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Intra-firm Trade from U.S. Multinational Enterprises to Emerging Market Economies: An Assessment of the Impact of the Global Recession and Intellectual Property Rights

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**Intra-firm Trade from U.S. Multinational Enterprises
to Emerging Market Economies: An Assessment of the
Impact of the Global Recession and Intellectual
Property Rights**

By

Trang Nguyen

Submitted in partial fulfillment
of the requirements for
Honors in the Department of Economics

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ABSTRACT

The level of US intra-firm imports from Emerging Markets, EM, (i.e., imports of MNEs from their foreign affiliates) has increased from 149 billion USD in 2002 to 347 billion USD in 2012. A similar magnitude is observed for US arm's length imports (i.e., imports of MNEs from third parties in foreign countries). This thesis estimates the responsiveness of US intra-firm and arm's length imports to Intellectual Property Rights (IPR) protection indicators, "Doing Business" indicators, and to the Global Recession. I use two panel data sets, one covering 332 industries (3-digit NAICS) and 43 emerging countries from 2002 to 2012, the other covering 10 industries (2-digit NAICS) and 190 countries over the same time period. My regressions control for fixed country, industry, and time effects. I find that the levels of both intra-firm trade and arm's length trade increase substantially in response to stronger IPRs. I also find that the share of intra-firm imports in total imports increases due to stronger IPRs, a result which suggests that firms increase their intra-firm activities by more than their arm's length activities. During the Great Recession, the share of intra-firm imports to Emerging Markets increases by 1.1 %. This implies that the decline in intra-firm imports is smaller than the decline in either arm's length trade or total intra-firm trade, a result which shows the relative resilience of intra-firm trade to fluctuations in global output. Finally, "Doing Business" indicators, including "Enforcing Contracts", do not have significant effects on the share of intra-firm imports.

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“I don’t get no respect.”

-Rodney Dangerfield

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Chapter 1 | Introduction

A new notion of international trade - Global Value Chains (GVC) is coined in the 1990s to describe the method of fragmentizing production process among different locations across the globe. Due to the fast decreasing cost of transportation and communication means, GVC has become a popular method for Multinational Enterprises (MNEs) to utilize comparative advantages of different countries in producing goods and services. A labor-abundant country, for example, offers an ideal location for MNEs to transfer the labor-intensive part of the production process over. Offshoring production assists MNEs in reducing costs and increasing efficiency. At the same time, host countries of MNE's production process benefit via knowledge spillovers and an increase in their exports. Recently, the surge in trade between developing and developed countries implies the growing importance of GVC in the international economy system.

Global Value Chains, however, can increase the vulnerability of trade system under the influence of negative shocks. During the global recession 2009, for example, drop in trade was “severe, sudden, and synchronized,¹” at the rate of 13%, six times higher than decline in world GDP in 2009 (-2.2%). Many economists believe that the interdependence among trade partners, thanks to GVC, propelled a transmission mechanism that made the crisis spread more quickly and its damage more severe. The impact of the transmission mechanism is apparent by observing the trade decline of related industry sectors in the same supply chain. For example, a reduction in U.S.

¹ See Baldwin (2009)

exports of semiconductors and components to developing countries is closely linked to the drop in US imports of computers and cell phones. The reason is that cellphone-assembly plants around the world, mostly concentrated in China and Southeast Asia, depend on intermediate goods manufactured in United States. Similarly, when exports decline in Japan as a result of the decreasing demand from US, the market of intermediate goods in China would suffer decline in sales.

In short, the integrated and interdependent world economy is both a blessing and a curse to MNEs. On the one hand, MNEs benefit from the vertical specialization of production, including cost reduction and access to host countries' resources. Moreover, as nearly 90% of sales from foreign affiliates happen in host country market or other foreign markets², investment in EMs opens the door to multiple potential markets around the globe. On the other hand, it can come with a lot of risks regarding both the political, social, and cultural differences and the interdependence between MNEs and their trade partners. Finding a way to either avoid or minimize the risk, especially when a negative macroeconomic shock occurs, is a top priority for MNEs. In order to achieve that, MNEs have to make the right choice of entry modes into host countries, either through intra-firm trade (greenfield investment, mergers and acquisitions) or arm's length trade (subcontracting, licensing, etc.).

Intra-firm trade (IFT) is the flow of exchanges in goods and services within the boundaries of multinational enterprises; between their headquarters and foreign affiliates or related parties located in different countries. In 2004, IF imports and exports accounts

² See Slaughter and Matthew (2010)

for 53% and 33% respectively of total US imports and exports³. An example of IFT is when a wholly owned subsidiary of Intel ships back to the US headquarter a component of its microchips that has been produced in the host country of the subsidiary. Arm's length trade (ALT) is when MNEs subcontract part of their production process to foreign manufacturers or directly purchase from them. Licensing and subcontracting are the most common ALT arrangements. For example, Nike subcontracts most of its shoe and apparel manufacturing process to independent producers in Thailand, Indonesia, Cambodia, and Vietnam.

IFT has been a large portion of total trade, though its value varies greatly among industries, countries, and MNEs. Most notably, IFT from developed to developing countries have been increasing significantly, especially after the global recession 2009. According to data of financial and operating expenses of U.S. BEA, total sales, assets, and employments of U.S. MNE's foreign affiliates in emerging markets are on an upward trend, compared to the stagnating data of foreign affiliates in developed countries. Data of US Census on Related-Parties⁴ Trade also shows a similar pattern. Figure 1 shows the trend of share of IFT imports/exports out of total imports/exports for the last 10 years. The graph on the left compares IFT imports of All Countries to that of exclusively EMs. Similarly, the right one is comparison of IFT exports. These two graphs show the increasing pattern of both share of IFT imports and exports to EMs. Especially, the share

³ See data from the U.S. Bureau of Economic Analysis (BEA)

⁴ Regarding terminologies, *IFT* and *related parties* trade can be exchangeable even though there are some minor differences due to data collection methods of BEA and US Census. In the export data, both institutions use the same definition of a related party in the Census data and an IFT in the BEA (the balance-of-payments threshold for FDI of a 10% ownership stake). In the import data, the BEA definition of an IFT stays the same, but the Census definition of related parties is broader, including both transactions of IF and AF⁴. In this paper, *related-parties* is exchangeable with *IFT*.

of IFT exports to EMs is on a significant increasing trend. To the contrary, the share of IF imports and exports to all countries are fairly stagnant.

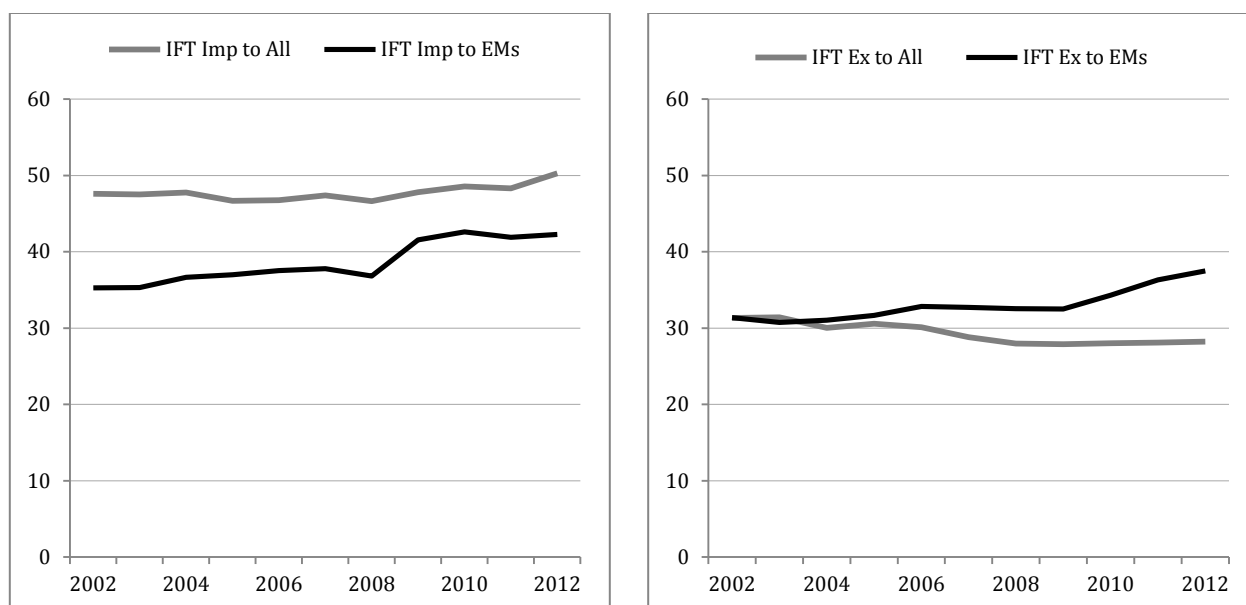


Figure 1: Share of Total IFT (%) to All Countries and IFT to Emerging Countries
(Source: US NAICS Bureau)

More interestingly, the data shows that IFT seems to be more resilient to macroeconomic shocks than ALT. Figure 2 demonstrates the responsiveness of IFT imports during the recession 2009. During the global crisis in 2008, the IFT imports to EMs declined by 14.3%, compared to 24% drop in the IFT imports to all countries. In 2009, IFT imports to EMs rebounded strongly to an increase in 27.7%, while the IFT imports to all countries went up by 24.5%. Figure 3 shows the percentage decrease of total imports, ALT, and IFT imports for three groups of countries: all countries, OECD countries, and five emerging countries. While the difference of the all countries group is not very huge – a decline of 26.8% in ALT imports compared to 24.1% of IFT imports during 2009, data of the emerging countries group shows a wide discrepancy. IFT

imports from US' MNEs to EMs dropped by the lowest percentage (-9.2%) compared to ALT imports to EMs (-17.5%) or IFT to other countries groups (around-23%).

