when many Indian graduates from the top-notch institutes of technology sought further study in US universities. After graduation, many of them were employed as scientists and engineers in research institutions or IT firms in Silicon Valley or other technological hubs in US. By 2000s, many of them had excelled in the high-tech industries and become influential in the corporate decision of MNCs in Silicon Valley. According to Pandey, Aggarwal, Devane and Kuznetsov (2006), Ghani, Kerr and Stanton (2014) and Shin and Moon (2018), the senior executives and prominent engineers of Indian origin were instrumental in awarding contracts to the software developers and outsourcing service providers in India. This was supported by Agrawal, Cockburn and Mchale (2006) and Pande (2014) who also found that the successful Indian technology entrepreneurs in Silicon

Valley had provided mentoring on entrepreneurship, technological know-how and even seed funds to their junior entrepreneurs or new start-up in homeland.

The recent literature had provided more evidences for the developmental role of transnational entrepreneurship in countries or regions in the world. Agunias and Newland (2012, p. 25-32), Pande (2014) and Shin and Moon (2018) testified that diaspora entrepreneurs and highly skilled emigrants of China and India had continued to play important roles in creating new business activities and transferring know-hows to their home countries until 2010s. They also documented in details how diaspora entrepreneurs had contributed to the industrial development, business start-ups, skill building and knowledge accumulation in the Philippines, Turkey, Liberia, Lebanon, Israel, Australia, Chile, Mexico, Ghana, Morocco, Ethiopia and European countries. Ataselim (2014) found that the Turkish diaspora entrepreneurs in USA had actively connected back home to share their skills, experiences and business networks. Trotz and Mullings (2013) showed that the Caribbean diaspora entrepreneurs were instrumental in transferring new capitals, entrepreneurship, skills and business networks from destinations to their home countries.

Bagwell (2015) and Sommer and Gamper (2018) had extended the concept of transnational entrepreneurship from just spanning between destination and home country to also involving the third countries. Bagwell (2015) found evidences that the Vietnamese diaspora entrepreneurs in London had developed their transnational business links to their home country as well as Vietnamese diasporic communities dispersing in other countries. The multipolar transnational linkages was important Vietnamese entrepreneurs in London to gain access to the business resources such as financing, expertise, materials, innovative ideas and business solutions, as well as market opportunities in the home and other countries. Similarly, Sommer and Gamper (2018) also applied multipolar perspective to investigate the transnational entrepreneurial activities (TEA) of the immigrants from the former Soviet Union (FSU) in Germany. They found that it is a common business strategy of the FSU immigrant entrepreneurs to utilise their transnational links to complement their local networks in Germany. The FSU diaspora entrepreneurs in the industries such as tourism, car export and car reparation, freight transport and musical performance tend to source for new ideas, business solutions and new markets through their business and family links to Russia as well as Russian diasporic communities in other European countries.

The study of Vandor and Franke (2016) provided another compelling reason for the home country to engage the transnational entrepreneurship of their HSDs. The cross cultural experience of the HSDs could enhance their entrepreneurial capabilities. This is because the exposure to diversified cultural contents, ideas, products and solutions could nurture their capabilities in recognising profitable business opportunities. The cross cultural experiences may also stimulate the creativity of the HSDs. By integrating the ideas, knowledge and solutions from different cultural contexts, the HSDs are able to create new business opportunities beneficial to both the home and destination country.

2.4.5.3 Diaspora Search Networks

Kuznetsov and Sabel (2008), Sabel and Saxenian (2008), Lee and Saxenian (2013) and Kuznetsov (2019) found that the transnational networks of the HSDs can be developed into the search networks for home country to locate technical expertise, innovation ideas, business solutions, new market and collaborative partners. Their insightful finding suggests that the developmental roles of HSDs are not confined to acting as facilitators of knowledge and business flows between destination and home countries, but also playing a proactive role in connecting the home countries to the global production chain.

The search network is the interconnection between producers or service providers through which they can locate each other for business solutions, innovative ideas and project cooperation (Sabel and Saxenian, 2008; Lee and Saxenian, 2013). Kuznetsov and Sabel (2008) and Kuznetsov (2019) explained that the emergence of search network as a new form of industrial organisation was caused by the accelerating process of globalisation starting from the 1960s. The enlarging market frontier, shortening product life cycle, intensifying competition and exponential technological change have confronted the engineering, innovation and managerial capabilities of large corporations. The challenges forced the large industrial complex to decentralise into a number of increasingly specialised producers and services providers, which in turn were re-organised into an interconnected search network. Facilitated by the advanced information and communication technology (ICT), the small and medium sized enterprises (SMEs) on the search network are able to outreach each other for innovative solutions, cost effective measures, new market opportunities and potential business partners.

Given the transnational nature of the diaspora network, Kuznetsov and Sabel (2008, 2019) purported that the diaspora networks can be developed into transnational search network, which facilitate entrepreneurs and companies from home countries to outreach to distant overseas markets, to seek for business solutions and to locate foreign business partners. In other words, the diaspora networks can be mobilised to help integrating the industries in home country into the global production chain.

Kuznetsov and Sabel (2008) and Lee and Saxenian (2013) use the experience of South Korea to support their argument. During the 1990s, the Korean Chaebols and government programmes faced increasing difficulties in acquiring key technologies through licensing from MNCs of the United States. Nevertheless, the Korean HSDs in the United States were able to overcome the problem by identifying business and technological solutions for the Korean SMEs and constructing channels to transfer necessary knowledge.

2.4.6 Summary

Social scientists employ the transnational framework to study the formal and informal networks formed by HSDs between their destination and home countries. Through the diaspora networks, the HSDs play various developmental roles, namely transnational entrepreneurs, diaspora knowledge networks (DKNs) and diaspora search network which transmit the overseas economic opportunities and technological know-how to their home countries. Such transfers from HSDs are instrumental to stimulate the technological development and industrial transformation of the home countries (Sinatti and Horst, 2015; Harijanti, Dewansyah, Abdurahman and Dramanda, 2018). Thus, the literature review shows that it is essential to study the connectivity and structure of the diaspora networks, in order to understand how home countries can gain access to the diaspora resources as identified from the spatial distribution of their HSDs (Epstein and Heizier, 2016).

2.5 Diaspora Engagement Policy and Strategy

2.5.1 HSDs as Development Agent for Home Countries

The focus of the contemporary literature on diaspora engagement strategy is to leverage on the diaspora transnationalism, in order to increase the transmission of diaspora resources from destinations to home countries (Sorensen, Van Hear and Engberg-Pedersen, 2003, p. 16; Gamlen, 2005, 2006; Newland and Tanaka, 2010; Keusch and Schuster, 2012, p. 21; Faist, 2015). Ataselim (2014), Elo (2015) and Sinatti and Horst (2015) advocated that HSDs are development agents who can contribute to the economic development of their home countries. The talents staying aboard are accessible to new economic opportunities such as innovative ideas, business networking, overseas market and technological advancement. They are also trained in more competitive and challenging working conditions and adapted to different cultural and social settings (Meyer and Brown, 1999; Asian Development Bank Institute [ADBI], 2014, p. 23; Vandor and Franke, 2016). The HSDs are also viewed as potential channels for home country to access to overseas markets, foreign investors, new knowledge and innovative ideas. Thus, Xiang (2005), Kuznetsov and Sabel (2006), OECD (2008, p. 54), Tung (2008), Royal Society (2011, p. 27), Trotz and Mullings (2013) and Sinatti and Horst (2015) argued that HSDs should be turned into active partners for the economic development of home countries.

Meyer and Brown (1999) coined the term ‘diaspora option’ to describe the strategy to connect to HSDs, in order to transfer their knowledge, skills, networks and entrepreneurship to the country of origin. Gamlee (2005, 2006) replaced the term ‘diaspora option’ with ‘diaspora engagement’, which is more popularly cited and used in the contemporary literature.

2.5.2 Four Elements of Diaspora Engagement Strategy

Agunias and Newland (2012, p. 23-24) stated that the national diaspora engagement strategy should contain four important elements: goal identification, knowledge on the diasporas, trust between government and diasporas, and mobilisation of diasporas to contribute to the home country.

Agunias and Newland (2012), French Ministry of Foreign Affairs (2012), African Diaspora Policy Centre (2011), Clemens (2013), Ho and

Boyle (2015) and Cheng (2016) advocated that the goals of diaspora engagement strategy and initiatives should be in line with the national development agenda and economic characteristics of the home country. While each country has its specific development needs, the goals of diaspora engagement strategy as generally referred by the literature include knowledge diffusion, transfer of skills, industrial transformation and access to overseas business opportunities.

The same goals are also mentioned in the diaspora engagement literature of ASEAN-5. Utomo (2011), ANTARA News (2013), Salim (2016) and Setijadi (2017) highlighted that diasporas are partners or assets for the economic development of Indonesia. Talent Corporation Malaysia (2012, p. 95-115) and The World Bank (2015, p. 23) reported that the Malaysia's diaspora engagement strategy is to tap the HSDs to fill the skills and human capital gaps, in order to stimulate industrial transformation, innovation, FDI and entrepreneurship in key economic sectors. Yap (1994) and Lee (2015) advocated that overseas talents are instrumental in connecting Singapore to the world economy and helping Singaporean businesses to expand globally. Opiniano and Castro (2006), Camroux (2008), Agunias and Newland (2012, p. 176) and Department of Trade and Industry Philippines (2019) highlighted that diaspora organisations had undertaken to promote the investments, new start-ups and technological development in the Philippines. Similarly, Bhumiratana, Songkasiri, Commins and Grimle (2009), International Labour Organisation (2015) and Raksaphaeng (2016) stated that HSDs should be engaged to help enhancing the science and technology capability of Thailand.

According to Agunias and Newland (2012, p. 25-32), the second element of diaspora engagement strategy is the knowledge on the characteristics of HSDs. These include their geographical distribution, migratory expectation, education levels and their skills or resources. According to Sorensen, Van Hear and Engberg-Pedersen (2003, p. 16), Ionescu (2006, p. 27), Meyer (2007), Globerman and Shapiro (2008) and King and Collyer (2016), the knowledge on the HSDs' migratory motives is essential to formulate a win-win engagement strategy, which fulfils both their career expectation and the goals of national development.

Concerning the third element of diaspora engagement strategy, i.e. trust building, both Meyer (2007), Agunias and Newland (2012, p. 29-31) and Gamlee (2014) and Brown (2017) posited that government should initiate programmes and events which help fostering the interaction, communication and the mutual confidence between diasporas and the home country. On the fourth element, i.e. mobilising the HSDs, Xiang (2005), Meyer (2007), Agunias and Newland (2012, p. 32-35), Gamlee (2014), Sinatti and Horst (2015) and Cheng (2016) discussed about the facilitating role of government agencies, intergovernmental organisations, diaspora organisations, civil societies and public-private partnership in mobilising the HSDs for the development programs of home country. de Hass (2006), Agunias and Newland (2012), Keusch and Schuster (2012, p. 51), Faist (2008, 2015), Gamlen (2006, 2014) and Sinatti and Horst (2015) advocated that national government should engage the HSDs with the cooperation of diaspora driven professional organisations, homeland associations, business chambers and civil societies. Such approach is described as ‘bottom-up’ or grassroots initiatives, which capitalises on the voluntary and self-driving participation of the HSDs through diaspora organisations (Faist, 2008, 2015; Meyer, Miao and Zhao, 2015).

2.5.3 Network Analysis for the Formulation of Diaspora Engagement Strategy

Meyer (2007) and Meyer, Miao and Zhao (2015) employed network analysis to examine how to engage diasporas in strengthening, mobilising and sustaining diaspora knowledge networks (DKNs). They argued that the sustainability of DKNs is depended on the commitment and active participation of the HSDs. The DKNs cannot be formed as a passive and static network, in which the HSDs merely play the intermediary role of information transmitter. Instead, the stakeholders of the diaspora engagement initiatives have to actively engage to sustain the dynamics of DKNs through concrete projects and actions. Such projects and actions should appeal to the interests of both the home country and HSDs. Thus, the strategic approach to sustain DKNs is to create a win-win situation between national development goals and the career development path of the HSDs.

Another significant contribution of Meyer (2007) and Meyer, Miao and Zhao (2015) is to employ network concept to analyse the position occupied by HSDs in the DKNs. The transnational network of highly skilled diaspora is often described as a kind of social capital (Meyer, 2007; Dahinden, 2010;

Morales and Jorba, 2010; Murat, Pistoresi and Rinaldi, 2011; Ataselim, 2014; Van Meeteren, Engbersen, Snel and Faber, 2014). According to Portes (1998) Borgatti, Everett and Johnson (2013, p. 8) and Shin and Moon (2018), social capital could be defined as the social ties or networks of individuals, organisations or nations which lead to the possession, accession or mobilisation of other types of capitals or resources. Hence, Meyer (2007) and Meyer, Miao and Zhao (2015) advocated that HSDs occupy a strategic position in the DKNs, which enables them to mediate the knowledge flows between destination and home countries. The mediation role is different from acting as intermediary, as the former modifies or adds value to the knowledge but latter merely channels the knowledge.

2.5.4 Summary

The primary objective of diaspora engagement is to mobilise HSDs as development agent for the home countries. The goal of the diaspora engagement strategies must be aligned with the development agenda of the home countries. The literature in this aspect suggested that good understanding on the driving forces of the international migration of highly skilled persons and their spatial distribution is crucial to formulate an effective diaspora engagement strategy. The above view justifies the general objective of this study, which aims at studying the macro-determinants of the spatial distributions of HSDs from ASEAN-5, through which the diaspora resources of the HSDs could be identified. In additions, the extant literature also suggested to employ network analysis to study the connectivity of HSDs between countries. This view also justifies another objective of this study: to understand the capabilities of ASEAN-5 to tap the diaspora resources via diaspora networks which connect destination and home countries.

2.6 Global Diaspora Network and Social Network Analysis

2.6.1 Global Diaspora Network

The insightful discourse of Meyer's (2007) and Turner, Gracia Flores and de Saint Leger (2015) on diaspora network and DKNs motivate this study to take an innovative approach in recommending diaspora engagement strategy for the ASEAN-5. Countries can be viewed as nodes in a global complex network which are formed by the transnational linkages of HSDs (Tranos, Gheasi, Nijkamp, 2012; Danchev and Porter, 2018). The global complex network is called the global diaspora network by Clemens, Ozden and Rapoport (2014) or the world migration network (WMN) by Danchev and Porter (2018) and network of global migration by Windzio (2018). The study adopts the terms 'global diaspora network' in the subsequent parts.

The knowledge on the position and connectivity of a given home country in the global diaspora network is essential to formulate a holistic diaspora engagement strategy. Based on this notion, the literature review investigates the knowledge gap of how to bridge between: (1) the resources associated with the HSDs originated from a given country *j*; and (2) the position and connectivity of the country *j* in the global diaspora network.

2.6.2 Social Network Analysis (SNA)

An extensive literature review reveals that social network analysis (SNA) can be employed to fill the knowledge gap of how ASEAN-5 can mobilise their HSDs to harness the diaspora resources in destination countries/economies. The SNA is a social science technique founded on statistical physics, graph theory and matrix algebra (Wasserman and Faust, 1994, p. 93; Koenig and Battison, 2009; Tranos, Gheasi and Nijkamp, 2012; Prell, 2012, p. 9-12; Scott, 2017, pp. 75-76; Borgatti, Everett and Johnson, 2018, pp. 13-27). It was initially invented by scholars of social psychology and social anthropology in the 1920s-30s. Since then, the SNA method had been further developed by scholars from multidisciplinary fields. In 1960s and 1970s, Harrison White and his team from the sociology department of Harvard University had contributed to the well-developed concepts and analysis techniques of SNA (Scott, 2000, p. 7-9, 33-37; 2012, p. 24; 2017, pp. 34-35; Prell, 2012, p. 19-20; Yang, Keller and Zheng, 2017, p. 23). In the recent years, the application of SNA is not confined to sociology or social science but there is increasing popularity in physics, epidemiology, biology, criminology and economics (Newman, 2001a; König and Battiston, 2009; Everton, 2010; Borgatti and Halgin, 2011; Jackson, 2014).

2.6.3 Social Network and Positional Advantages

Landherr, Friedl and Heidemann (2010), Borgatti and Halgin (2011), Prell (2012), Yang, Keller and Zheng (2017, pp. 5-7) and Borgatti, Everett and

Johnson (2018, pp. 2-4) defined a social network as a set of actors (or nodes) connected by a set of links or ties which features a particular pattern of social relation or interaction. Borgatti, Mehra, Brass and Labianca (2009), Kadushin (2012, p. 8), Scott (2017, pp. 79-80) and Borgatti, Everett and Johnson (2013, p. 7; 2018, pp. 2-5) developed the 'flow model' metaphor for social network, which describes the links and ties in a network as conduits for flows such as resources, ideas, knowledge, social influence and political power (Badi and Diamantidou, 2017). Hence, an actor's position within a network influences its advantages over others, such as its capability in accessing, receiving and mediating the resources flowing through the network. Burt (2000), Prell (2012, p. 222) and Borgatti, Everett and Johnson (2013, p. 7; 2018, pp. 314-316) and Iacobucci, McBride, Popovich and Rouziou (2018) described the actor's advantages associated with his/her links as social capital, which expedites access to other resources found within his/her network. Hanneman and Riddle (2005), Ryall and Sorenson (2007), Scott (2012, p. 25), Badi and Diamantidou (2017) and Antinyan, Horvath and Jia (2019) called such advantages accrued to an actor's network position as 'positional advantages'.

Hence, one of the primary objectives of SNA is to analyse how an actor, which could be an individual, an organisation or a nation capitalises on their positional advantages to achieve their goals within the network structure (Scott, 2012, p. 1; Badi and Diamantidou, 2017; Borgatti, Everett and Johnson, 2018, p. 7). The centrality metrics and brokerage analysis of SNA are referred by this study.

2.6.4 Centrality Metrics

2.6.4.1 The Concepts of Centrality

Wasserman and Faust (1994, p. 169), Prell (2012, p. 95), Scott (2017, p. 96), Yang, Keller and Zheng (2017, p. 61) and Borgatti, Everett and Johnson (2018, p. 190) stated that the concept of centrality is to discover the relative importance or prominence of an individual actor's position embedded in a complete network. A complete network is referred as the network structure formed by an entire set of actors and the links connecting them (Prell, 2012. P. 12; Borgatti, Everett and Johnson, 2018, pp. 2-3). Landherr, Friedl and Heidemann (2010) and Scott (2017, p. 96) advocated that a relatively central actor is the one who is strategically positioned by its interconnectedness with other actors in a network. Operationally, Prell (2012, p. 96) and Borgatti, Everett and Johnson (2013, p. 164; 2018, pp. 190-191) defined the centrality as the advantages of a focal actor relative to other actors with respect to the flows, such as information, economic opportunities, knowledge or innovative ideas passing through a complete network.

2.6.4.2 The Measurement of Centrality

The centrality of the actors is measured by a family of metrics, which were formalised by Freeman (1978), Bonacich (1987) and Wasserman and Faust (1994). These centrality metrics include 1) degree centrality, which is the count of the direct links connected to an individual actor, measuring the actor's capability in capturing flows from heterogeneous sources; 2) eigenvector centrality, which measures an individual actor's power in capturing the flows from the complete network through both direct and indirect links; 3) closeness centrality, which indicates the speed or promptness of an individual actor to capture the flows from the complete network; and 4) betweenness centrality which calibrates the actor's capability in controlling the flows between two other actors (Borgatti, 2005; Prell, 2012, p. 96-114; Yang, Keller and Zheng, 2017, pp. 61-70; Zhang and Luo, 2017; Borgatti, Everett and Johnson, 2018, pp. 191-201).

2.6.4.3 Empirical Studies Using Centrality Metrics

The centrality measures are widely employed in the network studies to examine the collaboration network of scientists, innovators or technological firms. In the seminal work of Newman (2001a, 2001b), the closeness and betweenness centrality were employed to examine the collaboration networks of scientists in physics, computer sciences and biomedical research through the co-authorship of scientific papers. The centrality metrics found close collaboration between scientists and a small number of them as nodes bridging scientists from different parts of the networks.

Neto, Correia, Pinto and Aguiar (2008) and Maggioni and Uberti (2011) employed centrality metrics to investigate the impacts of the evolution of scientific collaboration network on the knowledge diffusion among actors. In a study of Whittington, Owen-Smith and Powell (2009) on the knowledge networks between industrial clusters, the centrality metrics were used to examine whether network proximity among technological firms would affect the knowledge diffusion and innovation outputs.

Wu and Duan (2015) studied on the international scientific collaboration on psychiatry research. They used centrality metrics to investigate collaboration networks between researchers based on the co-authorships in journal papers. The centrality analysis identified the most central or prominent authors from 100 prolific authors. Based on the finding, the Harvard University was ranked as the most prestigious out of 100 research institutions while the United States was the most reputed among 30 countries for the psychiatry research.

The centrality analysis of Achora, Sseguya, Okello and Mkomwa (2016) is to analyse the knowledge networks of conservation agriculture (CA) among stakeholders in Kenya. The stakeholders analysed included farmers, research institutions, policy makers and others. The farmers were identified as occupying the most prominent positions among all stakeholders, indicating that farmers were the most powerful node in influencing the knowledge diffusion process and innovation activities. Similarly, Jessani, Boulag and Bennett (2016) utilised centrality analysis to identify which universities or research institutions were the most influential in shaping the public health policy in Kenya.

Badi and Diamantidou (2017) analysed the impacts of the adoption of building information modelling (BIM) on the communication and collaboration networks in the construction industry of Greek. Those managers and coordinators who had adopted BIM were found to occupy the most central positions in the networks, indicating that they could contribute to improve the efficiency in the communication and collaboration of the Greek construction industry.

Micleusanu (2017) employed centrality analysis to inspect the knowledge networks and innovation activities of the regional ceramic industry cluster in Valencia, Spain. He found that those relatively large and more diversified companies were central actors which benefited more from the knowledge flows and spearhead the innovation as well as the regional economic growth.

2.6.5 Brokerage Analysis

2.6.5.1 Ego Network

Another SNA method is the brokerage analysis. The concept of brokerage was conceived by Gould and Fernandez (1989). In contrast to the centrality metrics which apply to a complete network, the brokerage analysis is employed on the ego network or local network level. An ego-network is formed by (1) a focal actor, which is called as *ego*; (2) the actors to whom the *ego* is directly connected to, which are called as *alters*; and (3) the links between alters (Prell, 2012. P. 8; Borgotti, Everett and Johnson, 2013, p. 262; 2018, p. 305).

2.6.5.2 Types of Brokerage Roles

Gould and Fernandez (1989) posited that the actors in an ego-network could be partitioned into different groups according to their attributes, interests or goals. An actor can only be affiliated to one particular group and all groupings are exclusive. According to Gould and Fernandez (1989), Fernandez and Gould (1994), Everton 2010, p. 170), Prell (2012, p. 125-126), Gehlert, Carothers, Lee, Gill, Luke and Colditz (2015) and Seo (2019), the brokerage can be defined as the process played by an *ego* to mediate the flows or exchanges between two other actors (or *alters*), who might be affiliated either to one same group or to two separate groups. Through the development of the group affiliation framework, Gould and Fernandez (1989) discovered that an *ego* may assume the following brokerage roles (Everton, 2010, p. 170; Prell, 2012, p. 126-128; Chaudhary and Warner, 2015; Gehlert, Carothers, Lee, Gill, Luke and Colditz, 2015; Belso-Martínez, Expósito-Langa, Mas-Verdú and Molina-Morales, 2017; Seo, 2019):

1) Coordinator: Mediation between two *alters* which are in the same group with *ego*;

2) Representative: *Ego* regulates the flows from its group to another group;

3) Gatekeeper: *Ego* regulates the flows from another group to its group

4) Consultant: *Ego* mediates between *alters* from the same group where itself does not belong to the group

5) Liaison: Mediation between two groups where *ego* does not belong to either group

2.6.5.3 Empirical Studies based on Brokerage Analysis

The brokerage analysis is commonly used to investigate how a focal actor can leverage on its ego network position to mediate the information flows between different groups of actors, who might be the separate groups of individuals, social entities, organisations or nations, in order to accomplish specific goals or purposes.

Hargadon and Sulton (1997) and Long, Gunnigham, and Braithwaite (2013) employed brokerage analysis to investigate how a technological firm or a research institute can control or broker the knowledge flows between their counterparts, in order to design new products or develop a new solution. Stevenson and Greenberg (2000) used brokerage to study how various stakeholders or agencies in US interacted and collaborated in influencing the environmental policy of government.

Belso-Martínez, Expósito-Langa, Mas-Verdú and Molina-Morales (2017) employed brokerage analysis to study the changes of the technical advice relationships between firms in the foodstuff industry cluster in Valencia region of Spain. The firms were classified according to characteristics such as number of employers, sale volumes, founding year, natures of business (manufacturers or suppliers) and geographical proximity. Belso-Martínez, Expósito-Langa, Mas-Verdú and Molina-Morales (2017) found that among all brokerage roles, only coordinator role exhibited significant changes over time. They interpreted that the stability in other brokerage roles was caused by industrial maturity and low innovation performance in the cluster. Instead, the increase in the coordinator activities was attributed to the tendency of the firms to seek technical advices and inputs from highly prestigious brokers in geographical proximity. Belso-Martínez, Expósito-Langa, Mas-Verdú and Molina-Morales (2017) suggested that policy makers should break the stable connectivity of the reputed firms and reconnect them to more heterogeneous sources, in order to stimulate innovation activities of the cluster.

Seo (2019) employed brokerage analysis to study the technology transfer networks between three anchor regions, i.e. Beijing, Shenzhen and Shanghai and other regions in China. The brokerage analysis revealed how the three anchor regions could mediate or regulate the technology transfers between other regions, measured by the activities of patent licensing between technology based companies. Seo (2019) found that the three anchor regions played active liaison roles by intermediating knowledge flows and innovation collaboration among heterogeneous sources.

2.6.6 Empirical Studies of Diaspora Networks based on SNA

Although many scholars have recognised that diaspora linkage is a kind of social network (Xiang, 2005; Meyer 2007; Royal Society, 2011, p. 107; Agrawal, 2014; Ghani, Kerr and Stanton, 2014; Meyer, Miao and Zhao, 2015), the SNA literature on the relevant topics is very rare until quite recently. One early notable work was done by Maier and Vyborny (2005), who used SNA to study the patterns of internal migration across the states of United States. They suggested that SNA study could contribute to more strategic thinking in mobilising the migrants for the purposive actions. Tranos, Gheasi and Nijkamp (2012) employed SNA methods to study the migration networks and the clusters of diasporic communities formed among OECD countries. Their work contributes to analyse the topology of diaspora linkages between countries at macro or aggregate level. Kumar (2012) used SNA methods to study the internet based virtual networks which connected Sikh disporas residing in different countries. His purpose was to investigate how the discussions and exchange of opinions through internet based portals shaped the cultural narratives and identities of Sikh diasporas, as well as how such interactions dynamically influenced their political and economic relevance in destination countries.

In a recent work, Bilecen, Gamper and Lubbers (2018) advocate that SNA has long been neglected as the appropriate research tool to investigate the transnational networks of diasporas. They suggested using SNA to study the distributional structure of the diaspora links in the world migration network (WMN), the diaspora network effects in fostering the international linkages across geographical regions, the developmental impacts of diaspora network on the countries of origin and how resources or opportunities may be exchanged through the diaspora networks.

Danchev and Porter (2018) and Windzio (2018) are the two relatively recent works on the application of SNA in the international migration study. Both of them constructed the global diaspora network or WMN by using the datasets of global bilateral migration. Danchev and Porter (2018) conceptualised the WMN as a social-spatial network, in which the diasporas or migrants carry out social interaction through the links connecting different geographical regions or countries. Their exploratory study found that the world was increasingly interconnected by international migration during 1960-2000. They show that there were more inter-continental than intra-continental migration links for the past few decades. However, the groupings or clusters of countries in some regions in the WMN had become denser. This manifests a more heterogeneous distribution of diaspora links, their strength and their clustering across the WMN. Such network structure suggests that although there are increasing opportunities between countries located in different continents, the researchers should also pay attention to the circulation of opportunities within certain groupings or clusters of countries. This finding implies that the study on the diaspora networks of the ASEAN-5 should target their positions in both the global network and the local or ego-network. The ego-network of the ASEAN-5 countries reveals the links and countries which cluster around them.

Windzio (2018) applied SNA regression for the network structure analysis, i.e. exponential random graph models (ERGM) to investigate how the underlying network structures between countries influence the global migration pattern. Such underlying network structures between countries include geographical proximity, migration corridors between developed and developing countries, migration corridors between countries with large population and small and midsized population countries, cultural linkages and colony linkages. His findings largely conformed to the gravity theory for migration, which says that the strength of migration link is adversely related to geographical distance, positively related to the population size and development level in destinations; and intensified by the cultural proximity and historical ties with the destinations.

Although the research objectives of Danchev and Porter (2018) and Windzio (2018) are different from this study, their works enlighten the research methodology of this study in two aspects: Firstly, the countries in the world, including ASEAN-5 could be projected as nodes in the global diaspora network or WMN formed by the international migration of highly skilled people; secondly, the social-spatial network perspective for WMN (Danchev and Porter, 2018) is corresponding to Faist's concept of transnational social spaces (2006; 2010, p. 3) (see section 2.3.2), which describes that the HSDs connect the destinations to the home country through an array of social, economic, political and religious linkages. Hence, based on the work of Danchev and Porter (2018), the global diaspora network or WMN could be viewed as a transnational social space through which the countries interact and exchange economic resources with each other.

2.6.7 Summary

By introducing the SNA methods, the empirical studies on the diaspora resources can be extended to explore the strategies of mobilising such resources for the economic development of home countries. The centrality metrics is used to investigate the positional advantages of ASEAN-5 in capturing various diaspora resources flows circulating through the global diaspora network. Such diaspora resources include the flows of innovative ideas, technical know-how and business opportunities, which are generally cited by the studies of DKNs, transnational entrepreneurship and diaspora search network (Xiang, 2005; Meyer, 2007; Saxenian, 2002; 2006; Bagwell, 2015; Sommer and Gamper, 2016; Malecki, 2017; Kuznetov, 2019). The degree centrality measures the heterogeneity or extensiveness of the diaspora links of ASEAN-5; the eigenvector centrality indicates how influential is the ASEAN-5 in mobilising overseas resources throughout the entire global diaspora network, including the distant regions; the closeness centrality indicates how fast or promptly the ASEAN-5 can capture or respond to the flows circulating through the global diaspora network; and the betweenness centrality measures how important is the ASEAN-5 as mediator or broker for various flows in the global diaspora network.

The literature review also inspires this study to use brokerage analysis to investigate how the ASEAN-5 could leverage on their HSDs to mediate flows of diaspora resources between destination countries. The destination countries are classified into groups according to the potential diaspora resources, for examples, market sizes, development levels, international trade volumes and innovation activities. The 'coordinator' and 'consultant' show how a focal ASEAN-5 country is influential or active in mediating flows of diaspora resources between countries from the same groups, for example same development level. The 'representative', 'gatekeeper' and 'liaison' indicate how a focal ASEAN-5 can potentially mediate the flows of diaspora resources between countries affiliated to different groups, such as developed and developing country or between large trading and small trading nations. The analysis can contribute to identifying the type of brokerage roles which a focal ASEAN-5 country could play better than other ASEAN-5 countries. It also identifies the groups of destination countries to be focused by the diaspora engagement initiatives.

2.7 Conclusion

Both the works of neo-classical economists and social scientists show that the developmental roles of HSDs to their home country are closely related to their migratory motives or expectations. Social scientists adopted the transnationalism concept and showed that HSDs connect their home country to the destination countries through manifold and multifaceted transnational linkages, including professional networks, scientific collaboration, cross-bordering entrepreneurship and search networks.

The HSDs could act as developmental actors, in order to channel knowledge and economic opportunities from the destination, particularly the developed countries to their home country. Social science literature identified three major networks for HSDs to contribute to the development of their home countries: (1) the diaspora knowledge networks (DKNs), (2) the transnational entrepreneurship and (3) the diaspora search network. The development roles in the three major networks are useful reference to formulate HSD engagement policy for home country's economic development plan.

The literature on diaspora engagement strategy shows that the knowledge on the motivations of HSDs to emigrate is essential to identify the diaspora resources to be harnessed from destination countries. Such diaspora resources include entry into foreign market, knowledge and technological know-how from advanced countries, innovative solutions and innovation networks, and international trade opportunities. A better understanding on the diaspora resources of HSDs is crucial to formulate a win-win engagement strategy which would benefit both the economic development of the home country and the career prospects of HSDs.

To find a solution for a win-win HSD engagement strategy, the literature investigates contemporary theoretical frameworks and empirical studies on the macro-determinants of highly skilled emigration. The cross-border movement of highly skilled emigrants is mainly driven by better income prospects, employment opportunities, business opportunities and the network effects of the existing diaspora communities in destination countries. The gravity model of international migration is identified as the most suitable framework to explain the spatial distribution of highly skilled migrants between different destinations. The Poisson Pseudo Maximum Likelihood (PPML) is perceived as the most appropriate estimation method for gravity model of international migration. The estimators are robust when there is large number of zero values in the dependent variable and inherent heteroscedasticity problem. The empirical study shall lead to better understanding of the migratory expectation of the HSDs and thus their potential development resources to be exploited by ASEAN-5.

The literature on social network analysis (SNA) could bridge the gap between the knowledge on the resources of HSDs and formulation of informed strategy to engage them. The SNA defines a network as a set of nodes or actors interlinked by a particular type of relations or a given pattern of interactions. Thus, countries can be visualised as interconnected nodes in a global diaspora network, which is formed by the transnational links of HSDs between countries. By adopting the flow model of SNA (Borgatti, Mehra, Brass and Labianca 2009; Borgatti, Everett and Johnson, 2018, pp. 4-6), the diaspora links or ties in the global diaspora network are viewed as channels facilitating information flows across countries. The literature review found that the centrality metrics and brokerage analysis of SNA can be employed to evaluate the capacity of ASEAN-5 in capturing and mobilising the flows of diaspora resources, such as knowledge and economic opportunities circulating across the global diaspora network.

The interdisciplinary literature review synthesises various fields of knowledge. The purpose is to bridge the gap between knowledge on diaspora resources and the strategy to engage those resources in the development of home country. The findings and interpretations of the literature review are used to design the analytical framework and research methodology of the thesis, which are presented and elaborated in the next chapter.

CHAPTER THREE

METHODOLOGY

3.1 Introduction of the Analytical Framework

The analytical framework is divided into two major parts, PART I and PART II as shown in Figure 3.1.

PART I discusses the analytical framework designed to study the spatial distribution of highly skilled diasporas (HSDs) from ASEAN-5. The analytical framework is based on the neo-classical economic theories on the interaction or reciprocity between international migration and development. The reciprocity shows that it is essential to study the macro-determinants of the spatial distribution of HSDs, in order to understand the potential contribution of HSDs to the economic development of home countries (de Haas et al., 2018). The empirical study is carried out by an augmented gravity model, which relates the spatial distribution of HSDs with macro-determinants representing the overseas economic opportunities or the costs of migration, including geographical distances (Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016). The estimation of the empirical model will be conducted using by Pseudo Poisson Livelihood method (PPML), in order to account for the inherent heteroskedasticity in the international migration data (Beine, Bertoli and Fernández-Huertas Moraga, 2016; Draženović, Kunovac and Pripužić, 2018). The estimation results would reveal the relative importance of the overseas economic opportunities pursued by HSDs, which also point to the diaspora resources of HSDs (Ataselim, 2014; Gamlen, 2014; Wickramasinghe and Wimalaratana, 2016; Gheasi and Nijkamp, 2017; de Haas et al., 2018; Fok, Cheng and Tan, 2018).

PART II will investigate how ASEAN-5 can leverage on the transnational links of their HSDs to capture and mobilise the diaspora resources in destination countries or economies. A global diaspora network is constructed based on the dataset of bilateral highly skilled migrants between countries or economies. The countries or economies in the global diaspora network, including ASEAN-5 are nodes interconnected by their HSD links. By applying social network analysis (SNA), this study examines the positions and connectivity of ASEAN-5 in the global diaspora network. The centrality metrics of SNA is employed to inspect the network positions of ASEAN-5 which influence the capabilities to utilise the diaspora resources of their HSDs. In addition, the brokerage analysis is used to explore how ASEAN-5 can leverage on their HSDs to mediate and diffuse diaspora resources between destination countries or economies. The analysis leads to the identification of the positional advantages of ASEAN-5 in tapping diaspora resources from different parts of the global diaspora network.

The findings of PART 1, which identify the diaspora resources for ASEAN-5, can be integrated with the positional advantages of ASEAN-5 in the global diaspora network as defined by PART II. The integration allows further investigation of the capabilities of ASEAN-5 to gain access to various diaspora resources through the global diaspora network. The analysis will generate insights on the various developmental roles played by the HSDs for their ASEAN-5 home countries.

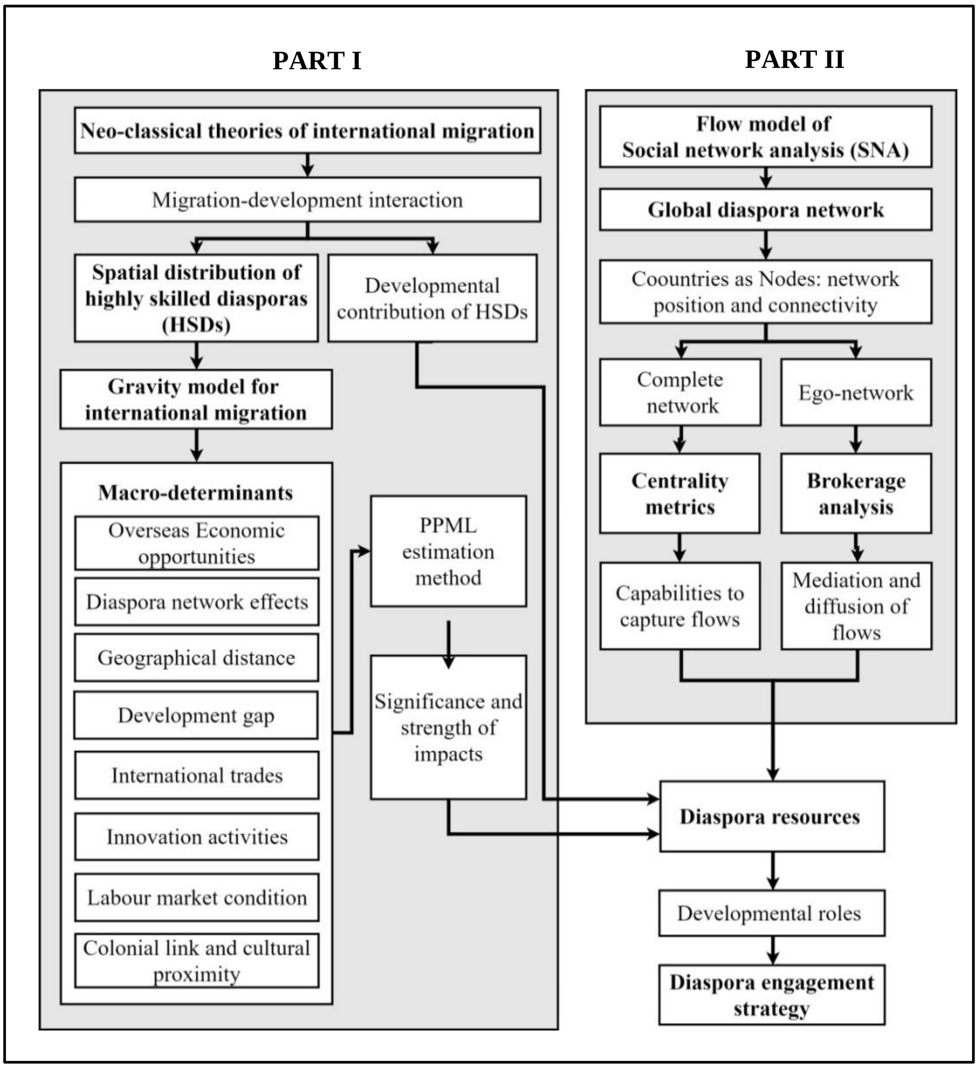


Figure 3.1: Analytical Framework

3.2 Data

In the past few decades, the biggest obstacle for research in international migration of highly skilled people is the lack of comprehensive data, particularly the information on skill or education levels of the international migrants (Durmont, Spielvogel and Widmaier, 2010, p. 7). The situation has improved lately after the release of DIOC-E 2010 (Release 1.0) datasets, jointly published by OECD and World Bank (OECD, 2019).

The DIOC-E 2010 (Release 1.0) dataset was compiled mainly from the national census data of 36 OECD and 55 non-OECD destination countries in 2010 (OECD, 2016, p. 116; OECD, 2019). It is considered as the most comprehensive and harmonised dataset on the international migration to-date (Dumont, Spielvogel and Widmaier, 2010; Docquier and Rapoport 2012; Arslan et al., 2016; OECD, 2016, p. 116; Fok, Cheng and Tan, 2018). The datasets provide information on the international migrant stocks according to their destination country, country of origin, age group, gender and educational attainment.

DIOC-E 2010 (Release 1.0) dataset classifies the education attainment of international migrants according to the International Standard Classification of Education (ISCED), which was published by UNESCO in 1997 (OECD, 2015, p. 17; 2019). The classification differentiates DIOC-E 2010 (Release 1.0) from other datasets in international migrations, such as the datasets published by United Nations, Department of Economic and Social Affairs (2013, 2017), which do not indicate the education levels of the international migrants.

However, DIOC-E 2010 (Release 1.0), similar to the datasets published by United Nations, Department of Economic and Social (2013, 2017), does not provide further classification on the occupations, expertise or industrial fields of the international migrants. This weakness is a predicament for further studies on the international migration and diaspora network at micro-level.

3.3 PART I: Analytical Framework

3.3.1 Definition of HSDs

According to the World Bank (2015, p. 12), the diasporas can be defined as people who emigrate from a given country and live overseas. The HSDs are defined as emigrants who have achieved tertiary education or equivalent professional training, which are indicated by the educational attainment at ISECD 5 or ISECD 6, the classification according to the International Standard Classification of Education (ISECD) (Docquier and Rapoport; 2009; Beine, Docquier and Ozden, 2011a; World Bank, 2011, p. 93; OECD, 2015, p. 13, 78; OECD, 2019).

This research follows the approach of Docquier and Rapoport (2009), Beine, Docquier and Ozden (2011a), World Bank (2011, p. 93), Ataselim

(2014), Artuc, Docquier, Ozden and Parsons (2015) and OECD (2017, p. 77), which define HSDs as the stock of emigrants aged 25 and above (+25) with tertiary education. This age category includes only those who are economically active in the destination countries, but excludes international students who might temporarily stay abroad for educational purpose (World Bank, 2011, p. 93; Artuc, Docquier, Ozden and Parsons, 2015).

3.3.2 Dependent Variable and the Size of Observations

The objective of PART I is to investigate the macro-determinants which drive the spatial distribution of the HSDs of ASEAN-5 in destination countries/economies. The analysis is based on a cross sectional study for the dependent variable M_{jk}, which represents the number of HSDs originating from ASEAN-5 country j and residing in the destination k in 2010.

The data for M_{jk} for each ASEAN-5 are extracted from DIOC-E 2010 (Release 1.0). The extraction produced 91 observations of M_{jk} for each ASEAN-5. However, the DIOC-E 2010 (Release 1.0) does not contain the data of the highly skilled emigrants or HSDs to Singapore. Thus, the sizes of the HSDs from Indonesia, Philippines and Thailand in Singapore are estimated from two other sources: the data of United Nations Population Division on the immigrant stocks in Singapore by countries of origin (United Nations, Department of Economic and Social Affairs, 2013, 2017); and the percentages of highly skilled emigrants according to OECD (2015, p. 80, 92, 100) (See Appendix A). For the size of the HSDs from Malaysia to Singapore, the estimation by World Bank is adopted (World Bank, 2011, p. 98). By adding the estimated HSDs from Indonesia, Malaysia, the Philippines and Thailand to Singapore, the number of the observations or sample size for M_{jk} is 92 for each ASEAN-5 country.

3.3.3 Empirical Model

3.3.3.1 Adoption of Gravity Model for International Migration Study

Figure 3.1 exhibits that PART I adopts the gravity model of international migration in the empirical study. The discussion in Section 2.3.4 shows that economists generally agreed that gravity model is appropriate model to study the spatial distribution of the HSDs in destination countries (Beine, Bertoli and Fernández-Huertas Moraga, 2016; Ramos, 2016; Wajdi, Adioetomo and Mulder, 2017). The gravity model can be augmented to include macro-determinants representing the overseas economic opportunities and the migration costs which influence the spatial distribution of the HSDs. Based on the recommendations of the seminal work of Santos Silva and Tenreyro (2006) and recent literature (Beine, Bertoli and Fernández-Huertas Moraga, 2016; Ramos, 2016; Wajdi, Adioetomo and Mulder, 2017), this study employs Poisson Pseudo Maximum Likelihood (PPML) to estimate the augmented gravity model. The PPML method is able to produce robust estimators which account for the inherent heteroscedasticity in the cross sectional data of international migration.

3.3.3.2 Micro-economic Foundation of the Gravity Model

Bertoli and Moraga (2013) and Beine, Bertoli and Moraga (2014, 2016) have developed the gravity model of international migration based on the micro-economic theory for utility maximisation, namely the random utility model (RUM) (Ramos, 2016; Czaik and Parsons, 2017).

Assuming that a highly skilled individual i emigrated from country *j* and lived in destination country *k*, then *i* has selected *k* from a set of alternate destination countries *D* by maximising his/her utility function as follow:

$$\mathrm{U}_{ijk} = \omega_{jk} - c_{jk} + \epsilon_{ijk} \tag{3.1}$$

where ω_{jk} is the deterministic component of the utility function, c_{jk} denotes the cost of migrating from j to k, and ϵ_{ijk} is the individual-specific random utility.

The distributional pattern of ϵ_{ijk} determines the expected probability $E(p_{jk})$ for individual i to choose country k as his utility-maximising destination. According to RUM, the probability distribution of ϵ_{ijk} follows the Extreme Value Type-1 distribution (EVT-1) (McFadden, 1974; Beine, Bertoli and Moraga, 2014), thus the expected probability is defined as:

$$E(p_{jk}) = \frac{e^{w_{jk}-c_{jk}}}{\sum_{l\epsilon D} e^{w_{jl}-c_{jl}}} \tag{3.2}$$

Where l is the alternative destination drawn from a set of alternative destinations D, i.e. $l \epsilon D$.

The expected probability $E(p_{jk})$ in equation (3.2) also indicates the expected ratio of highly skilled persons migrate from country of origin j to destination k. Thus, equation (3.2) can be rewritten as the expected volume of highly skilled diaspora stock from j to k:

$$E(M_{jk}) = \frac{e^{w_{jk}-c_{jk}}}{\sum_{l\epsilon D} e^{w_{jl}-c_{jl}}} s_j \qquad (3.3)$$

Where $M_{jk} = p_{jk}s_j$ represents size of the highly skilled diaspora from country j to country k, and s_j is size of the highly skilled persons in country j. For a given country of origin j, equation (3.3) can be rearranged into a way which resembles a gravity equation:

$$E(M_{jk}) = \phi_{jk} \frac{y_k}{\Omega_j} s_j \qquad (3.4)$$

Where $y_k = e^{w_k}$, $\phi_{jk} = e^{-c_{jk}}$, $\Omega_{jt} = \sum_{l\epsilon D} \phi_{jl}\, y_l$. Thus, the expected number of highly skilled diaspora of country j to k is influenced by a few major forces. Firstly, the pushing force s_j in country j to cause highly skilled emigration to k; secondly, the attractiveness y_k in destination country k which pull highly skilled emigrants from country j; thirdly, the cost of migration $\phi_{jk} < 1$ for potential highly skilled emigrants from country j to k; and fourthly,

Ω_j represents the expected utility for the prospective highly skilled emigrants from a set of alternative destinations. As $\frac{\partial \Omega_j}{\partial \phi_{jl}} = y_l > 0$, it is obviously that an increase in the accessibility of alternative destination ϕ_{jl} leads to a decrease in the expected number of highly skilled diaspora from j to k. This is the multilateral resistance effects as discussed in the Section 2.4.4 of Chapter Two. The multilateral resistance term describes the inverse correlation between the utility of migrating to a prospective destination k and the expected utility from a set of alternative destinations (Santos Silva and Tenreyro, 2006; Arvis and Shepherd, 2012; Anderson, 2016; Beine, Bertoli and Moraga, 2014, 2016; Ramos, 2016).

Empirically, equation (3.4) is estimated by adding a well-behave error term ν_{jk}, with $E(\nu_{jk}) = 1$, so that:

$$E(M_{jk}) = \phi_{jk} \frac{y_k}{\Omega_j} s_j \nu_{jk} \tag{3.5}$$

Equation (3.5) can be rewritten into the gravity equation which is usually used in the empirical study:

$$M_{jk} = \alpha \frac{(P_j * P_k)^{\beta_1}}{d_{jk}^{\beta_2}} \eta_{jk} \tag{3.6}$$

y_{kt}, the attractiveness of destination k in equation (3.5) is replaced by the population size in destination P_k in equation (3.6). *Ceteris paribus*, a larger P_{kt} implies more employment and career development opportunities in destination k for the highly skilled emigrants from country j. Similarly, s_j, the pushing force of the country of origin j in equation (3.5) is replaced by the population size in the country of origin P_j in equation (3.6). The larger P_j implies higher competition pressure in the employment market of the country of origin j, thus pushing more highly skilled persons to destination country k (Globerman and Shapiro, 2008; Docquier, Peri and Ruyssen, 2014; Yan and Zhou, 2018). The force of attraction between destination and home countries is represented by the multiplication of P_j and P_k or P_j x P_{kt} (Anderson, 2016; Poot, Alimi, Cameron and Mare, 2016). However, the attraction force is counterweighted by the costs of migration ϕ_{jk} from j to k, which is approximated by the geographical distance d_{jk} between the two countries in equation (3.6). The η_{jk} is the error term influenced by the multilateral resistance effects Ω_j, which causes heteroskedasticity problem in the empirical study. The α is a constant which is to be estimated in the equation (3.6) (Santos Silva and Tenreyro, 2006; Beine, Bertoli and Moraga, 2014, 2016; Anderson, 2016).

