Intra-industry Technology Spillover from Multinational Enterprises in South East Asia

Joshua Akinlolu Olayinka

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of
Master of Business Administration (International Program)
Prince of Songkla University
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Author	Mr. Joshua Akinlolu Olayinka
Major Program	Business Administration (International Program)

Major Advisor

……
(Dr.Sirinuch Loykulnanta)

Examining Committee:

..……Chairperson
(Assoc.Prof.Dr.Nathasit Gerdsri)

…… Committee
(Dr.Sirinuch Loykulnanta)

…… Committee
(Dr.Daraneekorn Supanti)

The Graduate School, Prince of Songkla University, has approved this thesis as partial fulfillment of the requirements for the Master of Business Administration (International Program)

……
(Prof.Dr.Damrongsak Faroongsarng)
Dean of Graduate School

This is to certify that the work here submitted is the result of the candidate's own investigations. Due acknowledgement has been made of any assistance received.

……..……. Signature
(Dr.Sirinuch Loykulnanta)
Major Advisor

……. Signature
(Mr. Joshua Akinlolu Olayinka)
Candidate

I hereby certify that this work has not been accepted in substance for any degree, and is not being currently submitted in candidature for any degree.

……. Signature
(Mr. Joshua Akinlolu Olayinka)
Candidate

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ABSTRACT

The main purpose of this study is to examine spillover of technology from MNEs to the domestic firms in Southeast Asia. The study focused on technology spillover from MNEs to domestic firms within the same industry. Using secondary panel data obtained from World Bank Enterprise Survey, this study examined the impact of technology spillover through three channels; demonstration effect, competition effect, and workers' mobility effect on the productivity of domestic firms in five Southeast Asia countries namely; Indonesia, Philippines, Vietnam, Laos, and Myanmar. The five countries were selected due to availability of panel data from the World Bank Enterprise Survey. The effect of the domestic firms' absorptive capacity on their productivity was also examined. This study therefore compared the results of the selected countries.

Multiple regression analysis was used to test the hypotheses of this study. The results revealed that the most important channel of technology spillover to the domestic firms is the workers' mobility effect and the absorptive capacity of the domestic firms influence their productivity. Furthermore, the result revealed that only firms in Vietnam benefit from technology spillover through demonstration effect. On the other hand, the effect of competition was largely negatively among the countries indicating that intense competition from the MNEs reduces the productivity of the

domestic firm. The implication of this is that tacit knowledge is the form of technology that spillover across the Southeast Asia countries studied.

Keywords: Technology spillover, Multinational enterprises, Southeast Asia

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Joshua Akinlolu Olayinka

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ABBREVATIONS

FP – Foreign Presence

GDP – Gross Domestic Products

HC – Human Capital

HHI – Herfindahl-Hirschman Index

ISIC - International Standard Industry Classification

MNC(s) – Multi-National Corporation(s)

MNE (s) – Multi-National Enterprise(s)

OLS – Ordinary Least Square

R & D – Research and Development

SPSS - Statistical Package for Social Sciences

TFP – Total Factor Productivity

UK – United Kingdom

UNCTAD – United Nations Conference on Trade and Development

USD – United State Dollars

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Apart from being a source of international capital flows, multinational enterprises (MNEs) have the tendency to breach the technology divide between developed countries and the developing countries (UNCTAD, 2010). MNEs from the developed countries are in fact the major creator of new and advanced technology since they often have the required fund for research and development. These technologies are transferred to their affiliates or subsidiaries in the host country through the process of internalization (Siripaisalpipat & Hoshino, 2000). The MNE's subsidiary in the host country competes with domestic companies with advanced technology transferred from the parent company as their firm-specific competitive advantage (Khayati, 2015; Martin & Salomon, 2003; Pitelis & Sugdan, 2000). The coexistence of the MNE's affiliates and domestic firms in a country can bring about the spillover of technology from the MNE's affiliates to the domestic firms, thus improving the efficiency and productivity of the domestic firms (Aitken & Harrison, 1999; Barrios, Gorg, & Strobl, 2005).

Technology has an important effect of the productivity of a country and is seen as the major driving force of economic growth (Wei & Liu, 2006). The use of technology creates a competitive advantage through product differentiation and efficient use of resources. This explains why many countries, most especially developing and emerging economy, often have certain incentives to attract multinational companies. The expectation is that MNEs will bring advanced technology to the country and the technology will spread to the domestic firms (Barrios et al., 2005; Buckley, Clegg, &Wang, 2007).

1.2 Problem Statement

According to the UNCTAD (2017), there is still a great technology divide between the developed countries and the developing or less developed countries. This suggests a good opportunity for developing countries to catch up. The more the

technology gap between developing countries and developed countries the more there is to catch up (Findlay, 1978; Lorentzen, 2005; Rattsø & Stokke, 2003; Wang & Blomstrom, 1992). The multinational enterprises from developed countries, being the major producer of advanced technology, have the potential to spread the technology to the developing or emerging economy.

Romer (1990) explains that technology spillover is one of the most important channels of the diffusion of modern technology across countries rather than through formal technology transfers arrangement. However, empirical researches on technology spillovers in the developing countries over the years have produced uneven results. There are those who reported positive technology spillover effect on the productivity of domestic firms (Blomstrom, 1986; Blostrom & Persson, 1983; Blomstrom & Sjoholm, 1999; Chuang & Lin, 1999; Gorg & Strobl, 2002; Kokko, 1994; Kokko, 1996). Some have reported negative technology spillover effect on the productivity of the domestic firms (Aitken & Harrison, 1999; Djankov & Hoekman, 2000; López-Córdova, 2002; Zukowska-Gagelmann, 2000). There are also those who have reported that there is no evidence of technology spillover from multinational companies to the domestic firms (Haddad & Harrison, 1993; Javorcik, 2004; Kathuria, 2000; Kokko, Tansini, & Zejan, 1996; Kokko, Tansini, & Zejan, 2001; Kugler, 2001). The reason for this inconsistency in the results (that is the positive, negative and no effect reported) of technology spillover researches has been identified as a problem of spillover measurement (Hamida, 2011). The technology spillover has been treated as a black box without empirically testing the channels of the spillover which are demonstration, competition and worker mobility channels (Barrios, Gorg, & Strobl, 2011; Driffield & Jindra, 2012; Hamida, 2011; Hamida & Gugler, 2009). Secondly, the empirical methodology employed (Gorg & Strobl, 2001) and the nature of domestic firms' absorptive capacity (Blalock & Simon, 2009; Ha & Giroud, 2015) have also been identified as the reason for the inconsistency in the spillover researches. Absorptive capacity is defined as the ability of the domestic firms to utilize knowledge acquired from MNEs and increase their realized spillovers (Meyer & Sinani, 2009; Narula &Marin, 2003). However, there have been limited studies that disentangle the channels of technology spillover. Hence, this study contributes to the literature on technology

spillover by examining the channels of spillover instead of treating spillover as a blackbox and examine the absorptive capacity of the domestic firms.

South East Asia is important for this study because of the increase in foreign direct investment (FDI) in the region caused by the increase in policy liberalization and multilateral economic cooperation and integration. Moreover, there has been spread of the value chain for international production and service networks into developing countries, and especially Southeast Asia (UNCTAD, 2001). This is because of the cheaper factor of production available in Southeast Asia. Figure 1 below shows the rise of FDI in Southeast Asia. Moreover, while comparative studies have been done in European countries, for instance Orlic, Hashi, and Hisarciklila (2018) studied technology spillover in five European transition countries, Damijan, Rojec, Majcen, and Knell (2013) studied technology spillover in ten European transition countries, there is still lack of comparative study of technology spillover in the developing South East Asia. This study therefore fills this gap in literature.

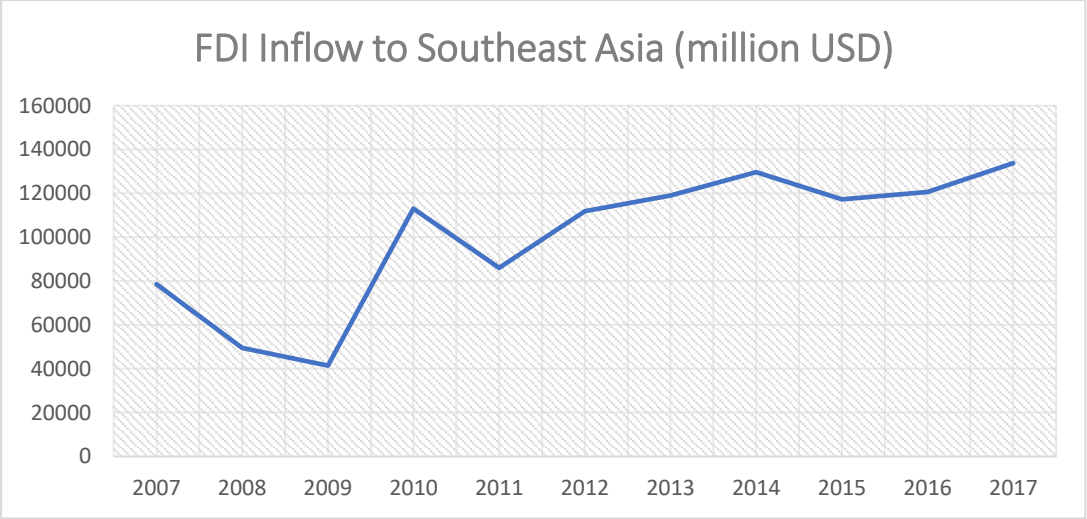

Figure 1: FDI inflow into Southeast Asia

Source: UNCTAD (www.unctad.org/fdistatistics)

1.3 Research Purpose:

This research aims to assess technology spillover from MNEs and its effect on the productivity of domestic firms in South East Asia.

1.4 Research Objectives:

The objectives of this research are as follows:

1.4.1 To examine the effect of technology spillover through demonstration by MNEs on the productivity of the domestic firms in South East Asia.

1.4.2 To examine the effect of technology spillover through competition from MNEs on the productivity of the domestic firms in South East Asia.

1.4.3 To examine the effect of technology spillover through worker mobility from MNEs to the domestic firms on the productivity of the domestic firms in South East Asia.

1.4.4 To examine the effect of the absorptive capacity of the domestic firms in South East Asia on their productivity.

1.5 Research Questions:

This research seeks to answer the following questions:

1.5.1 What is the effect of technology spillover through demonstration by MNEs on the productivity of domestic in South East Asia?

1.5.2 What is the effect of technology spillover through competition from MNEs on the productivity of domestic in South East Asia?

1.5.3 What is the effect of technology spillover through worker mobility from MNEs to the domestic on the productivity of the domestic in South East Asia?

1.5.4 What is the effect of the absorptive capacity of domestic firms in South East Asia on their productivity?

1.6 Definition of Terms

1.6.1 Technology Spillover: technology spillover is defined as the impact of the presence of MNEs' affiliates, using superior technology, on the productivity of the local or domestic firms in the host country.

1.6.2 Productivity: productivity can be defined as a measure of efficiency in production and is the quantity of output a firm can produce at a given level of input.

1.6.3 Demonstration Effect: This can be defined as a channel of technology spillover from MNEs to domestic firms which occurs when domestic or local firms can increase their efficiency and productivity by observing or imitating or doing reverse engineering of these technologies used by MNEs.

1.6.4 Competition Effect: This can be defined as a channel of technology spillover from MNEs to domestic firms which occurs when the entrance of MNEs into the industry forces the domestic firms to use their existing technology more efficiently or to upgrade their technology to be competitive and protect their market share.

1.6.5 Worker Mobility Effect: This can be defined as a channel of technology spillover from MNEs to domestic firms which occurs when domestic firms acquire tacit technological knowledge by recruiting employees who had already worked for MNEs.

1.6.6 Domestic Firms' Absorptive Capacity: This can be defined as the ability of the domestic firm to recognize new technology, assimilate it and use it to improve its productivity.

1.7 Chapter Summary

This chapter presented the background to this research as well as its justifications. It also presented the purpose of the research, the objectives that this study aims to achieve, the research question, and definition of key terms. The following chapter is the literature review explaining both the theoretical and empirical literature.

CHAPTER TWO

LITERATURE REVIEW

As previously mentioned in Chapter 1, this study aims to technology spillover from digital and technology MNEs to the domestic firms in Thailand. This chapter focuses on the review of conceptual definitions and theoretical foundation. The structure of the details in this chapter is as follows.

2.1. Conceptual Definitions

2.2. Theoretical Literature Review

2.3. Technology Spillover and Domestic Firms' Productivity

2.4. Absorptive Capacity and Domestic Firms' Productivity

2.5. Conceptual Framework

2.6. Chapter Summary

2.1. Conceptual Definitions

This section reviews definitions of concepts that are used in this study.

2.1.1. Multinational Enterprises

A multinational enterprise has been defined by Rugman and Verbeke (2001) as an enterprise that undertakes or performs value-added activities in at least countries. Alfaro and Chen (2014) defined multinational enterprise as a company that owns or controls and operates assets in at least two countries. MNEs undertake direct investment in a foreign market. According to IMF (2009), the direct investment in a foreign market could be at least ten percent voting right in another company abroad. Therefore, a multinational enterprise is defined as an enterprise that has at least ten percent ownership in another firm outside its national boundary.

2.1.2. Technology

Technology can be defined as product or production process technology as well as knowledge and skills which include management, marketing, organisation, and know-how (Sönmez, 2013). Kim (1997) defined technology as a collection of physical processes that converts input to output and the knowledge and skills required to make the conversion possible. David (1992) indicated that technology is a collection of theoretical and practical knowledge, as well as skills, that are used by firms to develop and produce its goods and services.

According to Polanyi (1962) and Keller (2004), technological knowledge has two components which are explicit and tacit components. The explicit component is coded and transferrable through machinery, blueprints, technical manuals, training hand-outs, technical specifications and quality control methods (Kim, 2001). The tacit component (also referred to as practical knowledge or know-how), on the other hand, cannot be codified. It is embodied in the workers' experience and skills and can be exchanged through face-to-face communication or on-the-job or apprenticeship-type training (David, 1992; Ernst & Kim, 2002; Keller 2004; Sönmez, 2013). The explicit and tacit components are also referred to as hardware and software technology respectively by Techakanont and Terdudomtham (2004). The tacit knowledge is as important as the explicit technology as organisations may not be able to benefit from explicit technology without the required tacit knowledge to use the technology (Techakanont & Terdudomtham, 2004). Technology is therefore defined in this study as productive knowledge which can either be coded explicitly in machines, products and manuals or not coded and tacitly embedded in workers' or management experience and skills.

2.1.3. International Technology Diffusion

International technology diffusion is defined as the spread of technology across the borders of countries (Keller, 2004). This means that technology created in one country is made available in another country. According to Keller (2004), international technology diffusion determines the pace of technological change in the

world. Technology diffusion is able to breach the technology divide between developed countries and developing or less-developed countries. Therefore, technology diffusion is defined in this study as the spread or flow of technology from the creator of the technology to every part of the world.

Technology diffusion across countries occurs through both market transactions and externalities (Keller, 2004). The market transactions are referred to as technology transfer while the externalities are referred to as technology spillovers. International technology diffusion happens more through technology spillover than the formal market transactions (Keller, 2004; Romer, 1990) and spillovers from inward Foreign Direct Investment (FDI) are particularly seen as the most efficient ways by which industrial development can occur (Narula & Dunning, 2000).

2.1.4. Technology Transfer

Technology transfer has been defined as the process by which technology is intentionally transmitted from firm to firm (Sönmez, 2013). Technology transfer could happen through arm's length licencing which is when technology is transferred from the source to the recipient and the recipient of technology must pay (Aulakh, Jiang & Pan, 2010; Techakanont & Terdudomtham, 2004) or through the parent MNEs transferring technology to their foreign affiliates (Keller, 2004; Sonmez, 2013) in order to compete successfully with the domestic firms in the host country.

However, compared with other MNE activities like exporting and licencing, inward FDI through establishment of affiliates or subsidiary in the host country is seen as the superior channel of international technology transfer. This is because FDI may involve significant resource commitment from the parent MNE to the subsidiaries (Tsang, 1997). Moreover, MNEs are more likely to transfer their technology to their subsidiaries than licencing in order to protect their intellectual property (Buckley, Clegg, & Wang, 2002)

2.1.5. Technology Spillover

Technology spillover has been defined slightly differently by researchers in the context of their research. Sonmez (2013) defined technology spillover from FDI as the unintentional transfer of intangible technology-related elements from foreign to local firm in the host country. Meyer (2004) stated that technology spillover is the diffusion of technology from MNEs to host country's firms through informal and non-contractual relationships. This does not imply any form of unlawful and unethical behaviour, like intellectual property theft or forced technology transfer, by the domestic firms or the host country. Some agreed that technology spillover occurs once there is improved efficiency of the host country's domestic firms due to presence of MNEs in the country and because the MNEs cannot completely internalize the value of their technology (Blomström & Kokko, 1998). Technology spillover has been referred to as knowledge spillover or productivity spillover or FDI spillover in literatures. In the context of this research however, technology spillover is defined as the impact of the presence of MNEs' affiliates, using superior technology, on the productivity of the local or domestic firms in the host country.

2.2. Theoretical Literature Review

The existence of technology spillover is founded upon three logical bases; MNEs own superior technologies; these technologies are transferred to their affiliates or subsidiaries in the host countries; and these technologies spread unintentionally from the affiliates or subsidiaries to the domestic firms in the host countries. These logical bases are explained by the theory of internalisation and the eclectic paradigm. The following sections therefore introduce these theories in order to understand technology spillover.

2.2.1. Internalization Theory

Internalization can be defined as the process of making market within a firm (Rugman, 2006). Internalization theory, as developed by Buckley and Casson (1976), Rugman (1981), and Hennart (1982), is a firm-level theory explaining why an MNE will exert proprietary control (ownership) over an intangible, knowledge-based,

firm-specific advantage (FSA) and create an internal market for the FSA. Firms are heterogenous in their factor or resource endowment and firms with the superior resources which are firm specific advantages can exploit the resources across the borders of its home country through exporting, licencing or foreign direct investment. Exporting and licencing are denied by MNEs due to the risk of dissipating the firm specific advantages. This is because the ownership of the FSA which are mostly intangible proprietary knowledge asset arising from technology, marketing, brand name, capital, access to financing, process efficiencies, size (economies of scale and scope), and managerial expertise (Rugman, 1981; Verbeke, 2013) are best protected within the management structure of MNEs. The process of keeping these superior resources which are specific to the firm internally over a worldwide scale is known as internalization. This is achieved by the transfer of intermediate products within the same enterprises.