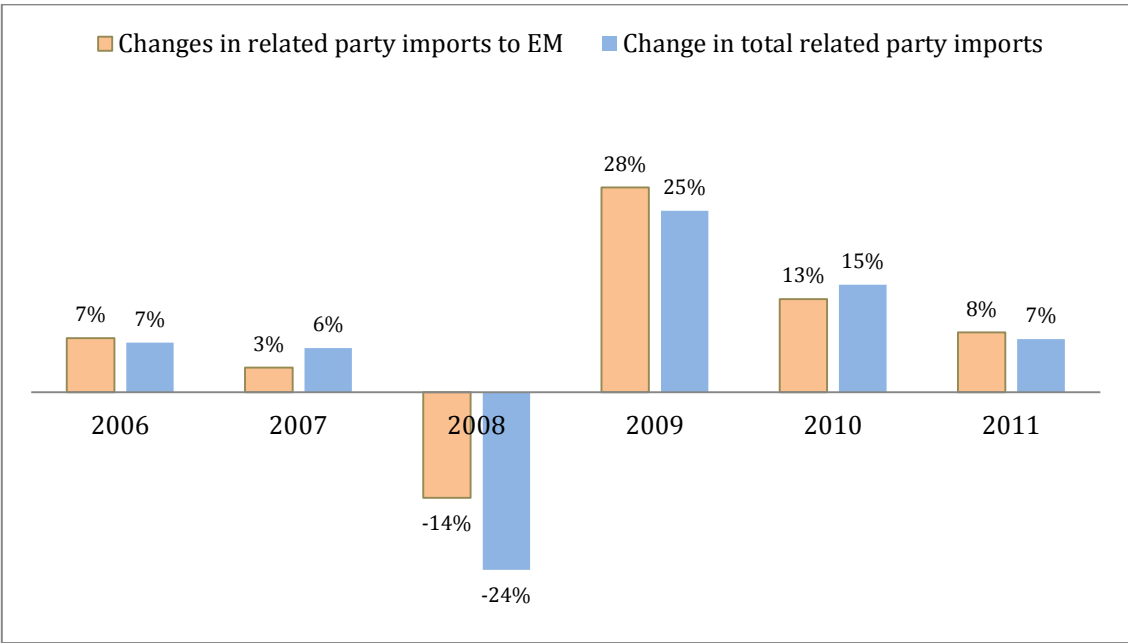


Figure 2: Year-to-Year Changes in IF Imports of All Countries and That of EMs
(Source: US Census Bureau, Related Party Database)

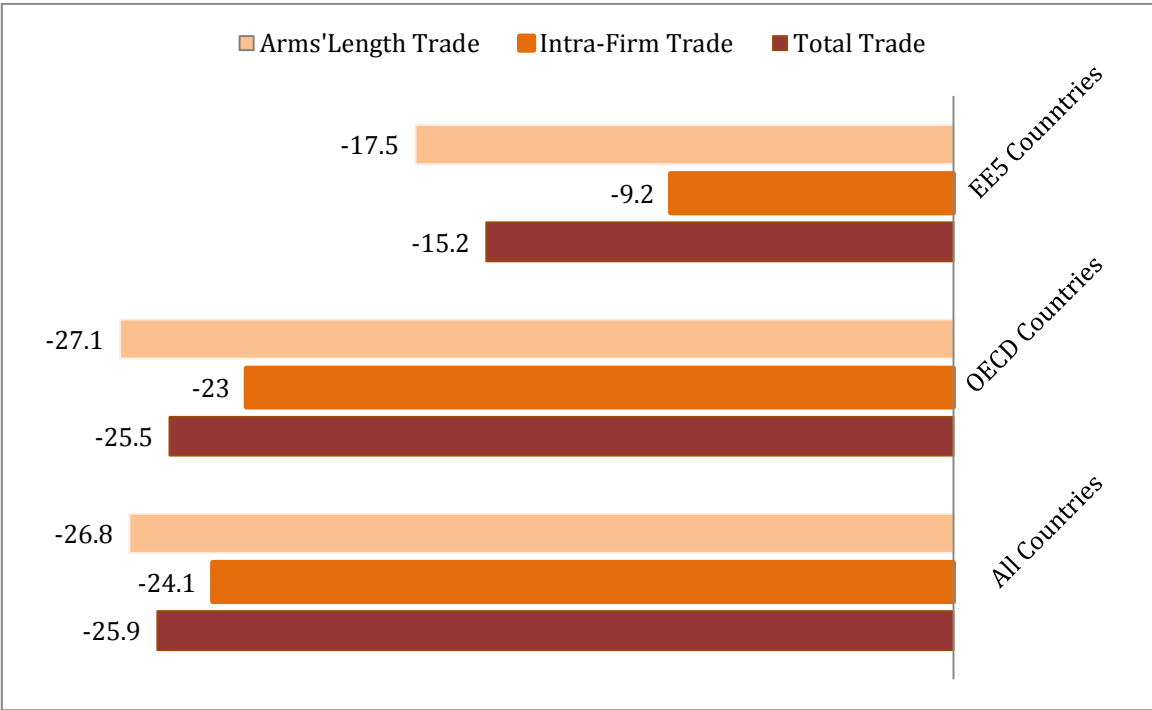


Figure 3: Percentage Changes in US Total Imports, IF, and AL Import in 2009

(⁵Source: US Census Bureau, Related Party Database)

An important paper of Bernard *et al.* (2009b) finds the same pattern during the Asian financial crisis 1997 when IFT seems to be much less vulnerable than ALT. What are the reasons behind this phenomenon? The *bullwhip* effect, a notion coined by Forester (1961), describes a phenomenon of inventories' adjustment within supply chains. To guarantee that the quantity of products meet demands, up-stream foreign suppliers have to store a big amount of inventories. When global recession hits, these suppliers have to suddenly halt production while their huge stocks of inventories remain static. The bullwhip effect magnifies the disastrous impact of the global recession on trade. The vertical integration of production process through IFT reduces the uncertainty of demand. As the estimation of sales along the supply chains within firms' boundaries will be more predictable, foreign affiliates do not deal with large inventories. Moreover, the information exchange between headquarters and foreign affiliates in IFT is faster and smoother, leading to a better management of inventories in the presence of IFT than ALT. Last but not least, IFT imports between MNEs and EMs is of smaller share (around 30% of total IFT as presented in Figure 1) and of lower values than IFT to developed countries. Thus, a negative shock would not affect them as hard compared to other trade types.

Yet, how much did IFT from U.S. MNEs to EMs actually decline during the global recession 2009? Is it significantly lower than other types of trade or merely enough due to its small portion in the total IFT? Not many studies have been focused exclusively on the IFT to EMs and its responsiveness during the global crisis 2009. Moreover, due to

⁵ The EE5 Countries are Brazil, China, India, Indonesia, and South Africa

the current shift in production and consumption from the North the fast growing emerging economies, it is crucial to understand in-depth the management decision of MNEs to invest in EMs and how trade policies and conditions in different EMs affect the IFT. Thus, the study contributes to and enhances the body of literature by assessing the impact of the global recession and Intellectual Property Rights on IFT of US' MNEs to EMs.

My methodology is to regress IFT and ALT levels on the commonly used IPR index developed by Ginarte and Park, Recession Dummy and doing business indicators as developed by the World Bank. I use two panel data sets, one covering 332 industries (3-digit NAICS) and 43 emerging countries from 2002 to 2012, the other covering 10 industries (2-digit NAICS) and 190 countries over the same time period. My regressions control for fixed country, industry, and time effects. I find that the levels of both intra-firm trade and arm's length trade increase substantially in response to stronger IPRs. I also find that the share of intra-firm imports in total imports increases due to stronger IPRs, a result which suggests that firms increase their intra-firm activities by more than their arm's length activities. During the Great Recession, the share of intra-firm imports to Emerging Markets increases by 1.1 %. This implies that the decline in intra-firm imports is smaller than the decline in either arm's length trade or total intra-firm trade, a result which shows the relative resilience of intra-firm trade to fluctuations in global output. Finally, "Doing Business" indicators, including "Enforcing Contracts", do not have significant effects on the share of intra-firm imports.

The rise in the levels of IFT and ALT activity is in line with the predictions of the theoretical literature. However, the increased share of IFT in overall Multinational

activity contradicts the findings of Kamal Saggi (1997), Helpman (1992), and Yang and Maskus (2009). My results suggest that increased IPRs as measured by the Ginarte and Park index simply do not provide the additional protection for firms to expand their activities beyond their own boundaries.

In Chapter 2, I define the concept of IFT and present a brief overview of the growing theoretical literature on IFT and its determinants. I will present a brief analysis of how these determinants affect IFT from US'MNEs to specifically EMs and outline couple of empirical studies that have investigated the reaction of Global Value Chain, in general and IFT, in particular to macroeconomic shocks. Finally, I review their methodologies and what I can apply to this study.

In Chapter 3, I set up the econometric model. I explain the choice of data and describe the framework used to measure the responsiveness. I also give a brief overview of Doing Business variables that link to the determinants of IFT and explain the rationale for the sample period and variables used in the model.

In Chapter 4, I explain the results of the regression estimation. I present the rationale of each coefficient in all regressions and whether it reconfirms findings of other research papers and how the result can contribute to the existing literature. Finally, I conclude my study in Chapter 5 with the significance of the result, its implication on trade policies, and recommendations on further investigation of the topic.

chapter 2 | Literature Review

2.1. Determinants of Intra-Firm trade (IFT)

Both empirical and theoretical literature on the determinants of IFT have been growing fast during the last decade. In terms of the theoretical foundation, economists have investigated the firm-level choice of organizations between internalizing the production process (IFT) and subcontracting to outside manufacturers (ALT). However as the data of intra-firm trade on a firm level is scarce and incomplete, most of the empirical literature of IFT looks into determinants on the country and industry level.