Equation (3.6) is the core equation for the empirical model to be developed in the next section. The equation (3.6) will be augmented by macro-determinants and control variables which relate to the push and pull factors in explaining the spatial movements of the HSDs (Beine, Noel and Ragot, 2014; Poot, Alimi, Cameron and Mare, 2016; Ramos, 2016),

3.3.4 Model Specification

In order to apply the PPML method to estimate the empirical model, the values of the dependent variable is assumed to follow a Poisson probability distribution. Let M_{jk} denotes the observed number of the highly skilled diaspora originating from country j and resided in country k at the year t = 2010. Assuming that M_{jk} is a nonnegative integer or $M_{jk} \geq 0$ and has a Poisson distribution with a conditional mean μ_{jk}:

$$Pr\left[M_{jk}\right] = \frac{exp^{-\mu_{jk}} \cdot (\mu_{jk})^{M_{jk}}}{M_{jk}!} \tag{3.7}$$

where M_{jk} = 0, 1 …, and $\mu_{jk} = E(M_{jk})$. The conditional mean μ_{jk} = $E(M_{jk})$ is an exponential function of a set of explanatory variables X with corresponding parameter vector β (Santo Silva and Tenreyro, 2006; Burger, Van Oort and Linders, 2009; Quantitative Micro Software, 2010, pp. 287-288; IHS Markit, 2017, pp. 378-379):

$$\mu_{jk} = E(M_{jk}) = exp\ (X'\beta) \tag{3.8}$$

Hence,

$$M_{jk} = exp\ (X'\beta)\eta_{jk} \tag{3.9}$$

where η_{jk} is the stochastic term following a Poisson distribution. The Equation (3.9) is structured as a Poisson model, which is a kind of count models and estimated by PPML method (QMS Quantitative Micro Software, 2010, pp. 287-288; Greene, 2012, p. 843; Ramos, 2016; IHS Markit, 2017, pp. 378-379; Wajdi, Adioetomo and Mulder, 2017). The PPML method is robust to the heteroscedasticity inherent in the gravity model, which is caused by the cross-sectional data and the effects of multilateral resistance. The advantage of PPML is that it is able to produce consistent estimates of the parameters even if the probability distribution function is unknown or incorrectly specified (Santos Silva and Tenreyro, 2006; IHS Markit, 2017, p. 380).

Another advantage of applying PPML is that Equation (3.9) can be estimated in the multiplicative form, instead of log-linear form. Hence, the dependent variable M_{jk} is spared from the log transformation, which will cause undefined value for zero value observations. Nonetheless, the log transformation can still be applied for individual independent variables, where the estimated parameters are equal to the magnitudes of elasticity (Santo Silva and Tenreyro, 2006; Beine, Bertoli and Moraga, 2014, 2016).

Based on Equation (3.9), an augmented gravity model is constructed to include relevant macro-determinants as exhibited in PART I of Figure 3.1. Table 3.1 displays the description, unit measurement and expected sign for each of the macro-determinants and control variables. The selection of the macro-determinants is based on the neo-classical economic theories on international migration (de Haas, 2014; O'Reilly, 2015; Gheasi and Nijkamp, 2017) and the gravity model of international migration (Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Ramos, 2016). The neo-classical economic theories states that the main drivers for international migration is the development gaps between countries, namely the differentials in income or GDP per capita levels and employment conditions (de Haas, 2014; Wickramasinghe and Wimalaratana, 2016; Gheasi and Nijkamp, 2017), whereas the gravity model of international migration emphasises on the attraction or pulling effects of the economic opportunities in destinations, which include the market opportunities in populous destinations, the international trade relationship, innovation activities in destinations, as well as the network effects which may facilitate the international migration of HSDs such as networks of the existing diasporas, free trade agreements, cultural links and colonial heritages (Beine, Bertoli and Moraga, 2014, 2016; Poot, Alimi, Cameron and Mare, 2016; Ramos, 2016; Czaik and Parsons, 2017).

The immigration policies of the destination countries are not included as independent variable in the empirical model. The discussion in Section 2.3.5.9 has shown that the contemporary immigration policies target mainly at the low skilled, illegal workers and irregular migrants such as asylum seekers (de Haas, Natter and Vezzoli, 2015, 2018). Conversely, most of the countries, especially advanced countries have relaxed their restriction on the highly skilled immigrants. The immigration policies for highly skilled immigrants have become more selective but not restrictive. In addition, the unavailability of standardised and widely recognised measures is another reason for not including the immigration policies in this study (Beine, Bertoli and Fernandez-Huertas Moraga, 2016; de Haas, Natter and Vezzoli, 2015, 2018).

Table 3.1: Dependent and Independent Variables of the Empirical Model

Variables	Description	Units of Measurement	Coefficient	Expected Sign
M_{jk}	Dependent variable: Size of HSDs from ASEAN-5 country *j* and residing in destination country *k*	Highly skilled population aged 25 and above (+25) but living in destination country *k*		
$P_k * P_j$	Product of the population sizes of home country (P_j) and destination country (P_k)	The total population	β_1	Positive
$DIST_{jk}$	Geographical distance between ASEAN-5 country *j* and a destination country *k*.	Kilometres	β_2	Negative
$STOCK_{jk}$	Existing stock of diasporas from ASEAN-5 country *j* in destination *k*.	The total number of diasporas in destination *k*	β_3	Positive
$GDPPCr_{kj}$	Ratio of the per capita GDP between a destination country *k* and ASEAN-5 country *j*.	Per Capital GDP measured in US Dollar (Nominal Price)	β_4	Positive
$INNOVr1_{kj}$	Ratio of the numbers of patent applications between destination country *k* and ASEAN-5 country *j*.	Number of patent application measured by patents filed through national patent offices and Patent Cooperation Treaty (PCT) route (WIPO, 2017b).	β_5	Positive
$TRADE1_{kj}$	Total trade, i.e. the sum of export and import values between ASEAN-5 country *j* and destination country k.	US Dollar (Thousand) (World Bank, 2019)	β_6	Positive
TA_{kj}	Whether ASEAN-5 country *j* and destination *k* are members of the same regional trade agreement (RTA) or bilateral free trade agreement (FTA).	Dummy Variable. TA_{kj} = 1 if country *j* and destination *k* are RTA or FTA partner countries. Otherwise, TA_{kj} = 0	β_7	Positive
$UNEMPr_{kj}$	Ratio in the unemployment rates between destination *k* and ASEAN-5 country *j*.	Unemployment rates measured in percentage	β_8	Negative
CUL_{kj}	The cultural proximity between destination *k* and ASEAN-5 country *j*	Cultural proximity index (Eff, 2008) with $0 \leq CUL_{kj} \leq 1$	β_9	Positive
COL_{kj}	Whether ASEAN-5 country *j (*except Thailand) is linked to destination *k* by colonial history.	Dummy variable. COL_{kj} = 1 if country *j* and destination *k* are linked by colonial history. Otherwise, COL_{kj} = 0	β_{10}	Positive/negative

The model specification is explained in detail as follows:

$$M_{jk} = exp\,[\,\beta_0 + \beta_1\, ln\big(P_j * P_k\big) + \beta_2\, ln\big(DIST_{jk}\big) + \beta_3 lnSTOCK1_{kj} + \beta_4 lnGDPPCr_{kj} + \beta_5 lnINNOVr1_{kj} + \beta_6 lnTRADE1_{kj} + \beta_7 TA_{kj} + \beta_8 UNEMPr_{kj} + \beta_9 CUL_{kj} + \beta_{10} COL_{kj} + \eta_{jk}] \qquad (3.10)$$

With j = home country, i.e. a given ASEAN–5 country), k = destination country and η_{jk} = stochastic term. The expected signs for the coefficients are β_1, β_3, β_4, β_5, β_6, β_7, β_9, $\beta_{10} > 0$ and β_2, $\beta_8 < 0$. The coefficients are estimated for each ASEAN-5 country.

Where,

(i) M_{jk}

M_{jk} is the dependent variable which represents the number of HSDs from one ASEAN-5 country j and residing in destination k. It is measured in the total number of HSDs in a given destination country. The data are acquired from the DIOC-E 2010 (Version 1.0) datasets jointly published by OECD and the World Bank for the year 2010 (OECD, 2019). The number of observations for M_{jk} for each ASEAN-5 is 92.

(ii) $P_j * P_k$

The term $P_j * P_k$ is the product of the whole population size of home country (P_j) and destination country (P_k). The population size implies the scale of economic activities in a country (Ramos, 2016; Yau and Zhou, 2018). The product term represents the potential economic attractiveness, i.e. the market size, career and employment opportunities of destination country *k*. It is hypothesised that β_1 is positive, implying a rise in the product term will enlarge the size of HSDs in destinations. The significance of $P_j * P_k$ also means that ASEAN-5 can leverage on their HSDs to capture the market opportunities in populous destination countries. The data of population sizes are acquired from the World Bank database.

(iii) $DIST_{jk}$

The *DIST* represents the geographical distance (measured in kilometres) between a given ASEAN-5 country *j* and a destination country *k*. It is computed by Mayer and Zignago (2011), using the great circle formula based on the latitudes and longitudes of the most important cities or agglomeration. It is the proxy variable for mobility costs or any movement costs between the home and destination country (Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Ramos, 2016). It is hypothesised that β_2 is negative, implying that the spatial distributions of HSDs are adversely influenced by the geographical distance or costs of migration. Conversely, a significantly positive sign may show that the HSDs are relatively mobile and venturous, not inhibited by geographical distance when choosing migratory destination.

(iv) $STOCK1_{jk}$

The *STOCK1* represents the network effects of the existing stock of diasporas in attracting highly skilled emigrants from ASEAN-5 to destination countries (Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Rapoport, 2016). The *STOCK1* is measured by the entire size of existing diaspora in 2000 for each destination country. The reason for taking the existing diaspora stock is to account for the network effects from all the diaspora links between destination and home country (Meyer, 2007; Beine, Bertoli and Fernández-Huertas Moraga, 2016).

The data for diaspora stocks in 2000 is acquired from the DIOC-E 2000 (Release 3.0) published by OECD. However, some of the observations of the *STOCK1* are zero values, which will become undefined after applying log transformation. Hence, all the values of *STOCK1* are added with a small constant, i.e. plus one (+1). By adding plus one (+1) on the zero values, the log transformation will return them to zeros. The impacts of plus one (+1) on the non-zero observations after log-transformation is trivial. This method is commonly used by econometricians for empirical study based on gravity model (Ortega and Peri, 2012; Ramos and Surinach, 2017).

The coefficient β_3 of *lnSTOCK1* is hypothesised to be positive. A significant *STOCK1* indicates the existence of relatively strong diaspora network between destination and home countries. The diaspora network is a kind of social capital which can be drawn to mobilise the HSDs in the development of home country.

(v) $GDPPCr_{kj}$

GDPPCr is the ratio of the per capita GDP between a destination country *k* and a given ASEAN-5 country of origin *j*. It is to measure the impacts of development gaps between destination and home countries in influencing the spatial dispersion of ASEAN–5 HSDs. β_4, the coefficient of *lnGDPPCr* is hypothesised to be positive. A significant and positive estimator for *GDPPCr* implies that HSDs are attracted to the countries with higher development level. This also points to the potential diaspora resources in these destinations, such as the knowledge, technological know-how and outsourcing business opportunities (Beine, Bertoli and Fernández-Huertas Moraga, 2014, 2016; Fok, Cheng and Tan, 2018). The data of per capita GDP are obtained from the World Bank DataBank.

(vi) $INNOVr1_{kj}$

INNOVr1, is the ratio of the numbers of patent applications between destination country *k* and a given ASEAN-5 home country *j*. The number of patent applications is a widely recognised indicator for innovation activities, technological development and knowledge flows (Burhan, Singh and Jain, 2017; Sharma and Tripathi, 2017). The number of patent applications by countries is measured by the patents filed directly through national patent offices and Patent Cooperation Treaty route (PCT) in 2010. The PCT is an international treaty which allows applicant to seek patent protection for an invention simultaneously in more than 140 Paris Convention countries. (PCT) (WIPO, 2017a, 2017b, 2019). Some of the destination countries might have zero patent application, which leads to zero values for *INNOVr1*. Hence, all the values of *INNOVr1* are added with value one (+1) for applying the log transformation as specified in equation (3.10). The data of patent applications are acquired from the databases of the World Intellectual Property Organization (WIPO).

It is hypothesised that β_5, the coefficient of *lnINNOVr1* is positive, indicating that HSDs are attracted to the innovation activities in destination countries.

(vii) $TRADE1_{kj}$

TRADE1 is the total trade, i.e. the sum of export and import in US Dollars between a given ASEAN-5 country *j* and a destination country *k*. It represents the economic linkage between the two countries. β_6, the coefficient of *lnTRADE1* is hypothesised to have a positive sign, implying that the HSDs are attracted to destinations which have strong bilateral trade relationship with their home countries (Globerman and Shapiro, 2008; Campaniello, 2014; Jut, 2015). Thus, it also means that the HSDs could be engaged to strengthen the trades between destination and home countries. The bilateral trade data are obtained from the World Bank Databank. As there are zero values for some of the observations of *TRADE1*, all the *TRADE1* values are added with a value one (+1) before applying the log transformation as specified in Equation (3.10).

(viii) *TA*

TA denotes regional trade agreement (RTA) and bilateral free trade agreements (FTAs). *TA* is measured as a dichotomous dummy variable, where *TA* = 1 if a given ASEAN-5 country *j* and a destination country *k* are member countries of a same regional trade agreement (RTA) or partner countries of a bilateral free trade agreement (FTA); otherwise *TA* = 0. The RTA and FTA usually include terms which facilitate the cross-border mobility of labours and talent between the signing counties (Globerman and Shapiro, 2008; Docquier, Peri and Ruyssen, 2014). Hence, the inclusion of *TA* is to control for the highly skilled emigration promoted by *RTA* or *FTA*. It is hypothesised that β_7, the parameter of *TA* is positive, implying that the home country could further intensify the economic links with their HSDs through the *RTA* or *FTA*. The information of the *RTA and FTA* is obtained from the website of World Trade Organization (WTO).

(ix) $UNEMPr_{jk}$

This independent variable represents the ratio of the unemployment rates between a destination *k* and a given ASEAN-5 home country *j*. It is a control variable to account for the influence of employment conditions in the destinations. It is hypothesised that β_8 is negative, implying that the sizes of HSDs will be reduced by the increase in unemployment rates in destinations relative to home countries (Globerman and Shapiro, 2008; Nica, 2015). The statistics of unemployment rates are downloaded from the World Bank Databank.

(x) CUL_{jk}

The *CUL* is a normalised measurement (with values between 0 and 1) invented by Eff (2008) to indicate the cultural proximity between pairs of countries. The cultural proximity is measured according to the language phylogeny among countries (Holman, Wichmann, Brown and Eff, 2015; Fok, Cheng and Tan, 2018).

It is hypothesised that β_9 is positive, implying that cultural proximity between a given ASEAN-5 country *j* and a destination country *k* will lower the migration and adaptation costs, thus increasing the size of HSDs in the destination country *k*. (Beine, Bertoli and Fernández-Huertas Moraga, 2016; Ramos and Suriñach, 2017). The positively significant *CUL* also means that

ASEAN-5 could capitalise on their HSDs to intensify the cultural link and thus fostering the economic relations with the destination countries.

(xi) COL_{kj}

COL denotes the former colonising countries of ASEAN-5 (except Thailand) and destinations which have the common former colonising countries with ASEAN-5. The spatial distribution of the HSDs of ASEAN-5 (except Thailand) might be influenced by their colonial history. The *COL* is a dichotomous dummy variable, where the indicators for colonial links are obtained from the dataset compiled by Mayer and Zignago (2011). *COL* = 1 if a destination country *k* is either 1) the former colonising country of a given ASEAN-5 country *j* or 2) sharing the same former colonising country with the ASEAN-5 country *j*; otherwise *COL* = 0

β_{10}, the coefficient of *COL* is hypothesised to be positive, implying that colonial links will facilitate the highly skilled emigrants from ASEAN-5. In this case, ASEAN-5 could engage their HSDs to strengthen the economic ties with their former colonising countries and destinations which were colonised by the same former colonising countries. However, it is also possible for *COL* to have a negative estimator. According to Head, Mayer, Ries (2011) and Stack, Ackrill and Bliss (2018), the negative estimator indicates that the influence of colonial links has eroded or declined after the independence of the home countries.

3.3.5 Robustness and Specification Tests for the Pseudo Poisson Maximum Likelihood (PPML) Estimation Method

Equation (3.10) is estimated by the PPML method. As discussed in Section 2.4.4 of Chapter Two, the PPML is the robust estimation method for empirical studies based on an augmented gravity equation. The PPML estimates equation (3.10) in the multiplicative form without log-linearisation.

Nevertheless, a correctly specified model under the Poisson assumption and PPML method must satisfy the following restriction:

$$Var\ (X, \beta) = E(X, \beta) \tag{3.11}$$

Equation (3.11) is called as the equality of the conditional mean and conditional variance or the mean-variance equality (Burger, van Oort and Linders, 2009; Quantitative Micro Software, 2010, pp. 287-288; Greene, 2012, pp. 332-333; IHS Markit, 2017, pp. 378-379). If the mean-variance equality is not held, the empirical model is not correctly specified and unable to estimate the standard errors consistently. The econometric consequence is the overdispersion of residuals for the estimated model (Quantitative Micro Software, 2010, pp. 292-294; IHS Markit, 2017, pp. 383-385). The reason for the overdispersion is due to failure of the model specification to capture the unobserved heterogeneity, resulting in $Var\ (X, \beta) > E(X, \beta)$.

The overdispersion can be detected by the Wooldridge approach, which is done by estimating the following auxiliary regression (Wooldrigde, 1997; Quantitative Micro Software, 2010, pp. 293-294; IHS Markit, 2017, pp. 384-385):

$$sresid^2 - 1 = \alpha\widehat{m}_{jk} + \varepsilon_{jk} \tag{3.12}$$

Where $\widehat{m}_{jk}$ is the estimated or forecasted value for the dependent variable m_{jk} of Equation (3.10), and $sresid$ is the standardised residuals of the estimated equation. If the estimated parameter α is statistically significant, then the assumption of mean-variance equality (3.11) is rejected.

Following Wooldridge (1997), the solution for the overdispersion is to re-estimate the Poisson model under the variance assumption of generalised linear model (GLM). The re-estimation will produce the QML estimators (quasi-generalised pseudo maximum likelihood estimators) with robust covariance matrix and thus more consistently estimated standard errors. The QML estimators satisfy the weaker condition of the correctly specified conditional mean $E(X, \beta)$ and the conditional variance $Var\ (X, \beta)$ which is proportional, but not necessarily equal to the conditional mean (Burger, van Oort and Linders, 2009; Quantitative Micro Software, 2010, pp. 295-296; IHS Markit, 2017, p. 385).

The specification test for the re-estimated Poisson model under GLM assumption is not the conventional likelihood ratio statistic (LR), which is only valid if the mean-variance equality condition is fulfilled. The test should be based the quasi-likelihood ratio statistic (QLR), which is computed by dividing the original LR statistic with the estimated GLM variance factor of the QLM estimators (Quantitative Micro Software, 2010, pp. 295-296; IHS Markit, 2017, pp. 386-387).

3.4 PART II：Analytical Framework

3.4.1 Flow Model of Social Network Analysis (SNA)

As an extension to the empirical findings of PART I, PART II applies the SNA to systematically explore how ASEAN-5 could capitalise on the networks with the destinations through HSDs (hereinafter called as HSD links): firstly, to capture the flows of resources, such as knowledge and economic opportunities from heterogeneous sources of destination countries; and secondly, to mediate, re-create and diffuse the flows of resources between countries; and thirdly based on the above findings, to explore how the HSDs of ASEAN-5 can contribute to the development of their home countries through diaspora knowledge network (DKN), transnational entrepreneurs and diaspora search network.

PART II of the study will conceptualise the transnational phenomenon of HSDs by using the flow model of SNA (Borgatti, Everett and Johnson; 2018, pp. 4-6). The transnational livelihood of HSDs is the underlying mechanism which establishes and sustains HSD links between destination and home countries, such as the diaspora knowledge network (DKN) and transnational entrepreneurship. Based on the concept of SNA, countries in the world, including ASEAN-5 can be viewed as nodes linked by the spatial movements of the highly skilled migrants or HSDs between countries. The countries (nodes) and the diaspora links form a network which is called the global diaspora network (Clemens, Ozden and Rapoport, 2014). According to the flow model of SNA, the diaspora links which interconnect the countries (or nodes) could be viewed as conduits for the flows of knowledge and economic opportunities which circulate between countries (Borgatti, Mehra, Brass and Labianca 2009; Elo, 2015; Malecki, 2017; Borgatti, Everett and Johnson, 2018, pp. 4-6). The exploratory analysis conducted in this study is based on the global diaspora network of 2010.

3.4.2 Adjacency matrix and Global Diaspora Network

Using the DIOC-E 2010 (Release 1.0) dataset published by the OECD, the study constructs an adjacent matrix which contains 203 countries or economies (203 x 203) to represent the global diaspora network in 2010. The adjacent matrix is denoted as *2010 (d, E)*, where *d* = density of the network and *E* = total HSD links actually exist between countries in the network.

3.4.3 Network Density

The density of the network d is defined as the number of HSD links actually exist in the *2010 (d, E)*, and expressed as a proportion of the maximum number of potential diaspora links among country pairs:

$$d = \frac{E}{n(n-1)/2} \tag{3.13}$$

With E = the actual diaspora link and n = number of countries in the 2010 *(d, E)*. As all the links are non-directional or symmetrical, i.e. two ways, the maximum number of possible links is n (n - 1)/2 (Yang, Keller and Zheng, 2017, pp. 58-60; Borgatti, Everett and Johnson, 2018, pp. 174-179). In this study, there are 203 countries or regions in the matrix, thus the maximum possible diaspora links between countries is 27, 261. The d reflects how nodes in a network are closely linked to each other. In other words, it measures the connectedness or cohesiveness of a network. The higher the d, the faster the flows travel among nodes in a network, or the more frequent the exchanges take place among nodes.

3.4.4 Strength of the Diaspora Link

In the adjacency matrix 2010 (*d*, *E*), the rows represent the countries of origin j and the columns indicate the destination countries k. A given cell in 2010 (*d*, *E*) is denoted as M_{jk}. An $M_{jk} > 0$ indicates that there is highly skilled diaspora originating from country j and residing in country k, thus a direct diaspora link between destination *k* and country of origin *j*. If $M_{jk} = 0$, there is no diaspora link between the country pair. If $M_{jk} > 0$ and $M_{kl} > 0$, then there is an indirect diaspora link between country *j* and country *l*.

Assuming that the quality of each highly skilled diasporic member is homogenous, it can be inferred that the capacity of flows transferable between two countries is proportional to the size of M_{jk}. Hence, M_{jk} is also an indicator for the strength of diaspora link between country *j* and country *k*.

3.4.5 Data Transformation for the adjacency matrix

To apply SNA method, some transformations on the original data of adjacency matrix is necessary and useful. Three data transformation methods which will be used in this study are normalisation, symmetrisation and dichotomisation:

3.4.5.1 Normalisation

The country of origin with large population tends to send a higher number of highly skilled emigrants. Hence, the scale effects of M_{jk} may obscure the comparison between countries of origin (Tranos, Gheasi and Nijkamp, 2012; Danchev and Porter, 2018). The scale effects can be controlled by normalising the value of M_{jk} against a common denominator. The focus of this study is the network positions and connectivity of countries of origin as formed by the highly skilled emigration. In other words, it is the outgoing links to destinations which are the main concern of this study. Thus, according to the SNA method of normalisation for outgoing links, all M_{jk} should be normalised by row based on a common denominator. Following the algorithm of UCINET, all M_{jk} in a given row are normalised by standardising their Euclidean Norm to value one (Hanneman & Riddle, 2005; Borgatti, Everett and Johnson; 2018, pp. 92-94). The normalised M_{jk} is denoted as nM_{jk}, which takes the value of $0 \leq nM_{jk} \leq 1$. After normalisation, the adjacency matrix *2010 (d, E)* is renamed as *n2010 (d, E)*. The normalisation removes the scale effects and indicates only the relative strength of each diaspora link. It makes nM_{jk} comparable across countries of origin.

3.4.5.2 Symmetrisation

Most of the SNA techniques, including centrality measures are developed mainly to analyse data in symmetrical form (Hanneman and Riddle, 2005; Borgatti, Everett and Johnson, 2018, pp. 86-87). The symmetrical form means that the links of the adjacency matrix are reciprocal or undirected, i.e. $M_{jk} = M_{kj}$. As the focus of this study is the HSDs of ASEAN-5 dispersing across destination countries, i.e. the HSDs in receiving countries from the columns of *n2010 (d, E),* the symmetrisation is done by setting the lower half equal to the upper half of the adjacency matrix (Hanneman and Riddle, 2005; Borgatti, Everett and Johnson, 2018, pp. 20-22). The new adjacency matrix after symmetrisation is denoted as S*n2010 (d', E')*. The reciprocal or non-directional diaspora links make sense for this study, as the flows of knowledge and opportunities between countries could be two-ways or reciprocal.

3.4.5.3 Dichotomisation

Many SNA techniques including centrality metrics and graph visualisation are developed for data in binary values. The 1 and 0 indicate the presence or absence of a link between two nodes, or in this case, between country *j* and *k*. (Hanneman and Riddle, 2005; Borgatti, Everett and Johnson, 2018, p. 291). The value data in the adjacent matrices can be transformed to binary data through dichotomisation, which is done by setting a cut-off point *c*. For normalised adjacency matrix *n2010* (*d*, *E*) or S*n2010 (d', E'),* the *c* should take the value $0 \leq c < 1$. If a cell value nM_{jk} is equal to or larger than *c*, it is recoded as 1. Otherwise, the cell value is set to 0.

The dichotomisation is especially a superior technique to deal with large networks, as it reduces the number of the links and only retains those which are more important or stronger for analysis (Borgatti, Everett and Johnson, 2018, p. 291). This is helpful if the target of the analysis is the structure of the connectedness between nodes.

3.4.6 The Two Levels of Network Analysis

PART II analysis shall be carried out in two levels: the complete network level and the ego-network level. The complete network level is the entire network constructed by all the nodes in the sample or population in a study, such as the global diaspora network in 2010 (Prell, 2012, p. 12; Dachev and Porter, 2028; Windzio, 2018). The ego-network is a local network formed by a given focal node or *ego*, the other nodes to which the *ego* is directly linked to and called as *alters*, and the links between the *alters* (Prell, 2012, p. 8; Borgotti, Everett and Johnson, 2018, p. 305).

3.4.6.1 The Complete Network Level

At the complete network level, the target of the analysis is the ASEAN-5 and other countries or economies as nodes in the global diaspora network *Sn2010 (d', E').* A given ASEAN-5 country *j* is connected with a particular destination *k* through its HSD. The destination *k*, in turn, is also country of origin in its own right and connected to another destination *l*, and so forth.

The analysis at this level explores the positional advantages of the ASEAN-5 in capturing and mobilising the flows circulating across countries in the global diaspora network *Sn2010 (d', E')* (Hanneman and Riddle, 2005; Ryall and Sorenson, 2006; Scott, 2012, p. 25; Badi and Diamantidou, 2017; Antinyan, Horvath and Jia, 2019). The analysis is done through a family of centrality metrics:

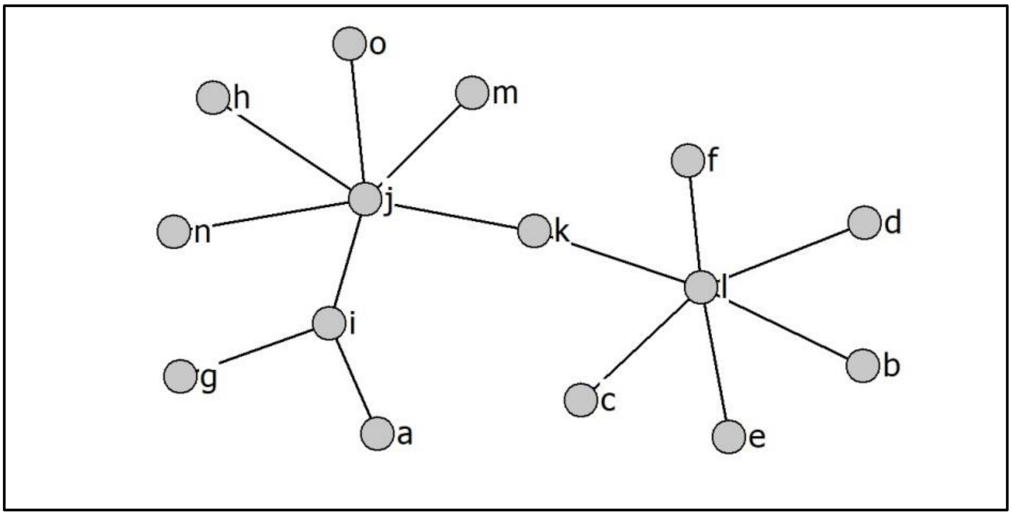
1) Degree centrality (C_D)

C_D counts the number of direct links to destination countries from a focal country of origin (See Figure 3.2). This is the most fundamental and intuitive measure of centrality (Prell, 2013, p. 97; Borgatti, Everett and

Johnson, 2018, pp. 191-194). A high C_D implies that the country of origin actively involves in global diaspora network and exposes to heterogeneous sources of knowledge and opportunities. The normalised degree centrality for an origin country j is calculated as:

$$C'_D(j)=\frac{C_D(j)}{n-1} \tag{3.14}$$

Where n is total number of countries in the global diaspora network of 2010. In this study n = 203.



Note: Country j and country l have the same C_D = 6 as both of them are linked to six destination countries. The country i has three connections, thus C_D = 3; and C_D = 2 for country k. All other countries have C_D =1.

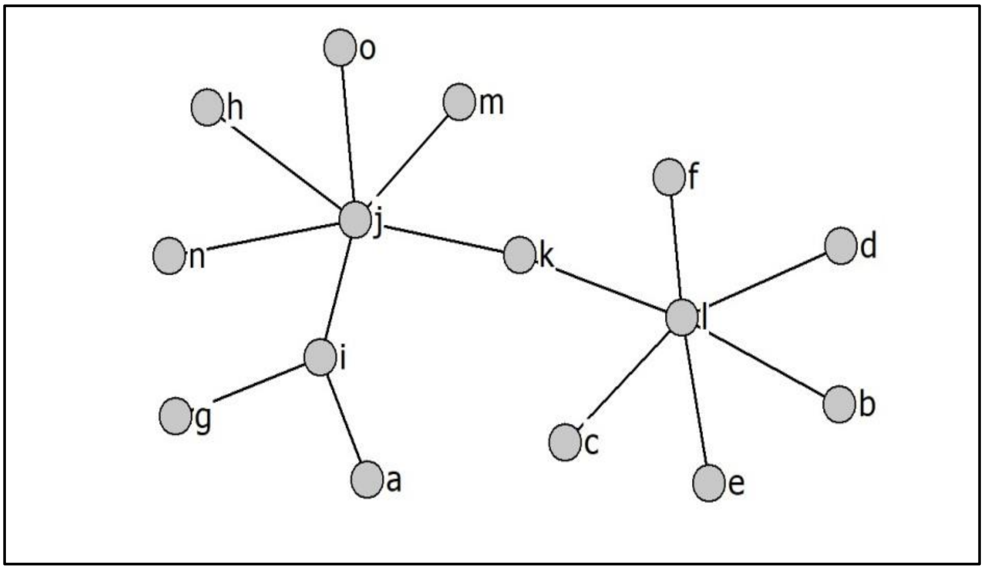
Figure 3.2: Degree Centrality (C_D).

2) Eigenvector centrality (C_E)

The degree centrality C_D measures the positional advantage of a given country j by counting its direct or local links to destinations. Nevertheless, C_E extends this concept by taking into account the numbers of links connected to each of the country j's destination and so forth (Bonacich, 1987; Prell, 2012, pp. 101-103; Borgatti, Everett and Johnson, 2018, pp. 194-196). Hence, the value of C_E is higher if the country of origin j is connected to destination countries which are also well-connected to other countries (See Figure 3.3). A higher C_E implies that the country j is more powerful or influential in capturing knowledge and opportunities diffusing from the entire global diaspora network. In matrix algebra, the circularity problem of the C_E is solved by:

$$Ae = \lambda e \tag{3.15}$$

Where A is the adjacency matrix representing the global diaspora network, e is the eigenvector of matrix A and λ is its corresponding eigenvalue. The solution for the C_E is to find the non-negative eigenvector associated with the largest eigenvalue (Borgatti, Everett and Johnson, 2013, pp. 168-169; 2018, pp. 194-196). The normalised eigenvector centrality for country of origin j is calculated iteratively until that the Euclidean norm for all normalised scores equal to one.



Note: Country *j* and country *l* have the same C_D = 6. However, Country *j* has a higher C_E than country *l*. It is because country *j* is linked to country *i*, which is relatively well connected as it is also linked to country *g* and country *a*.

Figure 3.3: Eigenvector Centrality (C_E).

3) Closeness Centrality (C_C)

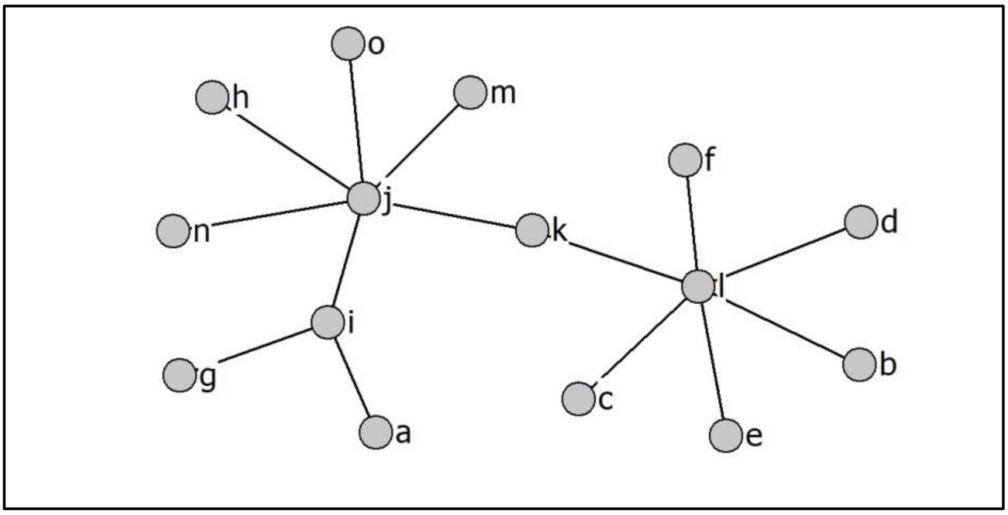
C_C measures how close is the country of origin to all other countries in the global diaspora network. A home country *j* with relatively high C_C is faster in receiving flows, such as knowledge, novel idea and new business opportunity from other countries (See Figure 3.4). The C_C of home country *j* is computed as the reciprocal of the sum of its geodesic ℓs connecting to other countries. In SNA terminology, a geodesic ℓ is defined as the number of consecutive links in the shortest path connecting country *j* to country *l*. (Hanneman and Riddle, 2005: Prell, 2012, pp. 107-109; Borgatti, Everett and Johnson, 2018, pp. 199-200):

$$C_c(j) = \frac{1}{\sum_{j \neq l}^{n} \ell_{jl}} \tag{3.16}$$

The UCINET algorithm also computed the normalised closeness centrality as:

$$C_C'(j) = [C_c(j)](n-1) \tag{3.17}$$

Where n = 203 is total number of countries or economies in the global diaspora network of 2010.



Note: According to the UCINET algorithm, country *j*, country *k* and country *l* score the highest C_C. They occupy network positions which can capture the flows from other countries relatively fast. Conversely, country *g* and country *a* have the lowest C_C as they are relatively far from other countries in the network.

Figure 3.4: Closeness Centrality (*Cc*).

4) Betweenness Centrality (C_B)

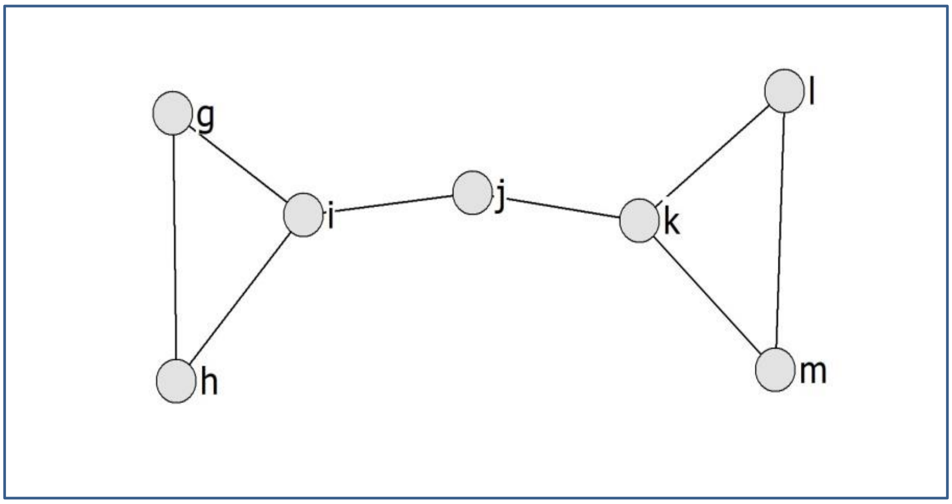
C_B measures how often a country of origin j locates on the ℓ s (geodesics) connecting two other countries or two sub-networks in the complete network (See Figure 3.5). It indicates the power or influence of country j to act as a mediator for the flows between pairs of any other countries i and k in the global diaspora network. Thus, C_B is computed as the ratio of the total geodesics linking country i and k by passing j over all the geodesics linking country i and k (Borgatti, Everett and Johnson, 2018, pp. 201-202):

$$C_B = \sum_{i<k} \frac{\ell_{ijk}}{\ell_{ik}} \tag{3.18}$$

To have a large C_B, the country j must lie on many geodesics linking country i and k. This enables country j to brokering and mediating the flows from heterogeneous sources of countries and passing between country i and k. The normalised betweenness centrality of country k is computed as:

$$C'_B(j) = \frac{C_B(j)}{[(n-1)(n-2)]/2} \tag{3.19}$$

Where n = 203 is total number of countries or economies in the global diaspora network of 2010. All the centrality metrics are calculated in normalised values so as they can compared across countries or economies.



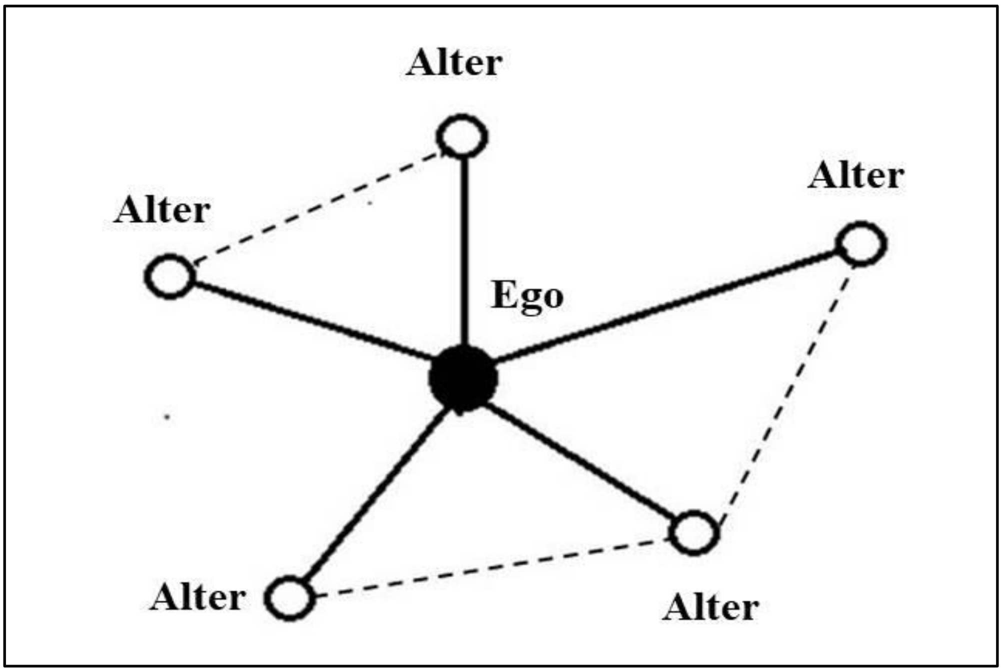
Note: According to the UCINET algorithm, country *j* has the highest C_B. Not only that it stands on the geodesic between country *i a*nd country *k*, but it also bridges the two sub-networks, i.e. (g, *h*, *i*) and (*k*, *l*, *m*). If country *j* was removed, the two sub-networks will be disconnected.

Figure 3.5: Betweenness Centrality (C_B)

For each centrality metric, the scores of the ASEAN-5 are compared with the scores of other countries in the global diaspora network, in order to understand the relative positional advantages of ASEAN-5 in the global diaspora network.

3.4.6.2 The Ego-network Level

The ego-network for a given ASEAN-5 country *j* is structured as follows: the ASEAN-5 country *j* as the focal point or the *ego*; the destinations or *alters* which are directly linked to country *j*; and the links between *alters* (Figure 3.6).



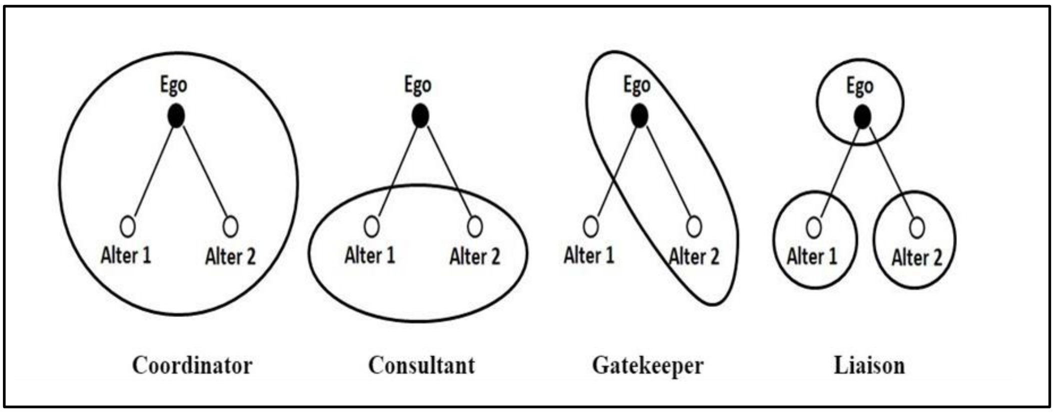
Note: The thick lines are the direct links between *ego* and *alters.* The dotted lines are links between *alters.*

Figure 3.6: An Example of Ego-network.

The brokerage concept involves three nodes or in this case, three countries. It can be defined as a process by which the *ego* facilitates the transaction or exchange between two other *alters* which do not have direct link or access to each other (Gould and Fernandez, 1989; Prell, 2012, pp. 125-126; Chaudhary and Warner, 2015; Seo, 2019). It is employed here to explore how the individual ASEAN-5 country, in this case the *ego*, can capitalise on their HSDs to broker or mediate the flows between *alters* or destination countries in their ego-network. The destination countries are classified into separate groups according to their attributes. The country attributes employed in the analysis are related to the significant explanatory variables as found in PART I, for examples the development level, market size, innovation activities and international trade volume of the destination countries. These attributes also imply the potential overseas resources, which could be harnessed by the ASEAN-5 through their HSDs.

The brokerage analysis helps to identify the destination countries/economies by which the ASEAN-5 should foster the economic linkages through their HSDs. The study is also expected to provide insights on how the HSDs can contribute to develop their ASEAN-5 home countries into an international hub for knowledge exchanges or international commercial activities.

In SNA, there are five types of brokerage roles potentially played by the *ego* in a directional network, i.e. coordinator, consultant, representative, gatekeeper and liaison (Prell, 2012; pp. 125-128; Chaudhary and Warner, 2015; Seo, 2019). However, as the global diaspora network in this study are symmetrical or non-directional (See Section 3.4.4.2), the representative and gatekeeper are symmetrically equivalent (Everton, 2010, p. 170). Thus, there are four types of brokerage roles to be explored for the highly skilled diasporas of ASEAN-5 (See Figure 3.7):



Note: The *ego* represents a given ASEAN-5 country *j*; *alters* represent destination countries directly linked to the *ego*; eclipses are the group boundaries. The nodes inside the boundaries are in the same group.

Figure 3.7: Brokerage Roles of *Ego*.

(1) Coordinator

A focal ASEAN-5 country *j* and two destination countries are in the same group, for example in the group for developing countries (Figure 3.7). Hence, the HSD from country *j* can support their counterparts or institutions in their home country to coordinate knowledge flows or business exchanges with another two developing countries.

(2) Consultant

The two destinations are embedded in the same group, but not the focal ASEAN-5 country (Figure 3.7). For example, the focal ASEAN-5 is a developing country but the two destinations are developed nations. In this case, the ASEAN-5 country can learn new knowledge or business know-hows from the two developed countries. The newly learned knowledge and business know-hows could be integrated and regenerated by the ASEAN-5 country as its peculiar expertise, which could be deployed to facilitate knowledge and business exchanges between the two developed countries.

(3) Gatekeeper

The focal ASEAN-5 country *j* and one of the destination countries are in the same group, but not another destination (Figure 3.7). Thus, ASEAN-5 country *j* can control the flows between the two destination countries. For example, assuming that the ASEAN-5 country *j* and the destination A are developing countries but destination B is a developed country. Then the ASEAN-5 country could become the gateway for country B to access the market of country A or *vice versa*.

(4) Liaison

All three countries are embedded in three different groups (Figure 3.7). For examples, the two destination countries are located in Europe and South America respectively. Then, the ASEAN-5 country *j*, which is in Asia could become a hub which liaisons the flows of knowledge or business opportunities between the three continents.

The brokerage analysis is carried out by the “G&F Brokerage Roles” algorithm of UCINET, which computes the number of counts for each brokerage role in an ego-network. The brokerage analysis based on the ego-network of each ASEAN-5 country is expected to provide useful knowledge on:

1) The best brokerage role played by each ASEAN-5 country through their HSDs;

2) The destination countries/economies by which each ASEAN-5 country should foster the economic linkages through their HSD;

3) The ASEAN-5 country which is more superior to others in playing a particular brokerage role.

3.5 Integrating the Findings from PART I and PART II

Figure 3.1 exhibits how the findings of PART I and PART II will be integrated to further explore the mechanism through which ASEAN-5 can effectively harness the resources of their HSDs via the global diaspora network. PART I identifies the diaspora resources of the HSDs from ASEAN-5, whereas PART II investigates the capabilities of ASEAN-5 to engage the diaspora resources through the global diaspora network. Thus, the integration is done by extending the discoveries of diaspora resources in PART I to the investigation of PART II on how the discovered diaspora resources can be engaged in the economic development of ASEAN-5.

In PART I, the empirical study is based on the augmented gravity model. The study identifies the economic opportunities which influence the spatial distribution of the HSDs from ASEAN-5. Such economic opportunities, including market opportunities in populous destinations, know-how and business opportunities in advanced countries, innovation activities abroad and international trades are defined as diaspora resources and can be tapped by the home country through their HSDs (Ionescu; 2006, p. 40; Docquier and Rapoport, 2009; African Diaspora Policy Centre, 2011; Trotz and Mullings, 2013; Gamlen, 2014; Hoo, Zainal and Chai, 2014; Elo, 2015; Acharya, 2017; Fok, Cheng and Tan, 2018).

Table 3.2 exhibits the potential diaspora resources and characteristics of HSDs as reflected by the independent variables of the empirical model (3.10). The potential diaspora resources as indicated by the four macro-determinants LnP_jP_k,, *LnGDPPCr1*, *LnINNOVr1* and *LnTRADE1* are denoted as DR1, DR2, DR3 and DR4 respectively. DR1 represents the market opportunities in populous destinations; DR2 is the economic opportunities, technology and business know how associated with developed destinations; DR3 indicates the opportunities of accessing to the innovative ideas, products and networks in highly innovative destinations and DR4 denotes the bilateral trade opportunities with destinations.

For a given ASEAN-5 country, if the estimation results show that a particular macro-determinant is significant, then the associated diaspora resource is accessible by the ASEAN-5 country. The diaspora resource will be extended to the exploratory study based on SNA in PART II. For example, in the case of Thailand, if the estimator of *LnP_jP_k* is significant, its elasticity or impact indicates the importance of DR1 relative to DR2, DR3 and DR4. PART II will examine how the positional advantages of Thailand in the global diaspora network could facilitate the engagement of DR1 in the economic development of home country.