Another reason for internalization according to Rugman (2006) is because of the natural market failure which is the imperfection in goods and factor market. For instance, there is not perfect market for knowledge and information, which are intermediate goods, possessed by MNEs. This means that the price of the proprietary knowledge cannot be determined by demand and supply. Although the price can be determined by the cost of the R & D that delivered the knowledge, it is subject to negotiation of the transacting parties in an external market (i.e exchange between independent buyers and sellers across national boundaries). The buyer or licensee of the knowledge asset will negotiate for the least cost possible as firms are institutions for minimizing transaction cost. Internalization allows the MNE to appropriate a fair return for its costly R & D expenditure in creating knowledge (Rugman, 2006). This can be done by setting a fiat price on the proprietary knowledge and making the subsidiaries pay for the use of the knowledge through royalty payment to the parent firm. Other imperfection in the use of external market is the transaction cost associated with creating contract, brokerage cost of finding the right price, cost of enforcement and the taxes paid on exchange transactions (Coase, 1937; Faeth, 2009). Hence, internalization is a response by MNEs to the external market failures through the creation of internal market for its firm specific advantages.

Internalization theory also explains why the MNEs are constantly doing R & D. Vernon (1977) argued that the FSA of an MNE is in constant danger of being eroded due the natural product or knowledge life cycle and MNEs need to generate new advantages to overcome the gradual decline. Due to this dynamic nature of knowledge, the MNEs need to constantly research and develop new knowledge and market it efficiently internally among its subsidiaries to sustain its competitive advantage.

2.2.2. Eclectic Paradigm

John Dunning built upon the theory of internalization developed by his colleagues, Peter Buckley and Mark Casson (Buckley & Casson 1976), to develop what has become known as the eclectic paradigm (Dunning, 1980; Dunning, 1981; Dunning, 1988). He developed three factors that determine the international activities of multinational enterprises (MNEs). These are ownership (O) advantages, location (L) advantages, and internalization (I) advantages. As explained by Neary (2011), the ownership advantage suggests that MNEs own or possess higher than average level of assets and these assets can be applied for production at different locations without reducing their effectiveness. These assets which are referred to as the firm specific advantage may include product development, managerial structures, patents, and marketing skills among others. For instance, MNEs undertake value added activities in at least two countries (Rugman & Verbeke, 2001), they possess experience and know-how in international marketing and have access to resources such as established international distribution networks and managerial practices (Blomström & Kokko, 1998; Fu & Gong, 2009) as a consequence of their multinationalism or geographical diversification. This ownership advantage must be enough to compensate for the additional administrative cost of setting up a foreign value- adding operations. It must also be sufficient to compete with the domestic firms in the host country and overcome the liability of foreignness (Zaheer, 1995).

The location advantage suggests that enterprises participate in FDI when they want to avoid the trade cost associated with exporting and when the benefit of FDI is higher than the associated fixed cost. Also, some countries possess certain advantages like natural resources, human resource, government incentive, institutional advantage

and other advantages that can enhance the ownership advantages of firm. Dunning (1992) further stated four motives for MNEs in participating in FDI based on location advantage which are: natural resource-seeking motive; market-seeking motive; efficiency-seeking motive and strategic-asset seeking motive. Dunning (2000) pointed out that the idea of L advantages has different views according to disciplines. Economists have investigated the impact of exchange rates on the location of FDI (Cushman 1985; Froot & Stein, 1991; Rangan, 1998). Business scholars assert that a competitive advantage involves the optimal location of portfolio assets (Enright, 2000; Porter, 1994; Porter, 1996).

Internalization advantage is the most important of Dunning's taxonomy according to Neary (2011) and it suggests that enterprises involve in FDI when they can exploit their firm specific advantage which is known as the ownership advantage in the host country by transferring their knowledge or asset to their subsidiaries instead of arm's length licensing. Transferring their firm specific asset is necessary in order to overcome locational disadvantages arising from differences in language, culture, legal system and other inter-country differences (Rugman, Verbeke, & Nguyen, 2011).

Also, there are three sets of issues that may affect arm's length licencing transactions between MNEs and local producers in host economies (Rugman et al., 2011). First, the problem arises because of the presence of incomplete contracts when it is not possible to write contracts covering all possible contingencies affecting the relationship between the firms because of uncertainty (Hart & Moore, 1988). The terms of the contract can be renegotiated ex-post, but if the investment is specific to the relationship, then the supplier's bargaining position will be weak causing the initial investment to become less than standard. Hence, the wholly owned subsidiary arises as a possible solution. The second problem is related to the diffusion of intangible assets. As local firms learn the MNEs' technology they become competitors and may threaten the future profits of MNEs. Furthermore, local suppliers can produce low quality products under high quality brands thus creating reputational risk for MNEs. The third issue is related to principal-agent problem arising from hidden action or hidden information about the local market (Spence, 1973). For these reasons, intangible assets

such as technology are costly to exchange through market-based transactions and internalisation emerges as a possible solution.

In conclusion, the internalization theory and the OLI model claimed that MNEs exploit their firm specific or ownership advantages in foreign market through the establishment of subsidiaries. The parent company transfer these FSA to the subsidiaries to have a competitive advantage over domestic firms in the host country and to overcome all the possible liability of foreignness.

2.2.3. Technology Spillover

When MNEs' affiliate use superior or advanced technology in the form of product, production process, marketing, distribution, know-how and skills (organization or management skills), domestic firms in the host country can gain knowledge of these technologies by observing them. The presence of MNEs affiliates also change the market condition for the domestic firms and will have an impact on the technological development or general productivity of domestic firms in the host country. This impact on the productivity of domestic firms may be positive or negative. It is positive when the presence of MNEs increases the productivity of domestic firms and negative when the presence of MNEs reduces the productivity of the domestic firms. The impact could be on the productivity of domestic firm in the same industry as the MNEs affiliate known as intra-industry spillover or horizontal spillover and the impact could be on the productivity of the domestic firms in other industries known as inter-industry spillover or vertical spillover (Blomström, Kokko & Zejan, 2000; Lin & Saggi, 2005). The inter-industry technology spillover happens through linkage between domestic firms and subsidiaries or affiliates of MNEs.

2.2.3.1. Technology Spillover through Linkages

Through formation of linkages, local firms can gain access to knowledge and technology of MNEs (Kugler, 2006). There are two types of linkages known as backward and forward linkages and the concept was first developed by Hirschman (1958). Backward linkage occurs when a domestic firm is the supplier to an MNE while forward linkage occurs when a domestic firm is a customer of an MNE. These

linkages are often referred to as vertical linkages. Technology externalities arise as MNEs facilitate learning by doing in the domestic firms and thus increase the productivity of the domestic firms (Eden, 2009). According to Giroud (2007), domestic suppliers can benefit from inter-firm exchange of technical and managerial knowledge. MNEs provide technical assistance on product design, quality control and inventory management as well as financial and procurement assistance (Zanfei, 2012). Customers of MNEs can benefit from spillovers and knowledge embodied in products, processes and technologies as well as improved access to enhanced or previously unavailable inputs and products (Jindra, Giroud, & Scott-Kennel, 2009).

The technology of the MNEs may spillover to the domestic firms when the domestic firms observe the technology used by the MNEs in the same industry, known as demonstration effect (Blomström & Kokko, 1998; Findlay, 1978) or when the presence of MNEs increase the competition and force the domestic firm to adopt better technology, known as competition effect (Kokko, 1996; Wang & Blomström, 1992) or when staff previously employed by MNEs are employed by the domestic firms, known as workers mobility (Fosfuri, Motta, & Rønde, 2001; Glass & Saggi, 2002). These are the possible channels of intra-industry technology spillovers identified in technology spillover literatures.

2.2.3.2. Technology Spillover through Demonstration Effect

According to Sonmez (2013), demonstration by MNEs or imitation by domestic firms is probably the most evident channel of technology spillover. When MNEs enters a new market, they demonstrate their advance technology in terms of production, process, quality control, distribution systems, and organization and domestic or local firms can increase their efficiency and productivity by observing or imitating or doing reverse engineering of these technologies used by MNEs (Blomström & Kokko, 1998; Blomström & Kokko, 2002; Sonmez, 2013). According to Meyer and Sinani (2009), technology can be easily observed if it is non-proprietary and MNEs have the incentive to increase measures to prevent spillover once they recognize local firms as competitors rather than needy recipient of development aids. MNEs try to prevent imitation by internalizing its technology or exclusive licensing

(Aulakh et al., 2010). However, Poole (2013) and Berry (2014) confirmed that technology imitation is possible even when the international technology exploitation is done within the organization. The scope of this imitation depends however on the complexity of the technological products and processes (Görg & Greenaway, 2004) and according to Ivus et al. (2017), imitation is low in high technology industry due to the technological complexity of products.

2.2.3.3. Technology Spillover through Competition Effect

The entrance of MNEs increases the competition for domestic firms in the host country. MNEs increase the competition by increasing the number of competitors, that is, quantity of competition and by using superior technology, that is, the quality of competition (Blomström & Driffield & Love, 2007). This competition forces domestic firm to use their existing technology more efficiently or to upgrade their technology to be competitive and protect their market share (Wang & Blomström, 1992; Sonmez, 2013) and this will increase the productivity of the domestic firms. This competition effect suggests that the technological or productivity improvement of the domestic firms is partly endogenous in nature even though it is motivated by the increase competition created by the entrance of MNEs in the industry. However, as stated by Aitken and Harrison (1999), the entrance of MNEs may negatively affect the productivity of the domestic firms. Since MNEs use superior technology, they are able to lower their marginal cost and these market-oriented foreign firms can draw demand away from local firms, causing them to cut production. This is known as market stealing or crowding out effect (Aitken & Harrison, 1999; Meyer & Sinani, 2009).

On the other hand, if competition from domestic firms does not threaten their market shares and profits, foreign firms will have no reason to import more and newer technologies from their parent companies, since technology imports are expensive (Perez, 1997). Thus, in such cases it is possible to have a large number of foreign firms coexist with a slow technology transfer and the transfer of old and non-proprietary technologies. Hence, it may result in a low volume of technology available for imitation by indigenous firms.

2.2.3.4. Technology Spillover through Workers' Mobility

Another channel technology from MNEs can spillover to domestic firms is by domestic firms employing workers who had previously worked in the MNEs. According to Sonmez (2013), workers employed by MNEs gain knowledge of its technology through training and experience and will transfer this knowledge to the domestic firms if employed by them. This is because according to Keller (2004), technology knowledge has both explicit and tacit component. The explicit component is coded and transferrable through machinery, blueprints, technical manuals, training hand-outs, technical specifications and quality control methods (Kim, 2001). The tacit component (also referred to as practical knowledge or know-how) on the other hand is not codified and it is embodied in the workers' experience and skill (David, 1992; Keller 2004; Sonmez, 2013). Therefore, skills and technological knowledge of the domestic workers employed and trained by MNEs may spillover to local firms when they set up their own firms or when they are hired by local firms in host country (Glass & Saggi, 2002; Kokko, 1996).

MNEs, however, try to prevent this kind of spillover by paying higher wage to its workers with the intention to prevent employee turnover (Lipsey & Sjöholm, 2004). On the other hand, it should be noted that this channel may also have a negative impact on local firms as MNEs may attract the skilled workers away from domestic firms by offering higher wages or increase the average wage demand by staff in the industry, thus increasing the cost for domestic firms and hence reduction in profitability (Girma & Wakelin, 2002). This study, however, focused on the intra-industry spillover through demonstration, competition and worker mobility effect. This is because there is no data available on the effect of linkages between digital and technology MNEs and other industries in Thailand.

2.2.4. Absorptive Capacity

Absorptive capacity is defined as the ability of the domestic firms to utilize knowledge acquired from MNEs and increase their realized spillovers (Meyer & Sinani, 2009; Narula &Marin, 2003). This involves the ability of the domestic firms to

recognize valuable new knowledge, adopt and adapt it for their own productive use. In theoretical literature, absorptive capacity is also referred to as the technological gap between the source and the recipient in terms of technological competence (Borensztein, De Gregorio, & Lee, 1998; Xu, 2000). According to Hamida (2011), domestic firms must possess sufficient levels of absorptive capacity to be able to efficiently take advantage of technology spillovers. Domestic firms must have some level of technological knowledge to be able to assimilate advanced technology. Developing absorptive capacity is a function of the firms' own R&D As firms invest in R&D to develop new technology, they also develop their ability to assimilate technology from other firms (Narula & Marin, 2003).

Absorptive capacity or technology gap has been measured differently in literature. Girma, Greenaway and Wakelin (1999) measured technology gap by individual firm's total factor productivity (TFP) gap relative to the 90^{th} percentile TFP of the corresponding industry in the previous year. This is because the level of difference in the TFP of the firm with the leading TFP in the industry indicates how far the firm is from the technological frontiers in terms of technological knowledge. Flores et al. (2002) used the ratio of foreign firm's productivity to domestic firms in the same industry. The level of productivity difference is also indicative of the technological gap between the foreign firm and the domestic firm. The higher the ratio shows the wider the technological gap between the foreign firms and the domestic firms and vice versa. Similarly, Girma (2005) used the difference between TFP of individual domestic firm and the maximum TFP in the industry.

Keller (2004), on the other hand, used the ratio of R&D to sales. As mentioned earlier, R&D is one of the ways that a firm develops its absorptive capacity; hence the use of the ratio of R&D to sale is a suitable measure of absorptive capacity. Liu, Siler, Wang, and Wei (2000) measured technology gap or technological capacity by intangible asset per employee while Orlic et al. (2018) used the ratio of intangible asset to tangible asset of the domestic firms. This is because technological knowledge is also considered as intangible asset. Blomström and Kokko (2003), Keller (1996) and Spencer (2008) all agreed that the capability of the potential recipient firms is a function of their human capital and their organizational structure that may facilitate innovation

and thus enhance their benefits from received knowledge. Hamida (2011) and Sonmez (2013) however, concluded that the existing knowledge base of the recipient firm and the intensity of their effort to assimilate new knowledge are two important foundations for absorptive capacity.

2.2.5. Domestic Firm Productivity

Productivity is also known as the measure of efficiency of production which quantifies how a firm manages its resources and also defined as a ratio of output to input (Bonner, 2016). Firm productivity can be defined as the quantity of output that a firm can produce with a given level of input (Hall, 2011). Productivity is a measure of performance of the firms with larger productivity associated with better performance. A firm is described as more productive if it can combine the same level of input like the other firm to yield higher level of output. Bonner (2016) stated that firms can increase their output either by increasing the input or by increasing productivity. Increasing productivity will allow the firm to have better output with the same level of input and hence greater income. This means that productivity will rise when the inputs in the production process are used optimally to produce higher level of output. At firm level, productivity can be improved with the use of technology. Technology helps the firm to use resources more efficiently. Firms can either develop its own technology through research and development (R&D) or acquire it from other firms with superior technology.

Productivity is important to the firm because it allows the firm to stay competitive in the industry. Firms in the same industry compete for limited factors of production; therefore, the ability to optimally use the limited factors of production gives a competitive hedge. A more productive firm can pay higher wages thus attracting the best of employees, it can also pay higher return to shareholders which will increase the firm's value and it can have more funds for investment. A less productive firm on the other hand may be forced to exit the industry; hence productivity is important to a firm.

Domestic firms' productivity has been used as the evidence of technology spillover from MNEs at firm level in the manufacturing and service sector

(Djankov & Hoekman, 2000; Hamida, 2011). Industry productivity has been used as the evidence of technology spillover in the industry by industry level researches (Blomström & Persson, 1983; Blomström, 1986) while the country's productivity in terms of gross domestic product (GDP) has been used as the evidence of spillover on a global level. This study therefore used domestic firms' productivity as the dependent variable since it is a firm level study.

2.3. Technology Spillover and Domestic Firms' Productivity

The empirical literature on intra-industry spillovers was pioneered by Caves (1974) using a cross sectional of manufacturing industries of Australia in 1966. He used augmented production function to test the impact that the presence of foreign firms has on the labour productivity (measured as value added per worker) of the domestic firms. The regression result proved that the presence of foreign firms has a positive impact of the labour productivity in the corresponding industries. Similar studies of Globerman (1979) in Canada, Blomström and Persson (1983) and Blomström (1986) in Mexico confirmed the result of Cave (1974). These studies were based on production function framework where labour productivity or its changes have been regressed on several explanatory variables, one of them being the share of foreign presence. Using aggregated data for the manufacturing sector, all these studies found a positive and statistically significant coefficient for the foreign presence variable and concluded that spillovers exist at industry level.

Empirical studies at firm level have produced inconsistent results. Blomström and Sjöholm (1999) used a cross sectional firm level data of 13,663 Indonesian establishments, with more than 20 employees, obtained for Indonesian Central Bureau of Statistics to test intra-industry technology spillover. The data was enterprise survey obtained from the establishments in the year 1991. The empirical model for the their study was labour productivity which is the dependent variable is a function of capital-labour ratio, skill level of the labour force, capacity utilization, economies of scale, and the foreign presence of the MNEs which was measured by the share of industry output produced by MNEs. The labour productivity was measured by output per labour, the skill level of the labour force was measured as measured as a

ratio of white to blue collar workers, the capacity utilization was measured as a ratio of actual output to potential output as reported by the establishment in the survey, the scale was measured as the ratio of the establishment's production to average production in its industry classified based on 5-digit International Standard Industrial Classification (ISIC). The result of the regression revealed that the presence of the MNEs in the industry positively impacted the productivity of the domestic firms in Indonesia.

Chuang and Lin (1999) investigated the technology spillover from FDI on domestic Taiwanese manufacturing establishment. Using a 1991 industrial and commercial census of 8,846 manufacturing firms, they tested spillover effect on the total factor productivity (TFP) of the domestic firms. They followed the empirical model used by Caves (1974), Globerman (1979), Blomström and Persson (1983) and Haddad and Harrison (1993) but changed the dependent variable to be TFP instead of partial productivity (labour productivity). Their empirical estimation was TFP of an individual establishment being a function of MNE presence in its industry measured by the share of foreign-owned asset in the industry. TFP is also a function of labour quality, economies of scale, concentration ratio of the industry and export participation of the firm and industry. They concluded from their regression result that there is positive productivity spillover from the presence of MNEs in the industry. Also, they stated that the spillover from MNEs is one of the substitutes to domestic firms engaging directly in R&D.

On the contrary, Aitken and Harrison (1999) found that the presence of MNEs negatively affect the productivity of the domestic firms in Venezuela. They used panel data of more than 4,000 Venezuela plants from 1979 to 1989 to test if the presence of MNEs has effect on the productivity of the domestic firms. The empirical estimate was done using a log-linear production function with output of the domestic firms (measured as values of sales less the changes in inventory) as the dependent variable and is regression on the vector of inputs and foreign equity participation averaged over all firms in the industry and weighted by each firm's share in the industry employment. They concluded that MNEs have negative effect on the productivity of the wholly domestically owned firms.

Djankov and Hoekman (2000) also found a negative effect of MNEs presence on the productivity of domestic firms in Czech. Using a panel data of 513 Czech firms from 1992 to 1996, they tested the effect of the presence of MNEs (measured by the share of foreign asset in the industry) on the output of domestically owned firms through an estimated production function. The regression result revealed that the presence of MNEs (including both joint venture and wholly owned subsidiaries) have a negative effect on the productivity of the domestic firms that has no foreign equity. Meanwhile, Bosco (2001), Kathuria (2000) and Kinoshita (2001) found no evidence of spillover from the presence of MNEs using firm level data from Hungary, India and Czech Republic respectively.

