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Technology sourcing as a determinant of FDI: An empirical analysis of a country's technological capabilities on inbound FDI

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Abstract

This thesis seeks to explore the determinants of technology sourcing FDI, which is a type of FDI that is motivated and aimed to find, transfer and integrate new advantages in a foreign country. The thesis uses quantitative methods to explore the relationship between a country's technological capabilities and the amount of technology sourcing FDI that they receive. Five Poisson regressions are modeled to test this relationship under different circumstances. The results of the regressions found support for the hypothesis that more technology sourcing FDI is attracted to countries with a higher technological profile. This relationship weakens under the conditions of higher corporate tax rates and more economic freedom, while the effect of the domestic concentration is found to be nonsignificant. Moreover, tariff rates and trade openness were found to be negatively related to the amount of inbound technology sourcing FDI. The thesis also found supporting empirical evidence that R&D intensity can act as a full moderator in the relationship between a country's technological capabilities and the amount of technology sourcing FDI that it receives.

Keywords: FDI, technology sourcing, technology sourcing FDI, technological capabilities, economic freedom, tax rate, trade openness, establishment modes, mergers & acquisition

Résumé

Cette thèse a pour objectif d'explorer les composantes du 'IDE d'acquisition de technologie' , un type d'IDE qui prétend identifier, transférer et intégrer de nouveaux avantages dans un pays étranger. Cette thèse se base sur des méthodes quantitatives qui explorent la relation entre les capacités technologiques d'un pays et le montant en 'IDE d'acquisition de technologie' reçu par ce même pays. Cinq régressions Poisson ont été modélisées afin de tester cette relation dans une variété de contextes différents. Les résultats de ces régressions viennent appuyer l'hypothèse comme quoi il y a davantage de 'IDE d'acquisition de technologie' chez les pays présentant un profil technologique plus avancé. La relation s'affaiblie sous certaines conditions telles qu'un taux d'imposition élevé ainsi qu'un fort indice de liberté économique, alors que l'effet de la concentration domestique est jugé insignifiant. Par ailleurs, le tarif douanier et l'ouverture commerciale ont démontré des impacts négatifs sur le montant des 'IDE d'acquisition de technologie' . Cette thèse présente également des preuves empiriques qui suggèrent que l'intensité en recherche et le développement peut jouer un rôle modérateur dans la relation existant entre la capacité technologique du pays et le montant des 'IDE d'acquisition de technologie' qu'il perçoit.

Mots-clés : IDE, sourcing technologique, IDE technologique, capacités technologiques, liberté économique, taux d'imposition, ouverture commerciale, modes d'établissement, fusions et acquisitions

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1. Introduction

When it comes to foreign direct investment (FDI), scholars traditionally have held the belief that firms conduct FDI only to exploit their ownership advantages in other places or countries. However, that point of view has gradually changed as more and more multinational enterprises (MNEs) use FDI to tap into locations that could give them access to technological sources that they need, even though those places do not offer any benefits with regard to exploiting their already owned advantages (Shan & Song, 1997).

This technology-seeking FDI is defined as a type of FDI that is not motivated by exploiting the ownership advantages of the investors, but by accessing the technological sources of the host country (Nigel Driffield & Love, 2005).

The body of literature that has studied technology sourcing FDI in the field of international business studies, the FDI theories, and FDI determinants creates the main theoretical domain of this thesis.

The technology sourcing FDI literature has studied this phenomenon through different lenses. Shan and Song (1997) investigated the fact that FDI in high technology industries is motivated by sourcing the technology from the host country for the biotechnology industry on a firm level. They found strong evidence that FDI in the form of equity participation is indeed motivated by sourcing the host country's technologies.

Neven and Siotis (1996) examined the flow of FDI into four major European countries at the industry level to see if technological sourcing is a motive behind investment originating from the United States and Japan. They found that technology

sourcing can be a motivation for FDI originated from the US and Japan, but not for the FDI that happens among European countries.

Anand and Kogut (1997) studied the technological motive behind new entries into the US in manufacturing industries. They concluded that industry rivalry is the primary motivation behind FDI investments in the US – not acquiring technology.

Technology sourcing can have implications for both firms and countries, but the papers related to technology sourcing FDI have done little to study this phenomenon on a country level. This thesis will try to fill that gap by conducting a full-scale, country-level quantitative analysis that is not confined to just one industry or one host country.

There are also few empirical analyses in the international business field (as much as this research could find) that have used the mergers and acquisitions (M&A) establishment mode to measure FDI of technology sourcing motives. Anand and Kogut (1997) have tested different modes of entry as part of their empirical research, but their data is obtained from five manufacturing sectors in only one host country. There is no mention of what those five manufacturing sectors were, or whether they would have fallen under high-technology industries. This is important because if the data was obtained from low-technology sectors, it would have been unsuitable to examine the technology-sourcing motive of the investing firms because a technology sourcing FDI is more likely to happen in high-technology sectors (Ruckman, 2005).

Moreover, the literature on technology sourcing has studied this phenomenon without regard to the fact that other specifications of their unit of analysis can have a moderation effect on the central phenomenon. By merely controlling for different FDI determinants one might miss some interesting characteristics of the phenomenon under the study in the context of different moderators. This thesis is one of the first of its kind that has looked at three moderating effects on the relationship between countries' technological capabilities and the amount of technology sourcing FDI that they receive. These three moderation effects include countries' tax rates, concentration rates, and

economic freedom levels.

Another novelty of this thesis will be the mediation effect analysis of the Research and Development (R&D) Intensity on the relationship between the countries' technological capacities and the amount of technology sourcing FDI that they receive. This has not been studied by the body of literature related to technology sourcing FDIs in international business journals, as much as this thesis could find.

The literature on FDI determinants has also, for the most part, neglected to study recipient countries' technological capabilities as a determinant of FDI, and there are very few empirical papers that have examined technology-sourcing as a determinant of FDI as much as this thesis could find.

These are all the gaps in the technology sourcing FDI literature that this thesis has tried to fill by addressing this question: What are the effects of countries' technological capabilities on the amount of technology sourcing FDI that they receive in different contexts? More specifically, the following three research questions will be examined in this thesis:

1- Do countries with higher technological capabilities receive more technology-sourcing FDI?
2- Can the relationship between countries' technological capabilities and technology sourcing FDI be explained with an indirect relationship?
3- Under what conditions can the relationship between the technological capabilities and technology sourcing FDI change, and how?

These questions intend to shed more light on understanding technology sourcing FDI from different angles and on a country level. A quantitative research study with different regression models is used in this thesis to answer the above research questions.

The empirical findings of this thesis are that countries' technological

capabilities attract FDI investments of technology sourcing type. The findings also indicate that countries' R&D intensity can play a full mediating role in the relationship between countries' technological capabilities and the amount of FDI that they might receive in the form of technology sourcing. Furthermore, it has been observed that domestic concentration's moderation effect on the relationship between countries' technological capabilities and technology sourcing FDI is not statistically significant. However, tax rates and economic freedom have a significant weakening effect on this relationship.

The rest of this paper is structured into five sections. Section two reviews the literature relevant to technology, the technology sourcing FDI, FDI determinants, FDI theories, and establishment mode choices summarizing the underlying theoretical framework and developing the hypotheses. Section three explains the measures, variables, how the dataset is built, statistical modeling and methods. Section four discusses the results and findings, and section five concludes.

2. Literature Review

The driving forces behind FDI have been studied by many researchers in international business, economics, and other related fields (see FDI review papers by Blonigen, 2005; Sethi, Guisinger, Phelan, & Berg, 2003). Although traditional FDI researchers have focused on the motive of deploying one's ownership advantages to exploit other markets (see Sethi et al., 2003 for a list of these scholars), other scholars recently have studied a different driver of FDI aimed to source technologies from a foreign market (Belderbos, Lykogianni, & Veugelers, 2008; Nigel Driffield & Love, 2003, 2005; Ruckman, 2005; Song & Shin, 2008).

Historically, technology sourcing FDI used to both occur in and initiate from developed countries. Gradually more countries with less developed economic status could join the tech-sourcing club due to improvements in their technological capabilities and innovative capacities (Furman, Porter, & Stern, 2002; Song & Shin, 2008).

In that sense, countries that have higher technological capabilities might receive a higher share of these technology sourcing FDIs in the international landscape, and this can have important implications for firms, as well as countries.

The rest of this chapter presents a review of the main FDI theories, the studies related to technology sourcing FDI, and establishment mode choices, followed by the development of hypotheses using relevant theoretical bases.

2.1 FDI Review

FDI is an important driver of international trade and transactions (Blonigen, 2005) and many determinants play a role in making FDI happen. For a long time,

international business and economics scholars have worked to build on the literature concerning FDI determinants (Blonigen, 2005)

The US Department of Commerce defines FDI as a direct investment in another foreign firm with at least 10% stake (Shan & Song, 1997). The minimum 10% equity holdings, although being arbitrary, is the rule of thumb to specify that the investing firm has gained at least some degree of control over how the recipient firm operates.

IMF (International Monetary Fund) and OECD (Organization of Economic Cooperation and Development) define FDI as follows:

"Foreign direct investment reflects the objective of establishing a lasting interest by a resident enterprise in one economy (direct investor) in an enterprise (direct investment enterprise) that is resident in an economy other than that of the direct investor. The lasting interest implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and ***a significant degree of influence on the management of the enterprise****. The direct or indirect ownership of 10% or more of the voting power of an enterprise resident in one economy by an investor resident in another economy is evidence of such a relationship. Some compilers may argue that in some cases the ownership of as little as 10% of the voting power may not lead to the exercise of any significant influence while on the other hand, an investor may own less than 10% but have an effective voice in the management. Nevertheless, the recommended methodology does not allow any qualification of the 10% threshold and recommends its strict application to ensure statistical consistency across countries." (OECD, 2008, p. 48)*

FDI is also defined in different textbooks and academic papers as an investment that gives the investing firm some degree of control over the operation of another firm located in a different country (Head, 2007). While this investment can be geared toward acquiring a stake in an existing firm, a recipient firm's involvement in the host country

is not necessarily required for an FDI to occur in the first place. This is explained by the fact that the investing firm can arrange for the FDI to happen without interacting with any other party (such as in a greenfield investment).

2.1.1 Types of FDI.

In different literature, FDI has been categorized based on various criteria. Knowing these different types of FDI and their underlying taxonomies can help us gain a better understanding of this phenomenon.

In a very simplistic view one can see FDI from the investment direction perspective (inward/inbound FDI vs. outward/outbound FDI). This categorization only helps to understand where the investor and the recipient entities are located or from which country the technology is sourced. One thing that this thesis found disturbing while studying the FDI-related literature is that it is sometimes unclear what inward/outward FDI refers to. For example, inward FDI from a home country's perspective is outward FDI from the host country's point of view. If it is not explicitly stated from whose perspective it is being discussed, it can become confusing for readers. Other simple taxonomies include FDI categorization based on the host country's economic status (i.e. developed vs. developing) or based on the service vs. manufacturing sectors.

Another classification commonly used for FDI which is of more managerial value is grouping FDI based on the establishment mode (Brouthers & Hennart, 2007). This type emphasizes the investing firm's preferences in selecting one mode over the other when investing in another country. Many papers have contributed to this area of study (see review paper by Brouthers & Hennart, 2007). This thesis will also investigate this classification of FDI to better understand the characteristics of the technology sourcing FDI.

The other criterion is what divides FDI into different classes based on the investor's main motive (Dunning, 2009) for which FDI can fall under resource-seeking, market-seeking, efficiency-seeking, and strategic-asset-seeking types. With this classification, and on a priori grounds, tech-sourcing motive can fall under the Dunning's strategic-asset-seeking FDI.

Some scholars also have used level of integration as a criterion to divide FDI into vertical or horizontal types (Blonigen, 2005). Ruckman (2005) in the study of technology sourcing from the US biotechnology firms found that foreign acquirers take over the US biotechnology firms that specifically do business on a different product line than that of themselves, while domestic firms tend to acquire firms that had the similar or same production line. How technology can transfer in different types of FDI concerning integration can be very interesting. As in the horizontal FDI, one can gain access to a competing firm's developing technology in the same level of value chain activities. In the case of vertical FDI, the firm can learn a lot from other business entities positioned lower or higher in their respective value chain.

In this sense, firms may use different types of FDI regarding the level of integration (Vertical vs. Horizontal) according to their knowledge sourcing requirements. If they need to acquire knowledge at the same degree of the value chain, they may choose horizontal FDI, and if they want to acquire knowledge in the upper or lower levels, they might go for the vertical type of FDI. Although, in this thesis, testing how the level of integration affects the technology sourcing determinant of FDI is not on the agenda, it can be a valuable future study for researchers of international business.

The FDI empirical studies can investigate different aspects of FDI including motives, occurrence, location, modality, volume (or magnitude), patterns and trends in various places (spatial) and during different timespans (temporal) in a cross-sectional manner or in a longitudinal way (Sethi et al., 2003). In cross-sectional empirical

research, FDI is analyzed at the time it happens without examining the changes that might happen to the investment afterward. In the longitudinal research, one or more aspects of the FDI change over time as a function of variations in other determinants (Sethi et al., 2003). FDI theories explain the rationale behind firms' FDI decisions, whether they are about its amount (how much question), location (where question), motives (why question), or modalities (how question).

In analyzing the FDI literature, it has been found that different FDI theories are used in building the theoretical framework of the papers based on the domain of the study, the schools of thoughts the researcher belongs to, and the time of the research. In what follows, the main theories behind FDI are reviewed.

2.1.2 FDI theories.

The theory of capital improvements (Aliber, 1971; Iversen, 1936) views FDI as a branch of portfolio investment and is one of the earliest explanations of FDI. Later on, Hymer (1960) looked at FDI as a way to transfer tangible or intangible knowledge in an industrial organization tradition. Then Vernon (1992) took a production lifecycle view and explained that firms engage in FDI only when their product in the home market has already gone through the maturation stage, and the product has become standardized (Sethi et al., 2003).

Knickerbocker (1973) explained the bandwagon effect as an underlying factor for firms to follow suit when their rivals conduct FDI in other countries. Buckley and Casson (1976), and later, Hennart (1982), described the logic behind FDI as the way to internalize transactions. Johanson and Vahlne (1977) came up with the Uppsala model that explains MNEs engagement in FDI is incremental. This means that firms might start from smaller investment in closer markets and later may move into more significant investment in more distant locations after they have augmented more experiences (Sethi et al., 2003).

The resource-based approach of Wernerfelt (1984) and Conner (1991); the evolutionary perspective of Nelson and Winter (1982) and Teece, Pisano, and Shuen (1999); and the organizational management view of Doz and Prahalad (1987), Bartlett and Ghoshal (2002) as well as Sethi and Guisinger (2002) all look at the FDI as a subsequent result of having ownership advantages that are difficult to replicate while focusing on the MNEs' ability to further exploit them by engaging in FDI in other locations (Sethi et al., 2003).

Among all FDI theories, the eclectic paradigm of Dunning (2000) or OLI framework is one of the most well-known. The OLI theory later leads to Dunning's categorization of FDI based on the investment motives to four categories of resource-seeking, market-seeking, efficiency-seeking and strategic-asset-seeking.

Based on the OLI framework, a firm will engage in an FDI if it satisfies three conditions simultaneously: It has an ownership advantage (also referred to as a competitive advantage or a firm-specific advantage), it finds locational advantages in another country, and it realizes advantages in the internalization of the overseas value-added activities. Otherwise, if any of the Ownership, Location and Internalization factors do not happen at the same time, engaging in an FDI is not viable (Dunning, 2000).

The ownership advantage is the firm's intangible assets, which can't be imitated, replicated or easily copied by the rivals, and it is long-lasting (Brouthers & Hennart, 2007). Such intangible assets include but are not limited to know-how, experiences, technology, and brand name.

The host country's location advantage can be thought of as any combination of immobile factors (Neven & Siotis, 1996), such as factor endowment (inexpensive raw materials, low-cost wages, and land), market opportunities, technology spillover, low tax rate, trade barriers, etc. It should also be noted that the host country's location

advantages should more than compensate for the disadvantages accrued by operating in a foreign country for an FDI to become likely (Anand & Kogut, 1997).

The internalization advantage refers to the fact that the firm should also feel a need to internalize the value-added activities in the foreign market instead of simply sourcing it via the open market (Dunning, 2000). If the locational advantages, such as technological capabilities, are difficult to transact (Brouthers & Hennart, 2007) and transfer, internalization is more viable and FDI more probable.