LnSTOCK1 represent the social capital in the form of diaspora networks linking the destination and home country (Faist, 2008, 2014; Van Meeteren, Engbersen, Snel and Faber, 2014; Malecki, 2017; Shin and Moon, 2018). The estimation of *LnSTOCK1* in PART I provides an understanding on the strength of the diaspora networks between destinations and individual ASEAN-5 country. The estimated results of *LnSTOCK1* in PART I will be extended to PART II, in order to evaluate whether the strength of diaspora networks could enhance the efforts of individual ASEAN-5 country in engaging the potential diaspora resources DR1, DR2, DR3 and DR4 as defined in Table 3.2. Similarly, the estimated results of *LnDIST* and control variables shall provide further insights on how they can support or enhance the diaspora engagement efforts of ASEAN-5.

Table 3.2: Independent Variables of the Empirical Model (3.10) and the Corresponding Diaspora Resources/HSDs' Characteristics

Macro-determinants	Description	DR
Potential Diaspora Resource (DR) in Destination k		
LnP_jP_k	Market opportunities in populous destinations	DR1
$LnGDPPCr_{kj}$	Economic opportunities, technology and business know-how in developed destinations	DR2
$LnINNOVr1_{kj}$	Innovative ideas, products and networks in highly innovative destinations.	DR3
$LnTRADE1_{jk}$	Bilateral trade opportunities with destinations	DR4
Diaspora Network between Destination k and home country j		
$LnSTOCK1_{kj}$	Social capital in the form of diaspora network, which can facilitate the transfers of potential diaspora resources from destinations.	
Geographical Distance/Migratory Costs		
$LnDIST_{jk}$	Influence of geographical distance on the spatial distribution of HSDs.	
Control Variables		
TA_{kj}	RTA or FTA which could be leveraged to strengthen the diaspora links.	
$UNEMPr_{kj}$	Response to the employment market fluctuation in destinations.	
CUL_{kj}	Cultural linkage which could be strengthened to promote market penetration and transnational entrepreneurship	
COL_{kj}	Historical linkage which could be strengthened to promote educational collaboration and economic exchanges	

3.5.1 Centrality Metrics

Table 3.3 exhibits how the centrality metrics are used to measure the positional advantages of ASEAN-5 in the global diaspora network. The positional advantages of ASEAN-5 reveal their capabilities to capture or mobilise the potential diaspora resources DR1, DR2, DR3 and DR4 of their HSDs. Table 3.3 also shows that the centrality metrics are applied to assess the capabilities of home countries to engage their HSDs as development agents through DKNs, transnational entrepreneurship and diaspora search networks.

The degree centrality C_D measures the extensiveness or heterogeneity of the destination countries directly linked to a given ASEAN-5 country. It reveals the capability of a given ASEAN country to engage their HSDs as transnational entrepreneurs or members of DKNs, in order to harness diaspora resources from an extensive and heterogeneous source of destination countries.

The eigenvector centrality C_E looks beyond the direct links or local network of a given ASEAN-5 country. It measures the power of ASEAN-5 in capturing the flows of diaspora resources through both direct and indirect links with countries in the global diaspora network. Thus, the value of C_E could indicate the extent to which ASEAN-5 can benefit from the diaspora search network, in order to locate business solutions, technical knowledge and overseas market opportunities from countries embedded in the global diaspora network (Kuznetsov and Sabel, 2008; Fok, Cheng and Tan, 2018; Kuznetsov, 2019). The closeness centrality C_C is also associated with the diaspora search networks. It can be used to measure whether ASEAN-5 can promptly locate business or technical solutions from the global diaspora network.

The betweenness centrality C_B evaluates the capability of ASEAN-5 to control and mediate flows of diaspora resources between countries through their HSDs as transnational entrepreneurs or DKNs. This measure is employed to examine how HSDs from ASEAN-5 can contribute to develop their home country into a knowledge or business hub.

Table 3.3: Centrality measures for the positional advantages of ASEAN-5 and the corresponding developmental roles of HSDs

Centrality Metrics	Positional Advantages	Developmental roles of HSDs played through
Degree centrality (C_D)	Heterogeneity and extensiveness of linkages	DKNs; transnational entrepreneurship
Eigenvector centrality (C_E)	Capability in capturing flows diffusing from the distant parts of the global diaspora network	Diaspora search network
Closeness centrality (C_C)	Promptness in capturing flows diffusing from any parts of the global diaspora network.	Diaspora search network
Betweenness centrality (C_B)	Controlling position for flows between countries or sub-networks	DKNs; transnational entrepreneurship

3.5.2 Brokerage Analysis

Table 3.4 presents the framework for using brokerage analysis to analyse how individual ASEAN-5 countries could mobilise their ego-network to engage the potential diaspora resources DR1, DR2, DR3 and DR4 as defined in Table 3.2. The ego-network of a given ASEAN-5 country is formed by itself as focal actor or *ego*; the destinations or *alters* to which the *ego* is directly connected through diaspora links; and the diaspora links between the destinations (Gould and Fernandez, 1989; Fernandez and Gould, 1994;

Everton 2010, p. 170; Bilecen, Gamper and Lubbers, 2018; Borgotti, Everett and Johnson, 2018, p. 123-125).

Based on the above set-up, the brokerage analysis investigates the capabilities of ASEAN-5 to mediate diaspora resources between countries by playing various brokerage roles through their HSDs. The analysis will show whether ASEAN-5 can engage their HSDs as DKNs and transnational entrepreneurs, in order to benefit from the knowledge and business opportunities transmitted between countries via diaspora networks (Sabel and Saxenian, 2008; Agunias and Newland, 2012, pp. 99, 136-140; 176, 244; Kennedy and Lyes, 2015; Bagwell, 2015; Vandor and Frankie, 2016; Sommer and Gamper, 2018). The analysis is expected to give insight into whether ASEAN-5 can mobilise their HSDs to develop the home countries into international knowledge and business hubs (Chen and Wong, 2015; Ho and Boyle, 2015; PricewaterhouseCoopers, 2015; Borneo Post Online, 2019)

The brokerage analysis will not examine the diaspora search networks of HSDs. The main objective of diaspora search network is to support home countries to locate business solutions or opportunities abroad, instead of mediating economic resources between countries (Kuznetov and Sabel, 2006; OECD, 2012, p. 27; Kuznetov, 2019). Thus, diaspora search network is more appropriate to be examined by the centrality metrics, particularly the closeness centrality which measures the capabilities of ASEAN-5 to react promptly to the overseas business opportunities from diversified sources of destinations.

The brokerage analysis is expected to provide important insights on: 1) the performance of a focal ASEAN-5 country for each type of brokerage roles; 2) the ASEAN-5 country which performs relatively superior for a particular type of brokerage role; 3) the strategy to increase the flows of potential diaspora resources to a focal ASEAN-5 country; and 4) the group of destination countries which should be prioritised by the diaspora engagement strategy of a focal ASEAN-5 country.

Table 3.4: Brokerage analysis for the ego-network of individual ASEAN-5 countries

Brokerage Roles	**Groupings of the destination countries according to potential diaspora resources in destination countries**			
	Diaspora Knowledge Networks (DKNs)		**Transnational Entrepreneurship**	
	Focal ASEAN-5 country in the same group	Focal ASEAN-5 country in a different group	Focal ASEAN-5 country in the same group	Focal ASEAN-5 country in a different group
Coordinator	✔		✔	
Consultant	✔		✔	
Gatekeeper		✔		✔
Liaison		✔		✔

PART II is expected to provide vital knowledge on how ASEAN-5 can harness and mediate potential diaspora resources transmitting from heterogeneous sources of destination countries. The knowledge is essential to recommend diaspora engagement strategies which target at promoting the developmental roles of HSDs for their home country.

CHAPTER FOUR

RESULTS OF ANALYSIS AND DISCUSSIONS

4.1 Introduction

This Chapter discusses the research findings obtained from econometric analysis and SNA. The findings relate to the research questions presented in Chapter 1. These discussions include the major driving forces for the spatial distributions of the highly skilled diasporas (HSDs) from ASEAN-5; the diaspora resources which could be accessed by ASEAN-5 through their HSDs; the links between ASEAN-5 and other countries/economies as formed by the spatial distribution of their HSDs; the strategies for ASEAN-5 to engage their diaspora resources in the economic development of home country; and the destination countries/economies with which ASEAN-5 should strengthen the economic links through their HSDs.

4.2 Descriptive Analysis on the Data Used for the Study

The highly skilled diaspora (HSDs) is defined as emigrant stocks aged 25 and above (+25) with at least a tertiary education. The age category is commonly used in the international migration study, as it excludes students who might return to their home country after finishing their degree or professional courses (World Bank, 2011, p. 93 Ataselim, 2014; World Bank, 2015, p. 12).

This study is based on the DIOC-2010 (Version 1.0) dataset published by the OECD (2015, p. 20; 2016, p. 116). The dataset is the most comprehensive and suitable one used for the international migration study (Dumont, Spielvogel and Widmaier, 2010; Beine, Docquier and Ozden, 2011a; Artu, Docquier, Ozden and Parsons, 2015; Arslan, Dumont, Kone, Ozden, Parsons and Xenogiani, 2016).

Table 4.1 exhibits the total diasporas and HSDs of ASEAN-5 based on the DIOC-E 2010 (Release 1.0) dataset. The total diasporas indicate the total emigrants from ASEAN-5 irrespective of their education levels, where the HSDs are the highly skilled diasporas. The share of HSDs to the total diasporas from a given ASEAN-5 country is indicated by the ratio of HSDs.

Table 4.1: The Total Diasporas and Highly Skilled Diasporas (HSDs) of ASEAN-5 in 2010

	Total Diasporas	**HSDs**	**Ratio of HSDs**
Indonesia	1,303,821	162981	12.5%
Malaysia	648,334	294,891	45.5%
Philippines	3,213,476	1,541,395	48.0%
Singapore	156,622	76,756	49.0%
Thailand	559,037	153,645	27.5%
Total	5,881,290	2,229,668	37.9%

Source: DIOC-E 2010 (Release 1.0), OECD (2015)

Both the total diasporas and HSDs of the Philippines were the largest among ASEAN-5. It should be noted that many overseas Filipinos, including highly skilled were recruited as temporary contract workers, or Overseas Filipino Workers (OFWs) under the Out-migration policy (Alburo and Abella, 2002; Opiniano and Castro, 2006; Nititham, 2011; Asian Development Bank Institute [ADBI], 2014, pp. 7-9; Meulen, 2016; Asis, 2017). Approximately 46-47% of the HSDs of Philippines were OFWs who worked for low and medium skilled jobs (OECD, 2012, p. 77; OECD, 2015, p. 95). However, even after excluding those who were OFWs, the HSDs of the Philippines were still enormous with more than 750,000 persons in 2010. Malaysia possessed the second largest HSDs among ASEAN-5. It was followed by Indonesia, Thailand and Singapore.

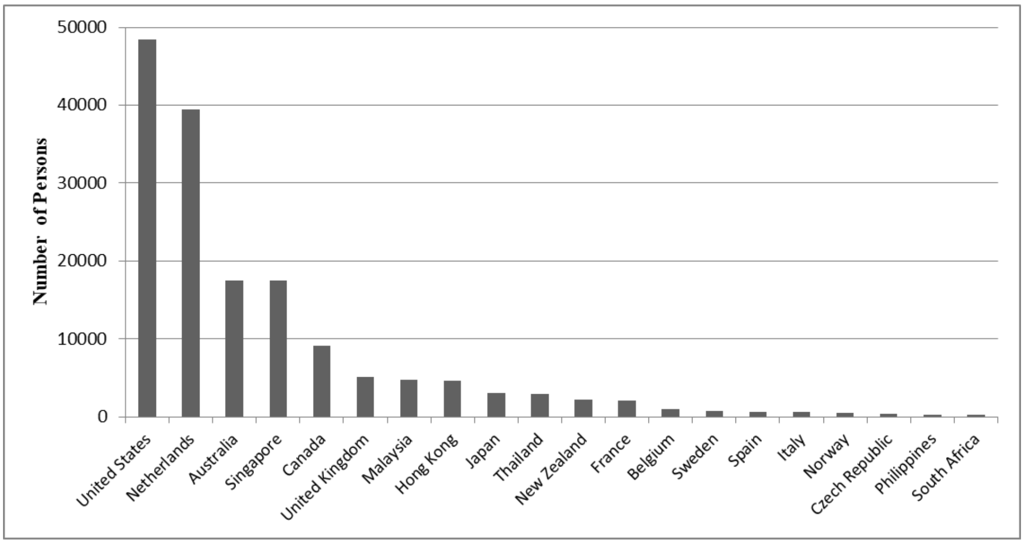
The ratios of HSDs to total diasporas were relatively high for Singapore, Philippines and Malaysia, but relatively low for Thailand and Indonesia. The high ratio for the Philippines could be explained by the Out-migration policy as mentioned above, which deliberately encouraged Filipinos to seek overseas jobs, including HSDs working as OFWs.

The HSD ratios of other four ASEAN countries could be explained by the "migration-hump" or inverted-U shape relation between migration and development as discussed in Chapter 2 (Martin, 2000; Czaika and de Haas, 2014; International Organisation for Migration, 2014, p. 37; OECD, 2016, p. 37). The development levels of Thailand and Indonesia were lower than Malaysia and Singapore. Based on the inverted-U relation, the smaller HSD ratios of Thailand and Indonesia were caused by smaller migratory capabilities of their highly skilled persons due to financial constraints and lower skill mobility.

On the contrary, the highly skilled persons of Singapore and Malaysia had higher migration capabilities due to lesser financial constraints and higher skill mobility. Although Singapore had the smallest diaspora stock residing overseas, approximately half of them were HSDs. The observation conforms to the notion that highly skilled persons of Singapore were internationally mobile and prone to overseas careers (National Population and Talent Division, 2013, p. 25; Singapore Business Review, 2013; Cheng and Wong, 2015, p. 73; Siau, 2018).

4.2.1 The Spatial Distribution of the HSDs from Indonesia

Figure 4.1 shows that the two largest groups of Indonesian HSDs were located in the United States and the Netherlands. The United States hosted 29.8%, whereas the former colonising country of Indonesia, Netherlands hosted 24.2% of the total HSDs. Other major destinations for Indonesian HSDs include Australia, Singapore, Canada, United Kingdom, Malaysia, Hong Kong, Japan, Thailand, New Zealand and France, most of which were developed economies except for Malaysia and Thailand.



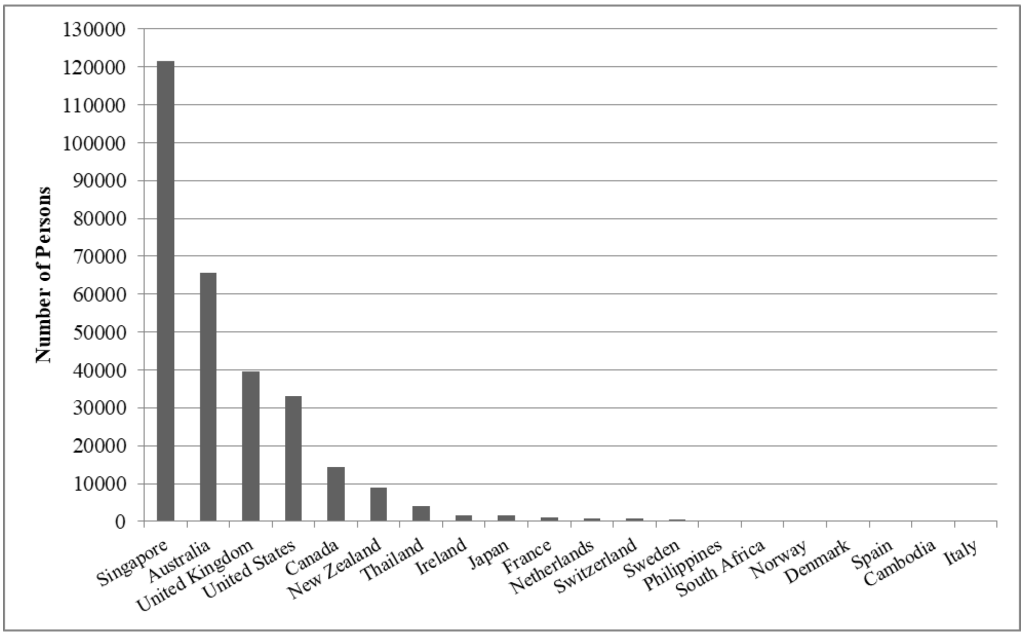
Source: DIOC 2010 (Release 1.0), OECD

Figure 4.1: The Top 20 Destinations for the Highly Skilled Diasporas of Indonesia in 2010

Majority of the Indonesian highly skilled emigrants to the United States, Netherlands and other advanced nations were former students who stayed on for the overseas jobs and careers (Faiz, 2007; Hugo 2007; Buchori, 2011; Rochmyaningsih, 2011; Darsono, 2017; Setijadi, 2017). The economic development of Indonesia is challenged by the shortage of highly skilled human resources, particularly in the science and technological fields (Faiz, 2007; Saefuloh, 2012; Aravindan and Nangoy, 2016; Modgil, 2019). According to the World Bank's statistics (2016), the ratio of tertiary educated persons in the total labour force of Indonesia was merely 7% in 2010, in contrast to over 29.3% in the Philippines, 21.2% in Malaysia and 16% in Thailand. It is important for Indonesia to engage their HSDs in order to compensate for the talent shortage in the home country (Utomo, 2011; Saefuloh, 2012; Ministry of Foreign Affairs Indonesia, 2019).

4.2.2 The Spatial Distribution of the HSDs from Malaysia

Figure 4.2 shows that the primary destination for HSDs from Malaysia was Singapore, which is its neighbouring country with geographical, linguistic and economic proximity. About 41.3% of Malaysian HSDs lived in Singapore in 2010. Malaysians were attracted to Singapore mainly by the employment opportunities available in universities, government agencies, and the professional, specialist and managerial jobs in industries (Ho and Tyson, 2011; Ghani and Jauhar, 2015). Other major destinations of the HSDs from Malaysia include developed economies such as Australia, United Kingdom, United States, Canada, New Zealand, Ireland, Japan, France, Netherlands and Thailand, one of the neighbouring countries of Malaysia.



Source: DIOC 2010 (Release 1.0), OECD

Figure 4.2: The Top 20 Destinations for the Highly Skilled Diasporas of Malaysia in 2010

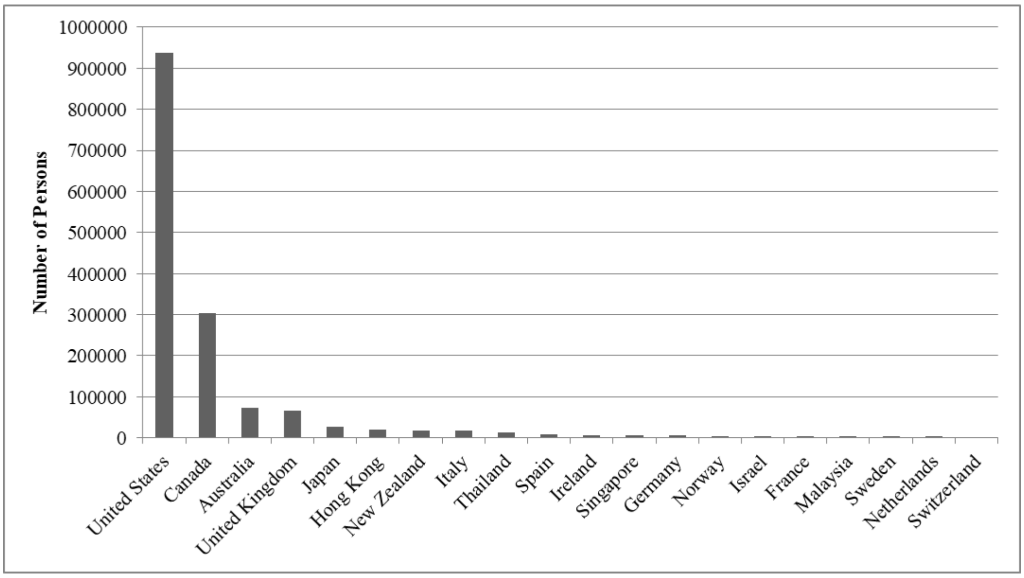
Malaysia is in the midst of economic transformation to achieve the high income country status. However, it faces great challenge in closing the human capital gap with developed nations (Wong and Day, 2019, pp. 10-11). The brain drain problem has exacerbated the deficiency of Malaysia's human capital (Singapore Business Review, 2018). If no effective remedial measures were taken to compensate the depletion of talent stock, the potential for Malaysia in knowledge creation, adoption of new technology and indigenous innovation will be further weakened (Wong and Day, 2019, p. 8). This contradicts with the goals of Malaysia to climb up the economic value chain and become the regional business and innovation hubs (World Bank, 2011; Performance Management and Delivery Unit, 2015, pp. 158-173; PricewaterhouseCoopers, 2015).

According to a survey by the World Bank (2011, p. 130) and Mamat (2014), the HSDs of Malaysia generally maintain a sense of attachment to the home country, especially in the early years of their migration. The HSDs also have the aspiration and intention to return or to help the home country if the government can implement active initiatives to engage them (Hugo, 2011; World Bank, 2011, p. 128; Wong and Day, 2019, p. 9).

4.2.3 The Spatial Distribution of the HSDs from the Philippines

As shown in Figure 4.3, the top five destinations of the Philippines HSDs in 2010 were the United States, Canada, Australia, United Kingdom and

Japan. The five countries have hosted 90.1% of the total 1,541,395 HSDs from the Philippines, with 60.9% of them residing in the United States.



Source: DIOC 2010 (Release 1.0), OECD

Figure 4.3: The Top 20 Destinations for the Highly Skilled Diasporas of the Philippines in 2010

The high concentration of the Philippines' HSDs in the advanced countries, especially the United States was mainly due to the job opportunities and careers in professional fields such as medical, ICT and teaching professionals (OECD, 2015, p. 95). However, it was estimated that approximately 45% of the HSDs in the United States were overseas Filipino workers (OFWs) working in low or medium skilled jobs such as technicians in electrical and electronics industry, construction workers, domestic workers, health workers and workers in various service industries (Opiniano and Castro 2006; OECD 2012, p. 77; Asis, 2017; Castro-Palaganas et al., 2017). This implies that a substantial number of the HSDs from the Philippines were doing jobs which required much lower qualification than possessed by the diasporas.

The highly skilled or professional migrants from the Philippines are very active in forming diaspora organisations in their residing countries. These organisations range from hometown associations, alumni associations, professional societies, business associations, religious groups and charities (Opiniano and Castro, 2006; Migration Polity Institute [MPI], 2014; Castro-Palaganas et al., 2017). These are the platforms which coordinate and facilitate the HSDs' collective actions in safeguarding their employment, business opportunities and socio-economic status in foreign countries. These platforms were also used to promote investment, business ventures, entrepreneurship development and technological collaboration in their home country.

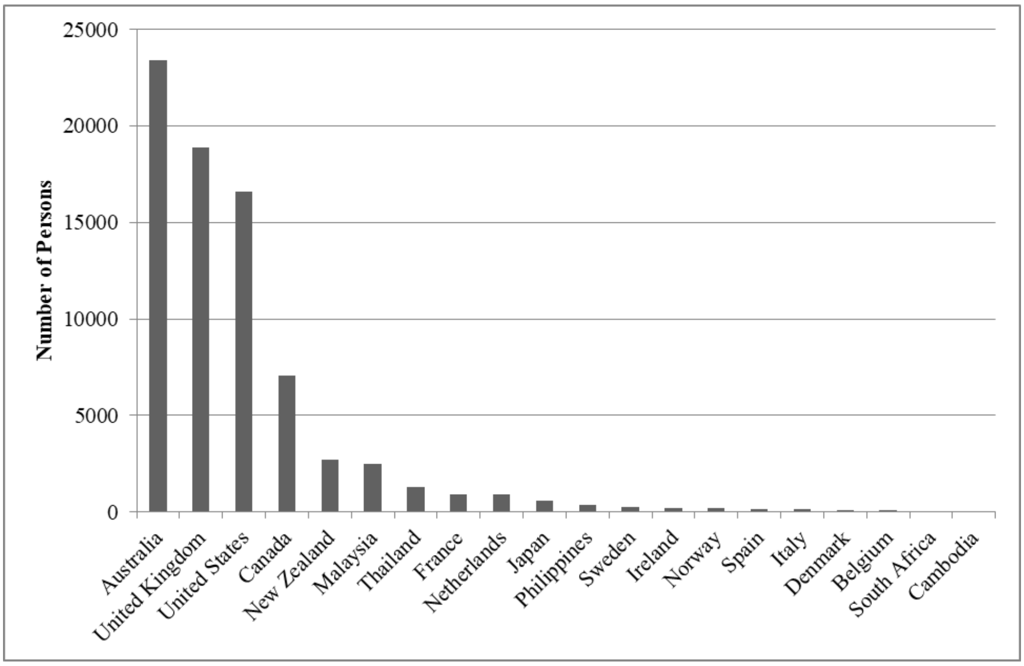
The notable examples of the organisations established by highly skilled Filipino diasporas include the Philippines Institute for Certified Public Accountants (PICPA), which helps to promote the growth and development of the Philippines Accountancy profession through chapters around the world; The Association of Filipino Teachers (AFTA) based in New York city, which organises programmes to train teachers in the Philippines; Brain Gain Network (BGN), which endeavours to connect the business networks of the Filipino engineers, scientists and organisations to their counterparts in the home country; and the Massachusetts Institute of Technology-Philippine Emerging Start-ups Open (MIT-PESO), which promotes members to use their knowledge and expertise to contribute to the development of the Philippines (Opiniano and Castro, 2006; Agunias and Newland, 2012, p. 176; Battistella and Liao, 2013, p. 98; Barrett, 2019; Brain Gain Network, 2019). One of the outstanding examples in recent years is the Philippines Development

Foundation (PhilDev), which was founded in California, United States. Originally a charity initiative, it has evolved into an active contributor to the economic development of the Philippines. PhilDev is now a networking platform to link the Filipino scientists, engineers and entrepreneurs in Silicon Valley to the scientific, technological and business development in the Philippines (MPI, 2014; Philippines Development Foundation [PhilDev], 2019).

4.2.4 The Spatial Distribution of the HSDs from Singapore

Figure 4.4 shows that Australia, United Kingdom, United States, Canada, New Zealand, Malaysia and Thailand were the major destinations for the HSDs from Singapore in 2010. The above seven countries hosted 94.5% of the total 76,756 HSDs from Singapore.

Singapore is the most developed economy among the ASEAN-5. The highly skilled Singaporeans are described as more cosmopolitan and internationally mobile than their counterparts in other ASEAN countries (Lee, 2015). In 2010, there were 9.5% of the Singaporean highly skilled persons living abroad, which was the highest among ASEAN-5. The ratios for other ASEAN countries in the same year were: 8.1% for Philippines, 5.2% for Malaysia, 2.7% for Thailand and 2.6% for Indonesia (OECD, 2015). In view of the small population size of Singapore, the ratio of 9.5% of highly skilled persons living abroad indicates a serious loss of highly educated and talented population (Saha, 2009; Tan, 2012). To compensate the continued outflows of talent, Singapore maintains a strategic open door policy to attract highly skilled immigrants (Saha, 2009; Rikvin, 2012; Siau, 2018).

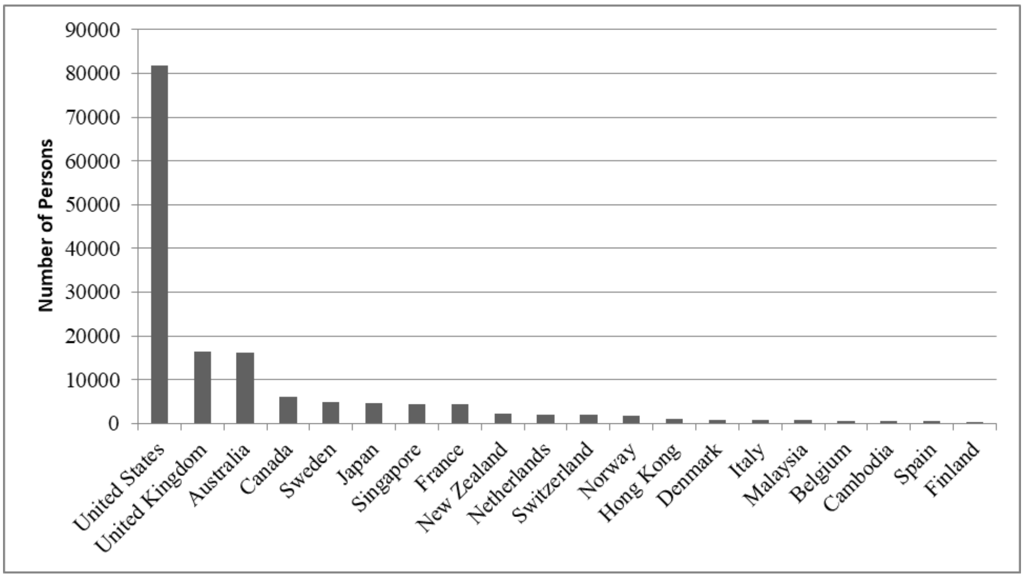


Source: DIOC 2010 (Release 1.0), OECD

Figure 4.4: The Top 20 Destinations for the Highly Skilled Diasporas of Singapore in 2010

4.2.5 The Spatial Distribution of the HSDs from Thailand

Figure 4.5 shows that the HSDs from Thailand, like their counterparts from the Philippines, were also highly concentrated in the United States. The United States hosted 53.2% of the total 153,645 HSDs from Thailand, whereas the balance were distributed extensively across advanced economies such as United Kingdom, Australia, Canada, Sweden, Japan, Singapore, France, New Zealand, Netherlands, Switzerland and Norway as well as other ASEAN countries like Malaysia and Cambodia..



Source: DIOC 2010 (Release 1.0), OECD

Figure 4.5: The Top 20 Destinations for the Highly Skilled Diasporas of Thailand in 2010

The HSDs from Thailand, like the Philippines, are also proactive in establishing diaspora organisations in their destination countries. The overseas talents interlinked each other through these diaspora organisations to extend professional and business networks to their home country. Among the prominent organisations of Thai HSDs are The Association of Thai Professionals in America and Canada (ATPAC) (Association of Thai Professionals in America and Canada, 2020), The Association of Thai Professionals in Europe (ATPER) (Association of Thai Professionals in Europe, 2019), The Association of Thai Professionals in Japan (ATPIJ) (Tanpipat, 2015) and the Thai Restaurants Association of Australia (Beasley, Hirsch and Rungmanee, 2014, p. 24).

4.3 PART I: Econometric Analysis for the Spatial Distribution of HSDs from ASEAN-5

PART I analysis investigated the macro-determinants for the spatial distributions of the HSDs from ASEAN-5 in 2010. The dependent variable M_{jk} is defined as the number of HSDs originating from SEAN-5 country j and residing in destination k in the year 2010. M_{jk} is a function of the macro-determinants and control variables as defined by the augmented gravity equation shown by Equation (3.10).

Equation (3.10) is estimated by the Poisson Pseudo Maximum Likelihood (PPML) method, to account for the inherent heteroscedasticity caused by the cross-sectional data and effects of multilateral resistance as discussed in Section 2.4.4. The PPML method produces efficient, unbiased and consistent estimators if the estimated equation fulfil the condition of mean-variance equality or $E(X, \beta) = Var\ (X, \beta)$.

The robustness tests for the PPML estimation are carried out using overdispersion test and likelihood ratio (LR). The overdispersion test diagnoses whether the mean-variance equality holds and the LR statistic tests whether the conditional mean $E(X, \beta)$, i.e. the empirical model is specified adequately (Burger, van Oort and Linders, 2009; Greene, 2012, pp. 332-333; Quantitative Micro Software, 2017, pp. 386-387).

4.3.1 Descriptive Statistics for M_{jk}

Table 4.2 exhibits the descriptive statistics for the dependent variable M_{jk}, i.e. the size of HSDs originating from ASEAN-5 country j and residing in destination k in 2010. The number of observations for M_{jk} shows that there are 92 destinations for each country.

Table 4.2: The Descriptive Statistics for the Dependent Variable M_{jk}

	Indonesia	**Malaysia**	**Philippines**	**Singapore**	**Thailand**
Observations	92	92	92	92	92
Mean	1,771.5	3,205.3	16,754.3	843.3	1,670.1
Median	3.000	0.000	22.500	0.000	0.000
Maximum	4,849	12,1662	938,285	23,419	81,790
Minimum	0	0	0	0	0
Standard Deviation	6,969.7	15,234	102,658.4	3,609.6	8,835.3
Coefficient of Variations	3.934	4.753	6.127	4.280	5.290
Skewness	5.337	6.182	8.235	5.067	8.337
Kurtosis	32.553	44.262	72.825	28.176	75.293

Source: DIOC-E 2010 (Release 1.0)

The mean value of M_{jk} indicates the average size of HSDs in each destination. The mean value of M_{jk} for the Philippines was the largest among ASEAN-5. This is because the Philippines possessed the largest number of HSDs in various destinations. On the contrary, Singapore had the smallest size of HSDs, which also resulted in the lowest mean value of M_{jk}. The standard deviations of M_{jk} are high for all ASEAN-5., as indicated by the coefficients of variation ranging from 3.9 to 6.1. This is caused by the high variations of the sizes of HSDs in different destinations for each ASEAN-5 country.

The medians of M_{jk} are either zero or much lower than the means of M_{jk}, indicating the positively skewed distribution of M_{jk}. The high skewness values further show that the distributions of M_{jk} for all ASEAN-5 strongly deviate from normality. The asymmetrical distributions are due to majority HSDs from ASEAN-5 were highly concentrated in a small number of destinations, particularly developed economies such as the United States, United Kingdom, Canada, Australia, New Zealand, France, Netherlands, Japan and Sweden; whereas a smaller number of HSDs dispersed across a large number of other destination.

The highly skewed distribution for the dependent variable M_{jk} is the main reason to apply PPML estimation method in this study. The PPML is able to produce consistent estimation for the parameters even if the distribution of errors is not correctly specified and not normal (Santos Silva and Tenreyro, 2006; Quantitative Micro Software, 2010, p. 289; Docquier and Ozden, 2011; Arvis and Shepherd, 2013; Beine, Bertoli and Moraga, 2014).

The high kurtosis values imply that the distributions of M_{jk} for ASEAN-5 have “heavy tail”. This shows that majority of the HSDs were clustering in a small number of destinations, while the remaining small number of HSDs are dispersed across a large number of destinations.

However, it can be observed that the kurtosis values of M_{jk} for Singapore, Indonesia and Malaysia in 2010 are much smaller than those of Thailand and the Philippines. This implies that the HSDs from Thailand and the Philippines were dispersed more widely or extensively than those from Indonesia, Malaysia and Singapore. Such distributional patterns of HSDs will affect the network position and connectivity of ASEAN-5 in the global diaspora network. This will be further discussed in PART II analysis.

4.3.2 Correlations between Determinants

The empirical model (3.10) includes a few explanatory variables or determinants which may correlate with each other. The high correlations are expected for variables such as *LnSTOCK1*, *LnGDPPCr*, *LnINNOVr1* and *LinTRADE1*, which are the common factors to attract HSDs. A correlation between explanatory variables or the multicolinearity problem will increase the standard errors of the estimators, resulting in larger confidence intervals and inaccuracy in the estimated results.

Gujarati (2004, p. 359), Signori (2011) and Williams (2015) advocate that if the pairwise correlation coefficients between explanatory variables or determinants exceed 0.800, the multicolinearity might be a concern for the analysis. Table 4.3 to 4.7 exhibit the Pearson's correlation between determinants of M_{jk} as defined by the equation (3.10) for ASEAN-5 in 2010. None of the correlation coefficient exceeds 0.800. This may indicate that there is no serious multicollinearity among the independent variables.

Table 4.3: Pearson's Correlation between Determinants of M_{jk} for Indonesia, 2010

	LnP$_J$P$_K$	***LnSTOCK1***	***LnDIST***	***LnGDPPCr***	***LnINNOVr1***	***LnTRADE1***	***UNEMPr***	***RTA***	***CUL***	***COL***
LnP$_J$P$_k$	1.000	0.301	0.004	-0.078	0.473	0.683	0.191	0.181	-0.165	0.039
LnSTOCK1	0.301	1.000	-0.285	0.579	0.623	0.624	-0.130	0.440	0.219	0.266
LnDIST	0.004	-0.285	1.000	0.055	-0.029	-0.285	0.189	-0.694	-0.561	0.030
LnGDPPCr	-0.078	0.579	0.055	1.000	0.640	0.350	0.001	0.053	-0.055	0.126
LnINNOVr1	0.473	0.623	-0.029	0.640	1.000	0.682	-0.057	0.155	-0.099	0.180
LnTRADE1	0.683	0.624	-0.285	0.350	0.682	1.000	-0.086	0.419	0.026	0.130
UNEMPr	0.191	-0.130	0.189	0.001	-0.057	-0.086	1.000	-0.256	-0.217	-0.078
RTA	0.181	0.440	-0.694	0.053	0.155	0.419	-0.256	1.000	0.421	-0.032
CUL	-0.165	0.219	-0.561	-0.055	-0.099	0.026	-0.217	0.421	1.000	-0.025
COL	0.039	0.266	0.030	0.126	0.180	0.130	-0.078	-0.032	-0.025	1.000

Table 4.4: Pearson's Correlation between Determinants of M_{jk} for Malaysia, 2010

	LnP$_J$P$_K$	***LnSTOCK1***	***LnDIST***	***LnGDPPCr***	***LnINNOVr1***	***LnTRADE1***	***UNEMPr***	***RTA***	***CUL***	***COL***
LnP$_J$P$_k$	1.000	0.288	-0.058	-0.090	0.441	0.632	0.191	0.218	-0.052	-0.363
LnSTOCK1	0.288	1.000	-0.269	0.500	0.557	0.595	-0.130	0.461	0.295	-0.055
LnDIST	-0.058	-0.269	1.000	0.057	-0.004	-0.248	0.168	-0.680	-0.674	-0.184
LnGDPPCr	-0.090	0.500	0.057	1.000	0.582	0.286	0.003	0.027	-0.003	-0.072
LnINNOVr1	0.441	0.557	-0.004	0.582	1.000	0.520	-0.064	0.129	-0.093	-0.175
LnTRADE1	0.632	0.595	-0.248	0.286	0.520	1.000	-0.043	0.385	0.156	-0.266
UNEMPr	0.191	-0.130	0.168	0.003	-0.064	-0.043	1.000	-0.233	-0.209	-0.195
RTA	0.218	0.461	-0.680	0.027	0.129	0.385	-0.233	1.000	0.482	-0.062
CUL	-0.052	0.295	-0.674	-0.003	-0.093	0.156	-0.209	0.482	1.000	0.137
COL	-0.363	-0.055	-0.184	-0.072	-0.175	-0.266	-0.195	-0.062	0.137	1.000

Table 4.5: Pearson's Correlation between Determinants of M_{jk} for Philippines, 2010

	LnP_JP_K	***LnSTOCK1***	***LnDIST***	***LnGDPPCr***	***LnINNOVr1***	***LnTRADE1***	***UNEMPr***	***RTA***	***CUL***	***COL***
LnP_JP_k	1.000	0.319	0.041	-0.078	0.478	0.587	0.187	0.197	-0.149	-0.042
LnSTOCK1	0.319	1.000	-0.155	0.637	0.681	0.646	-0.079	0.294	0.037	0.193
LnDIST	0.041	-0.155	1.000	-0.058	-0.133	-0.278	0.231	-0.613	-0.535	-0.059
LnGDPPCr	-0.078	0.637	-0.058	1.000	0.667	0.488	0.001	0.061	-0.042	0.154
LnINNOVr1	0.478	0.681	-0.133	0.667	1.000	0.738	-0.048	0.171	-0.090	0.131
LnTRADE1	0.587	0.646	-0.278	0.488	0.738	1.000	-0.079	0.384	0.098	-0.016
UNEMPr	0.187	-0.079	0.231	0.001	-0.048	-0.079	1.000	-0.258	-0.214	0.115
RTA	0.197	0.294	-0.613	0.061	0.171	0.384	-0.258	1.000	0.385	-0.066
CUL	-0.149	0.037	-0.535	-0.042	-0.090	0.098	-0.214	0.385	1.000	0.280
COL	-0.042	0.193	-0.059	0.154	0.131	-0.016	0.115	-0.066	0.280	1.000

Table 4.6: Pearson's Correlation between Determinants of M_{jk} for Singapore, 2010

	LnP_JP_K	***LnSTOCK1***	***LnDIST***	***LnGDPPCr***	***LnINNOVr1***	***LnTRADE1***	***UNEMPr***	***RTA***	***CUL***	***COL***
LnP_JP_k	1.000	0.386	-0.107	-0.087	0.427	0.452	0.181	0.149	-0.006	-0.343
LnSTOCK1	0.386	1.000	-0.255	0.502	0.565	0.537	-0.060	0.397	0.520	-0.075
LnDIST	-0.107	-0.255	1.000	0.121	0.031	-0.210	0.166	-0.424	-0.401	-0.184
LnGDPPCr	-0.087	0.502	0.121	1.000	0.540	0.475	0.015	0.113	0.257	-0.097
LnINNOVr1	0.427	0.565	0.031	0.540	1.000	0.463	-0.063	0.092	0.082	-0.165
LnTRADE1	0.452	0.537	-0.210	0.475	0.463	1.000	-0.099	0.266	0.250	-0.036
UNEMPr	0.181	-0.060	0.166	0.015	-0.063	-0.099	1.000	-0.276	-0.173	-0.194
RTA	0.149	0.397	-0.424	0.113	0.092	0.266	-0.276	1.000	0.155	-0.141
CUL	-0.006	0.520	-0.401	0.257	0.082	0.250	-0.173	0.155	1.000	0.237
COL	-0.343	-0.075	-0.184	-0.097	-0.165	-0.036	-0.194	-0.141	0.237	1.000

Table 4.7: Pearson's Correlation between Determinants of M_{jk} for Thailand, 2010

	LnP_JP_K	*LnSTOCK1*	*LnDIST*	*LnGDPPCr*	*LnINNOVr1*	*LnTRADE1*	*UNEMPr*	*RTA*	*CUL*
LnPJPK	1.000	0.277	-0.050	-0.086	0.450	0.649	0.202	0.206	-0.004
LnSTOCK1	0.277	1.000	-0.312	0.624	0.670	0.630	-0.146	0.404	0.298
LnDIST	-0.050	-0.312	1.000	0.049	-0.043	-0.284	0.145	-0.541	-0.766
LnGDPPCR	-0.086	0.624	0.049	1.000	0.599	0.356	-0.003	0.049	-0.034
LnINNOVR1	0.450	0.670	-0.043	0.599	1.000	0.636	-0.065	0.112	-0.092
LnTRADE1	0.649	0.630	-0.284	0.356	0.636	1.000	-0.060	0.423	0.261
UNEMPR	0.202	-0.146	0.145	-0.003	-0.065	-0.060	1.000	-0.210	-0.264
RTA	0.206	0.404	-0.541	0.049	0.112	0.423	-0.210	1.000	0.574
CUL	-0.004	0.298	-0.766	-0.034	-0.092	0.261	-0.264	0.574	1.000

4.3.3 Diagnosis of Multicolinearity by Variance Inflation Factor (VIF)

A more popular diagnosis for multicolinearity is to compute the variance inflation factor (VIF) for each explanatory variable (Greene, 2012, pp. 129-131; Adkins, p. 133, 2014; PennState Eberly College of Science, 2018). The VIF measures the extent to which the variance of an estimator is inflated due to the presence of multicolinearity (Gujarati, 2004, p. 351; William, 2015). The VIF for a given determinant X_i is defined as:

$$VIF_i = \frac{1}{1 - R_i^2} \tag{4.1}$$

Whereas R_i^2 is the coefficient of determination for the ordinary least square (OLS) estimation for a regression of X_i on the rest of the determinants included in an empirical model. Gujarati (2004, p. 359), Wooldridge (2013, p. 98) and Adkins, (2014, p. 133) suggested that the multicolinearity is not serious if VIF_i < 10. However, Signori (2011) advocated that the multicolinearity should become a concern if VIF_i > 5 or R_i^2 > 0.80. After this threshold level, the variance of the estimator will be inflated with accelerating speed.

Table 4.8 exhibits the *VIFs* for determinants included in the empirical model (3.10) for each ASEAN-5 country in 2010. Some of the determinants, such as *LnGDPPCr*, *LnINNOVr1* and *LnTRADE1* have VIF values relatively higher than others across ASEAN-5. However, none of the VIFs is higher than 5. Thus, based on the criteria of Gujarati (2004, p. 359) and Adkins, (2014, p.

133) or Signori (2011), the multicolinearity is considered not serious among the independent variables of M_{jk} for ASEAN-5. This implies that all the determinants or independent variables specified in (3.10) can be retained for the study.

Table 4.8: Variance Inflation Factors (VIFs) for the Determinants of M_{jk} in 2010

	Indonesia	Malaysia	Philippines	Singapore	Thailand
LnP_jP_k	4.310	3.058	4.000	3.049	3.289
LnSTOCK1	2.950	2.571	2.611	3.155	3.226
LnDIST	2.688	3.030	2.188	1.689	2.841
LnGDPPCr	3.802	2.571	4.425	3.344	3.205
LnINNOVr1	3.676	2.849	4.587	2.591	3.636
LnTRADE1	4.329	2.747	4.082	2.353	3.559
UNEMPr	1.361	1.300	1.350	1.385	1.357
RTA	2.481	2.538	2.041	1.727	1.848
CUL	1.524	2.096	1.799	1.980	3.247
COL	1.142	1.337	1.342	1.437	-*

Note*: Independent Variable COL is not applicable to M_{jk} of Thailand, as Thailand has never been colonised.

4.3.4 Estimation Results of the Empirical Model

Chapter 3 defined the empirical model (3.10) for the analysis in PART I as follows:

$$M_{jk} = exp\ [\ \beta_0 + \beta_1\ ln(P_j * P_k) + \beta_2\ ln(DIST_{jk}) + \beta_3 lnSTOCK1_{kj} + \beta_4 lnGDPPCr_{kj} + \beta_5 lnINNOVr1_{kj} + \beta_6 lnTRADE1_{kj} + \beta_7 RTA_{kj} + \beta_8 UNEMPr_{kj} + \beta_9 CUL_{kj} + \beta_{10} COL_{kj} + \eta_{jk}] \quad (3.10)$$

With j = a given ASEAN–5 country, k = destination country and η_{jk} = stochastic term.

Equation (3.10) is also called the constant elasticity model as the parameters of the log-transformed or logarithmic determinants are equivalent to their elasticity values (Santos Silva and Tenreyro, 2006; Shepherd, 2013). Hence, the study is able to compare the impacts or strengths of each variable in influencing the M_{jk} for a given ASEAN-5 country, or to compare the relative strength of each determinant across ASEAN-5.

Table 4.9 exhibits the PPML estimators for the empirical model (3.10). The estimation was performed for each ASESN-5 country in 2010. The robustness of PPML estimators was checked by the overdispersion test, which required the estimated equations to satisfy the Poisson assumption of mean-variance equality or $Var\ (X, \beta) = E(X, \beta)$ (3.11). Based on the Wooldridge approach (Wooldrigde, 1997; Quantitative Micro Software, 2010, pp. 293-294; IHS Markit, 2017, pp. 384-385), the overdispersion test was carried by estimating the auxiliary regression (3.12). Table 4.9 shows that the parameter α of the test variable $\widehat{m}_{jkt}$ is insignificant across ASEAN-5, implying that all estimated equations satisfy the robustness condition of $Var\ (X, \beta) = E(X, \beta)$.

Table 4.9: The Determinants of the Spatial Distributions of Highly Skilled Diasporas (HSDs) of ASEAN-5 in 2010: Estimation Results

Determinants	Indonesia	Malaysia	Philippines	Singapore	Thailand
C	-40.906***	-0.871***	-32.904***	-13.581***	-23.979***
	(0.375)	(0.318)	(0.165)	(0.392}	(0.273)
LnP_jP_k	0.605***	0.286***	0.348***	-0.019	0.659***
	(0.016}	(0.012)	(0.004)	(0.013}	(0.009)
LnSTOCK1	0.256***	0.719***	0.665***	0.846***	0.804***
	(0.003}	(0.003)	(0.001)	(0.005}	(0.005)
LnDIST	0.878***	-1.790***	1.661***	0.820***	0.225***
	(0.024}	(0.014)	(0.004)	(0.013}	(0.021)
LnGDPPCr	1.609***	0.323***	0.446***	0.032*	0.791***
	(0.021}	(0.012)	(0.009)	(0.017}	(0.017)
LnINNOVR1	-0.773***	-0.860***	-0.462***	-0.633***	-0.391***
	(0.007}	(0.006)	(0.003)	(0.010}	(0.007)
LnTRADE1	1.052***	0.866***	0.718***	0.829***	-0.030***
	(0.013}	(0.009)	(0.003)	(0.012}	(0.005)
UNEMPr	-0.327***	-0.232***	-0.035***	-1.044***	0.006***
	(0.012}	(0.006)	(0.006)	(0.020}	(0.002)
TA	-0.126***	-2.338***	0.259***	-1.596***	0.465***
	(0.010}	(0.027)	(0.004)	(0.037}	(0.015)
CUL	0.758	-134.69***	-39.705***	-71.665***	-38.703***
	(0.567}	(0.931)	(0.316)	(1.046}	(1.678)
COL	1.154***	0.100***	-1.411***	-0.728***	-
	(0.018}	(0.010}	(0.007)	(0.019}	-
Adjusted R^2	0.974	0.990	0.994	0.992	0.986
Overdispersion test:					
α of $\widehat{m}_{jk}$ in equation (3.12)	0.026 (0.089)	0.010 (0.022)	0.006 (123.128)	0.008 (108.841)	0.014 (0.023)
LR statistic	737656.1	1616708	9177019	391949.9	791236.40
p-value	0.0000	0.0000	0.0000	0.0000	0.0000

Note: *** 0.01 significant level, ** 0.05 significant level, * 0.1 significant level
Number in parenthesis refers to the standard error of the estimator.