Dunning (1977, 1981) created the OLT framework to explain the incentives of MNEs to opt for IFT when entering a foreign country. They are:

- 1) *Ownership Advantage*: IFT allows MNEs to protect their technology (patents, blue prints) and even trade secret internally.
- 2) *Location Advantage*: It is more profitable to produce in a certain country due to its endowments of labor and natural resources.
- 3) *Internalization Advantage*: the production process is exploited internally within the firm, thus, preventing competitions.

Moreover, there is a wide variation of intra-firm trade across countries and industries. Industry characteristics that have positive links to intra-firm trade are product complexity, contractility, R&D intensity, and productivity dispersion. Country characteristics includes those from the gravity models such as GDP, distance, exchange rates and others including labor skills, the ease of doing business, and intellectual property rights (IPR). While my study focuses on country-level determinants, the

following subsection will give an overview of literature reviews on some of the most important determinants of IFT. They are product contractibility, IPR, Productivity Dispersion and R&D intensity.

2.1.1. Product Cycle and Product Contractibility

Antras (2003) provides a model of how the product cycle hypothesis and the product contractibility influence firms' decision on choosing AL or IFT. According to Raymond Vernon, who first described the product cycle, firms produce novice products first in the North. When the process is standardized, firms have incentives to shift the production process to the South due to lower wages. The decision of choosing either IFT or ALT, Vernon argued, depends on the degree of standardization of the technology.

Antras expanded the product cycle argument by showing that the voluntary transferring process outside MNEs' boundaries can happen even with new, unstandardized products. However, the incomplete nature of contracts prevents firms to do so.

“Contracts are incomplete because neither the quality of the intermediate input nor the amount of investments in capital and labor can be verified by a third party and contracts cannot be written on sales revenues. The only contractible are therefore the allocation of residual rights of control and an ex ante transfer between the final goods suppliers and intermediate input producers.” (Antras, 2003)

Incomplete contracts of ALT can generate the *hold-up problem* as Southern independent subcontractor may not act upon agreements. When fears of the hold-up problem outweighs the benefit of low labor costs, firms have more incentives to either produce unstandardized goods in the North or in case of offshoring, transfer the production process internally (IFT). The incomplete contracts also explain why IFT is

more concentrated among developed countries where “suboptimal relationship-specific investment” between headquarters and foreign affiliates is easier to establish. Antras also asserted that the improvement in the contracting environment in international transaction increases investment of MNEs in the developing countries.

2.1.2. Intellectual Property Rights

An empirical study by Corcos et al. (2009), using a data set of French import transaction at firm, country, and product levels in 1999, investigates IFT and its relations with intellectual property rights (IPR). These authors suggest that IPR plays an important role in firms’ choice between IFT and ALT. Especially, when firms’ products are complex and resulted from costly R&D, MNEs are much more careful with the protection of their intangible assets when placing them in a foreign country. They would choose either to internalize the production process (IFT) in order to “reduces the dissipation of intangible assets” or to subcontract (ALT) in a country that heavily enforces IPR to prevent imitation. (Corcos et al, 2009). Their result corresponds with Naghavi et al.(2013) who analyzed a dataset of French firm-level survey in order to investigate the influence of IPR protection on MNEs’ mode of entry in a foreign countries.

Kamal Saggi (1997) also contribute to the IPR literature by conducting a survey on IFT and international technology transfer.

“If [local partners via ALT] can get access to the multinational’s proprietary knowledge, the value of such knowledge can be dissipated either because of increased competition (Ethier and Markusen, 1991, Markusen, 1999, and Saggi, 1996 and 1999) or because the local partner has inadequate incentives to protect the multinational’s reputation (Horstmann and Markusen, 1987). The incentive to prevent the dissipation of knowledge-based assets is reflected in the fact that multinationals transfer technologies of new vintage via direct investment, preferring to license or transfer their older technologies via joint ventures (see Mansfield and Romeo, 1980).”

While Yang and Maskus (2009), and Helpman (1992) study the effects of Southern IPR enforcement on the Northern firm behavior reaches the same conclusion with previous studies, they also found that multinationals are less likely to set up manufacturing and R&D facilities in countries with IPR regimes and more likely to set up sales and marketing ventures, since the latter run no risk of technology linkage.

2.1.3. Productivity Dispersion and R&D Intensity

As discussed above, IFT varies widely across not only countries, but also industries. There have been some empirical studies to test determinants of IFT that are based on firms and industry characteristics. Antras and Helpman (2004) expanded their analysis by considering firm heterogeneity and found out that the dispersion of firm productivity is positively associated with an increase in the share of IF imports out of US imports. The research of Nunn and Trefler (2008) examines this relationship empirically with the US data on IF and AL imports for 5,323 products in 210 countries. Their result confirms that the IFT is largest with the highest level of both products' complexity and MNEs' productivity. Figure 4 shows the percentage of intra-firm imports out of total imports in all 3-digit NAICS industry sectors. It is apparent that high-tech industries such as transportation equipment, computer, and machines have higher ratios of IFT than low-tech industries such as materials, textiles.

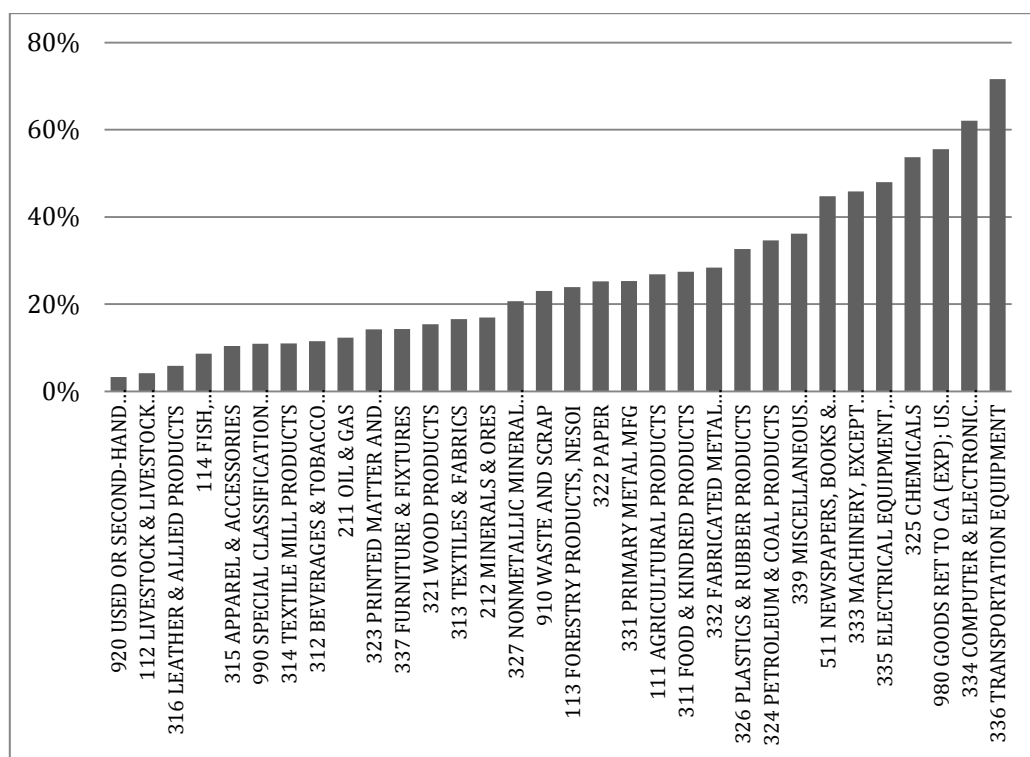


Figure 3.1: IFT ratios of 3-digit NAICS code industries

Another empirical study of Yeaple (2006) supports the theoretical model. Using data from the 1994 Benchmark Survey of Bureau of Economic Analysis, Yeaple tested the impact of productivity dispersion⁶, capital-labor ratio, R&D intensity to sale on the share of IFT and its variation among three groups of countries: least developed, emerging/newly developed, and developed. The study shows the positive relationship of all these above independent variables on the IFT. However, while productivity dispersion has a statistically significant impact on IFT shares in only developed countries, the

⁶ Productivity Dispersion is measured as the standard deviation of the logarithm of firm sales across firms within an industry. According to Antras and Helpman (2004) differences in firm size as measured by final good sales reflect differences in productivity because more productive firms sell more.

coefficients of capital-labor ratio and R&D intensity are positive and significant for emerging/ newly developed economies.

In sum, Table 2.1 below summarizes the determinants that influence MNEs' choice of establishing their own production facilities abroad (IFT) instead of subcontracting or licensing (ALT).

2.2. Global Value Chains and Trade Crisis

Surprisingly, only a few studies have focused on the responsiveness of IFT to macroeconomic shocks so far. In fact, most of the literature looked into the role of Global Value Chains in the trade crisis 2009. The most notable paper is by Bernard (2009b), which used data from US Linked/Longitudinal Firm Trade Transaction Database to investigate how trade reacted to the Asian financial crisis 1997. His method of difference-in-difference approach compares the treatment group of crisis countries (Thailand, Indonesia, Korea, Malaysia, Philippines) to a control group of all other countries before and after July 1997. The paper concluded that IFT is indeed more resilient than ALT during the crisis. US arm's length trade declined 26% between 1996-1998 while intra firm trade exports declined by only 4%. "The extensive margin, the number of exporting firms fell by 16% for ALT and by 7% for IFT while the intensive margin, the development in trade due to surviving firms fell by 8% for arms length exports and by 9% for IF exports." (Bernard *et al.* 2009b)