According to Hamida (2011), one of the reasons for the contradictory findings in spillover researches is the variable employed to proxy for the presence of MNEs (e.g foreign employment, asset or sales share) which does not seem to capture effects from all channels of technology spillover. In terms of measurement for presence of MNEs, empirical studies have used employment share of foreign owned firms in the industry or output or value-added share of the foreign owned firm in the industry (Görg & Strobl, 2001). Haddad and Harrison (1993), Blomström and Sjoholm (1999), and Chuang and Lin (1999) measured the presence of MNEs as the share of assets held by foreign firms. Aitken and Harrison (1999) used the share of foreign equity participation, while Kathuria (2000) used the share of sales of foreign firms. Driffield (2001) calculated the growth of sales in foreign-owned firms as a measure of presence of MNEs.

Hamida (2011) further stated that there is a need to disentangle the effect of each channel of technology spillover in assessing spillover benefit. Limited empirical studies (Hamida 2011, Orlic et al., 2018) have separated the effect from the channels of technology spillovers in their studies of intra-industry spillovers.

2.3.1. Demonstration Effect and Domestic Firms Productivity

Demonstration effect is a channel of technology spillover from MNEs to domestic firms which occurs when domestic or local firms can increase their

efficiency and productivity by observing or imitating or doing reverse engineering of these technologies used by MNEs (Sonmez, 2013). Hamida and Gugler (2009) investigated demonstration related spillover in the manufacturing and service sector of Switzerland using the innovation activity survey for a total of 1941 firms in 1999 and 2002. Using a production function, the dependent variable in their study was the value added for domestic firms and demonstration effect, expressed in terms of share of sales by foreign company in the industry, was used as one of the independent variables. The other independent variables were capital and labour used by the domestic firms. The study controlled for the effect of company size and the age since these two factors could improve the efficiency of the firms. The study found no evidence spillover through demonstration when the domestic firms are aggregated. However, the domestic firms were divided into three separate groups based on their technological gap (small gap, mid gap, and large gap) measured as a ratio of labour productivity of foreign owned firms to the labour productivity of domestic firms. The result thereafter showed a positive and significant demonstration related technology spillover effect on the productivity of domestic firms with mid technology gap. The also separated the domestic firms into two groups based on their investment in absorptive capacity (high and low), measured by the amount spent on acquiring new equipment and training. The result also shows a positive and significant demonstration related technology spillover effect on the productivity of the domestic firms with high investment in absorptive capacity.

Damijan, Knell, Majcen, and Rojec (2003) studied and compared technology spillover from ten different transition countries. Using a panel data of 8,000 firms in these advanced transition countries from the year 1995 to 1999, their result showed that the increasing presence of MNEs (measured by the share of total sales of foreign affiliates in the industry) increase the productivity (measured by total factor productivity) of the domestic firms in the same industry. Although, they found that vertical spillover is stronger than the horizontal spillover, the horizontal spillover due to increase in the presence of MNEs are also strong, positive and significantly affect the productivity of the domestic firms. Based on these empirical findings, this study tests the following hypothesis.

H_1: Technology spillover through demonstration has positive effect on domestic firms' productivity

2.3.2. Competition Effect and Domestic Firms Productivity

Competition effect is channel of technology spillover from MNEs to domestic firms which occurs when the entrance of MNEs into the industry forces the domestic firms to use their existing technology more efficiently or to upgrade their technology to be competitive and protect their market share (Sonmez, 2013). Spillovers from competition, unlike those from demonstration effects, are not proportional to the presence of foreign firms as they depend on the interaction between foreign and domestic firms (Kokko, 1996). Taking these considerations into account Chen, Kokko, and Tingvall (2011) include two measures of spillovers, one related to contagion effect and the other competitors' effect in their study of FDI and spillover in China. Their study employed data from the China National Bureau of Statistics on firms from 195 manufacturing industries. The dependent variable for this study was labour productivity measured in terms of value added per employee. The independent variables were spillover from competition and spillover from contagion which were measured based on the productivity of competitor and the employment share of foreign owned firms in the industry respectively. The study control for capital intensity (measured as asset per employee), size (measured as log of number of employee), industry competition (measured as share of industry sales concentrated to the three largest firms), export intensity (measured as the ratio of industry export to sales) and scale economies (measured as average firm size). They analyse the system of equations for domestic and foreign firms with multiple regression and find that spillovers from contagion exhibit an inverse U-shaped relationship, whereas spillovers from competition are more linear. This means that spillover from competition has a positive and significant effect on the productivity of the domestic firms in China.

Kosova (2010), in examining whether foreign firms crowd out domestic firms, disentangled competition effects and technology spillover effects for firms in the Czech Republic. She analysed the effects of foreign presence on growth and survival/exit of domestic firms by developing a model that combines a dominant

firm/competitive fringe framework with a model of firm and industry dynamics by Jovanovic (1982) and Sun (2002). The dependent variable which was the growth of the domestic firms measured as domestic firms' growth in sales was regression on a number of independent variables which include sales growth of foreign firms, foreign employment share in the industry among others. She found that upon initial entry, MNCs induce crowding out effect which is short term phenomena. This effect is offset by the increasing number of foreign companies in the sector. Local competitors adapt their production processes to the changing market conditions, with their growth and survival rates increasing as more MNCs enter. Based on these empirical findings, this study tests the following hypothesis.

H_2: Technology spillover through competition has positive effect on domestic firms' productivity.

2.3.3. Worker Mobility and Domestic Firm Productivity

Workers' mobility is a channel of technology spillover from MNEs to domestic firms which occurs when domestic firms acquire tacit technological knowledge by recruiting employees who had already worked for MNEs (Sonmez, 2013). Görg and Strobl (2005) investigated spillover from foreign firms to the domestic firms through workers' mobility. They used data on whether the owner or chairman of a domestic firm has previous experience in a multinational and relate this information to firm-level productivity in Ghana. The data was a World Bank survey of 228 domestic firms in Ghana from 1991 to 1997. The dependent variable used was the TFP of the domestic firms and was regressed on training from foreign firm, work experience from MNEs in the same industry with the domestic firm and experience from MNE in different industry from the domestic firm. They control for the underlying capability of entrepreneurs, using years of schooling and previous experience in the same industry to control for possible ambiguity in the direction of causality between productivity and labour mobility. Their result suggests that firms which are run by owners who worked for multinationals in the same industry immediately prior to opening their own firm or managing a domestic firm are more productive than other domestic firms.

Balsvik (2011) using data from Norwegian manufacturing industry and tracing the flow of workers from MNCs to non-MNCs finds a robust and significantly positive correlation between the share of workers with MNCs experience and the productivity of non-MNCs that employed them. The data was on 4827 manufacturing firms from 1990 to 2000. The dependent variable used was the log of output of the non-MNEs and was regressed on the share of workers with experience form MNEs, share of workers with experience from non-MNEs. The result showed that worker with previous MNE experience contributes 20% more to productivity of the domestic firms than workers without such experience. The independent variables were also regressed on Levinsohn-Petrin residual, which is a multilateral index of TFP, and labour productivity and the result is the same. The results hold even after controlling for unobservable worker characteristics, thus providing evidence consistent with labour mobility channel of FDI spillovers. Based on these empirical findings, this study therefore tests the following hypothesis.

H_3: Technology spillover through worker mobility has positive effect domestic firms' productivity

2.4. Absorptive Capacity and Domestic firms' Productivity

Absorptive capacity is the ability of the domestic firm to recognize new technology, assimilate it and use it to improve its productivity (Narula & Marin, 2003). The empirical studies on the effect of absorptive capacity of the domestic firm on technology spillover have been consistent. Narula and Marin (2003) stated in their study of spillover and absorptive capacity in Argentina that only domestic firms with high investment in absorptive capacity can benefit from FDI spillovers which increased their productivity. Using a firm-level data from the UK manufacturing industry, Girma (2005) found out that a minimum absorptive capacity threshold is required for the domestic firms to benefit from technology spillover. Based on cross-sectional data for manufacturing firms operating in Greece, Dimelis (2005) also provided evidence that only domestic firms with a small technology gap experience positive spillovers. This means that as the technology gap between the MNEs and the domestic firm reduces, the domestic firm's productivity increases. This study adapted the measure of

absorptive capacity by Dimelis (2005) and Hamida (2011). The adsorptive capacity is measured as the technology or productivity gap between the MNEs and the domestic firms. Firms with lower productivity gap are expected to have increased productivity while firms with larger productivity gap are expected to have lower productivity. Kinoshita (2001) also using firm-level panel data for the Czech Republic, found no evidence of spillovers on average but found positive spillovers for local firms that are research and development (R&D) intensive. She interpreted this as evidence that absorptive capacity is important. This is because R&D contribute to the development of absorptive capacity by the firms (Keller, 2004). Based on these empirical findings, this study therefore tests the following hypothesis:

H_4: Domestic firms' absorptive capacity has a positive effect on its productivity.

Absorptive capacity or technology gap can also affect the channel of technology spillover. As stated by Mody (1989), relatively high technology firms are highly likely to benefit from spillovers through demonstration and/or competition effects, while low-technology firms, which are not in a position to compete with foreign firms, gain a lot from other forms of spillovers such as worker mobility, since this channel provides assistance (technical, managerial, etc.) which can help domestic firms to better understand and implement the foreign technology. Hamida and Gugler (2008) also found that domestic firms with high technological capacity appear to gain benefit from spillovers from the increase of competition, while mid-technology firms benefit a lot from demonstration effects. Hamida (2011), found out from Swiss service and construction industry that domestic firms with high technological capacities gain spillover benefit from increased competition from MNEs, while mid and low technology firms benefit from demonstration effects. Orlic et al. (2018) confirmed that the direction and intensity of spillovers depend on the absorptive capacity of domestic firms in their research on spillover from FDI in Czech Republic, Estonia, Hungary, Slovakia and Slovenia. From the previous empirical evidences, absorptive capacity of the domestic firms has a positive impact on their productivity and the level of benefit they get from technology spillover from MNEs.

2.5. Conceptual Framework

Based on the literature reviewed and the objectives of this study which are to ascertain technology spillover form the presence of MNEs, evaluate the channels of the spillover and their effect on the productivity of the domestic firm, the conceptual framework is as stated below.

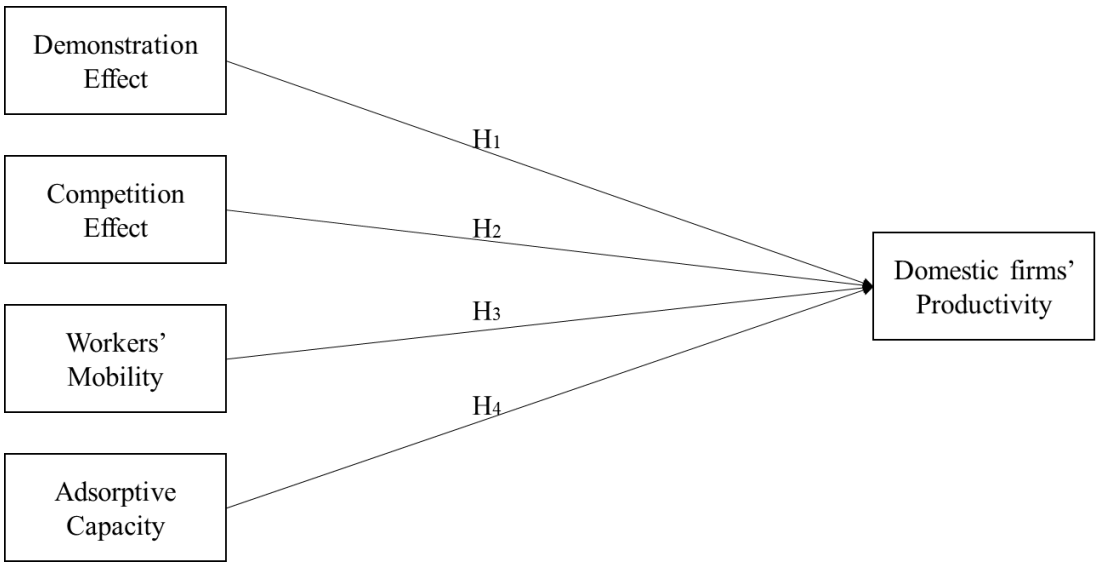

Figure 2: Conceptual Framework

2.6. Chapter Summary

This chapter reviewed concepts related to this study which are; digital and technology MNEs, technology, technology diffusion, technology transfer, and technology spillover. It also reviewed the MNE theory of internalization and the eclectic paradigm. The chapter further elucidated the channels of technology spillover and the essence of domestic firms' absorptive capacity in capturing the spillover. The chapter concluded with the proposed conceptual framework for this study. The next chapter, therefore, discusses the proposed methodology and research approach that will be employed in this study.

CHAPTER THREE

METHODOLOGY

3.1. Introduction

This chapter details the research method that was used in this study. This chapter presents how the research was conducted in terms of describing the population, the source of data, the empirical model for estimation and the statistical analytical tool that was used to analyse the data obtained.

3.2. Population and Sample

The study examined technology spillover from MNEs to the domestic firms in South East Asia. There are ten countries in South East Asia namely: Indonesia, Vietnam, Thailand, Philippines, Malaysia, Singapore, Cambodia, Laos, Myanmar, and Brunei. This study used purposive sampling to select five countries out of the ten countries. Purposive sampling techniques is the deliberate choice of informants based on the characteristics of the informant (Tongco, 2007). The selection criterion was the availability of panel data. Five countries namely; Indonesia, Philippines, Vietnam, Laos, and Myanmar in the South East Asia were studied. The five countries were selected due to the availability of panel data from the World Bank Enterprise Survey as at the time the study is conducted. Moreover, the five countries represent the developing Southeast Asia nations. The target population for the research are the firms in each country studied. The population size is unknown however, this study relied on the secondary data obtained from the World Bank Enterprise Survey. The World Bank Enterprise Survey is a firm-level survey of the manufacturing and service firms for 139 countries. The Enterprise Survey used stratified random sampling method as the sampling method. Panel data is a priority for the Enterprise survey, although, the surveys are mostly not conducted yearly. Therefore, the panel data for a country may be bi-annually, tri-annually or an uneven spaced panel data. This study used panel data because of it can control for the unobserved individual heterogeneity of the firms. In addition, Görg and Strobl (2001) argued that panel data using firm-level data are the most appropriate estimating framework for technology spillover because of two

reasons. First, they permit investigation of the development of domestic firms' productivity over a longer time period, rather than at one point in time. Second, they allow investigation of spillovers after controlling for other factors. Cross-section data, particularly if aggregated at the industry level, fail to control for time-invariant differences in productivity across sectors that might be correlated with foreign presence without being caused by it. Thus, coefficients on cross-section estimates are likely to be biased.

The selected five countries are the countries with available panel data in South East Asia, others with the exception of Brunei and Singapore where the surveys are not collected, have cross-sectional survey done but not conducted with the same firm over time. The number of observations in the panel data for each of the five countries are presented in the Table 3.1 below.

Table 3.1 Data Information

Country	**Data Years**	**Total observations**
Indonesia	2009/2015	2042
Philippines	2009/2015	2080
Vietnam	2009/2015	1548
Laos	2009/2016	688
Myanmar	2014/2016	700

As shown in Table 3.1 above, the data were not obtained in consecutive years. Previous studies like Hamida (2011) used innovation activity surveys obtained in 2002 and 2005 as panel data for the empirical study of technology spillover in Switzerland. Driffield (2001) also used data obtained from the UK Office of National Statistics in 1989 and 1992 to test the impact of FDI on domestic productivity. According to Duncan (2015), a panel data may differ in the interval between rounds of data collection and the length of the survey. Panel survey could be conducted daily, weekly, biweekly, monthly, quarterly, biannually, and more or less frequently (Duncan, 2015).

Furthermore, the data obtained from the World Bank Enterprise Survey are unbalanced. This means that panel data for some firms are missing. Therefore, balance panel data are extracted from the unbalanced panel data for the inferential data analysis in this study. Thus, the number of observations for the inferential analysis for each country is smaller than the number of observations reported in Table 3.1 above.

3.3 Empirical Model and Variables Measurement

To understand the measurement of technology spillover, there is a need to know how technology is measured. Technology is elusive and difficult to measure. According to Keller (2004), technology has been widely measured indirectly by three approaches. The first approach is by measuring the input to the development of technology which is R&D. The second approach is by measuring the output of R&D which is patent. The third approach is by measuring the effect of technology which is higher productivity. The limitation of using amount spent on R&D is that increase in R&D expenditure does not necessarily translate to development of new technology because of the stochastic nature of innovation (Keller, 2004). More so, technology may not be developed by a firm but acquired from other firms as in the concept of technology transfer and spillover.

Patent gives its holder a temporary legal monopoly to use an innovation in a specific market at the price of public disclosure of technical information in the patent description. Although an innovation must be sufficiently important to be worthy of a patent as judged by a trained patent examiner, the use of patent to measure technology is not without limitation. One of the limitations is that patent count does not indicate technological impact of the innovation. According to Keller (2004), a small number of patents account for most of the value of all patents. This issue has been addressed by using citation weighted patent data (Jaffe & Trajtenberg, 2002). However, because tacit technology knowledge cannot be codified, patent will only represent the explicit component of technology. Besides, the decision to file for patent by organization is voluntary, hence patent may not capture all the technology used by a firm.

The effect of technology in terms of higher productivity seems to be a more reliable measure of technology. It also supports the concept of technology spillover because technology spillover involves spillover of more of the tacit knowledge than the explicit knowledge (Techakanont & Terdudomtham, 2004). This means that when technology is in use, it gives competitive advantage to the user and increase the productivity of the user. More so, the effect of technology encompasses both the input and output of technology described above. According to Keller (2004), the idea since the 1950s is that the difference between the output and the input of labour and capital is the technology factor. Hence, majority of spillover literature have used production function to estimate spillover by using the productivity of the domestic firms as the dependent variable and the presence of MNEs as a key regressor (Meyer & Sinani, 2009). A positive and significant coefficient of the presence of MNEs indicates positive spillover effect while a negative coefficient means negative spillover effect.

The productivity of the domestic firms have been proxied by labour productivity, which is measured by output or value added per employee (Blomström & Persson, 1983; Kokko, 1996; Blomström & Sjöholm, 1999) or by growth in output or value added (Aitken & Harrison, 1999; Javorcik, 2004; Hamida, 2011). Blomström (1986) and Kathuria (2000) used a different measurement called the efficiency index, which compares the efficiency changes in firms with the efficiency frontier in the industry, as the dependent variable.