The adjusted R^2 are very high for the estimation equations of ASEAN-5. The high R^2 also appears in the estimation results based on PPML by Beine, Docquier and Ozden (2009), Bertoli and Fernández-Huertas Moraga (2012), Beine, Noel and Ragot (2014), Artuc, Docquier, Özden and Parsons (2015) and Wajdi, Adioetomo and Mulder (2017). Greene (2012, pp. 573-574) stated that R^2 is not an appropriate measure of fit for any count model estimated by the maximum likelihood method, such as PPML.

In the case of ordinary least square method (OLS), a linear regression with a constant is estimated to fit the observed values and a R^2 is produced to measure the proportion of variation explained by the regression. However, the PPML method is to generate estimators by maximising the log likelihood function of the joint probability of the observations (Greene, 2012, pp. 549-550; IHS Markit, 2017, pp. 378-379). Thus, the R^2 or adjusted R^2 are not a proper measure under PPML as there is no proportion of variation to be measured. Instead, Greene (2012, pp. 566-567) and IHS Markit (2017, p. 382, 386) suggested to refer to the specification test based on likelihood ratio (LR) for PPML or any other maximum likelihood method. Greene (2012, p. 550) further advocated that the estimated parameters of the equations should be the focus of the empirical study based on maximum likelihood.

In Table 4.9, the p-value shows that the LR statistic is significant at 1% level for all the estimated equations, implying that there is no statistical evidence to reject the model specification (3.10). In other words, the estimated equations are able to predict the dependent variable, $M_{jk.}$ for ASEAN-5.

Equation (3.10) is also called the constant elasticity model as the parameters of the log-transformed or logarithmic determinants are equivalent to their elasticity values (Santos Silva and Tenreyro, 2006; Shepherd, 2013). Hence, the study is able to compare the impacts or strengths of each variable in influencing the M_{jk} for a given ASEAN-5 country, or to compare the relative strength of each determinant across ASEAN-5.

The explanations for the unexpected signs of *LnDIST*, *RTA*, *COL* and *CUL* are provided in the subsequent analysis for individual ASEAN-5 countries. However, the negative sign for the estimators of *LnINNOVr1* across all ASEAN-5 countries is discussed separately in the next section. The purpose is to provide an interpretation for the common phenomenon of negative influence of *LnINNOVr1* on M_{jk} across all ASEAN-5 countries.

4.3.4.1 Negative estimators for *LnINNOVr1* across ASEAN-5

The negative estimators of *LnINNOVr1* for all ASEAN-5 echoed the work of Driouchi, Trandas-Boboc and Zouag (2010), which showed that innovation ability as represented by the knowledge economy index (KEI) of the destinations has no positive influence on the highly skilled immigration. This study improves the work of Driouchi, Trandas-Boboc and Zouag (2010) by introducing the number of patent applications as indicator of the innovation activities in destinations (Kurtossy, 2004; Burhan, Singh and Jain, 2017; Sharma and Tripathi, 2017).

Nonetheless, this led to the surprising discovery that the level of innovativeness in the destinations has negative attraction for HSDs from ASEAN-5. The HSDs from ASEAN-5 mainly consist of talents in scientific and technological fields (OECD, 2012, p. 63, 67, 77, 79, 83). Section 4.2.3 has shown that the empirical model (3.10) has no serious multicolinearity problem. Thus, the negative estimators of *LnINNOVr1* are not likely to be caused by the correlations between *LnINNOVr1* and other determinants.

As discussed in Section 2.3.7, Hall (2004), Kurtossy (2004), Svensson (2015), Burhan, Singh and Jain (2017) and Sharma and Tripathi (2017) advocated that the appropriate measure for the innovation activities at national level is the number of patent applications originated from a given country. This is because the number of patent applications reflects the productive innovation works and thus the associated career opportunities in the technology related fields. In this respect, this study measures the innovation activities occurred in a given country by the number of patents filed through national patent offices and Patent Cooperation Treaty (PCT) route (WIPO, 2017a, 2017b, 2019).

In order to countercheck the validity of the negative signs, the empirical model (3.10) was re-estimated by replacing *LnINNOVr1* with the ratio of the share of gross domestic expenditure on research and development (GERD) in GDP between destinations and ASEAN-5. The share of GERD in GDP, or GERD/GDP indicates the relative size of inputs in innovation activities of a country. Thus, GERD/GDP is also used by economists to measure the innovation level of a country (Shambaugh, Nunn and Portman, 2017, p. 3; UNESCO Institute for Statistics, 2019). As shown in Appendix H, I, J, K and L respectively, the estimated equations of ASEAN-5 retain all independent variables in Table 4.9 but substituting the ratio of GERD/GDP or *LnGERD/GDPr1* for *LnINNOVr1*. The estimation results show that the coefficients of *LnGERD/GDPr1* are also negative for all ASEAN-5 countries. As both alternate measures of innovation levels are estimated with negative signs, it can be inferred that the unexpected sign for *LnINNOVr1* should not be caused by data issues or measurement errors.

The negative influence of *LnINNOVr1* could be explained by the 'crowding effects in destinations', which is advocated by Yan and Zhou (2018). Yan and Zhou designed a destination choice game (DCG) based on game theory to explain the migration pattern between geographical locations. They discovered that in a migration decision game with asymmetrical information, a potential emigrant might avoid destinations which are expected to be very attractive to other potential migrants. This is because the potential emigrant predicts that he or she will incur higher migratory risks by moving into such destinations, in term of intense competition for employment and career opportunities.

Based on Yan and Zhou's (2018) concept of crowding effects, the negative estimators of *LnINNOVr1* could be interpreted as the tendency of HSDs from ASEAN-5 to avoid the highly innovative destinations. The HSDs from ASEAN-5 may expect that such destinations would also attract large number of highly skilled immigrants from other countries of origin. This will result in intense competition for career opportunities in innovation and technology related occupations in the destinations.

The crowding effect does not suggest that HSDs from ASEAN-5 are not interested in technology and innovation related careers. It merely shows that HSDs from ASEAN-5, *ceteris paribus*, tended to avoid moving into highly innovative destinations, in which they might have to compete intensely with immigrants from other countries.

The spatial distribution of HSDs is the outcome of the total effects as specified by the empirical model (3.10). Similarly, based on Yan and Zhou's model (2018), it can be understood that a highly skilled emigrant may decide to move into a highly innovative destination if other positive influences of the destination, such as higher incomes, large market size and bilateral trade relation with the home country outweigh the negative influence of crowding effects.

Table 4.9 shows that the magnitudes of *LnINNOVr1* for Thailand and the Philippines are -0.391 and -0.462 respectively, which are relatively lower than Malaysia, Indonesia and Singapore. Following Yan and Zhou's line of argument (2018), this implies that the HSDs from Thailand and the Philippines were less influenced by crowding effects than Indonesia, Malaysia and Singapore.

The Philippines HSDs had actively participated in the *Balik* Scientist Programme and other diaspora oriented organisations, through which they contributed to the technological development, international R&D collaborations and technopreneurship development of their home country. This may be due to the existence of a substantial number of Filipino technologists and scientists in the highly innovative destinations (Opiniano and Castro, 2006; MPI, 2014; Caunan, 2017). Similarly, Thailand's efforts to engage their HSDs in technological transfers were also highly recognised in many studies (Agunias and Newland, 2012, pp. 171-172; International Labour Organisation [ILO], 2015; Raksaphaeng, 2016). This also suggests the significant presence of Thai scientific community in highly innovative advanced economies. On the contrary, there is lack of study which discusses about the technological and innovation networks connecting Indonesia, Malaysia and Singapore to their HSDs in the highly innovative destinations.

4.3.4.2 Estimation Results for Indonesia

Hugo (2007), Utomo (2011), Darsono (2017) and Setijadi (2017) stated that Indonesian HSDs were driven to advanced countries in pursuit of better career prospect. In this study, it is further discovered that the migratory decision of the HSDs of Indonesia was positively influenced by the population size of the destinations. They were also attracted to the destinations where they were active international trades with their home country. However, the network effects of existing diaspora stocks (*LnSTOCK1*) of Indonesia in attracting new HSDs were smaller than other ASEAN-5 countries.

Table 4.9 shows that the estimated coefficients or elasticity of *LnGDPPCr* for Indonesia are 1.609, which is elastic and the highest among ASEAN-5. This indicates that the influences of development gaps (*LnGDPPCr*) on the spatial distribution of HSDs (M_{jk}) are stronger for Indonesia relative to other ASEAN-5 countries. The GDP per capita of Indonesia was the lowest among ASEAN-5. The World Bank classified

Indonesia as a lower middle income country in 2010 (World Bank, 2018). Thus, Indonesian HSDs are more responsive to development gaps with the destinations relative to other ASEAN-5 countries. This finding echoes Buchori's (2011) claim that Indonesian HSDs preferred to work in developed countries, in order to increase their employability when returning to the home country in the future. The Indonesian HSDs in developed countries are valuable links for Indonesia to gain access into the state-of-the art business and technological know-hows, foreign direct investment (FDI) and comprehensive research and development facilities in advanced destinations (ANTARA News, 2013; Kotarumalos, 2013; Budiari, 2017).

The coefficient of *LnTRADE1* for Indonesia is 1.052, which is also the highest among ASEAN-5. This shows that Indonesian HSDs tended to base their migratory decision on the strength of bilateral trades between home and destination countries. The higher coefficient of *LnTRADE1* for Indonesia relative to other ASEAN-5 implies that the international trade relations had greater influence on the spatial distribution of Indonesian HSDs or M_{jk}. According to Buchori (2011), Gusnelly (2012), Welcker (2016), Darson (2017) and Setijadi (2017), the HSDs of Indonesia were mainly composed of former students who stayed on for overseas occupations and talented persons who went overseas to seek better job opportunities. Thus, the international trade links might be the important channel for Indonesians to obtain vital information of further studies, highly skilled job opportunities and socio-economic conditions in the destinations (Campaniello, 2014; Jut, 2015). In addition, the HSDs' knowledge of the international trade links can be engaged to strengthen the bilateral trades between the destinations and Indonesia.

The estimated coefficient of LnP_jP_k, for Indonesia is 0.605, which is the second highest among ASEAN-5, preceded by the 0.659 for Thailand. This implies that Indonesian HSDs, like Thailand, also have relatively high preference for populous destinations. According to the gravity model for international migration, the population size P_k represents career and market opportunities in the destinations (Greenwood, 2005; Globerman and Shapiro, 2008; Lewer and van den Berg, 2008; Starck, 2012; Beine, Bertoli and Fernández-Huertas Moraga, 2016; Fok, Cheng and Tan, 2018). As the primary objective of Indonesian HSDs was to seek for overseas jobs, they might choose populous destinations which offered abundant employment opportunities (Buchori, 2011; Gusnelly, 2012; Welcker, 2016; Darson, 2017; Setijadi, 2017). The Indonesian HSDs in populous destinations can be engaged to establish networks which transfer overseas market opportunities to their home country.

The estimated coefficient for *LnDIST* of Indonesia was positive. This shows that the spatial movements of Indonesian HSDs were not negatively influenced by the geographical distance and migratory costs. The spatial distribution of Indonesian HSDs, as shown in Figure 4.1 also reveals that majority of the Indonesian HSDs are located in distant destinations, particularly developed economies such as United States, Netherlands and Canada. The positive estimator of *LnDIST* is in line with previous studies on the increased international mobility of Indonesian highly skilled persons (Saefuloh, 2012; Setijadi, 2017).

The elasticity of *LnSTOCK1* was the lowest among all the determinants of M_{jk} for Indonesia. Notably, the elasticity was also the lowest among ASEAN-5. This shows that the HSDs from Indonesia were less dependent on their existing diaspora stocks to obtain information pertaining to the employment and career opportunities in migratory destinations. This also implies that the interaction between Indonesian diasporas and the highly skilled persons in their home country was relatively weak. The reason for the weaker diaspora network could be that majority of the Indonesian HSDs were former tertiary students who stayed for overseas jobs after completing their studies (Buchori, 2011; Muhidin and Utomo, 2015; Welcker, 2016; Siagian and Tike, 2019). The former tertiary students who were lack of industrial experience in Indonesia might have weaker professional, occupational or business links with their home country.

Table 4.9 exhibits that *UNEMPr* for Indonesia was estimated with the expected negative sign, implying that the unemployment rate in destinations has adverse impacts on M_{jk}. The influence of unemployment rate in the destinations on the spatial distribution of HSDs is an aspect seldom covered in the literature. However, the sustainability and continuation of the diaspora engagement initiatives are important aspects emphasised in the literature on diaspora engagement strategy (Xiang, 2005; Meyer, 2007; Keusch and Schuster, 2012, pp. 27-66; OECD, 2012, p. 29; International Organisation of

Migration [IOM], 2014, p. 323). If the spatial distribution of HSDs was highly influenced by the fluctuation in overseas employment conditions, the diaspora networks between HSDs and the home county, and thus the programmes of the diaspora engagement initiatives might also expose to the risks of disruption and discontinuation. This study recommends that unemployment rate in the destinations should be monitored closely by the home country, in order to examine its impacts on the diaspora engagement initiatives.

The negative sign of *TA* shows that AFTA (ASEAN Free Trade Area) and the free trade agreements with Australia, Japan and New Zealand had not promoted the spatial distribution of Indonesian HSDs. Further studies are required to investigate whether the negative estimator of *TA* represents the crowding effects from the FTA partner countries (Yan and Zhou, 2018). The crowding effects may be caused by the intense competition from immigrant talents from other countries. Another explanation for the negative sign is that Indonesian HSDs were discouraged by the occupational obstacles and regulation issues yet to be harmonised by the FTAs through mutual recognition arrangements (MRAs), such as practicing licenses, professional accreditations, incentives and information dissemination on the employment opportunities for immigrant talent (Florene, 2017; Paweenawat and Vechbanyongratana, 2019).

The estimated parameter of *CUL* for Indonesia is positive but not significant, indicating that cultural proximity is not significantly influencing the spatial distribution of the HSDs from Indonesia. *CUL* measures whether the HSDs are inclined to reside in destinations which have strong cultural ties with their home country. Hence, the insignificant estimator of *CUL* for Indonesia may be attributed to Indonesian HSDs' adaptation to destinations which have different cultural and linguistic environments (Saefuloh, 2012; Welcker, 2016; Siagian and Tike, 2019). The positive estimator for C*OL* indicates that Netherlands, the former colonising country of Indonesia still exerted considerable pulling effects on the migratory decision of its HSDs.

The above analysis found that Indonesian HSDs travelled distantly but to destinations with large population, strong international trade relationship and higher income. However, the analysis shows that the linkage between Indonesian diasporas and their home country was relatively weak. This suggests that the diaspora engagement of Indonesia should emphasise on strengthening the transnational networks between Indonesian HSDs and the highly skilled individuals, institutions and industries in the home country. The establishment of the Indonesian Diaspora Network (IDN) in 2013 is a proactive initiative to connect Indonesian diasporas for joint contribution to the economic development of their home country (Setijadi, 2017; Indonesian Diaspora Network, 2018).

The current Indonesian government under President Joko Widodo has continued the Masterplan for Acceleration and Expansion of Indonesia's Economic Development 2011–2025 (MP3EI) of his predecessor, President Yudhoyono (2004–2014). However, the Joko Widodo's administration has reoriented the infrastructure development focus to four main areas, which are energy, maritime and transportation, food sovereignty, and public housing (Al'ayubby, 2018; Salim and Negara, 2018). Following the Indonesian government’s recognition of HSDs as national assets (ANTARA News, 2013; Salim, 2016), the Indonesian HSDs in developed countries, populous destinations and large trading economies can be mobilised to channel the business know-hows, technological expertise and trade opportunities which are essential to develop the four main areas as emphasised by the Indonesian government.

4.3.4.3 Estimation Results for Malaysia

World Bank (2011, p. 121), Hoo, Zainal and Chai (2014) and Wong and Day (2019) found that Malaysian highly skilled emigrants were primarily motivated by better career prospects abroad. This study further showed that Malaysian HSDs were attracted to destinations having close international trades relations with Malaysia. The existing diaspora stocks of Malaysia in the destinations created positive network effects in attracting more highly skilled emigrants from Malaysia.

Table 4.9 exhibits that the estimated coefficient of *LnDIST* for Malaysia is -1.790, which is negatively elastic. This implies that the HSDs from Malaysia were negatively influenced by the geographical distance between destinations and their home country. This shows that majority Malaysian highly skilled emigrants tried to avoid distant and non-regional destinations. This is also substantiated by the statistics as shown in Figure 4.2

that more than 63% of Malaysian HSDs resided in Singapore and Australia. The negative estimator corroborates Foo's finding (2011) that the geographical distance between destinations and Malaysia significantly reduced the highly skilled emigrants from Malaysia.

The estimated coefficient of *LnTRADE1* for Malaysia is the second highest after Indonesia. Its magnitude is also the highest relative to the estimated coefficients of LnP_jP_k, *LnGDPPCr*, and *LnINNOVR1* for Malaysia. This implies that the HSDs of Malaysia, like Indonesia, were inclined to move to destinations which had close economic ties with their home country. The HSDs' preference for the trade partners of Malaysia as their migratory destinations can be explained according to the interpretation of Globerman and Shapiro (2008), Campaniello (2014) and Jut (2015). The main objective of Malaysian HSDs is to seek for better overseas careers (World Bank, 2011, p. 121; Hoo, Zainal and Chai, 2014). Thus, the economic ties between Malaysia and its trade partners might become major channels for the highly skilled emigrants to obtain vital information of career prospects and employment opportunities in destinations. The HSDs' familiarity with the economic ties between destination and home countries could be engaged to strengthen the international trades of Malaysia.

The estimator of *LnSTOCK1* for Malaysia is 0.719, which is lower than Singapore and Thailand but higher than Philippines and Indonesia. This indicates that the spatial distribution of Malaysian HSDs, like Singapore and Thailand was somewhat facilitated by the transnational networks between existing diasporas and the highly skilled persons in the home country. The potential highly skilled emigrants of Malaysia may obtain vital information on career opportunities, market conditions and living environment in the destinations through their overseas diasporas. The existence of moderately strong diaspora links also suggests that the overseas diasporas of Malaysia have maintained considerable interactions with their home country. In this respect, the estimated result corroborates the findings of World Bank (2011, p. 130) and Mamat (2014) that Malaysian diasporas have maintained the sense of belonging, patriotism and national allegiance to their home country.

The elasticity of LnP_jP_k for Malaysia is 0.286 and relatively low compared to Thailand, Indonesia and the Philippines. The magnitude is also lower than the elasticity of *LnGDPPCr*, *LnTRADE1* and *LnSTOCK1* of Malaysia, implying that the M_{jk} of Malaysia was less driven by the population sizes in destinations. This shows that the HSDs of Malaysia may differ from their Thai and Indonesian counterparts, who were more positively influenced by the entrepreneurial opportunities in populous destinations. Previous studies also show that most Malaysian HSDs moved abroad for professional or highly skilled jobs but not setting up their own businesses (World Bank, 2011, p. 125; Saieed, 2017; Sukumaran, 2017).

The coefficient of *LnGDPPCr* for Malaysia is the second lower after Singapore. The reason for the low elasticity of *LnGDPPCr* for both Malaysia and Singapore can be explained by the inverted-U relationship between migration and development levels (Martin, 2000; Czaika and de Haas, 2014;

OECD, 2016, p. 31; Idu, 2019). According to the inverted-U relationship, the migratory decision of potential emigrants from a country of origin with relatively high development level is less influenced by development gaps with the destinations. The GDP per capita or development level of Malaysia was the second highest, after Singapore. Thus, the influence of *LnGDPPCr* on the spatial distributions of the HSDs from Malaysia and Singapore are reasonably smaller than that of Indonesia, Thailand and Philippines.

The estimated parameter of *UNEMPr* for Malaysia is -0.232. The negative influence on M_{jk} was higher than the Philippines but smaller than Indonesia and Singapore. This shows that the Malaysian HSDs as a whole were less adversely impacted by the unemployment rates in destinations relative to Indonesia and Singapore. The lower negative impact of unemployment rates abroad may be attributed to the adaptability and job stability of Malaysian HSDs, especially the large number of Malaysian professionals in Singapore (Ghani and Jauhar, 2015).

The *TA* of Malaysia had negatively affected the spatial distribution of its HSDs. The negative magnitude is higher than those of Singapore and Indonesia. Similar to the case of Indonesian HSDs, further studies are required to understand whether Malaysian HSDs were driven away by crowding effects from the FTA partner countries. The HSDs may expect intense competition for career opportunities with immigrant talents from other countries to the FTA partner countries of Malaysia (Yan and Zhou, 2018). Another explanation is that AFTA and other FTAs were unable to provide career opportunities and mutual recognition arrangements (MRAs) of professional qualifications which can attract the HSDs from Malaysia. This implies that ASEAN Economic Community (AEC) might have to evaluate the effectiveness of its initiatives in promoting the regional mobility of the Malaysian highly skilled persons.

The *CUL* for Malaysia is estimated with a negative sign, similar to other ASEAN-5 except for Indonesia. In addition, the magnitude of the negative coefficient for Malaysia was the highest relative to Singapore, Thailand and the Philippines, implying that Malaysian HSDs had the highest tendency to choose destinations which have no cultural links with their home country. In other words, the HSDs of Malaysia are more venturous and adaptable to foreign environment, enabling them to move beyond countries culturally connected with their home country. This finding on the characteristic of Malaysia is supported by the previous studies which stated that Malaysian HSDs are multicultural, multilingual, adaptable and global-minded (Mamat, 2014; Ghani and Jauhar, 2015). The negative estimator for *CUL* is a meaningful finding of this study. It may reflect that highly skilled migrants have become more cosmopolitan and adaptive to multiculturalism. This study calls for further studies based on measures of cultural proximity as advanced by Eff (2008), in order to understand more on the characteristics of highly skilled emigrants.

The estimated parameter of *COL* for is 0.100, indicating that the colonial links (*COL*) has exerted positive but marginal influence on the spatial distribution of Malaysian HSDs. The weak influence of *COL* shows that the potential highly skilled emigrants of Malaysia have depended less on the colonial past of their home country while choosing migration destinations. Instead, this study shows that the economic ties of Malaysia, as indicated by the stronger influence of international trade relations were the main driver of the Malaysian HSDs.

The above analysis has contributed to new insights and knowledge on the characteristics of HSDs from Malaysia. The World Bank (2011, p. 121), Foo (2011), Hoo, Zainal and Chai (2014) and Wong and Day (2019) show that better career prospect was the main driver for talent emigration of Malaysia. Nevertheless, this study has made further discovery that the spatial distribution of Malaysian HSDs were mainly driven by the bilateral trade relationship and diaspora networks of Malaysia. Malaysia was the 29th largest export country in the world in 2017 (Central Intelligence Agency, 2017). Its ratio of export of goods and services to GDP was 70.2% in 2018, which was the 21st largest share of national GDP in the world in 2018 (World Bank, 2019). The international trade statistics show that the economy of Malaysia is highly depended on export (Yusof, 2019). In this respect, the HSDs should be engaged to contribute to the enhancement of international trade relations between destinations and Malaysia.

The diaspora networks between overseas Malaysians and the highly skilled persons in their home country could be further strengthened and intensified by the national agencies, civil societies and industrial organisations. The strong diaspora links are essential to expedite the diffusion of business know-how and economic opportunities between destinations and Malaysia (Talent Corporation Malaysia Berhad, 2018, p. 8, 10).

This study highlights two aspects which need further investigation in developing the diaspora engagement initiatives of Malaysia. Firstly, the Malaysian HSDs are inclined to reside in destinations which are relatively close to their home country, particularly Singapore and Australia (Hoo, Zainal and Chai, 2014; Ghani and Jauhar, 2015). This shows that the Malaysian HSDs are less capable to establish diaspora links to distant developed countries, especially the advanced economies in the North America and Europe.

The second aspect is related to the low responsiveness of Malaysian HSDs to population sizes in the destinations. The population size in the destinations represents the market size and entrepreneurial opportunities which would normally attract immigrants (Greenwood, 2005; Globerman and Shapiro, 2008; Lewer and van den Berg, 2008; Starck, 2012; Ramos and Surinach, 2013; Fok, Cheng and Tan, 2018). The low elasticity of LnP_jP_k shows that Malaysian HSDs are less driven by economic opportunities in the populous destinations. This implies that the efforts of Talent Corporation of Malaysia to promote transnational entrepreneurship might be challenged by Malaysian HSDs' lack of interest in the entrepreneurial opportunities in populous destinations (Talent Corporation Malaysia Berhad, 2012, pp. 95-115; World Bank, 2015, p. 23). To overcome this problem, it is essential for the government agencies, industries and entrepreneurs in Malaysia to reach out to their HSDs proactively, in order to promote their entrepreneurship and help them recognising the business opportunities in overseas markets (Talent Corporation Malaysia Berhad, 2018, p. 6).

4.3.4.4 Estimation Results for the Philippines

A substantial portion of the Philippines HSDs is composed of contract workers, who are generally called as Overseas Filipino Workers (OFWs). The overseas occupations of OFWs are defined by their employment contracts (ADBI, 2014, pp. 7-9; OECD, 2015, p. 95). This study found that the migratory distribution of the Philippines HSDs was influenced by the presence of OFWs in two aspects: 1) low responsiveness to the development gap and the population size of the destinations; and 2) inclination to move to geographically distant destinations. This study also shows that the regional trade agreement (RTA) and free trade agreements (FTAs) signed by the Philippines helps to facilitate the migratory movements of their highly skilled emigrants.

Table 4.9 shows that the spatial distribution of the Philippines HSDs is positively influenced by LnP_jP_k. However, the estimated coefficient of LnP_jP_k for the Philippines is smaller than Thailand and Indonesia. The relatively low positive influence of LnP_jP_k for the Philippines could be interpreted by the fact that there was a substantial number of HSDs who worked abroad as overseas contract workers (OFWs), who were mainly the low and medium skilled workers. The number of Philippines HSDs who worked as OFWs is approximately 533,970 or 47.1% of the total in 2010 (ADBI, 2014, pp. 7-9; OECD, 2015, p. 95; OECD, 2017, p. 46). The jobs of OFWs were defined and secured by pre-arranged or *ex-ante* contracts. Thus, the highly skilled emigrants who worked as OFWs might be less responsive to the population and market size in destinations (Camroux, 2008; OECD, 2017, p. 168).

The estimator of *LnDIST* was positive in 2010, indicating that the spatial movements of HSDs from the Philippines were not discouraged by the geographical distances and migratory costs. The result also coincides with the observation of Figure 4.4 that a large portion of HSDs from the Philippines, i.e. more than 70% dispersed in distant advanced countries such as the United States, Canada and United Kingdom. The substantial number of OFWs among HSDs from the Philippines may also contribute to the positive estimator of *LnDIST*. As OFWs based their migratory decision on the terms of their work contracts, their spatial distribution may not be impeded by the geographical distance and migration costs.

The coefficient of *LnTRADE1* for the Philippines is significantly positive. However, the elasticity was the second lowest among ASEAN-5. The relatively low elasticity implies that the highly skilled emigrants from the Philippines were less driven by international trades between their home country and the destinations. The sizeable portion of OFWs among HSDs from the Philippines may be partly responsible for the low elasticity of *LnTRADE1*. As the OFWs were more concerned with the terms of their job contracts, they would be less responsive to other factors, including the trade relationship of their home country (Camroux, 2008; IOM, 2010, p. 24; Castro-Palaganas et al., 2017; OECD, 2017, p. 168).

The coefficient of *LnGDPPCr* for the Philippines is 0.446, which is much lower than Indonesia and Thailand. Indonesia, the Philippines and Thailand are the less developed countries relative to Malaysia and Singapore. Intuitively, the impacts of development gaps on the HSDs from Indonesia, the Philippines and Thailand should not differ substantially from each other. The much lower elasticity of *LnGDPPCr* for the Philippines may be attributed to the substantial number of OFWs among the HSDs. OFWs who worked for low and medium skilled jobs (OECD, 2015, p. 95) were likely to make their migratory decision based on the benefits and terms offered by the employment contracts. Thus, the OFWs might accept overseas jobs with less consideration on the development gaps between destinations and their home country (Camroux, 2008; IOM, 2010, p. 24; Castro-Palaganas et al., 2017; OECD, 2017, p. 168). Hi

The elasticity of *LnSTOCK1* for the Philippines is 0.665, which is moderate relative to Singapore, Thailand and Malaysia, implying that Filipino diasporas have exerted moderate network effects in attracting highly skilled emigrants from their home country. The moderate network effects support the fact that the diasporas of the Philippines had maintained transnational links with their home country, either through informal links such as family ties and kinship or formal links like diaspora oriented organisations, business networks and scientific networks (Opiniano and Castro, 2006; Camroux, 2008; MPI, 2014; Asis, 2017). Such diaspora networks can be strengthened and intensified in order to multiply the transmission of knowledge, technological know-how and entrepreneurial opportunities abroad to the Philippines.

The estimated coefficient of *UMEMPr* was negative but close to zero at -0.035. This indicates that a rise in the unemployment rate of destinations will have very small adverse impacts on the size of the Philippines HSDs. The small negative impacts could be explained by the large scale of outmigration which has happened since 1970s. Over the past few decades until 2010, a sizeable number of HSDs had resided overseas. Many HSDs had become permanent or long term residents in their destination countries (Alburo and Abella 2002, p. 19; ADBI, 2014, pp. 7-9). Thus, the changes in unemployment rate in destinations may barely reduce the number of HSDs (Arslan et al., 2014).

The coefficient of *TA* is moderately positive, indicating that AFTA and other FTAs of the Philippines have facilitated the migration of its HSDs to FTA partner countries. Apart from the regional free trade agreement AFTA, the Philippines had also formed FTAs with Australia, Japan and New Zealand. The positive estimator of *TA* shows that AFTA and other FTAs may promote the immigration of HSDs from the Philippines. The HSD links of the Philippines to AFTA region and other FTA partner countries could be augmented to promote the economic interaction and international mobility of human capital.

Table 4.9 shows that the estimated coefficient of *CUL* for the Philippines is significantly negative. The negative *CUL* suggests that the HSDs from the Philippines tend to move beyond the comfort zone of cultural proximity and reside in destinations with different cultural environments. This could be partly caused by the OFWs among HSDs, who move to destinations which are culturally different from the Philippines. However, previous studies also highlighted the overseas Filipinos' high susceptibility and adaptability to multiculturalism (Camroux, 2008; Nititham, 2011; OECD, 2017, pp. 49-50).

The coefficient of *COL* for the Philippines is estimated as -1.411, indicating that if there is a colonial link between a given destination and the Philippines, the M_{jk} will be reduced by 1.41%, *ceteris paribus,*. According to Head, Mayer and Ries (2011) and Stack, Ackrill and Bliss (2018), the negative estimator for colonial link indicates the erosion or weakening of colonial influence after a former colony has become an independent nation. Thus, the negative estimator of *COL* could be interpreted as the declining influence of colonial history to the spatial distribution of the Philippines HSDs. The major destinations of the Philippines HSDs are no longer confined to their former colonising countries, i.e. Spain and United State, but spreading to a wide range of destination countries/economies.

The Philippines has implemented comprehensive diaspora engagement programmes since 1980s (MPI, 2014; Caunan, 2017; OECD, 2017, pp. 57-58). The HSD communities have established stable, transnational and reciprocal links between destinations and their home country. These transnational networks are social capital for the Philippines to gain access to diaspora resources located in the destinations, particularly technological know-hows and business opportunities from the developed countries.

The empirical results show that the population sizes of the destinations had lower positive impacts on the HSDs from the Philippines than Indonesia and Thailand. The Philippines should proactively engage their HSDs in exploring and tapping the entrepreneurial opportunities in the populous destinations. In this respect, the national agencies, industrial organisations, businesses and other stakeholders of the Philippines should take initiatives by forming partnerships with their HSDs, in order to channel market information, business know-how and entrepreneurial opportunities from the populous destinations to the home country (Agunias and Newland, 2012, p. 16, 23; Keusch and Schuster, 2012; Trotz and Mullings, 2013; Meulen, 2016).

4.3.4.5 Estimated Results for Singapore

Table 4.9 exhibits that the estimated coefficient of *LnDIST* for Singapore is significantly positive at 0.820, implying that the Singaporean HSDs, similar to Indonesia, the Philippines and Thailand, were inclined to transcend the geographical distance and venture into distant destinations.

However, the coefficient of LnP_jP_k for Singapore is insignificant and negative, indicating that the market and entrepreneurial opportunities in populous destinations might not have significant influence on the spatial distribution of Singaporean HSDs. This implies that although the Singaporean HSDs' primary motive is to seek for career opportunities abroad (Yap, 1994; Tan, 2012; Teng, 2014; Lee, 2015), they might be less interested in the career and market opportunities provided by populous destinations. According to previous studies, the primary migratory motives of Singaporean highly skilled emigrants were better overseas careers, less stressful lifestyle and exposure to new working environment (Tan, 2012; Teng, 2014; Lee, 2015). However, this study reveals a knowledge gap on the Singaporean HSDs' career expectation, such as their willingness to go into business venture and entrepreneurial activities. Such information is important for Singapore to formulate strategies to incentivise its HSDs to explore the business opportunities in populous destinations (Docquier, Peri and Ruyssen, 2014; Ho and Bolye, 2015; Fok, Cheng and Tan, 2018).

The estimated coefficient of *LnSTOCK1* for Singapore was the highest among ASEAN-5. This shows that the existing diaspora stocks of Singapore in destinations had relatively strong network effects to attract more highly skilled emigrants from their home country. The finding also suggests the existence of strong transnational links between Singaporean diasporas and their home country (Ho and Boyle, 2015). Through the transnational links, the potential highly skilled emigrants from Singapore could obtain relevant information about the destinations, such as career opportunities and socio-economic conditions (Jut, 2015).

Like Philippines, the coefficient of *COL* for Singapore was estimated with a negative sign. Referring to Heads, Mayer and Reis (2011) and Stack, Ackrill and Bliss (2018), the negative sign for *COL* could be interpreted as the weakened influence of colonial links on the spatial distribution of the Singaporean HSDs. Instead, the increased skill mobility of Singaporean talents has expedited them to venture to other countries or economies for more attractive career opportunities (Chen and Wong, 2015; HR in Asia, 2016). Similarly, the negative estimator of *CUL* points to the multiculturalism and adaptability of Singaporean HSDs, enabling them to move away from the countries which have strong cultural links with their home country (Saha, 2009; Lee, 2015; Ho and Boyle, 2015).

The estimator of *LnGDPPCr* for Singapore is significantly positive but close to zero, indicating that the development gap had marginal influence on the spatial distribution of the Singaporean HSDs. This coincides with the inverted-U relationship between migration and development level of the country of origin (Martin, 2000; Czaika and de Haas, 2014; Cheng and Wong, 2015). Singapore had achieved the status of developed economy before 2000. The GDP per capita of Singapore in 2000 was USD 23,793.04 and it increased by 91.5% to USD 45,569.69 in 2010, one of the highest in the world. Thus, the Singaporean HSDs' low responsiveness to development gaps was in line with the inverted-U relationship between migration and development level.

The estimated coefficient of *LnTRADE1* for Singapore is the third highest among ASEAN-5. The finding shows that the highly skilled emigrants from Singapore, like their counterparts from Indonesia and Malaysia also depended on the international trade links of their home countries to obtain vital information regarding employment and career opportunities in the destinations. In this respect, this study has corroborated the empirical findings of Globerman and Shapiro (2008), Campaniello (2014) and Jut (2015) on the positive influence of bilateral trades on the sizes of HSDs in destinations.

The negative estimator of *UMEMPr* for Singapore is the highest among Indonesia, Malaysia and the Philippines. It shows that a 1.00% rise in the ratio of unemployment rates will reduce the number of Singaporean HSDs in the destinations by 1.04%. The adverse impacts can also be explained with the inverted-U relationship (Martin, 2000; Czaika and de Haas, 2014; OECD, 2016, p. 31). As Singapore is an advanced economy, its income level and career opportunities for highly skilled persons are also as promising as other developed economies. Thus, the rise in the unemployment level of a given destination may reduce the size of HSDs from Singapore, as they would shift to other destinations or return to their home country for better employment options.

Similar to Indonesia, Malaysia and Thailand, the *TA* for Singapore is estimated with a negative sign. This indicates that Singaporean HSDs had also responded negatively to the AFTA and FTAs with other countries. The reason could be that the human capital mobility frameworks of the AFTA and FTAs, such as mutual recognition arrangements (MRAs) and job creation failed to meet the job expectations of the Singaporean HSDs. This study calls for further investigation into the reasons behind the negative impacts of *TA* on the HSDs from Singapore, Malaysia, Indonesia and Thailand. Such knowledge is crucial for the ASEAN Economic Community (AEC) to formulate strategies to promote the intra-regional talent mobility.

Based on the World Bank classification (2018), Singapore is the only developed nation among ASEAN-5. Its HSDs were less responsive to the development gap between destinations and their home country. Further to the previous studies which found that the primary motive of Singaporean highly skilled emigrants is better career prospect (Tan, 2012; Singapore Business Review, 2013; Ho and Boyle, 2015), this study showed that they were attracted to destinations which have large volumes of bilateral trades with their home country.

The above analysis led to the strategic insight that the Singaporean HSDs could be mobilised to strengthen the status of Singapore as the global financial and business hub. The transnational links of the Singaporean diasporas could also be further developed to channel economic opportunities and business know-how from advanced economies to their home country. The findings justify the diaspora engagement strategy of Singapore implemented since the 2000s, which emphasises on strengthening the global links of Singapore through its citizens living abroad (Saha, 2009; National Population and Talent Division, 2013, p. 25; Ho and Boyle, 2015).

4.3.4.6 Estimated Results for Thailand

Table 4.9 exhibits that the estimator of *LnGDPPCr* for Thailand is the second highest among ASEAN-5. The magnitude of the elasticity of *LnGDPPCr* for Thailand was higher than Singapore and Malaysia but lower than Indonesia. The phenomenon can be explained by the inverted-U relationship between migration and development (OECD, 2016, p. 37; de Haas et al., 2018). The development level of Thailand was lower than Singapore and Malaysia but higher than Indonesia (World Bank, 2018). Thus, the HSDs of Thailand should be more responsive to the development gaps than Singapore and Malaysia but less responsive than Indonesia.

Another explanation for Thai HSDs to respond strongly to development gaps might be the outflows of science and technology (S&T) talents to seek for better careers in advanced countries (Raksaphaeng, 2016; Bangkok Post, 2018). The HSDs of Thailand are valuable nodes for their home country to strengthen the interactions with advanced economies, particularly the technology transfer and FDI inflows (Raksaphaeng, 2016).

The elasticity of *LnSTOCK1* for the M_{jk} of Thailand is the second highest after Singapore in 2010. The estimated coefficient of *LnSTOCK1* is also higher than LnP_jP_k, *LnGDPPCr* and *LnTRADE1*, indicating that the existing diasporas have greater influence than other factors on the spatial distribution of the HSDs from Thailand. The potential highly skilled emigrants might obtain vital information on the career opportunities and working environment in destinations through the Thai diasporas living abroad. This also implies that the diasporas of Thailand have maintained relatively strong links and intense interactions with their home country. This finding is in line with the notion of previous studies that diasporas of Thailand are closely connected with their home country through transnational links such as business networks, diaspora oriented organisations and familial ties (Beasley, Hirsch and Rungmanee, 2014, p. 24; Boonyopakorn, 2014; Tanpipat, 2015).

The estimated coefficient of LnP_jP_k for Thailand was the highest among ASEAN-5. Previous studies show that the HSDs from Thailand were active in setting up various types of business ventures in destinations, including business services and professional consultancies (Beasley, Hirsch and Rungmanee, 2014, p.24; Tanpipat, 2015; Weng and Chanwong, 2016; Webster and Haandrikman, 2017). The relatively high elasticity of LnP_jP_k reveals reveal that the career and business opportunities in populous destinations may have greater influence on the Thai HSDs than other ASEAN-5 countries.

The estimator of *LnTRADE1* for Thailand is negative but with a magnitude close to zero. A 1% increase in the bilateral trade volume with a given destination, the size of HSDs in the destination would reduce by only 0.03%. The marginal impact shows that the spatial distribution of the Thai HSDs was weakly linked to the international trade relations of their home country. Previous studies show that many Thai HSDs carry out business activities in destinations, particularly various types of business and professional services (Beasley, Hirsch and Rungmanee, 2014; Weng and Chanwong, 2016; Webster and Haandrikman, 2017). However, the marginal impact of *LnTRADE1* on M_{jk} implies that the business activities carried out by Thai HSDs may mainly focus on serving the domestic market of their destinations. Thus, it is suggested that Thailand should take effective measures to motivate the HSD entrepreneurs and business operators to promote the international trades of their home country. To formulate the diaspora engagement strategy for this purpose, it is recommended to conduct further studies on the HSDs' business activities in destinations, the potential links of their businesses with the home country, and their capabilities and willingness to contribute to the international trade relations of Thailand.

Thailand is the only ASEAN-5 countries which had a positive estimator for *UNEMPr*, albeit it is close to zero. This suggests that the unemployment rate in destinations had no negative impacts on the size of HSDs from Thailand. This phenomenon could be explained by the major occupations and careers undertaken by the HSDs from Thailand. According to Bhumiratana, Songkasiri, Commins and Grimley (2009), Tanpipat (2015), ILO (2015), Raksaphaeng (2016), and Weng and Chanwong (2016), many HSDs from Thailand were professionals in science and technological fields or entrepreneurs who provide various types of business services. As the occupations of Thai HSDs were either highly specialised or self-employed, they might be more capable to weather the rise in the overseas unemployment rates.

The positive estimator for *LnDIST* indicates that the HSDs from Thailand, similar to their counterparts from Indonesia, Philippines and Singapore, were not hindered by the geographical distance while choosing migratory destinations. The negative estimator of *CUL* shows that the HSDs from Thailand, like Malaysia, Philippines and Singapore, were inclined to venture into destinations which are not culturally linked to their home country.

The estimator of *TA* for Thailand is positively significant; indicating that AFTA and other FTAs entered by Thailand had facilitated the migratory movements of its HSDs. Thailand can engage its HSDs in the AFTA region to strengthen the talent networks of the AEC. Similarly, the HSDs residing in other FTA partner countries can be mobilised to strengthen the bilateral economic ties and knowledge transfer to Thailand (Tanpipat, 2015).

The diaspora engagement of Thailand is often cited as one of the successful cases (Gamlee, 2006, p. 19; Agunias and Newland, 2012, pp. 171-172; ILO, 2015). Since the 2007, the National Science and Technology Development Agency of Thailand (NSTDA) has shifted their diaspora strategy from returning overseas talents to actively engaging them in international research collaboration and technological transfer from their destinations (Bhumiratana, Songkasiri, Commins and Grimley, 2009; ILO, 2015; Raksaphaeng, 2016).

Thai government has launched the Thailand 4.0 in 2016 to transform the county into a value-based, innovation driven and digitally advanced economy (Thailand Board Of Investment, 2017, pp. 3-5; The Government Public Relations, 2017; Theparat and Arunmas, 2018). The strong diaspora networks between Thai HSDs and Thailand, as identified in this study can be utilised to formulate diaspora engagement initiatives which contribute to the Thailand 4.0. Since the HSDs from Thailand are mostly professionals in S&T and entrepreneurs, the diaspora networks of Thai HSDs should be developed into DKNs which transmit knowledge, technological know-how, and business opportunities from the advanced economies and populous countries to Thailand, in order to stimulate the economic transformation under Thailand 4.0 (The Government Public Relations, 2017; Theparat and Arunmas, 2018).

This study shows that the Thai HSDs was not drawn to the destinations by the international trade relations of their home country. However, previous studies show that Thai HSDs were active in setting up small and medium sized enterprises (SMEs) to provide various types of professional and business services to the local market of destinations (Bhumiratana, Songkasiri, Commins and Grimley, 2009; Beasley, Hirsch and Rungmanee, 201s4; Weng and Chanwong, 2016; Webster and Haandrikman, 2017). Thus, it is recommended that the government agencies, industries and exporters of Thailand should proactively engage the HSDs' entrepreneurship, business know-how and familiarity with destinations to enter into the new markets abroad.

4.3.5 Diaspora Resources Identified from the Empirical Results

Table 4.10 exhibits the potential diaspora resources DR1, DR2, DR3 and DR4 corresponding to the four macro-determinants *LnP_jP_k, LnGDPPCr, LnINNOVr and LnTRADE1* as explained in Table 3.2 of Chapter 3. The four macro-determinants reflect the HSDs' migratory motives and expectations which, in turn, point to the diaspora resources possessed by HSDs in the destinations (Ionescu; 2006, p. 27; de Haas, 2010a, 2010b; African Diaspora Policy Centre, 2011; King, 2012; Docquier, Peri and Ruyssen, 2014; Hoo, Zainal and Chai, 2014; Gamlen, 2014; Elo, 2015; Gamlen, Cummings and Vaaler, 2017; Fok, Cheng and Tan, 2018).

The four diaspora resources, which are the economic opportunities in populous destinations (DR1), economic opportunities and knowledge in developed destinations (DR2), innovation activities and collaboration opportunities in highly innovative destinations, (DR3) and bilateral trades with destinations (DR4), are also the focuses of the studies related to highly skilled emigration and diaspora engagement strategies (Meyer, 2007; Globerman and Sapiro, 2008; Saxenian, 2011; Agunias and Newland, 2012; Docquier and Rapoport, 2012; National Population and Talent Division, 2013; Beasley, Hirsch and Rungmanee, 2014; Gibson and Mckenzie, 2014; Sams, Freeman and Thomas, 2014; Sinatti and Horst, 2015; Raksaphaeng, 2016; Setijadi, 2017; Fok, Cheng and Tan, 2018; Sommer and Gamper, 2018).

Table 4.10: Diaspora Resources (DRs) Corresponding to the Macro-Determinants of the Spatial Distribution of HSDs in 2010

Macro-determinants	Expected sign	Diaspora Resources (DR) in Destination *k*	DR	ASEAN-5 *(Arranged in descending order according to the magnitude of parameter for the corresponding macro-determinants)*
LnP_jP_k	Positive	Market and business opportunities in populous destinations	DR1	Thailand (+) Indonesia (+) Philippines (+) Malaysia (+) Singapore (-)
$LnGDPPCr_{kj}$	Positive	Economic opportunities and knowledge in developed destinations	DR2	Indonesia (+) Thailand (+) Philippines (+) Malaysia (+) Singapore (+)
$LnINNOVr1_{kj}$	Positive	Innovation activities and collaboration opportunities in highly innovative destinations	DR3	**Crowding effect for ASEAN-5:** Indonesia (-) Thailand (-) Philippines (-) Malaysia (-) Singapore (-)
$LnTRADE1_{jk}$	Positive	Bilateral trades with destinations	DR4	Indonesia (+) Malaysia (+) Singapore (+) Philippines (+) Thailand (-)

Note: Sign in parentheses indicates the estimated sign.

The diaspora resources identified for each ASEAN-5 country are extended to PART II analysis, which is based on the framework of global diaspora network and flow model of social network analysis (SNA). PART II analysis investigates whether the network positions and connectivity of ASEAN-5 can enhance their capability in capturing and mediating the diaspora resources of their HSDs.

The rightmost column of Table 4.10 arranges ASEAN-5 in descending order according to the magnitude of the estimated parameters for the four macro-determinants, *LnP_jP_k, LnGDPPCr, LnINNOVr1, LnTRADE1*. As each macro-determinant points to a corresponding diaspora resource, the magnitude of the estimated parameters also implies the strength of the corresponding diaspora resource for a particular ASEAN-5 country.

The analysis in PART II investigates how ASEAN-5 can gain access to DR1, DR2, DR3 and DR4 through their positions and connectivity in the global diaspora network. If the macro-determinants in PART I were estimated with an expected positive sign, for example the LnP_jP_k for Thailand, then an advantageous network position in the global diaspora network would enhance the capabilities of Thailand to gain access to the corresponding diaspora resource DR1.

However, there might be cases when an unexpected sign was estimated for a given macro-determinant in PART I but PART II found that the home country was well connected to destinations which contain the corresponding diaspora resource. For example, PART I found a negative estimator of *LnTRADE1* for Thailand but PART II shows that Thailand is closely connected to destinations which are active in international trades. In this case, the network proximity of Thailand to diaspora resource DR4 highlights an important finding: Although Thai HSDs were not positively influenced by the international trade relations, their presence or dwelling in large trading economies shows that Thailand possesses the advantage of gaining access to DR4. This implies that Thailand should take appropriate diaspora engagement measures to motivate and incentivise its HSDs to contribute to the international trades of their home country. In this respect, PART II can complement PART I by discovering diaspora resources which the home country may be unable to identify from the migratory motives and expectation of the HSDs.