Table 2.1: Determinants of IFT and Their Expected Signs

<i>Level</i>	<i>Determinants of IFT</i>	<i>Explanation</i>	<i>Expected Sign</i>	<i>Expected Sign</i>
Firm	R& D Intensity	Ratio of expenditures on R&D over sales of MNEs	+	+
	Capital Intensity	Ratio of assets per employee of MNEs	+	+
	The intensity of international production	Ratio of total asset of FA/total asset of parents	-	-
Industry	Products' Complexity	The Inputs-Outputs Matrix Table	+	+
	Productivity Dispersion	Standard Deviation of the logarithm of firm sales across firms within an industry	+	+
Country	GDP/ GDP per capital	In current USD	+	+
	Exchange Rate	Effective, against current USD	+	+
	IPR Index	The measurement of how countries comply with the law of Intellectual Protection Right	+	-
	Strength of Investor Protection	The average of measurements on the extent of disclosure the extent of director liability index, and the ease of shareholder suits index.	+	-
	Total Taxes	Taxes as % of Profit	-	-
	Costs of Trade	In current USD	-	-
	Product Contractibility	How likely subcontractors in foreign countries will act upon agreement.	+	-

Another paper looks broadly into the role of Global Value Chains in the global recession 2009 through the dataset of French firms' transactions⁷, concluding that IFT reacts more intensely than ALT. During 2009, it has a “faster drop followed by a faster recovery.” The paper attributes this responsiveness to the ability of MNEs to adjust inventories more quickly and efficient due to “the synchronized circulation of information and the ensuing optimal management of stocks within the boundaries of the groups.” (Altamonte *et al.* 2012)

2.3. IFT inflow to emerging markets during the financial crisis

To assess the responsiveness of IFT, it is also important to look into the reaction of the IFT inflow of emerging economies to the global recession. During the first half of 2008, where the crisis started affecting developed countries severely, emerging economies actually received an increase in IFT inflows at a slower pace than previous year. As the global crisis prolonged, liquidity constraints made MNEs to significantly tighten their investment abroad. More importantly, “the resilience of [IFT] inflows to emerging economies after their crises [for example, Asia in 1997 and Latin America in 2000] is in marked contrast to the grim IFT developments in 2009, where M&A deals and Greenfield investments declined in most emerging markets- despite the equally open investment policy environment.”⁸ (Poulsen and Hufbauer, 2011) Moreover, although slowly beginning to rise again in 2010, inflows to emerging markets remained more than 20% below their 2008 level. The paper also compared the level of IF debt and equity

⁷ 62 million of transaction by 167,833 exporting and importing firms located in France in the period of 2007-2009, including 5754 headquarters of MNEs connecting through the proprietary linkages of 690,501 co affiliates worldwide

⁸ See Poulsen and Hufbauer (2011), Foreign Direct Investment in Times of Crisis,

investment that shows the MNEs' long-term strategic commitment in emerging market. In 2009, according to World Bank (2009, p.52), while the flow of debt from US parents to foreign affiliates reduced to a much extent (similar to past crises), the equity investment declined substantially (in contrast to past crises). As IFT accounts for almost half of trade from MNEs to EMs, this phenomenon explains why recovery of IFT in the global recession 2009 was much slower than the Asian crisis 1997 or other past crises. Another reason for slower growth of emerging market is due to the ability of foreign affiliates to monitor their destinations of sales under the influence of macroeconomic shock. Being part of MNEs' networks allows foreign affiliates to switch from domestic sales to exports if crisis hit the host country. During the Asian crisis, IF exports from emerging markets to US increased as foreign affiliates shipped most of products back to the MNEs' headquarters.⁹ However, the widespread of the global recession 2009 prevented the foreign affiliates to do the same thing. Thus, IFT in EMs during 2009 would not be as resilient to the macroeconomic as what Bernard et al. (2009b) found in Asian crisis 1997. Yet, in the overall comparison to developed economies, EMs with smaller initial vulnerabilities was affected by the recession later and exited earlier, also experienced considerably smaller declines in output during the global recession 2009.

⁹ See UNCTAD, The Financial Crisis in Asia and Foreign Direct Investment: An Assessment

chapter 3 | Data Description and Model

Following the extensive literature in Chapter 2, I will test the responsiveness of IFT to the global recession and its relationships with country-level determinants such as Paying Taxes, Trade Across Borders, and Enforcing Contracts indexes and the IPR indexes constructed by Walter Parker. The study analyzes a panel dataset that covers trade data of all 3-digit NAICS industries from US to all countries during the period 2002-2012. This sector will give an overview of the data description.

3.1. Dependent Variable

For my dependent variable, I use the panel data of US Census Bureau, which is comprised of the values of intra-firm imports and total imports of all industries from US to 103 countries over the period 2002-2012. Related-parties imports are defined as import transactions between parties “[that] are directly or indirectly, owning, controlling or holding power to vote, 6 percent of the outstanding voting stock or shares of any organizations”.¹⁰ The dependent variables take forms of both the value of intra-firm imports and the share of intra-firm imports out of total imports on independent variables. Thus, the results of these regressions will shed light on the responsiveness of intra-firm imports in terms of both the level and the share.

¹⁰ See <http://sasweb.ssd.census.gov/relatedparty/relatedhelp.html#variables>

3.2. Independent Variables

3.2.1. Dummy Variable

I create a dummy variable to capture recession years. The Recession Dummy (REC) takes the value of 1 for recession years (2008 and 2009) and 0 for the rest of the period (2002 - 2012).

3.2.2. IPR index

I gather the Intellectual Property Right (IPR) index constructed by Walter Park. The index is measured based on five criteria: the coverage of patentable inventions, memberships in international treaties, duration of protection, enforcement mechanisms, and restrictions.¹¹ Because the IPR data set comprises of index for only every 5 years, I have to reproduce data of 2000 for 2002 and 2003, data of 2005 for 2004, 2006, 2007, and the rest from data of 2010. My assumption is that IPR index of a certain year will have lagging effect on the time period after or before the year benchmark, within the variation of +/- 2 years. However, it should be noted that this method may undermine the persistency of the regression model.

3.2.3. Doing Business Variables

There are four variables from the Doing Business website that I focus on. They are Strength of Investor Protection Index, Trading Across Border, Paying Taxes, and Enforcing Contracts.

1. The *Strength of Investor Protection* Index ranges from 0-10 with the higher value indicating more investor protection. The index is the average of measurements on the extent of disclosure (how a corporate

¹¹ See Park Walter (2008)

body processes and discloses information of transactions), the extent of director liability index (how much liability directors have), and the ease of shareholder suits index (how much power shareholders have to challenge the transaction).

2. The *Trading Across Border* variable is measured as the Cost of importing a 20-foot container in current USD. Cost of Imports is comprised of all the fees associated with the procedures to import the goods, such as costs for documents, administrative fees for customs clearance and inspections, customs broker fees, port-related charges and inland transport costs. (No customs tariffs and duties or costs related to sea transport are recorded.)
3. The *Paying Taxes* variable is measured by the ratio of total tax out of EBIT¹². The measurement includes all different taxes and payable contributions, such as profit or corporate income tax, social contributions and labor taxes, property taxes, turnover taxes and other taxes (municipal fees and vehicle taxes).
4. The *Enforcing Contract* variable is measured by the total cost as the percentage of claim; the total cost includes court costs, enforcement costs, and average attorney fees.

Based on the literature discussed in the previous chapter, these Doing Business variables demonstrate factors that will influence the trade volume and the choice of Intra-Firm Trade (IFT) and Arm's Length Trade (ALT) to some extent. The higher the

¹² EBIT stands for Earnings Before Interest and Taxes

Strength of Investor Protection in a country, the higher the value of trade inflow will be. Thus, the variable is positively linked to the values of intra-firm import. The Cost of Import and Total Taxes Rate, on the other hand, are expected to have a negative relationship with the flow of trade to a country. According to Antras and Helpman (2004), Enforcing Contract is negatively linked to the value of intra-firm trade. If the total cost as percentage of claim is high, related parties are more likely to follow the contract. Given the other factors unchanged, MNEs, thus, will be more inclined to subcontract their production process (ALT) instead of choosing IFT when Enforcing Contract increases. In figure 5, I plot the Enforcing Contracts data of EMs on a scatter plot against each country's share of IFT imports. The data do not show any clear correlation between two variables.

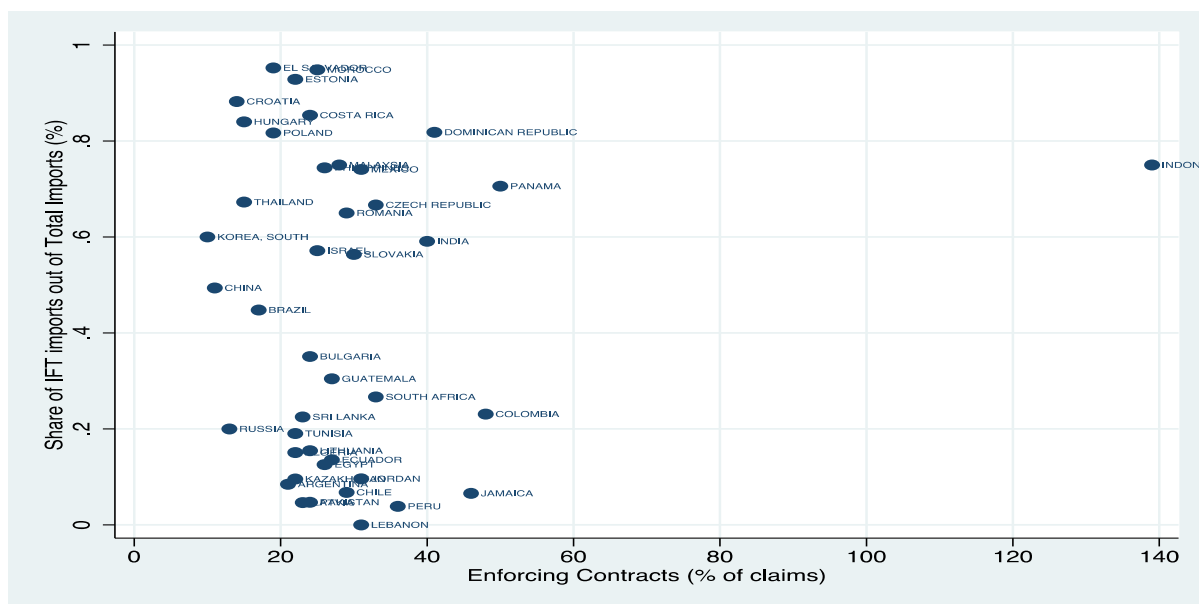


Figure 5: Relationship between Share of IFT imports out of Total Imports and Enforcing Contracts of EMs Dataset

One problem with the Doing Business dataset is the time frame 2004-2014. To merge it with the rest of the dataset, which has the time frame 2002-2012, I have to move back each year of Doing Business variables into two years earlier. For example, data of Doing Business variables in 2004 will become that of 2002. Correspondingly, the data of 2005 is changed into that of 2003 and so forth. My assumption is that data from the Doing Business survey is more likely to have a lagging impact on IFT and ALT. It is also important to note that the dataset does not show a lot of variation of these indexes of each country over time.