2.1.3 FDI determinants.

Empirical studies that have based their research on the location aspect of Dunning's OLI framework found market size; market growth; trade barriers; the cost of wages, production, and transportation; political stability; psychic distance; taxation and trade policies as the most important of FDI's determinants (Sethi et al., 2003). These determinants can be divided into policy and non-policy factors according to (Loree & Guisinger, 1995) as cited by Sethi et al. (2003).

The location element of the eclectic paradigm can also take a broader regional shape, and instead of dyadic pairs between each MNE and the most advantageous location in the host country, MNEs can take into consideration regions instead of single locations to evaluate their FDI destinations (Sethi et al., 2003). Thus, regional benefits from contiguous countries' economic integration such as unified markets; common infrastructures; similar cultures, development levels and institutions; and lower trade barriers are factors that can influence FDI decisions (Sethi et al., 2003).

In another study by Reuber (1973) as cited by Sethi et al. (2003), the traditional determinants of FDI are named as market perspectives (GNP, population, growth, purchasing power), government policy in liberating trade and removal of barriers, political and economic stability, technological infrastructure, skilled labor, and cultural proximity. Each destination (whether it be a country or a region) that gives an optimal

mix of these traditional FDI determinants will attract market-seeking FDI. On the other hand, each MNE might consider its own unique combination of traditional FDI determinants to engage in an FDI as explained by Reuber (1973).

What is of particular importance is that when competition rises in a particular location, MNEs tend to restructure their FDI moving to countries with lower wages or untapped markets (Sethi et al., 2003), thus giving rise to second-hand efficiency-seeking and market-seeking FDI investments. Through simple analogy, the same thing can be said when technology sourcing is the primary motive behind the initial FDI investment. That means if one country becomes a hub in certain technologies, it can become the target of tech-sourcing FDI investments relocated from other previously-important technology hubs.

2.1.4 FDI and Technology sourcing.

In this section, first technology is defined and its different types are explored. Then, thoughts about countries' technological capabilities (independent construct) are discussed, such as why technology is said to be location-bound, how it can be a source of competitive advantage, and how absolute and relative technological capabilities differ. Then, thoughts about technology sourcing FDI (dependent construct) are covered, including how technology-exploiting FDI and technology-sourcing FDI vary, as well as ideas from different scholars about using FDI as a means to transfer technology. Next, a summary of technology sourcing empirical studies is presented.

2.1.4.1 Understanding technology.

According to Wahab, Rose, and Osman (2012), not only is the concept of technology as a phenomenon difficult to grasp because of its abstract nature, but this concept has changed in the past few decades and differs from one discipline to another. Past scholars, based on their viewpoint and perspective, have come up with many definitions for technology (for a list of these definitions see Table 1). Ricken and Malcotsis (2016, p. 16) define technology as:

"The knowledge of how to perform tasks, solve problems and provide products and services in organizations. Technology denotes not only the sum of knowledge, experience and skills necessary to manufacture and market a product economically: it also refers to the knowledge necessary for the planning, establishment and operation of a firm (UNCTAD, 2001, p. 6)"

Year	Scholars	Definitions
1968	Merrill	Technology connotes the practical arts, bodies of skills, knowledge and procedures for making, using, and doing useful things.
1968	Strassman	The tools, a stock-pile of utensils, but to a kind of tool-using behavior, a set of methods for making specific goods.
1970	Jones	The way in which the resources inputs are converted into commodities.
1971	Hawthorne	The application of science to solve well-defined problems.
1972	Galbraith	The systematic application of knowledge to practical tasks.
1976	Teese	A set of knowledge or experience related to the production of a product or the implementation of a process.
1981	Hawkins and Gladwin	The specialized knowledge pertaining to the production of the goods and services in organized economic activity, including the knowledge and skills required to manage a set of interrelated technical processes.
1983	Pacey	The application of scientific and other organized knowledge to practical tasks by ordered systems that involve people and organizations, living things, and machines.
1987	Woolgar	An integration process of physical objects, the process of making the objects and the meaning associated with the physical objects. These elements are not distinctive and separable factors, but form a seamless web that constitutes technology
1989	Goulet	The application of science because of their special relationship.
1991	Methe	A process where its origins and destination are connected and its dynamic nature is highlighted.
1992	OECD	A structure or a network due to various feedback loops between it and other sub-systems within a society, and to its obviously non-linear development projections
1992	Natarajan and Tan	The knowledge or expertise that is required in the production or assembly of a given good. Technology therefore embodied in the related machinery and utilized by a firm.
1996	Levin	Technology is not really a 'thing'; it is better characterized as an approach. It is the application of scientific principles to solve practical problems. Technology has been described as having three facets: material artifacts (things), the use of artifacts to pursue a goal, and the knowledge to use these artifacts.
1996	Burgelman et al.	The theoretical and practical knowledge, skills, and artifacts that can be used to develop products and services as well as their production and delivery systems. Technology is embodied in people, materials, cognitive and physical processes, facilities, machines and tools.
1998	Lovell	Technologies are separated into 'product technologies' (associated with the physical and engineering aspects of equipment) and 'process technologies' (associated with the processed by which problems are solved).
2002	Tihanyi and Roath	Information such as a patent, know-how or trade secrets. Conversely it can be modified as equipment, component assemblies/parts or as a final product. Production techniques/processes, which require necessary skills to apply different methods of production, represent a combination of tangible and intangible technology. Technology can also include information that is not easily reproducible or transferable.
2003	Maskus	The information necessary to achieve a certain production outcome from a particular means of combining or processing selected inputs which include production processes, intra-firm organizational structures, management techniques, and means of finance, marketing method or any of its combination. Technology may be codified in formulas, blueprints, drawings, and patent applications or uncodified in the sense of requiring implicit know-how on the part of personnel.
2006	Reisman	The development and application of tools, machines, materials and processes that help in solving human problems.

Table 1: Definitions of Technology by Past Scholars (Wahab et al., 2012, p. 70)

Wahab et al. (2012) explain that there are two views on technology. The older concept states that technology is easy to apply, reproduce, and reuse. The more recent concept says that technology is a firm-specific and intangible asset that contributes to the firm's competitive advantage and is not easy to reproduce or transfer.

According to Wahab et al. (2012), technology can fall under different classes including general, system-specific, and company-specific. Each of these classes can also be embodied or disembodied. The embodied type falls under various categories such as capital embodied, and human embodied as suggested by Madeuf (1984) or product embodied, process embodied and person embodied as preferred by G. Hall, Johnson, and Vernon (1970).

General technology is the knowledge known by all the firms operating in one sector. The system-specific technology is what is built inside the firm to achieve a particular task and handle a specific problem. The company-specific technology is what resides in the company's human resources, and comes from the experiences accrued by doing a particular task for a long time (Wahab et al., 2012).

2.1.4.2 Countries' technological capabilities (independent construct).

Countries have similarities as well as differences. Although globalization has resulted in convergence (Dowrick & DeLong, 2003), national boundaries are still a matter of great importance. Not only do market and production factors such as land, labor, raw material, or the cost of capital differ from one country to another, but nations also vary in their skills, knowledge, experiences, and technological capabilities (Anand & Kogut, 1997). Citing from Kogut (1990), Shan and Song (1997) explain that technological advantages are heterogeneously spread among different countries, and the technological advantages of the countries, for the most part, are time-persistent.

These differences arise from the unique composition of each country's institutional environment. Factors that play vital roles in determining the technological

positions of countries include firms' linkage to research centers and universities; the path-dependence historical augmentation of skills and capabilities embodied in countries' local firms; and the local workforce (Anand & Kogut, 1997). That means one element that can differ from one nation to another is the technological capacities that reside within the boundaries of each country. These differences in high-tech capabilities of countries might be one of the things (among all the other factors) that contributes to the countries' attractiveness in pulling new FDI (Anand & Kogut, 1997).

2.1.4.2.1 Technology is location-bound.

Anand and Kogut (1997) state that although it is not very well understood why technological knowledge is locally-bounded, (which means it requires proximity to be identified, transferred or integrated) there is increasing evidence that supports it is of that nature. Song and Shin (2008) state that knowledge stays within a confined geographical boundary because it is sticky (Jaffe, Trajtenberg, & Henderson, 1993). Firms located near university research centers patent more frequently (Jaffe et al., 1993), as stated in Anand and Kogut (1997). Firms located in innovative regions and center of excellence have better access to new technologies, compared with their spatially-distant counterparts. They can better recognize, transfer, and integrate this knowledge into their operations, according to Almeida, Song, and Grant (2002) as stated by Song and Shin (2008). Therefore, firms might need to physically exist in the areas outside of their homeland boundaries to internalize the technology or knowledge located outside of their home country.

According to Shan and Song (1997), the fact that technology is country-bound arises from a country's specific configuration of institutions, such as the university networks, venture capital, research centers, and government agencies, as well as their interaction, inter alia, which is too complex to replicate by other countries. For that reason, technology is country-bound, and that's what gives rise to technology-seeking FDI. These specific configurations of institutions in countries can also be related to the notions of national organizing principle and national innovation system (Shan & Song, 1997).

According to Nigel Driffield and Love (2005), there is significant empirical evidence that support technology spillovers are geographically localized and limited within countries (NL Driffield, 1999; Head, Ries, & Swenson, 1995).

2.1.4.2.2 Technology is a competitive advantage.

Nigel Driffield and Love (2003) show that firms might choose to place FDI in a market to benefit from positive spillover effects caused by proximity to technological leaders in the host country. Due to the externalities related to these technologies, the investing firm's production costs across its production bases at home and abroad might decline. Also, Siotis (1999) could show that a technologically laggard firm might place FDI into a market even if the cost of export is close to zero (Nigel Driffield & Love, 2003) because the positive spillover advantages arise from the closeness to technological leaders (Nigel Driffield & Love, 2005).

Ricken and Malcotsis (2016) describe that technology can be thought of as significant strategic resources. They continue to explain that technology is strategically critical because of being scarce, hard to transfer and hard to replicate, especially the tacit technology (Grant, 1996, p. 375). Gaining access to new technologies can help the firm obtain cost or differentiation advantage over their rivals (M. Porter, 1985, p. 377). Moreover, the ability of the firm in absorbing and integrating new technologies is a matter of great importance. The ability to absorb and make use of the new technologies can be related to absorptive capacity of the firms (Ricken & Malcotsis, 2016, pp. 38-40; Rothaermel & Alexandre, 2009) which is out of the scope of this research. Ricken and Malcotsis (2016) further explain that technology not just helps with the competitive advantage at the firm level but also it helps with the competitive advantage of the regions and nations too.

Shan and Song (1997) argue that knowledge is sticky and is constrained in a restricted geographical area (Jaffe et al., 1993). Thus, being in those areas offer a competitive advantage (Almeida, 1996). They continue to explain that MNEs can add to their competitive advantage by placing their subsidiaries in locations that are

technological centers of excellence as long as they can identify, learn, transfer, and integrate these technologies across their operations at home or in different countries (Almeida et al., 2002).

According to M. E. Porter (1985), a diverse technological base can be a source of competitive advantage for countries and their firms. Hashai, Asmussen, Benito, and Petersen (2010) state that technology-intensive firms need to obtain a diverse technological base in order to sustain and improve their competitive advantage. They mention that according to strategic management research, the ability to make use of diverse knowledge is a crucial source for competitive advantage. This is because knowledge diversity provides a better viewpoint which can, in turn, evoke innovation and improve problem-solving.

2.1.4.2.3 Absolute vs. relative technological advantage.

Countries' technological capabilities can be seen from an absolute or relative point of view. Song and Shin (2008) state that these absolute and relative levels of technological capabilities are important. They explain that most studies have focused on absolute levels of technological capabilities, which are the capabilities held by the firms (investing or investee), and the home or the host countries. Relative levels can be expressed in terms of the MNE's technological capabilities relative to the other firms' technological capabilities in its home country. It can also be expressed as the firm's technological capabilities relative to other firms' technological capabilities in the host country. The differences and similarities between the technological profile of the home and host countries is another way of expressing the relative levels of technological capabilities.

2.1.4.3 Technology sourcing FDI (dependent construct).

In recent years, numerous papers have studied technology sourcing FDI (Belderbos et al., 2008; Nigel Driffield & Love, 2003, 2005; Ruckman, 2005; Song & Shin, 2008), a type of FDI that is not motivated through the exploitation of investors' ownership advantages, but by the host country's technological capabilities (Nigel

Driffield & Love, 2005). In the literature, technology sourcing is also referred to as technology acquisition (Nigel Driffield & Love, 2003; Fosfuri & Motta, 1999). Another similar notion used in technology-sourcing literature is reverse spillover, which refers to the positive externalities generated by the host country's domestic firms that can be captured by the investing foreign firms (Nigel Driffield & Love, 2005). The technology sourcing concept has also been referred to (in the international business literature) as knowledge-sourcing and knowledge-seeking (Ruckman, 2005).

2.1.4.3.1 Home-base exploiting FDI vs. home-base augmenting FDI.

Anand and Kogut (1997) indicated two types of FDI drivers: The FDI investment can result from a push exerted by the home country's ownership advantages and knowledge spillover (push effect) or can be a result of the host country's spillover (pull effect). In the former, the goal is to utilize one's already owned advantages such as its technology competencies in a different spatial location for various econometric reasons (market seeking) without any technology sourcing motive. In the latter case, the main objective is to find and internalize complementary advantages residing outside of one's national boundaries (strategic asset seeking). In the pull effect, as explained by Anand and Kogut (1997), the technological capabilities of the host country in industries with technological superiority would pull FDI into that country, making technology sourcing the main motive behind the FDI. This means MNEs not only use FDI to push their current ownership advantages to exploit overseas markets, but can also use it to augment their capabilities and resources by doing business near places that possess high technological capabilities (Almeida et al., 2002; Shan & Song, 1997; Singh, 2004), as explained by Song and Shin (2008). Kuemmerle (1999) refers to the same notion as home-base exploiting FDI to exploit one's own advantages abroad, and home-base augmenting FDI to gain access to externalities and resources created in different locations (Nigel Driffield & Love, 2003).

2.1.4.3.2 FDI as a means of transferring technology.

According to Shan and Song (1997), Dunning (1995) emphasizes the fact that researchers should recognize that firms conduct FDI not only to exploit their current

competitive advantage that arises from their home operations, but also to apprehend and receive the complementary technologies. In terms of push and pull effects, that means FDI is not only pushed by the firms' current competitive advantage, but may also be pulled by the centers of innovations. This pulling effect takes place due to the need for access to the technologies being developed in these centers for the firm to augment new advantages in order to stay competitive in the international landscape (Shan & Song, 1997).

According to Shan and Song (1997), Dunning (1958) is one of the first scholars who recognized the possibility of using FDI as a way to source technology. Hymer (1960), as mentioned in Sethi et al. (2003), defined FDI as a means of transferring technology and other firms' tacit or tangible knowledge. Also, Kogut (1983) has seen FDI as a knowledge transfer channel as stated in Sethi et al. (2003) and according to Bengoa and Sanchez-Robles (2003), FDI is a particular channel through which technology spills over from countries with higher technological capabilities to the ones with lower technological capabilities. Borensztein, De Gregorio, and Lee (1998) mention that FDI can be thought of as advanced technology transmission vehicles among countries.

2.1.4.3.3 Technology sourcing empirical studies.

Although in some papers it is taken for granted that FDI is a means of transferring technologies, authors of other papers have put this assumption into the empirical test. Cantwell (1989), as mentioned in Shan and Song (1997), empirically tested the relationship between where technology is located and where FDI happens. He found that MNEs in West Germany and the US are pulled toward locations that are famous sites of innovation in their respective sectors. Moreover, Cantwell (1989) noticed that more foreign technological activities happen in countries of technological leadership (Shan & Song, 1997).

Kogut and Chang (1991) also observed that Japanese FDI in the US is attracted toward R&D intensive sectors (Shan & Song, 1997). They also noticed that a Japanese FDI is more likely to happen in industries where local Japanese firms fall behind their US counterparts regarding R&D activities (Neven & Siotis, 1996). Firms lacking R&D or innovation compared to the industry standards are more likely to engage in technology sourcing FDI (Blonigen, 2005).

Neven and Siotis (1996) in their study of FDI into four of the major European Community (EC) countries in a five-year period (1984-1989) empirically tested to see if FDI originating from Japan and the US could have been motivated by tech-sourcing motive. They put their focus on the fact that domestic technology might get appropriated through FDI which might, in turn, endanger the countries' national security. They concluded that tech-sourcing is indeed an important motive behind FDI flows into EC countries originating from Japan and the US.