The estimators of *LnINNOVr1* are negative across ASEAN-5 in 2010. The phenomenon is interpreted as crowding effects from the destinations with high level of innovation activities. Based on the theoretical insight of Yan and Zhou (2018), the crowding effects indicate that HSDs from ASEAN-5 tried to avoid highly innovative countries/economies activities, *ceteris paribus*. It is because the HSDs expect that they would face intense competition from highly skilled immigrants from other countries of origin for career opportunities in these destinations.

The crowding effects have complicated the interpretation of the influence of *LnINNOVr1* on the spatial distributions of HSDs. However, PART II analysis shall address this issue by looking into the connectivity of ASEAN-5 to the highly innovative countries/economies in the global diaspora network. The analysis will provide insight on the strategy to engage the HSDs of ASEAN-5 in advanced destinations, most of which are also highly innovative countries/economies.

4.4 PART II: SNA Analysis on the Global Diaspora Network

4.4.1 Centrality Analysis

The global diaspora network of 2010 is represented by the normalised and symmetric adjacency matrix *Sn2010 (d=0.1742, E=7146)*, where *d* = network density and *E* = actual diaspora links among countries or economies. It is constructed from the bilateral stock of HSDs among 203 countries or economies (203 x 203), based on the DIOC-E 2010 (Release 1.0) dataset published by the OECD.

The network of *Sn2010 (d=0.1742, E=7146)* constitutes of 7,146 links formed by HSDs between pairs of countries/economies (hereinafter called as HSD links). In SNA, it is a common practice to reduce the size of a network in order to reveal the important structure of the connectivity between nodes (Borgatti, Everett and Johnson, 2018, pp. 290-295). Section 3.4.4.3 of Chapter Three suggests that a network can be reduced through dichotomisation to remove the weaker links and retain the stronger ones for analysis. Another reason for dichotomisation is to facilitate analysis because most of the SNA methods are designed for analysing binary data (Hanneman and Riddle, 2005; Borgatti, Everett and Johnson, 2013, pp. 77-78; Borgatti, Everett and Johnson, 2018, pp. 87-88).

However, there is no systematic way to determine a cut-off point for the dichotomisation process. An optimal cut-off point should retain the richness of the data but also reveal the underlying network structure, which is the target of SNA analysis (Windzio, 2017; Borgatti, Everett and Johnson, 2018, pp. 87-88). Many SNA researchers propose an interactive approach to dichotomise the network at different cut-off points or network density levels. An optimal cut-off point can be identified if it generated a relatively stable network structure (Borgatti, Everett and Johnson, 2013, pp. 77-78; Borgatti, Everett and Johnson, 2018, pp. 87-88).

Figure 4.6 exhibits the normalised degree centrality C_D' of ASEAN-5 with respect to various cut-off points and the corresponding levels of network density. The C_D' of Philippines was the highest among ASEAN-5 in the original network *Sn2010 (d=0.1742, E=7146)* before the dichotomisation, i.e. at the cut-off point c = 0.000. However, the C_D' of the Philippines dropped rapidly at 0.000 < c < 0.002 and it was overtaken by Thailand at c = 0.002. This suggests that although the Philippines had more direct links to destinations through their HSDs, many of the links were relatively weak. The C_D' of Thailand was quite stable at 0.002 < c < 0.010. In addition, the C_D' of Indonesia, Malaysia and Singapore decline slowly at 0.003 < c < 0.010. Most notably, the density of the global diaspora network also declines slowly at 0.003 < c < 0.010. Thus, the cut-off point for the dichotomisation can be fixed at c = 0.003, which produced a new network structure *Sn2010 (d=0.075, E=3060)*. The density of the dichotomised network was 0.075. It had 3060 HSD links, roughly half of the HSD links in the original network.

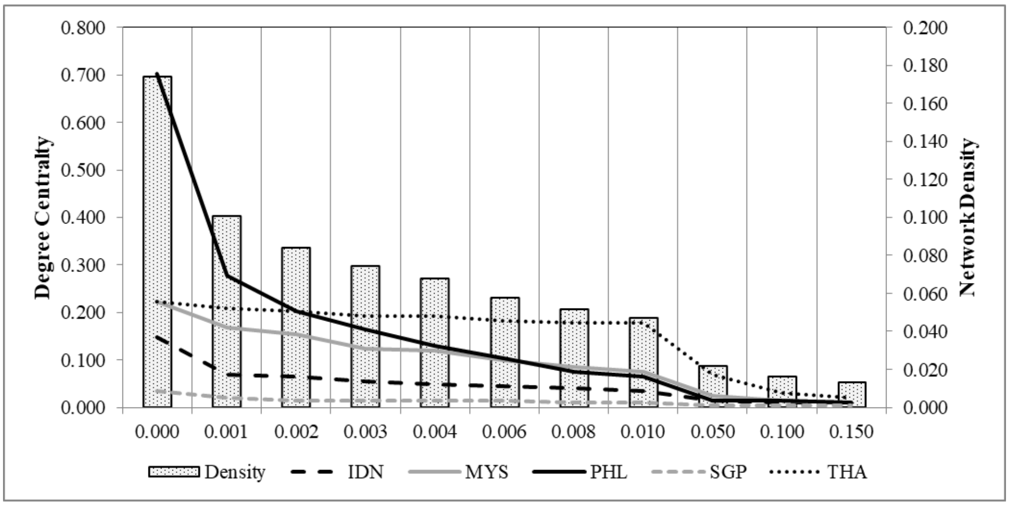


Figure 4.6: Choosing a Cut-off Point for Dichotomisation Based on Normalised Degree Centrality and Density of Global Diaspora Network

Table 4.11 exhibits the 30 countries with the highest normalised centrality metrics under the *Sn2010 (d=0.075, E=3060)*. The second column of the table exhibits their degree centrality C_D. Others columns show the normalised centrality metrics C'_D, C'_C, C'_E and C'_B of the 30 countries. The normalised centralities for the ASEAN-5 are exhibited at the bottom of the table. The sub-column *R.* under each normalised centrality metric ranks the corresponding countries in relation to other countries/economies in the global diaspora network. The ranks are arranged in descending order. A relatively high rank, *ceteris paribus*, signifies a more central position which is closer to the core of the global diaspora network. On the contrary, a relatively low rank implies a more periphery position in the global diaspora network.

Table 4.11 shows that the United States scores the highest C_D', C_C' C_B' and second highest C_E' relative to other countries in the world. The C_D' value of the United States indicates that it has direct links to 58.9% or 119 countries/economies in the global diaspora network. The highest C_C' implies that the United States has strong capability to respond to the flows of knowledge, ideas and economic opportunities diffused through the global diaspora network.

Similarly, the highest C_B' indicates that United States has occupied a network position which renders it the greatest advantage to mediate the flows of diaspora resources between countries. Sweden was ranked the highest for C_E' and followed by the United States. This implies that Sweden has strong capability in mobilising their HSDs to capture flows diffused from any parts of the global diaspora network.

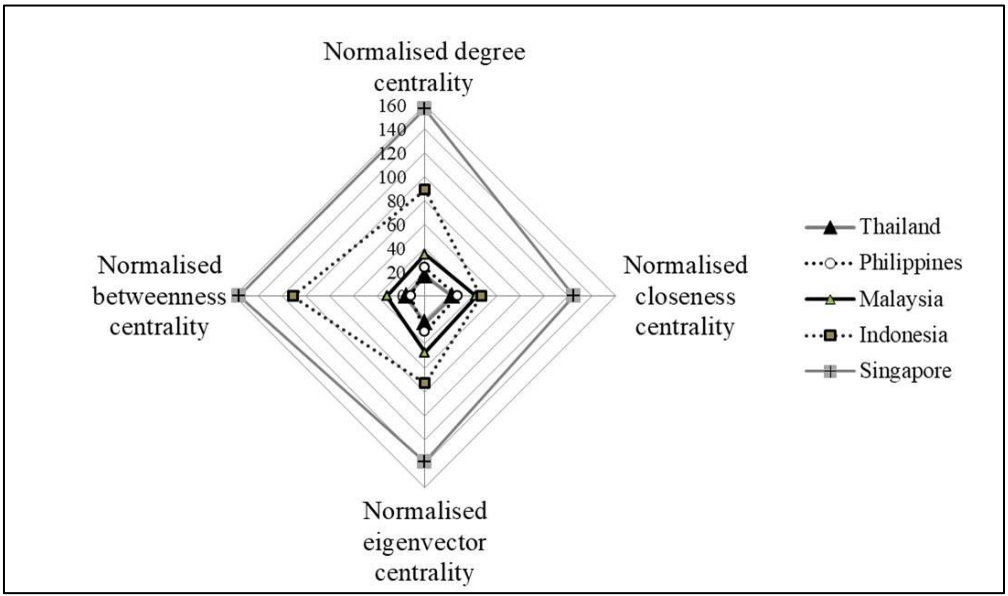
Other countries ranked at the top 30 include advanced countries such as the Netherlands, Italy, United Kingdom, France, Norway, Spain, Russia, Canada, Ireland, Denmark, Germany and emerging economies such as South Africa, Thailand, and the Philippines. The strong network positions of these countries, as shown by the centrality metrics, could enhance their capabilities in tapping diaspora resources from the global diaspora network.

Table 4.11 shows that Thailand and the Philippines had achieved the top 30 ranking for all normalised centrality metrics. The relatively high C_D and C'_D of Thailand and the Philippines indicate that they were connected to a larger number of destinations through their HSDs. Figure 4.7 further exhibits that Thailand and Philippines attained the highest ranks for all normalised centrality measures compared with other ASEAN-5. The normalised centrality metrics of Malaysia ranked lower than Thailand and the Philippines but higher than Indonesia and Singapore.

Table 4.11: Centrality Metrics for the Global Diaspora Network in 2010 (*Sn2010, d=0.075, E=3060)*

Country	Degree Centrality C_D	Normalised Degree Centrality C'_D		Normalised Closeness Centrality C'_C		Normalised Eigenvector Centrality C'_E		Normalised Betweenness Centrality C'_B	
	Count	Score	*R.*	Score	*R.*	Score	*R.*	Score	*R.*
USA	119	0.589	*1*	0.564	*1*	0.321	*2*	0.206	*1*
SWE	115	0.569	*2*	0.555	*2*	0.343	*1*	0.109	*2*
NLD	101	0.500	*3*	0.534	*3*	0.320	*3*	0.078	*4*
ITA	93	0.460	*4*	0.523	*4*	0.320	*4*	0.054	*5*
GBR	81	0.401	*5*	0.508	*5*	0.286	*6*	0.040	*7*
FRA	78	0.386	*6*	0.505	*6*	0.298	*5*	0.027	*9*
ZAF	75	0.371	*7*	0.494	*8*	0.217	*9*	0.099	*3*
NOR	73	0.361	*8*	0.496	*7*	0.258	*8*	0.036	*8*
ESP	67	0.332	*9*	0.482	*9*	0.264	*7*	0.017	*11*
RUS	60	0.297	*10*	0.469	*10*	0.182	*17*	0.043	*6*
CAN	48	0.238	*11*	0.458	*15*	0.197	*14*	0.010	*14*
IRL	48	0.238	*12*	0.464	*11*	0.206	*11*	0.008	*16*
DNK	43	0.213	*13*	0.463	*12*	0.212	*10*	0.004	*23*
GRC	43	0.213	*14*	0.461	*13*	0.202	*13*	0.006	*19*
NZL	43	0.213	*15*	0.450	*20*	0.178	*19*	0.024	*10*
CHE	40	0.198	*16*	0.460	*14*	0.204	*12*	0.004	*24*
THA	39	0.193	*17*	0.448	*23*	0.156	*22*	0.009	*15*
AUS	38	0.188	*18*	0.457	*16*	0.176	*20*	0.008	*17*
BEL	36	0.178	*19*	0.455	*18*	0.185	*16*	0.004	*22*
DEU	36	0.178	*20*	0.456	*17*	0.181	*18*	0.003	*25*
AUT	35	0.173	*21*	0.455	*18*	0.186	*15*	0.003	*27*
PRT	34	0.168	*22*	0.450	*20*	0.150	*26*	0.007	*18*
MEX	33	0.163	*23*	0.431	*37*	0.132	*33*	0.005	*20*
PHL	33	0.163	*24*	0.442	*27*	0.141	*30*	0.016	*12*
HUN	31	0.153	*25*	0.450	*20*	0.163	*21*	0.002	*31*
LUX	30	0.149	*26*	0.438	*30*	0.150	*27*	0.003	*26*
CHL	29	0.144	*27*	0.436	*31*	0.149	*29*	0.002	*34*
TUR	29	0.144	*28*	0.434	*34*	0.109	*37*	0.015	*13*
BRA	28	0.139	*29*	0.435	*33*	0.151	*24*	0.001	*36*
CZE	28	0.139	*30*	0.447	*24*	0.156	*23*	0.002	*35*
ASEAN-5									
THA	39	0.193	*17*	0.448	*23*	0.156	*22*	0.009	*16*
PHL	33	0.163	*24*	0.442	*27*	0.141	*30*	0.016	*12*
MYS	25	0.124	*35*	0.431	*43*	0.102	*47*	0.003	*32*
IDN	11	0.054	*89*	0.427	*47*	0.073	*73*	0.000	*111*
SGP	3	0.015	*157*	0.394	*125*	0.024	*139*	0.000	*156*

Note: The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B. Refer to Appendix M for the centrality scores of all countries/economies in the global diaspora network.



Note: Ranking is in descending order, smaller numbers indicate higher ranks.

Figure 4.7: Rankings of the Centrality Metrics for ASEAN-5

According to the literature, C_D or C_D' is always positively associated with C_C', C_E' and C_B' (Landherr, Friedl and Heidemann, 2010; Dekker, 2013, December). Table 4.12 shows that C_D' is positively correlated with other three centrality metrics for countries/economies in the global diaspora network *Sn2010 (d=0.075, E=3060)*. This implies that a relatively high C_D or C_D' of Thailand and Philippines also contributed to their high C_C' C_E' and C_B'.

Table 4.12: Correlations between Centrality Metrics for the Global Diaspora Network, 2010

	C_D'	C_C'	C_E'	C_B'
C_D'	1.0000			
C_C'	0.6147	1.0000		
C_E'	0.9530	0.6891	1.0000	
C_B'	0.7862	0.3544	0.6130	1.0000

Table 4.11 and Figure 4.7 show that the C_D of Malaysia, Indonesia and especially Singapore is relatively low. The normalisation process as explained

in Section 3.4.4.1 has removed the scale effects of HSD sizes from the global diaspora network *Sn2010 (d=0.075, E=3060)*. Thus, the total size of HSDs has no influence on C_D or C'_D. The relative low C_D or C'_D of Malaysia, Indonesia and Singapore can be explained based on the comparison of kurtosis values of M_{jk} for ASEAN-5 as discussed in Section 4.2.1. The kurtosis values of M_{jk} for Malaysia, Indonesia and Singapore were lower than Thailand and the Philippines. This shows that the spatial distribution of HSDs for Thailand and the Philippines has longer tails or is fatter than Malaysia, Indonesia and Singapore. In other words, the HSDs of Malaysia, Indonesia and Singapore were clustered in a smaller number of destinations. Conversely, the spatial distribution of the HSDs from Thailand and the Philippines was relatively more extensive, resulting in higher C_D or C'_D.

The dichotomisation process which produced *Sn2010 (d=0.075, E=3060)* has removed the weaker links, i.e. those below the cut-off point of 0.003 in order to reveal a stronger structure of the global diaspora network. Thus, the lower C_D or C'_D indicates that Malaysia, Indonesia and especially Singapore had smaller number of strong HSD links relative to Thailand and the Philippines.

The rankings of the centrality metrics of Thailand were in the range of 16-23, which were close to the advance economies located in the core of the global diaspora network. The centrality metrics of Thailand were also the highest among developing countries/economies in the world. Thailand ranked higher than the Philippines in all centrality metrics, except for C'_B. The high value of C'_D for Thailand and Philippines shows that these two countries had stronger and more extensive HSD links relative to other ASEAN-5 countries. This suggests that Thailand and the Philippines had greater capability in promoting the diaspora knowledge networks (DKNs) and transnational entrepreneurship.

The relatively high C'_C and C'_E should enable Thailand and the Philippines to engage their diaspora links as effective search networks, which could promptly locate knowledge and economic opportunities from heterogeneous sources in the global diaspora network. A higher C'_B value for the Philippines and Thailand also show that they had occupied better network positions than their ASEAN-5 counterparts in mediating or brokering flows of diaspora resources between countries. This positional advantage is especially crucial to develop the home country into an international business hub or technological cluster.

Both Table 4.11 and Figure 4.7 show that Malaysia had occupied a weaker network position than Thailand and the Philippines. This shows that the diaspora links of Malaysia had connected to less diversified sources of diaspora resources as compared to Thailand and the Philippines. Nonetheless, the moderate level of C'_B indicates that Malaysia has the capability to mobilise their HSDs to mediate knowledge and economic opportunities between countries. The network advantage can contribute to the development of Malaysia into a regional hub of business services, international trades and innovation activities (Performance Management and Delivery Unit, 2015, pp. 158-173; PricewaterhouseCoopers Malaysia, 2015; InvestKL, 2019).

The centrality metrics of Indonesia and Singapore ranked far behind Malaysia. This shows that their network position and connectivity in the global diaspora network were relatively weak. This might weaken the capability of Indonesia and Singapore to mobilise their HSDs to channel the overseas knowledge and economic opportunities to the home country. This is especially disadvantageous for Indonesia as the government has recently put forth the efforts to engage their HSDs in the economic development programmes under the MP3EI (Antara News, 2013; Al'ayubby, 2018; Salim and Negara, 2018). In the case of Singapore, the government has maintained its “open door” policy to attract more foreign talents, in order to complement the efforts of connecting to the world through HSDs (Saha, 2009; Rikvin, 2012; Siau, 2018)

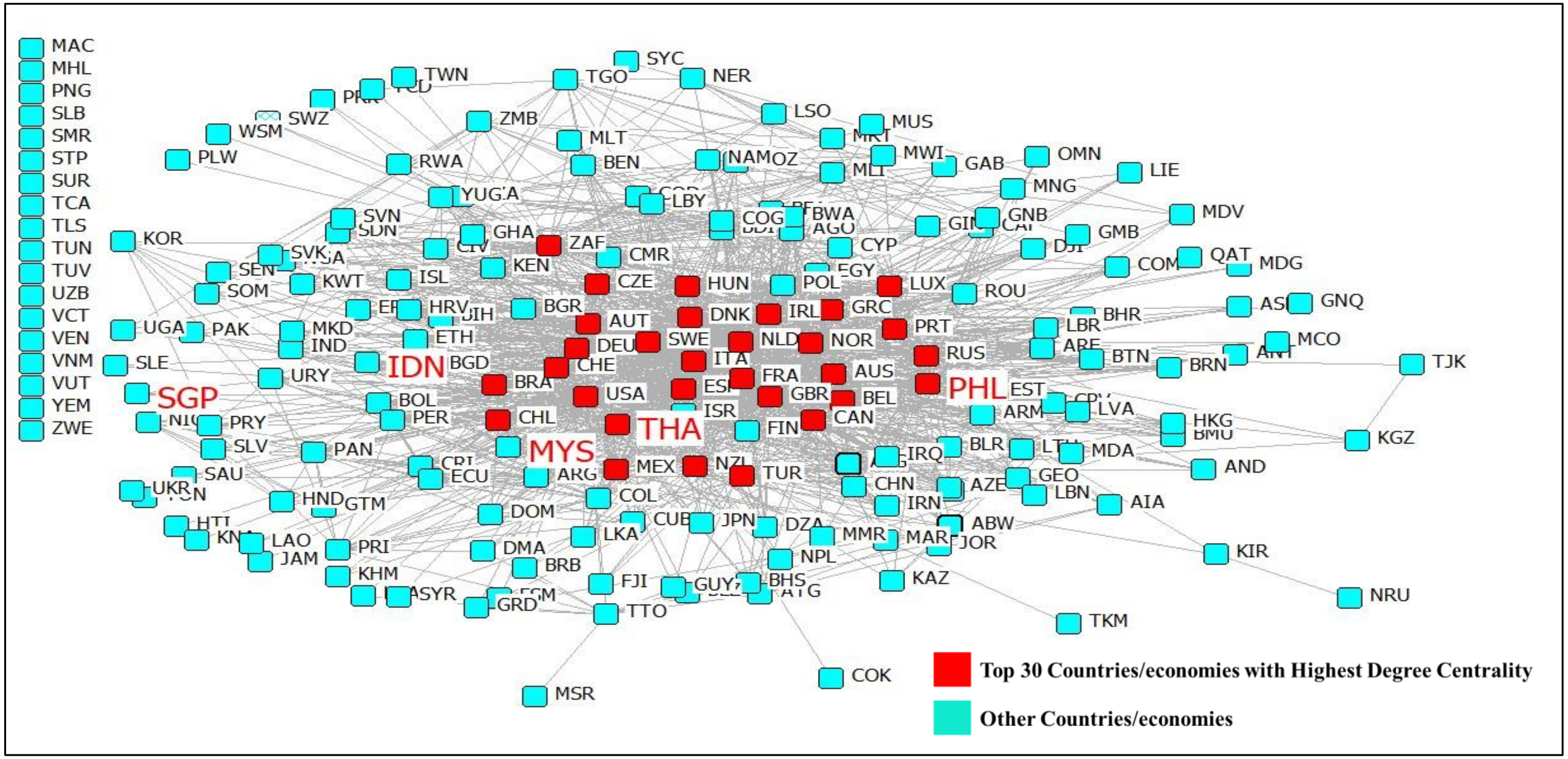
4.4.2 The Visualisation of the Positional Advantages of ASEAN-5 in the Global Diaspora Network

Figure 4.8 presents the network positions of the countries/economies based on *Sn2010 (d=0.075, E=3060)*. The visualisation was produced by the graph theoretic layout algorithm of UCINET (Prell, 2012, pp. 83-86; Borgatti, Everett and Johnson, 2018, pp. 119-121). The algorithm constructs the network according to the geodesic distance or shortest path length ℓ between nodes or countries/economies. As ℓ is the key factor for computing C_C' and C_B', the algorithm can visualise approximately the network positions and interconnectivity of the countries/economies in *Sn2010 (d=0.075, E=3060)*. The close proximity between countries/economies indicates that they are closely connected with each other through the HSD links.

The core region is densely interconnected by HSD links which facilitated intense knowledge and economic exchanges between countries/economies. The countries/economies situated at the core region are the most central countries in the global diaspora network. The United States, which scored the highest C_D', C_C', C_B' and second highest C_E' is located in the core region. Other advanced countries such as Sweden, Netherlands, Italy, United Kingdom, France, Norway, Spain, Germany, Australia, and emerging economies such as South Africa, which top the centrality metrics are also located in the core region. Conversely, the countries/economies which are located at the periphery of the global diaspora network are loosely or weakly connected to the countries/economies in the core region. The countries/economies which are disconnected or isolated from the global diaspora network are placed at the left corner of Figure 4.8.

Thailand and the Philippines are located at close proximity to the core region of the global diaspora network. The positions facilitated Thailand and the Philippines to engage the diaspora resources from the advanced economies in the core region. Malaysia occupies a middle position between the core and periphery regions. Indonesia, whose centrality metrics are lower than the above three ASEAN-5 countries, is located further away from the core and closer to the periphery region. The centrality metrics of Singapore are relatively low and it is placed at the periphery region of the global diaspora network.

Based on the visualised global diaspora network for 2010, the study investigates how the network positions of ASEAN-5 can facilitate their efforts in engaging the diaspora resources of their HSDs. The objective of the analysis is to deepen the understanding on how the connectivity and network proximity of ASEAN-5 could enhance their capability to harness diaspora resources from heterogamous sources of destinations. Figure 4.9 to 4.12 classified the countries/economies (or nodes) in the global diaspora network according to their population sizes, income or development levels, number of patent applications and international trade volumes (in USD), which correspond to the diaspora resource DR1, DR2, DR3 and DR4 respectively as exhibited in Table 4.10.



Source: Table 4.11 and Appendix M..

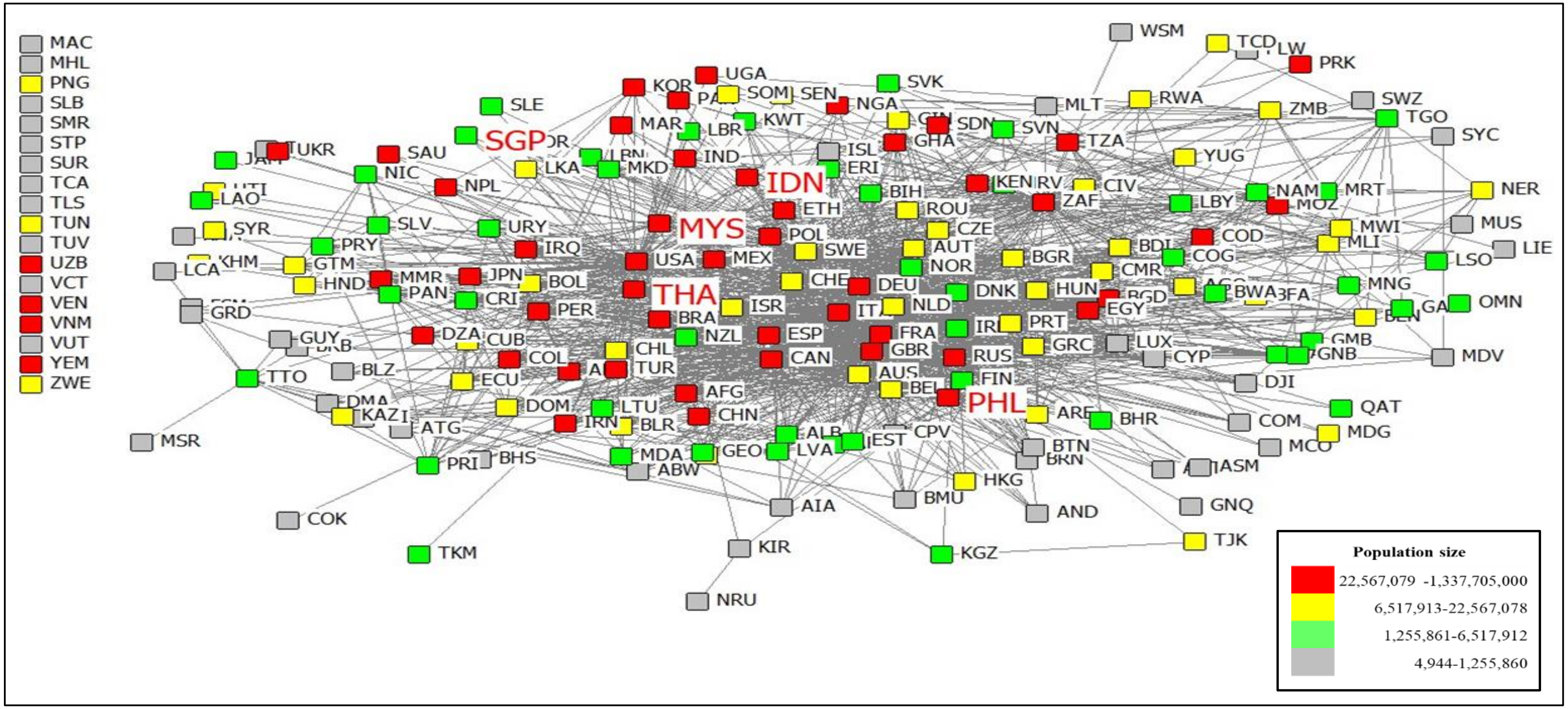
Note: The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B

Figure 4.8: The Global Diaspora Network in 2010

4.4.2.1 DR1: Market Sizes of Destinations (Population Sizes)

Table 4.10 shows that Thailand possesses the greatest potential among ASEAN-5 to mobilise DR1, which is the economic and market opportunities associated with populous destinations. The potential of DRI for Thailand is further enhanced by Thailand's positional advantage in the global diaspora network as shown in Figure 4.9. The countries/economies in Figure 4.9 are classified according to quartiles of population sizes. Thailand is closely linked by their HSDs to a number of populous countries such as United States, Mexico, Brazil, Peru, Japan, Iraq and Poland. Similarly, the capability of the Philippines to mobilise DR1 is also enhanced by HSD links to a number of countries with large or moderately large populations, including Russia, United Kingdom, France, Italy, Spain, Canada, Australia and United Arab Emirates.

In Figure 4.9, Malaysia is located in a region between the core and the periphery of the global diaspora network. It is linked with a smaller number of populous destinations than Thailand and the Philippines. However, Malaysia is closely connected to the United States and Mexico, which are the two most populous destinations in Northern America. Malaysia can leverage on its network positon to mediate the flows of DR1, i.e. economic opportunities from the populous United States and Mexico to other countries/economies in the periphery.



Source: World Bank Data

Note: The population sizes of countries/economies are categorised according to quartiles. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B

Figure 4.9: Population Sizes of the Countries/economies (DR1) in the Global Diaspora Network of 2010

Figure 4.9 shows that Indonesia is located further away from the core of the global diaspora network. This indicates that Indonesia has relatively weak ties with the populous developed countries/economies located in the core region. Indonesia is also weakly linked with populous developing countries, except India and Ethiopia. The analysis in PART I found that the spatial distribution of HSDs from Indonesia was positively influenced by population sizes in the destinations. However, the efforts of Indonesia to obtain DR1 from heterogeneous sources might be dampened by its low connectivity to populous developed countries.

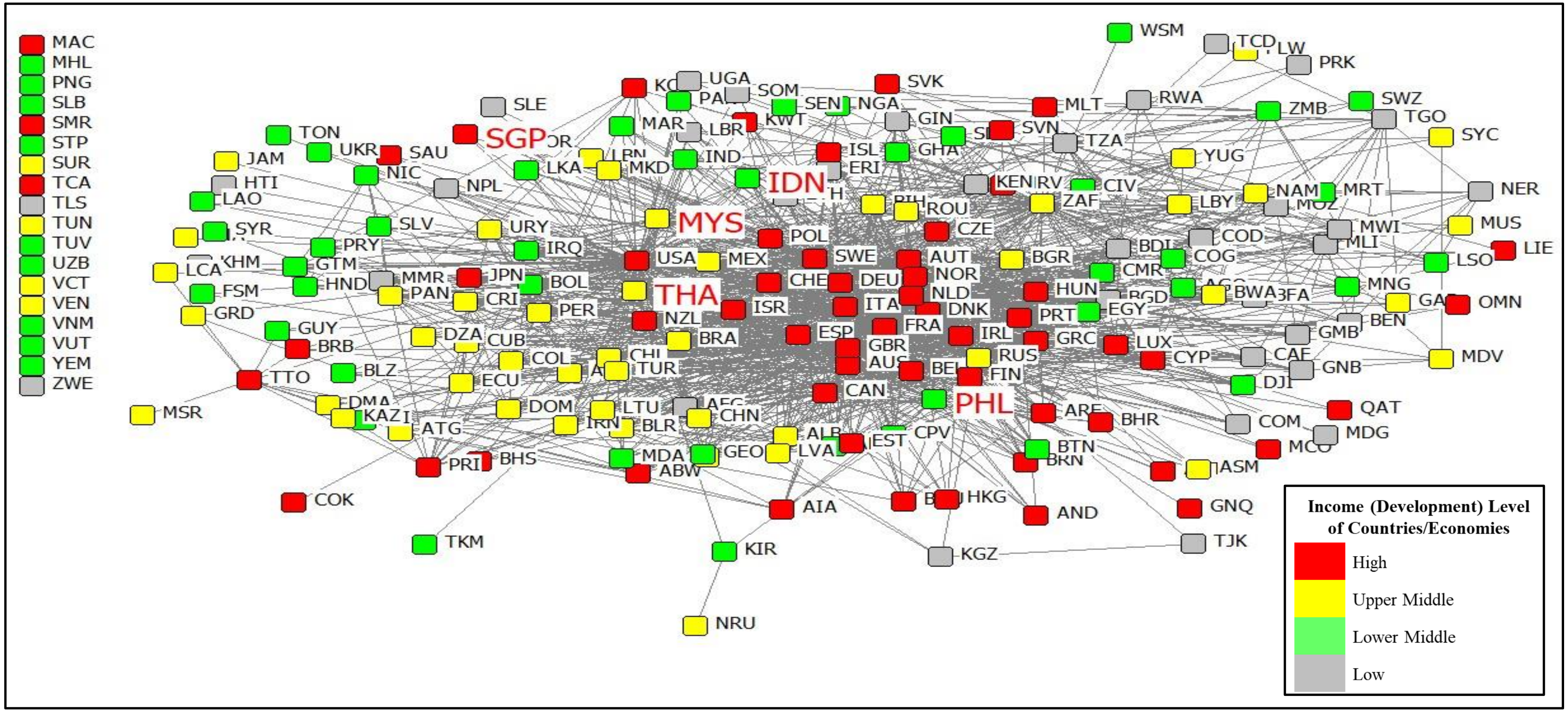
Table 4.10 indicates that the spatial distribution of Singaporean HSDs is not significantly influenced by populations in the destinations. Figure 4.9 further demonstrates that Singapore has low potential to mobilise DRI from heterogeneous source of destinations due to its periphery position.

4.4.2.2 DR2: Development Level of Destinations (Economic Opportunities from Developed Countries)

In Figure 4.10, the countries/economies in the global diaspora network are classified according to their development levels (World Bank, 2018). As found in PART I analysis and Table 4.10, the spatial distribution of HSDs from Indonesia is highly responsive to the development level of the destinations. However, Figure 4.10 shows that Indonesia is located far from the core of the global diaspora network. This implies that that Indonesia has very few strong HSD links with the developed and emerging economies situated in the core region. The network position of Indonesia limits its potential to capture DR2 from developed countries/economies.

On the contrary, Thailand is close to the core which is composed of developed economies. The Philippines and Malaysia are also closely linked to a number of high and upper middle income countries. This shows that the potential of Thailand, Philippines and Malaysia to capture DR2 is enhanced by their strong HSD links to a larger number of developed economies.

Although Singapore is a high income country itself, its network position and connectivity to the developed core is the weakest among ASEAN-5. The small number of strong HSD links to developed economies might restrict the capability of Singapore to tap DR2.



Source: World Bank Data

Note: The classification of income (development level) is according to World Bank. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B

Figure 4.10: Income (Development Level) (DR2) of Countries/Economies the Global Diaspora Network of 2010.

4.4.2.3 DR3: Innovation Activities in Destinations

One of the important findings in PART I is the crowding effect of highly innovative destinations on the spatial distribution of HSDs from ASEAN-5. The phenomenon implies that HSDs from ASEAN-5, *ceteris paribus* tend to avoid destinations which have high level of innovation activities. It is because such destinations are also attractive to highly skilled immigrants from other countries. This will trigger intense competition between HSDs from different countries for employment and career opportunities, especially in the technology and innovation related fields.

Nonetheless, it is also found that HSDs from Thailand and the Philippines were less affected by the crowding effects of highly innovative destinations. There are also literature which point to the significant presence of scientific and technological diaspora community originated from Thailand and the Philippines in the highly innovative destinations (Agunias and Newland, 2012, pp. 171-172; Migration Policy Institute [MPI], 2014; ILO, 2015; Raksaphaeng, 2016; Caunan, 2017)

Figure 4.11 classifies the countries/economies in the global diaspora network according to their innovation activities, which are represented by the 20^{th}, 40^{th}, 60^{th} and 80^{th} percentile. The network position of Thailand is close to developed destinations which are also highly innovative, such as United States, Israel, Sweden, Switzerland and Germany. Thailand is also close to emerging or developed economies which have moderate level of innovation activities, such as New Zealand, Mexico, Poland, Brazil and Malaysia. Similarly, the Philippines is linked to advanced destinations which have high level of innovation activities such as Finland, Russia, Belgium, Australia, Canada, France and United Kingdom.

Figure 4.11 indicates another positional advantage for both Thailand and the Philippines. Thailand and the Philippines are respectively situated at a middle network region, which is in between the highly innovative countries/economies as stated above and another group of less innovative countries/economies. In the case of the Philippines, such less innovative countries/region include United Arab Emirates, Bhutan, Brunei, Andorra, Estonia, Latvia, Albania, Cape Verde, Bahrain and American Samoa. In the case of Thailand, the less innovative countries within its network proximity are Iraq, Bolivia, Peru, Uruguay, Chile and Argentine.

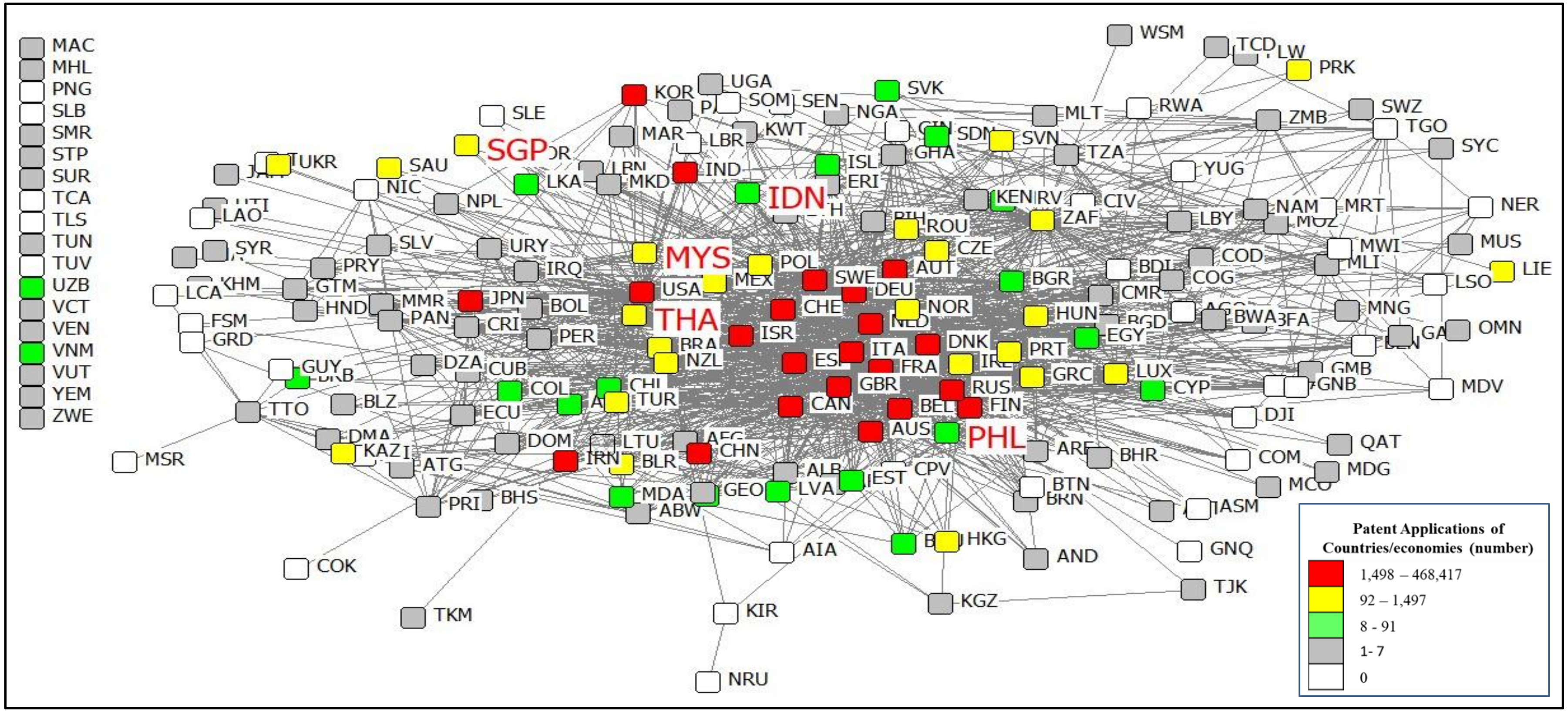
The middle network position implies that Thailand and the Philippines could leverage on their HSDs to form collaborative networks between countries/economies of different innovation levels. The potential mediator role of Thailand and the Philippines also confirm the findings of Table 4.11, i.e. higher betweenness centrality of the two countries relative to other ASEAN-5 countries.

Malaysia is strongly linked by their HSDs to United States, which is a highly developed and innovative economy. Although Malaysia has more HSD links to the innovative core than Indonesia and Singapore, it is less than

Thailand and the Philippines. This indicates that, based on the connectivity in the global diaspora network, Malaysia is less capable than Thailand and the Philippines to connect to innovation activities of the developed countries/economies.

Indonesia is situated at the network region which is far from the innovative core. It is at the proximity to the highly innovative India and the moderately innovative Malaysia and Poland. However, other countries within the network proximity of Indonesia are either less or least innovative. Such network position weakens the capability of Indonesia to capture DR3. The periphery position of Singapore also shows that it has very few strong links to the developed and innovative countries/economies in the core via its diaspora networks.

Through the SNA analysis, it is understood that Thailand and the Philippines, and to a lesser degree, Malaysia have high potential to mobilise their HSDs to connect with the highly innovative countries/economies. The phenomenon of crowding effects (Yan and Zhou, 2018) cause difficulties in interpreting the negative estimators of *LnINNOVr1* in PART I. The SNA method has partly solved the problem by showing how ASEAN-5 countries could utilise their HSD links to connect with the innovative destinations, most of which are also developed countries/economies. Based on the above insight, the future micro-level studies should identify those HSDs who reside in the developed destination and are able to contribute to the innovation activities of their home country.



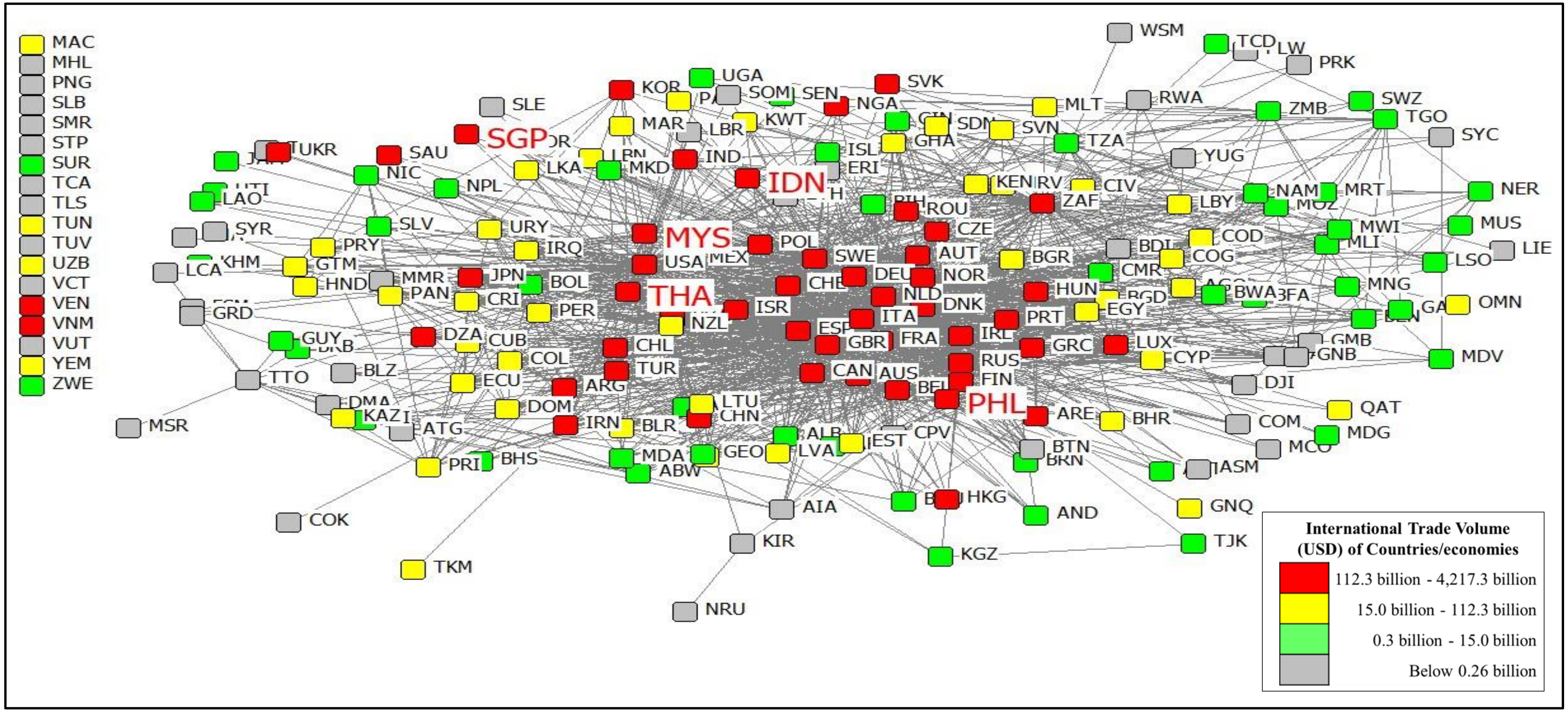
Source: World Intellectual Property Organisation (WIPO)
Note: The numbers of patent applications are categorised according to 20th, 40th, 60th and 80th percentile. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

Figure 4.11: Patent Applications (number) (DR3) of Countries/economies in the Global Diaspora Network of 2010

4.4.2.4 DR4: International Trade Volumes of the Destinations

Figure 4.12 classified the countries/economies in the global diaspora network according to quartiles of their international trade volumes in US dollars.

PART I analysis and Table 4.10 show that the spatial distribution of HSDs from Thailand were not driven by the bilateral trades with destinations. However, Figure 4.12 highlights that Thailand is closely linked to a number of developed destinations which are coincidentally the large trading economies, including United States, Brazil, Mexico, Israel, Poland, Switzerland, Sweden, Spain, Germany and Italy. This finding is very insightful as it shows that Thailand possesses the network advantage to gain access to DR4 via the global diaspora network. It is recommended that Thailand should take appropriate diaspora engagement measures to motivate their HSDs to contribute to the international trade of their home country. For example, identifying and reaching out to those HSDs who are potential and willing to channel DR4 to Thailand.



Source: World Bank Data

Note: The international trade volumes are categorised according to quartiles**.** The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

Figure 4.12: International Trade Volumes (DR4) of Countries/Economies in the Global Diaspora Network of 2010.

Similarly, the Philippines has occupied a network position connecting to large trading economies such as Russia, Canada, Belgium, Australia, Ireland, United Kingdom, France, Spain, United Arab Emirates and Hong Kong. PART I analysis suggests that the spatial distribution of HSDs from the Philippines were driven by the bilateral trades of their home countries. The promising network connectivity further enhances the capability of the Philippines to capture international trade opportunities from heterogeneous destinations.

Malaysia has also occupied a relatively advantageous network position for DR4. It is closely linked with some large trading countries/economies, which include the United States, Mexico, Poland, Brazil, India, Indonesia and Thailand. According to the analysis in PART I and Table 4.10, the spatial distribution of HSDs from Malaysia is strongly driven by the bilateral trades between destinations and their home country. The network position could facilitate Malaysia’s efforts in engaging HSDs to promote bilateral trades with the destinations.

Table 4.10 indicates that the migratory movements of HSDs from Indonesia were positively influenced by the bilateral trade relations of their home country. However, Figure 4.12 shows that Indonesia is located farther away from the core relative to Thailand, the Philippines and Malaysia. This implies that Indonesia has a smaller number of strong HSD links with the advanced and large trading economies. The network position shows lower capability of Indonesia to channel DR4 from heterogeneous sources of advanced and large trading countries/economies.

The periphery location of Singapore shows that it has very few strong HSD links with the developed and large trading economies in the core of the global diaspora network. The previous studies call for Singapore to engage their HSDs as global links to the international trade opportunities (Yap, 1994; Saha, 2009; National Population and Talent Division, 2013, p. 25; Ho and Boyle, 2015). However, Singapore’s capability to gain access to DR4 is weakened due to lack of strong HSD links to large trading countries/economies.

4.4.2.5 Summary of the Centrality Analysis Based on the Visualised Global Diaspora Network in 2010

Table 4.13 summarises the outcomes of the analysis based on Figure 4.9 to 4.12. The analysis contributes to the understanding of whether the network position of ASEAN-5 in the global diaspora network could enhance or undermine the efforts in tapping various diaspora resources for their economic development.

The analysis shows that the network position of Thailand could facilitate the mobilisation of various diaspora resources. The positional advantage of Thailand is indicated by its proximity to advanced economies in the core region of the global diaspora network. This was especially crucial to search and channel economic opportunities from the populous and advanced destinations to Thailand.

The Philippines and Malaysia are also closely connected to the developed and innovative core of the global diaspora network. The network connectivity could facilitate the diaspora engagement efforts of the Philippines and Malaysia, particularly in terms of mobilising their HSDs to penetrate developed markets and to search for innovative solutions from heterogeneous sources of destinations.

Indonesia and Singapore have occupied a periphery position in the global diaspora network. This implies that Indonesia and Singapore have weaker connectivity to the developed core than Thailand, the Philippines and Malaysia. This might undermine the capabilities of Indonesia and Singapore to channel diaspora resources, such as business know-how, technological networks and international trade opportunities from a more heterogeneous source of destinations.

Table 4.13: Comparison of Connectivity of ASEAN-5 in the Global Diaspora Network (Based on Normalised Centrality Metrics)

Diaspora Resources		Corresponding Determinants	**Indonesia**	**Malaysia**	**Philippines**	**Singapore**	**Thailand**
			Network Connectivity	Network Connectivity	Network Connectivity	Network Connectivity	Network Connectivity
DR1:	Population size of Destinations	LnP_jP_k	Weak	Moderate	Strong	Weak	Strong
DR2:	Developed economies	*LnGDPPCr*	Weak	Moderate	Strong	Weak	Strong
DR3:	Innovation activities	*LnINNOVr1*	Weak	Moderate	Strong	Weak	Strong
DR4:	Bilateral Trades	*LnTRADE1*	Weak	Moderate	Strong	Weak	Strong

4.4.3 Brokerage Analysis

This section discusses the results of the brokerage analysis based on the ego-network of individual ASEAN-5 country. An ego-network is formed by: 1) a focal ASEAN-5 country, i.e. the *ego* which sends HSDs overseas; 2) the destinations countries/economies, i.e. *alters* which receive HSDs from the *ego* and thus directly linked to the *ego* 3) the HSD links among the destination countries/economies or *alters*.