3.2.4. Country Characteristics Variables

To control for country characteristics, I gather data of GDP, GDP per capita, effective exchange rate¹³, and inflation from the World Bank Database. Higher values of real exchange rate imply an appreciated dollar relative to the local currency, increasing the likelihood of import by the US industry. Thus, we expect a positive sign for the real exchange rate's coefficient. Table 3.1 below summarizes all the variables, their definition, unit measurement, and sources.

¹³ Please refer to the Appendix for the calculation of Real Exchange Rate

Table 3.1: All Variables of Regression

<i>Variables Names</i>	<i>Explanation of Unit</i>	<i>Source</i>
Intra-Firm Imports	The value in USD The ratio of IFT imports out of total imports	US Census Bureau
IPR	IPR index	Walker Park
GDP, GDP per capital	In current USD	World Bank Database
Real Exchange Rate	Effective Exchange Rate (as 2005 – the base year) Adjusted for Inflations	World Bank Database
Investor Protection Index	The average of measurements on the extent of disclosure the extent of director liability index, and the ease of shareholder suits index. (0-10)	Doing Business
Cost of Imports	Fee of 20-feet container of imported goods in USD	Doing Business
Paying Taxes	Total Tax Rate as percentage of profit before all taxes.	Doing Business
Enforcing Contracts	The total cost as the percentage of claim, including court costs, enforcement costs, and average attorney fees.	Doing Business

3.3 Final Datasets

From these different sources described above, I finalize two data sets. The first one covers in total 332 industries subsectors (3-digit NAICS code) and 43 emerging market economies from the period 2002 to 2012. The selection of 43 Emerging Market Economies¹⁴ follows Arbatli (2011). Each country in the list has experienced stably high growth rate and an impressive economic development for the last decade. The second one covers 10 industries (2-digit NAICS code) and 103 countries that trade with US MNEs over the same time period.

¹⁴ Please refer to the Appendix for the list of countries.

Table 3.2: Descriptive Statistics of Data Set 1 – Emerging Countries

Variables	Mean	Std. Dev.	Min	Max
Total Import (Billion USD)	0.585	3.970	0	160
Related Parties Import (Billion USD)	0.236	2.180	0	79
IPR index (0-5)	3.002469	1.253091	0	4.68
Strength of Investor Protection Index (0-10)	5.243151	1.455926	3	9
Total Taxes (% of Profit)	46.76896	17.18835	20	113
Cost to Imports (Fee of a 20-foot container in USD)	1168.242	593.0607	317	4865
Enforcing Contract (% of the claim)	28.6007	19.71832	10	139
Log of Real Exchange Rate	7.63128	4.743214	1.238267	53.10346
Log of GDP	11.43433	9.763538	-.6906835	29.23871
Log of GDP per capita	10.35312	8.88558	-.6821083	29.6219
IPR_Strength of Investor Protection	16.31875	8.168224	0	33.75
IPR_Enforcing Contract	90.32808	83.65046	0	550.44

Table 3.3: Descriptive Statistics of Data Set 2 – All Countries

Variables	Mean	Std. Dev.	Min	Max
Total Import (Billion USD)	1.3200	8.0300	0	190
IFT Import (Billion USD)	0.7040	5.4300	0	144
IPR Index (0-5)	3.2640	0.8883	0	4.68
Strength of Investor Protection Index (1-10)	5.2336	1.6344	1	10
Total Taxes (% of Profit)	47.7464	29.5793	14	280
Cost of Imports (Fee of a 20-foot container in USD)	1551.742	1077.0	317	9025
Enforcing Contracts (Costs of Claims in USD)	36.4336	27.2349	8	150
Log of Real Exchange Rate	7.037434	9.996286	-2.31009	735.0582
Log of GDP	24.6717	2.0803	19.8292	29.4160
Log of GDP per capita	8.3173	1.6952	4.6823	11.6265
IPR_Strength of Investor Protection	20.2029	11.8828	1.0600	49.9400
IPR_Enforcing Contract	98.6999	48.0947	1.3300	285.6600

Table 3.1 and 3.2 show the descriptive statistics for the dependent and independent variables used in the regressions. In particular, it shows that the average of total imports from U.S.'s MNEs to EMs is 0.58 Billion USD for the time period 2002 to 2012. Out of that, 0.23 Billion USD (almost 50%) is related-parties Imports. Compared to the dataset of all countries, the average total imports of all countries double that of EMs. Similarly, the mean of IFT imports to all countries (0.7 Billion USD) are significantly higher than that of IFT imports to EMs (0.23 Billions USD). Thus, intra-firm trade from US's MNEs is more often with trade partners from developed countries than emerging countries.

Another interesting observation is the IPR index. From the dataset of EMs, the IPR Index on average is surprisingly high, 3 on the scale 0-5. The average IPR of all countries is just a little bit higher; yet there is less variation in the index (with standard deviation of 0.88) than that of EMs Plotting the share of IFT of Manufacturing, Part 3 and IPR index in Figure 5 does not show any apparent correlation between IPR index and the share of intra-firm imports out of total imports.

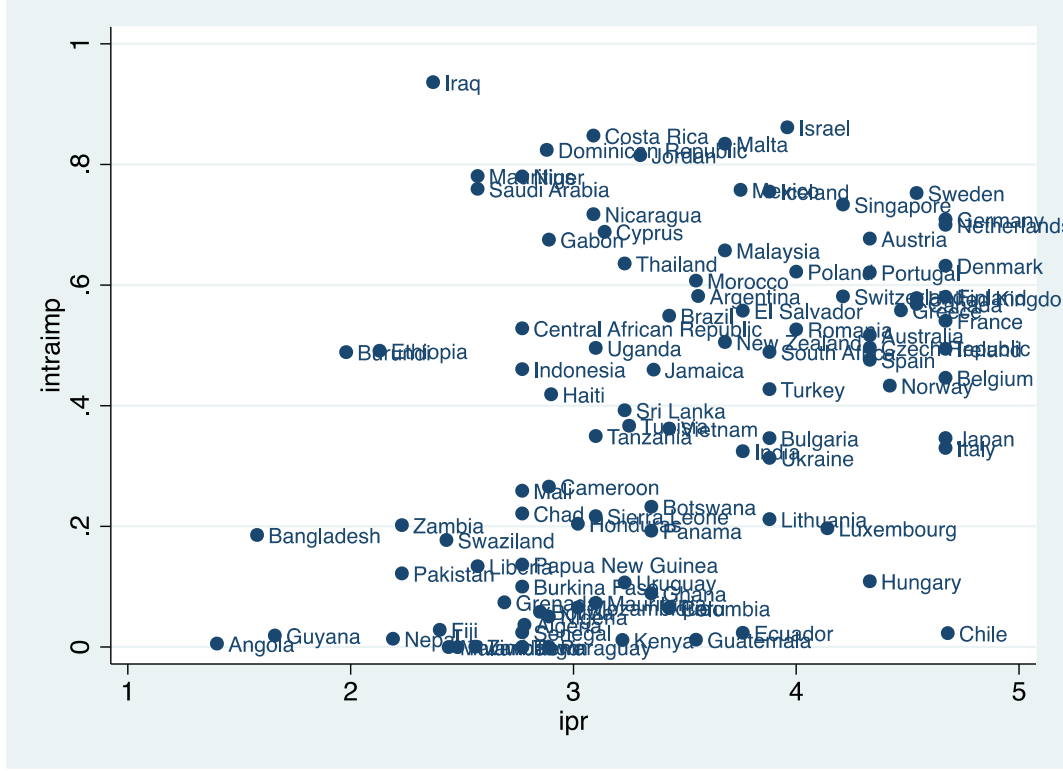


Figure 5: Relationship between Share of IFT Imports of Computer Industry and IPR index

3.4. Econometric Models

To assess the responsiveness of intra-firm imports to the global recession 2009, I regress the value and share of intra-firm imports on recession dummy and various time-varying country characteristics variables. The final dataset includes the value imports by each 3-digit-NAICS industry sectors from US MNEs to each EMs over the time period 2002-2012. I also extend my study by running the regression of the value of IFT imports and its share on the dataset of all countries, not only EMs. The regression model is:

$$ITF_{cit} = \alpha_i + \alpha_c + \alpha_t + \beta_1 H_{ct} + \beta_2 REC + \beta_3 DOBUZ + \beta_4 IPR_{ct} + \varepsilon$$

where: IFT is the Intra-firm Import with the subindex c for the country that hosts the foreign affiliates of MNEs, i for the industry index, and t for the time. α is the fixed

effects. H is the country characteristics, including GDP, GDP per capita, and the real exchange rate. DOBUZ is the Doing Business variables, including Strength of Investor Protection, Paying Taxes, Trading Across Border, and Enforcing Contracts. I expect to see an positive relationship between the value of IFT and Strength of Investor Protection while Paying Taxes and Trading Across Border are negatively linked to the value of IFT. The higher the Enforcing Contracts, the more likely MNEs will choose ALT instead of IFT. Thus, I expect to see a negative relationship between Enforcing Contracts and share of IFT out of total IFT. REC is the binary variable for recession, taking the value 1 for recession years and 0 for the rest of the time period. IPR is the Intellectual Property Right index (0-5) constructed by Walker Park.