3.3.1 Model Specification

The technology spillover effect on the productivity of domestic firms for this study is modelled within the context of Cobb Douglas production function as stated below:

$$Y_{ijt} = A_{ijt} L_{ijt}^{\propto 1} K_{ijt}^{\propto 2} \quad (1)$$

Where Y = Output

L = Labour

K = Capital

A = level of productivity

$_i$ = firm

$_j$ = industry

$_t$ = time

The output Y of a domestic firm (i) in industry (j) at time (t) is a function of the inputs; labor (L) and capital (K). The level of productivity is given by A_{ijt}, which is assumed to vary across firms within each industry and across time. A number of previous studies like Aitken and Harrison (1999), Tian (2007), Zhang, Li, Li, and Zhou (2010), and Hamida (2011) had also based their empirical estimation on extended Cobb Douglas production function.

After taking logarithm and factor in the changes in time the equation will be as stated below:

$$\text{In } Y_{ij} = \text{In } A_{ij} + \beta_1 \text{In } L_{ij} + \beta_2 \text{ In} K_{ij} + e_{ij} \quad (2)$$

The stochastic disturbance term (e) is introduced in the equation. Most empirical studies have proxy A to be the presence of MNEs in the industry and control for firm size and industry type. However, this research adopts the model used by Hamida (2011) because it disentangles the effects from the different channels of horizontal technology spillover. Hamida (2011) proxied A as follows:

$$A = \beta_3 FP_{jt} + \beta_4 HC_{ijt} + \beta_5 FP_{jt} * HC_{ijt} + \beta_6 Comp_{jt} + \beta_7 Industry_{it} \quad (3)$$

FP = foreign presence which is the measure of demonstration effect

HC = Human Capital

Comp = Competition effect

When equation three is put together with equation two it becomes:

$$\text{In } Y_{ij} = \propto_0 + \beta_1 \text{In } L_{ij} + \beta_2 \text{ In}K_{ij} + \beta_3 FP_{jt} + \beta_4 HC_{ijt} + \beta_5 FP_{jt} * HC_{ijt} + \beta_6 Comp_{jt} + \beta_7 Industry_{it} + e_{ij} \quad (4)$$

3.3.2 Variables Measurement

The dependent variable which is the output of the domestic firm Y is proxied by value added of the domestic firm in consistence with Blomström and Persson (1983), Kokko (1996), and Blomström and Sjöholm, (1999). The value added is calculated as sales less intermitted consumptions. This is appropriate for this study because the firms included both manufacturing and service providing firms. The service providing firms have no tangible output, thus value added is the uniform measure of output for both the manufacturing and service firms.

The independent variables for this research are technology spillover through demonstration effect, technology spillover through competition effect, technology spillover through workers mobility, and absorptive capacity.

Demonstration effect is represented in the equation 4 above as foreign presence (FP) and it is measure as the share of sales by foreign firms or MNEs in the industry. This is consistent with the measurement of foreign presence by Kathuria (2000). The share of sale is likely to show demonstration effect because domestic firm can observe the product sold by MNEs and copy or do a reverse engineering of it. The formula is therefore clearly stated below.

$$Foreign\ Presence\ (FP) = \frac{Total\ sales\ by\ MNEs\ in\ the\ industry}{Total\ sales\ by\ all\ firms\ in\ the\ industry} \quad (5)$$

The competition effect is represented by $Comp_j$ in equation 4. Following Orlic et al. (2018), this study used Herfindahl-Hirschman Index (HHI). The HHI is degree of market concentration in an industry (Rhoades, 1993). The HHI is calculated by squaring the market share of the firms in the industry, thus giving more value firms with higher market share. The industry with just one firm will have an index value of 1. This means that the market concentration of the firm is high. However, in this study,

that author used one minus HHI to measure competition. Since, the lower the HHI, the higher the competition. This is because HHI measures the market concentration and the higher the value, the higher the concentration and thus the lower the market competition. Hence the formula for competition is given below

$$Competition = 1 - HHI \tag{6}$$

$$Herfindahl - Hirschman\ Index\ (HHI) = \sum_{i=1}^{n} MS_i^2 \tag{7}$$

Where, n = number of firms in the industry

MS = market share of a firm

HC will be measured as average labour cost for the individual firm consistent with Hamida (2011). The formula for HC is clearly stated below.

$$Human\ Capital\ (HC) = \frac{Total\ labour\ cost}{Number\ of\ employees} \tag{8}$$

The interaction term FP*HC between the share of foreign presence and the firm's human capital is proxied to determine the effect of worker mobility related to the presence of foreign firms in the domestic market. Apart from Hamida (2011) that used this interaction term, Orlic et al (2018) also used the same interaction term to proxy for the effect of worker mobility in their study of technology spillover in transition economies in Europe. The interaction means the changes in human capital as foreign presence changes. To prevent multicollinearity between workers' mobility, FP and HC, the standardized value of HC was used in the calculation of workers' mobility. The formula for workers' mobility is therefore shown below.

$$Workers'Mobility = \mathrm{FP_{jt}} * \mathrm{HC_{ijt}} \tag{9}$$

The absorptive capacity was measured by the ratio of average labour productivity of the MNEs in the industry to the domestic firms' labour productivity in consistence with Hamida (2011). A lower ratio indicates a lower technology gap

between the MNEs and domestic firms and represents high absorptive capacity. The absorptive capacity is expected to be negative in the multiple regression analysis since the lower calculated value of absorptive capacity indicates a high absorptive capacity. The formula for absorptive capacity is clearly stated below.

$$Absorptive\ Capacity = \frac{Average\ labour\ productivity\ of\ the\ MNEs\ in\ the\ industry}{Labour\ productivity\ of\ domestic\ firms} \quad (10)$$

Where:

$$MNEs'\ average\ labour\ productivity = \frac{Sum\ of\ labour\ productivity\ of\ the\ MNEs}{Number\ of\ MNEs} \quad (11)$$

$$Labour\ productivity = \frac{Value\ added}{Number\ of\ employees} \quad (12)$$

The domestic firm input labour (L) is measured as the number of employees of firm (i) at industry (j) and across time (t). The capital (K) is measured Net Book Value of the firms' physical asset. Industry is a dummy variable and is represented by the four-digit United Nations' International Standard Industry Classification of all Economic Activities (ISIC) forth revision (United Nations Statistical Division, 2008). The four-digit ISIC code is given to the firms based on the major product or service of the firms.

3.4 Data Analysis

Both the descriptive statistical analysis and inferential statistical analysis were conducted on the data obtained from World Bank Enterprise Survey. The descriptive statistic of percentage, mean, minimum, maximum, standard deviation were done. Firstly, the participation of MNEs in the Sectors of the countries were analysed. Secondly, the descriptive statistics of the variables for each country and the correlation among the variables were done.

Lastly, multiple regression analysis was used to test all the hypotheses. After the data were tested for normality, linearity, homoscedasticity and no multicollinearity in order to fulfil the assumptions of multiple regression analysis. The outliers were removed, and the multiple regression analysis will be done using IBM's Statistical Package for Social Sciences (SPSS). The resultant coefficient of variance for each of the independent variable in the empirical model is therefore interpreted as the effect on the value added of the domestic firms which is the dependent variable.

3.5 Research Procedure

This section details the stepwise procedure used in conduction the research.

Step 1: Retrieving Data: The data for the countries in South East Asia were on the World Bank website. The five countries were selected due to the availability of panel data. The author obtained authorization and password to assess the data from the World Bank Enterprise Survey Group in the USA via email. The data were thereafter spooled from the website and converted from Stata format to excel format using STATA 15.1 application.

Step 2: The data were prepared for analysis. The independent variables of the foreign presence (demonstration effect), human capital, workers mobility, competition and absorptive were computed by the author from the information provided in the data and by using equations 5 to 12.

Step 3: The data analysis was thereafter conducted. Firstly, the MNEs participation in the sectors were analysed using percentage of sales in the sector by MNEs, percentage of labour productivity accounted for by MNEs in the sector, percentage of employees employed by MNEs in the sector, the number of MNEs in the sector, and the total number of firms in the sector were analysed. The sector was defined as two-digit ISIC code. The MNEs participation were analysed separately for each country.

Step 4: The descriptive statistic of the variables (independents, dependents, and control variables) were analysed using minimum, maximum, mean, and standard deviation for each country. The Pearson correlation of the variables were also analysed for each country.

Step 5: Following the model in equation 4, the logarithms of value added, labour, and capital were taken. The author also took log of HC to correct for normality. The outliers in the data were removed using the 1.5 multiplied by the interquartile range rule done on the IBM SPSS. The panel data for each country was also formatted to contain balanced data only. Therefore, data from firms that are not included in both years of the data collection were deleted from the sample. As explained earlier the use of panel data is to control for individual heterogeneity. Thus, a balanced panel is required. The dependent variable was also corrected for inflation by dividing it with the GDP deflator for the year.

Step 6: The data was tested for linearity and homoscedasticity using the scatter plots and all the data passed the test of linearity and homoscedasticity. The data was also tested for multivariate normality by using the normal probability plots and plot of the standardized predicted values against the standardized residual value. Furthermore, multicollinearity among the independent variables was tested using Variance Inflation Factor (VIF) and Tolerance. The test of linearity, homoscedasticity, multivariate normality, and no multicollinearity was conducted separately for the data in all the five countries. These tests were conducted on the SPSS.

Step 7: Multiple regression analysis using ordinary least square (OLS) method was conducted to test the hypotheses of this study. The results were thereafter interpreted and discussed.

3.6 Chapter Summary

This chapter presented the research methodology used to examine the research objectives. A quantitative research method is employed to solve research problem. The information in this chapter discussed the overall of research design procedure, empirical estimation model, and data analysis.

CHAPTER FOUR

FINDINGS

4.1 Introduction

This chapter presents the results of the analysis the impact of technology spillover from MNEs to domestic firms in five countries in South East Asia namely Indonesia, Philippines, Myanmar, Vietnam, and Laos. Secondary data from the World Bank Enterprise Survey was used in this study. The five countries were selected due to the availability of panel data on the firms in the countries. It is important to note two limitations to the data, firstly, the data for the countries were not obtained in the same years. However, the author decided to continue with the comparative studies because the data for the countries are not pooled together. It is impossible to pool the data for the countries together because of differences in currency, differences in economic situation like inflation and other national differences. Therefore, the hypotheses were tested in each country and the results compared. Secondly, the panel data were not collected in consecutive years. Previous studies like Hamida (2011) used innovation activity surveys obtained in 2002 and 2005 as panel data for the empirical study of technology spillover in Switzerland. Driffield (2001) also used data obtained from the UK Office of National Statistics in 1989 and 1992 to test the impact of FDI on domestic productivity. According to Duncan (2015), a panel data may differ in the interval between rounds of data collection and the length of the survey. Panel survey could be conducted daily, weekly, biweekly, monthly, quarterly, biannually, and more or less frequently (Duncan, 2015).

The chapter is structured as follows; first the participation of MNEs in each country are presented at industrial sector level. The industrial sector is defined as two-level United Nations' ISIC (United Nations Statistical Division, 2008). Secondly, the descriptive statistics and Pearson correlation of the independent and the dependent variables are presented for each country. Lastly the multiple regression for all the five countries are presented. As explained in Chapter 3, multiple regression analysis with the adapted model is used to test the various hypotheses in this study. This section concludes with summary of the result and decision on the hypotheses.

4.2 MNEs Participation in Indonesia.

This section presents information on the participation of MNEs in Indonesia derived from the data obtained from the World Bank Enterprise Survey. The panel data for Indonesia was collected in 2009 and 2015. The number of observations for the unbalanced panel data for both years is 2042. A total of 15 sectors are represented in the data. Table 4.1 below therefore, presents the participation of MNEs in different industrial sectors in Indonesia based on their share of sales, share of labour productivity, share of employment, the number of MNEs in the sector, and the total number of firms from each sector that are included in the data. The author used this form of classification because it gives a vital information about the type of firms (i.e. what sectors are they from) included in the data, what sectors are represented in the data, and it describe the level of involvement of MNEs in each of these sectors. The MNEs share of sale, share of labour productivity and share of employment are presented in percentage which are calculated by dividing total sales by MNEs in the sector with the sales of all the firms in the sector, total labour productivity by MNEs with total labour productivity in the sector, total number of employees by MNEs with total number of employees in the sector respectively. The table further shows the extent of the contribution of MNEs to sales, productivity and employment in the country based on the firms surveyed. Moreover, the number of MNEs in the sector and the total number of firms in the sector provides information on the proportion and composition of the MNEs and non-MNEs in the sectors. All this information can be used to understand the level of participation and involvement of MNEs in the sectors and in the country.

Table 4.1 MNEs Participation in Indonesia

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2015	2009	2015	2009	2015	2009	2015	2009	2015
1	Manufacture of leather and related products	1.96	94.07	1.68	38.92	15.03	30.74	7	17	146	169
2	Manufacture of paper and paper products	17.35	68.32	2.04	70.28	21.03	5.30	7	3	154	86
3	Printing and reproduction of recorded media	31.1	74.77	6.45	77.46	51.89	32.17	13	16	129	166
4	Manufacture of chemicals and chemical products	92.92	78.61	23.98	56.14	57.61	37.21	1	14	38	68
5	Manufacture of basic metals	47.78	84.74	66.42	79.00	42.75	25.65	17	17	118	86
6	Manufacture of fabricated metal products, except machinery and equipment	43.02	47.76	29.96	63.43	27.61	21.89	14	11	117	127

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2015	2009	2015	2009	2015	2009	2015	2009	2015
7	Manufacture of computer, electronics and optical products	13.07	58.59	6.36	52.48	11.93	61.58	6	17	130	135
8	Manufacture of electrical equipment	75.32	98.49	44.36	97.21	33.80	59.23	1	10	9	29
9	Manufacture of machinery and equipment	92.48	6.18	79.34	16.65	23.55	60.44	2	9	14	27
10	Manufacture of motor vehicle, trailers and semi-trailers	50.27	44.61	57.52	25.72	47.07	68.69	3	3	5	7
11	Electricity, gas, steam and air conditioning supply	94.02	69.10	44.81	36.51	60.96	15.55	2	1	15	23
12	Wholesale and retail trade and repair of motor vehicles and motorcycles	4.13	7.22	23.50	0.73	6.59	28.58	2	2	18	31

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	**2015**	**2009**	**2015**	**2009**	**2015**	**2009**	**2015**	**2009**	**2015**
13	Water transport	44.32	26.43	41.13	22.04	19.67	31.94	3	2	14	13
14	Warehousing and support activities for transportation	33.58	68.97	0.01	73.82	26.18	14.23	1	9	50	63
15	Accommodation	21.9	0.35	14.47	0.12	10.42	27.84	1	2	17	38
	Overall	**15.84**	**65.9**	**17.09**	**33.36**	**31.67**	**34.08**	**80**	**133**	**974**	**1068**

Source: Author's compilation

As shown in Table 4.1 above, in 2009, MNEs had the highest share of sales in the electricity, gas, steam and air conditioning supply sector with 94.02% of the sales in the sector by MNEs. The sector where MNEs had the least share of sales in year 2009 was in the manufacturing of leather and related products sector with 1.96% share of sales in the sector. In 2015, the sector where MNEs had the highest share of sales was the manufacturing of electrical equipment sector with MNEs accounting for 98.49% of the sales in the sector. However, accommodation sector had the lowest MNEs share of sales (0.35%) in the year 2015. In terms of labour productivity, for the year 2009, the sector where the MNEs had relative highest share of labour productivity was the manufacturing of machinery and equipment sector (79.34%), whereas, the sector where MNEs had the lowest share of labour productivity was the warehousing and support activities for transportation sector (0.01%). In 2015, the sector with the highest share of MNEs labour productivity was manufacturing of electrical equipment with the MNEs accounting for 97.21% of the total productivity in this sector. The sector with the lowest MNEs share of labour productivity was the accommodation sector with MNEs accounting for 0.12% of the productivity in the sector.

In terms of employment, the sector where the MNEs had the highest share of employment in the year 2009 was the electricity, gas, steam and air conditioning supply sector and MNEs accounted for 60.96% of the total employment in the sector. The sector with the lowest MNEs share of employment in 2009 was wholesale and retail trade and repair of motor vehicles and motorcycles sector where MNEs accounted for 6.59% of the total employment in the sector. However, in 2015, manufacture of motor vehicle, trailer and semi-trailer sector had the highest MNEs' share of employment of 68.69% while manufacture of paper and paper products sector had the lowest MNEs share of employment of 5.30%. The sector with the highest number of MNEs in 2009 was the manufacture of basic metals with 17 MNEs in the sector. In 2015, both the manufacture of leather and related products, and manufacture of basic metals sectors have the highest number of MNEs in the sector with 17 MNEs in each sector.

Overall, the total sales accounted for by MNEs in 2009 was 15.84% while MNEs share of sales in 2015 was 65.9%. In terms of productivity, MNEs accounted for 17.09% of the labour productivity in 2009 and 33.36% of labour

productivity in 2015. More so, MNEs employed 31.67% of all the employees in 2009 and 34.08% of the employees in 2015. The total number of firms included in the survey of 2009 were 974 out of which 80 firms were MNEs. In 2015, the total number of firms included in the survey were 1,068 out of which 133 were MNEs. Therefore, a total of 2,042 observations were made in both years.

4.3 MNEs Participation in the Philippines

This section presents information on the participation of MNEs in the Philippines derived from the data obtained from the World Bank Enterprise Survey. The panel data for the Philippines was collected in 2009 and 2015. The Table 4.2 below presents the MNEs participation by sector in Philippines. As shown in Table 4.2, there are 21 sectors represented in the data. In all the total observation for the unbalanced panel data was 2,080 for both years.

As shown in Table 4.2 below, in 2009, MNEs had the highest share of sales in the information service activities sector with 99.11% of the sales in the sector by MNEs. The sector where MNEs had the least share of sales in year 2009 was in the manufacturing chemical and chemical products sector with 0.77% share of sales in the sector. However, in 2015, MNEs had the highest share of sales in the manufacturing of chemical and chemical products sector with MNEs accounting for 90.97% of the sales in the sector. The manufacturing of rubber and plastics products sector had the lowest MNEs share of sales (2.53%) in the year 2015. In terms of labour productivity, for the year 2009, the sector where the MNEs had relative highest share of labour productivity was the manufacturing of machinery and equipment sector (98.75%), whereas, the sector where MNEs had the lowest share of labour productivity was the manufacturing of of chemical and chemical products (0.16%). In 2015, the sector with the highest share of MNEs labour productivity was manufacturing of furniture with the MNEs accounting for 93.85% of the total productivity in this sector. The sector with the lowest MNEs share of labour productivity was the warehousing and support activities for transportation sector with MNEs accounting for 5.12% of the productivity in the sector.

Table 4.2 MNEs Participation in Philippines.