Potterie and Lichtenberg (2001) in their empirical study of FDI's relationship with the international dissemination of technology found that outward FDI (outward from the home country's perspective) is an effective channel to source technology from other countries. They state that the inward FDI (inward from the host country's perspective) can act as a Trojan horse intended to acquire the host country's technology base rather than to diffuse home-based technological advantages in the host country (Nigel Driffield & Love, 2003).

Fosfuri and Motta (1999) conducted a comparative analysis between two firms endowed with different levels of technologies. The two firms had the option of placing FDI, exporting, or not entering another country. They found that the firm with the lower level of technologies would find it profitable to do the FDI when the likelihood of acquiring technologies is high, even though it had an efficiency disadvantage caused by an inferior technology base (Nigel Driffield & Love, 2003).

Siotis (1999) conducted a two-firm, two-country research in which the firms

have to decide between exports or FDI. He found that the more technologically advanced firm prefers exports over FDI for the purpose of preventing knowledge spillovers, while the less technologically advanced firm prefers FDI over exports in order to source technology (Belderbos et al., 2008).

Song and Shin (2008) in an empirical analysis of the knowledge sourcing of the MNE's headquarters from their overseas R&D labs in the semiconductor industry using patent data from the US patent office reach two important results. The first result (as they name it) is paradox of technological capability. That means knowledge sourcing will improve the headquarters' learning capabilities or absorptive capacities, which further improves the capabilities to source technology from host countries. However, headquarters with high technological capabilities are less likely to be motivated to source new knowledge from host countries because they have well-established technological trajectories that might restrict their willingness to seek new capabilities (Nelson & Winter, 1982; Stuart & Podolny, 1996).

The second result that Song and Shin (2008) reach is that relative and absolute levels of technological capabilities are important in the MNE's motivation to source the technology from a host country. They propose the relative levels of technological capabilities as being the MNE's technological capabilities relative to those of the rest of the home country's firms, as well as the home country's level of technological capabilities relative to the host countries' technological capabilities and profile. They posited that if the MNE is a technological leader in the home country, it will be more motivated to learn from the host country because there is little left in the home country to learn from. They also argue that MNEs are more likely to learn from the host countries that are relatively higher than that of their home country in terms of technological capabilities.

But is that the FDI itself that can facilitate technology transfer from the host country to the home, or is the modality of the FDI also important in making it happen?

To answer this question, a review of literature related to FDI mode choices can be helpful.

2.2 Mode Choice Review

According to Hashai et al. (2010), a quick review of the literature related to establishment/entry modes reveals that different modes bring about different learning experiences. In fact, FDI mode choice is one of the topics that has been studied a lot by different scholars (Hashai et al., 2010). In international business literature, there are two streams of strategic decision related to mode choice when expanding into a new country. One is related to the decision to buy an established facility in the destination country (Acquisition) or to establish a new one from scratch (Greenfield). The next decision is to choose between full or partial ownership, thus to decide between wholly owned subsidiary (WOS) or partially owned subsidiary. The first strategic decision is named establishment mode choice and the second one is referred to as entry mode choice (Dikova & van Witteloostuijn, 2007).

Likewise, Brouthers and Hennart (2007) state that an acquisition can be either fully or partially owned. On the other hand, greenfield can also be either partially-owned (Greenfield JV) or wholly-owned (Greenfield WOS). Figure 1 visually displays these four establishment/entry types. These modes are commonly arranged along a continuum of increasing control, commitment, and risk so that the firm will choose the Greenfield WOS when it wants to have maximum control, and is willing to make maximum commitment and take more risk (Brouthers & Hennart, 2007).

According to Ruckman (2005) acquisition in high-tech sectors is an important and common way of getting access to new technologies. Ruckman (2005) continues that foreign acquirers that have low R&D intensity go for firms with higher R&D intensities, and she concludes that this shows technology sourcing is the main motive for these investments.

Anand and Kogut (1997) explain that when technology sourcing is the motivation behind FDI and when technology is proprietary to the hosting firms, the acquisition is the preferred mode. While acquisition reveals the motive behind acquiring host country assets, a greenfield (either be a WOS or a JV) more likely reflects exploitation motive of the home-owned advantages (Anand & Kogut, 1997).

		Establishment mode	
		greenfield	**acquisition**
Ownership mode	**shared**	1. Greenfield JV	3. Partial acquisition
	full	2. Greenfield WOS	4. **Full** acquisition

Note: WOS = wholly owned subsidiary; JV = joint venture.

Figure 1: Establishment vs. Ownership (Brouthers & Hennart, 2007, p. 399)

Neven and Siotis (1996) also mention that firms choose a Greenfield WOS in order to minimize their knowledge leakage when they have specific knowledge resources they need to protect. On the other hand, firms that want to access specific knowledge would pursue an acquisition establishment mode that helps maximize spillovers between the investing and host firms (Neven & Siotis, 1996).

Chang and Rosenzweig (2001) found that firms that possess superior technological capabilities choose a greenfield mode to enter a new market for the first time. Shan and Song (1997) explain that greenfield requires a large investment and a high incubation time. Moreover, technological advancement is more often than not embedded in the local firms, not in the location per se. These factors will make it less likely for the firms to use a greenfield investment to source technology (Shan & Song, 1997).

The role of the Greenfield JV is a bit ambiguous. It can maximize inter-firm knowledge spillover, as there is another party involved in the process of expanding into a new country. On the other hand, because a new firm is being established from the ground up, it might limit it in the sense that it can't immediately gain access to the destination country's knowledge. That's because the new firm gets created by sharing the resources of two other firms, thus the investing firms choose to what extent they want to share their already owned, valuable knowledge for the other party.

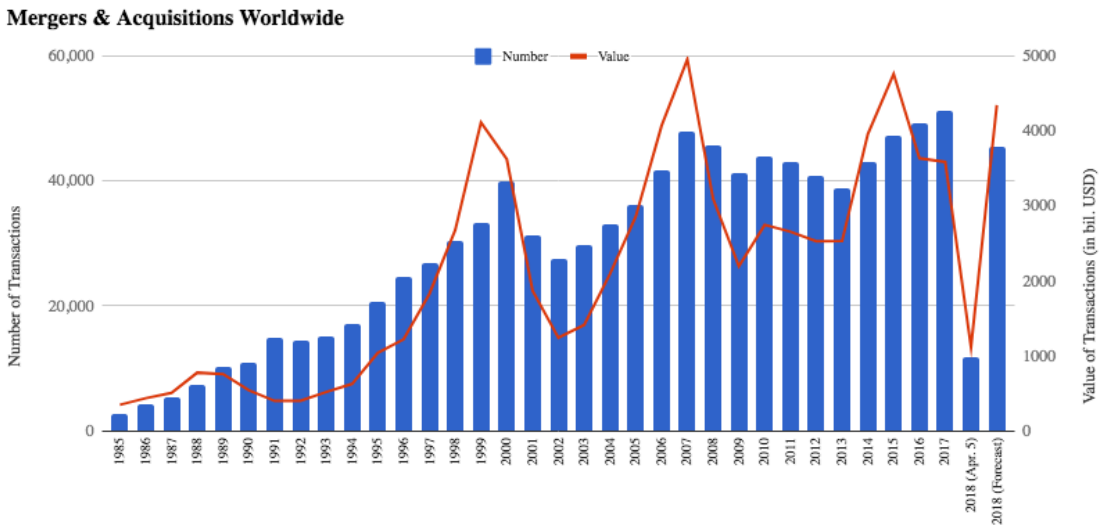

Figure 2: M&A Trends Worldwide (IMAA, 2018)

With that being said, the choice of the establishment mode can reveal the firm's intention behind their FDI decision (Neven & Siotis, 1996) and the growing number of M&A investments (see Figure 2, and Figures 18-26 in Appendix A) in recent decades

may be an important indicator of growth in technology sourcing FDI (Neven & Siotis, 1996).

2.3 Hypotheses development

2.3.1 Hypothesis 1.

Nigel Driffield and Love (2003) state that technology sourcing FDI relies on the host country's presence of domestic to foreign technological externalities. According to Anand and Kogut (1997), technology sourcing FDI is motivated by gaining access to the technologies that reside outside of one's own country. Thus, if technology sourcing is the primary motive behind the investment, it follows that all else being equal, the locations that have higher technological capabilities are likely to attract more technology sourcing FDI. That means FDI with technology-sourcing motives should be attracted to the countries with the high technological profile. This makes the first hypothesis of this thesis:

H1: The more technological capabilities each country has, the more technology sourcing FDI they will receive.

This relationship between the technological capabilities of the countries and their technology sourcing FDI is depicted in Figure 3.

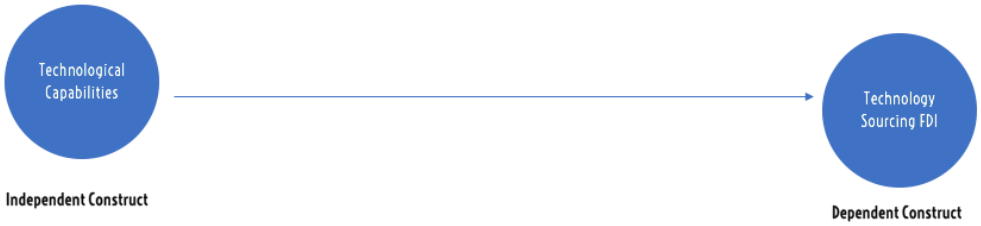

Figure 3: Hypothesis 1

2.3.2 Hypothesis 2.

Florida and Heinz III (1997) assert that the rapid growth in R&D investments may reflect the motive to harness host countries' technological capabilities. Thus,

technological capabilities of the countries can lead to more R&D intensity. Also, patents have been widely used to capture countries' technological capabilities (Kotha, Zheng, & George, 2011) and according to the theories related to R&D and patents reverse causation (Baraldi, Cantabene, & Perani, 2014), more patents can lead to more R&D intensity. Thus, countries' technological capabilities can lead to more R&D intensity as shown by line A in Figure 4.

It should be noted that on a priori grounds, R&D intensity might also positively influence the technological capabilities. Also from a theoretical perspective R&D intensity is said to be a source of technology generation (Archibugi & Coco, 2005) and is often used as a measure of technological capabilities (Schoenecker & Swanson, 2002; Yiu, Lau, & Bruton, 2007). That means the relationship between technological capabilities and R&D intensity can be thought of as being a two-way reinforcing relationship. However, testing this two-way relationship is not in line with the objectives of this thesis.

On the other hand, countries with more R&D intensity attract more FDI with technology sourcing motive (Nigel Driffield & Love, 2005). Anand and Kogut (1997) state that R&D-intensive industries receive more foreign investment. Nigel Driffield and Love (2003) explain that technology sourcing depends upon the research efforts of the domestic firms. Therefore, it is more likely to happen in locations where externalities to be captured by foreign firms are greatest and where domestic industries have invested a lot in R&D. Noland (1999) also found that R&D expenditures are positively correlated with inbound FDI in the US and Japan. These all support that more R&D intensity can result in more technology sourcing FDI as shown by line B in Figure 4.

In summary, countries with higher technological capabilities spend more on their R&D and thus have higher R&D intensity. Countries with more R&D intensity receive more technology sourcing FDI. Therefore, R&D intensity acts as an

intermediate construct between countries' technological capabilities and countries' technology sourcing FDI. That means R&D intensity can play a mediation role (either partial or full) in the relationship between the countries' technological capabilities and technology sourcing FDI. This mediation effect is shown in Figure 4. Therefore, the second hypothesis of this thesis is:

H2: Countries' R&D intensity plays a mediator role in the relationship between their technological capabilities and technology sourcing FDI.

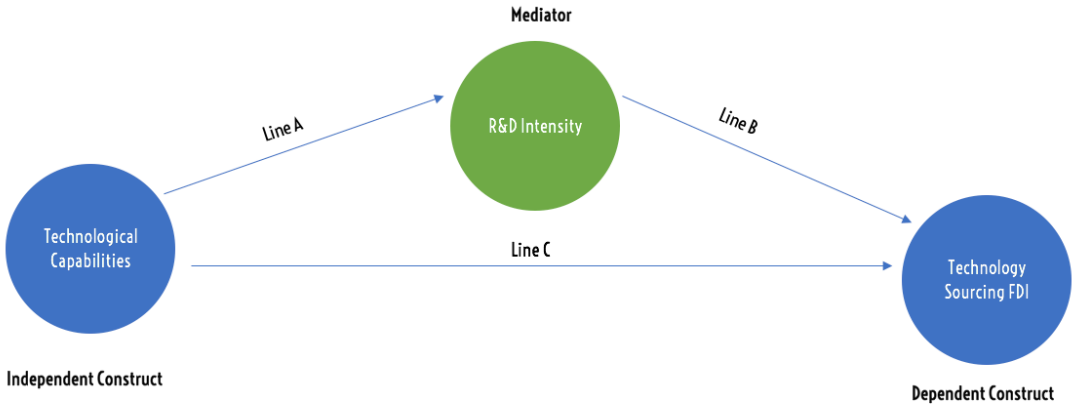

Figure 4: Hypothesis 2

2.3.3 Hypothesis 3.

Concentration may discourage inbound FDI. Noland (1999) in a quantitative study using the Herfindahl–Hirschman index of concentration (HHI) found a negative correlation between concentration and inbound FDI. HHI, which is a common measure of the concentration rate, is calculated as the sum of the squares of the market share held by each of the firms in one sector or the entire country (Weston & Weaver, 2004).

Also, Kogut and Chang (1991) found that the US host concentration is negatively associated with incoming FDI. This implies that if countries' technological capabilities remain the same, greater concentration in the host country can result in

attracting less FDI. Thus, the relationship between the countries' technological capabilities and technology sourcing FDI may weaken as a function of higher concentration in the host country. Moreover, concentration rate decreases the $\frac{\Delta Ts}{\Delta TC}$ ratio which is the slope of the line that relates countries' technological capabilities (TC) with their inbound technology sourcing FDI (TS). It decreases the $\frac{\Delta Ts}{\Delta TC}$ ratio as it can decrease the numerator (ΔTs) and increases the denominator (ΔTC). Concentration decreases the ΔTs because it can discourage inbound FDI (Noland, 1999). Concentration can also increase the ΔTC of the country due to the fact that in high-tech industries concentration can increase the innovation according to the findings of Bhattacharya and Bloch (2004) and more innovation can lead to higher technological capabilities (Archibugi & Coco, 2005). Thus, concentration reduces the slope that relates TC to TS, and therefore it can be said to have a weakening moderation effect on the relationship between TC and TS (see Figure 5). This makes the third hypothesis of this thesis:

H3: Countries' domestic concentration can have a weakening moderation effect on the relationship between technological capabilities of the firm and technology sourcing FDI.

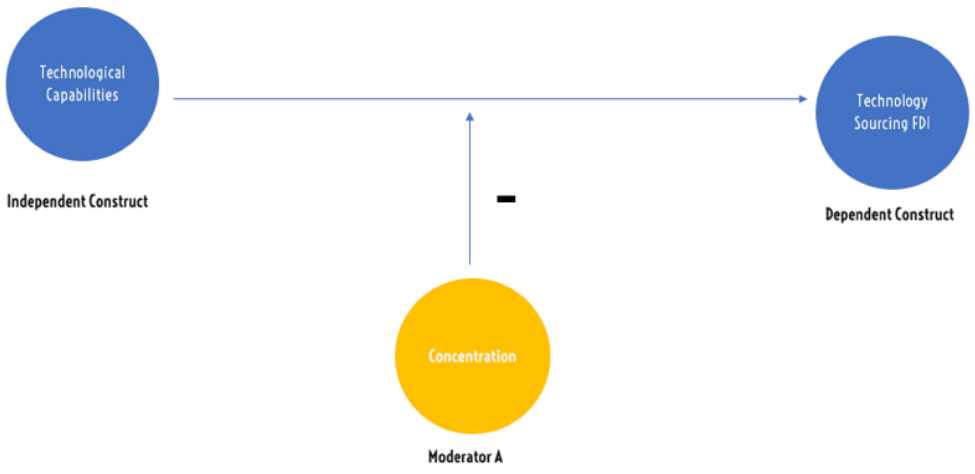

Figure 5: Hypothesis 3

2.3.4 Hypothesis 4.

According to Bengoa and Sanchez-Robles (2003), based on the priori grounds countries' economic freedom should be related to higher FDI attraction. They also tested this relationship as a part of their empirical research and found that for a sample of Latin American countries, the higher level of economic freedom is related to higher inward FDI. Moreover, Azman-Saini, Baharumshah, and Law (2010) state that it is widely accepted that a free market provides better opportunities for FDI investments as much as a regulated market can deter investments.