The coefficient β_2 of the Recession Dummy captures the increase/decrease of IFT imports in terms of value and share during the recession years. Similarly, the coefficient β_4 illustrates how much IFT imports will change in response to each unit change in the IPR index. According to the literature, the higher the IPR index, the larger the levels of IFT and ALT.

I also add the interaction terms of IPR with two Doing Business variables: Strength of Investor Protection Index and Enforcing Contracts Index as the impact of IPR on Intra-firm Imports also depends on the value of these two Doing Business variables. The coefficients of Interaction Terms take into account the effects of Enforcing Contracts/ Investor Protection on IFT imports to a country coupled with the country's IPR index. The motivation to use the interaction term comes from the fact that the IPR index is mostly focused on the statutory aspects of the IPR protection and not on actual

enforcement. In a country with a strong Enforcing Contracts, an increase in IPR would have a larger impact of on IFT. Thus it is important to take into consideration of these interaction terms.

Chapter 4 | Regression Results

This chapter presents the regression results for two datasets of Emerging Markets Economies and All Countries. The regression results on Table 4.1 and 4.2 are of the values of IFT imports from US' MNEs to EMs for the time period 2002-2012 while Table 4.3 are results of the values of ALT imports to EMs. Correspondingly, Table 4.4, 4.5, and 4.6 present the results of the All Countries dataset. I also include the result of natural log regression in which the dependent variables are the natural log of IFT and ALT in Table 4.5. Furthermore, because of a large number of missing values of the real exchange rate variable, observations drop significantly from the baseline regression to the other regressions. I run another set of regressions without controlling for the real exchange rate in order to cover a bigger portion of datasets and make it easier to compare among results of different regression models. Table 4.7 displays their results.

4.1. Regression Results of Emerging Markets Economies (*Table 4.1, 4.2, & 4.3*)

4.1.1. Responsiveness of IFT Imports (from US to EMs) to the global recession

In Table 4.1, the signs of recession dummy's coefficients are negative, indicating that IFT imports decrease during recession years. While this results are expected, these coefficients are not statistically significant. Regressing the share of IFT imports shows more meaningful results of its responsiveness to the global recession. In table 4.2, the baseline regression model (Model 1) suggests that the share of IFT imports to EMs increases by 1.26% at the significance level of 5%. Adding time-varying countries characteristics: log of GDP, log of GDP per capita, and log of real exchange rate in Model 2 suggests that the share IFT imports out of total imports increases by 1.16% (at

the significant level of 10%) during recession year. Model 3 includes four Doing Business variables, and Model 4 adds the interaction terms of IPR and Investors Protection Index and Enforcing Contrast. In Model 5, I remove other Doing Business variables except Enforcing Contracts and the interaction terms between IPR and Enforcing Contracts. The coefficients in these models suggests similar patterns, however, they are not statistically significant.

4.1.2. IPR Index and IFT Imports to EMs

In table 4.1, the coefficients of IPR index in all regression models have positive signs, showing that the higher the IPR, the higher the value of IFT imports. The result is not surprising because a strong IPR protection is one of the important factors to boost foreign investments, leading to an increase in the value of IFT imports. In the baseline regression (Model 1), one unit increase in IPR index leads to an increase of 135 Million USD in IFT imports to EMs (at the significance level of 5%). Controlling for log of GDP, GDP per capita, and the Real Exchange Rate shows a more significant increase in IFT imports (367.4 Millions USD) corresponding to one-unit increase in IPR index (at the significance level of 1%). In Model 5 when we just include only Enforcing Contracts and its interaction terms with IPR, the coefficient of IPR index suggests even a higher increase in the value of IFT imports to EMs, 852 Million USD, at the significance level of 1%.

Table4.1: Dependent Variable: Value of IFT Imports To EMs (in Million USD)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Recession Dummy	-11.8288 (46548423.0)	-32.230 (71562419.7)	-75.275 (79551813.1)	-70.352 (80176166.9)	-24.065 (61365389.6)
IPR index (0-5)	135.011** (52963438.7)	367.462*** (120491229.2)	184.287 (176298277.7)	388.105 (703742085.5)	852.231*** (224147428.3)
Log of GDP (in current USD)		0.221 (3152633.8)	0.221 (3849460.1)	0.0993 (3855666.5)	-0.2066 (2689022.1)
Log of Real Exchange Rate (2005 is baseline)		2.925 (3596149.7)	3.740 (4585012.2)	3.355 (4593733.4)	2.319 (3036081.2)
Log of GDP per capita (in current USD)		-0.506 (2489843.2)	-0.656 (4124776.9)	-1.547 (4170437.2)	
Investors Protection (0-10)			57.041 (67416971.6)	-126.264 (434969473.4)	
Total Taxes (% of profit)			-17.987* (10834300.6)	-14.449 (11272570.1)	
Cost of Import (Fee of a 20-foot container in USD)			0.0198 (166354.0)	0.0138 (167740.6)	
Enforcing Contracts (% of claims)			-24.85 (35542524.4)	37.478 (55991854.2)	57.189 (37213345.1)
IPR* Investor Protection				58.916 (136366788.2)	
IPR*Enforcing Contracts				-16.189 (11225626.1)	-20.458*** (7152205.8)
Constant	-413.878** (210142643.0)	-1108.48** (475448965.4)	982.364 (1.51676e+09)	-27.172 (2.62490e+09)	-2454.8*** (950658632.9)
Obs	13551	8819	7230	7230	10624
R2	0.161	0.174	0.177	0.177	0.162

All regression models include fixed Effects for years, countries, and industries. Recession Dummy is equal to one for recession year 2008 and 2009. IPR index (0-5) is from Walker Park dataset. Log of GDP and GDP per capita is US\$ come from World Bank. Log of Real Exchange rate is calculated by using nominal effective exchange rate and inflation from World Bank measured for US and country c. Investors Protection Index (1-9), Cost of Import (USD), Enforcing Contracts (Costs of Claims in USD), Paying Taxes (% of total Profit) are from Doing Business Dataset of World Bank. In Model 4 and 5, we include the interaction terms of IPR and two Doing Business variables, Investors Protection Index and Enforcing Contracts. Standard Errors of variables are put in parentheses.

***, **, and * show significance level at the 1%, 5%, and 10% levels.

Table 4.2: Dependent Variable: Share of IFT Imports To EMs

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Recession Dummy	0.0126** (0.00509)	0.0116* (0.00648)	0.00153 (0.00682)	0.00224 (0.00688)	0.00786 (0.00616)
IPR index (0-5)	0.0230*** (0.00568)	0.0337*** (0.0108)	0.00146 (0.0149)	-0.0538 (0.0592)	0.0336 (0.0220)
Log of GDP (in current USD)		-0.0000479 (0.000284)	0.000110 (0.000329)	0.0000943 (0.000330)	0.000116 (0.000269)
Log of Real Exchange Rate (2005 is baseline)		-0.000133 (0.000325)	0.000179 (0.000393)	0.000175 (0.000394)	-0.0000191 (0.000305)
Log of GDP per capita (in current USD)		0.0000984 (0.000223)	0.000209 (0.000351)	0.000220 (0.000356)	
Investors Protection (0-10)			0.0113* (0.00577)	-0.0191 (0.0366)	
Total Taxes (% of profit)			-0.00132 (0.000921)	-0.00121 (0.000958)	
Cost of Import (Fee of a 20-foot container in USD)			0.0000378*** (0.0000142)	0.0000362** (0.0000143)	
Enforcing Contracts (% of claims)			0.00310 (0.00306)	0.00194 (0.00474)	0.00540 (0.00369)
IPR* Investor Protection				0.00964 (0.0115)	
IPR*Enforcing Contracts				0.000294 (0.000942)	-0.0000430 (0.000700)
Constant	0.0503** (0.0242)	-0.00948 (0.0432)	-0.0180 (0.130)	0.154 (0.222)	-0.109 (0.0945)
Obs	12805	8418	6902	6902	10034
R2	0.282	0.304	0.314	0.314	0.287

All regression models include fixed Effects for years, countries, and industries. Recession Dummy is equal to one for recession year 2008 and 2009. IPR index (0-5) is from Walker Park dataset. Log of GDP and GDP per capita is US\$ come from World Bank. Log of Real Exchange rate is calculated by using nominal effective exchange rate and inflation from World Bank measured for US and country c. Investors Protection Index (1-9), Cost of Import (USD), Enforcing Contracts (Costs of Claims in USD), Paying Taxes (% of total Profit) are from Doing Business Dataset of World Bank. In Model 4 and 5, we include the interaction terms of IPR and two Doing Business variables, Investors Protection Index and Enforcing Contracts. Standard Errors of variables are put in parentheses.

***, **, and * show significance level at the 1%, 5%, and 10% level.

Table 4.3: Dependent Variable: Value of ALT Imports To EMs (in Million USD)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Recession Dummy	-22.60 (41.106)	-47.33 (68.45)	-97.62 (76.38)	-92.97 (76.516)	-34.875 (68.837)
IPR index (0-5)	328.327*** (52.188)	614.55*** (91.26)	311.36** (130.165)	792.493* (438.45)	1376*** (212.088)
Log of GDP (in current USD)		-0.54 (2.97)	-1.611 (3.64)	-0.947 (3.65)	-0.359 (2.975)
Log of Real Exchange Rate (2005 is baseline)		1.44 (2.35)	3.386 (3.94)	3.341 (3.943)	0.376 (2.38)
Log of GDP per capita (in current USD)		3.078 (3.371)	1.987 (4.333)	2.636 (4.344)	3.1857 (3.370)
Investors Protection (0-10)			66.3015 (64.788)	34.235 (239.779)	
Total Taxes (% of profit)			-30.733*** (10.231)	-26.385** (10.487)	
Cost of Import (Fee of a 20-foot container in USD)			0.0130 (0.1603)	0.0916 (0.162)	
Enforcing Contracts (% of claims)			-16.979 (34.045)	83.390 (59.544)	131.394*** (43.299)
IPR* Investor Protection				16.410 (71.096)	
IPR*Enforcing Contracts				-26.708** (13.044)	-37.482*** (9.416)
Constant	-792.927*** (196.440)	-1825.62*** (402.921)	1162.4 (1414.11)	-1144.45 (2119.3)	- 4442.20*** (1013.72)
Obs	14583	8850	7230	7230	8850
R2	0.266	0.275	0.286	0.287	0.276

All regression models include fixed Effects for years, countries, and industries. Recession Dummy is equal to one for recession year 2008 and 2009. IPR index (0-5) is from Walker Park dataset. Log of GDP and GDP per capita is US\$ come from World Bank. Log of Real Exchange rate is calculated by using nominal effective exchange rate and inflation from World Bank measured for US and country c. Investors Protection Index (1-9), Cost of Import (USD), Enforcing Contracts (Costs of Claims in USD), Paying Taxes (% of total Profit) are from Doing Business Dataset of World Bank. In Model 4 and 5, we include the interaction terms of IPR and two Doing Business variables, Investors Protection Index and Enforcing Contracts. Standard Errors of variables are put in parentheses.