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2015	2009	2015	2009	2015	2009	2015	2009	2015
1	Manufacture of leather and related products	21.41	35.99	31.87	7.51	29.97	22.15	9	15	98	128
2	Manufacture of paper and paper products	30.12	61.89	40.50	75.21	43.75	23.64	3	1	8	4
3	Printing and reproduction of recorded media	54.58	46.63	11.64	26.5	61.23	49.11	26	28	101	126
4	Manufacture of chemical and chemical products	0.77	90.97	0.16	47.05	4.73	90.23	1	1	10	3
5	Manufacture of pharmaceuticals, medicinal chemical and botanical products	96.84	98.23	92.69	58.58	51.08	87.59	2	1	7	3
6	Manufacture of rubber and plastics products	12.9	2.53	18.71	15.55	18.49	6.91	3	2	11	13

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2015	2009	2015	2009	2015	2009	2015	2009	2015
7	Manufacture of basic metals	35.56	30.72	23.91	9.66	29.62	21.18	23	23	118	142
8	Manufacture of fabricated metal products, except machinery and equipment	51.13	13.41	52.94	33.67	40.29	30.51	42	47	149	152
9	Manufacture of computer, electronics and optical products	57.67	84.28	29.92	53.31	34.01	60.85	16	7	94	22
10	Manufacture of electrical equipment	98.67	3.82	97.47	24.33	80.14	17.74	4	3	7	9
11	Manufacture of machinery and equipment	98.12	53.71	98.75	64.38	74.75	41.05	7	42	16	139
12	Manufacture of motor vehicles, trailers, and semi-trailers	98.35	89.81	98	56.88	88.11	62.24	2	3	3	8
13	Manufacture of furniture	97.75	95.93	86.9	93.85	83.17	77.37	59	59	99	112
14	Other manufacturing	89.2	59.84	68.44	35.69	93.66	39.64	22	4	30	7

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	**2015**	**2009**	**2015**	**2009**	**2015**	**2009**	**2015**	**2009**	**2015**
15	Repair and installation of machinery and equipment	96.59	82.44	78.3	22.2	92.61	88.84	7	5	10	9
16	Electricity, gas, steam and air conditioning supply	89.24	49.48	44	21.82	63.47	50.97	9	5	38	15
17	Wholesale and retail trade and repair of motor vehicles and motorcycles	30.18	3.13	9.33	6.82	19.33	1.83	3	1	17	11
18	Water transport	77.34	15.82	84.87	17.24	58.21	18.12	6	1	18	10
19	Warehousing and support activities for transportation	12.36	15.32	4.98	5.12	8.8	44.12	8	10	119	121
20	Accommodation	78.50	14.73	76.48	5.28	8.26	14.79	4	5	35	36
21	Information service activities	99.11	37.12	77.91	16.72	72.34	34.82	2	4	12	10
	Overall	**84.59**	**51.31**	**59.65**	**32.03**	**59.53**	**43.92**	**258**	**267**	**1000**	**1080**

Source: Author's compilation

In terms of employment, the sector where the MNEs had the highest share of employment in the year 2009 was the other manufacturing sector and MNEs accounted for 93.66% of the total employment in the sector. The sector with the lowest MNEs share of employment in 2009 was manufacturing of chemical and chemical products sector where MNEs accounted for 4.73% of the total employment in the sector. However, in 2015, manufacturing of chemical and chemical products sector had the highest MNEs share of employment of 90.23% while warehousing and support activities for transportation sector had the lowest MNEs share of employment of 1.83%. The manufacturing of furniture sector had the highest number of MNEs in 2009 and 2015 with 59 MNEs each present in both years.

Overall, the total sales accounted for by MNEs in 2009 was 84.59% while MNEs share of sales in 2015 was 51.31%. In terms of productivity, MNEs accounted for 59.65% of the labour productivity in 2009 and 32.03% of labour productivity in 2015. Furthermore, MNEs employed 59.53% of all the employees in 2009 and 43.92% of the employees in 2015. The total number of firms included in the survey of 2009 were 1,000 out of which 258 firms were MNEs. In 2015, the total number of firms included in the survey were 1,080 out of which 267 were MNEs. Therefore, a total of 2,080 observations were made in both years.

4.4 MNEs Participation in the Vietnam

The panel data for Vietnam was collected in 2009 and 2015. Table 4.3 below presents the participation of MNEs by sectors in Vietnam. As shown in Table 4.3, there are 16 sectors represented in the data. In all the total observation for the unbalanced panel data was 1,548 for both years. Therefore, the table presents information on eighteen sectors.

Table 4.3 MNEs Participation in Vietnam.

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2015	2009	2015	2009	2015	2009	2015	2009	2015
1	Manufacture of leather and related products	43.69	49.34	12.04	13.71	30.63	62.29	13	12	123	129
2	Manufacture of paper and paper products	66.79	25.98	37.1	11.17	52.48	35.58	27	3	94	24
3	Printing and reproduction of recorded media	36.03	33.69	28.01	11.45	31.21	33.25	26	22	115	138
4	Manufacture of coke and refined petroleum products	66.71	40.8	19.79	8.62	45.5	48.87	2	3	9	14
5	Manufacture of chemicals and chemical products	30.73	1.25	19.27	1.49	12.97	3	3	1	37	21
6	Manufacture of pharmaceuticals, medicinal chemical and botanical products	4.41	34.19	1.12	29.51	12.58	59.73	1	2	25	8

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2015	2009	2015	2009	2015	2009	2015	2009	2015
7	Manufacture of basic metals	36.51	22.88	12.61	8.52	39.46	5.17	4	1	23	18
8	Manufacture of fabricated metal products, except machinery and equipment	38.26	26.69	31.52	5.42	39.3	46.43	5	3	29	18
9	Manufacture of computer, electronic and optional products	36.13	24.21	14.47	5.63	14.73	22.89	10	11	114	130
10	Manufacture of electrical equipment	85.35	4.31	80.13	4.43	45.98	0.67	4	1	25	14
11	Manufacture of machinery and equipment	54.23	11.11	31.12	5.42	31.72	36.5	14	9	85	97
12	Manufacture of motor vehicles, trailers, and semi-trailers	77.49	81.47	23.62	19.95	37.99	67.05	4	4	28	33
13	Manufacture of furniture	50.45	1.46	1.04	1.17	77.49	10.13	4	1	17	9

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	**2015**	**2009**	**2015**	**2009**	**2015**	**2009**	**2015**	**2009**	**2015**
14	Other manufacturing	21.15	87.45	26.83	64.86	24.19	48.77	1	1	4	4
15	Water collection, treatment and supply	5.25	37.37	0.74	16.78	5.79	61.07	1	3	7	14
16	Warehousing and support activities for transportation	0.57	0.39	1.96	1.85	0.81	0.51	1	1	83	59
	Overall	**43.54**	**41.84**	**39.37**	**8.45**	**33.42**	**41.43**	**120**	**78**	**818**	**730**

Source: Author's compilation

As shown in Table 4.3 above, in 2009, MNEs had the highest share of sales in the manufacture of motor vehicles, trailers and semi-trailers sector with 77.49% of the sales in the sector by MNEs. The sector where MNEs had the least share of sales in year 2009 was in the warehousing and support activities for transportation sector with 0.57% share of sales in the sector. However, in 2015, MNEs had the highest share of sales in the other manufacturing sector with MNEs accounting for 87.45% of the sales in the sector. The warehousing and support activities for transportation sector had the lowest MNEs share of sales (0.39%) in the year 2015. In terms of labour productivity, for the year 2009, the sector where the MNEs had relative highest share of labour productivity was the manufacturing of electric equipment sector (80.13%), whereas, the sector where MNEs had the lowest share of labour productivity was the water collection, treatment and supply sector (0.74%). In 2015, the sector with the highest share of MNEs labour productivity was other manufacturing with the MNEs accounting for 64.86% of the total productivity in this sector. The sector with the lowest MNEs share of labour productivity was the manufacturing of furniture sector with MNEs accounting for 1.17% of the productivity in the sector.

In terms of employment, the sector where the MNEs had the highest share of employment in the year 2009 was the manufacturing of furniture sector and MNEs accounted for 77.49% of the total employment in the sector. The sector with the lowest MNEs share of employment in 2009 was warehousing and support activities for transportation sector where MNEs accounted for 0.81% of the total employment in the sector. However, in 2015, manufacture of motor vehicles, trailers and semi-trailers sector had the highest MNEs share of employment of 67.05% while warehousing and support activities for transportation sector had the lowest MNEs share of employment of 0.51%. Printing and reproduction of recorded media sector had the highest number of MNEs in 2009 and 2015 with 26 and 22 MNEs present in both years respectively.

Overall, the total sales accounted for by MNEs in 2009 was 43.54% while MNEs share of sales in 2015 was 41.84%. In terms of productivity, MNEs accounted for 39.37% of the labour productivity in 2009 and 8.45% of labour productivity in 2015. Furthermore, MNEs employed 33.42% of all the employees in 2009 and 41.43% of the employees in 2015. The total number of firms included in the survey of 2009 were 818 out of which 120 firms were MNEs. In 2015, the total number

of firms included in the survey were 730 out of which 78 were MNEs. Therefore, a total of 1,548 observations were made in both years.

4.5 MNEs Participation in the Laos

The panel data for Laos was obtained in 2009 and 2016. Table 4.4 below presents the participation of MNEs by sectors in Laos. In all the total observations for the unbalanced panel data was 688 for both years. Furthermore, the table presents information on eleven sectors.

As shown in Table 4.4 below, in 2009, MNEs had the highest share of sales in the manufacture of rubber and plastics products sector with 77.46% of the sales in the sector by MNEs. The sector where MNEs had the least share of sales in year 2009 was in the wholesale and retail trade and repair of motor vehicles and motorcycles sector with 1.56% share of sales in the sector. Moreover, in 2016, MNEs had the highest share of sales in the manufacture of rubber and plastics products sector with MNEs accounting for 77.20% of the sales in the sector. The warehousing and support activities for transportation sector had the lowest MNEs share of sales (3.98%) in the year 2016. In terms of labour productivity, for the year 2009, the sector where the MNEs had relative highest share of labour productivity was the manufacture of fabricated metal products, except machinery and equipment sector (59.10%), whereas, the sector where MNEs had the lowest share of labour productivity was the wholesale and retail trade and repair of motor vehicles and motorcycles sector (1.37%). In 2016, the sector with the highest share of MNEs labour productivity was manufacture of rubber and plastics products with the MNEs accounting for 61.12% of the total productivity in this sector. The sector with the lowest MNEs share of labour productivity was the warehousing and support activities for transportation sector with MNEs accounting for 1.44% of the productivity in the sector.

Table 4.4 MNEs Participation in Laos.

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	2016	2009	2016	2009	2016	2009	2016	2009	2016
1	Manufacture of wearing apparel	6.04	17.86	6.65	3.67	2.67	23.52	1	1	15	20
2	Manufacture of paper and paper products	9.37	31.55	2.03	18.74	28.33	29.03	1	2	9	8
3	Printing and reproduction of recorded media	66.07	28.42	54.12	32.44	50.89	46.49	18	7	51	18
4	Manufacture of chemicals and chemical products	17.48	8.59	31.70	9.52	19.00	13.44	4	3	28	23
5	Manufacture of rubber and plastics products	77.46	77.20	48.89	61.12	53.76	76.60	3	4	8	9
6	Manufacture of fabricated metal products, except machinery and equipment	46.44	15.40	59.10	22.36	31.41	16.54	4	3	15	13

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2009	**2016**	**2009**	**2016**	**2009**	**2016**	**2009**	**2016**	**2009**	**2016**
7	Wholesale and retail trade and repair of motor vehicles and motorcycles	1.56	11.64	1.37	25.87	4.03	3.87	2	1	13	12
8	Water transport	39.50	20.54	7.48	26.68	42.72	40.02	4	4	22	27
9	Warehousing and support activities for transportation	11.10	3.98	6.52	1.44	11.58	11.73	6	5	113	137
10	Accommodation	68.97	55.66	31.15	21.68	47.76	53.63	11	13	56	77
11	Information service activities	49.52	48.84	28.40	5.94	58.60	58.25	3	1	9	5
	Overall	**44.81**	**29.78**	**29.17**	**14.72**	**43.39**	**39.54**	**57**	**44**	**339**	**349**

Source: Author's compilation

In terms of employment, the sector where the MNEs had the highest share of employment in the year 2009 was the manufacturing of rubber and plastics products sector and MNEs accounted for 53.76% of the total employment in the sector. The sector with the lowest MNEs share of employment in 2009 was manufacture of wearing apparel sector where MNEs accounted for 2.67% of the total employment in the sector. Moreover, in 2016, manufacturing of rubber and plastics products sector had the highest MNEs share of employment of 76.60% while wholesale and retail trade and repair of motor vehicles and motorcycles sector had the lowest MNEs share of employment of 3.87%. Printing and reproduction of recorded media sector had the highest number of MNEs in 2009 with 18 MNEs in the sector, while accommodation sector had the highest number of MNEs in 2016 with 13 MNEs in the sector.

Overall, the total sales accounted for by MNEs in 2009 was 44.81% while MNEs share of sales in 2016 was 29.78%. In terms of productivity, MNEs accounted for 29.17% of the labour productivity in 2009 and 14.72% of labour productivity in 2016. Furthermore, MNEs employed 43.39% of all the employees in 2009 and 39.54% of the employees in 2016. The total number of firms included in the survey of 2009 were 339 out of which 57 firms were MNEs. In 2016, the total number of firms included in the survey were 349 out of which 44 were MNEs. Therefore, a total of 688 observations were made in both years.

4.6 MNEs Participation in the Myanmar

The panel data for Myanmar was collected in 2014 and 2016. Table 4.5 below presents the participation of MNEs by sectors in Myanmar. The total number of observations for both years was 700. Furthermore, the table presents information about nine sectors.

Table 4.5: MNEs Participation in Myanmar

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2014	2016	2014	2016	2014	2016	2014	2016	2014	2016
1	Printing and reproduction of recorded media	35.91	65.36	10.03	26.92	44.9	66.59	18	15	57	43
2	Manufacture of basic metals	0.22	0.18	1.94	25.01	1.09	0.45	1	1	13	9
3	Manufacture of fabricated metal products, except machinery and equipment	31.36	53.32	28.12	4.26	24.75	15.85	1	1	25	17
4	Manufacture of electrical equipment	3.27	3.17	18.28	21.26	1.75	0.64	1	1	15	15
5	Manufacture of machinery and equipment	57.06	43.77	22.73	9.7	29.66	10.87	1	2	16	44
6	Manufacture of motor vehicles, trailers and semi-trailers	55.43	15.19	6.14	16.96	19.48	62.52	1	4	41	62

S/N	Sector	MNEs share of sales (%)		MNEs share of labour productivity (%)		MNEs share of employment (%)		Number of MNEs		Total number of firms	
		2014	**2016**	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**	**2014**	**2016**
7	Water collection, treatment and supply	29.23	66.58	43.01	50.66	3.85	32.19	1	2	17	20
8	Warehousing and support activities for transportation	3.44	5.11	8.86	4.9	1.35	1.56	2	2	84	92
9	Accommodation	22.79	23.81	8.38	8.35	7.69	14.9	2	3	74	56
	Overall	**29.93**	**35.51**	**11.77**	**10.12**	**39.53**	**51.22**	**28**	**31**	**342**	**358**

Source: Author's compilation

As shown in Table 4.5 above, in 2014, MNEs had the highest share of sales in the manufacturing of machinery and equipment sector with 57.06% of the sales in the sector by MNEs. The sector where MNEs had the least share of sales in year 2014 was in the manufacturing of basic metals sector with 0.22% share of sales in the sector. However, in 2016, MNEs had the highest share of sales in the water collection, treatment and supply sector with MNEs accounting for 66.58% of the sales in the sector. The manufacturing of basic metals sector had the lowest MNEs share of sales (0.18%) in the year 2016. In terms of labour productivity, for the year 2014, the sector where the MNEs had relative highest share of labour productivity was the water collection, treatment and supply sector (43.01%), whereas, the sector where MNEs had the lowest share of labour productivity was the manufacturing of basic metals (1.94%). In 2016, the sector with the highest share of MNEs labour productivity was water collection, treatment and supply sector with the MNEs accounting for 50.66% of the total productivity in this sector. The sector with the lowest MNEs share of labour productivity was the manufacturing of fabricated metal products, except machinery and equipment sector with MNEs accounting for 4.26% of the productivity in the sector.

In terms of employment, the sector where the MNEs had the highest share of employment in the year 2014 was the printing and reproduction of recorded media sector and MNEs accounted for 44.90% of the total employment in the sector. The sector with the lowest MNEs share of employment in 2014 was manufacturing of basic metals sector where MNEs accounted for 1.09% of the total employment in the sector. Also, in 2016, printing and reproduction of recorded media sector had the highest MNEs share of employment of 66.59% while manufacturing of basic metals sector had the lowest MNEs share of employment of 0.45%. The printing and reproduction of recorded media sector had the highest number of MNEs in 2014 and 2016 with 18 and 15 MNEs respectively.

Overall, the total sales accounted for by MNEs in 2014 was 29.93% while MNEs share of sales in 2016 was 35.51%. In terms of productivity, MNEs accounted for 11.77% of the labour productivity in 2014 and 10.12% of labour productivity in 2016. Furthermore, MNEs employed 39.53% of all the employees in 2014 and 51.22% of the employees in 2016. The total number of firms included in the survey of 2014 was 342 out of which 28 firms were MNEs. In 2016, the total number

of firms included in the survey were 358 out of which 31 were MNEs. Therefore, a total of 700 observations were made in both years.

4.7 Descriptive Statistics of the Variables in Indonesia

As stated in the conceptual framework presented in Chapter 3, the dependent variable for this study is firm productivity measured by value added for each firm and the independent variables are demonstration effect also referred to as foreign presence which is measured the MNEs share of sales in the industry, competition effect which is measured by one minus Herfindahl-Hirschman index, workers mobility which is measure by the interaction of foreign presence and human capital, and the absorptive capacity measured by the productivity gap. Other variables that are included in the advances Cobb Douglas model discussed in Chapter three include physical capital which is the net book value of the fixed asset of the firms, labour which is the number of employee of the firms, and human capital which is the total labour cost per employee of the firms. The mean and standard deviation of the dependent variable, independent variables, and the control variable are presented in the Table 4.6 below. However, the variables that are in nominal scale are not included in the descriptive analysis. Moreover, the workers' mobility is not included in the descriptive table as well since it is measured as the interaction between the human capital and foreign presence which are included in the descriptive statistics. The values of physical capital, human capital and value added which are originally reported in the country's currency have been converted to USD for ease of comparison among the countries and the conversion rate is stated beneath the table.