Furthermore, Cheng (2006) in an empirical study of determinants of FDI's mode choices using a surveyed sample of Taiwanese firms' investments into different EU and East Asian countries found that a higher Economic Freedom Index lead to significantly more greenfield investments over the acquisition. Cheng (2006) used the Index of Economic Freedom that gets published every year jointly by Wall Street Journal and the Heritage Foundation. The index they used was on a 1 to 5 scale and the higher the score, the lower the economic freedom. Thus, countries with higher economic freedom should receive less greenfield over acquisitions. Cheng (2006) used the transaction cost theory to argue that countries with lower levels of economic freedom accrue more costs related to acquisition activities due to the lack of information and market inefficiency of the host country, making an acquisition less likely and greenfield investment more likely.

Therefore, if technological capabilities of the countries remain the same, the higher economic freedom should lead to more FDI and more acquisition over greenfield type. Also since FDI of M&A type can be an indicator of technology sourcing FDI (Anand & Kogut, 1997; Neven & Siotis, 1996; Ruckman, 2005; Shan & Song, 1997), the relationship between the countries' technological capabilities and technology sourcing FDI will strengthen as a function of higher economic freedom (as shown in the Figure 6).

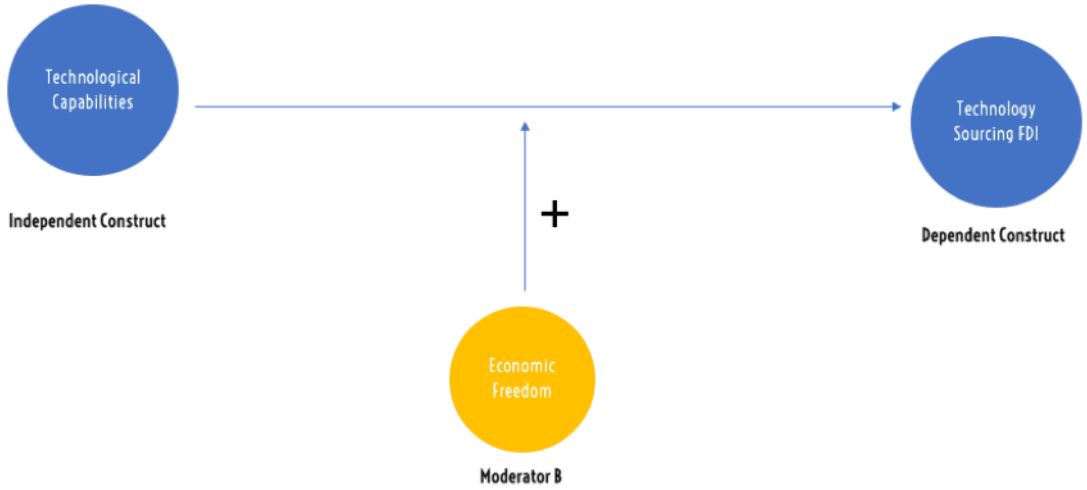

Figure 6: Hypothesis 4

Furthermore, based on the theories mentioned above, economic freedom can increase the likelihood of technology sourcing FDI investments which means it can increase ΔTs. Meanwhile, on a priori grounds, technological capabilities of the countries may be unrelated to economic freedom as countries with different technological capabilities can have a higher or lower economic freedom based on their needs and their policy requirements. That means that ΔTC may not change as a function of changes in economic freedom from one country to another or from one year to another. Therefore, the $\frac{\Delta Ts}{\Delta TC}$ ratio which is the slope of the TC-TS function increases as a function of higher economic freedom because the numerator increases and the denominator might remain constant. That estimates a strengthening moderation relationship for the economic freedom.

Therefore, economic freedom can play a strengthening moderation role in the relationship between the technological capabilities of the countries and technology sourcing FDI. This makes the fourth hypothesis of this thesis:

H4: Countries' economic freedom can have a strengthening moderation effect on the relationship between the firm's technological capabilities and technology sourcing FDI.

2.3.5 Hypothesis 5.

According to Hebous, Ruf, and Weichenrieder (2010), different empirical studies have shown that countries' corporate tax rates are negatively associated with the amount of inbound FDI they receive. That means countries with higher taxes might experience less FDI regardless of the investment establishment mode.

Hebous et al. (2010) also examined whether this relationship differs for two investment modes: Greenfield vs. M&A. They found that for both investments, the higher corporate tax rate is related to less inbound FDI investment. That means keeping the technological capabilities of the country constant, higher taxes should lead to less inbound FDI investments (either be of greenfield type or M&A type). Thus, the relationship between the countries' technological capabilities and the technology sourcing FDI under the circumstance of higher taxes will weaken because the higher tax rate is associated with fewer FDI investments of either M&A or greenfield type (as shown in the Figure 7).

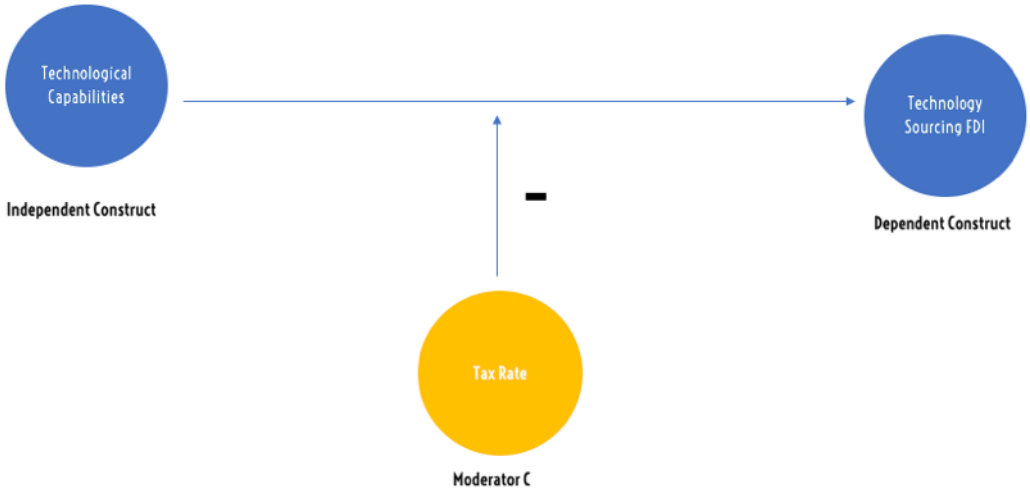

Figure 7: Hypothesis 5

Moreover, tax rate can decrease the slope of the function that relates TC and TS. Thus, the $\frac{\Delta Ts}{\Delta TC}$ ratio decreases because based on the aforementioned theoretical grounds tax rate can decrease the technology sourcing FDI investment (Hebous et al., 2010), which means the ΔTs will decreases. On the other hand, there are no indications based on existing theories that tax rate might have an effect on countries' technological capabilities which means ΔTC can remain unchanged in different amounts of tax rates. Therefore, the numerator decreases and the denominator remain constant. As a result, the $\frac{\Delta Ts}{\Delta TC}$ ratio which is the slope that relates TC and TS decreases as a function of higher tax rates. That means tax rate can have a weakening moderation effect on the relationship between TC and TS. This makes the fifth hypothesis of this thesis:

H5: Countries' tax rates can have a weakening moderation effect on the relationship between the firm's technological capabilities and technology sourcing FDI.

In the next chapter, the research design and the statistical modeling used to formulate and operationalize the empirical analysis of this thesis (to test each of the hypotheses 1-5) is explained.

3. Methodology

In the literature review covered in Chapter Two, the main areas related to the technology sourcing FDI was explored, and the five hypotheses of this thesis were articulated. In this chapter, the main goal is to operationalize the quantitative research model to examine the relationship between the technological capabilities of the countries and technology sourcing FDI. To reach this goal, the criteria for the sample selection is discussed, including the selected countries, time range, and industries. Next, the process of constructing the dataset from different data sources is explained. Then, the variables selected as the measures and their specifications are described, followed by the analytical approach to test each of the hypotheses.

3.1 Type of Research

The design of this thesis utilizes a quantitative research method to examine the relationship between the main variables in order to test the hypotheses covered in the last chapter. Quantitative analysis is chosen because the relationship between the main constructs (technological capabilities of the countries and the technology sourcing FDI) is the primary focus of this thesis and not the process of how the main phenomenon (technology sourcing FDI) works or takes place (Jaccard & Jacoby, 2010). Also, a quantitative research method seeks prediction, causal relationship and generalization of results (Golafshani, 2003; Hoepfl, 1997), which are more in line with the objectives of this thesis.

3.2 Sample

The empirical research is planned out on a country level and includes country-year data points from a pool of 32 countries on a 16-year date range (from 1998 to 2013). This time span is specially selected because the most observations for the

dependent and independent variables could be obtained during this period using the databases consulted for gathering data for this research.

To test the hypotheses of this thesis and for the results to be generalizable, as many countries as possible have been included. The 32 countries chosen for statistical analysis include developed, developing, and those having a transitional economic development status and is aimed to be the representative of a larger population of all countries with all economic development statuses. Below is the list of the 32 countries used in this research:

Australia, Austria, Belgium, Brazil, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, India, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Romania, Russian Federation, South Africa, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

To avoid patents from non-tech-intensive industries diluting the sample pool, patenting activities only in a selected list of high-tech industries are included. This is because the goal of this thesis is to see whether the level of technological capabilities of countries in high-tech industries can explain the amount of the technology sourcing FDI they would receive under different circumstances. Industries that are not of a high-tech nature may not be a good target of technology sourcing FDI. However, they might be a good target for entries with market-seeking or efficiency-seeking motives to benefit from the economies of scale or a reduction in production costs. According to Sethi et al. (2003), resource-seeking and efficiency-seeking FDI is normally attracted to less developed countries with low levels of technological infrastructure and less high-tech labor force, while market-seeking FDI is attracted to countries with lucrative markets regardless of their technological level.

The selected high-tech industries include semiconductors, pharmaceuticals, biotechnology, healthcare equipment, electronics and another category called other

high-tech industries. These industries are chosen by consulting the Eurostat indicators of high-tech industries (Eurostat, 2006), the industries used in the past tech-sourcing studies and based on the availability of M&A data in the Thomson Reuters Eikon Database, as well as the availability of the patents data from the OECD Database.

By selecting the same high technology industries across the countries under the study, the industry effect or the differences in the propensity in patenting that might differ from one industry to another is controlled for. Also, the data for the dependent and independent variables are obtained from the exact-match or close-match high technology industries across the consulted databases for the selected countries.

3.3 Measures

The variables used in this study to quantify the conceptual elements (constructs) include M&A, patents, tariff rate, gross domestic product (GDP), trade openness, R&D expenses, the intensity of local competition, economic freedom, and tax rate. M&A is the dependent variable, and patents is the independent variable. Tariff rate, GDP, and trade openness are the control variables. Intensity of local competition, tax rate, and economic freedom are the moderators, and the R&D expenses is the mediator. In the rest of this section, the logic behind selecting different measures to quantify each of the above variables is explained. All variables are time-varying and will be measured at country-level.

3.3.1 Main independent variable.

Patents in recent decades have become very popular in indicating technological output and innovative capacities (B. H. Hall, Jaffe, & Trajtenberg, 2000; Song & Shin, 2008). Shan and Song (1997) state that a commonly used measure for technological capabilities is patenting activities. Jaffe (1986) is one of the first researchers who used patents to position countries into different technological profiles. Patents are widely used by many scholars to determine technological capabilities of countries (Kotha et al., 2011). Therefore, patent counts in the selected high-technology industries is used

in this thesis as the main independent variable of interest to measure the technological capabilities of the countries.

Patent data is obtained from OECD's Patent Cooperation Treaty (PCT) patent office for the inventor's country of residency. The PCT international patent office is specially selected instead of country-specific patent offices such as USPTO, EPO, JPO, DPMA, and KIPO or the OECD Triadic patent family for better comparability and to avoid the patent data from being biased toward certain countries or their regional partners related to the geo-strategic location of the patent office.

The single office patents are restricted by the home advantage effect, which argues that patent applicants are more likely to file their innovations in the patent office of their home country of residency. For example, the USPTO might overestimate the patenting activities of the US-based firms and underestimate the patenting activities of the non-US firms (Criscuolo, 2006).

According to Kim and Lee (2015), the correct selection of the patent database is critical, as it will significantly impact the study's results. Kim and Lee (2015) state that one shortcoming of the patent data is that they are dispersed because each country has its own patent office. They continue to explain that a lot of studies have either neglected or failed to consider solid selection criteria to go for the most appropriate patenting database that meets the needs of the study's objective.

There are other limitations to using patents as a measure of technological capabilities and innovation capacities. One limitation is that there are other ways to protect technological capabilities, such as protecting via trade secret mechanism. Other restrictions are related to the propensity of patenting being related to the characteristics of the firm, industry, patent costs, and legislation (Kim & Lee, 2015). Nevertheless, the availability and accessibility of the patents data offsets these shortcomings and

makes it a widely used measure of innovation and technological capabilities at country, industry, and firm levels (Kim & Lee, 2015).

3.3.2 Dependent variable.

According to the theories covered in the literature review, it's been widely indicated that merger and acquisition (M&A) can be the best establishment mode for entries with technology sourcing motive (Anand & Kogut, 1997; Neven & Siotis, 1996; Ruckman, 2005; Shan & Song, 1997). For that reason, to measure the amount of technology sourcing FDI (the dependent construct), the number of M&A (in the selected high-tech industries) obtained from the Thomson Reuters Eikon database is used as the dependent variable.

Thus, the main Dependent Variable (outcome or response variable) is the number of M&A (in each country at each year) with at least 9.9% acquisition share sourcing from a country other than the recipient country with a deal size greater than zero and a completed deal status. The effective date is used to map the M&A data with the data for the other variables, as opposed to announcement deal date.

3.3.3 Mediator.

In order to test the second hypothesis, the mediation role of the R&D intensity on the relationship between the technological capabilities of the countries and their inbound technology sourcing FDI, a measure for the R&D intensity should be selected. R&D intensity at the firm level is usually calculated as the ratio of the R&D expenditures to the sales or assets (Ruckman, 2005). At the country level, R&D intensity can be calculated as the ratio of the R&D expenditures over GDP. According to Archibugi and Coco (2005), R&D intensity can be compared at country level using the R&D/GDP ratio. Moreover, Archibugi, Denni, and Filippetti (2009) used R&D expenditures as a percentage of GDP to measure the R&D intensity. Therefore, the R&D expenditure as a percent of GDP data from World Bank's World Development Indicators database is used as the measure for R&D intensity.

3.3.4 Moderators.

For the purpose of examining the hypotheses numbers 3-5 for the three moderation effects of the countries' domestic concentration, countries' tax rates, and countries' economic freedom, proper measures are needed for each of the three moderators.

According to Dikova and Brouthers (2016), concentration measures widely vary from one study to another and include either the subjective measurement of intensity of local competition or the largess firm concentration ratio measure. In this thesis, the intensity of local competition from the Global Competitive Index is chosen to capture the domestic concentration rate at the country level.

For the tax rate moderation effect, the statutory corporate income tax rate from the OECD database is used. The selection of the statutory corporate income tax rate is motivated by the results of the Buettner and Ruf (2007) empirical research, which found that the statutory tax rate has more explanatory power than the effective corporate tax rates (Hebous et al., 2010).

For economic freedom, there are two frequently used indicators that measure economic freedom of the countries: The Fraser Institute index of economic freedom and the economic freedom index from Heritage Foundation (Bengoa & Sanchez-Robles, 2003). The economic freedom index from Heritage Foundation named as the free trade score is selected because of having better country-year coverage for this research.

3.3.5 Control variables.

In order to isolate the effect of countries' technological capabilities on their technology sourcing FDI and to exclude alternative explanations by accounting for all possible explanatory effects, a few country-level FDI determinants are used in this thesis as the control variables.

According to Dikova and Brouthers (2016), the country level predictors of the establishment mode as used by the past scholars are cultural distance, economic growth rate, level of economic development, legal restrictions/barriers, communication barriers, country risk, lack of acquisition targets, psychic distance, human resources, openness, institutions, investment incentives, quality and cost of resources, tax and exchange rate, political uncertainty, agglomeration, inflation, market capitalization, bilateral trade and host technology.