The objective of the brokerage analysis is to investigate how ASEAN-5 countries can leverage on their HSDs to mediate the flows or exchanges of the four types of diaspora resources, i.e. DR1, DR2, DR3 and DR4 between destination countries/economies.

To carry out brokerage analysis, the countries/economies in an ego-network, including the *ego*, which is a given ASEAN-5 home country; and the *alters*, which are the destinations of the HSDs originated from ASEAN-5 country, are classified according to groupings or affiliations with respect to the four types of diaspora resource as shown in Table 4.14. For example, in the ego-network of which Malaysia is the focal node or *ego*, the *ego* and *alters* can be classified according to the groupings of DR1, DR2, DR3 and DR4 respectively.

Table 4.14: Groupings of Countries/Economies in the Ego-Networks of ASEAN-5 According to Diaspora Resources

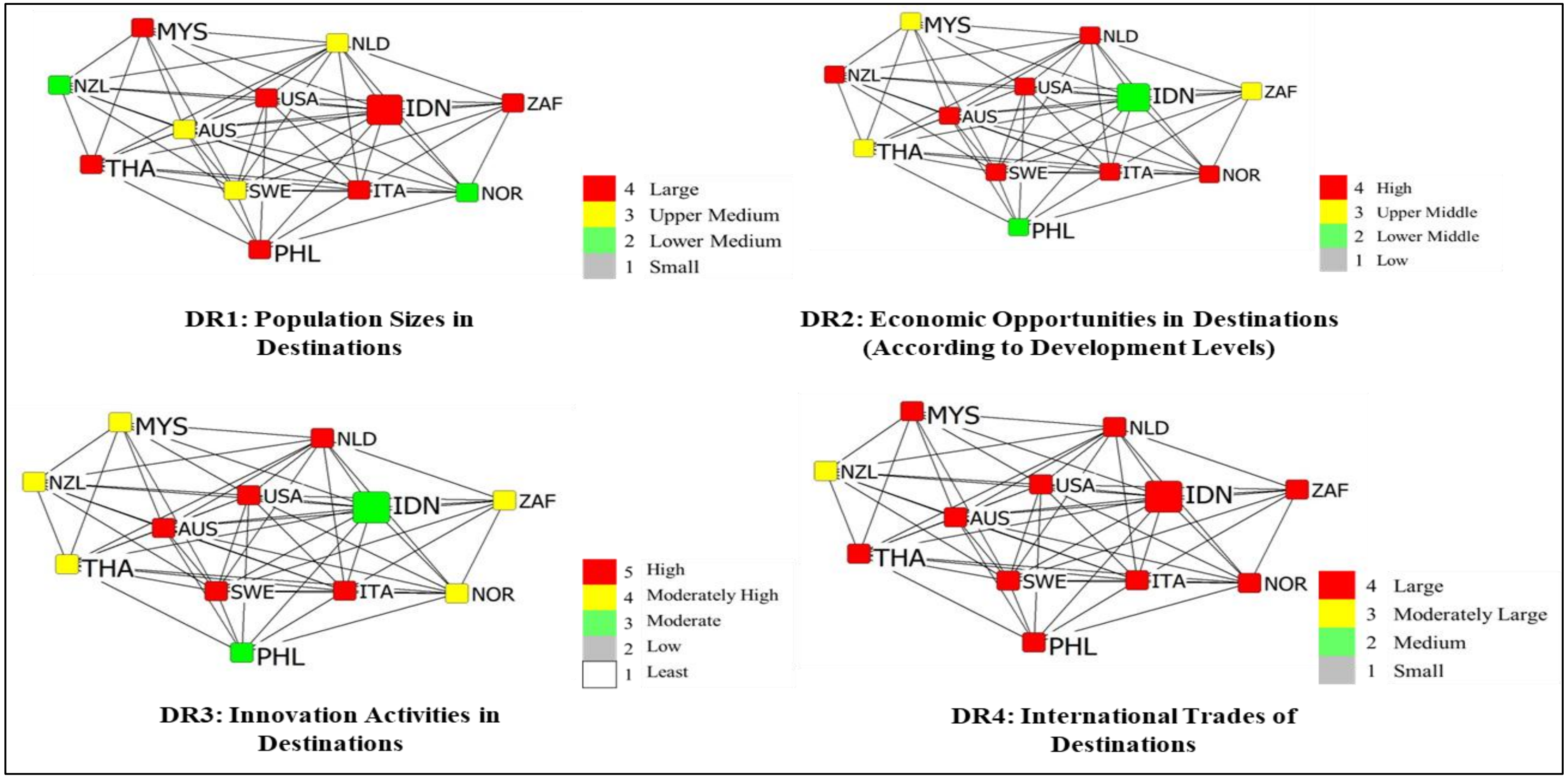
Diaspora Resource		Groupings	Ranges *(Refer to note for definition)*
DR1	Population size of destinations [i]	Large	22,567,079 and above
		Upper Medium	6,517,913-22,567,078
		Lower Medium	1,255,861-6,517,912
		Small	Smaller than 1,255,860
DR2	Development level of destinations [ii]	High Income	According to the classification of the World Bank (2018)
		Upper Middle	
		Lower Middle	
		Low Income	
DR3	Innovation level of destinations (indicated by the number of patent applications) [iii]	High	above 10000
		Moderately High	1001-10000
		Moderate	201-1000
		Low	1-200
		Least	0
DR4	International trade volumes of destinations [iv]	Large	above USD 112.3 Billion
		Moderately Large	USD 15.0 - 112.3 Billion
		Medium	USD 2.7 - 15.0 Billion
		Small	Below USD 2.7 Billion

Source: World Bank (2018a, 2018b, 2018c); WIPO (2017a)
Note:
[i] Classification according to quartiles.
[ii] Classification according to the World Bank (2018a)
[iii] Classification by the researcher
[iv] Classification according to quartiles

4.4.3.1 The Ego-networks of ASEAN-5

The UCINET produces the ego-network of a focal node from the complete network by using the "extract" algorithm or the filtering procedure of visualisation tool NetDraw (Hanneman and Riddle, 2005; Borgatti, Everett and Johnson, 2013, pp. 108-109). In this study, the ego-network of each ASEAN-5 country was extracted by the UCINET from the global diaspora network represented by *Sn2010 (d=0.075, E=3060).* For a given ASEAN-5 country, the ego-network is composed of itself (*ego*), the destination countries/economies (*alters*) directly linked to the ASEAN-5 country, and the interconnectivity between the destination countries/economies.

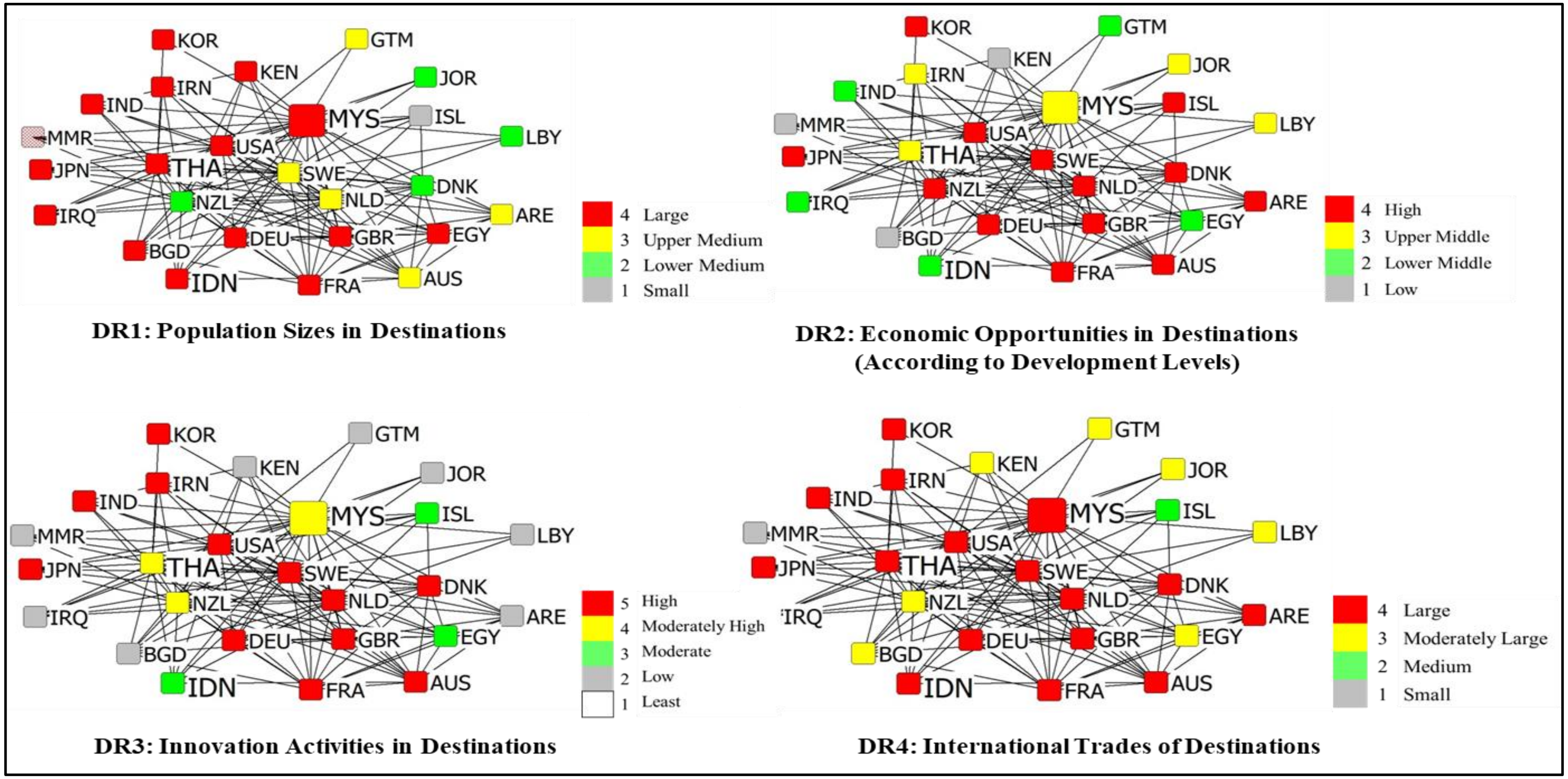
Figure 4.13 to 4.17 exhibit the ego-networks of Indonesia, Malaysia, Philippines, Singapore and Thailand respectively. For an individual AEAN-5 country, the nodes or countries/economies in its ego-network are classified into groupings with respect to various types of diaspora resources as indicated in Table 4.14. The groupings for each ego-network are differentiated by colour labels. The total number of *alters* directly linked to a focal ASEAN-5 country is shown as the network size at the bottom of Figure 4.13 to 4.17. Thailand and the Philippines have the greatest network size as shown by the largest number of *alters* relative to other ASEAN-5 countries. This implies that Thailand and the Philippines are strongly linked to more *alters* or destinations relative to other ASEAN-5 countries. Malaysia possesses the third largest ego-network. Indonesia and Singapore are having the smallest ego-networks.



Source: Table 4.14.

Note: Extracted from the *Sn2010 (d= 0.075, E= 3060)*, Network size= 11, Density= 0.818. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

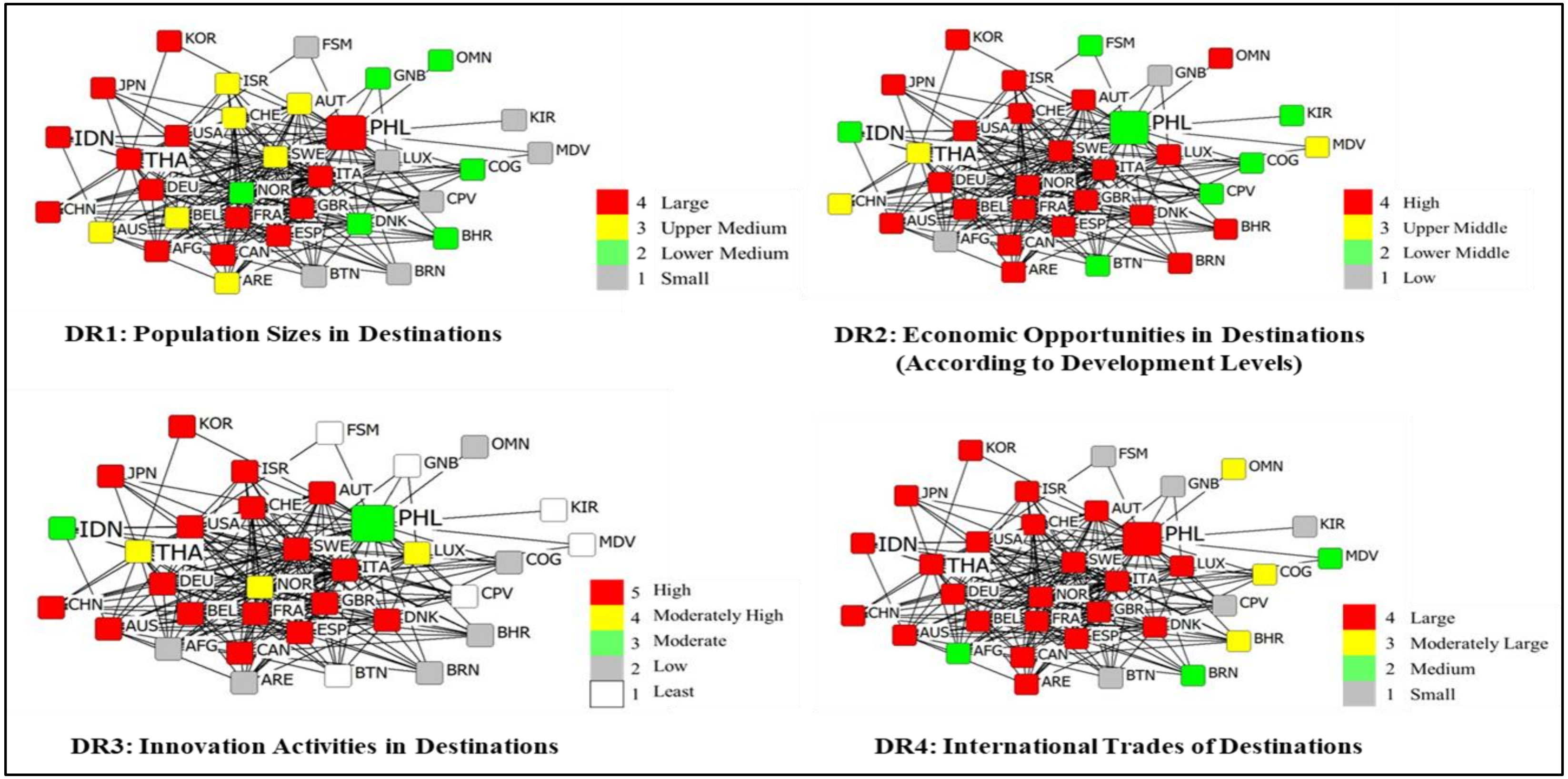
Figure 4.13: Ego-networks of Indonesia According to Groupings of Diaspora Resources



Source: Table 4.14

Note: Extracted from the *Sn2010 (d= 0.075, E= 3060)*, Network size= 25, Density= 0.373. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

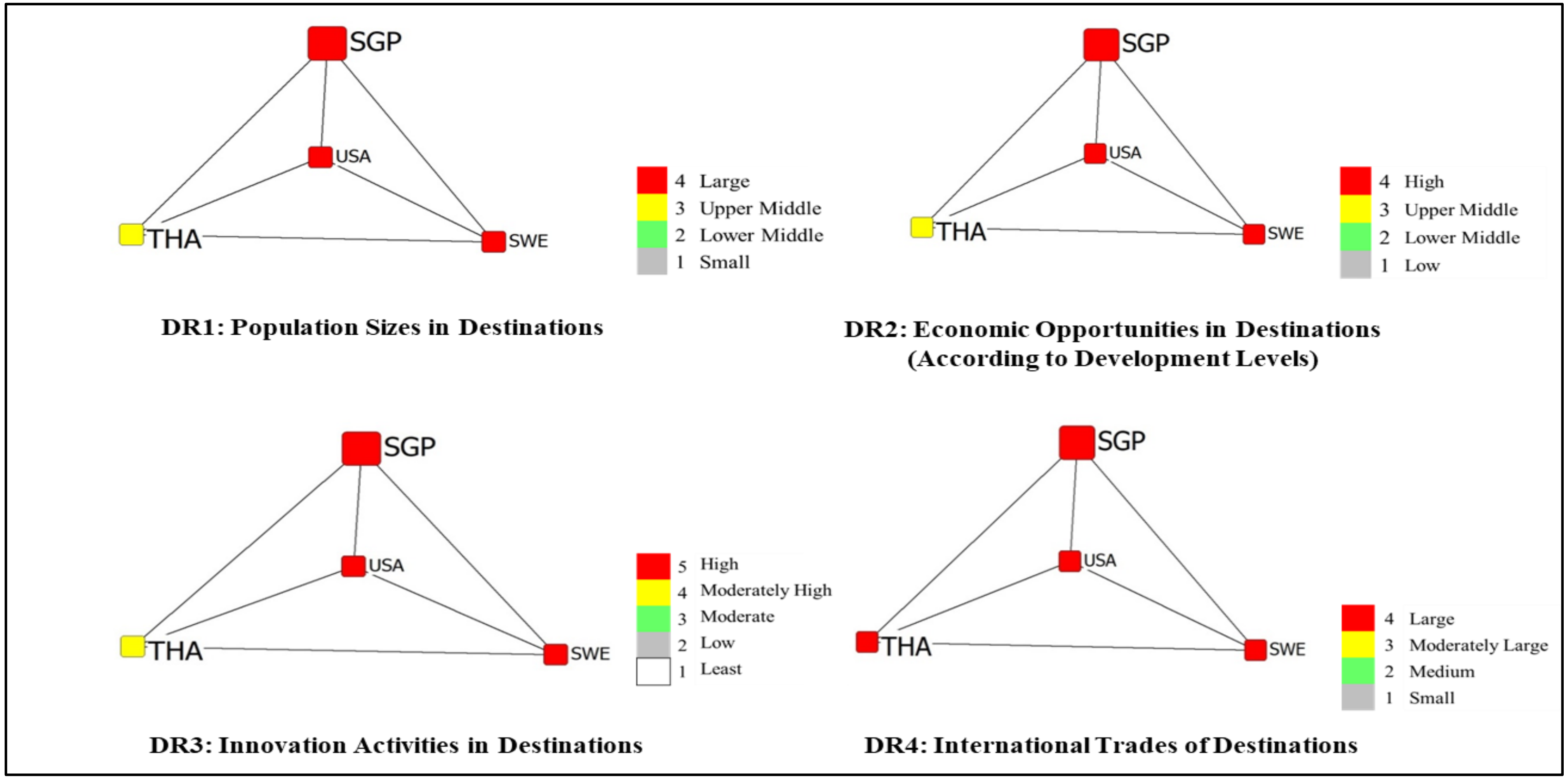
Figure 4.14: Ego-networks of Malaysia According to Groupings of Diaspora Resources



Source: Table 4.14

Note: Extracted from the *Sn2010 (d= 0.075, E= 3060)*, Network size= 33, Density= 0.371. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

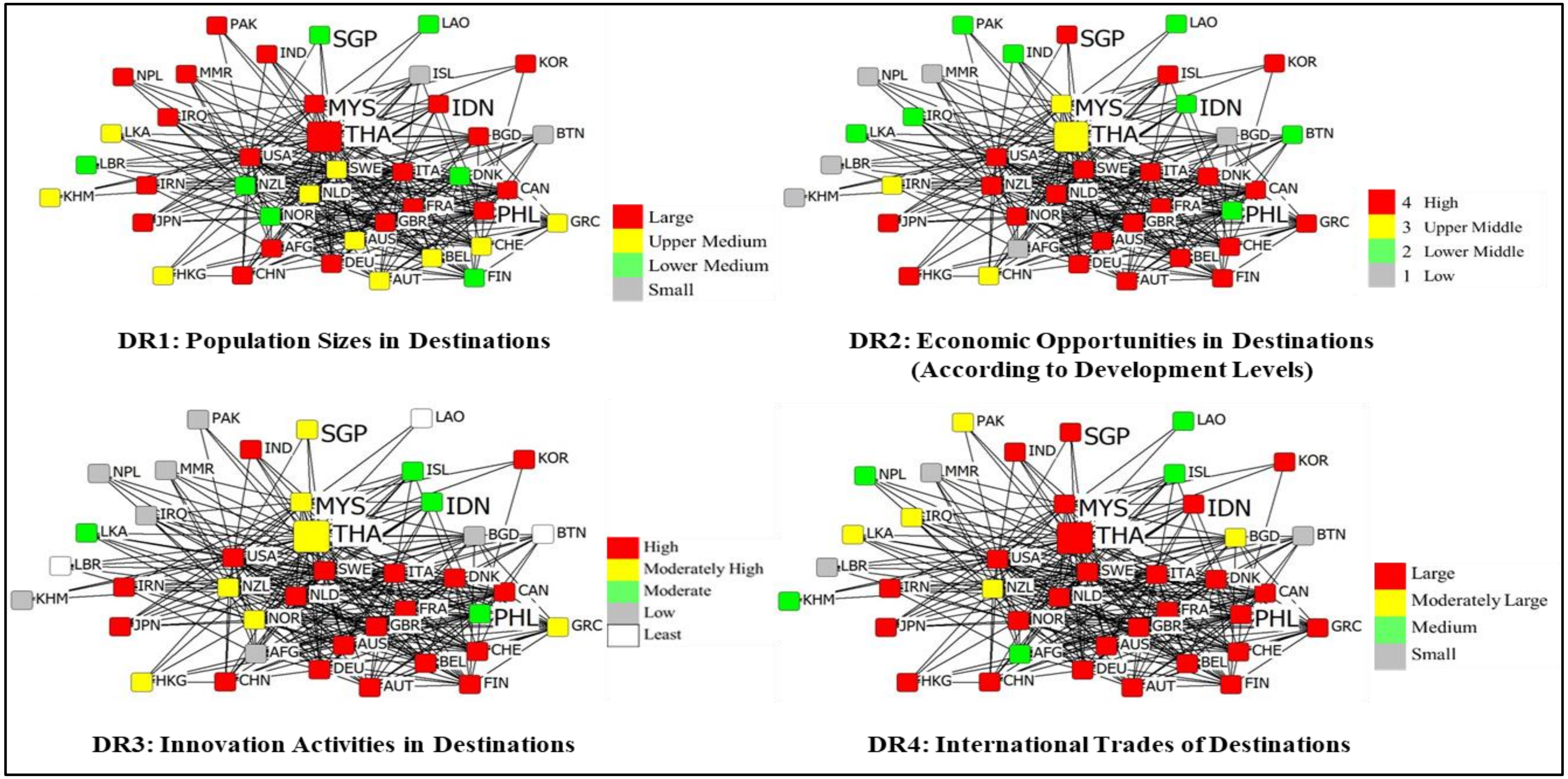
Figure 4.15: Ego-networks of the Philippines According to Groupings of Diaspora Resources



Source: Table 4.14

Note: Extracted from the *Sn2010 (d=0.075, E=3060)*, Network size=3, Density=1.000. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

Figure 4.16: Ego-networks of Singapore According to Groupings of Diaspora Resources



Source: Table 4.14

Note: Extracted from the *Sn2010 (d= 0.075, E= 3060)*, Network size= 39, Density= 0.354. The countries/economies are labelled according to the International Standards Organisation (ISO) 3-digit alphabetic codes as shown in Appendix B.

Figure 4.17: Ego-networks of Thailand According to Groupings of Diaspora Resources

Figure 4.17 and Figure 4.15 show that Thailand and the Philippines are linked to more heterogeneous sources of diaspora resources. For example, Thailand is connected to destinations which are advanced or emerging economies such as the United States, Sweden, United Kingdom, France, Italy, Finland, Denmark, Austria, Germany, Switzerland, Netherlands, Australia, Japan, China, India, Canada, Korea and Hong Kong. The HSDs of Thailand could be mobilised to establish the diaspora knowledge networks (DKNs) to transfer knowledge, technical know-how and innovations between the destinations and their home country (Raksaphaeng, 2016).

Thailand possesses great potentials to mobilise DR1, DR2 and DR4 through the ego-network. Thus, the HSDs of Thailand can be engaged as transnational entrepreneurs to penetrate populous markets or to promote the bilateral trades between advanced economies and their home country. Notably, Thailand is also closely connected to a group of neighbouring countries in the ASEAN region, namely Cambodia, Indonesia, Laos, Malaysia, Myanmar, Indonesia, Philippines and Singapore. The network advantage enables Thailand to play a crucial role in promoting the intra-regional human capital mobility of ASEAN Economic Community (AEC) (Sugiyarto and Agunias, 2014; Susantono, 2015; Corong and Aguiar, 2019).

The PART 1 analysis shows that the overseas diaspora of Thailand had maintained strong linkages and interactions with their home country. This social capital could be utilised to further strengthen the capability of Thailand in mobilising their HSDs.

Similarly, the relatively large and heterogeneous ego-network has rendered great advantages to the Philippines in mobilising DR1 and DR2, which facilitate the access to large overseas markets and economic opportunities in the advanced destinations.

The Philippines and Thailand are strongly connected to more or less a similar set of advanced and emerging economies. This means that the Philippines could benefit from the heterogeneous sources of diaspora resources as Thailand, particularly DR3, i.e. the innovation activities and networks in advanced economies.

Figure 4.14 shows that Malaysia is connected closely to a smaller pool of destinations relative to Thailand and the Philippines, but larger than Indonesia and Singapore. It is linked to a smaller number of advanced economies including the United States, United Kingdom, France, Sweden, Netherlands, Australia, Germany, Denmark and Japan. Malaysia is also strongly connected to a few ASEAN countries which included Indonesia, Myanmar, Singapore and Thailand. This indicates that Malaysia, similar to Thailand, could play an active role in promoting the intra-regional human capital mobility in the AEC.

The PART 1 analysis shows that Malaysia could benefit from DR4, i.e. to mobilise its HSDs to promote bilateral trades with the destinations. However, the ego-network of Malaysia is smaller than Thailand and the

Philippines. Thus, Malaysia may be less capable than Thailand and the Philippines to tap DR4 from heterogeneous sources of destinations.

Indonesia has a much smaller ego-network than Thailand, the Philippines and Malaysia. Figure 4.13 exhibits that Indonesia is linked to a small number of advanced economies, namely United States, Sweden, Australia, Netherlands, Italy and two ASEAN countries, which are Malaysia and Thailand. PART I analysis found that Indonesia could benefit from DR2. However, the relatively small ego-network of Indonesia shows that it may have less potential than Thailand, the Philippines and Malaysia to harness diaspora resources from a bigger and more heterogeneous pool of destinations.

However, Indonesia could leverage on its HSDs to intensify the bilateral trades with a few advanced economies such as United States, Australia, Sweden, Netherlands and Italy, and emerging economies including Malaysia, Thailand and South Africa. The strong diaspora link of Indonesia to South Africa is a notable asset which is not available to other ASEAN-5 countries. The Indonesian HSDs in South Africa can become the entry point for ASEAN-5 to expand the international trades with African continent.

Figure 4.16 displays that Singapore has the smallest ego-network among ASEAN-5. Singapore has strong HSD links with only three destinations, which are the United States, Sweden and Thailand. The small size of the ego-network may undermine the efforts of Singapore to mobilise its HSDs as global links for the home economy (National Population and Talent

Division, 2013, p. 25; Ho and Boyle, 2015). PART I shows that the diasporas of Singapore had maintained strong connections and interactions with the highly skilled persons in their home country. Singapore might leverage on this advantage to intensify the flows of diaspora resources, particularly new knowledge, innovations and economic opportunities from the United States, Sweden and Thailand (Ho and Boyle, 2015).

The network density indicated at the bottom of Figure 4.13 to 4.17 demonstrates another important feature of the ego-networks. The ego-networks of Thailand and the Philippines, despite having the large network size, are structured with the lowest density. This shows that within the ego-networks of Thailand and the Philippines, there are considerable numbers of *alters* or destinations which are not linked to each other. The absence of links between *alters,* which is called the empty spaces or structural holes in the SNA terminology (Prell, 2012, pp. 122-123; Sommer and Gamper, 2018), indicates the opportunities for Thailand and Philippines to play brokerage roles between *alters* or destinations.

The density for the ego-network of Malaysia is just slightly higher than the Philippines. This indicates that Malaysia also possesses considerable opportunities to play brokerage roles among *alters* or the destinations in its ego-networks. On the contrary, the high density of the ego-network of Indonesia indicates that most destinations of its HSDs (*alters*) were linked to each other. This implies that Indonesia has limited capacity to meditate the transmission of diaspora resources, such as international trade opportunities or innovative ideas among destinations, as most of the destinations can carry out the transmission through their direct links to each other. The density of the ego-network of Singapore is 1.0, indicating that the three *alters*, i.e. the United States, Sweden and Thailand are closely interconnected to each other. This implies that Singapore, like Indonesia, can benefit little from the brokerage roles as the three destinations are able to transmit diaspora resources directly among themselves.

4.4.3.2 The Brokerage Roles Played by ASEAN-5

Figure 4.18 (a) to 4.18 (d) exhibit the counts of the brokerage roles played by ASEAN-5 in their ego-networks for diaspora resources DR1, DR2, DR3 and DR4 respectively. The counts were generated by the "Gould and Fernandez (G&F) Brokerage Roles" algorithm of UCINET. The algorithm counts the times of a focal ASEAN-5 country positioned between two destinations (*alters*) which are not directly linked to each other (Gould and Fernandez, 1989; Prell, 2012, pp. 125-126). The results further corroborate the findings from the previous sections that Thailand and the Philippines possess the largest positional advantages than other ASEAN-5 countries in the global diaspora network.

The brokerage analysis enables better understanding on how ASEAN-5 (*ego*) can play various brokerage roles among destinations (*alters*) for the different types of diaspora resources. There are four types of brokerage roles to be played by an ASEAN-5 country through its HSD links:

1) Coordinator: Mediation between two destinations which are in the same group with the ASEAN-5 country;

2) Consultant: the ASEAN-5 country mediates between destinations from the same group but itself does not belong to the group;

3) Gatekeeper: the ASEAN-5 country regulates the flows of diaspora resources between its group and another group;

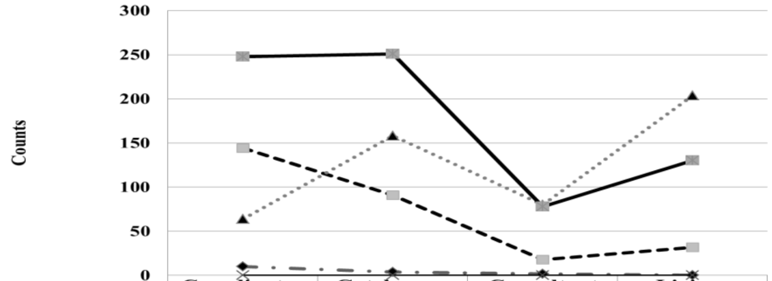
4) Liaison: Mediation between two groups where the ASEAN-5 country does not belong to either group.

The analysis provides insights into how the economic development of ASEAN-5 can benefit from the two networking roles of HSDs, i.e. diaspora knowledge networks (DKNs) and transnational entrepreneurship.

Thailand plays either the most or second most active brokerage roles for all type of diaspora resources. For example, Thailand is the most active coordinator for DR1, DR3 and DR4. This shows that Thailand is capable to mediate actively the business opportunities in populous destinations, innovation activities in highly innovative destinations and international trades between destinations which belong to its own grouping. Thailand also acts as the most active gatekeeper for all types of diaspora resources. This suggests that Thailand could leverage on their HSDs to mediate the diaspora resources exchanged between its same grouping and other groupings.

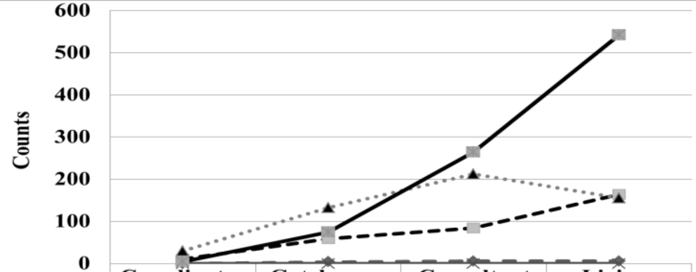
Thailand is the most prominent consultant for DR2, DR3 and DR4. This indicates that Thailand is capable to mobilise their HSDs to mediate the above diaspora resources between two destinations from a similar grouping but not in its same grouping. For example, Thailand can mobilise their HSDs to coordinate the innovation activities between two highly innovative destinations, or to bridge the business opportunities between two high income countries.

Thailand also plays a prominent liaison role for DR2, DR3 and DR4. This means that Thailand, for example as an upper middle income country, can leverage on their HSD to mediate DR2, i.e. the economic opportunities between a high-income country and a lower middle income country. Similarly, Thailand, which has moderate level of innovation activities, can leverage on its HSDs to mediate DR3, for example the innovation collaboration opportunities between a highly innovative and a low innovative destinations.



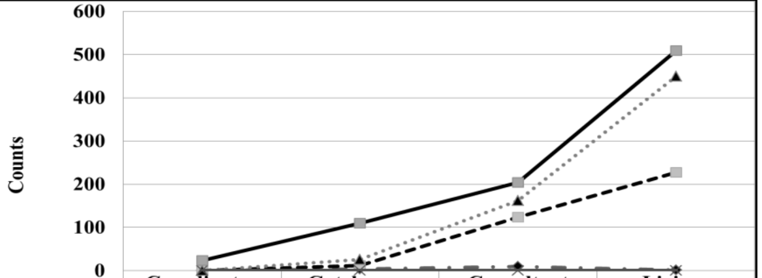
	Coordinator	Gatekeeper	Consultant	Liaison
Indonesia	10	4	2	0
Malaysia	144	91	18	32
Philippines	64	158	80	204
Singapore	0	0	0	0
Thailand	248	251	78	130

Figure 4.18 (a): DR1: Population Size of Destinations



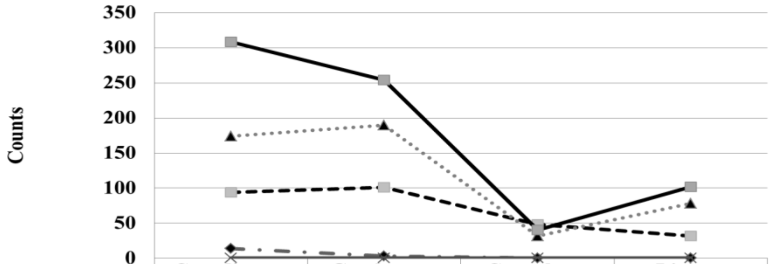
	Coordinator	Gatekeeper	Consultant	Liaison
Indonesia	0	4	6	6
Malaysia	10	59	84	164
Philippines	30	133	212	156
Singapore	0	0	0	0
Thailand	4	74	264	542

Figure 4.18 (b): DR2: Development Level of Destinations



	Coordinator	Gatekeeper	Consultant	Liaison
Indonesia	0	4	10	2
Malaysia	0	12	124	228
Philippines	0	26	162	450
Singapore	0	0	0	0
Thailand	24	110	204	510

Figure 4.18 (c): DR3: Innovation Level of Destinations



	Coordinator	Gatekeeper	Consultant	Liaison
Indonesia	14	3	0	0
Malaysia	94	101	48	32
Philippines	174	190	32	78
Singapore	0	0	0	0
Thailand	308	254	40	102

Figure 4.18 (d): DR4: International Trade Volumes of Destinations

Figure 4.18: The Brokerage Counts of ASEAN-5

The prominent brokerage roles of Thailand show that it is more capable than other ASEAN-5 countries in promoting DKNs and transnational entrepreneurship, which bridged the different groups of destinations (Meyer, 2007; Morales and Jorba, 2010; Murat, Pistoresi and Rinaldi, 2011; Borgatti, Everett and Johnson, 2013, p. 8; Ataselim, 2014; Meeteren, Engbersen, Snel and Faber, 2014). Thus, the diaspora engagement of Thailand should be strategised to integrate the business networks, knowledge and innovative ideas transmitted by their HSDs from heterogeneous destinations, in order to create new knowledge and economic opportunities which could impact positively on the development of home country (Seo, 2019).

Figure 4.18 shows that generally the Philippines plays the second most active brokerage roles. The Philippines could play a more active consultant and liaison role than Thailand for DR1. Thus, the Philippines could leverage on their HSDs to mediate the economic opportunities, for examples the business services or entrepreneurial activities originated from the destinations of different population sizes. The Philippine plays the most active gatekeeper role for DR2. This suggests that the Philippines HSDs could contribute to develop their home country into a business hub to mediate economic opportunities between lower middle income destinations and destinations with either relatively higher or lower income levels. The Philippines is also able to play an active consultant and liaison roles for the diaspora DR3. This implies that the Philippines could engage their HSDs to develop the home country into an innovation hub, which mediated the innovation activities and R&D collaborations between destinations of different innovation levels.

Figure 4.18 (d) shows that the Philippines could play the active coordinator, gatekeeper and liaison roles for DR4. PART I analysis found that the migratory movements of the Philippines HSDs were driven by the bilateral trades between their home country and the destinations. The brokerage analysis further shows that the Philippines can leverage on its HSDs to develop international trade businesses which mediate trade flows between their destinations and home country, or between countries/economies with different sizes of international trades volumes.

Malaysia is generally ranked after Thailand and the Philippines for brokerage potentiality in all types of diaspora resources. Malaysia can play active liaison role for DR2, implying that Malaysia can mediate economic opportunities and know-how from destinations of different development levels. This suggests that Malaysia could engage its HSDs in developing the home economy into an international hub for knowledge exchanges and business services (PricewaterhouseCoopers Malaysia, 2015; InvestKL, 2019).

Similarly, the HSDs of Malaysia can support their home country as an international business hub through their brokerage roles for DR4. Malaysia is the most active coordinator, gatekeeper, liaison and second most active consultant for DR4. This implies that the HSDs could be mobilised to bridge the international trades between Malaysia and countries/economies of different international trade volumes.

Malaysia is ranked third in its role as consultant and liaison for DR3. The two brokerage roles are crucial for Malaysia to capture innovative ideas from heterogeneous sources. The HSDs of Malaysia, like their counterparts of Thailand and Philippines, could contribute to strengthen the international innovation network of their home country. Thus, the innovative ideas channelled by the HSDs of Malaysia from different destinations could generate new ideas, products or solutions which would benefit the development of the home country (Sorenson, Rivkin and Fleming, 2006; Oettl and Agrawal, 2008; Seo, 2019).

The small ego-network of Indonesia has limited its capability to play brokerage roles between destinations. As indicated by Figure 4.18 (a), Indonesia has little potentiality to mediate the flows of economic opportunities between populous destinations. Figure 4.18 (c) suggests that Indonesia could play small brokerage role for the innovation activities between destinations. This could generate some positive impacts to the technological and business innovation in Indonesia.

Singapore could play no brokerage role within its small ego-network. This implies that Singapore might have low capability to mobilise their HSDs to mediate the flows of knowledge, innovation ideas and economic opportunities between destinations. Thus, it is recommended that it should look beyond its ego-network and maintain the “open door” policy which absorbs talented persons from other countries (Saha, 2009; Rikvin, 2012; Siau, 2018). The expatriate talents from different countries could bring in heterogeneous knowledge, innovative ideas and business networks which are beneficial to the economic development of Singapore,

4.4.3.3 Brokerage Roles between Groupings of Destinations

Figure 4.19 to 4.22 exhibit the block matrices of brokerage role for Thailand, the Philippines, Malaysia and Indonesia respectively with respect to the diaspora resources DR1, DR2, DR3 and DR4. The block matrices of Singapore are not exhibited as all their cells are zero values, indicating the absence of brokerage opportunity.

The group number shown on the top of each block matrix indicates the group to which a focal ASEAN-5 country is affiliated according to the classification as shown in Table 4.14. For example, in the block matrix of Thailand with respect to DR1 in Figure 4.19 (a), the group to which Thailand is affiliated is shown as group 4, i.e. country with large population (See Table 4.14). The numbers on the top row and leftmost column of the block matrix represent the groupings of destinations according to the sizes of DR1 as shown in Table 4.14. The numbers in the cells indicate the counts for the brokerage role mediated by Thailand between groups of destinations. The legend placed at the bottom-centre of Figure 4.19 represents the brokerage roles of coordinator, gatekeeper, consultant and liaison respectively.

The brokerage analysis for the block matrices in Figure 4.19 to 4.22 is to examine how ASEAN-5 can mobilise their HSDs to play various brokerage roles between heterogeneous destinations, in order to find out whether the HSDs can be engaged as transnational entrepreneurs and diaspora knowledge networks (DKNs) for the development of their home countries.

4.4.3.4 Coordinator

Figure 4.19 (a) and Figure 4.21 (a) show that Thailand and Malaysia are more active coordinators for DR1 than the Philippines and Indonesia. Thailand and Malaysia could engage their HSDs as transnational entrepreneurs to mediate economic opportunities between populous countries. This also implies that the HSDs of Thailand and Malaysia could be developed as nodes or entry points to destinations of large populations. However, the analysis from PART 1 suggests that the HSDs of Malaysia might be less influenced by entrepreneurial opportunities in the populous destinations than Thailand. Thus, in order to optimise the potential coordinator role for DR1, Malaysia should endeavour to promote the entrepreneurial spirits of their HSDs in populous destinations (World Bank, 2011, pp. 134-135; Saieed, 2017).

Thailand as Group 4

	1	2	3	4
1	2	10	17	32
2	10	32	38	92
3	17	38	44	127
4	32	92	127	$\boxed{248}$

(a) DR1: Population Sizes of Destinations

4 Large
3 Upper Medium
2 Lower Medium
1 Small

Thailand as Group 3

	1	2	3	4
1	30	47	15	95
2	47	52	20	129
3	15	20	$\boxed{4}$	39
4	95	129	39	182

(b) DR2: Development Levels of Destinations

4 High
3 Upper Middle
2 Lower Middle
1 Low

Thailand as Group 4

	1	2	3	4	5
1	6	21	11	16	47
2	21	42	27	29	101
3	11	27	10	16	48
4	16	29	16	$\boxed{24}$	49
5	47	101	48	49	146

(c) DR3: Innovation Levels of Destinations

5 High
4 Moderately High
3 Moderate
2 Low
1 Least

Thailand as Group 4

	1	2	3	4
1	6	15	14	62
2	15	20	22	104
3	14	22	14	88
4	62	104	88	$\boxed{308}$

(d) DR4: International Trade Volumes of Destinations

4 Large
3 Moderately Large
2 Medium
1 Small

Coordinator
Gatekeeper
Consultant
Liaison

Figure 4.19: Thailand: The Brokerage between Groupings of Destinations according to Diaspora Resources

Philippines as Group 4

	1	2	3	4
1	40	33	43	70
2	33	22	26	51
3	43	26	18	37
4	70	51	37	64

(a) DR1: Population Sizes of Destinations

4 Large
3 Upper Medium
2 Lower Medium
1 Small

Philippines as Group 2

	1	2	3	4
1	2	12	5	30
2	12	30	16	105
3	5	16	4	43
4	30	105	43	206

(b) DR2: Development Levels of Destinations

4 High
3 Upper Middle
2 Lower Middle
1 Low

Philippines as Group 3

	1	2	3	4	5
1	30	36	6	12	87
2	36	30	6	12	67
3	6	6	0	1	13
4	12	12	1	2	11
5	87	67	13	11	100

(c) DR3: Innovation Levels of Destinations

5 High
4 Moderately High
3 Moderate
2 Low
1 Least

Philippines as Group 4

	1	2	3	4
1	20	15	15	90
2	15	6	9	47
3	15	9	6	53
4	90	47	53	174

(d) DR4: International Trade Volumes of Destinations

4 Large
3 Moderately Large
2 Medium
1 Small

Coordinator
Gatekeeper
Consultant
Liaison

Figure 4.20: Philippines: The Brokerage between Groupings of Destinations according to Diaspora Resources

Malaysia as Group 4

	1	2	3	4
1	0	3	3	13
2	3	10	10	39
3	3	10	8	39
4	13	39	39	144

(a) DR1: Population Sizes of Destinations

4 Large
3 Upper Medium
2 Lower Medium
1 Small

Malaysia as Group 3

	1	2	3	4
1	0	0	0	0
2	0	0	0	0
3	0	0	0	3
4	0	0	3	10

(b) DR2: Development Levels of Destinations

4 High
3 Upper Middle
2 Lower Middle
1 Low

Malaysia as Group 4

	1	2	3	4	5
1	0	0	0	0	0
2	0	56	23	9	71
3	0	23	6	2	20
4	0	9	2	0	1
5	9	71	20	1	62

(c) DR3: Innovation Levels of Destinations

5 High
4 Moderately High
3 Moderate
2 Low
1 Least

Malaysia as Group 4

	1	2	3	4
1	0	1	7	12
2	1	0	8	10
3	7	8	48	79
4	12	10	79	94

(d) DR4: International Trade Volumes of Destinations

4 Large
3 Moderately Large
2 Medium
1 Small

Coordinator
Gatekeeper
Consultant
Liaison

Figure 4.21: Malaysia: The Brokerage between Groupings of Destinations according to Diaspora Resources

Indonesia as Group 4

	1	2	3	4
1	0	0	0	0
2	0	2	0	3
3	0	0	0	1
4	0	3	1	10

(a) DR1: Population Sizes of Destinations

4 Large
3 Upper Medium
2 Lower Medium
1 Small

Indonesia as Group 2

	1	2	3	4
1	0	0	0	0
2	0	0	2	2
3	9	2	4	3
4	0	2	3	2

(b) DR2: Development Levels of Destinations

4 High
3 Upper Middle
2 Lower Middle
1 Low

Indonesia as Group 3

	1	2	3	4	5
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	3	1
4	0	0	3	10	1
5	0	0	1	1	0

(c) DR3: Innovation Levels of Destinations

5 High
4 Moderately High
3 Moderate
2 Low
1 Least

Indonesia as Group 4

	1	2	3	4
1	0	0	0	0
2	0	0	0	0
3	0	0	0	3
4	0	0	3	14

(d) DR4: International Trade Volumes of Destinations

4 Large
3 Moderately Large
2 Medium
1 Small

Coordinator
Gatekeeper
Consultant
Liaison

Figure 4.22: Indonesia: The Brokerage between Groupings of Destinations according to Diaspora Resources

Figure 4.19 (d), Figure 4.20 (d) and Figure 21 (d) exhibit that Thailand, the Philippines and Malaysia are active coordinator for DR4. This means that the HSDs of the three countries can be developed as transnational entrepreneurs who contribute to increase the international trades between large trading destinations and their home country. Many HSDs of Thailand involve in entrepreneurial activities in their destinations, particularly as providers of business and professional services (Beasley, Hirsch and Rungmanee, 2014; Weng and Chanwong, 2016; Webster and Haandrikman, 2017). Thus, Thailand should leverage on the coordinator role for DR4 to engage the Thai entrepreneurs abroad to contribute to the international trades of their home country.

PART I found that Indonesian HSDs were positively influenced by the population size of destinations and bilateral trades of the home country. However, Figure 4.22 (a) and Figure (d) show that Indonesia can play very limited coordinator role for DR1 and DR4. Thus, apart from the limited coordinator roles, Indonesia should increase the efforts of engaging its HSDs to transfer economic opportunities and know-how from populous destinations and large trading countries, in order to stimulate the economic development under MP3EI (Al'ayubby, 2018; Salim and Negara, 2018).

4.4.3.5 Gatekeeper

Figure 4.19 (a) and Figure 4.20 (a) demonstrate that Thailand and the Philippines are active gatekeepers for DR1 transmitted between destinations of large and smaller population. The HSDs of Thailand and the Philippines could be engaged as transnational entrepreneurs to help developing their home country into stepping stone for entering markets of heterogeneous populations (Thailand Board of Investment, 2017; Paweenawat and Vechbanyongratana, 2019, p. 261)

Figure 4.20 (b) reveals that the Philippines, a lower middle income country, is the active gatekeeper for DR2 transmitted between lower middle income and high income destinations. The Philippines could mobilise their HSDs to establish economic links bridging the developed and lower middle income destinations. The active gatekeeper role for DR2 implies that the industrial and entrepreneurship development of the Philippines can benefit from the new knowledge and economic opportunities abroad (Asis, 2017; Caunan, 2017; Barrett, 2019).

Thailand, as an upper middle income country, is able to play the gatekeeper role between upper middle income and developed destinations. However, Malaysia and Indonesia are relatively inactive gatekeepers for DR2. The weak gatekeeper role for DR2 is especially disadvantageous for Indonesia, which has just increased the efforts to interconnect its overseas diasporas, in order to channel economic opportunities and technological know-how from advanced economies (Jegho, 2016; Salim, 2016; Jakarta Post, 2017; Setijadi, 2017).