***, **, and * show significance level at the 1%, 5%, and 10% level.

Comparing between IFT and ALT, I found that IPR index has a more robust impact on the values of ALT imports to EMs. In Table 4.3 shows the result of regressing the values of ALT imports; all coefficients of IPR index are significant at 1% level in Model 1, 2, and 5, and 5% level at Model 3. Controlling for all countries, Doing Business variables, and interaction terms in Model 4, I found that one unit increase in IPR leads to 792.5 Million USD increase in ALT imports to EMs (at the significant level of 10%).

Considering the impact of IPR on both the values IFT and ALT imports, it is interesting to see the positive correlation between IPR index and share of IFT imports to EMs in Table 4.2. At the significance level of 1%, share of IFT imports will increase by 3.3% in correspondence to 1 unit increase in IPR (in model 2). This result contradicts the literature discussed in Chapter 2. As discussed in the Literature Review section, the higher the IPR, the more likely MNEs will choose ALT over IFT as their technologies transfer to subcontractors are less likely to leak out to other parties. While the Model 4's regression does not show statistically significant results, adding interaction terms between IPR and Investors Protection/Enforcing Contract changes the sign of IPR coefficient into negative.

4.1.3. Doing Business Variables and Their Impacts on IFT Imports to EMs

Most of these other Doing Business variables and the interaction terms are not statistically significant. In Table 4.1, the coefficients of Total Taxes shows a positive link to the value IFT imports with 1% increase in taxes percentage out of total profit leads to a decrease of IFT imports to EMs by 18 Million USD. In Table 4.2, Cost of Imports has a statistically significant coefficient at the 1% level. However as the unit measurement of

Cost of Imports variable is minimal (fee of 20-foot container in USD), its impact on the share of IFT imports is negligible. When only including Enforcing Contracts variable in Model 5, the coefficients suggest a positive relationship with IFT imports to EMs on both the level and the share measurement. It is opposite to the theoretical paper of Antras and Helpman on product contractibility and Intra-firm trade. However, it is arguable that the measurement of Enforcing Contracts as percentage of claims does not effectively reflect the definition of product contractibility that Antras and Helpman provided. The interaction terms between Enforcing Contracts and IPR in table 4.1 yields a negative coefficient at 1% significance level, indicating that each unit increase in the IPR index results in a flatter slope of regression line of Enforcing Contracts and values of IFT imports to EMs.

The R2 indicates the goodness of fit of the predicted models. As more variables are added to the regression, observations decrease due to missing values of Real Exchange Rate and Doing Business variables. However, R2 in table 4.1 increases from 16.1% in the baseline regression to around 17% for other models. This means that relatively little of the variation of IFT imports from US's MNEs to EMs can be explained by recession dummies and other variables while controlling for countries, years, and industries. On table 4.2, regressing the share of IFT imports yields a higher R2, around 30% after I add more independent variables to the baseline regression model.

4.2: Regression Results of All Countries Dataset (*Table 4.4, 4.5, & 4.6*)

For the second dataset of all countries, the regressions of the value of IFT and ALT imports do not yield significant coefficients. However, regressing the share of IFT imports in Table 4.5, I found statistically significant coefficients of Recession Dummy,

Investors Protection, and Total Taxes variables. In terms of IFT imports' responsiveness to the global recession, the baseline model of Table 4.4 shows that the share of IFT imports to all countries increase by 0.97 % at the significance level of 10%. Controlling for time-varying country characteristics first and then Doing Business variables, I found that the share of IFT imports increase by around 0.05%, however, all these coefficients are not statistically significant. It is important to note that all these coefficients of IFT imports to all countries are smaller than that of IFT imports to emerging economies (presented in Table 4.2). Thus, the result confirms that IFT imports to EMs are more resilient to the global recession than either IFT imports to all countries or ALT imports.

The IPR index has a statistically significant and positive link to the share of IFT imports (Table 4.5). The baseline regression results suggest that share of IFT imports increase by 4.6% in response to one unit surge in IPR index at the 1% significance level. Controlling for country variables reduced the increase of share of IFT imports to 2.8%. In table 4.6, the results suggest a negative link between IPR index and the values of ALT imports (except the baseline regression). Again, the direction of the relationship is opposite to the expectation.

Regarding the Doing Business variables in table 4.4, coefficients of Investor Protections and Total Taxes have positive sign while those of Costs of Imports and Enforcing Contracts are negative. However all these coefficients are not significant. Table 4.5: Regression of share of IFT imports shows a more meaningful result. The Investor Protection coefficient of model 3 suggests that one unit increase in Strength of Investor Protection index results in 2% decrease in the share of IFT imports at the significant level of 5%. The result is not surprising. MNEs will be more likely to

subcontract with a non-related party in a foreign country whose protection for foreign investors is strong. The coefficient of Total Taxes suggests a minimal increase in share of IFT imports at the significant level of 5%. All other Doing Business variables have insignificant coefficients. At the 10% significance level, the coefficient of Investor Protection suggests that one unit increase in the Strength of Investor Protection Index results in a range of 2.7% - 5% decrease in share of IFT imports. The negative relationship is expected, as MNEs are more likely to choose subcontracting their production process in a foreign country when their investments and rights are safeguarded. Total Taxes have a positive relationship with the share of IFT imports as indicated in the Table 4.5. The R-square of regressions on the second dataset is around 35-40%, thus regression models in this dataset explain more observations than the first one.

Table 4.4: The value of IFT Imports to All Countries (in Millions USD)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Recession Dummy	73.75 (248)	465.14 (480)	108.58 (429)	108.15 (433)	520.47 (501)
IPR index (0-5)	-67.98 (419.72)	-65.04 (567.49)	-1.86 (1,492.96)	-15.83 (461.71)	-80.54 (461.71)
Log of GDP (in current USD)		283.03 (2,038)	311.62 (3,036)	316.25 (3,056)	346.92 (2,134)
Log of GDP per capita (in current USD)		-722.52 (2,236)	-490.81 (3,311)	-496.30 (3,331)	-816.71 (2,329)
Log of Real Exchange Rate (2005 is the base year)		4.23 (10.43)	2.02 (14.64)	2.03 (14.66)	4.31 (10.70)
Investors Protection (0-10)			148.39 (117.67)	5.00 (404.68)	
Total Taxes (% of profit)			1.29 (2.34)	1.05 (2.43)	
Cost of Import (Fee of a 20-foot container in USD)			-0.02 (0.32)	-0.02 (0.32)	
Enforcing Contracts (USD)			-0.50 (14.11)	-0.81 (14.97)	-0.09 (13.27)
IPR* Investor Protection				44.91 (121.25)	
IPR*Enforcing Contracts				-0.19 (2.34)	-0.18 (2.17)
Constant	541.96 (413.97)	-5426.37 (19787.70)	-4457.84 (29713.70)	-4946.33 (29768.90)	-6036.43 (20783.60)
Obs	10702.00	6786.00	5524.00	5524.00	6584.00
R2	0.32	0.39	0.39	0.39	0.39

All regression models include fixed Effects for years, countries, and industries. Recession Dummy is equal to one for recession year 2008 and 2009. IPR index (0-5) is from Walker Park dataset. Log of GDP and GDP per capita is US\$ come from World Bank. Real Exchange rate is calculated by using nominal exchange rate from World Bank and price ratio from the Penn World Table. Investors Protection Index (1-9), Cost of Import (USD), Enforcing Contracts (Costs of Claims in USD), Paying Taxes (% of total Profit) are from Doing Business Dataset of World Bank. In Model 4 and 5, we include the interaction terms of IPR and two Doing Business variables, Investors Protection Index and Enforcing Contracts. Standard Errors of variables are put in parentheses. ***, **, and * show significance level at the 1%, 5%, and 10% level

Table 4.5: Dependent Variable: The share of IFT Imports to All Countries

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Recession Dummy	0.00967* (0.00537)	0.00597 (0.00692)	0.0048 (0.00710)	0.00547 (0.00711)	0.0062 (0.00693)
IPR index (0-5)	0.0468*** (0.00842)	0.0279** (0.0167)	0.0232 (0.0213)	-0.0582 (0.0605)	0.0238 (0.0179)
Log of GDP (in current USD)		0.149*** (0.0782)	0.194** (0.109)	0.222*** (0.110)	0.146** (0.0799)
Log of GDP per capita (in current USD)		-0.275*** (0.0890)	-0.334*** (0.125)	-0.347*** (0.126)	-0.275*** (0.0907)
Log of Real Exchange Rate (2005 is base year)		-0.000243 (0.000383)	-0.000551 (0.000549)	-0.000499 (0.000550)	-0.000230 (0.000384)
Investors Protection (0-10)			-0.0156* (0.00824)	-0.0528* (0.0290)	
Total Taxes (% of profit)			0.0004640** (0.000176)	0.000386** (0.000180)	
Cost of Import (Fee of a 20-foot container in USD)			0.0000375* (0.0000224)	0.0000367 (0.0000224)	
Enforcing Contracts (USD)			-0.000101 (0.00107)	0.000305 (0.00112)	-0.000310 (0.00100)
IPR* Investor Protection				0.0114 (0.00868)	
IPR*Enforcing Contracts				0.000188 (0.000166)	0.000165 (0.000157)
Constant	-0.0602* (0.0317)	-5.104*** (1.284)	-6.118*** (1.799)	-6.036*** (1.806)	-5.098*** (1.314)
Obs	9664	6252	5059	5059	6072
R2	0.352	0.380	0.390	0.390	0.387