Table 4.6: Descriptive Analysis for Variables in Indonesia

Variables	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
Physical Capital (USD)	0.57	318.96 (10^6)	2.15 (10^6)	237380.33
Labour	2.00	7000.00	198.54	609.12
Human Capital (USD)	0.72	404736.22	2738.88	296762.13
Foreign Presence	0.01	99.84	57.74	34.23
Competition	0.03	0.92	0.45	0.30

Variables	Minimum	Maximum	Mean	Standard Deviation
Productivity Gap	0.00002	152881.53	1189.28	8935.81
Value Added (USD)	21.26	1325.49 (10^6)	147.21 (10^6)	121865.36

1 United States Dollar = 14,107.30 Indonesian Rupiah

As shown in Table 4.6 above, the company with the least physical capital had fixed asset worth 0.57USD while the company with the highest amount of physical capital had fixed asset worth 318.96 million USD. The average physical of 2.15 million USD. The company that has the minimum number of employees had only two employees while the company with the maximum number of employees had 7,000 employees. On the average there are 198 employees per company. In terms of human capital, the least cost of labour per employee for a firm is 0.72USD while the maximum labour cost per employee in a year by a firm is about 404 thousand USD. On the average the labour cost per employee for the firms is about 2,738.88 USD. The foreign presence is the MNEs share of sales in the industry and the industry is categorised as the four-level ISIC of the firms' main product. The minimum foreign presence in an industry is 0.01 which means that industry with the least presence of MNEs has 0.01% of the sales accounted for by MNEs. However, the industry with the highest foreign presence has 99.84% of its sales accounted for by the MNEs. On the average 57.74% of sales in all the industry are accounted for by MNEs. In terms of competition, the least competitive industry has the index of 0.03 while the highest competitive industry has the index of 0.92. On the average the competition index for all the industries is 0.45 (S.D = 0.30). In terms of absorptive capacity measured by the productivity gap, the company with the least productivity gap has a ratio of 0.00002. That the ratio of the average labour productivity of MNEs in the industry to the firm's labour productivity is 0.00002. The firm with the highest productivity gap has productivity gap ratio of 152881.53. On the average the productivity gap for ration the firms is 1189.28. In terms of value added, the firm with the minimum value added had earned 21.26USD while the firm with the maximum value earned about 1325.49 million USD in a year. However, on the average, the firms earned about 147.21 million USD.

The Pearson correlation among the variables is presented in Table 4.7 below. Pearson correlation was conducted to examine the relationship among the variables used in this study. The Pearson correlation reveals that there are positive and significant relationship between the dependent variable (value added) and physical capital, labour, human capital, and workers mobility. This means that these variables behave in similar manner. That is, these variables tend to increase together or decrease together. In other words, as physical capital of the firm increases, the value added also increases. Secondly, as the number of employees (labour) of a firm increase, the value added also tend to increase. Thirdly, as the labour cost per employee (human capital) of the company increases, that value added gained by the company also increases. Lastly, as the movement of employees from MNEs to domestic firms increases, the value added of the domestic firms tend to increase also. However, Pearson correlation does not imply causal effect relationship. Moreover, there is no significant relationship between value added of a firm and the level of MNEs' presence in its industry, or the level of competition is its industry.

The strongest correlation among the independent variables is found between workers mobility and foreign presence at correlation coefficient (r) of 0.25 ($p< .01$). This is anticipated because workers mobility is the interaction term between foreign presence and human capital. The weakest correlation among the independent variables however is between foreign presence and human capital which are negatively related. This means that as the foreign presence increases, human capital decrease and vice versa.

Table 4.7 Pearson Correlation of Variables in Indonesia

Variables	1	2	3	4	5	6	7
Physical Capital (1)	1.00						
Labour (2)	0.19**	1.00					
Human Capital (3)	0.21**	0.003	1.00				
Foreign Presence (4)	-0.11*	-0.14**	-0.09*	1.00			
Competition (5)	-0.3	0.001	-0.08	0.09*	1.00		

Variables	1	2	3	4	5	6	7
Workers Mobility (6)	0.03	-0.01	0.11*	0.25**	-0.02	1.00	
Value Added (7)	0.19**	0.12**	0.36**	-0.03	0.01	0.23**	1.00

Note: ** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

4.8 Descriptive Statistics of the Variables in Philippines

Table 4.8 below presents the descriptive analysis of the variables that are used in this study from the data on the Philippines. The descriptive analysis is presented in minimum, maximum, mean, and standard deviation. As shown in Table 4.8 below, the company with the least physical capital had fixed asset worth 487.85USD while the company with the highest amount of physical capital had fixed asset worth 226.36 million USD. The average physical of 3.88 million USD. The company that has the minimum number of employees had only two employees while the company with the maximum number of employees had 5,000 employees. On the average there are 115 employees per company. In terms of human capital, the least cost of labour per employee for a firm is 39.03 USD while the maximum labour cost per employee in a year by a firm is about 1.15 million USD. On the average the labour cost per employee for the firms is about 18,606.74 USD. The foreign presence is the MNEs share of sales in the industry and the industry is categorised as the four-level ISIC of the firms' main product. The minimum foreign presence in an industry is 0.01 which means that industry with the least presence of MNEs has 0.01% of the sales accounted for by MNEs. However, the industry with the highest foreign presence has 99.99% of its sales accounted for by the MNEs. On the average 35.84% of sales in all the industry are accounted for by MNEs. In terms of competition, the least competitive industry has the index of 0.03 while the highest competitive industry has the index of 0.996. On the average the competition index for all the industries is 0.68 (S.D = 0.27). In terms of absorptive capacity measured by the productivity gap, the company with the least productivity gap has a ratio of 0.002. That the ratio of the average labour productivity of MNEs in the industry to the firm's labour productivity is 0.002. The firm with the highest productivity gap has productivity gap ratio of 4580.93. On the average the productivity gap for ration the firms is 39.59. In terms of value added, the firm with the

minimum value added had earned 1,853.83 USD while the firm with the maximum value earned about 5,113.84 million USD in a year. However, on the average, the firms earned about 17.99 million USD.

Table 4.8: Descriptive Analysis for Variables in Philippines

Variables	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
Physical Capital (USD)	487.85	226.36 (10^6)	3.88 (10^6)	8285868.76
Labour	2.00	5000.00	115.18	329.68
Human Capital (USD)	39.03	1.15 (10^6)	18606.74	4172373.13
Foreign Presence	0.01	99.99	35.84	36.88
Competition	0.03	0.996	0.68	0.27
Productivity Gap	0.002	4580.93	39.59	276.43
Value Added (USD)	1853.83	5113.84 (10^6)	17.99 (10^6)	11330635.43

1 United States Dollar = 51.25 Philippine Peso

The relationship among the variables are examined through Pearson correlation. Table 4.9 below presents the correlation among the variables.

Table 4.9: Pearson Correlation of Variables in Philippines

Variables	1	2	3	4	5	6	7
Physical Capital (1)	1.00						
Labour (2)	0.17**	1.00					
Human Capital (3)	0.45**	-0.04	1.00				
Foreign Presence (4)	-0.11	0.13**	-0.01	1.00			
Competition (5)	-0.004	0.01	0.01	0.52*	1.00		
Workers Mobility (6)	0.29**	-0.01	0.70**	0.17**	0.07	1.00	
Value Added (7)	0.04*	0.09*	0.05	-0.01	0.08	0.06	1.00

Note: ** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

As shown in Table 4.9 above, there is positive correlation between the dependent variable value added and physical capital. This implies that as physical capital increases, value added for the firm also tend to increase or vice versa. Value added is also positively and significantly correlated with labour. This means that as the number of employees increases in the firm, the value added also tend to increase. The strongest correlation among the independent variables is found between workers mobility and human capital and as explained above, this is anticipated because workers mobility is the interaction term between human capital and foreign presence.

4.9 Descriptive Statistics of the Variables in Vietnam

Table 4.10 below presents the descriptive analysis of the variables that are used in this study from the data on the Vietnam. The descriptive analysis is presented in minimum, maximum, mean, and standard deviation. As shown in Table 4.10 below, the company with the least physical capital had fixed asset worth 42.94 USD while the company with the highest amount of physical capital had fixed asset worth 179.40 billion USD. The average physical of 88.88 million USD. The company that has the minimum number of employees had only two employees while the company with the maximum number of employees had 19,047 employees. On the average there are 316 employees per company. In terms of human capital, the least cost of labour per employee for a firm is 0.18USD while the maximum labour cost per employee in a year by a firm is about 1.85 million USD. On the average the labour cost per employee for the firms is about 1,699.08 USD. The foreign presence is the MNEs share of sales in the industry and the industry is categorised as the four-level ISIC of the firms' main product. The minimum foreign presence in an industry is 0.57 which means that industry with the least presence of MNEs has 0.57% of the sales accounted for by MNEs. However, the industry with the highest foreign presence has 98.74% of its sales accounted for by the MNEs. On the average 30.90% of sales in all the industry are accounted for by MNEs. In terms of competition, the least competitive industry has the index of 0.03 while the highest competitive industry has the index of 0.74. On the average the competition index for all the industries is 0.87 (S.D = 0.15). In terms of absorptive capacity measured by the productivity gap, the company with the least productivity gap has a ratio of 0.003. That the ratio of the average labour productivity of MNEs in the industry to the firm's labour productivity is 0.003. The firm with the

highest productivity gap has productivity gap ratio of 1495.45. On the average the productivity gap for ration the firms is 7.12. In terms of value added, the firm with the minimum value added had earned 436.26 USD while the firm with the maximum value earned about 858.77 million USD in a year. However, on the average, the firms earned about 2.60 million USD.

Table 4.10: Descriptive Analysis for Variables in Vietnam

Variables	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
Physical Capital (USD)	42.94	179.40 (10^9)	88.88 (10^6)	89610185.57
Labour	2.00	19,047.00	316.61	881.84
Human Capital (USD)	0.18	1.85 (10^6)	1699.08	1306651.05
Foreign Presence	0.57	98.74	30.90	0.20
Competition	0.03	0.74	0.87	0.15
Productivity Gap	0.003	1495.45	7.12	53.69
Value Added (USD)	436.26	858.77 (10^6)	2.60 (10^6)	5965842.65

1 United States Dollar = 23,290.00 Vietnamese Dong

The relationship among the variables are examined through Pearson correlation. Table 4.11 below presents the correlation among the variables. As shown in Table 4.11 below, the dependent variable, value added, has a positive and significant relationship with physical capital, number of employees (labour), human capital, competition, and workers' mobility. This means that when physical capital increases, the value added tend to increase as well. Also, when labour increases, value added tend to increase as well. Moreover, when human capital expenditure increases, value added tend to increase as well. Finally, when competition or workers mobility increases, valued added tend to increase and vice versa. The strongest correlation among the independent variables is found between workers mobility and human capital and as explained above, this is anticipated because workers mobility is the interaction term between human capital and foreign presence.

Table 4.11: Pearson Correlation of Variables in Vietnam

Variables	1	2	3	4	5	6	7
Physical Capital (1)	1.00						

Variables	1	2	3	4	5	6	7
Labour (2)	-0.004	1.00					
Human Capital (3)	0.004	-0.02	1.00				
Foreign Presence (4)	-0.01	-0.03	0.006	1.00			
Competition (5)	-0.01	-0.003	0.06*	0.14**	1.00		
Workers Mobility (6)	0.001	-0.02	0.62**	0.27**	0.07**	1.00	
Value Added (7)	0.02*	0.34**	0.33**	0.03	0.06**	0.09**	1.00

Note: ** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed)

4.10 Descriptive Statistics of the Variables in Laos

Table 4.12 below presents the descriptive analysis of the variables that are used in this study from the data on the Laos. The descriptive analysis is presented in minimum, maximum, mean, and standard deviation. As shown in Table 4.12 below, the company with the least physical capital had fixed asset worth 1,606.22 USD while the company with the highest amount of physical capital had fixed asset worth 918.99 million USD. The average physical of 4.00 million USD. The company that has the minimum number of employees had five employees while the company with the maximum number of employees had 14,000 employees. On the average there are 90 employees per company. In terms of human capital, the least cost of labour per employee for a firm is 22.95 USD while the maximum labour cost per employee in a year by a firm is about 22,536.41 USD. On the average the labour cost per employee for the firms is about 1,249 USD. The foreign presence is the MNEs share of sales in the industry and the industry is categorised as the four-level ISIC of the firms' main product. The minimum foreign presence in an industry is 0.36 which means that industry with the least presence of MNEs has 0.36% of the sales accounted for by MNEs.

However, the industry with the highest foreign presence has 98.67% of its sales accounted for by the MNEs. On the average 32% of sales in all the industry are accounted for by MNEs. In terms of competition, the least competitive industry has the index of 0.07 while the highest competitive industry has the index of 0.68. On the

average the competition index for all the industries is 0.78 (S.D = 0.16). In terms of absorptive capacity measured by the productivity gap, the company with the least productivity gap has a ratio of 0.01. That the ratio of the average labour productivity of MNEs in the industry to the firm's labour productivity is 0.01. The firm with the highest productivity gap has productivity gap ratio of 329.49. On the average the productivity gap for ration the firms is 8.44. In terms of value added, the firm with the minimum value added had earned 435.97 USD while the firm with the maximum value earned about 137.68 million USD in a year. However, on the average, the firms earned about 1.09 million USD.

Table 4.12: Descriptive Analysis for Variables in Laos

Variables	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
Physical Capital (USD)	1606.22	918.99 (10^6)	4.00 (10^6)	40410907.89
Labour	5.00	14,000.00	90.82	200.68
Human Capital (USD)	22.95	22536.41	1249.41	15134353.31
Foreign Presence	0.36	98.67	32.00	0.28
Competition	0.07	0.68	0.78	0.16
Productivity Gap	0.01	329.49	8.44	28.45
Value Added (USD)	435.97	137.68 (10^6)	1.09 (10^6)	623677812.31

1 United States Dollar = 8,721.85 Laotian Kip

The relationship among the variables are examined through Pearson correlation. Table 4.13 below presents the correlation among the variables. As shown in Table 4.13 below, the dependent variable, value added, has a positive and significant relationship with physical capital, number of employees (labour), and workers' mobility. This means that when physical capital increases, the value added tend to increase as well. Also, when labour increases, value added tend to increase as well. Moreover, when there is increase in workers' mobility, value added tend to increase as well. The strongest correlation among the independent variables is found between workers mobility and human capital and as explained above, this is anticipated because workers mobility is the interaction term between human capital and foreign presence.

Table 4.13: Pearson Correlation of Variables in Laos

Variables	1	2	3	4	5	6	7
Physical Capital (1)	1.00						
Labour (2)	0.11*	1.00					
Human Capital (3)	0.07	0.02	1.00				
Foreign Presence (4)	-0.01	0.20**	0.002	1.00			
Competition (5)	-0.02	0.02	0.18**	0.15**	1.00		
Workers Mobility (6)	0.02	0.07	0.53**	0.49**	0.24**	1.00	
Value Added (7)	0.05*	0.18**	0.02	0.07	0.001	0.09**	1.00

Note: ** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

4.11 Descriptive Statistics of the Variables in Myanmar

Table 4.14 below presents the descriptive analysis of the variables that are used in this study from the data on the Myanmar. The descriptive analysis is presented in minimum, maximum, mean, and standard deviation. As shown in Table 4.14 below, the company with the least physical capital had fixed asset worth 32.93 USD while the company with the highest amount of physical capital had fixed asset worth 12.50 million USD. The average physical of 221, 639.06 USD. The company that has the minimum number of employees had only one employee while the company with the maximum number of employees had 22,000 employees. On the average there are 117 employees per company. In terms of human capital, the least cost of labour per employee for a firm is 52.68 USD while the maximum labour cost per employee in a year by a firm is about 4,701.85 USD. On the average the labour cost per employee for the firms is about 1,191 USD. The foreign presence is the MNEs share of sales in the industry and the industry is categorised as the four-level ISIC of the firms' main product. The minimum foreign presence in an industry is 0.002 which means that industry with the least presence of MNEs has 0.002% of the sales accounted for by MNEs. However, the industry with the highest foreign presence has 6.00% of its sales accounted for by the MNEs. On the average 0.33% of sales in all the industry are accounted for by MNEs. In terms of competition, the least competitive industry has the

index of 0.05 while the highest competitive industry has the index of 0.90. On the average the competition index for all the industries is 0.67 (S.D = 0.27). In terms of absorptive capacity measured by the productivity gap, the company with the least productivity gap has a ratio of 0.0003. That the ratio of the average labour productivity of MNEs in the industry to the firm's labour productivity is 0.0003. The firm with the highest productivity gap has productivity gap ratio of 50.45. On the average the productivity gap for ration the firms is 2.62. In terms of value added, the firm with the minimum value added had earned 3,292.61 USD while the firm with the maximum value earned about 6.06 million USD in a year. However, on the average, the firms earned about 325,442.03 USD.

Table 4.14: Descriptive Analysis for Variables in Myanmar

Variables	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**
Physical Capital (USD)	32.93	12.50 (10^6)	221639.06	1178847.05
Labour	1.00	22,000.00	117.72	288.25
Human Capital (USD)	52.68	4701.85	1191.93	914,262.35
Foreign Presence	0.002	6.00	0.30	0.40
Competition	0.05	0.90	0.67	0.27
Productivity Gap	0.0003	50.45	2.62	5.22
Value Added (USD)	3292.61	6.06 (10^6)	325442.03	1063321.89

1 United States Dollar = 1,518.55 Myanmar Kyat

The relationship among the variables are examined through Pearson correlation. Table 4.15 below presents the correlation among the variables.

Table 4.15: Pearson Correlation of Variables in Myanmar

Variables	1	2	3	4	5	6	7
Physical Capital (1)	1.00						
Labour (2)	0.45**	1.00					
Human Capital (3)	0.10*	-0.13**	1.00				

Variables	1	2	3	4	5	6	7
Foreign Presence (4)	0.01	0.14**	-0.03	1.00			
Competition (5)	0.02	-0.21**	0.15**	-0.24**	1.00		
Workers Mobility (6)	0.03	0.07	0.26**	0.90**	-0.14**	1.00	
Value Added (7)	0.52**	0.64**	0.05	0.08	-0.03	0.09	1.00

Note: ** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

As shown in Table 4.15 above, there is positive correlation between the dependent variable value added and physical capital. This implies that as physical capital increases, value added for the firm also tend to increase or vice versa. Value added is also positively and significantly correlated with labour. This means that as the number of employees increases in the firm, the value added also tend to increase. The strongest correlation among the independent variables is found between workers mobility and foreign presence and as explained above, this is anticipated because workers mobility is the interaction term between human capital and foreign presence.

4.12 Multiple Regression Analysis.

The above sections have focussed on describing the data for the five countries that are used in this study by using descript statistics of percentage and mean. The correlation among the variables was also examined in the above section. This section therefore examines the cause and effect relationship among the variables using inferential statistics of multiple regression analysis. Multiple regression analysis is used the hypotheses earlier proposed in Chapter two to explain the influence of the independent variables (demonstration effect, competition effect, workers' mobility and adsorptive capacity) on the dependent variable (firm productivity which is measure as the value added). As stated in Chapter 3 of this study, the demonstration effect is also referred to as the foreign presence and it is a measure of MNEs share of sales in the industry. The competition effect is measured by the HHI. However, since HHI is a measure of market concentration with a value of one indicating Monopoly which means only one firm in the industry, competition for the multiple regression analysis is therefore measure as 1-HHI. This means that the higher the value of 1-HHI, the higher the competition in the industry. The interaction between human capital and foreign

presence is used as a proxy measure of workers' mobility. The absorptive capacity of a firm is measured as the ratio of the average labour productivity of MNEs to the firm's labour productivity. It is expected that the lower it is the higher the firm's absorptive capacity. Hence, a negative coefficient of the absorptive capacity will indicate a positive influence of absorptive capacity on the productivity. The dependent variable which is productivity measure by value added was deflated using each country's GDP deflator obtained from the World Bank. This is to remove the effect of inflation. Moreover, in line with the model explained in Chapter three, the log of value added, labour, physical capital was taken. This section presents the results for all the five countries simultaneously for ease of comparing the results.