Also, Blonigen (2005) in a review of the FDI empirical literature found exchange rate movements, taxes, and tariffs as the main exogenous macroeconomic factors affecting FDI decisions. Anand and Kogut (1997) in their country-level technology sourcing empirical study used concentration rate and advertising to control for barriers to entry. They also used dollar value of shipments to control for the size of the industry. Another control variable they used was the degree of import penetration.

The control variables selected for this research include tariff rate as a way to control for the tariff barriers, GDP to control for the countries' economic size, and trade openness to control for the countries' trade restrictiveness. For tariff rate and GDP, the World Bank database is consulted, and for trade openness, the trade openness index is obtained from the United Nation's database. The UN trade openness index is calculated as the sum of all imports and exports as a percent of GDP.

In this thesis, GDP at current prices (not adjusted for inflation) is chosen over GDP at constant prices. Using GDP at current prices is due to the fact that the two other variables that are used in this research, trade openness (sum of all exports and imports divided by GDP) and R&D intensity (R&D expenses as a percent of GDP) were also calculated using GDP at current prices by the databases we consulted. For the sake of consistency of data, GDP at current prices is used to estimate the economic size of the countries at each year.

3.3.5.1 GDP.

According to Liargovas and Skandalis (2012) GDP captures the countries' market size and countries with bigger market size are expected to receive a greater amount of FDI. Also, Chakrabarti (2001) mentions that the market size is the single most widely accepted and significant FDI determinant. Chakrabarti (2001) continues that the market size determinant has been used as an explanatory variable in many empirical research related to FDI, and has been tested validly across various research models with different countries, time periods and other research specifications. Therefore, it is expected to see a positive coefficient sign for this control variable in the analytical research of this thesis, too.

3.3.5.2 Trade openness.

Yanikkaya (2003) mentions that trade openness measurements can fall into two groups. The first group measures trade volumes, and the second group measures the trade restrictions. Yanikkaya (2003) continues that an ideal measure for trade openness of different countries would be an index that accounts for all the barriers that might get in the way of trade among different nations.

According to Liargovas and Skandalis (2012), trade openness attracts export-orientated FDI, while trade restrictiveness induces tariff-jumping FDI with the goal of taking advantage of the local market (Kosteletou & Liargovas, 2000). Liargovas and Skandalis (2012) further explain that trade openness might impact inbound FDI either positively or negatively and the relationship between these two variables is very complex. They continue to discuss that although from an empirical point of view there exist studies that have found a positive association between trade openness and FDI (Biglaiser & DeRouen, 2006; Chakrabarti, 2001), there also are studies that have found a negative relationship (Seim, 2009). Therefore, although trade openness impacts the dependent variable, the evidence is inconclusive in predicting the sign of this effect.

Name of the variable	Role in the research	Source	Level	Specification	Type
Merger and Acquisition	Dependent Variable	Thomson Reuters Eikon	Country	Number of M&A with at least 9.9% acquisition share sourcing from a country other than the recipient country with a deal size greater than zero and a completed deal status	Count
Patents	Main Independent Variable of Interest	OECD	Country	Fractional counts sum of HT industries, Data from PCT patent office for inventor's country of residence divided by 1000.	Continuous
Tariff Rate	Control Variable	World Bank	Country	applied, weighted mean, all products (%)	Continuous
GDP	Control Variable	World Bank	Country	GDP (current 10 Billion US$)	Continuous
Trade Openness	Control Variable	United Nations Conference on Trade and Development Stat	Country	Sum of imports and exports as % of GDP	Continuous
R&D Expenses	Mediator	World Development Indicators (World Bank)	Country	Research and development expenditure (% of GDP)	Continuous
The Intensity of Local Competition	Moderator	Global Competitiveness Index	Country	GCI's 6th pillar: Goods market efficiency - A. Competition	Continuous
Economic Freedom	Moderator	Fraser Institute	Country	Index of Economic Freedom published by Heritage Foundation	Continuous
Tax Rate	Moderator	OECD	Country	Statutory Corporate Income Tax Rate	Continuous

Table 2: Variables Summary

3.3.5.3 Tariff rate.

According to Chakrabarti (2001), the impact of trade barriers on FDI is also highly debated among different scholars. It's been hypothesized that due to the tariff discrimination and in order to avoid barriers to trade, FDI is placed in countries with high tariff barriers, and lack of such tariff barriers should reduce the amount of FDI (Mundell, 1957).

Schmitz and Bieri (1972) and Lunn (1980) found a significant positive effect of trade barriers on FDI, while Culem (1988) observed a negative correlation. Beaudreau (1987) and Blonigen and Feenstra (1996) found that trade barriers have no significant effect on FDI (Chakrabarti, 2001). Therefore, the expected sign of the tariff rate is difficult to predict.

3.4 Data

This study is done at a country level, and the variables are consequently measuring different characteristics of countries over a set period. The dataset is built upon data from 32 countries over a 16-year date range (from 1998 to 2013). The data points include each country-year and the dataset consist of a pool of 512 country-year data. Data is extracted for different variables according to the requirements of the empirical research. For the purpose of compiling the dataset, the publically available secondary databases from various sources are consulted except for M&A data for which the Reuters Thomson Eikon database is used. Table 2 indicates where the data for each of the variables are obtained along with their other specifications.

3.5 Analytical Approach

To test the first hypothesis, the correlation between the number of patents and M&A counts will be tested, which forms the initial model. According to the theories covered in the previous chapter, it is expected to see a positive correlation between patent counts and M&A counts. Furthermore, the Mediation effect of R&D Expenses on the correlation between patent counts and number of M&A is examined, to see if

the relationship between patents and M&A can better be explained through an indirect path. The analysis has also been repeated in the context of three different moderators including concentration, economic freedom, and tax rate. The effect of the moderators is examined one at a time and not in the presence of the mediator or the other moderators.

3.6 Regression Models

Seven regression analyses are performed using Stata version 14 to test five different models that together construct the research design of this thesis to analyze the hypotheses as mentioned earlier. The first model is to examine the relationship between the DV and IV without any of the moderators or the mediator being involved (Test 1). The second model is designed to experiment the mediator effect of R&D Expenses (Test 2). Likewise, the models 3 to 5 test the correlation between the DV and IV each time with the presence of one of the three proposed moderators (Test 3-5).

To test the first hypothesis, a Poisson regression is used. Poisson regression is selected because the dependent variable, number of M&A in each country at each year, is of a count nature and has a mean lower than 10 (Coxe, West, & Aiken, 2009) as shown in the descriptive statistic table (Table 3). A count variable measures the number of occurrence of a phenomenon in a given time and only takes zero or positive integers (Coxe et al., 2009). Moreover, the M&A as the dependent variable ranges between 0 to 91, which is not high enough to make a normal distribution. To make sure that the M&A data does not make a normal distribution, M&A frequency plot is sketched using Stata to investigate the distribution of the M&A data (see Figure 8).

As it can be seen from Figure 8, the M&A distribution is far from a normal distribution or a symmetric bell-shaped curve. The right tail of the curve is longer than the left tail and is pulled toward the right side, while the curve itself is leaning left. Thus, it is right-skewed, or in other words, positively skewed. Moreover, since the distribution has a pick that is sharper than a normal distribution, it is also kurtotic. Thus,

violating the assumption of normal distribution for DV in the OLS regression (Coxe et al., 2009).

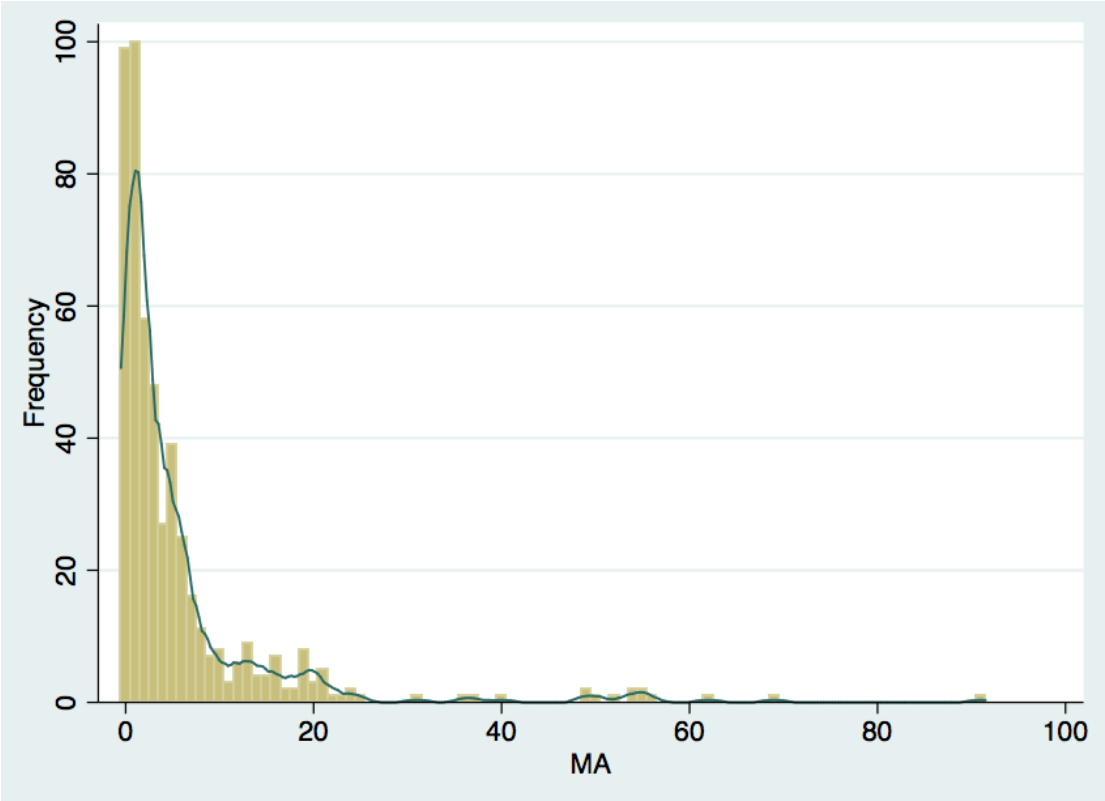

Figure 8: M&A Distribution

To test the second hypothesis, a mediation analysis is performed. Baron and Kenny (1986) define a mediator as a variable that accounts for the relationship between the independent and dependent variables to explain how or why a certain effect will occur. Jaccard and Jacoby (2010, p. 142) explain that a mediator is a variable that the independent variable work through to affect the dependent variable. According to Baron and Kenny (1986), in order to test a mediation effect three conditions shall be met:

1- The mediator should be explained by the independent variable.
2- The dependent variable should be explained by the mediator.

3- When using the mediator and the independent variable together, the effect of the independent variable should weaken or become insignificant. In the former case, the mediator has a partial mediation effect, and in the latter case, it will have a full mediation effect on the relationship between the dependent and independent variable.

To test the hypotheses 3-5, a moderation analysis is done. Baron and Kenny (1986) define a moderator as a qualitative or quantitative variable that impacts the direction or strength of the relationship between an independent variable and a dependent variable. The moderation analysis is performed by including an interaction term as a product of the main independent variable of interest and the moderator following the Baron and Kenny (1986) seminal paper.

In the next chapter, the results of the regression models along with their interpretation are reported and discussed.

4. Results

In this chapter, the results of the statistical analyses will be reported. For each model, the regression output from the statistical software is presented followed by the interpretation of the results and justification of the findings for each model's fit and significance as well as the significance, and sign of each variable. For the moderation and mediation tests, a short introduction about how the tests have been performed is also included. This chapter ends with a summary of the findings and a table that displays and summarizes all five models together.

4.1 Descriptive Statistics

The Table 3 shows the descriptive statistics for the different variables in the dataset. It also shows the figures related to their number of observations, the mean, the standard deviation, and the minimum and the maximum values for each of the variables in the study.

	obs	*Mean*	*Std. Dev.*	*Min*	*Max*
M&A	512	5.763672	10.1444	0	91
Patents	512	2.744226	6.541526	0.0051917	39.35476
Tariff Rate	492	3.096098	3.677489	0	28.55
GDP	512	136.8713	248.1995	0.8146074	1669.152
Trade Openness	512	72.60094	34.60975	15.78308	200.1975
Local Competition	224	5.431247	0.4831637	3.964295	6.381267
Free Trade Score	512	67.45547	8.478732	47.4	83.1
Statutory Tax Rate	364	27.36401	6.708476	8.5	42.2
R&D Expenses	465	1.804011	0.9801871	0.31644	4.40546

Table 3: Descriptive Statistics

4.2 Correlation Matrix

The Table 4 summarizes the Correlation Matrix analysis for all the variables in the study:

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1- M&A	1								
2- Patents	0.8251	1							
3- Tariff Rate	-0.0952	-0.1075							
4- GDP	0.8525	0.9465	-0.0657	1					
5- Trade Openness	-0.2662	-0.2999	-0.3273	-0.3732	1				
6- Local Competition	0.3034	0.3093	-0.2585	0.2246	0.2216	1			
7- Free Trade Score	0.2625	0.2438	-0.4771	0.1478	0.1778	0.4606	1		
8- Statutory Tax Rate	0.1985	0.2241	0.1928	0.2442	-0.2764	0.0783	-0.2188	1	
9- R&D Expenses	0.2222	0.3332	-0.2793	0.2119	0.1294	0.4477	0.4937	-0.0577	1

Table 4: Correlation Matrix

4.3 Test 1: Main Hypothesis

In this test, the correlation between the dependent variable (number of M&A) and the independent variable of interest (patents), is being examined using three country-level control variables, tariff rate, GDP, and trade openness. As said before, because the dependent variable (number of M&A) is of a count nature, a Poisson regression is used. The output of this regression is shown in Figure 9:

```
. poisson MA Patents GDP Tariff_Rate Trade_Openness

Iteration 0:   log likelihood = -9650.1689
Iteration 1:   log likelihood = -5346.2429
Iteration 2:   log likelihood = -2665.6349
Iteration 3:   log likelihood = -1786.4563
Iteration 4:   log likelihood = -1743.0066
Iteration 5:   log likelihood = -1742.6265
Iteration 6:   log likelihood = -1742.6264

Poisson regression                              Number of obs     =        492
                                                LR chi2(4)        =    2834.33
                                                Prob > chi2       =     0.0000
Log likelihood = -1742.6264                     Pseudo R2         =     0.4485

------------------------------------------------------------------------------
          MA |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     Patents |    .013858   .0055232     2.51   0.012     .0030328    .0246833
         GDP |   .0015342   .0001408    10.89   0.000     .0012581    .0018102
 Tariff_Rate |  -.0340502   .0077076    -4.42   0.000    -.0491568   -.0189436
Trade_Openness |  -.0033161   .0007693    -4.31   0.000     -.004824   -.0018082
       _cons |   1.578024   .0722229    21.85   0.000      1.43647    1.719578
------------------------------------------------------------------------------
```

Figure 9: Regression Output - Test 1

Since the P-Value for the entire model (see Figure 9) is less than 0.05, the whole model holds from a statistical point of view. Also, the R-squared is 44%, which means that 44% of the variability of the M&A can be explained by this model. Moreover, all variables including patents as the Main IV of interest are significant at 0.05 level. The positive sign of the coefficient for patents was expected and shows that the increase in the number of patents is positively correlated to the number of M&A that has occurred in each country at each year. Thus, the first hypothesis is supported, and countries with higher levels of technological capabilities are to receive a higher amount of technology sourcing FDI. This result is line with the theories related to the technology sourcing motive of FDI that is covered in the literature review.

4.4 Test 2: Regression with the R&D Expenses as the Mediator

To test if R&D expenses can mediate the relationship between patents and M&A as, respectively, the main independent variable of interest and the dependent variable, three regressions are performed to test each of the conditions explained in the methodology section for mediation analysis.