All regression models include fixed Effects for years, countries, and industries. Recession Dummy is equal to one for recession year 2008 and 2009. IPR index (0-5) is from Walker Park dataset. Log of GDP and GDP per capita is US\$ come from World Bank. Log of Real Exchange rate is calculated by using nominal effective exchange rate and inflation from World Bank measured for US and country c. Investors Protection Index (1-9), Cost of Import (USD), Enforcing Contracts (Costs of Claims in USD), Paying Taxes (% of total Profit) are from Doing Business Dataset of World Bank. In Model 4 and 5, we include the interaction terms of IPR and two Doing Business variables, Investors Protection Index and Enforcing Contracts. Standard Errors of variables are put in parentheses. ***, **, and * show significance level at the 1%, 5%, and 10% level.

Table 4.6: Value of ALT Imports to All Countries (in Million USD)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>
Recession Dummy	5.981 (61817526.0)	-34.382 (93672991.0)	-37.917 (93993513.0)	-38.912 (94029627.1)	-35.861 (93741582.8)
IPR index (0-5)	195.459** (97261058.7)	-46.935 (225484377.0)	-14.581 (226813709.5)	-89.030 (289126606.4)	-118.669 (283780669.2)
Log of GDP (in current USD)		208.804 (1.04374e+09)	166.215 (1.05232e+09)	293.065 (1.07430e+09)	229.055 (1.04513e+09)
Log of Real Exchange Rate (2005 is baseline)		-4.789 (5156723.7)	-2.227 (5533399.2)	-2.611 (5573595.6)	-5.374 (5230265.6)
Log of GDP per capita (in current USD)		182.184 (1.19091e+09)	-11.045 (1.20466e+09)	-133.997 (1.22470e+09)	179.291 (1.19157e+09)
Investors Protection (0-10)			38.178 (34005982.9)	-0.2564 (72187085.6)	
Total Taxes (% of profit)			0.2918 (3468184.9)	0.5538 (3491690.2)	
Cost of Import (Fee of a 20-foot container in USD)			-0.173 (328705.6)	-0.147 (331534.1)	
Enforcing Contracts (% of claims)			-3.744 (5468941.5)	-8.114 (19733687.1)	-11.266 (19504554.4)
IPR* Investor Protection				9.427 (16079732.7)	
IPR*Enforcing Contracts				1.386 (5790121.0)	2.596 (5714558.2)
Constant	-140.896 (362454864.0)	-5889 (1.71088e+10)	-3719 (1.73107e+10)	-5643 (1.76669e+10)	-6022 (1.71482e+10)
Obs	10702	6786	6786	6786	6786
R2	0.376	0.393	0.393	0.393	0.393

All regression models include fixed Effects for years, countries, and industries. Recession Dummy is equal to one for recession year 2008 and 2009. IPR index (0-5) is from Walker Park dataset. Log of GDP and GDP per capita is US\$ come from World Bank. Real Exchange rate is calculated by using nominal exchange rate from World Bank and price ratio from the Penn World Table. Investors Protection Index (1-9), Cost of Import (USD), Enforcing Contracts (Costs of Claims in USD), Paying Taxes (% of total Profit) are from Doing Business Dataset of World Bank. In Model 4 and 5, we include the interaction terms of IPR and two Doing Business variables, Investors Protection Index and Enforcing Contracts. Standard Errors of variables are put in parentheses. ***, **, and * show significance level at the 1%, 5%, and 10% level.

chapter 5 | Conclusion

As the flow of MNE's investment in emerging countries (EMs) keeps rising, it is important to learn more about the trade patterns to these countries and the country characteristics of doing business that play an important role. The choice of entry mode made by MNEs also account for a big difference in the effectiveness of foreign investment in an EM. Some developing countries promote joint ventures and licensing (Arm's Length Trade) through their trade policies with the aim of maximizing technology transfer. However, compared to ALT, intra-firm trade (IFT) is more beneficial to the development as IFT can lead to a significant improvement on infrastructure and better training of the labor force hired by foreign investors. Even though the technology spillover is not apparent, these investments in labor skills and infrastructure via IFT have a significant impact on the economic growth in the long run. As a result, understanding more about IFT can assist implementing more efficient trade policies. It also helps preventing protectionism which stems out of fear that allowing multinational enterprises to establish wholly owned subsidiaries may prevent domestic companies to compete or break into some industries.

The primary purpose of the study is to assess the responsiveness of IFT from US' MNEs to EMs during the recession year using fixed effects of countries, industries, and times. The second purpose is to assess the impact of IPR and some Doing Business variables on IFT imports. To do that, I work with two data sets, one covers 43 Emerging Markets Economies and the others All Countries that US has trade relationship with. The major contributions of my study are three-fold. *First*, the share of IFT imports out of total

Imports increase during recession years while its values decrease as expected. The result confirms that IFT is more resilient than ALT in response to the Global Recession. The magnitude of increase in share of IFT imports during recession years to exclusively emerging countries (1.2%) is higher than that of IFT to all countries (0.9%). *Second*, IPR is positively linked to IFT imports to emerging countries on both the value and share level. The results contradict previous studies that the higher the IPR index, the more likely MNEs choose ALT instead of IFT. It is also important to note that the coefficient of IPR index is statistically significant only in regressions of share of IFT imports. This shows that a strong intellectual property protection in an emerging country is not compelling enough for MNEs to choose ALT instead of IFT. In other words, to promote ALT from MNEs in order for higher level of technology spillover to occur, EMs have to improve all aspects of their business environments, not just IPR index. *Third*, most of Doing Business variables are not significant. In case of statistically meaningful result, the coefficients are very small, suggesting minimal impact on IFT imports.

Despite these contributions, there are some limitations of the study to address. *First*, the dataset of US Census Bureau on Related Parties Trade provides a broad cover of trade values from all countries and industries. However, the strict definition of intra-firm trade is slightly different than related-parties trade in terms of percentage of ownership and relationships between foreign affiliates and headquarters. It is because of the scarcity of disaggregated data on the firm-transaction level. *Second*, Enforcing Contract variable does not reflect the definition of the Product Contractibility according to Antras and Helpman (2009). The Doing Business website vaguely describes the Enforcing Contract's measurement as percentage of claims while Product

Contractibility's definition refers to be more specific to the nature of products. Some studies have attempted to measure the level of Product Contractibility based on the Input-Output Matrix Table and other sources that I do not have access to.

In summary, the study indicates some interesting patterns of Intra-firm trade to Emerging Markets and their responses to macroeconomic shocks and other country-level determinants. Hopefully, it will sparks more interest on the matter, leading to more investigation and analysis of a higher disaggregated dataset.

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Appendix

1. List of Emerging Market Economies:

Algeria, Argentina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Dominican Republic, Ecuador, Egypt, ~~Salvador~~, Estonia, Guatemala, Hungary, India, ~~Indonesia~~, ~~Jamaica~~, Kazakhstan, ~~Korea~~, Lebanon, Lithuania, Malaysia, Mexico, Morocco, Pakistan, Panama, Peru, Philippines, Poland, Romania, ~~Russia~~, South Africa, Sri Lanka, ~~Thailand~~, Turkey.

2. Top Ten Intra-firm Trade Partners with the US

(Source: US Census Bureau)

<i>Top Ten IFT-Imports Countries</i>	<i>Total Imports (in value)</i>	<i>% of Total Imports</i>	<i>IFT imports (in value)</i>	<i>Share of IFT Imports</i>
Canada	316396.5	14.46747	162045.3	51.21589
Mexico	262671	12.01083	155712.5	59.28045
China	398466.8	18.2202	111598.7	28.00702
Japan	127901.2	5.848377	97788.93	76.45664
Germany	96539.24	4.41433	65755.65	68.11287
Ireland	39071.8	1.786588	34592.57	88.53592
Saudi Arabia	45129.62	2.063586	33850.27	75.00678
Korea, South	56006.03	2.560918	33724.82	60.21642
United Kingdom	51044.82	2.334063	28154.45	55.15634
France	39596.21	1.810567	20559.13	51.92197

<i>Top Ten IFT - Exports Countries</i>	<i>Total Export (in values)</i>	<i>% of Total Export</i>	<i>IFT exports (in value)</i>	<i>Share of IFT Exports</i>
Canada	233,774	15.8	98,098	42.0
Mexico	159,910	10.8	60,515	37.8
Japan	61,409	4.1	18,673	30.4
Netherlands	38,254	2.6	17,088	44.7
China	96,898	6.5	15,325	15.8
Germany	44,240	3.0	15,187	34.3
United Kingdom	49,984	3.4	13,657	27.3
Singapore	28,224	1.9	12,290	43.5
Belgium	25,881	1.7	11,390	44.0
Brazil	37,275	2.5	9,170	24.6

3. Calculation of Natural Log of Real Exchange Rate

The natural log of real exchange rate (e_c) is calculated from the log of effective exchange rate (E_c) adjusted for inflation of US and country c. As the real exchange rate of a foreign currency in terms of US dollars is: $e_c = E_c * P_c / P_{us}$

By taking the natural log for two sides of the equations, we can derive the natural log of real exchange rate as: $\text{Log } e_c = \text{Log } E_c + \Pi_c - \Pi_{us}$.