Before, conducting multiple regression analysis outliers were removed from the data using the 1.5 interquartile range rule and done on the IBM SPSS. Also, balanced panel data is used and therefore the number of observations for each country is reduced. The assumptions of linearity, multivariate normality, and no multicollinearity. The assumption of linearity is tested by scatterplots of the independent variables and the dependent variables. The results of the test of linearity for each country are presented in Appendix 1. The multivariate normality is tested with normal probability plots and histogram done using the IBM SPSS. The results of the normality test are presented in Appendix 2. Both the test of for linearity and multivariate normality support the assumptions and therefore the data can be used for multiple regression analysis.

Variance inflation factor (VIF) and tolerance are used to check for multicollinearity among the independent variables. Multicollinearity was observed between human capital and workers' mobility. This is because workers' mobility is a measure of interaction between human capital and foreign presence. Similar result was found by Hamida (2011). This was however resolved by taking logarithm of the human capital value as a variable, whereas the whole value human capital was used in the calculation of workers' mobility. The VIF and tolerance after resolving all multicollinearity issues for all the five countries are presented in Table 4.16 below.

According to Tabachnick and Fidel (2007), a maximum VIF value of 10 and a minimum tolerance of 0.10 indicate no sign of multicollinearity among the

independent variables. Therefore, from Table 4.16 below, there is no evidence of multicollinearity in any of the data.

After the test of the assumptions of multiple regression, the regression analysis was conducted for all the countries. A pooled ordinary least square (OLS) was used to test the influence of the independent variables on the dependent variable while controlling for the firm's industry. The parameters are estimated through the maximum likelihood estimation method. Table 4.17 below therefore present the result of the multiple regression analysis for the five countries.

Table 4.16: Multicollinearity Test

	Indonesia		**Philippines**		**Myanmar**		**Vietnam**		**Laos**	
Variables	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**	**Tolerance**	**VIF**
Log physical capital	0.51	1.97	0.48	2.08	0.59	1.70	0.64	1.57	0.63	1.58
Log labour	0.58	1.73	0.56	1.79	0.79	1.26	0.55	1.82	0.34	2.98
Log Human capital	0.3	3.3	0.25	3.97	0.85	1.18	0.77	1.29	0.9	1.11
Demonstration	0.26	3.92	0.24	4.23	0.30	3.30	0.94	1.06	0.46	2.19
Competition	0.84	1.19	0.7	1.43	0.76	1.32	0.95	1.05	0.65	1.53
Workers' mobility	0.16	6.38	0.15	6.64	0.27	3.65	0.76	1.32	0.48	2.1
Absorptive capacity	0.89	1.12	0.96	1.04	0.8	1.24	0.92	1.09	0.75	1.33

Labour, physical capital, and human capital all have positive influence on the productivity of the domestic firms across the five countries and these confirm the Cobb Douglas production model. As shown in the Table 4.17 above, in Indonesia, demonstration effect has a negative influence on the productivity of domestic firms at β = -0.26 (p< 0.01). Also, competition has a negative effect on the productivity of the domestic firms at β = -0.05 (p< 0.01). However, workers' mobility has a positive influence on the productivity of domestic firms at β = 0.38 (p< 0.01). The firms' absorptive capacity also has a positive influence on its productivity. As mentioned earlier, the coefficient of absorptive capacity is expected to be negative, hence, a negative coefficient is interpreted as positive influence and vice versa. This is because absorptive capacity is measured by the productivity gap between the MNEs and the domestic firms. A small productivity gap indicates a high-level ability to absorb the technology of the MNEs while a large productivity gap indicates a lower absorptive capacity. Hence, absorptive capacity positively influences the productivity of the domestic firms at β = -0.14 (p< 0.01). Out of all the independent variables of this study, workers' mobility has the strongest positive and significant influence on the productivity of domestic firms in Indonesia. Overall, the model explained about 73% of the variation in the productivity of the domestic firms in Indonesia.

Table 4.17: OLS Regression Results

	Indonesia		Philippines		Vietnam		Laos		Myanmar	
Variables	**Beta**	**T-test**	**Beta**	**T-test**	**Beta**	**T-test**	**Beta**	**T-test**	**Beta**	**T-test**
Log physical capital	0.11**	3.60	0.37**	9.32	0.28**	8.82	0.08**	3.91	0.02*	3.86
Log labour	0.67**	22.81	0.38**	10.19	0.19**	4.14	0.09**	41.46	0.78**	26.04
Log Human capital	0.12**	5.21	0.07*	2.12	0.02*	3.79	0.05**	3.40	0.20**	6.71
Demonstration	-0.26**	-7.18	-0.15**	-3.27	0.07*	2.59	-0.45**	-19.74	-0.03	-0.52
Competition	-0.05**	-2.08	-0.05	-1.60	-0.01	-0.42	-0.03**	-4.59	-0.10**	-2.93
Workers' mobility	0.38**	10.02	0.28**	6.50	0.55**	11.84	0.72**	30.48	0.07*	2.13
Absorptive capacity	-0.14**	-5.90	-0.11**	-3.88	-0.06*	-2.05	-0.04**	-3.63	-0.27**	-8.97
Industry	-0.02	-1.03	0.05	1.52	-0.02	-0.81	0.14**	7.15	0.18**	3.56
R-square	0.73		0.62		0.40		0.89		0.67	
F-test	177.20**		102.65**		76.78**		433.61**		122.22**	
N	546		518		938		423		482	

Note ** means $p < 0.01$, * means $p < 0.05$. N means number of observations. The beta reported is the standardize beta.

In the Philippines, the multiple regression result indicates that demonstration effect has a negative influence on the productivity of the domestic firms at β = -0.15 (p< 0.01). Workers' mobility and absorptive capacity have positive and significant influence on the productivity of the domestic firms. The strongest positive and significant influence on the productivity of domestic firms among the independent variables comes from workers' mobility at β = 0.28 (p< 0.01). As explained earlier, the coefficient of absorptive capacity which is β = -0.11 (p< 0.01), indicates that that absorptive capacity positively influences domestic firms' productivity. The negative coefficient is due to the measure of absorptive capacity employed in this study. The low value of productivity gap used as the measure of absorptive capacity indicate a high level of absorptive capacity. However, the competition effect has no statistically significant influence on the productivity of the domestic firms in the Philippines. This model explains about 62% of the variation in the productivity of the domestic firms.

In Vietnam, the multiple regression analysis result indicates that demonstration effect, workers' mobility, and absorptive capacity all have positive and significant influences on the productivity of the domestic firms. Demonstration effect has a positive influence on the productivity of the domestic firms at β = 0.07 (p< 0.05). Workers' mobility effect has a positive influence on the productivity of the domestic firms at β = 0.55 (p< 0.01). Also, absorptive capacity has a positive influence on productivity of the domestic firms at β = -0.06 (p< 0.05). Although, the coefficient of absorptive capacity is negative, the influence is positive because of the measure of absorptive capacity employed in this study. As the value of productivity gap (which is used as proxy for absorptive capacity) increases, it indicates lower absorptive capacity. Thus, a negative coefficient in the multiple regression is interpreted as positive influence of absorptive capacity. The strongest positive and significant influence on the productivity of domestic firms among the independent variables comes from workers' mobility. Competition in the industry, however, has no statistically significant influence on the productivity of the domestic firms in Vietnam. The model explains about 40% of the variation in domestic firms' productivity.

In Lao, the result of the multiple regression analysis indicates that demonstration effect and competition effect both have negative and significant influences on the productivity of the domestic firms. Demonstration effect negatively

influences the productivity of the domestic firms at β = -0.45 (p< 0.01). Competition effect negatively influences the productivity of the domestic firms at β = -0.03 (p< 0.01). On the other hand, workers' mobility has a positive influence on the productivity of domestic firms at β = 0.72 (p< 0.01). Moreover, absorptive capacity has a positive influence on the productivity of the domestic firms at β = -0.04 (p< 0.01). As explained earlier, the coefficient of absorptive capacity is negative, but the influence is interpreted as positive due to the measurement of absorptive capacity used in this study. As the value of productivity gap (which is used as proxy for absorptive capacity) increases, it indicates lower absorptive capacity. Thus, a negative coefficient in the multiple regression means a positive influence of absorptive capacity. The strongest positive influence on the productivity of the domestic firms comes from workers' mobility. The model explains about 89% of the variation in the productivity of the domestic firms.

Lastly, in Myanmar, the multiple regression analysis result indicates that competition in the industry has a negative influence on the productivity of the domestic firms at β = -0.10 (p< 0.01). Workers' mobility has positive and significant influence on the productivity of the domestic firms at β = 0.07 (p< 0.05). Also, absorptive capacity has a positive influence on the productivity of the domestic firms at β = -0.27 (p< 0.01). Although, the coefficient of absorptive capacity is negative, the influence is positive because of the measure of absorptive capacity employed in this study. As the value of productivity gap (which is used as proxy for absorptive capacity) increases, it indicates lower absorptive capacity. Thus, a negative coefficient in the multiple regression is interpreted as positive influence of absorptive capacity. The strongest positive and significant influence on the productivity of domestic firms among the independent variables comes from the absorptive capacity. However, demonstration effect has no statistically significant influence on the productivity of domestic firms in Myanmar. The model explains about 67% of the variation in the productivity of the domestic firms.

4.13 Summary of Hypotheses

There are four hypotheses in this study which are:

H_1: Technology spillover through demonstration has positive effect on domestic firms' productivity.

H_2: Technology spillover through competition has positive effect on domestic firms' productivity.

H_3: Technology spillover through worker mobility has positive effect domestic firms' productivity

H_4: Domestic firms' absorptive capacity has a positive effect on its productivity.

The outcome of the multiple regression conducted in the five countries therefore showed that technology spillover through demonstration negatively influence the productivity of domestic firms in Indonesia, Philippine, and Laos, and insignificant in Myanmar. It means that in Myanmar, at a 95% confidence interval, the result obtained through the multiple regression is due to chance and therefore could not be accepted. Thus, the first hypothesis is rejected in these countries. However, since the result revealed that demonstration effect positively influences the productivity of the domestic firms in Vietnam, the first hypothesis is accepted in Vietnam. Secondly, the result revealed that competition effect has a negative impact on the productivity of the domestic firms in Indonesia, Myanmar, and Laos while it has no effect in the Philippines and Vietnam. Therefore, the second hypothesis is rejected in this study.

Moreover, the result showed that workers' mobility and absorptive capacity have positive and significant impact on the productivity of the domestic firms in all the five countries. Therefore, the third and the fourth hypothesis are accepted. The summary of the hypotheses for the five countries are therefore presented in the Table 4.18 below.

Table 4.18 Summary of Hypotheses

Hypothesis	**Indonesia**	**Philippines**	**Myanmar**	**Vietnam**	**Laos**
H_1*: Technology spillover through demonstration has positive effect on*	Reject	Reject	Reject	Accept	Reject

Hypothesis	**Indonesia**	**Philippines**	**Myanmar**	**Vietnam**	**Laos**
domestic firms' productivity.					
H_2: *Technology spillover through competition has positive effect on domestic firms' productivity.*	Reject	Reject	Reject	Reject	Reject
H_3: *Technology spillover through workers' mobility has positive effect on domestic firms' productivity.*	Accept	Accept	Accept	Accept	Accept
H_4: *Domestic firms' absorptive capacity has a positive effect on its productivity*	Accept	Accept	Accept	Accept	Accept

CHAPTER FIVE
DISCUSSION

The previous chapter has presented the outcome of the statistical analysis of the data obtained from the World Bank Enterprise Survey on the five countries in South East Asia (Indonesia, Philippines, Myanmar, Vietnam, and Laos). This chapter therefore discuss the outcomes in detail, compare the result with the outcomes from previous empirical studies, and provide possible explanation for the outcomes. The discussion of the outcomes is aimed at answering the research questions of the study. This chapter is therefore structured as follows: firstly, conclusion is drawn from the study, thereafter the outcomes of the study are discussed. The limitation, implication and recommendation for future studies are also presented.

5.1 Conclusion

This study aims to examine technology spillover from MNEs to domestic firms in South East Asia. The study focusses on intra-industry spillover of technology. As identified in the literature review in Chapter 2, the intra-industry spillover theoretically happens through three major forms which are when MNEs demonstrate their advanced technology and domestic firms can observe, imitate or do reverse engineering of the technology (Sonmez, 2013). Secondly, when the presence of the MNEs in the industry increase the competition and forces the domestic firms to use their existing technology more efficiently or to upgrade their technology to be competitive and protect their market share (Blomström & Driffield & Love, 2007). Thirdly, the domestic firms can acquire tacit technological knowledge by recruiting (Fosfuri, Motta, & Rønde, 2001; Glass & Saggi, 2002).

However, from previous empirical studies, it shows that domestic firms need the capacity to absorb the technology of the MNEs in order to benefit from the technology spillover. Overall, the outcome of technology spillover to the domestic firms is observed in the increase on productivity of the domestic firms. Therefore, this study examined the effect of demonstration effect, competition effect, workers' mobility effect, and the absorptive capacity on the productivity of the domestic firms. The study was carried out in five South East Asia countries with panel data obtained from the World Bank Enterprise Survey. Although, the data from the five countries were collected at different year, the aim of the study is to compare them and not pull

the data together since each country has different policy environment and they are heterogenous in terms of presence of MNEs in the country. In Indonesia the data was collected in the year 2009 and 2015 with a total of 2,042 observations used in the descriptive analysis. The Philippines data was collected also in 2009 and 2015 with a total of 2,089 observations.

However, the data for Myanmar was collected in 2014 and 2016 with a total of 700 observations. The data for Vietnam was collected in the year 2009 and 2015 with a total of 1,548 observations. Lastly, the data for Laos was collected in the year 2009 and 2016 with a total of 688 observations. The description of the firms surveyed which include the MNEs share of sales in the sectors, share of employment and share of productivity for each year, and parameter distribution (minimum, maximum, mean, and standard deviation) of the variables are presented in Chapter 4. The productivity of the firms was measured with the value added per year. The demonstration effect was measured by the share of sales in the 4-digit ISIC industry accounted for by the MNEs in the industry. The competition effect is measure by HHI while the workers' mobility effect is measured by the interaction between foreign presence and human capital. The absorptive capacity is proxied by the productivity gap between MNEs and domestic firms which is measured by the ratio of average labour productivity of MNEs in the industry to the labour productivity of each domestic firm. The study used the extension of Cobb Douglas' production model to establish the relationship between the dependent variable and the independent variables as discussed in Chapter 3. Multiple regression analysis is used as the inferential statistics to test the proposed hypotheses. The outcome of the multiple regression analysis is therefore discussed further in the following section.

5.2 Discussion

This section discusses the outcome of the analysis in line with the research questions.

5.2.1 Spillover through Demonstration and Domestic Firms' Productivity

The outcome of the multiple regression analysis as shown in Table 4.17 indicates that technology spillover through demonstration has a positive effect on productivity of domestic firms in Vietnam. This result is consistent with the findings of

Damijan et al. (2003) which found that the increasing demonstration effect of MNEs have positive productivity spillover effect on the domestic firms. Moreover, Jude (2016) also found positive and significant demonstration effect on the productivity of the domestic firms in Romanian suggesting that domestic firms enjoy productivity gains due to imitation or demonstration effect. The result suggests that domestic firms in Vietnam can observe and copy technology form MNEs thereby increasing their level of productivity in the long run.

On the other hand, the outcome of the multiple regression analysis revealed that technology spillover through demonstration has a negative effect on productivity of domestic firms in Indonesia, in the Philippines and in Laos PDR. These findings are contrary to the results of Damijan et al. (2003) and Jude (2016). The reason for the contrary findings may be attributed to different composition of MNEs in the countries explored. Both Damijan et al. (2003) and Jude (2016) conducted their study in Europe while this study focused on developing Southeast Asia hence the characteristics of the sample surveyed will be different. The findings of this study therefore suggest that MNEs have market stealing effect on the domestic firms in Indonesia, Philippines, and Laos. This means that when MNEs come into the industry, they take the customers away from the domestic firms and force the domestic firms to reduce their production. According to Aitken and Harrison (1999), because MNES have high level of technology improvement, they could produce at large economies of scale driving down the cost of production and can lower the selling price, thus stealing the market away from the domestic firms.

Furthermore, this confirms the findings from previous studies which stated that MNEs have very strong incentives to protect their technology from being observed and copied by the domestic firms (Newman, Rand, Talbot, & Tarp, 2015). Therefore, the outcome suggests that MNEs in Indonesia, Philippines and Laos engage in activities to take the market away from the domestic firms or activities that strongly prevent their technologies from being observed and copied by the domestic firms or a combination of both strategy, thus leading to reduced productivity of the domestic firms.

However, the result from Myanmar reveals that there is no significant effect from technology spillover through demonstration effect on the domestic firms in

the country. This means that there is no spillover from MNEs through demonstration to the domestic firms in Myanmar. This result suggests that domestic firms in Myanmar are not able to copy the technology of the MNEs by looking at their products.

5.2.2 Spillover through Competition and Domestic Firms' Productivity

The outcome of the multiple regression analysis reveals that technology spillover through competition has a negative effect on the productivity of the domestic firms in Indonesia, Myanmar, and Laos. These finding are contrary to the finding of Chen et al. (2011) which found spillover from competition to positively impact the productivity of the domestic firms in China. Moreover, Kosova (2010) found that local competitors adapt their production processes to the changing market conditions and their productivity and survival increased as more MNEs enter the industry. The different result may be attributed to different policy environment and level of development in the countries as explained earlier. The result of this study, however, suggest that industry competition makes the domestic firms less productive in Indonesia, Myanmar, and Laos. Therefore, when MNEs enter the industry and increase the level of competition in the industry, the domestic firms suffer it through lower productivity. This further support the previous studies that stated that MNEs have competitive advantages over the domestic firms due to their firm specific proprietary asset which they can exploit in competing with the domestic firms (Mauri, Song, & Neiva de Figueiredo, 2016). This implies that MNEs in these countries capture the market share forcing the domestic firms to lower their production. However, competition has no effect on the productivity of the domestic firms in Philippine and Vietnam.

5.2.3 Spillover through Workers' Mobility and Domestic Firms' Productivity

The outcome of the multiple regression analysis indicates that technology spillover through workers' mobility has a positive influence on the productivity of the domestic firms in all the five countries (Indonesia, Philippines, Myanmar, Vietnam, and Laos). This result is consistent with the findings of Orlic et al.