The first regression (as shown in Figure 10) tests if the proposed mediator (R&D expenses) can be explained by the main independent variable of interest (patents). This is the first condition to be met for R&D Expenses to serve as a Mediator in this model (according to the mediation investigation method stated in the methodology chapter). This test is examined using a linear regression. A linear regression is used because in this particular test the mediator (R&D expenses) acts as the outcome variable and since it is of a continuous nature with a normal distribution, a linear regression is more suitable.

```
. reg RD_Expenses Patents Tariff_Rate GDP Trade_Openness
```

Source	SS	df	MS	Number of obs	=	446
				F(4, 441)	=	40.91
Model	116.057232	4	29.0143079	Prob > F	=	0.0000
Residual	312.802303	441	.709302275	R-squared	=	0.2706
				Adj R-squared	=	0.2640
Total	428.859535	445	.963729293	Root MSE	=	.8422

RD_Expenses	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Patents	.1672026	.0186685	8.96	0.000	.1305122	.2038929
Tariff_Rate	-.0480149	.0116054	-4.14	0.000	-.0708236	-.0252062
GDP	-.003319	.000516	-6.43	0.000	-.0043331	-.0023049
Trade_Openness	.0026464	.0013164	2.01	0.045	.0000593	.0052335
_cons	1.749424	.1373574	12.74	0.000	1.479468	2.01938

Figure 10: Regression Output - Test 2 (IV -> Mediator)

The P-value for the entire regression is less than 0.05, and the R-squared shows that 84% of the variability of RD expenses can be explained by this regression. The P-Value for the independent variable of interest in this particular test (patents) is also significant, and this can indeed prove that patents can explain R&D expenses and thus it should be good to move into the next stage of testing the mediator effect of R&D expenses.

If R&D expenses can act as a mediator in this model, it should also be able to explain the changes in M&A. Thus, there should be a significant correlation between R&D expenses and M&A. The regression output displayed in Figure 11 shows the result of the Poisson regression used to test this relationship (Mediator -> DV). In this test, the mediator acts as the independent variable that should explain M&A as the dependent variable. This is the second condition to be met for R&D expenses to have a mediator effect in the model.

```
. poisson MA RD_Expenses GDP Tariff_Rate Trade_Openness

Iteration 0:   log likelihood = -8460.2236
Iteration 1:   log likelihood = -4290.8028
Iteration 2:   log likelihood = -2271.8603
Iteration 3:   log likelihood = -1614.8515
Iteration 4:   log likelihood =  -1605.452
Iteration 5:   log likelihood = -1605.4246
Iteration 6:   log likelihood = -1605.4246

Poisson regression                              Number of obs     =        446
                                                LR chi2(4)        =    2782.07
                                                Prob > chi2       =     0.0000
Log likelihood = -1605.4246                     Pseudo R2         =     0.4642
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
RD_Expenses	.1470124	.0243378	6.04	0.000	.0993112	.1947137
GDP	.0017407	.000047	37.06	0.000	.0016486	.0018327
Tariff_Rate	-.0239294	.0078939	-3.03	0.002	-.039401	-.0084577
Trade_Openness	-.0043391	.000793	-5.47	0.000	-.0058934	-.0027848
_cons	1.373778	.0873729	15.72	0.000	1.20253	1.545026

Figure 11: Regression Output - Test 2 (Mediator -> DV)

As it can be seen in Figure 11, the P-value for the entire regression is significant, and the R-squared shows that 46% of the changes in M&A can be explained by this model. Moreover, the P-value for the R&D expenses is significant, too, which means M&A can be explained by RD expenses, and that leads to moving forward to the last stage in testing the mediator effect.

Given that the first two conditions for R&D expenses to act as a mediator in this model are met, now both the independent variable of interest (patents) and the mediator (R&D expenses) are used at the same time in a new regression. If R&D expenses has a mediator effect, it should either completely remove (in which case it is called full mediation effect) or reduce (partial mediation) the effect of the patents on M&A. The regression result for this test is shown in Figure 12:

```
. poisson MA Patents RD_Expenses GDP Tariff_Rate Trade_Openness

Iteration 0:   log likelihood = -8376.3616
Iteration 1:   log likelihood =  -4016.124
Iteration 2:   log likelihood = -2177.1296
Iteration 3:   log likelihood =  -1614.558
Iteration 4:   log likelihood = -1605.0801
Iteration 5:   log likelihood = -1605.0559
Iteration 6:   log likelihood = -1605.0559

Poisson regression                              Number of obs     =        446
                                                LR chi2(5)        =    2782.81
                                                Prob > chi2       =     0.0000
Log likelihood = -1605.0559                     Pseudo R2         =     0.4643

------------------------------------------------------------------------------
          MA |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     Patents |   .0049943   .0058047     0.86   0.390    -.0063826    .0163712
  RD_Expenses|   .1400804   .0256435     5.46   0.000       .08982    .1903408
         GDP |   .0016247   .0001429    11.37   0.000     .0013447    .0019047
  Tariff_Rate|  -.0234863   .0078945    -2.98   0.003    -.0389592   -.0080133
Trade_Openness|  -.0042344   .0008005    -5.29   0.000    -.0058033   -.0026655
       _cons |   1.379391    .087555    15.75   0.000     1.207786    1.550996
------------------------------------------------------------------------------
```

Figure 12: Regression Output - Test 2 (IV -> Mediator -> DV)

As it is shown in Figure 12, the model is a good model in terms of R-squared and P-value for the whole test. Moreover, the P-value for the patents in this model has raised to 0.390 which is above the 0.05 significant level, while R&D expenses and all other variables in the model are still significant. This supports the fact that R&D expenses can indeed play a full mediating effect in the relationship between the patents and M&A.

That means the total effect of the patents on M&A is partitioned into two sub-effects. One indirect effect that is shown by the mediator path in this model (patents -> R&D expenses -> M&A) and second is the direct effect that is shown by the direct path between the IV of interest and DV (patents -> M&A). Once the indirect effect is included in the model, the direct effect loses its significance.

As a result, the relationship between the patents and M&A can be explained through a new path in which R&D expenses plays the role of a mediator. This supports the second hypothesis of this thesis.

4.5 Test 3: Testing the Moderation Effect of the Concentration

In this test, the moderation effect of the concentration rate in the relationship between technological capabilities of the countries and technology sourcing FDI will be examined. To check this moderation effect, the intensity of local competition variable as the measure of concentration is included as an interaction term with the main independent variable of interest, which is patents. The regression output shown in Figure 13 displays the result related to this test:

```
. poisson MA Patents GDP Tariff_Rate Trade_Openness Local_Competition c.Patents#c.Local_Competition

Iteration 0:   log likelihood = -3743.5947
Iteration 1:   log likelihood = -1691.0791
Iteration 2:   log likelihood =  -842.7249
Iteration 3:   log likelihood = -602.52398
Iteration 4:   log likelihood =  -600.6443
Iteration 5:   log likelihood = -600.64234
Iteration 6:   log likelihood = -600.64234

Poisson regression                              Number of obs     =        220
                                                LR chi2(6)        =    1705.43
                                                Prob > chi2       =     0.0000
Log likelihood = -600.64234                     Pseudo R2         =     0.5867
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Patents	-.0229647	.0581025	-0.40	0.693	-.1368435	.0909141
GDP	.0033959	.0002764	12.28	0.000	.002854	.0039377
Tariff_Rate	-.0008188	.0169874	-0.05	0.962	-.0341135	.0324759
Trade_Openness	-.0061663	.001165	-5.29	0.000	-.0084496	-.003883
Local_Competition	1.307235	.1000867	13.06	0.000	1.111069	1.503401
c.Patents#c.Local_Competition	-.0105399	.0094928	-1.11	0.267	-.0291455	.0080656
_cons	-5.611868	.5563044	-10.09	0.000	-6.702205	-4.521532

Figure 13: Regression Output - Test 3 (Moderation Effect of the Concentration)

As it can be seen in the Figure 13, although the P-value for the whole model is less than the 0.05 significant level, and the R-squared is about 58%, which shows the

entire model holds, the interaction term that is included to test the effect of the moderator is not statistically significant. That is because the P-value for the interaction term is above the 0.05 level. Thus, it can't be concluded that concentration measured with the intensity of local competition index can moderate the relationship between patents and M&A. Therefore, the third hypothesis cannot be supported.

4.6 Test 4: Testing the Moderation Effect of the Economic Freedom

Just like model 3, the moderation effect of the countries' economic freedom on the relationship between the patents and M&A is tested in this model. The regression result shown in Figure 14 is the outcome of this second moderation test:

```
. poisson MA Patents GDP Tariff_Rate Trade_Openness Free_Trade_Score c.Patents#c.Free_Trade_Score

Iteration 0:   log likelihood = -10971.603
Iteration 1:   log likelihood = -4830.2527
Iteration 2:   log likelihood = -2544.4309
Iteration 3:   log likelihood = -1712.8224
Iteration 4:   log likelihood = -1696.5376
Iteration 5:   log likelihood = -1696.4872
Iteration 6:   log likelihood = -1696.4872

Poisson regression                              Number of obs     =        492
                                                LR chi2(6)        =    2926.61
                                                Prob > chi2       =     0.0000
Log likelihood = -1696.4872                     Pseudo R2         =     0.4631
```

MA	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Patents	.1588105	.0275978	5.75	0.000	.1047199	.2129011
GDP	.0017178	.0001412	12.16	0.000	.001441	.0019945
Tariff_Rate	-.0001027	.0083106	-0.01	0.990	-.0163913	.0161858
Trade_Openness	-.0033979	.0007755	-4.38	0.000	-.0049177	-.001878
Free_Trade_Score	.0310018	.0033138	9.36	0.000	.0245069	.0374967
c.Patents#c.Free_Trade_Score	-.0020369	.0003542	-5.75	0.000	-.002731	-.0013428
_cons	-.6596978	.2523215	-2.61	0.009	-1.154239	-.1651568

Figure 14: Regression Output - Test 4 (Moderation Effect of the Economic Freedom)

The P-value of zero for the whole model indicates that the model holds in general and the 46% of the variability of the outcome variable can be explained by this model. Free trade score as the measure for economic freedom is included as an

interaction term to test this moderation effect. The interaction term is statistically significant, but because the coefficient of the interaction term has a negative sign, it appears that it has a weakening effect on the relationship between patents and M&A. This is against the expectation of the fourth hypothesis. Therefore, it can be said that the relationship between the technological capabilities of the countries and the technology sourcing FDI will weaken for the countries with more economic freedom. In the Predictive Margins plot shown in Figure 15, this weakening effect is displayed for this specific model.

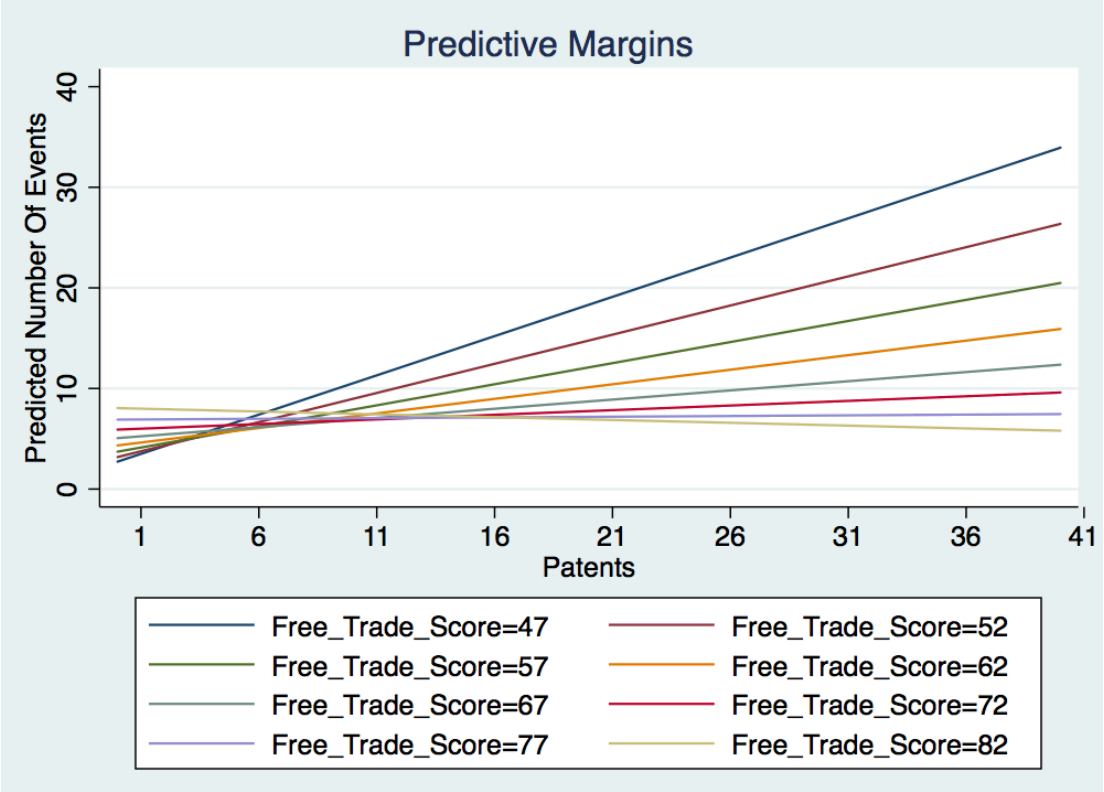

Figure 15: Predictive Margins for Economic Freedom Moderation Effect

As it can be seen from Figure 15, the higher values of free trade score are associated with lower slope for the correlation between patents and M&A.

4.7 Test 5: Testing the Moderation Effect of the Tax Rate

To test the fifth hypothesis of this thesis, just like model 3 and 4, now the moderation effect of the tax rate is tested. For this purpose, statutory tax rate is included in the regression as an interaction term with the main independent variable of interest (patents). The output shown in Figure 16 displays the regression result for this particular test:

```
. poisson MA Patents GDP Tariff_Rate Trade_Openness Statutory_Tax_Rate c.Patents#c.Statutory_Tax_Rate

Iteration 0:   log likelihood =  -7212.859
Iteration 1:   log likelihood = -3307.8235
Iteration 2:   log likelihood = -1810.7375
Iteration 3:   log likelihood = -1259.6216
Iteration 4:   log likelihood = -1256.5452
Iteration 5:   log likelihood = -1256.5388
Iteration 6:   log likelihood = -1256.5388

Poisson regression                              Number of obs     =        361
                                                LR chi2(6)        =    2389.13
                                                Prob > chi2       =     0.0000
Log likelihood = -1256.5388                     Pseudo R2         =     0.4874

------------------------------------------------------------------------------
          MA |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     Patents |   .1286913   .0244827     5.26   0.000     .0807062    .1766765
         GDP |   .0016916   .0001621    10.44   0.000     .0013739    .0020093
  Tariff_Rate |  -.0709283   .0180032    -3.94   0.000    -.1062139   -.0356427
Trade_Openness |  -.003607   .0008732    -4.13   0.000    -.0053185   -.0018956
Statutory_Tax_Rate |   .0040129   .0045984     0.87   0.383    -.0049998    .0130255
                   |
c.Patents#c.Statutory_Tax_Rate |  -.0035493   .0007444    -4.77   0.000    -.0050082   -.0020903
                   |
             _cons |    1.51479   .1656293     9.15   0.000     1.190162    1.839417
------------------------------------------------------------------------------
```

Figure 16: Regression Output - Test 5 (Moderation Effect of the Tax Rate)

P-value and the R-squared for this model are, in order, zero and 48%. Since the interaction term has a significant P-value, it indicates that tax rate moderates the relationship between patents and M&A. Moreover, because the coefficient sign of the interaction term is negative, it can be said that the slope that relates patents to M&A gets lower as a function of the tax rate. That means tax rate has a weakening effect on the correlation between patents and M&A. The predictive margins shown in the Figure 17 depict this weakening effect:

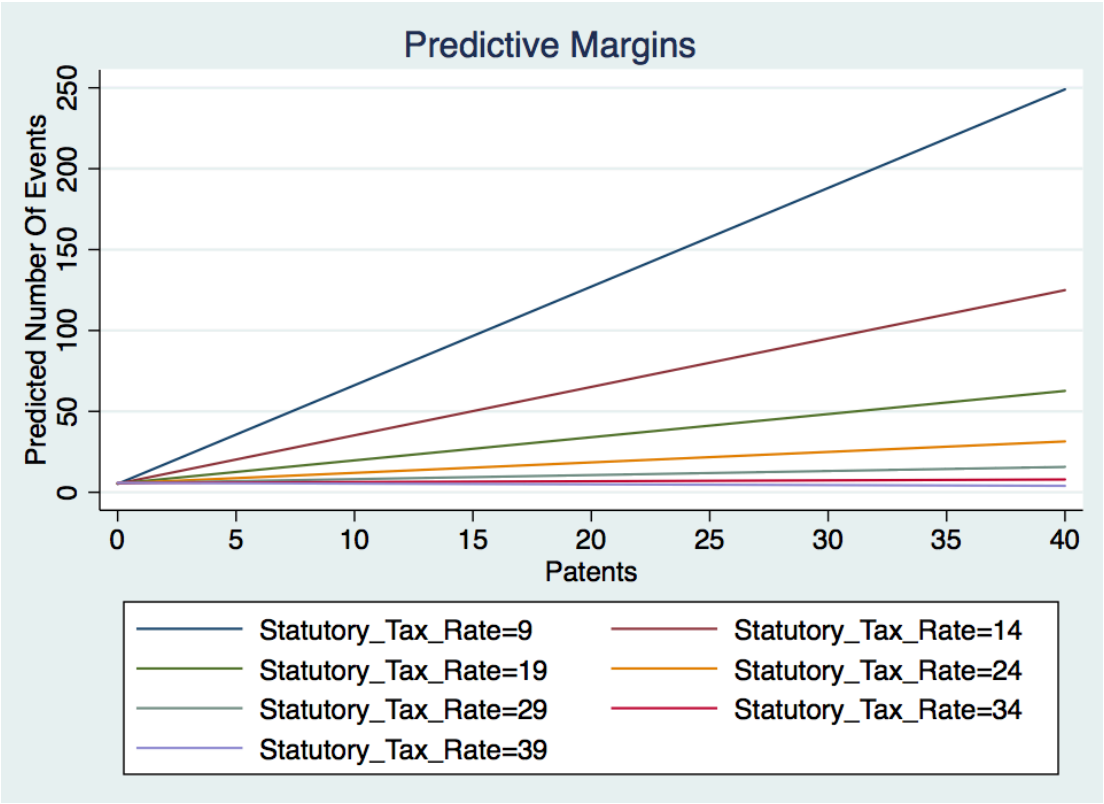

Figure 17: Predictive Margins for Tax Rate Moderation Effect

As it can be seen in Figure 17, more tax rate is associated with a lower slope for the correlation between the patents and M&A, which is due to the weakening moderation effect of tax rate.