As exhibited by Figure 4.19 (d) and Figure 20 (d), Thailand and the Philippines are active gatekeepers for DR4, i.e. the economic opportunities transmitted between destinations with heterogeneous sizes of international trades. Similarly, Figure 4.21 (d) also demonstrates that Malaysia can become gatekeeper for the economic opportunities exchanged between large and smaller trading countries. The active gatekeeper roles enable Thailand, the Philippines and Malaysia to engage the HSDs' entrepreneurship, business know-how and familiarity with overseas markets to develop their home countries into international business hubs (Chen and Wong, 2015; Salmi and Salmi, 2017; Habibu, 2019).

4.4.3.6 Consultant

Figure 19 (b) and Figure 20 (b) exhibit that Thailand and the Philippines are the active consultants for DR1 between developed destinations. The HSDs of Thailand and the Philippines could be engaged as transnational entrepreneurs who bridge the economic activities between developed destinations. The HSDs could also be mobilised to build DKNs which facilitate the knowledge flows between developed destinations. Such consultant role is vital for Thailand and the Philippines to gain access to economic opportunities and business know-how of the advanced destinations (Meulen, 2016; Raksaphaeng, 2016).

Figure 4.19 (c), Figure 4.20 (c) and Figure 4.21 (c) demonstrate that Thailand, the Philippines and Malaysia play the active consultants for DR3 between highly innovative destinations. This implies that the HSDs of Thailand, the Philippines and Malaysia could be mobilised to establish DKNs to bridge the innovation activities and research collaborations among highly innovative destinations.

The active consultant role for DR3 substantiates the previous claims that the HSDs of Thailand and the Philippines are potential agents to connect their home country to the innovation activities abroad and international research networks (Agunias and Newland, 2012, pp. 176-177; International Labour Organisation [ILO], 2015; Tanpipat, 2015; Raksaphaeng, 2016; Asis, 2017; Caunan, 2017). This study recommends that Thailand, the Philippines and Malaysia should promote their HSDs to establish DKNs interconnecting the highly innovative destinations and their home countries. Such innovation oriented DKNs can generate new ideas, creative solutions and technological collaboration opportunities for Thailand, the Philippines and Malaysia (Hoo, Zainal, Chai, 2014; Raksaphaeng, 2016, Caunan, 2017).

4.4.3.7 Liaison

Generally, Thailand and the Philippines are active liaisons for the four types of diaspora resources transmitting between heterogeneous destinations. Figure 4.19 (b) shows that Thailand is the active liaison for DR2 transmitted between high income and lower middle income countries, as well as between high income and low income countries. Thailand could leverage on the advantageous liaison role to engage its HSDs to contribute to the business service industry of their home country (Paweenawat and Vechbanyongratana, 2019).

Figure 4.19 (c) and Figure 4.20 (c) also shows that Thailand and Philippines are the active liaisons for DR3 transmitted between highly innovative and less innovative destinations. Thailand and the Philippines could mobilise their HSDs to establish DKNs interconnecting destinations of heterogeneous innovation levels. The liaison role for DR3 enables Thailand to engage its HSDs to support the innovation activities under the Thailand 4.0 (Thailand Board of Investment, 2017, pp. 3-5; Foreign Office, The Government Public Relations, 2018; Theparat and Arunmas, 2018).

Similarly, the Philippines should strengthen the DKNs of their HSDs to promote circulations of ideas and collaboration opportunities between highly innovative and less innovative destinations. The Philippines' active liaison role for DR3 substantiates the previous claim that the HSDs of the Philippines can contribute to connect their home country to the overseas innovation activities (Camroux, 2008; Rodis, 2013; Asis, 2017; Caunan, 2017).

Malaysia, as shown by Figure 4.21 (c), can play the active liaison for DR3 between highly innovative and low innovative destinations. This implies that Malaysia could also encourage their HSDs to form DKNs between highly innovative destinations and low innovative destinations, in order to tap into the international circulation of innovative ideas, solutions and knowledge.

4.5 Conclusion for the Analysis

The analysis from PART I and PART II are designed to solve two sets of interrelated research problems. PART I empirically investigated the macro-determinants of the spatial distributions of HSDs from ASEAN-5. An augmented gravity model for international migration was constructed for the empirical study (Globerman and Shapiro, 2008; Ramos and Surinach, 2013; Docquier, Peri and Ruyssen, 2014; Ramos, 2016). The models for each ASEAN-5 were estimated by the PPML method (Santos Silva and Tenreyro, 2006; Bertoli and Moraga, 2013; Beine, Noel and Ragot, 2014; Beine, Bertoli and Moraga, 2016; Wajdi, Adioetomo and Mulder, 2017).

The analysis from PART I led to an understanding of the HSDs' migratory expectation and motives, which also pointed to the diaspora resources pursued by them in the destination countries (Ionescu, 2006, p. 40; African Diaspora Policy Centre, 2011; Docquier and Rapoport, 2012; Trotz and Mullings, 2013; Hoo, Zainal and Chai, 2014; Elo, 2015; World Bank, 2016, p. 29; Fok, Cheng and Tan, 2018).

PART II analysis applied social network analysis (SNA) to model and operationalise the transnational links of the HSDs. The study constructed a global diaspora network based on the OECD dataset of bilateral HSDs between countries/economies in 2010.

ASEAN-5 countries, among other countries/economies are nodes in the global diaspora network. The ASEAN-5 countries are connected to other countries/economies or destinations (i.e. other nodes) through the diaspora links of HSDs, which are denoted as HSD links. The HSD links are channels for the flows of diaspora resources, such as entrepreneurial opportunities, technical know-how, innovation activities and international trade opportunities to circulate across countries/economies in the global diaspora network. By applying the centrality metrics and brokerage analysis of the SNA, PART II explores how ASEAN-5 can mobilise or mediate the diaspora resources, which are identified by PART I.

One of the major findings of PART I is that the migratory decision of HSDs from ASEAN-5 was influenced by crowding effects from the highly innovative destinations. The crowding effects from popular migratory destinations were discovered by Yan and Zhou (2018). Based on the notion of crowding effects, the negative estimators of *LnINNOVr1* across ASEAN-5 can be interpreted as the tendency of their HSDs to avoid destinations which are highly active in innovations. It is because such destinations are also attractive to highly skilled immigrants from other countries of origin. Thus, the HSDs from ASEAN-5 may abstain from moving into the highly innovative destinations, *ceteris paribus*, in order to stay away from competing with HSDs originated from other countries.

The empirical results in Table 4.9 show that the spatial distributions of HSDs from ASEAN-5 were positively influenced by development gaps and bilateral trades with the destinations. Most of such developed and large trading destinations are also highly innovative economies. This shows that the HSDs from ASEAN-5 would move into the highly innovative economies if the positive effects from the population of destinations, development gaps, bilateral trades with destinations and other determinants outweigh the crowding effects.

The crowding effects have complicated the investigation of influences of innovation activities on the spatial distributions of HSDs from ASEAN-5. However, existing literature shows that the Philippines HSDs in advanced economies have actively participated in the diaspora engagement programmes of their home country for research collaboration, technical skill trainings and technopreneurship development (Opiniano and Castro, 2006; MPI, 2014; Caunan, 2017).

Thailand and Indonesia have also received good responses and active participations of their HSDs in diaspora engagement initiatives which target at connecting with the overseas talents in science and technological fields (Agunias and Newland, 2012, pp. 171-172; Saefuloh, 2012; ILO, 2015; Raksaphaeng, 2016; Darsono, 2017). Similarly, Malaysia and Singapore have prioritised the engagement of HSDs in the technological development and innovation activities of the home country (World Bank, 2011, pp. 134-136; Hoo, Zainal and Chai, 2014; Ho and Boyle, 2015; Siau, 2018).

The above phenomenon points to the existence of overseas talent pools for ASEAN-5 in sciences, technology and innovation fields. Such HSDs could play a vital role in connecting ASEAN-5 with the technological clusters around the world and to form international collaboration in innovation activities. Further studies should be conducted to understand their sizes and locations in destinations, expertise, career expectation and adherence to home countries.

PART I found that HSDs from Thailand, Indonesia and the Philippines were highly driven by population sizes and development levels of the destinations. This implies that the HSDs could be mobilised by their home countries to gain access to the market of populous destinations and harness the economic opportunities in developed economies. In addition, the HSDs from Indonesia, Malaysia, the Philippines and Singapore could be engaged to promote the international trades of their home country, particularly those between the destinations of HSDs and their home country.

The analysis from PART II produced many insightful findings for the diaspora engagement strategy of ASEAN-5. It is found that Thailand possesses the greatest positional advantages among ASEAN-5 in the global diaspora network. The HSD links of Thailand enables it to promptly locate and mobilise diaspora resources from heterogeneous destinations, particularly from the developed, innovative and large trading economies located in the core of the global diaspora network.

Thailand could engage their HSDs to penetrate the market of populous destinations, to search for the economic opportunities and knowledge in advanced destinations and to connect to highly innovative destinations. The analysis from PART I suggests that the spatial distribution of HSDs from Thailand were not strongly influenced by the bilateral trades with destinations. However, PART II shows that Thailand has maintained strong HSD links with the developed economies which happen to be important players in international trades. Thus, Thailand should motivate its HSDs in such developed economies to strengthen the bilateral trades with their home countries.

Most notably, the brokerage analysis shows that Thailand was able to mobilise their HSDs to mediate various types of diaspora resources among destinations, for example the economic opportunities in populous destinations, innovation activities and international trade opportunities. Thailand should utilise such network advantages to engage its HSDs as transnational entrepreneurs and diaspora knowledge networks (DKNs) for contributing to the economic transformation under the Thailand 4.0 (Office of the Board of Investment, 2017, pp. 3-5; Foreign Office, The Government Public Relations, 2018; Theparat an Arunmas, 2018).

According to the centrality metrics, the Philippines possesses the second largest network advantages among ASEAN-5. The HSDs of Philippine could contribute to strengthen the economic linkages of their home country with the high-income, populous, innovative and large trading destinations.

Like Thailand, the Philippines can mobilise its HSDs to mediate diaspora resources among heterogeneous destinations for the development of home country, particularly the innovation activities and international trades. The network advantage as indicated by greater brokerage opportunities could be utilised to strengthen the existing diaspora engagement initiatives, for example the *Balik* Scientist Programme (Opiniano and Castro, 2006; Caunan, 2017).

The network connectivity of Malaysia is weaker than Thailand and the Philippines but stronger than Indonesia and Singapore. Malaysia could mobilise its HSDs to strengthen the economic ties with developed and highly innovative destinations such as the United States, Sweden, Netherlands, Germany, France and Japan. This study found that the migratory movements of Malaysian HSDs were highly driven by the international trade relations of their home country. Malaysia can engage its HSDs to enhance the bilateral trades with destinations, particularly the advanced and large trading economies.

Despite playing a smaller number of brokerage roles than Thailand and the Philippines, Malaysia can mediate international trade opportunities and innovation activities between the destinations of its HSDs. In this respect, the HSDs of Malaysia can contribute to develop their home country into an international hub of business services, innovation activities and international trades (Performance Management and Delivery Unit, 2015, pp. 158-173; PricewaterhouseCoopers Malaysia, 2015; InvestKL, 2019).

Indonesia and Singapore have weaker connectivity than other three ASEAN-5 countries in the global diaspora network. The two countries, especially Singapore have only a small number of strong links connected to the developed core of the global diaspora network.

According to PART I, the migratory decision of HSDs from Indonesian was influenced by population sizes, development gaps and bilateral trades with the destinations. However, the periphery position of Indonesia in the global diaspora network may limit its capability to capture diaspora resources from heterogeneous sources of countries/economies. The Indonesian policy makers endeavour to engage its HSDs in the economic transformation programmes of MP3EI. However, the disadvantageous position and low connectivity of Indonesia in the global diaspora network may adversely affect the efforts of engaging its HSDs to transfer knowledge, know-how and innovative ideas from advanced countries to the four main areas of MP3EI, namely energy, maritime and transportation, food sovereignty and public housing (Coordinating Ministry for Economic Affairs, 2011, pp. 31-44; Saefuloh, 2012; Antara News, 2013; Al'ayubby, 2018; Salim and Negara, 2018).

Indonesia may be able to compensate its weak network position by exploiting its strong colonial link. PART I found that the colonial link was significant driver for the spatial distribution of HSDs from Indonesia. Indonesia should strengthen the historical and economic ties to its former coloniser, Netherlands (Embassy of the Kingdom of the Netherlands in Jakarta, 2013; Setijadi, 2017). Netherlands is one of the developed countries located at the core of the global diaspora network. Indonesia could engage the Indonesian HSDs in Netherlands to connect their home country to the economic opportunities and innovation activities in other developed countries (Welcker, 2016).

Singapore possesses the smallest number of strong HSD links relative to other ASEAN-5 countries. This could undermine the efforts of Singapore to connect to the overseas economic opportunities through their HSDs (Yap, 1994; National Population and Talent Division, 2013, p. 25; Ho and Boyle, 2015). This study suggests that the diaspora engagement efforts of Singapore should be complemented by its “open door” policy, which welcomes expatriate talents around the world (Saha, 2009; Rikvin, 2012; Siau, 2018). The foreign talents would bring in knowledge, innovative ideas and business networks from heterogeneous sources of countries/economies.

CHAPTER FIVE

CONCLUSION, IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 Overview of the Study

The highly skilled emigration was often portrayed as brain drain or talent exodus until early 1990s. The conventional policy response to the brain drain is to implement return migration policy, to call back the highly skilled diasporas (HSDs) to their home countries (Dainton et al., 1963; Bhagwati and Hamada, 1974; Docquier, Lohest & Marfouk, 2007; Chaichian, 2011; Susantono, 2015; OECD, 2016, p. 28).

However, the return migration is unable to stop the increasing migration of highly skilled persons at both the national and global level (Roobol and Oonk, 2011; OECD, 2015, p. 16; Arslan, Dumont and Parsons, 2016, p. 6). Instead, the accelerating paces of globalisation and a more interconnected world economy have expedited the international mobility of the highly skilled persons (United Nations, 2013b, p. 69; Czaika and de Haas, 2014; OECD, 2016, p. 72).

From the perspective of economic theory, the decision of a highly skilled emigrant to move to a destination reflects his/her rational choice to maximise migratory benefits, for instances higher overseas income, better career opportunities, exposure to overseas experience and access to new knowledge, after deducting the migratory costs, such as geographical distance and adaptability to foreign environment (de Haas, 2010a; Buchori, 2011; Docquier and Rapoport, 2012; Docquier, Peri and Ruyssen, 2014; Vandor and Franke, 2016; Sommer and Gamper, 2018).

Since the early 1990s, the brain drain view and return migration has been gradually replaced by diaspora option or diaspora engagement initiatives (Faist, 2007, Gamlen, 2005, 2006, 2014; Sinatti and Horst, 2015). According to the viewpoint of the diaspora engagement, HSDs could serve as the global links for their countries of origin (Saha, 2009; Czaika and de Haas, 2014). Hence, the HSDs can be mobilised to channel business networks, knowledge, and technological innovations and international trade opportunities from destinations to their home country, even without their physical and permanent return. To date, the diaspora engagement strategy is an integral part of the diaspora or migration policies of many countries and inter-governmental organisations (Biao, 2005; Gamlen, 2005, 2006; de Haas, 2006; Saha, 2009; de Haas and Vezzoli, 2011; Keusch and Schuster, 2012; OECD, 2012; Trotz and Mullings, 2013; Sinatti and Horst, 2015; Kennedy and Lyes, 2015; Gamlen, Cummings and Vaaler, 2017).

The paradigm shift from brain drain to diaspora engagement initiatives was driven by the emergence of Silicon Valley and other technological clusters in advanced countries since 1970s. The technological clusters have attracted HSDs from developing and emerging economies around the world. Even if they are working abroad, the HSDs maintain close interactions and ties with their home country through various types of informal and formal links, including kinship, family ties, alumni, business partnership, professional networks, diaspora oriented associations and short term visits (Sabel and Saxenian, 2008; Tung, 2008; Royal Society, 2011, p. 26; Saxenian, 2011; Gibson and McKenzie, 2014; Faist, 2015; Ho and Boyle, 2015; Van Hear, Bakewell and Long, 2018).

Through the formal and informal transnational links, the HSDs play the instrumental role in transmitting knowledge, technological innovations, know-how and business opportunities from the global technological clusters to their countries of origin. Such transmissions have contributed to the industrial transformation, technological catching up and innovation activities in Taiwan, India, South Korea, China and other countries/economies in Europe, Caribbean, South America and Africa from the 1980s to 2010s (Biao, 2005; Meyer and Wattiaux, 2006; Meyer, 2007; Sabel and Saxenian, 2008; Kuznetsov and Sabel, 2008; African Diaspora Policy Centre, 2011; Chaichian, 2011; Trotz and Mullings, 2013; Bilgili, 2014; Gibson and McKenzie, 2014; Kennedy and Lyes, 2015; Shin and Moon, 2018).

The ASEAN-5, namely Indonesia, Malaysia, the Philippines, Singapore and Thailand have also implemented their diaspora engagement initiatives during the past three decades. For examples, the *Balik* Scientist Programme of Philippines from 1993 until today (Opiniano and Castro, 2006;

Caunan, 2017), the diaspora outreach campaigns implemented by the Talent Corporation of Malaysia since 2011 (Talent Corporation Malaysia 2012; World Bank, 2015, p. 12), the initiatives taken by the National Science and Technology Development Agency (NSTDA) of Thailand to connect with the diasporic communities since 1997 (Tanpipat, 2015), the establishment of the Indonesian Diaspora Network (IDN) in 2013 (Indonesia Diaspora Network, 2017) and the diaspora strategy of Singapore to engage their HSDs as global links for the economic development of home country (Saha, 2009; National Population and Talent Division, 2013; Ho and Boyle, 2015).

The review of the ASEAN-5 literature highlights a limited number of studies focusing on the quantitative analysis of the migratory motives of HSDs. Thus, this study contributes to fill the knowledge gap by investigating macro-determinants for the spatial distributions of the HSDs from ASEAN-5. The empirical results also identified the types of diaspora resources pursued by HSDs in their destinations, namely the population or market sizes of the destinations, economic opportunities in developed countries/economies, innovation activities in destinations and bilateral trades between destinations and the home country of HSDs. Such diaspora resources could be engaged and mobilised for the economic development of the home country (Ionescu, 2006, p. 27; Globerman and Shapiro 2008; de Haas, 2010a, 2010b; Docquier and Rapoport, 2012; King, 2012; Kennedy and Lyes, 2015; Cheng, 2016).

The study is guided by the general objective to understand how the spatial distributions and diaspora networks of HSDs could influence the capabilities of ASEAN-5 to engage them in the economic development of home countries. Thus, the study comprises of two main parts: 1) to identify the diaspora resources which can be obtained from the destination countries through the HSDs of ASEAN-5; and 2) to examine the positional advantages of ASEAN-5 in the global diaspora network, which would affect their capabilities to harness the diaspora resources from the destination countries.

The study started with an investigation of the macro-determinants of the spatial distribution of the HSDs, through which the migratory motives and diaspora resources of the HSDs could be identified. The study further extends the above findings to examine how the positional advantages of ASEAN-5, as demonstrated by their locations and connectivity in the global diaspora network could influence their capability to mobilise the diaspora resources of their HSDs. The findings contribute to the formulation of diaspora engagement strategies for ASEAN-5, including the types of diaspora resources, the destination countries/economies to be focused on, the potential developmental contributions of the HSDs and how the home country can leverage on their HSDs to mediate diaspora resources from heterogeneous sources of destinations.

The prominent scholars in the study of international migration, de Haas (2010a, 2010b, 2011, 2014a, 2014b), Czaika and de Haas (2014) and de Haas et al. (2018) had inspired the analytical framework of this study. Two important notions of de Haas were adopted in this study: firstly, the reciprocity between the migratory motives of the highly skilled emigrants and their developmental impacts on the economy of home country. The migratory motives reflect the economic opportunities or overseas resources pursued by the HSDs. Such economic opportunities or overseas resources, which are defined as diaspora resources, are also what HSDs can contribute to the development of their home countries (Ionescu, 2006; Aqunias and Newland, 2012, pp. 24-25; 146; Trotz and Mullings, 2013; Ataselim, 2014; Gamlen, 2014; Acharya, 2017; Fok, Cheng and Tan, 2018).

Secondly, according to de Haas (2010a, 2010b, 2011, 2014b), the connections and interplays between various components in the migration-development interaction must be understood through an interdisciplinary approach. In this study, the two important interplayed components are the transnational networks of HSDs and the developmental roles for their home country. The transnational networks, such as transnational entrepreneurship, search networks and diaspora knowledge networks (DKNs) facilitate HSDs to contribute to the development of their home countries (Biao, 2005; Meyer, 2007; Sabel and Saxenian, 2008; Kuznetsov and Sabel, 2008, African Diaspora Policy Centre, 2011; Trotz and Mullings, 2013; Gibson and McKenzie, 2014; Kennedy and Lyes, 2015). The discovery of the two interplayed components leads to another insight: the extensiveness and strength of the diaspora links can affect the capabilities of ASEAN-5 to mobilise their diaspora resources (Faist, 2006; 2010, p. 3; Danchev and Porter, 2018; Windzio, 2018).

Based on the interdisciplinary approach as advocated by de Haas (2010a, 2010b, 2011, 2014b), the study developed an analytical framework which integrates two parts of the research, namely PART I and PART II.

PART I investigated the macro-determinants of the spatial distributions of the HSDs from ASEAN-5. The study used the augmented gravity model and the Pseudo Poisson Maximum Livelihood (PPML) method to analyse the international emigration from ASEAN-5. The modelling and estimation method were able to generate robust estimators by taking into account the inherent heteroscedasticity in the cross-sectional data of international migration (Santo Silva and Tenreyro, 2006; Bein Docquier and Ozden, 2011; Arvis and Shepherd, 2013; Beine, Bertoli and Moraga, 2014, 2016). PART I identified both the drivers for the spatial distributions of HSDs from ASEAN-5 and the diaspora resources which could be engaged for the development of home country.

PART II analysed how the transnational links of HSDs from ASEAN-5, namely the HSD links of diaspora resources can contribute to the economic development of their home country. The analysis moved beyond the conventional methodology of economic research, which is based on rational choice of economic actors and equilibrium framework (Granovetter, 1985; Goyal, 2009, p. 4-5; de Haas, 2007, 2010; Docquier and Rapoport, 2012; King, 2012; Starck, 2012; Wickramasinghe and Wimalaratana, 2016; Gheasi and Nijkamp, 2017). The study employed the social network analysis (SNA) to examine how the HSD links can be utilised to benefit the economic development of home country (Bilecen, Gamper and Lubbers, 2018; Sommer and Gamper, 2018).

The analytical framework of PART II synthesised two applications of SNA, i.e. the global diaspora network conceptualised by Danchev and Porter (2018) and Windzio (2018) and the flow model of the SNA (Borgatti, Mahra, Brass and Labianca, 2009; Borgatti and Halgin, 2011; Kadushin, 2012, p. 8 and Borgatti, Everett and Johnson, 2013, p. 7; Borgatti, Everett and Johnson, 2018, pp. 2-5). The analysis constructed a global diaspora network based on the data of bilateral HSDs between countries in 2010. The flow model of SNA operationalises the HSD links as channels for flows of diaspora resources, such as economic opportunities, know ◦ -how, innovation activities and international trade opportunities.

Based on the above set up, the study applied the SNA methods of centrality metrics and brokerage analysis to explore how the network positions of the ASEAN-5 can influence their accession and mobilisation of the diaspora resources, which were identified in PART I. The centrality metrics investigated how the HSDs from ASEAN-5 can be engaged to channel diaspora resources from the destinations. The application of brokerage analysis is another contribution of this study. It investigated how individual ASEAN-5 country can leverage on their HSDs to mediate diaspora resources from heterogeneous sources of destinations, in order to benefit from the creation and diffusion of economic opportunities, international trades and technological innovations.

5.2 Summary of Key Findings and Recommendations

By integrating the findings of PART I and PART II, the study provides a better understanding on the capabilities of ASEAN-5 to tap the diaspora resources of their HSDs from the global diaspora network. The findings also reveal how ASEAN-5 can engage the HSDs as development agents through transnational entrepreneurship (Bagwell, 2015; Sommer and Gamper, 2018), diaspora search networks (Sabel and Saxenian, 2008, Aikins and White, 2011, p. 21; Kuznetov, 2019) and diaspora knowledge networks (DKNs) (Meyer, 2007; Ho and Boyle, 2015; Cheng, 2016; Malecki, 2017).

5.2.1 Crowding Effects from the Innovation Activities in Destinations.

One of the unexpected findings of the study is that the HSDs from ASEAN-5 tend to avoid moving into destinations which have high levels of innovation activities. The phenomenon can be explained by the crowding effects from popular migratory destinations as discovered by Yan and Zhou (2018). The HSDs from ASEAN-5, *ceteris paribus*, tried to avoid moving into highly innovative destinations as such countries/economies are also highly attractive to highly skilled immigrants from other countries of origin. The HSDs from ASEAN-5 expect that they would face intense competition for career opportunities in such destinations, especially in the technology and innovation related fields.

The crowding effects complicated the analysis for influences of innovation activities on the spatial distributions of the HSDs from ASEAN-5. However, the study looks at the issue from two other aspects: The first aspect is based on the network analysis in PART II. It was shown that HSDs from Thailand, the Philippines and to a lower degree, Malaysia were closely interconnected with the advanced economies in the core region of the global diaspora network, most of which were also active in innovations (Kerr, Kerr, Ozden and Parsons, 2016; WIPO, 2017a). Secondly, the extant literature shows that HSDs of ASEAN-5, especially the Philippines and Thailand have participated actively in the diaspora engagement programmes aimed at technological transfers, international collaboration on innovation activities and technopreneurship development (Agunias and Newland, 2012, p. 171-172; Saefuloh, 2012; Migration Policy Institute [MPI], 2014; International Labour Organisation [ILO], 2015; Caunan, 2017; Raksaphaeng, 2016; Darsono, 2017). The above two aspects implied that the HSDs from ASEAN-5, especially Thailand, the Philippines and Malaysia might move into highly innovative destinations due to other positive forces such as higher incomes, market opportunities or international trade relations. ASEAN-5 should identify those HSDs who can contribute to the technological advancement, business innovation and technopreneurship development of their home country. Further studies are needed to understand the HSDs' occupations, expertise, career expectation and networks to their home countries. Such knowledge is essential to engage overseas talents who could contribute to the economic transformation under the Fourth Industrial Revolution (4IR) (Mckenzie, 2017; Fink and Gentile, 2019).

5.2.2 Key Findings and Recommendations for Thailand

The populous destinations had relatively strong influence on the spatial distributions of HSDs from Thailand compared to other ASEAN-5 countries. This implies that the HSDs from Thailand were attracted to the abundant entrepreneurial opportunities in populous destinations. Previous studies also show that the HSDs from Thailand actively involved in various types of business ventures in destinations, including business services and professional consultancies (Beasley, Hirsch and Rungmanee, 2014, p.24; Weng and Chanwong, 2016; Webster and Haandrikman, 2017). The entrepreneurial HSDs can be mobilised to promote the economic cooperation between populous destinations and Thailand, for example to open new market for the products or services from the home country.

The positive influence of development gaps on the HSDs from Thailand is the second strongest among ASEAN-5. The previous studies show that many Thai talents in science and technology (S&T) seek for better occupations, research environment and S&T facilities in advanced economies (Raksaphaeng, 2016; Bangkok Post, 2018). This implies that the attraction of better income and career opportunities in developed countries might be stronger than the crowding out effects of innovation activities at destinations (Yan and Zhou, 2018). Thailand should proactively engage their HSDs in developed countries to help identifying the opportunities of international collaboration in science and technology (S&T).

PART I shows that the diaspora network had greater positive influence on the spatial distributions of Thai HSDs than populous destinations and development gaps. This finding is in line with the finding of previous studies that the diasporas of Thailand have maintained strong transnational links with their home country, such as business networks, diaspora oriented organisations, cultural adherence and familial ties (Beasley, Hirsch and Rungmanee, 2014, p. 24; Boonyopakorn, 2014; Gsir and Mescoli, 2015; Tanpipat, 2015).

PART II found that Thailand is one of top 30 countries which have the strongest connectivity with other countries/economies in the global diaspora network. This implies that Thailand has occupied the most central position than other ASEAN-5 in the global diaspora network. Compared to other ASEAN-5 countries, Thailand is closely connected with more developed and emerging economies. The positional advantage enables Thailand to gain access to various diaspora resources from heterogeneous source of destination countries. In addition, the capability of Thailand to mobilise various diaspora resources is bolstered by the active interactions between Thai overseas diasporas and the highly skilled persons in the home country (Beasley, Hirsch and Rungmanee, 2014, p. 24; Boonyopakorn, 2014; Gsir and Mescoli, 2015). Thailand can also engage their HSDs as diaspora search networks which locate business solutions, partners and investors globally (Fok, Cheng and Tan, 2018; Kuznetsov, 2019).

The brokerage analysis based on the ego-network also shows that Thailand can leverage on its HSDs to mediate the transmission of various diaspora resources, especially innovation activities and international trade opportunities between a large numbers of destinations. Thus, Thailand should engage its HSDs as transnational entrepreneurs and DKNs, in order to capture, recreate, mediate and diffuse knowledge or economic opportunities among countries/economies in the global diaspora network. The government of Thailand endeavours to raise the country to the status of regional economic hub (Thailand Board of Investment, 2017). In this respect, the policy makers can leverage on the brokerage roles of Thailand via the ego-network to strengthen the economic linkages and interactions between Thailand and other parts of the world.

PART I shows that the migratory movements of the HSDs from Thailand were negatively though marginally influenced by the international trade relations. However, PAR II shows that Thailand is closely connected with many developed economies located at the core of the global diaspora network. Most of these developed economies are also active in international trades. The contradictory findings imply that Thailand may possess unrealised advantage to benefit from the international trade opportunities. In this aspect, Thailand should implement diaspora engagement measures which target at those HSDs who have the willingness and capabilities to contribute to the international trade relations of their home country (Thailand Board of Investment, 2017).

The Thai government has launched the Thailand 4.0 in 2016, aiming to transform the county into a value-based, innovation driven and digitally advanced economy (Thailand Board Of Investment, 2017, pp. 3-5; The Government Public Relations, 2017; Theparat and Arunmas, 2018). It is recommended that the Thai government should capitalise on the extensive connectivity of its diaspora network, in order to mobilise Thai HSDs to mediate knowledge, technological know-how, and international trade opportunities between heterogenous groups of destination countries. The intense interaction between Thai HSDs and talents from diversified countries are able to create new economic opportunities and innovative ideas, which are beneficial for the acceleration of economic transformation under the Thailand 4.0 (Foreign Office, the Government Public Relations, 2018).

5.2.3 Key Findings and recommendations for the Philippines

The spatial distributions of the HSDs from the Philippines were positively influenced by the international trade relations, the existing diasporas, the development gaps and the populous destinations. However, the magnitudes of the positive influences were either moderate or low relative to other ASEAN-5 countries. The reason being that a substantial number of the Philippines HSDs, approximately 47.1% were overseas Filipino Workers (OFW), whose jobs were secured by pre-arranged or *ex-ante* contracts (Camroux, 2008; OECD, 2015, p. 95; OECD, 2017, p. 46, 168). The HSDs who worked as OCWs might be less responsive to the various macro-determinants investigated by this study.

However, the centrality analysis in PART II shows that positional advantage of the Philippine in the global diaspora network is second to Thailand and higher than other ASEAN-5 countries. According to the centrality analysis, the Philippines, like Thailand is among the top 30 countries which are closely linked to other countries/economies in the global diaspora network. The strong connectivity enables the Philippines to locate various diaspora resources promptly and to harness them from heterogeneous source in the global diaspora network.

In addition, the brokerage analysis also shows that the Philippines, like Thailand can play active brokerage roles for various diaspora resources. The Philippines is especially capable of mediating the transmission of innovation activities between destinations. It is recommended that the Philippine government should leverage on the strong connectivity in the global diaspora network to increase the effectiveness of the current diaspora engagement initiatives, particularly by engaging Filipino HSDs to transfer innovative solutions and technological collaboration opportunities from heterogeneous sources of developed and emerging economies. For example, to intensify the interactions with migrant Filipino scientists and technologists, in order to optimise the effectiveness of *Balik* Scientist Programme through the technology transfer from a more diversified source of countries. The government can also engage Filipino HSDs to contribute to the Startup Ecosystem Development Programme by channelling entrepreneurship, business opportunities, expertise and knowledge from heterogeneous source of countries, in order to help creating a resilient ecosystem for the technological new start-ups (Meulen, 2016; Asis, 2017; Caunan, 2017; OECD, 2017, p. 58; Barret, 2019; Department of Trade and Industry Philippines, 2019).

The brokerage analysis also shows that the Philippines is able to play active mediating roles for diaspora resources transmitted between populous and developed destinations. Thus, the government, business organisations and industries of the Philippines should proactively reach out to their HSDs, in order to turn them into transnational entrepreneurs who open overseas markets for the products and services from the home country (Asis, 2017; OECD, 2017, p. 159).

5.2.4 Key Findings and recommendations for Malaysia

The spatial distribution of the HSDs from Malaysia was found to be relatively responsive to the international trades between destinations and their home country. However, the populous destinations and development gaps had less influence on the HSDs from Malaysia as compared to Thailand, Indonesia and the Philippines. The smaller influence of populous destinations implies that Malaysian HSDs might be less interested in the entrepreneurial opportunities in the populous destinations. Previous studies also found that the primary objective of Malaysian HSDs is to work abroad as professionals or highly skilled workers, whose major concerns would be the overseas income levels and working environment rather than the entrepreneurial opportunities of setting up business ventures (World Bank, 2011, p. 125; Saieed, 2017; Sukumaran, 2017).

The magnitude of the elasticity to the development gaps for Malaysia was the second lower after Singapore. This can be interpreted by the inverted-U relationship between migration and development levels, which shows that the emigrants from more developed countries are less influenced by the development gaps with destinations (Czaika and de Haas, 2014; OECD, 2016, p. 31; Idu, 2019). The development level of Malaysia was the second highest after Singapore among ASEAN-5. Thus, the influence of development gaps on the spatial distributions of the HSDs from Malaysia is reasonably smaller than that of Indonesia, Thailand and Philippines.

The relatively strong influence of international trade relations indicates that Malaysian HSDs rely on the economic ties of their home country to locate overseas employment opportunities and to understand the working environment abroad (Globerman and Shapiro, 2008; Campaniello, 2014; Jut, 2015). This implies that the Malayian government should engage the HSDs' familiarity with the international trade relations and practices to strengthen the bilateral trades between destinations and Malaysia.

Malaysia is striving to escape the middle income trap (World Bank, 2011, p. 45; Ho and Tyson, 2011; Rosli, 2019) and to accelerate its technological advancement under the Fourth Industrial Revolution (4IR) (Habibu, 2019; Wong and Day, 2019; Talent Corporation Malaysia Berhad, 2019). However, the efforts of Malaysian government and industries to engage their HSDs to achieve the above goals might be dampened by the findings of this study in PART II. It is found that Malaysia was linked to less heterogeneous sources of destinations through their HSDs, implying a weaker network position than Thailand and the Philippines in the global diaspora network. It is recommended that the government of Malaysian should optimise the existing diaspora networks by intensifying the economic interactions between its HSDs and various stakeholders from the home country, such as the relevant government agencies, embassies, business organisations, professional bodies and research institutions (Talent Corporation Malaysia Berhad, 2018, p. 9). In addition, the diaspora engagement initiatives of Malaysia should not only introduce the career opportunities in Malaysia to the HSDs, but also encouraging them to help Malaysia tapping the overseas resources, including international trade opportunities from the destinations (World Bank, 2015, p. 12-13; Borneo Post Online, 2019).

5.2.5 Key Findings and recommendations for Indonesia

The spatial distributions of the HSDs from Indonesia were found to be strongly driven by the development gaps and international trade relations as compared to other ASEAN-5. The positive influence of the populous destinations was also the second strongest among ASEAN-5. The previous studies stated that the Indonesian HSDs were mainly composed of previous students who stayed on for overseas occupations or highly skilled emigrants who sought international working experience (Buchori, 2011; Gusnelly (2012), Welcker (2016), Darson (2017) and Setijadi (2017). The developed economies and populous destinations can provide ample job opportunities for the Indonesian HSDs. The international trade partners of Indonesia are also the major sources for Indonesian HSDs to obtain information pertaining overseas career opportunities and working environment (Campaniello, 2014; Jut, 2015).

Thus, PART I of this study found that Indonesian HSDs are potential contributors for various types of diaspora resources to their home country, including the economic opportunities in populous and advanced destinations, and the bilateral trade opportunities from the destinations. However, the analysis in PART II showed that Indonesia has occupied a less central position in the global diaspora network, indicating that it has weaker connectivity to other countries than Thailand, the Philippines and Malaysia.

The brokerage analysis in PART II also reveals that Indonesia is only able to mediate diaspora resources for a less heterogeneous pool of destinations. Consequently, Indonesia is found to be less capable to mediate knowledge and economic opportunities between groups of destinations through their HSDs. This might dampen the efforts of Indonesia in engaging their HSDs to contribute to the infrastructure development under the Master Plan for Acceleration of Indonesia Economic Development (MP3EI), which requires the transfers of state-of-the-art technology, knowledge and business opportunities from developed countries (Coordinating Ministry for Economic Affairs, Republic of Indonesia, 2011, p. 31-44; Antara News, 2013; Al'ayubby, 2018; Salim and Negara, 2018).

This study found that Indonesia has retained a strong link with its former colonising country, the Netherlands. Thus, it is recommended that

Indonesian government should formulate measures to engage their HSDs to intensify the economic interactions with the Netherlands (Setijadi, 2017). PART II shows that the Netherlands is one of the developed countries closely connected to other countries/economies in the global diaspora network. The Indonesian HSDs in the Netherlands should be engaged to form business, technical and professional networks with highly skilled immigrants from other places of origin, especially advanced countries/economies. Such networks between Indonesian HSDs and other countries/economies are important for Indonesia to extend its global economic outreach, in order to transfer overseas technology, expertise and economic opportunities for the development of four main areas under MP3EI, i.e. energy, maritime and transportation, food sovereignty, and public housing (Al'ayubby, 2018; Salim and Negara, 2018). Thus, this study further recommends that the Indonesian Diaspora Network (IDN), a government-promoted civil society initiative should play a more proactive role to connect Indonesian HSDs with highly skilled migrants originated from other countries (Welcker, 2016; Harijanti, Dewansyah, Abdurahman and Dramanda, 2018; Indonesian Diaspora Network, 2018).

5.2.6 Key Findings and recommendations for Singapore

The spatial distribution of HSDs from Singapore was significantly driven by the international trade relations between destination and home countries. This is an evidence for the HSDs from Singapore, like Indonesia, Malaysia and the Philippines to rely on the economic ties of their home country to obtain vital information of employment opportunities and working environment in the destinations (Campaniello, 2014; Jut, 2015). It is also found that the existing diasporas have strongest positive influence on the spatial distribution of HSDs from Singapore than other ASEAN-5 countries, indicating the existence of relatively strong interactions between Singaporean diasporas and the highly skilled persons in their home country (Ho and Boyle, 2015).

However, it is found that the spatial distribution of the Singaporean HSDs was not significantly driven by population sizes of the destinations. This implies that the HSDs were not attracted by entrepreneurial opportunities in the populous destinations. This could be explained by the study of Singapore Polytechnic (2014) and Hoong (2017), which stated that the primary motives for highly skilled emigrants from Singapore were better job prospects and less stressful lifestyle.

One of the important development agendas of Singapore is to maintain the country's status as a global hub for financial services, knowledge creation and innovation activities (National Population and Talent Division, 2013; Ho and Boyle, 2015; HR in Asia, 2016). However, this study found that the efforts of Singapore to engage its HSDs as global links for international economic expansion might be dampened by the weak network position and connectivity in the global diaspora network. This implies that Singapore is connected to less heterogeneous source of developed and emerging economies situated at the core region of the global diaspora network. Similarly, the weak connectivity also results in the smallest size of ego-network of Singapore among ASEAN-5, limiting its capacity to mediate diaspora resources between destinations. This will dampen the efforts of engaging the HSDs as global links for the businesses in Singapore (Saha, 2009; Ho and Boyle, 2015).

It is recommended that the policy makers of Singapore should maintain its open door policy, which compensates for their brain drain with inflows of expatriate talents from diversified countries of origin. The open door policy is a powerful gateway to absorb economic opportunities and innovative ideas from heterogeneous sources across the world (Saha, 2009; Rikvin, 2012; Siau, 2018).

5.3 Implications of the Study

The study contributes to discover the heterogeneity in the migratory motives and destinations of the HSDs from ASEAN-5. This also reflects the heterogeneity of the diaspora resources accessible by ASEAN-5. For examples, the HSDs of Thailand, Indonesia and the Philippines were inclined to move into populous destinations and advanced economies, whereas the HSDs of Indonesia, Malaysia and Singapore had higher preference for destinations which have active bilateral trades with their home countries. The study found that Thailand, the Philippines and Malaysia can play a more active role in promoting the intra-regional mobility of highly skilled persons within the ASEAN Economic Community (AEC), whereas the strong HSD links of Indonesia with South Africa could become an entry point for ASEAN-5 to gain access to the market of African continent.

In addition, the HSDs of Thailand and the Philippines were found to be less influenced by crowding effects from the highly innovative destinations than Indonesia, Malaysia and Singapore. Although this cannot prove that the HSDs from Thailand and the Philippines are more attracted to the innovation opportunities in the destinations, the previous studies had shown that the two countries have substantial numbers of HSDs in science, technology and innovation related fields. The HSDs are also keen to contribute their knowledge and experience to the technological advancement and technopreneurship development of their home countries (Agunias and Newland, 2012, pp. 171-172; MPI, 2014; ILO, 2015; Raksaphaeng, 2016; Caunan, 2017).

The heterogeneity in the diaspora resources and HSD links suggests that ASEAN-5 should establish a collaborative platform to interconnect each other's HSDs, in order to pool together their expertise, knowledge, innovative ideas, professional networks and economic opportunities. The collaborative platform will bolster the diaspora engagement capabilities of ASEAN-5, enabling them to capture diaspora resources from more heterogeneous sources of destinations. The existing examples of such collaborative platforms in the world include: the African Diaspora Policy Centre (African Diaspora Policy Centre, 2011, 2019a, 2019b), a think tank which mobilises the African diasporas in Europe to contribute to the development of Africa; and the European Network on Migration and Development (EUNOMAD), a platform formed by 10 countries of European Union (EU) to jointly promote the intra-EU migrants to participate in the development of their home countries

(Keusch and Schuster, 2012; European Network on Migration and Development [EUNOMAD], 2019).

As the proposed collaborative platform would allow ASEAN-5 to draw from a heterogeneous pool of overseas talents, it can strengthen the connectivity to technological hubs scattering across the diasporic destinations (Ministry of International Trade and Industry, 2016). The scientific and innovation activities have been increasingly clustered in a number of technological hubs widely dispersed around the world (Royal Society, 2011, p. 5-6, 41; Mckenzie, 2017). The innovations and technological breakthroughs are taking place at an exponential pace under the 4^{th} Industrial Revolution (4IR) (Schwab, 2015; Xu, David and Kim, 2018). Thus, the joint diaspora network can bolster the capabilities of ASEAN-5 to absorb new technology, innovative ideas and economic opportunities, which are crucial to integrate their domestic industries into the global value chains. Through the collaborative platform, the ASEAN-5 can also promote their HSDs to contribute to the innovation and value added activities in the AEC.

The study conceives a new strategic thinking for the diaspora engagement initiatives. The extant literature on diaspora engagement focuses on the characteristics of diasporas such as their spatial distributions, migratory motives and expertise (Agunias and Newland, 2012, p. 27-29; Cheng, 2016). This shows that the contemporary strategies focus on the destinations of HSDs without further considering the HSD links which connect their destinations to other countries (OECD, 2012, p. 24-37; Ragazzi, 2014; Sinatti and Horst, 2015). By operationalising the concepts of DKNs (Meyer, 2007; Ho and Boyle, 2015; OECD, 2016, p. 37) and transnational entrepreneurship (Sabel and Saxenian, 2008; Tung, 2008; Bagwell, 2015; Sommer and Gamper, 2018) through the flow model of SNA, this study demonstrates that HSDs can also gain access to heterogeneous ideas, knowledge and economic opportunities channelled into their destinations by highly skilled immigrants from other countries.

Hence, this study goes beyond the direct HSD links between destination and home countries. It looks at the interconnectivity between countries/economies from the perspective of global diaspora network (Danchev and Porter, 2018; Windzio, 2018). Based on the novel strategic thinking, this study contributes to the investigation of developmental roles of HSDs through their mediation activities in receiving, creating and diffusing diaspora resources among heterogeneous groups of destination countries (Meyer, 2007; Malecki, 2017).

The new strategic thinking implies that diaspora engagement initiatives should prioritise destinations which are also highly attractive to highly skilled immigrants from other countries. This is because the HSDs in these destinations will have greater opportunities to interact with talented people originated from diversified backgrounds, in terms of their expertise, innovative ideas, economic opportunities and cultural upbringings. This strategic insight coincides with the notion that interactions among highly skilled persons from different parts of the world lead to the creation of new knowledge, innovative solutions and economic opportunities (Gamlen, 2005, p. 7; Meyer, 2007; OECD, 2008, p. 47; Oettl and Agrawal, 2008; World Bank, 2011, p. 131; Kerr, Kerr, Ozden and Parsons, 2016).

5.4 Limitations of the Study

This study investigated the diaspora resources of ASEAN-5 and developmental roles of the HSDs from a macro perspective. However, there are a few limitations which should be highlighted. The first limitation is the dataset used in this study, i.e. the DIOC-E 2010 (Version 1.0) published by OECD. Although DIOC-E is the most updated dataset available for international migration as noted by previous studies (Dumont, Spielvogel and Windmaier, 2010; Arslan et al, 2014; Artuc, Docquier, Özden and Parsons, 2015), it did not provide information on the types of expertise, professions and industries of the HSDs. The limitation impedes more detailed studies on the development roles and diaspora resources of the HSDs. It is suggested that ASEAN countries should set up a joint initiative under AEC to collect and compile detailed data on the characteristics, spatial movements and locations of the HSDs. The detailed dataset is essential for ASEAN countries to implement the more effective diaspora engagement targeted at technology transfer and industrial development.

The second limitation is that the macro-approach of the study is unable to examine the dynamics of the interaction between HSDs and their counterparts in the home country at micro-level. For instances, the knowledge transfers between HSDs of certain expertise or professions and the highly skilled individuals, business unites or industries in the home country. The limitation is also related to the unavailability of more detailed dataset on the international migration. The SNA method employed in this study is a powerful tool to analyse the creation and diffusion of knowledge in the networks of individuals, organisations or countries (Neto, Correia, Pinto and Aguiar, 2008; Whittington, Owen-Smith and Powell, 2009; Maggioni and Uberti, 2011; Long, Cunningham and Braithwaite, 2013; Dawn, 2016; Micleusanu, 2017). However, the unavailability of detailed dataset could hinder the more in-depth SNA study on the development role of HSDs according to their transnational activities at micro-level. It is suggested that ASEAN countries should undertake joint efforts to survey the existing and potential business, professional and scientific networks between their HSDs and ASEAN region as well as between the HSDs and other countries. The joint survey is essential to map out the international networks of the HSDs from ASEAN region according to their professions, expertise and industries.

The third limitation is that this study was based on cross-sectional data, which was unable to examine the intertemporal variations in the spatial distribution of HSDs and the evolution of the structure of global diaspora network. The limitation is due to the absence of comprehensive time series data on the characteristics and cross-border movements of highly skilled persons. The collection and compilation of more comprehensive database on international migration, for example the DIOC-E 2010 (Version 1.0) used in this study has been a recent effort (OECD, 2010; 2011; 2016, p. 116). This limitation could only be overcome until the availability of time series or historical data for a longer period.

The fourth limitation is that this study did not investigate the influence of the immigration policies of destinations on the spatial distribution of HSDs. The previous studies show that most countries, particularly developed nations have relaxed their restriction on immigration of highly skilled persons since the 2000s due to the escalating global competition for talents (OECD, 2008, p. 127-136; Beine, Docquier and Özden, 2011b; Ghani, 2018). The contemporary restrictive immigration policies are no longer targeted at highly skilled immigrants but low skilled labours, illegal workers and irregular migrants, such as refugees and asylum seekers (de Haas, Natter and Vezzoli, 2015, 2018). However, the highly skilled immigrants may still encounter the selective immigration policies of the destinations, which are designed to select the immigrant talents with particular types of professions, skills or expertise as demanded by the destinations (Arslan, Dumont, Kone, Ozden, Parsons and Xenogiani, 2016; Kone and Ozden, 2017; Ghani, 2018). However, the influence of the selective immigration policies cannot be examined without the micro-level data on HSDs' professions, expertise and skills (de Haas, Natter and Vezzoli, 2015, 2018). In addition, there is also lack of standardised measures to compare the selective immigration policies among countries (Beine, Bertoli and Fernandez-Huertas Moraga, 2014; de Haas, Natter and Vezzoli, 2015, 2018). To overcome this limitation for future studies, ASEAN-5 should work closely with international organisations such as International Migration Institute (IMI) to establish database and indicators for the immigration policies implemented by the major destinations of HSDs from ASEAN region (DEMIG, 2015). Such indicators or measurements are essential to understand how the selective immigration policies would affect the choice of destinations by HSDs classified according to their expertise, professions and industries.