(2018) which found that workers' mobility as a channel of technology spillover has a positive and significant effect on the productivity of the domestic firms in Czech Republic, Estonia, Hungary, and in Slovakia. It means that as human capital expenditure increases due to the presence of MNEs, productivity of the domestic firms also increases. This result suggests that although the movement of workers from MNEs to domestic firms often require the payment of wage premium, the wage premium is however not higher than the cost of training staff internally. Therefore, the productivity gains from hiring staff who had previously work with MNEs more than compensate for the wage premium paid to those staff. Out of all the three channels of intra-industry technology spillover, workers' mobility gives a stable outcome in all the countries and it positively and significantly influence productivity. This support past studies which claimed that workers mobility is the surest form of knowledge, technology and productivity spillover from the MNEs to the domestic firms (Fosfuri et al., 2001; Hakkala & Sembenelli, 2018).

5.2.4 Absorptive Capacity and Domestic Firms' Productivity

The study also examined the effect of the domestic firms' absorptive capacity on their productivity. The result indicates that the domestic firms' absorptive capacity has a positive effect on the productivity of the domestic firm in all the five countries. The absorptive capacity is proxied by the labour productivity gap between the domestic firms and the MNEs. This implies that as the productivity gap between the MNEs and the domestic firms narrows, there is increase in the productivity of the domestic firms. Domestic firms with small productivity gap with the MNEs have similar technology with the MNEs and so can recognise, capture, and assimilate the new and improved technology from the MNEs. This is consistent with the findings of Aldieri, Sena, and Vinci (2018) who found that the absorptive capacity of the firms has a positive effect on their productivity gains in the US. Moreover, Lew and Liu (2016) also found that the absorptive capacity of the firms improve their abilities to utilize knowledge and innovation spillover from inward foreign direct investment. Therefore, the absorptive capacity of the domestic firms in Indonesia, Philippines, Myanmar, Vietnam, and Laos are important to their level of productivity.

In conclusion, the results revealed that the effect of workers' mobility and absorptive capacity are constant across the South East Asia countries included in this study with positive and significant effect on the productivity of the domestic firms. Thus, revealing the best way for the domestic firms in these countries to capture productivity gains or technological externalities from the MNEs.

5.3 Limitations

This study has few limitations. Firstly, the data used were not collected in successive years but at different years in different Countries. While the inflation effect that has the potential to impact the outcome of the study has been controlled by deflating the dependent variable with the GDP deflator, and the regression analysis are conducted separately for each country using the same model, this is still a limitation. Secondly, only intra-industry technology spillover is examined and the author is not able to examine the inter-industry spillover due to unavailability of data. The author is not able to obtain input-output data for each of the country that could be used to proxy for inter-industry spillover. Finally, five out of the ten South East Asia with panel data available through the World Bank Enterprise Survey were used for the study. Therefore, the result could not be generalised for all the countries in South East Asia.

5.4 Recommendation for Future Study

This study examined the intra-industry spillover in Indonesia, Philippines, Myanmar, Vietnam, and Laos and based on the limitations discussed above, it is recommended that future studies be conducted to compare other countries in South East Asia and to include the inter-industry technology spillover. This is because, previous studies have found inter-industry spillover to be a stronger source of technology spillover than the intra-industry spillover (Jude 2016; Newman et al., 2015). Therefore, it is recommended that future studies include the inter-industry spillover to have a wholistic understanding of the impact of the presence of MNEs in South East Asia.

5.5 Practical Implication

The result showed that workers' mobility is a viable source of technology spillover. Therefore, domestic firms willing to capture the intrinsic advance knowledge of the MNEs should recruit employees who have previously worked in an MNE. Most especially, from MNEs who are the technology frontiers in the industry where they operate. The domestic firm may have to pay a wage premium to attract the employees of MNEs but the cost of training such employee may be lower than recruiting from elsewhere and has implied by the study, the productivity gain compensates for the increase in human capital expenditure. However, managers of MNEs willing to keep their employees and preventing the leakage of their tacit proprietary knowledge will have to also pay a wage premium to keep the employee on the job or provide other incentives for the employees to stay on the job. Also, the result revealed that the absorptive capacity of the domestic firms is important for them to capture the externalities for the MNEs. Therefore, domestic firms could do more in R&D. Since R&D has been identified in previous studies (Keller, 2004; Orlic et al., 2018) to increase the absorptive capacity of a firm. For instance, they could partner with Universities for their R&D to increase their absorptive capacity. This is because R&D increases the ability of the firm to recognize and exploit external innovation (Denicolai, Ramirez, & Tidd, 2016). For example, R&D in product development will improve the chances of the firm to recognize improved and advanced product development technology from the MNEs by observing the product of the MNE. R&D could also help the firm to be capable of doing reverse engineering to understand the technology behind the product development of the MNE.

The policy recommendation on the part of the government, however, is that policy makers should encourage the inflow of more knowledge base MNEs since the tacit knowledge of the firms can easily spillover to the domestic firms. Moreover, the government should promote R&D spending that have the potential to increase the absorptive capacity of the domestic firms and their productivity. Policy makers of these countries (Indonesia, Philippines, Vietnam, Laos, and Myanmar) should also review their antitrust laws to promote healthy competition within each industry.

5.6 Chapter Summary

In section 5.2, the results of this study were discussed in line with the four research questions of the study. The outcome of this study suggests that MNEs in Indonesia, Philippines and Lao PDR engage in activities to take the market away from the domestic firms or activities that strongly prevent their technologies from being observed and copied by the domestic firms or a combination of both strategy, thus leading to reduced productivity of the domestic firms. Domestic firms are rather weak competitors to the MNEs. The most viable means of technology spillover however occur through the movement of workers from MNEs to the domestic firms in all the five countries. This shows that tacit knowledge is the major of technology spillover that flows from the MNEs to the domestic firms in the host country. The absorptive capacity of the domestic firm also play an important role in increasing the productivity of the domestic firms.

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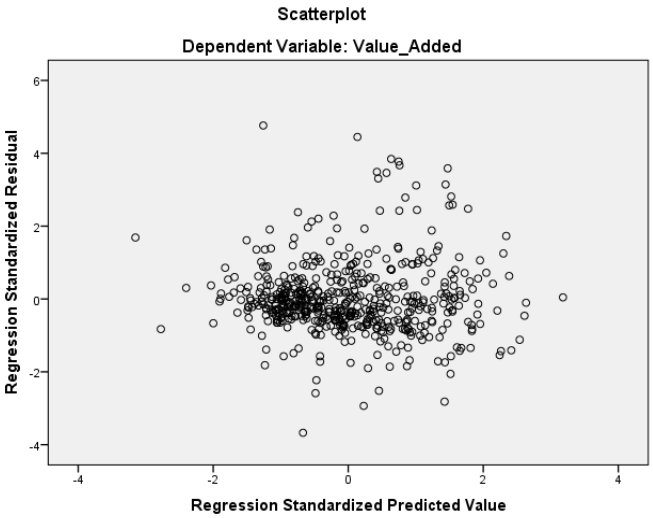
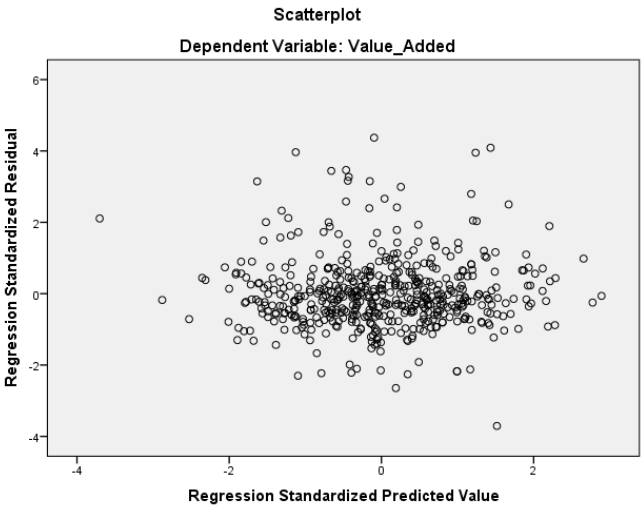
APPENDIX ONE

Linearity and homoscedasticity Test (Scatterplot) Indonesia:

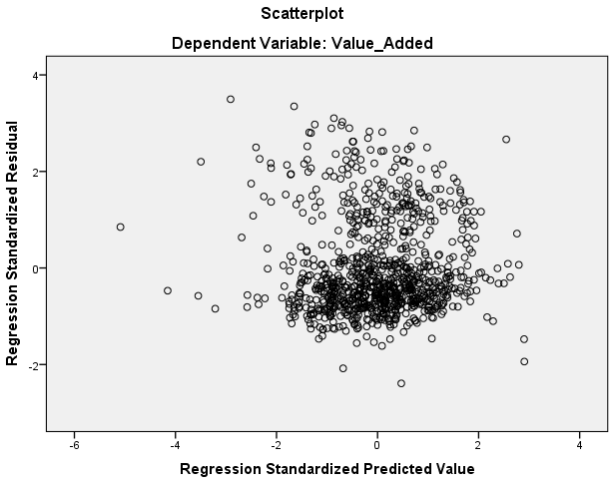


Linearity and homoscedasticity Test (Scatterplot) Philippines:

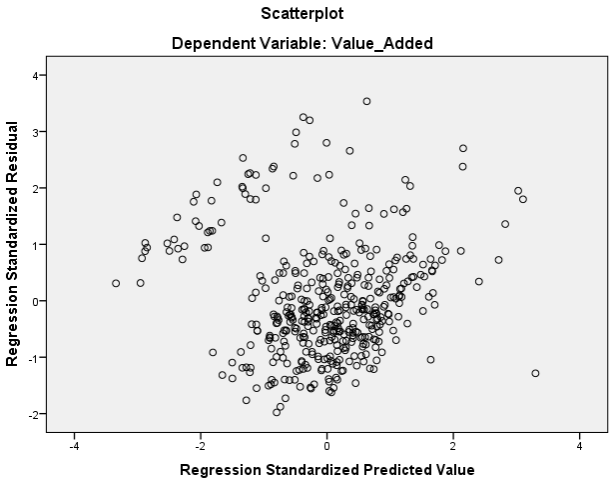


APPENDIX ONE (CONT)

Linearity and homoscedasticity Test (Scatterplot) Vietnam:

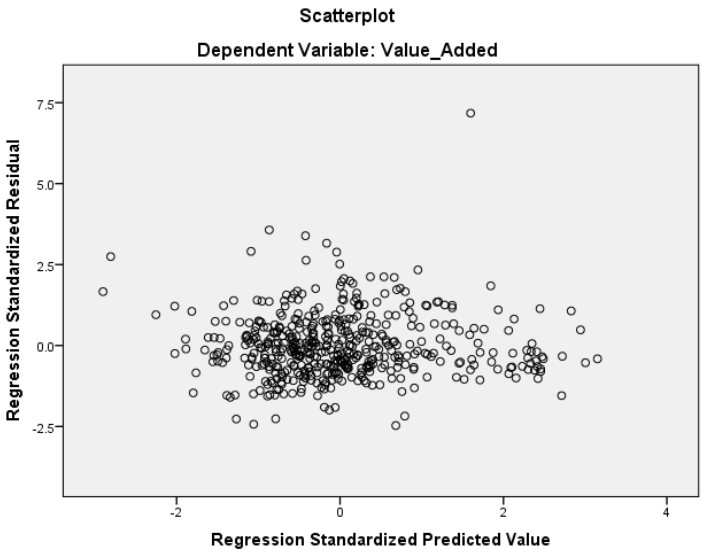


Linearity and homoscedasticity Test (Scatterplot) Laos:



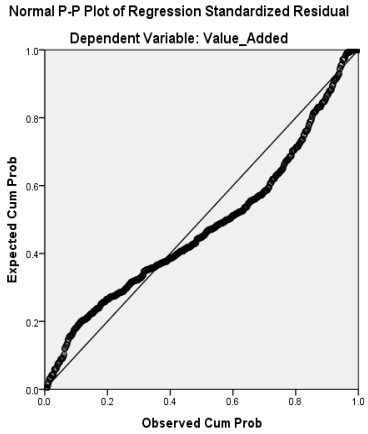
APPENDIX ONE (CONT)

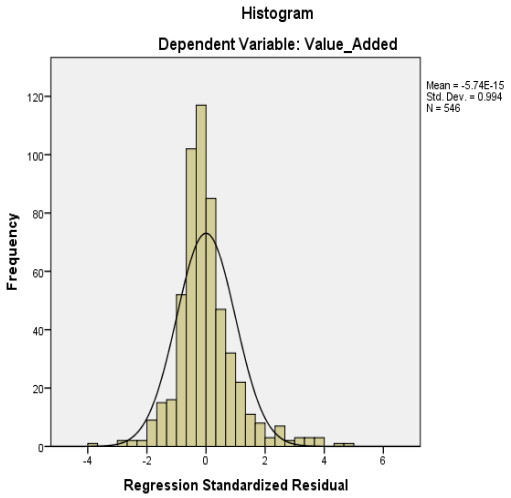
Linearity and homoscedasticity Test (Scatterplot) Myanmar:



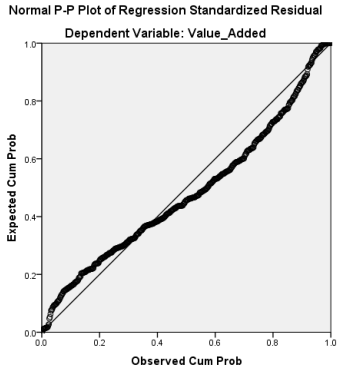
APPENDIX TWO

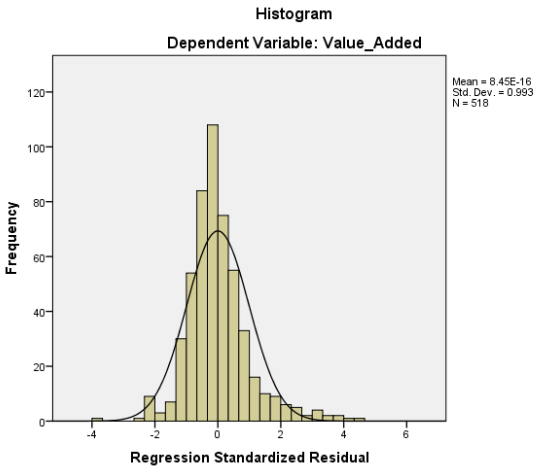
Normality Test (Probability plots and histogram) Indonesia





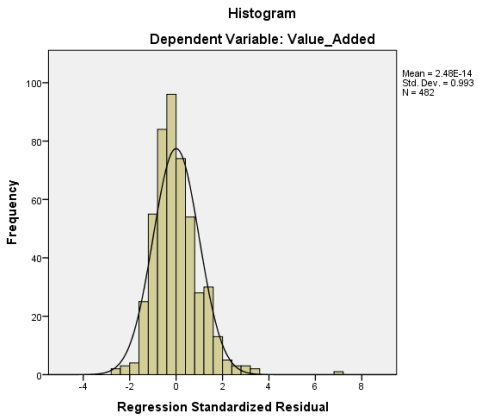
Normality Test (Probability plots and histogram) Philippines

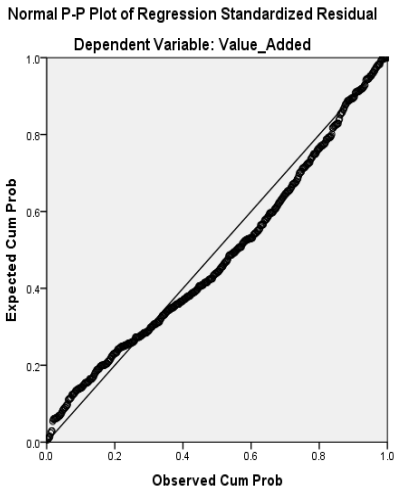




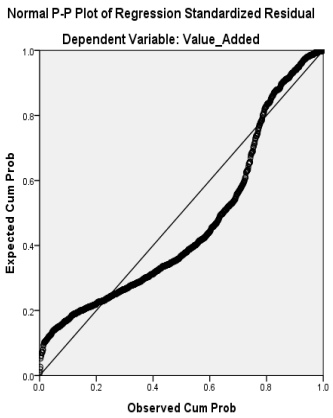
APPENDIX TWO (CONT)

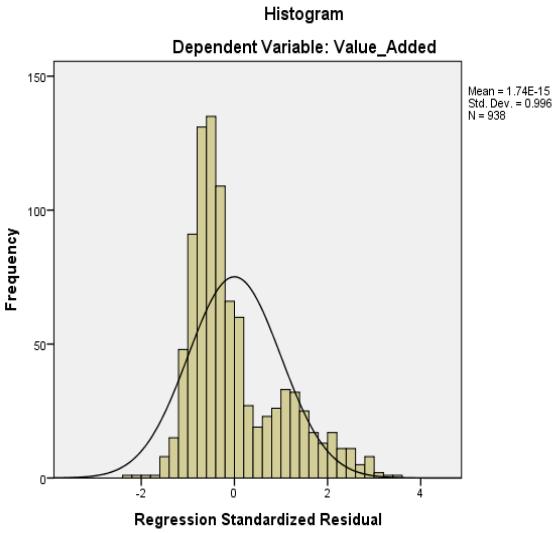
Normality Test (Probability plots and histogram) Myanmar





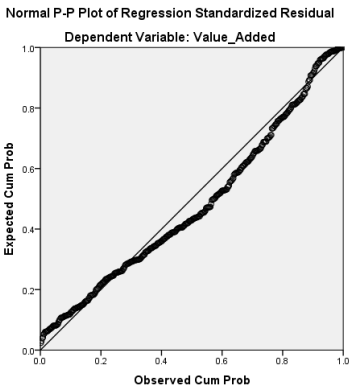
Normality Test (Probability plots and histogram) Vietnam

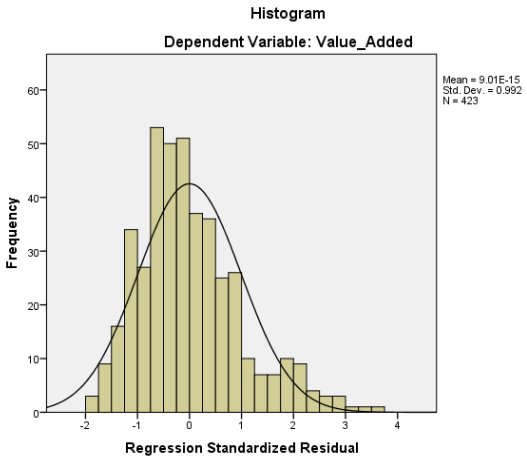




APPENDIX TWO (CONT)

Normality Test (Probability plots and histogram) Laos





VITAE

Name Mr. Joshua Akinlolu Olayinka

Student ID 6010521001

Educational Attainment

Degree	Name of Institution	Year of Graduation
Bachelor of Agriculture	University of Ilorin, Nigeria	2011

List of Publication and Proceeding

Olayinka, J.A., & Loykulnanta, S. (2019). *Is institutional environment important to technology spillover in developing countries? A meta-analysis.* Paper presented at the 3rd Japan International Business and Management Research Conference 2019, Tokyo, Japan.