Table 5 displays the regression results for all the above models (1-5). Patents count is positively correlated to the dependent variable (M&A) in all five models except in Model 2, in which its effect has faded out by the R&D expenses mediation effect, as well as in Model 3, in which the patents is insignificant.

GDP is positively correlated to the dependent variable and is significant in all five models. Tariff rate is negatively correlated and is significant in three out of the five models. Trade openness is also negatively correlated and significant in all five models. R&D expenses used in Model 2 for its mediation effect is positively correlated

with the dependent variable (M&A). Out of the three interaction terms used to test the moderator effects two of them (interaction term with tax rate and interaction term with free trade score) are significant. These two significant interaction terms have a negative sign, which means they have a weakening effect on the relationship between the dependent variable and the independent variable. The main effect of the local competition, as well as the free trade score on the dependent variable are significant and positive, while the tax rate's main effect on the dependent variable is not significant.

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Patents	0.013858*	0.0049943	-0.0229647	0.1588105*	0.1286913*
GDP	0.0015342*	0.0016247*	0.0033959*	0.0017178*	0.0016916*
Tariff Rate	-0.0340502*	-0.0234863*	-0.0008188	-0.0001027	-0.0709283*
Trade Openness	-0.0033161*	-0.0042344*	-0.0061663*	-0.0033979*	-0.003607*
R&D Expenses		0.1400804*			
Local Competition			1.307235*		
Local_Competition#Patents			-0.0105399		
Free Trade Score				0.0310018*	
Free_Trade_Score#Patents				-0.0020369*	
Statutory Tax Rate					0.0040129
Statutory_Tax_Rate#Patents					-0.0035493*
R2	44%	46%	58%	46%	48%
N	492	446	220	492	361

Table 5: All Regression Results Models 1-5, *P<0.05

In the next chapter, these findings will be discussed in more detail, and their relevance and implications will be analyzed along with the limitations of this research and opportunities for the new researchers.

5. Conclusion

Technology sourcing FDI which is defined as a type of FDI that is motivated by exploiting the technological spillovers existing in a host country has many implications both at the firm and at the country levels.

At the firm level, with the rapid technological changes in high technology industries, MNEs constantly seek new ways to improve their technological bases to avoid becoming outdated. In high technology industries, MNEs might be prone to losing their competitive advantage if they only rely on their internal capabilities. If MNEs lock themselves onto certain technologies in their possession and ignore the evolving world in the international landscape, they might lose out to their competitors and be forced to withdraw from their existing markets (Shan & Song, 1997). MNEs that want to stay up-to-date and relevant in their respective sectors can use FDI to tap into the technologies that are being developed in the other countries (Shan & Song, 1997).

The same thing can be said about the countries, too. Countries are also prone to losing their comparative advantage in the international market. FDI and growth are more or less related (Alfaro, Chanda, Kalemli-Ozcan, & Sayek, 2004), and governments may want to attract more and more foreign investments to create more jobs for their residents and enable their local firms to compete in the international market. Thus, if countries want to become a point of attraction for the technology sourcing FDI, they can do so by investing in the policies that lead to more knowledge creation and more technological development in their focal countries. Another scenario might be when countries have a certain degree of technological advantages in one or

more sectors they need to protect. In this case, they might want to take policies that enhance the protection of these industries. To deliver on the intention of protecting their technological advantages from being sourced by other nations, governments might need to take protectionism paths that might not necessarily be against their open market policies.

5.1 Analysis of the Findings

In this thesis, the relationship between the technological capabilities of the countries and their inbound FDI of technology sourcing type has been investigated. Also, the indirect relationship with the presence of different moderators and one mediator has been studied using quantitative methods and statistical modeling.

One finding was that countries with higher technological capabilities receive more technology sourcing FDI. In all the statistical models the coefficient for the patents as the measure of the countries' technological capabilities (if significant) was positive. This finding has good application to the theories related to the choice of the M&A as the preferred establishment mode for benefiting from technology sourcing FDI (Anand & Kogut, 1997; Neven & Siotis, 1996; Ruckman, 2005; Shan & Song, 1997).

One other important finding of this thesis was that the effects of the trade openness and tariff barriers on the technology sourcing FDI were found to be negative. Trade openness in all of the regressions had a negative coefficient sign, and trade barriers also was negatively correlated to the technology sourcing FDI. In theories, there have been contradictory results about the effects of trade openness and tariff barriers on inbound FDI, so this finding can be helpful in coming up with some empirical evidence applicable to the effect of these two variables on the technology sourcing FDI.

The negative association of trade openness with technology sourcing FDI might be related to the fact that the host countries with higher trade openness might be more attractive to export-oriented FDI, according to Okafor, Piesse, and Webster (2015). The export-oriented FDI can be thought of more as market exploitation nature than technology sourcing nature. This might be why trade openness is negatively related to technology sourcing FDI.

The negative effect of the tariff rate may be related to the fact that technology sourcing FDI happens when there are some spillovers to capture in the destination country. This type of FDI is not primarily motivated by barrier-jumping motives. This makes FDI of technology sourcing type less likely to increase when tariff rates increase. As a result, tariff barriers not only may fail to increase FDI, but also can discourage it when FDI has technology sourcing motives. The negative correlation of tariff rate and technology sourcing FDI can also simply be attributed to the fact that countries' tariff rates have reduced over time (see Figure 27 in Appendix B), while the amount of M&A has increased over time (see Figure 2, and Figures 18-26 in Appendix A).

Another finding was that the R&D intensity could introduce a new path in the relationship between countries' technological capabilities and the technology sourcing FDI. This means that countries with higher technological capabilities might be able to invest more in R&D and will, therefore, have a higher R&D intensity. This higher R&D intensity will make them more attractive for technology sourcing FDI. This can be meaningful, as countries' technological capabilities (in order to attract more technology sourcing FDI) might need a mechanism or pathway through which it can be understood by investors, and R&D intensity can act as this pathway.

The moderating effect of economic freedom was found to have a negative sign. This was against this thesis's hypothesis, which proposed that economic freedom would have a strengthening effect in the relationship between countries' technological

capabilities and technology sourcing FDI. This may be related to the fact that countries with higher economic freedom might be more attractive to export-oriented FDI with market exploitation motives than technology sourcing FDI (Okafor et al., 2015).

Also, the moderation effect of the concentration rate was not statistically significant. This can be related to the fact that although higher concentration rate might negatively affect inbound FDI, it might also result in more acquisition over greenfield. Cheng (2006) conducted an empirical study of FDI's mode choice determinants using a surveyed sample of Taiwanese firms' investments into different EU and East Asian countries. He found that industrial concentration may result in more acquisition over greenfield investment. This can reduce the expected weakening moderation effect of the concentration rate because acquisition mode is associated with technology sourcing FDI (Anand & Kogut, 1997; Neven & Siotis, 1996; Ruckman, 2005; Shan & Song, 1997).

The last finding was that the tax rate has a weakening effect on the relationship between countries' technological capabilities and technology sourcing FDI. This was in line with the expectation of the fifth hypothesis of this thesis that proposed that tax rate should weaken this relationship because it reduces willingness to invest in a country. This can have some application for the theories related to the tax rate's effect on countries' inbound FDI for M&A investment type (Hebous et al., 2010).

5.2 Limitations

One limitation of this thesis is related to the assumption that M&A establishment mode can reveal the technology-sourcing intention of the FDI investment. It might be hard to know the strategic intention of the investing parties without actually asking them about it. Nevertheless, this assumption is a common assumption in the technology sourcing FDI papers which makes it fair to be used for the purpose of this research too.

Another limitation is related to the lack of having a countries' fixed effect to be used as a control variable. Initially, in this thesis, the OECD FDI regulatory restrictiveness index was planned to be used to capture countries' fixed effect but lack of data for the time frame chosen for this thesis urged the study to run without controlling for the countries' fixed effect.

Another limitation was related to the difficulties with matching high-tech industries over different databases for dependent and independent variables. When building the dataset, only two exact-match industries were found. This limitation was circumvented by including close-match industries.

The empirical research also didn't control for the non-tariff barriers. This limitation results from the difficulty in quantifying all non-tariff barriers into one index for different countries and over different timeframes. However, given the fact that technology sourcing FDI is not motivated by barrier-jumping motives, this limitation is less likely to influence the research outcome.

The use of the PCT patent office also is not completely free of flaw. Data from this patent family has no home advantage effect (Criscuolo, 2006), but it should be recognized that selecting a patent office by the inventors highly depends on their objectives. This limitation is common in all the studies that use patents to quantify innovation or technological capabilities of the countries.

In the research design of this thesis, the countries' technological capabilities were measured by number of M&A investments. It could have been more insightful if Greenfield JV would have been included for comparison purposes. The reason the Greenfield JV data was not included is due to the limitation of the databases consulted in constructing this thesis's dataset on a country level for different sectors.

5.3 Practical Contributions

This thesis contributed to the study of technology sourcing FDI by empirically analyzing the determinants of this type of FDI and their effects on the countries' capacity to attract technology sourcing FDI. It revealed that inbound FDI can be used as a two-edged sword. On one hand, it can bring in funds for local businesses, but it also can deplete countries' technological capabilities. The increase in number of M&A investments in recent years (see Figure 2, and Figures 18-26 in Appendix A) can support the fact that technology sourcing FDI has become a prominent force in the international landscape and has gained a higher share of international FDI investments. This can be concerning for governments and policy makers, as a nation's wealth and prosperity might be at stake. Local governments might decide to create policies that ensure domestic technologies are well protected in industries that are vital for their national security, while letting the domestic industries still benefit from the positive externalities related to the inbound FDI. These policies may include regional cooperation with countries that share similar markets to keep technology invaders at bay while making sure that the forward-looking perspective of domestic high-tech industries will still be fed by trusted investors.

5.4 Future Research

The study of technology sourcing for international business researchers can be very interesting because it is related to MNEs' performance, competition in the international landscape (Nigel Driffield & Love, 2005; Hill & Rothaermel, 2003; Nicholls-Nixon, 1995; Rothaermel, 2001; Rothaermel & Alexandre, 2009), and recent R&D internationalization trends (Belderbos et al., 2008).

This thesis has tried to pave the way for the future researchers who might be interested in technology sourcing. The findings of this thesis can be tested in future research by including more countries with varying economic statuses, or can be conducted on a set of countries from a specific region. It also can be replicated for comparison between two groups of countries: developed and developing.

This thesis also contributes to the new trend of PCT patent data application in empirical research instead of traditionally preferred USPTO and EPO patent offices. The OECD triadic patent family may be a good candidate for replicating this research to see whether the results will remain the same if this patent family is selected over the PCT family.

Another interesting study for the future would be to see if the relationship between countries' technological capabilities and technology sourcing FDI can change as a function of their economic development levels. One other study could look into the service sector versus manufacturing to see if tech-sourcing FDI differs in any way for these two categories. Future researchers also might want to investigate technology sourcing FDI from a level of integration perspective to compare the properties of the horizontal and vertical FDI of technology sourcing type.

6. Appendices

6.1 Appendix A

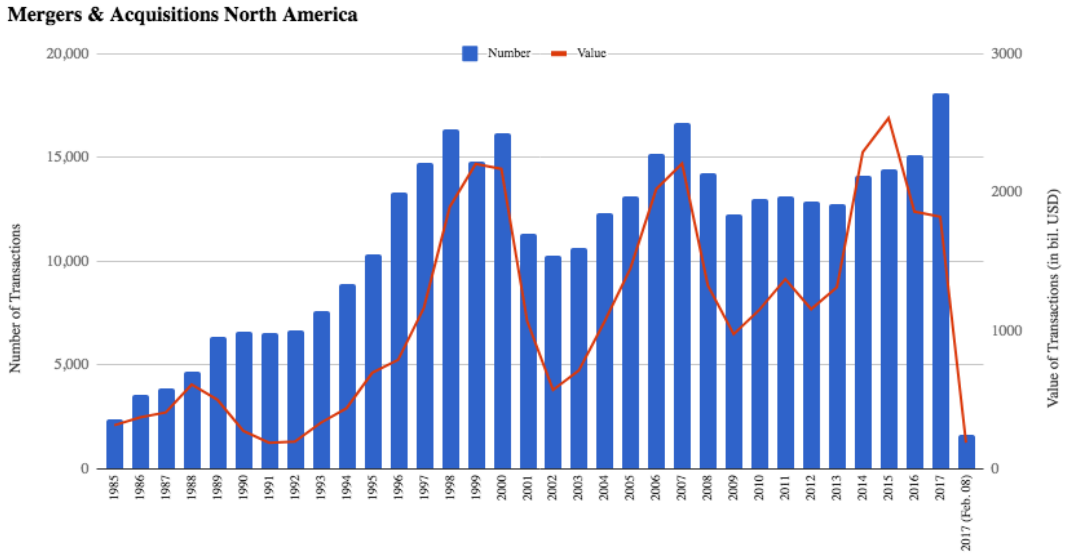

Figure 18: M&A Trends North America (IMAA, 2018)

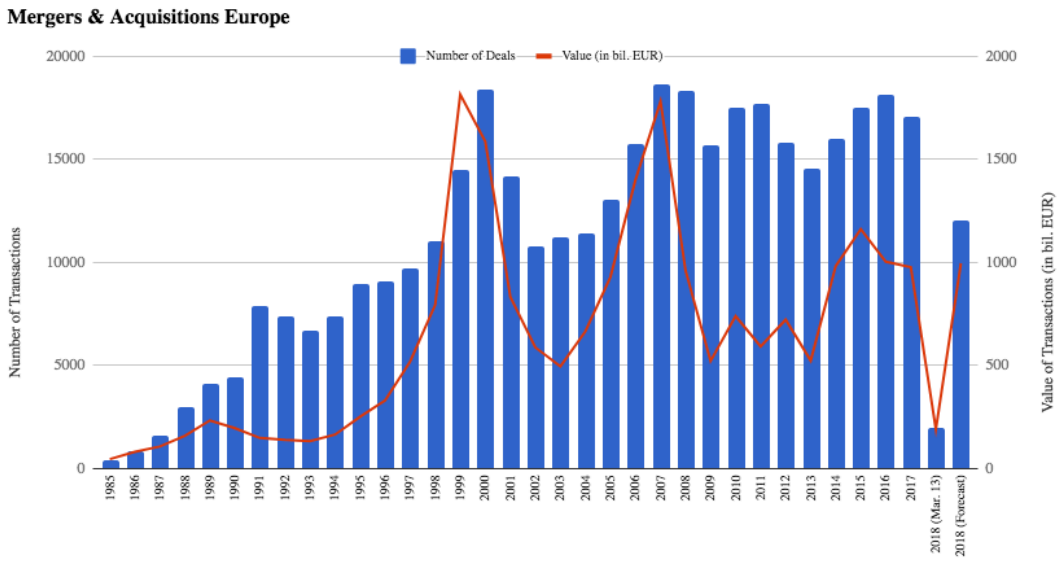

Figure 19: M&A Trends Europe (IMAA, 2018)