The fifth limitation is attributed to the focus of the present study on the pulling forces of diaspora resources, which are reflected by the development gaps and differentials in economic opportunities between destination and home countries. However, the push factors from home countries such as political instability, social inequality and racial or religious conflicts may be influential in motivating highly skilled persons to leave their home countries. Such push factors are also associated with the sense of attachment, national allegience and emotional ties of the HSDs to their home countries, thus also affecting the effectiveness of the efforts to reach out and engage them (Mamat, 2014; Koh, 2015; Van Hear, Bakewell and Long, 2018). As the primary objective of this study is to investigate the influence of the economic attraction between countries on the spatial distribution of HSDs, the push factors assoicated with the political, social and racial conditions of home countries were not examined. Although future studies could include such push factors as determinants or control variables in the gravity model, the researchers would have to find a solution to measure such sentimental, pyschological and subjective factors quantitatively.

The last limitation is concerning the definition of HSDs as highly skilled emigrants aged 25 and above (+25). The definition is widely used by researchers in the relevant fields in order to focus on HSDs who are economically active and looking for overseas career and employment opportunities (Beine, Docquier and Ozden, 2011a; World Bank, 2011, p. 85; Ataselim, 2014; Artuc, Docquier, Ozden and Parsons, 2015; Fok, Cheng and Tan, 2018). However, such generalisation might play down the influence of certain HSDs who are former international students and staying on in destination countries after the completion of their study. The migratory motive of this group of HSDs might be more complicated and not only driven by the economic gaps between destination and home countries. The expansion of the present study by isolating HSDs who are former international students and including the current international students might enrich the discovery of the migratory motives and diaspora resources.

5.5 Recommendations for Future Research

The future study at micro level is essential to deepen the understanding of the roles of HSDs in networking the highly skilled persons, businesses, innovation activities and technological hubs across countries. Such knowledge is crucial for the home country to engage their HSDs in the technological advancement and business innovations under the 4IR (Mckenzie, 2017). This study recommends that the governmental agencies, research institutes and industrial organisations of the ASEAN-5 should undertake in-depth mappings on the spatial distributions and transnational links of the HSDs according to their expertise, occupations, economic activities and industries (Tanpipat, 2015; OECD, 2019, p. 60).

This study further recommends improving the neo-classical theoretical framework on the migration-development interaction. Docquier and Rapoport (2012) show that HSDs reside in advanced economies can contribute to the economic development of their home country. However, their theoretical model only accounts for the development impacts which increase proportionately to the size of the diaspora stock in destinations. This study suggests that economists should incorporate a more complex structure of diaspora network, which models the interaction of HSDs from different countries of origin in a given destination (Rapoport, 2016, 2018). The proposed model is expected to show that the increased heterogeneity in the diaspora resources will further stimulate the economic growth of the home country. The idea of a more complex network structure could also be extended to model the endogeneity of innovation networks, international trade relations or the interdependence in the international financial market. The modified model is believed to be able to describe the economic trajectory under the impacts of 4IR (Menon and Fink, 2017; Fink and Gentile, 2019).

5.6 Conclusion

The objective of the study is to fill the knowledge gaps between 1) the diaspora engagement efforts of ASEAN-5 and the potential diaspora resource of HSDs and 2) the engagement of diaspora resources and the connectivity of ASEAN-5 with other countries/economies through their HSDs.

The study developed an analytical framework which integrated the neo-classical models on migration-development interaction and the social scientists’ studies on the transnational phenomenon of HSDs. The analysis was carried out in two parts, i.e. PART I and PART II. PART I investigated the macro-determinants of the spatial distribution of the HSDs from ASEAN-5. The study analysed the driving forces which drew HSDs to their migratory destinations. The analysis identified the potential diaspora resources which could be tapped by ASEAN-5 from the diasporic destinations. PART II extended the findings of PART I on the diaspora resources of ASEAN-5, to further examine how the positions and connectivity of ASEAN-5 in the global diaspora network could affect their capabilities to engage the diaspora resources. Although in this study, the analytical approach was developed for the ASEAN-5 countries, the approach can be generalised to other countries or a wider context, for example, the diaspora networks connecting geographical regions or economic blocks.

The novel research approach has contributed to various academic insights, which could inspire further studies on the highly skilled emigration and diaspora engagement strategies of ASEAN-5. The study had found heterogeneity in the migratory motives and diaspora resources among ASEAN-5. Thailand and the Philippines were found to be more capable than

Indonesia, Malaysia and Singapore to harness diaspora resources from heterogeneous sources of destinations.

Based on the analysis outcomes, this study recommends diaspora engagement strategies targeted at enhancing the existing engagement initiatives and supporting the developmental agenda of ASEAN-5. Thailand is found to possess strong connectivity in the global diaspora network and play active brokerage roles between destinations. It is recommended that the government of Thailand should design policy measures to encourage its HSDs to become transnational entrepreneurs who contribute to the international trades of the home country. Thailand can also engage its HSDs as diaspora knowledge networks (DKNs) to mediate innovation activities between heterogeneous countries, in order to channel innovative ideas and solutions for the economic transformation and technological advancement under the Thailand 4.0 (Thailand Board Of Investment, 2017, pp. 3-5; The Government Public Relations, 2017; Theparat and Arunmas, 2018).

Similar to Thailand, the Philippines possesses advantageous position in the global diaspora network and play active brokerage roles among destinations. It is recommended that the Philippine government should mobilise its overseas talents of science and technology (S&T) to channel new opportunities of scientific collaboration to their home country, in order to enhance the existing diaspora engagement initiatives for technology transfer and technopreneurship development (MPI, 2014; Caunan, 2017). The HSDs should also be engaged to help establishing a resilient ecosystem for technology start-ups in the Philippines (Asis, 2017; Caunan, 2017; OECD, 2017, p. 58; Barret, 2019; Department of Trade and Industry Philippines, 2019). In addition, the HSDs from the Philippines in populous countries and large trading economies should also be engaged as transnational entrepreneurs to open new markets for the products and services of their home country.

Malaysia possesses moderate positional advantage among ASEAN-5 in the global diaspora network. It has network proximity with a smaller number of advanced economies than Thailand and the Philippines but larger than Indonesia and Singapore. It is recommended that Malaysian government should take more proactive action to utilise the existing HSD links to advanced economies, including United States, United Kingdom, Australia and Singapore, in order to gain access to the overseas business opportunities and technological innovation. The existing HSD links are also instrumental for Malaysia to mediate economic opportunities and knowledge between destinations, which can contribute to enhance Malaysia's status as a regional hub for business and innovation activities (Performance Management and Delivery Unit, 2015, pp. 158-173; PricewaterhouseCoopers, 2015).

Indonesia is located at a relatively periphery positon in the global diaspora network, implying that it has network proximity to a relatively small number of advanced economies. It is recommended that Indonesian government should focus on strengthening the HSD links with Netherlands, Norway, United States, Sweden, Australia and South Africa, which possess strong connectivity in the global diaspora network. The HSDs in these destinations should be encouraged to form business and scientific networks with immigrant talents from other countries, in order to channel heterogeneous business opportunities and innovation activities to the economic transformation programmes of MP3EI (Al'ayubby, 2018; Salim and Negara, 2018).

Singapore is found to possess the weakest network connectivity among ASEAN-5. This might dampen Singapore's endeavour to make its HSDs as the global links for the economic development. It is suggested that the government of Singapore should maintain its 'open door' policy to attract expatriate talents from other countries, in order to receive heterogeneous economic opportunities, know-how and innovative ideas from different parts of the world (Saha, 2009; Rikvin, 2012; Siau, 2018).

The research outcomes lead to two major strategic insights. The first strategic insight is that ASEAN-5 should form a collaborative platform to pool together the expertise, knowledge, professional networks and economic opportunities of their HSDs. The collaborative platform will interconnect the HSDs from ASEAN-5 and thus extend the reaching of ASEAN-5 in the global diaspora network. The collaborative platform is expected to bolster the capability of ASEAN-5 to channel heterogeneous economic resources to their respective countries.

The second strategic insight is that ASEAN-5 should focus on destinations which are popular to the highly skilled immigrants from other countries, as the HSDs in these destinations could interact and connect with talented people who bring along knowledge and economic opportunities from diversified backgrounds.

For future study, it is recommended that ASEAN-5 should carry out in-depth study on the HSDs' transnational networks with their home countries according to their expertise, occupations and industries. Such knowledge is essential to develop focused strategies for the diaspora engagement initiatives of ASEAN-5.

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Appendix A

Estimation of the Highly Skilled Diasporas (HSDs) of Indonesia, the Philippines and Thailand in Singapore in 2010

The HSDs of Indonesia, Philippines and Thailand in Singapore in 2010 are estimated by the following formula:

$$HSDSGP_i = [IMS_i] * [HSE_i]$$

Whereas,

i	=	Indonesia, Philippines or Thailand
$HSDSGP_i$	=	HSDs from country i and residing in Singapore
IMS_i	=	Immigrants stock from country i in Singapore (United Nations, Department of Economic and Social Affairs, 2013)
HSE_i	=	Proportion (%) of the country i's emigrants which were HSDs (OECD, 2015, p. 80, 84, 92, 100)

Based on the above formula, the size of HSDs in Singapore from country *I* was estimated as follows:

Country *i*	IMS_i	HSE_i	$HSDSGP_i$
Indonesia	136, 979	0.128	17,533
Philippines	12, 820	0.470	6,025
Thailand	15, 658	0.273	4,275

Appendix B

ISO ALPHA-3 Code for Countries/Areas

ISO ALPHA-3 codes (ISO 3166-1 alpha-3 codes) are three-letter country codes from the ISO 3166-1 standard for countries and dependent territories. They are published by the International Organization for Standardization (ISO) as part of its ISO 3166 standard. They were first included as part of the ISO 3166 standard in its first edition in 1974.

ISO ALPHA-3 code	Country or area name	ISO ALPHA-3 code	Country or area name
ABW	Aruba	CYM	Cayman Islands
AFG	Afghanistan	CYP	Cyprus
AGO	Angola	CZE	Czech Republic
AIA	Anguilla	DEU	Germany
ALA	Åland Islands	DJI	Djibouti
ALB	Albania	DMA	Dominica
AND	Andorra	DNK	Denmark
ANT	Netherlands Antilles	DOM	Dominican Republic
ARE	United Arab Emirates	DZA	Algeria
ARG	Argentina	ECU	Ecuador
ARM	Armenia	EGY	Egypt
ASM	American Samoa	ERI	Eritrea
ATG	Antigua and Barbuda	ESH	Western Sahara
AUS	Australia	ESP	Spain
AUT	Austria	EST	Estonia
AZE	Azerbaijan	ETH	Ethiopia
BDI	Burundi	FIN	Finland
BEL	Belgium	FJI	Fiji
BEN	Benin	FLK	Falkland Islands (Malvinas)
BFA	Burkina Faso	FRA	France
BGD	Bangladesh	FRO	Faeroe Islands
BGR	Bulgaria	FSM	Federated States of Micronesia
BHR	Bahrain	GAB	Gabon
BHS	Bahamas	GBR	United Kingdom
BIH	Bosnia and Herzegovina	GEO	Georgia
BLM	Saint-Barthélemy	GGY	Guernsey
BLR	Belarus	GHA	Ghana
BLZ	Belize	GIB	Gibraltar
BMU	Bermuda	GIN	Guinea
BOL	Bolivia	GLP	Guadeloupe
BRA	Brazil	GMB	Gambia
BRB	Barbados	GNB	Guinea-Bissau
BRN	Brunei Darussalam	GNQ	Equatorial Guinea
BTN	Bhutan	GRC	Greece
BWA	Botswana	GRD	Grenada
CAF	Central African Republic	GRL	Greenland
CAN	Canada	GTM	Guatemala
CHE	Switzerland	GUF	French Guiana
CHL	Chile	GUM	Guam
CHN	China	GUY	Guyana
HKG	Hong Kong	MHL	Marshall Islands

ISO ALPHA-3 code	Country or area name	ISO ALPHA-3 code	Country or area name
HND	Honduras	MKD	The former Yugoslav Republic of Macedonia
HRV	Croatia	MLI	Mali
HTI	Haiti	MLT	Malta
HUN	Hungary	MMR	Myanmar
IDN	Indonesia	MNE	Montenegro
IMN	Isle of Man	MNG	Mongolia
IND	India	MNP	Northern Mariana Islands
IRL	Ireland	MOZ	Mozambique
IRN	Iran	MRT	Mauritania
IRQ	Iraq	MSR	Montserrat
ISL	Iceland	MTQ	Martinique
ISR	Israel	MUS	Mauritius
ITA	Italy	MWI	Malawi
JAM	Jamaica	MYS	Malaysia
JEY	Jersey	MYT	Mayotte
JOR	Jordan	NAM	Namibia
JPN	Japan	NCL	New Caledonia
KAZ	Kazakhstan	NER	Niger
KEN	Kenya	NFK	Norfolk Island
KGZ	Kyrgyzstan	NGA	Nigeria
KHM	Cambodia	NIC	Nicaragua
KIR	Kiribati	NIU	Niue
KNA	Saint Kitts and Nevis	NLD	Netherlands
KOR	Republic of Korea	NOR	Norway
KWT	Kuwait	NPL	Nepal
LAO	Laos	NRU	Nauru
LBN	Lebanon	NZL	New Zealand
LBR	Liberia	OMN	Oman
LBY	Libyan Arab Jamahiriya	PAK	Pakistan
LCA	Saint Lucia	PAN	Panama
LIE	Liechtenstein	PCN	Pitcairn
LKA	Sri Lanka	PER	Peru
LSO	Lesotho	PHL	Philippines
LTU	Lithuania	PLW	Palau
LUX	Luxembourg	PNG	Papua New Guinea
LVA	Latvia	POL	Poland
MAC	Macao	PRI	Puerto Rico
MAF	Saint-Martin (French part)	PRK	Democratic People's Republic of Korea
MAR	Morocco	PRT	Portugal
MCO	Monaco	PRY	Paraguay
MDA	Moldova	PSE	Occupied Palestinian Territory
MDG	Madagascar	PYF	French Polynesia
MDV	Maldives	QAT	Qatar
MEX	Mexico	REU	Réunion
ROU	Romania	VEN	Venezuela
RUS	Russian Federation	VGB	British Virgin Islands
RWA	Rwanda	VIR	United States Virgin Islands
SAU	Saudi Arabia	VNM	Viet Nam
SDN	Sudan	VUT	Vanuatu
SEN	Senegal	WLF	Wallis and Futuna Islands
SGP	Singapore	WSM	Samoa
SHN	Saint Helena	YEM	Yemen
SJM	Svalbard and Jan Mayen Islands	ZAF	South Africa
SLB	Solomon Islands	ZMB	Zambia
SLE	Sierra Leone	ZWE	Zimbabwe
SLV	El Salvador		
SMR	San Marino		

ISO ALPHA-3 code	Country or area name	ISO ALPHA-3 code	Country or area name
SOM	Somalia		
SPM	Saint Pierre and Miquelon		
SRB	Serbia		
STP	Sao Tome and Principe		
SUR	Suriname		
SVK	Slovakia		
SVN	Slovenia		
SWE	Sweden		
SWZ	Swaziland		
SYC	Seychelles		
SYR	Syrian Arab Republic		
TCA	Turks and Caicos Islands		
TCD	Chad		
TGO	Togo		
THA	Thailand		
TJK	Tajikistan		
TKL	Tokelau		
TKM	Turkmenistan		
TLS	Timor-Leste		
TON	Tonga		
TTO	Trinidad and Tobago		
TUN	Tunisia		
TUR	Turkey		
TUV	Tuvalu		
TZA	United Republic of Tanzania		
UGA	Uganda		
UKR	Ukraine		
URY	Uruguay		
USA	United States of America		
UZB	Uzbekistan		
VAT	Holy See		
VCT	Saint Vincent and the Grenadines		

Appendix C

Estimation Output of Eviews for the Determinants of M_{jk} for Indonesia in 2010

Indonesia, 2010

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 03/27/18 Time: 22:48
Sample: 1 92
Included observations: 92
Convergence achieved after 10 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-40.90627	0.374659	-109.1827	0.0000
LPJPK	0.604870	0.016459	36.74931	0.0000
LSTOCK1	0.256280	0.002667	96.10233	0.0000
LDIST	0.878179	0.024151	36.36177	0.0000
LGDPPCR	1.609155	0.020692	77.76876	0.0000
LINNOVR1	-0.773220	0.006994	-110.5560	0.0000
LTRADE1	1.052479	0.012874	81.75546	0.0000
UNEMPR	-0.327127	0.012379	-26.42583	0.0000
RTA	-0.125583	0.010212	-12.29798	0.0000
CUL	0.757592	0.567061	1.335997	0.1816
COL	1.154379	0.017913	64.44393	0.0000

R-squared	0.974055	Mean dependent var	1771.533
Adjusted R-squared	0.970852	S.D. dependent var	6969.699
S.E. of regression	1189.928	Akaike info criterion	424.7093
Sum squared resid	1.15E+08	Schwarz criterion	425.0109
Log likelihood	-19525.63	Hannan-Quinn criter.	424.8310
Restr. log likelihood	-388353.7	LR statistic	737656.1
Avg. log likelihood	-212.2351	Prob(LR statistic)	0.000000

Appendix D

Estimation Output of Eviews for the Determinants of M_{jk} for Malaysia in 2010

Malaysia, 2010

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 03/27/18 Time: 22:49
Sample (adjusted): 2 92
Included observations: 91 after adjustments
Convergence achieved after 9 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.870876	0.317799	-2.740334	0.0061
LPJPK	0.285689	0.011621	24.58297	0.0000
LSTOCK1	0.718996	0.002548	282.2307	0.0000
LDIST	-1.789682	0.014035	-127.5167	0.0000
LGDPPCR	0.322793	0.011877	27.17724	0.0000
LINNOVR1	-0.860033	0.005849	-147.0508	0.0000
LTRADE1	0.865818	0.009324	92.86207	0.0000
UNEMPR	-0.232297	0.005591	-41.54709	0.0000
RTA	-2.337597	0.026846	-87.07558	0.0000
CUL	-134.6881	0.930741	-144.7106	0.0000
COL	0.100387	0.010159	9.881651	0.0000

R-squared	0.989948	Mean dependent var	3240.560
Adjusted R-squared	0.988691	S.D. dependent var	15314.61
S.E. of regression	1628.612	Akaike info criterion	541.9966
Sum squared resid	2.12E+08	Schwarz criterion	542.3002
Log likelihood	-24649.85	Hannan-Quinn criter.	542.1191
Restr. log likelihood	-833003.7	LR statistic	1616708.
Avg. log likelihood	-270.8774	Prob(LR statistic)	0.000000

Appendix E

Estimation Output of Eviews for the Determinants of M_{jk} for the Philippines in 2010

Philippines, 2010

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 03/27/18 Time: 22:51
Sample: 1 92
Included observations: 92
Convergence achieved after 9 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-32.90395	0.164680	-199.8050	0.0000
LPJPK	0.348127	0.004438	78.43524	0.0000
LSTOCK1	0.665425	0.001242	535.7443	0.0000
LDIST	1.661467	0.004381	379.2312	0.0000
LGDPPCR	0.446383	0.009431	47.33126	0.0000
LINNOVR1	-0.462045	0.003082	-149.9247	0.0000
LTRADE1	0.717536	0.002899	247.5088	0.0000
UNEMPR	-0.034980	0.005649	-6.192544	0.0000
RTA	0.258573	0.004026	64.22559	0.0000
CUL	-39.70479	0.316316	-125.5225	0.0000
COL	-1.411148	0.006819	-206.9572	0.0000

R-squared	0.993555	Mean dependent var	16754.29
Adjusted R-squared	0.992759	S.D. dependent var	102658.4
S.E. of regression	8735.662	Akaike info criterion	3988.395
Sum squared resid	6.18E+09	Schwarz criterion	3988.696
Log likelihood	-183455.2	Hannan-Quinn criter.	3988.517
Restr. log likelihood	-4771965.	LR statistic	9177019.
Avg. log likelihood	-1994.078	Prob(LR statistic)	0.000000

Appendix F

Estimation Output of Eviews for the Determinants of M_{jk} for Singapore in 2010

Singapore, 2010

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 03/27/18 Time: 22:51
Sample: 1 92
Included observations: 92
Convergence achieved after 9 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-13.58086	0.391581	-34.68213	0.0000
LPJPK	-0.018807	0.013415	-1.401949	0.1609
LSTOCK1	0.846354	0.005127	165.0753	0.0000
LDIST	0.820040	0.013283	61.73647	0.0000
LGDPPCR	0.032203	0.016784	1.918627	0.0550
LINNOVR1	-0.633460	0.010356	-61.17052	0.0000
LTRADE1	0.828505	0.011928	69.45621	0.0000
UNEMPR	-1.044440	0.020119	-51.91432	0.0000
RTA	-1.596064	0.036627	-43.57635	0.0000
CUL	-71.66472	1.046319	-68.49223	0.0000
COL	-0.727987	0.018834	-38.65237	0.0000

R-squared	0.992189	Mean dependent var	834.3043
Adjusted R-squared	0.991224	S.D. dependent var	3609.597
S.E. of regression	338.1430	Akaike info criterion	204.7348
Sum squared resid	9261597.	Schwarz criterion	205.0364
Log likelihood	-9406.803	Hannan-Quinn criter.	204.8565
Restr. log likelihood	-205381.8	LR statistic	391949.9
Avg. log likelihood	-102.2479	Prob(LR statistic)	0.000000

Appendix G

Estimation Output of Eviews for the Determinants of M_{jk} for Thailand in 2010

Thailand, 2010

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 03/27/18 Time: 22:52
Sample: 1 92
Included observations: 92
Convergence achieved after 7 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-23.97921	0.272876	-87.87597	0.0000
LPJPK	0.659349	0.009317	70.76651	0.0000
LSTOCK1	0.803777	0.004694	171.2249	0.0000
LDIST	0.224876	0.021256	10.57938	0.0000
LGDPPCR	0.791115	0.016774	47.16255	0.0000
LINNOVR1	-0.391399	0.006877	-56.91635	0.0000
LTRADE1	-0.030250	0.005343	-5.661786	0.0000
UNEMPR	0.005892	0.001949	3.023385	0.0025
RTA	0.464796	0.015078	30.82700	0.0000
CUL	-38.70317	1.677739	-23.06865	0.0000

R-squared	0.985514	Mean dependent var	1670.054
Adjusted R-squared	0.983924	S.D. dependent var	8835.333
S.E. of regression	1120.258	Akaike info criterion	345.4197
Sum squared resid	1.03E+08	Schwarz criterion	345.6939
Log likelihood	-15879.31	Hannan-Quinn criter.	345.5304
Restr. log likelihood	-411497.5	LR statistic	791236.4
Avg. log likelihood	-172.6012	Prob(LR statistic)	0.000000

Appendix H

Estimation Output of Eviews for Indonesia After replacing *LnINNOVr1* with *LnGERD/GDPr1*

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 07/04/19 Time: 23:42
Sample: 1 92
Included observations: 92
Convergence achieved after 10 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.26859	0.198491	-51.73329	0.0000
LnPJPK	-0.059843	0.013237	-4.520791	0.0000
LnSTOCK1	0.402677	0.002951	136.4620	0.0000
LnD	0.643696	0.021465	29.98795	0.0000
LnGDPPCR	0.973970	0.025900	37.60475	0.0000
LnGERD/GDPr1	-0.772752	0.020853	-37.05762	0.0000
LnTRADE1	0.734850	0.011964	61.42186	0.0000
UNEMPR	0.115870	0.011825	9.798380	0.0000
RTA	0.341912	0.012533	27.28083	0.0000
CUL	-6.849694	0.622438	-11.00462	0.0000
COL	0.417260	0.014699	28.38726	0.0000

R-squared	0.949847	Mean dependent var	1771.533
Adjusted R-squared	0.943656	S.D. dependent var	6969.699
S.E. of regression	1654.396	Akaike info criterion	542.9837
Sum squared resid	2.22E+08	Schwarz criterion	543.2852
Log likelihood	-24966.25	Hannan-Quinn criter.	543.1054
Restr. log likelihood	-388353.7	LR statistic	726774.9
Avg. log likelihood	-271.3723	Prob(LR statistic)	0.000000

Appendix I

Estimation Output of Eviews for Malaysia After replacing *LnINNOVr1* with *LnGERD/GDPr1*

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 07/04/19 Time: 23:43
Sample: 1 92
Included observations: 92
Convergence achieved after 9 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	19.94615	0.351333	56.77274	0.0000
LPJPK	-0.515431	0.012631	-40.80617	0.0000
LSTOCK1	0.865491	0.003143	275.3646	0.0000
LD	-0.922758	0.014701	-62.76822	0.0000
LGDPPCR	-0.435335	0.011680	-37.27331	0.0000
LGERD/GDPr1	-0.261629	0.020183	-12.96308	0.0000
LTRADE1	0.593108	0.012117	48.95030	0.0000
UNEMPR	-0.120202	0.006842	-17.56735	0.0000
RTA	-1.184223	0.031805	-37.23424	0.0000
CUL	-96.98872	1.093633	-88.68490	0.0000
COL	0.237511	0.014012	16.95079	0.0000

R-squared	0.992157	Mean dependent var	3205.337
Adjusted R-squared	0.991189	S.D. dependent var	15233.98
S.E. of regression	1429.950	Akaike info criterion	767.1884
Sum squared resid	1.66E+08	Schwarz criterion	767.4899
Log likelihood	-35279.66	Hannan-Quinn criter.	767.3100
Restr. log likelihood	-836226.5	LR statistic	1601894.
Avg. log likelihood	-383.4746	Prob(LR statistic)	0.000000

Appendix J

Estimation Output of Eviews for the Philippines
After replacing *LnINNOVr1* with *LnGERD/GDPr1*

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 07/05/19 Time: 00:38
Sample: 1 92
Included observations: 92
Convergence achieved after 8 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-15.48607	0.079605	-194.5364	0.0000
LPJPK	-0.089286	0.002550	-35.01085	0.0000
LSTOCK1	0.731865	0.001107	660.8526	0.0000
LD	1.663334	0.004312	385.7264	0.0000
LGDPPCR	0.220754	0.009494	23.25126	0.0000
LGERD/GDPr1	-0.813627	0.007598	-107.0887	0.0000
LTRADE1	0.588717	0.002628	224.0282	0.0000
UNEMPR	-0.005637	0.005813	-0.969692	0.3322
RTA	0.578149	0.004592	125.9121	0.0000
CUL	-35.43420	0.327562	-108.1755	0.0000
COL	-1.205946	0.006394	-188.6027	0.0000

R-squared	0.993210	Mean dependent var	16754.29
Adjusted R-squared	0.992371	S.D. dependent var	102658.4
S.E. of regression	8966.347	Akaike info criterion	4101.427
Sum squared resid	6.51E+09	Schwarz criterion	4101.729
Log likelihood	-188654.7	Hannan-Quinn criter.	4101.549
Restr. log likelihood	-4771965.	LR statistic	9166620.
Avg. log likelihood	-2050.594	Prob (LR statistic)	0.000000

Appendix K

Estimation Output of Eviews for Singapore
After replacing *LnINNOVr1* with *LnGERD/GDPr1*

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 07/05/19   Time: 00:41
Sample: 1 92
Included observations: 92
Convergence achieved after 8 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	8.903124	0.362886	24.53424	0.0000
LPJPK	-0.615495	0.013625	-45.17382	0.0000
LSTOCK1	1.109824	0.005792	191.6252	0.0000
LD	0.289405	0.015334	18.87279	0.0000
LGDPPCR	0.940880	0.026823	35.07753	0.0000
LGERD/GDPr1	-6.790745	0.103164	-65.82502	0.0000
LTRADE1	1.201425	0.015274	78.65789	0.0000
UNEMPR	-1.763886	0.024325	-72.51345	0.0000
RTA	-2.799968	0.043622	-64.18762	0.0000
CUL	-120.4232	1.481155	-81.30358	0.0000
COL	-2.098567	0.026422	-79.42571	0.0000

R-squared	0.993952	Mean dependent var	834.3043
Adjusted R-squared	0.993205	S.D. dependent var	3609.597
S.E. of regression	297.5423	Akaike info criterion	191.0914
Sum squared resid	7171044.	Schwarz criterion	191.3930
Log likelihood	-8779.207	Hannan-Quinn criter.	191.2131
Restr. log likelihood	-205381.8	LR statistic	393205.1
Avg. log likelihood	-95.42616	Prob(LR statistic)	0.000000

Appendix L

Estimation Output of Eviews for Thailand After replacing *LnINNOVr1* with *LnGERD/GDPr1*

Dependent Variable: M
Method: ML/QML - Poisson Count (Quadratic hill climbing)
Date: 07/05/19 Time: 01:11
Sample: 1 92
Included observations: 92
Convergence achieved after 7 iterations
Covariance matrix computed using second derivatives

	Coefficient	Std. Error	z-Statistic	Prob.
C	-11.57447	0.239190	-48.39025	0.0000
LPJPK	0.248183	0.005717	43.40925	0.0000
LSTOCK1	0.839887	0.004992	168.2351	0.0000
LD	0.435308	0.019137	22.74705	0.0000
LGDPPCR	0.749508	0.015542	48.22324	0.0000
LGERD/GDPr1	-0.858599	0.018618	-46.11653	0.0000
LTRADE1	-0.021064	0.004542	-4.637736	0.0000
UNEMPR	0.037441	0.002032	18.42374	0.0000
RTA	0.808606	0.011844	68.26883	0.0000
CUL	-26.86944	1.561431	-17.20821	0.0000

R-squared	0.982313	Mean dependent var	1670.054
Adjusted R-squared	0.980372	S.D. dependent var	8835.333
S.E. of regression	1237.828	Akaike info criterion	358.5021
Sum squared resid	1.26E+08	Schwarz criterion	358.7762
Log likelihood	-16481.10	Hannan-Quinn criter.	358.6127
Restr. log likelihood	-411497.5	LR statistic	790032.8
Avg. log likelihood	-179.1424	Prob(LR statistic)	0.000000

Appendix M

Centrality Metrics Computed by UCINET for Countries/areas in 2010

Country/Area	Degree Centrality	Normalised Degree Centrality		Normalised Closeness Centrality		Normalised Eigenvector Centrality		Normalised Betweenness Centrality	
	C_D	C'_D		C'_C		C'_E		C'_B	
	Count	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**
USA	119	0.589	*1*	0.564	*1*	0.321	*2*	0.206	*1*
SWE	115	0.569	*2*	0.555	*2*	0.343	*1*	0.109	*2*
NLD	101	0.500	*3*	0.534	*3*	0.320	*3*	0.078	*4*
ITA	93	0.460	*4*	0.523	*4*	0.320	*4*	0.054	*5*
GBR	81	0.401	*5*	0.508	*5*	0.286	*6*	0.040	*7*
FRA	78	0.386	*6*	0.505	*6*	0.298	*5*	0.027	*9*
ZAF	75	0.371	*7*	0.494	*8*	0.217	*9*	0.099	*3*
NOR	73	0.361	*8*	0.496	*7*	0.258	*8*	0.036	*8*
ESP	67	0.332	*9*	0.482	*9*	0.264	*7*	0.017	*11*
RUS	60	0.297	*10*	0.469	*10*	0.182	*17*	0.043	*6*
CAN	48	0.238	*11*	0.458	*15*	0.197	*14*	0.010	*15*
IRL	48	0.238	*12*	0.464	*11*	0.206	*11*	0.008	*18*
DNK	43	0.213	*13*	0.463	*12*	0.212	*10*	0.004	*26*
GRC	43	0.213	*14*	0.461	*13*	0.202	*13*	0.006	*21*
NZL	43	0.213	*15*	0.450	*20*	0.178	*19*	0.024	*10*
CHE	40	0.198	*16*	0.460	*14*	0.204	*12*	0.004	*27*
THA	39	0.193	*17*	0.448	*23*	0.156	*22*	0.009	*16*
AUS	38	0.188	*18*	0.457	*16*	0.176	*20*	0.008	*19*
BEL	36	0.178	*19*	0.455	*18*	0.185	*16*	0.004	*25*
DEU	36	0.178	*20*	0.456	*17*	0.181	*18*	0.003	*28*
AUT	35	0.173	*21*	0.455	*18*	0.186	*15*	0.003	*30*
PRT	34	0.168	*22*	0.450	*20*	0.150	*26*	0.007	*20*
MEX	33	0.163	*23*	0.431	*43*	0.132	*33*	0.005	*22*
PHL	33	0.163	*24*	0.442	*27*	0.141	*30*	0.016	*12*
HUN	31	0.153	*25*	0.450	*20*	0.163	*21*	0.002	*41*
LUX	30	0.149	*26*	0.438	*30*	0.150	*27*	0.003	*29*
CHL	29	0.144	*27*	0.436	*31*	0.149	*29*	0.002	*46*
TUR	29	0.144	*28*	0.434	*35*	0.109	*42*	0.015	*13*
BRA	28	0.139	*29*	0.435	*34*	0.151	*24*	0.001	*48*
CZE	28	0.139	*30*	0.447	*24*	0.156	*23*	0.002	*47*
BGR	27	0.134	*31*	0.444	*26*	0.150	*25*	0.001	*49*
ISR	27	0.134	*32*	0.446	*25*	0.134	*31*	0.002	*39*
ARG	26	0.129	*33*	0.433	*37*	0.133	*32*	0.001	*55*
FIN	26	0.129	*34*	0.434	*35*	0.150	*28*	0.001	*80*
MYS	25	0.124	*35*	0.431	*43*	0.102	*47*	0.003	*32*
PER	25	0.124	*36*	0.428	*46*	0.120	*37*	0.002	*44*
COG	24	0.119	*37*	0.431	*43*	0.104	*44*	0.005	*24*
CMR	22	0.109	*38*	0.439	*29*	0.122	*36*	0.003	*31*
EGY	22	0.109	*39*	0.441	*28*	0.130	*34*	0.001	*52*
POL	22	0.109	*40*	0.436	*31*	0.097	*53*	0.002	*42*
AFG	21	0.104	*41*	0.433	*37*	0.126	*35*	0.000	*88*
BDI	21	0.104	*42*	0.425	*51*	0.113	*39*	0.002	*34*
COL	20	0.099	*43*	0.425	*51*	0.111	*40*	0.000	*83*
CRI	20	0.099	*44*	0.423	*57*	0.101	*49*	0.001	*62*

Country/Area	Degree Centrality C_D	Normalised Degree Centrality C'_D		Normalised Closeness Centrality C'_C		Normalised Eigenvector Centrality C'_E		Normalised Betweenness Centrality C'_B	
	Count	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**
KEN	20	0.099	*45*	0.436	*31*	0.085	*61*	0.002	*40*
PAN	20	0.099	*46*	0.416	*79*	0.074	*70*	0.002	*43*
BLR	19	0.094	*47*	0.425	*51*	0.102	*46*	0.001	*75*
BOL	19	0.094	*48*	0.424	*55*	0.110	*41*	0.000	*108*
AGO	18	0.089	*49*	0.419	*71*	0.101	*50*	0.001	*71*
ARE	18	0.089	*50*	0.416	*79*	0.115	*38*	0.000	*117*
ECU	18	0.089	*51*	0.422	*64*	0.102	*48*	0.000	*121*
CYP	17	0.084	*52*	0.421	*67*	0.100	*51*	0.000	*91*
HRV	17	0.084	*53*	0.433	*37*	0.100	*52*	0.000	*82*
LVA	17	0.084	*54*	0.422	*64*	0.074	*72*	0.002	*33*
MLI	17	0.084	*55*	0.408	*97*	0.052	*94*	0.002	*38*
TZA	17	0.084	*56*	0.415	*82*	0.039	*113*	0.005	*23*
ARM	16	0.079	*57*	0.423	*57*	0.097	*54*	0.000	*96*
BGD	16	0.079	*58*	0.432	*41*	0.106	*43*	0.000	*99*
BIH	16	0.079	*59*	0.433	*37*	0.103	*45*	0.001	*77*
BFA	15	0.074	*60*	0.420	*68*	0.086	*59*	0.001	*59*
CHN	15	0.074	*61*	0.425	*51*	0.094	*55*	0.001	*58*
EST	15	0.074	*62*	0.423	*60*	0.091	*56*	0.000	*109*
IRQ	15	0.074	*63*	0.427	*47*	0.077	*68*	0.002	*37*
LTU	15	0.074	*64*	0.418	*72*	0.071	*77*	0.001	*63*
NAM	15	0.074	*65*	0.408	*97*	0.057	*89*	0.001	*51*
PRI	15	0.074	*66*	0.371	*162*	0.048	*97*	0.001	*53*
ROU	15	0.074	*67*	0.423	*60*	0.073	*74*	0.001	*76*
TGO	15	0.074	*68*	0.338	*179*	0.024	*137*	0.002	*45*
COD	14	0.069	*69*	0.417	*75*	0.079	*64*	0.001	*56*
DOM	14	0.069	*70*	0.414	*85*	0.078	*67*	0.000	*101*
ETH	14	0.069	*71*	0.432	*41*	0.091	*57*	0.000	*98*
URY	14	0.069	*72*	0.423	*60*	0.067	*80*	0.001	*50*
YUG	14	0.069	*73*	0.390	*137*	0.065	*82*	0.000	*104*
ABW	13	0.064	*74*	0.399	*111*	0.062	*86*	0.002	*35*
ALB	13	0.064	*75*	0.418	*72*	0.090	*58*	0.000	*130*
AZE	13	0.064	*76*	0.420	*68*	0.079	*65*	0.000	*122*
BWA	13	0.064	*77*	0.416	*79*	0.072	*75*	0.001	*57*
CIV	13	0.064	*78*	0.427	*47*	0.081	*63*	0.002	*36*
LBY	13	0.064	*79*	0.413	*87*	0.056	*91*	0.001	*54*
CUB	12	0.059	*80*	0.417	*75*	0.071	*78*	0.000	*87*
ERI	12	0.059	*81*	0.427	*47*	0.086	*60*	0.000	*119*
IRN	12	0.059	*82*	0.423	*60*	0.074	*71*	0.000	*112*
TTO	12	0.059	*83*	0.386	*142*	0.019	*151*	0.011	*14*
BEN	11	0.054	*84*	0.394	*125*	0.056	*90*	0.001	*81*
BHR	11	0.054	*85*	0.406	*105*	0.079	*66*	0.000	*144*
BTN	11	0.054	*86*	0.409	*96*	0.075	*69*	0.000	*136*
CAF	11	0.054	*87*	0.411	*92*	0.065	*83*	0.000	*100*
CPV	11	0.054	*88*	0.420	*68*	0.082	*62*	0.000	*140*
IDN	11	0.054	*89*	0.427	*47*	0.073	*73*	0.000	*111*
IND	11	0.054	*90*	0.422	*64*	0.061	*87*	0.000	*94*
ISL	11	0.054	*91*	0.424	*55*	0.072	*76*	0.000	*113*
JPN	11	0.054	*92*	0.418	*72*	0.063	*84*	0.000	*106*
MOZ	11	0.054	*93*	0.403	*107*	0.047	*99*	0.000	*85*
ZMB	11	0.054	*94*	0.361	*167*	0.021	*145*	0.001	*60*
GNB	10	0.050	*95*	0.406	*102*	0.051	*96*	0.001	*67*
MKD	10	0.050	*96*	0.416	*77*	0.054	*92*	0.000	*84*
SDN	10	0.050	*97*	0.414	*85*	0.042	*109*	0.000	*86*
SVN	10	0.050	*98*	0.401	*110*	0.051	*95*	0.000	*110*
BRN	9	0.045	*99*	0.394	*125*	0.066	*81*	0.000	*147*
DJI	9	0.045	*100*	0.403	*107*	0.067	*79*	0.001	*72*
GEO	9	0.045	*101*	0.415	*82*	0.052	*93*	0.000	*128*
GHA	9	0.045	*102*	0.423	*57*	0.060	*88*	0.001	*68*
GIN	9	0.045	*103*	0.411	*92*	0.044	*106*	0.001	*66*
NER	9	0.045	*104*	0.354	*169*	0.018	*152*	0.001	*69*

Country/Area	Degree Centrality C_D	Normalised Degree Centrality C'_D		Normalised Closeness Centrality C'_C		Normalised Eigenvector Centrality C'_E		Normalised Betweenness Centrality C'_B	
	Count	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**
SVK	9	0.045	*105*	0.398	*117*	0.042	*110*	0.001	*61*
AIA	8	0.040	*106*	0.388	*140*	0.039	*114*	0.001	*65*
BMU	8	0.040	*107*	0.380	*145*	0.045	*103*	0.001	*74*
KOR	8	0.040	*108*	0.380	*145*	0.026	*132*	0.001	*78*
LBR	8	0.040	*109*	0.411	*89*	0.048	*98*	0.000	*127*
MWI	8	0.040	*110*	0.394	*125*	0.034	*123*	0.000	*102*
PRY	8	0.040	*111*	0.398	*114*	0.036	*117*	0.000	*90*
SLV	8	0.040	*112*	0.402	*109*	0.034	*121*	0.000	*120*
COM	7	0.035	*113*	0.391	*134*	0.044	*105*	0.000	*118*
DZA	7	0.035	*114*	0.411	*92*	0.062	*85*	0.000	*156*
GTM	7	0.035	*115*	0.399	*111*	0.029	*126*	0.000	*116*
HKG	7	0.035	*116*	0.388	*140*	0.041	*111*	0.000	*150*
MDA	7	0.035	*117*	0.413	*87*	0.043	*108*	0.000	*134*
MMR	7	0.035	*118*	0.411	*89*	0.045	*104*	0.000	*132*
NIC	7	0.035	*119*	0.398	*117*	0.027	*130*	0.000	*124*
RWA	7	0.035	*120*	0.389	*138*	0.024	*140*	0.001	*70*
AND	6	0.030	*121*	0.368	*164*	0.038	*116*	0.000	*154*
ATG	6	0.030	*122*	0.395	*122*	0.027	*131*	0.000	*97*
DMA	6	0.030	*123*	0.397	*120*	0.036	*118*	0.000	*93*
GAB	6	0.030	*124*	0.398	*117*	0.035	*119*	0.000	*95*
GMB	6	0.030	*125*	0.395	*122*	0.043	*107*	0.000	*135*
HND	6	0.030	*126*	0.398	*114*	0.026	*133*	0.000	*125*
KWT	6	0.030	*127*	0.416	*77*	0.045	*101*	0.000	*148*
LBN	6	0.030	*128*	0.411	*89*	0.045	*102*	0.000	*138*
LKA	6	0.030	*129*	0.410	*95*	0.046	*100*	0.000	*151*
NGA	6	0.030	*130*	0.415	*82*	0.038	*115*	0.001	*79*
JOR	5	0.025	*131*	0.406	*102*	0.035	*120*	0.000	*142*
KAZ	5	0.025	*132*	0.392	*131*	0.021	*144*	0.000	*143*
LSO	5	0.025	*133*	0.383	*143*	0.019	*149*	0.000	*114*
MAR	5	0.025	*134*	0.406	*102*	0.040	*112*	0.000	*146*
MDV	5	0.025	*135*	0.367	*166*	0.019	*150*	0.001	*64*
MNG	5	0.025	*136*	0.391	*134*	0.029	*127*	0.000	*129*
MRT	5	0.025	*137*	0.389	*138*	0.017	*153*	0.001	*73*
NPL	5	0.025	*138*	0.406	*105*	0.034	*122*	0.000	*139*
ANT	4	0.020	*139*	0.374	*155*	0.027	*129*	0.000	*156*
ASM	4	0.020	*140*	0.370	*163*	0.024	*141*	0.000	*152*
BHS	4	0.020	*141*	0.395	*122*	0.033	*124*	0.000	*156*
BLZ	4	0.020	*142*	0.392	*131*	0.025	*136*	0.000	*145*
BRB	4	0.020	*143*	0.394	*125*	0.024	*138*	0.000	*123*
FJI	4	0.020	*144*	0.396	*121*	0.028	*128*	0.000	*156*
KGZ	4	0.020	*145*	0.339	*178*	0.011	*165*	0.000	*115*
LIE	4	0.020	*146*	0.352	*170*	0.017	*154*	0.000	*137*
MLT	4	0.020	*147*	0.391	*134*	0.023	*142*	0.000	*149*
PAK	4	0.020	*148*	0.408	*97*	0.030	*125*	0.000	*141*
SEN	4	0.020	*149*	0.408	*97*	0.026	*134*	0.000	*89*
SOM	4	0.020	*150*	0.407	*101*	0.026	*135*	0.000	*92*
GRD	3	0.015	*151*	0.379	*148*	0.012	*164*	0.000	*133*
GUY	3	0.015	*152*	0.398	*114*	0.019	*147*	0.000	*105*
KHM	3	0.015	*153*	0.379	*148*	0.019	*148*	0.000	*156*
KIR	3	0.015	*154*	0.332	*180*	0.009	*173*	0.009	*17*
OMN	3	0.015	*155*	0.375	*154*	0.016	*157*	0.000	*126*
SAU	3	0.015	*156*	0.394	*125*	0.022	*143*	0.000	*153*
SGP	3	0.015	*157*	0.394	*125*	0.024	*139*	0.000	*156*
SYC	3	0.015	*158*	0.347	*171*	0.008	*174*	0.000	*107*
UGA	3	0.015	*159*	0.399	*111*	0.016	*156*	0.000	*103*
FSM	2	0.010	*160*	0.383	*143*	0.013	*162*	0.000	*156*
LAO	2	0.010	*161*	0.376	*153*	0.014	*161*	0.000	*156*
LCA	2	0.010	*162*	0.378	*150*	0.010	*166*	0.000	*156*
MCO	2	0.010	*163*	0.373	*161*	0.015	*160*	0.000	*155*
MDG	2	0.010	*164*	0.367	*165*	0.017	*155*	0.000	*156*

Country/Area	Degree Centrality C_D	Normalised Degree Centrality C'_D		Normalised Closeness Centrality C'_C		Normalised Eigenvector Centrality C'_E		Normalised Betweenness Centrality C'_B	
	Count	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**	**Score**	**R.**
MUS	2	0.010	*165*	0.378	*150*	0.016	*158*	0.000	*156*
PRK	2	0.010	*166*	0.342	*174*	0.007	*177*	0.000	*156*
QAT	2	0.010	*167*	0.380	*145*	0.015	*159*	0.000	*156*
SLE	2	0.010	*168*	0.391	*133*	0.019	*146*	0.000	*156*
SWZ	2	0.010	*169*	0.342	*173*	0.007	*175*	0.000	*156*
SYR	2	0.010	*170*	0.377	*152*	0.012	*163*	0.000	*156*
TCD	2	0.010	*171*	0.344	*172*	0.007	*176*	0.000	*131*
TJK	2	0.010	*172*	0.330	*181*	0.006	*181*	0.000	*156*
COK	1	0.005	*173*	0.320	*182*	0.005	*182*	0.000	*156*
GNQ	1	0.005	*174*	0.355	*168*	0.009	*172*	0.000	*156*
HTI	1	0.005	*175*	0.373	*156*	0.009	*167*	0.000	*156*
JAM	1	0.005	*176*	0.373	*156*	0.009	*167*	0.000	*156*
KNA	1	0.005	*177*	0.373	*156*	0.009	*167*	0.000	*156*
MSR	1	0.005	*178*	0.286	*184*	0.001	*184*	0.000	*156*
NRU	1	0.005	*179*	0.255	*185*	0.000	*185*	0.000	*156*
PLW	1	0.005	*180*	0.341	*175*	0.006	*179*	0.000	*156*
TKM	1	0.005	*181*	0.312	*183*	0.003	*183*	0.000	*156*
TON	1	0.005	*182*	0.373	*156*	0.009	*167*	0.000	*156*
TWN	1	0.005	*183*	0.341	*175*	0.006	*179*	0.000	*156*
UKR	1	0.005	*184*	0.373	*156*	0.009	*167*	0.000	*156*
WSM	1	0.005	*185*	0.341	*175*	0.006	*178*	0.000	*156*
MAC	0	0.000	*186*	0.167	*186*	0.000	*193*	0.000	*156*
MHL	0	0.000	*187*	0.167	*186*	0.000	*193*	0.000	*156*
PNG	0	0.000	*188*	0.167	*186*	0.000	*193*	0.000	*156*
SLB	0	0.000	*189*	0.167	*186*	0.000	*197*	0.000	*156*
SMR	0	0.000	*190*	0.167	*186*	0.000	*192*	0.000	*156*
STP	0	0.000	*191*	0.167	*186*	0.000	*198*	0.000	*156*
SUR	0	0.000	*192*	0.167	*186*	0.000	*191*	0.000	*156*
TCA	0	0.000	*193*	0.167	*186*	0.000	*199*	0.000	*156*
TLS	0	0.000	*194*	0.167	*186*	0.000	*200*	0.000	*156*
TUN	0	0.000	*195*	0.167	*186*	0.000	*201*	0.000	*156*
TUV	0	0.000	*196*	0.167	*186*	0.000	*202*	0.000	*156*
UZB	0	0.000	*197*	0.167	*186*	0.000	*190*	0.000	*156*
VCT	0	0.000	*198*	0.167	*186*	0.000	*189*	0.000	*156*
VEN	0	0.000	*199*	0.167	*186*	0.000	*188*	0.000	*156*
VNM	0	0.000	*200*	0.167	*186*	0.000	*187*	0.000	*156*
VUT	0	0.000	*201*	0.167	*186*	0.000	*203*	0.000	*156*
YEM	0	0.000	*202*	0.167	*186*	0.000	*186*	0.000	*156*
ZWE	0	0.000	*203*	0.167	*186*	0.000	*193*	0.000	*156*