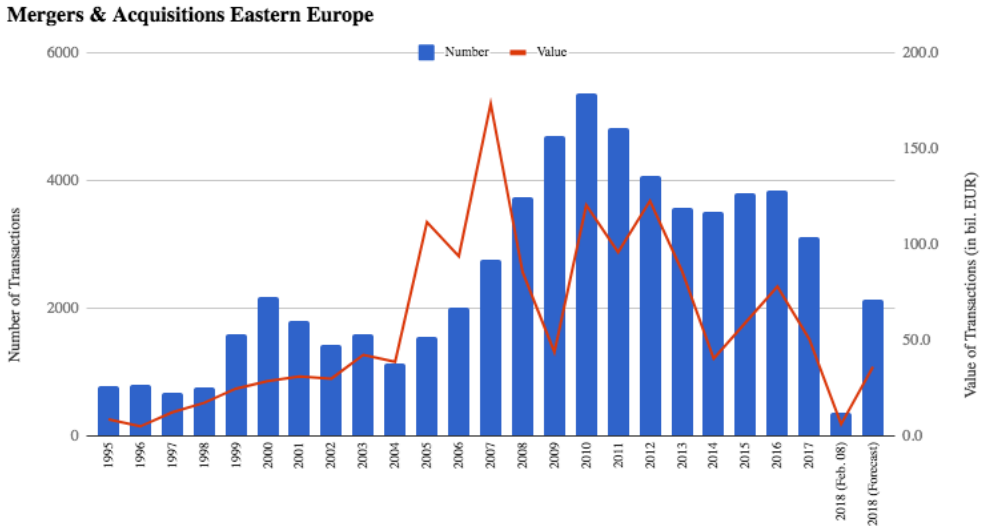

Figure 20: M&A Trends Eastern Europe (IMAA, 2018)

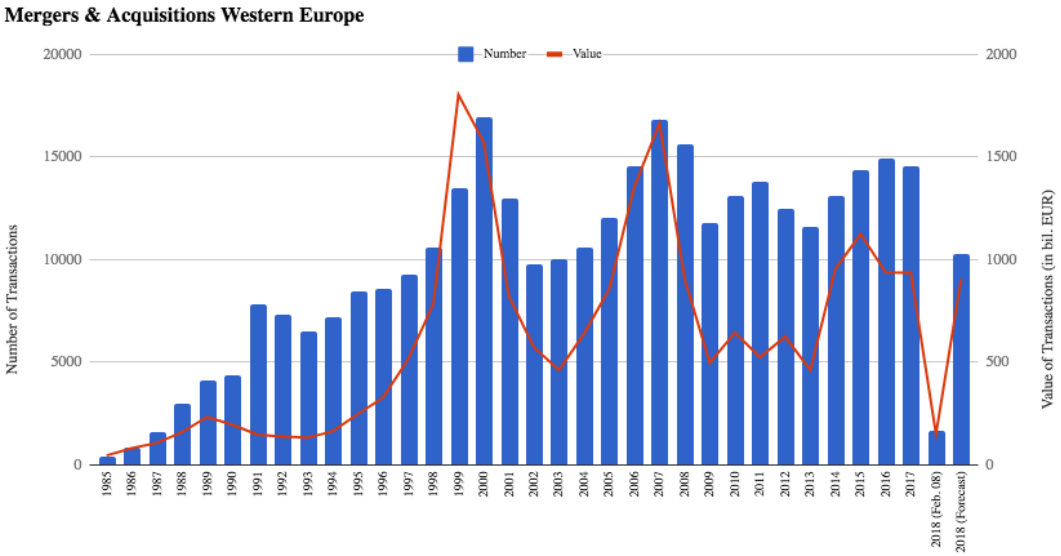

Figure 21: M&A Trends Western Europe (IMAA, 2018)

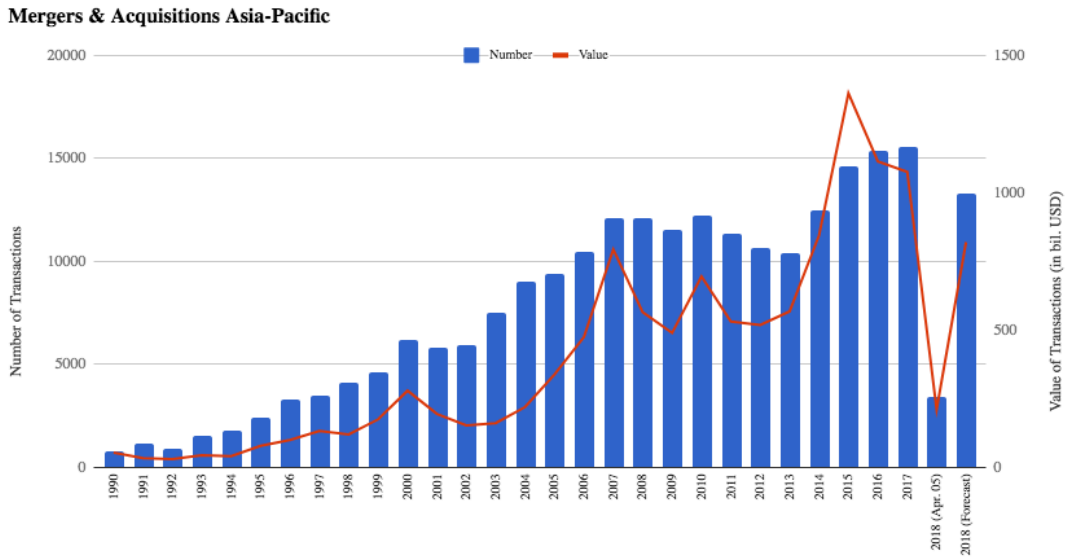

Figure 22: M&A Trends Asia-Pacific (IMAA, 2018)

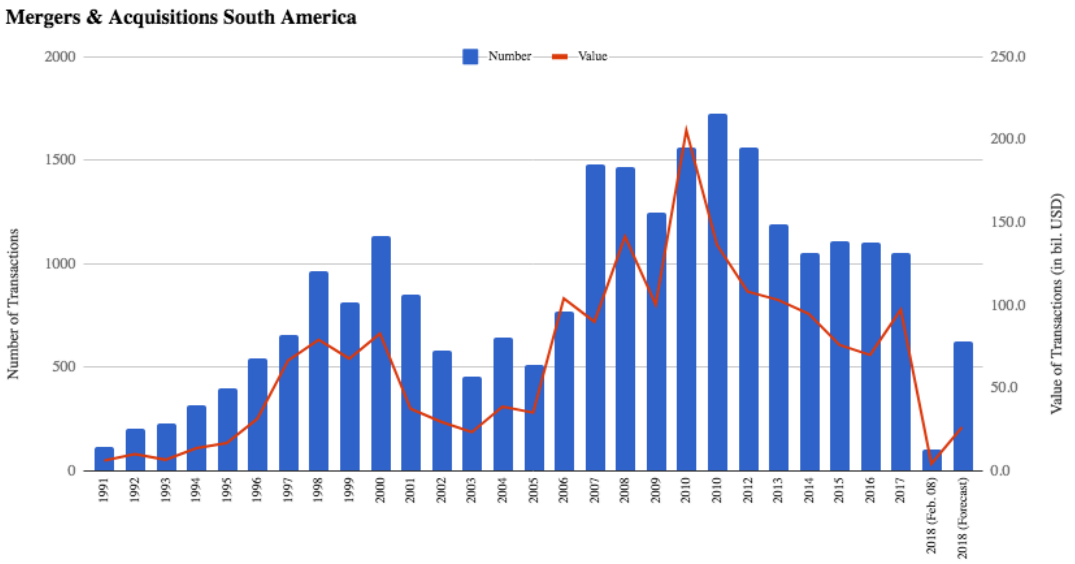

Figure 23: M&A Trends South America (IMAA, 2018)

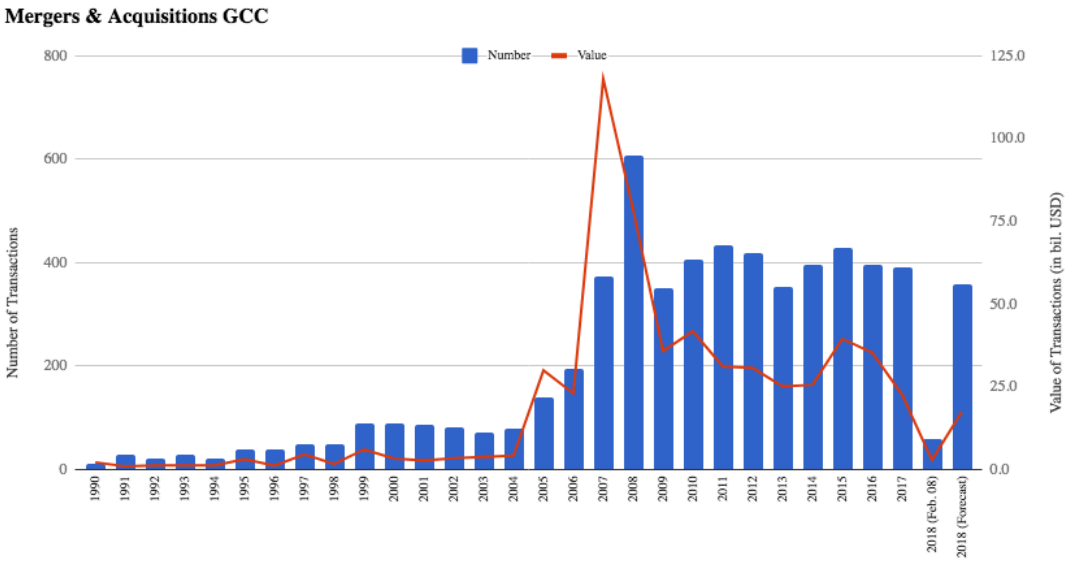

Figure 24: M&A Trends Gulf Cooperation Council (IMAA, 2018)

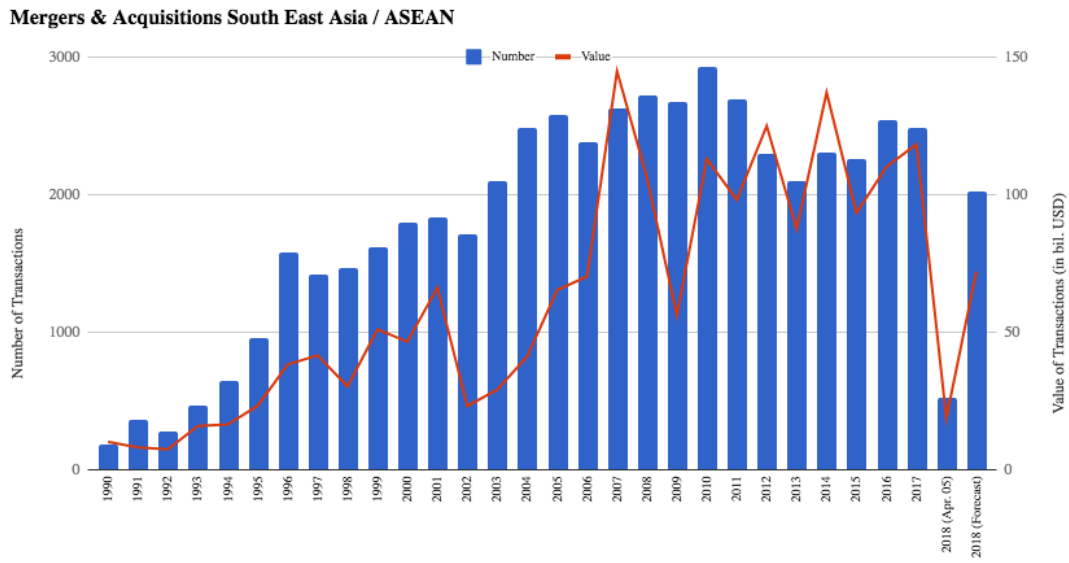

Figure 25: M&A Trends South East Asia - ASEAN (IMAA, 2018)

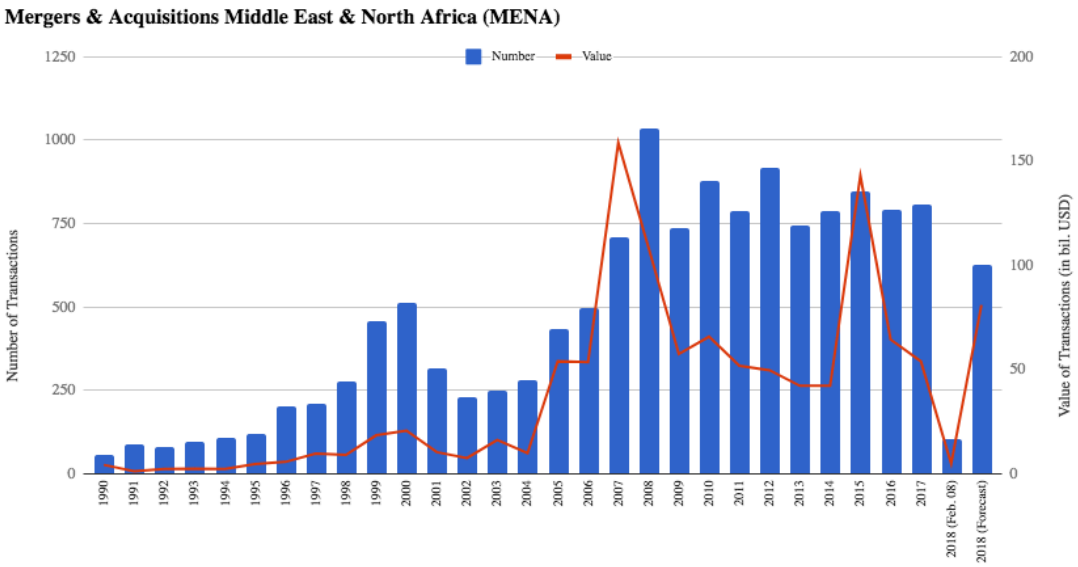

Figure 26: M&A Trends Middle East & North Africa (MENA) (IMAA, 2018)

6.2 Appendix B

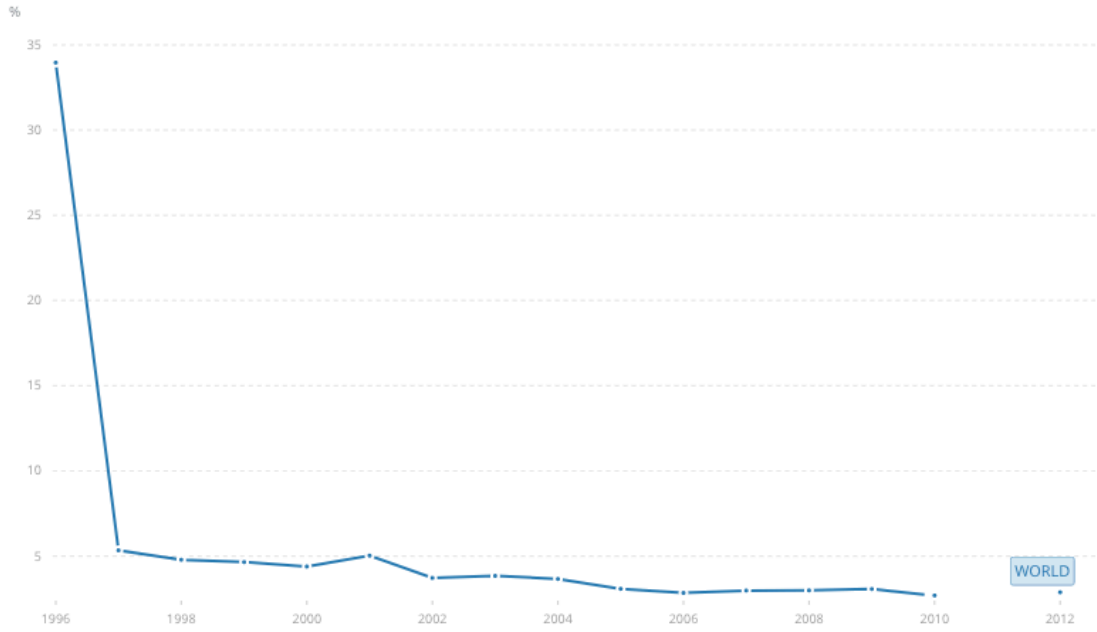

Figure 27: Tariff Rate Changes – World (World Bank, 2018)

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