International Trade and Foreign Direct Investment: Complements or Substitutes?

An Empirical Investigation

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DECLARATION

I declare that the thesis entitled **"International Trade and Foreign Direct Investment: Complements or Substitutes? An Empirical Investigation"** submitted by me for the award of the degree of **Doctor of Philosophy** of Jawaharlal Nehru University is my own work. The thesis has not been submitted for any other degree of this University or any other university.

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CERTIFICATE

We recommend that this thesis be placed before the examiners for evaluation.

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List of Abbreviations

ASEAN	Association of Southeast Asian Nations
I-O	Industrial Organization
LDCs	Least Developing Countries
NE	National Enterprise
OECD	Organization for Cooperation and Economic Development
SUR	Seemingly Unrelated Regression
2SLS	Two-Stage Least Squares
ASI	Annual Survey of Industries
BIPA	Bilateral Investment Promotion and Protection Agreement
CECA	Comprehensive Economic Cooperation Agreement
CEPA	Comprehensive Economic Partnership Agreement
CES	Constant Elasticity of Substitution
CMIE	Centre For Monitoring Indian Economy Pvt. Ltd
CSD	Cross-Sectional Dependence
DGFT	Directorate General of Foreign Trade
DIPP	Department of Industrial Policy and Promotion
DWH	Durbin-Wu-Hausman
EDI	Electronic Data Interchange
EOUs	Export Oriented Units
EPCG	Export Promotion Capital Goods
EPZ	Export Processing Zone
EXIM	Export-Import
FDI	Foreign Direct Investment
FE	Fixed Effects
FE-2SLS IV	Fixed-Effect 2-Stage Least Square Instrument Variable
FEMA	Foreign Exchange Management Act
FERA	Foreign Exchange Regulation Act
FEVD	Fixed Effects Vector Decomposition
FGLS	Feasible Generalized Least Squares

FIFP	Foreign Investment Facilitation Portal
FIPB	Foreign Investment Promotion Board
FTA	Free Trade Agreement
FTP	Foreign Trade Policy
GATT	General Agreement On Tariffs And Trade
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GMM	Generalized Method Of Moments
GNP	Gross National Product
GVA	Gross Value Added
H-O	Heckscher-Ohlin
HOS	Heckscher-Ohlin-Samuelson
IIP	Index Of Industrial Production
ISIC	International Standard Industrial Classification
IV	Instrumental Variable
JV	Joint Venture
MAI	Market Access Initiative
MEIS	Merchandise Exports from India Scheme
MEP	Minimum Export Price
MFN	Most Favored Nation
MIGA	Multilateral Investment Guarantee Agency
MNE	Multinational Enterprise
MOSPI	Ministry of Statistics and Programme Implementation
MRTP	Monopolies and Restrictive Trade Practices
NIC	National Industrial Classification
NIMZ	National Investment And Manufacturing Zones
NMP	National Manufacturing Policy
NRIs	Non-Resident Indians
OCB	Overseas Corporate Bodies
ODI	Overseas Direct Investment
OGL	Open General Licensing

OLS	Ordinary Least Squares
PCSE	Panel Corrected Standard Errors
PLC	Product Life Cycle
PPML	Poisson Pseudo-Maximum Likelihood
PTA	Preferential Trade Agreement
RBI	Reserve Bank Of India
RE	Random Effects
RMS	Risk Management System
SEIS	Services Exports from India Scheme
SEZ	Special Economic Zone
SOP	Standard Operating Procedures
TSCS	Time Series Cross Section
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
WDI	World Development Indicators
WGI	Worldwide Governance Indicators
WITS	World Integrated Trade Solution
WOS	Wholly Owned Subsidiary
WPI	Wholesale Price Index
WTO	World Trade Organization

Chapter 1

Introduction

1.1 Background

Since the end of the Second World War, the world economy has witnessed an accelerated pace of globalization. The relationship between international trade and foreign direct investment (FDI) is at the center of the multifaceted and multidimensional issues of the globalization process which have led to a fundamental transformation in the structure of international trade (Fontagne, 1999).

First, since 1980s the annual global FDI flows have risen substantially bringing out ascent in its relative importance as a "source of investment funds for a number of countries" (Blackhurst and Otten, 1996). The flow of FDI has risen from US$ 54.40 billion in 1980 to US$ 1.43 trillion in 2017 (UNCTAD, 2018a). Studies have suggested that the growth of world FDI flows has been faster than both world trade and world output (Mallampally and Sauvant, 1999; Blonigen, 2005). The rapid growth of FDI and the associated restructuring of businesses has transformed the manner in which production process and economic activities are conducted across international borders (Fontagne, 1999).

Second, trade is increasingly being conducted by Multinational Enterprises (MNEs)[1] in the form of intra-firm trade at the global level. As noted by Blackhurst and Otten (1996), about 33 percent of world trade takes place in the form of intra-firm trade among MNEs. The remaining two-third takes place either in the form of exports by MNEs to non-affiliates (about one-third of total world trade) or in the form of trade among non-MNE national firms (another one-third of total world trade). The organization of multinational firms has also dramatically changed with the rise of global value chains which have further intensified the significance of intra-firm trade flows (Fontagne, 1999).

Third, estimates indicate that the value of sales of foreign affiliates of multinational enterprises is higher than the value of world trade in goods and services (Dunning, 2009). A study by

[1] Multinational Enterprises (MNEs) are the key economic agents that carry out Foreign Direct Investment (FDI). The terms "MNEs" and "FDI" are typically used indistinctly, which is also the case in the present thesis.

UNCTAD (1997) documented that the sales of MNEs foreign affiliates, in the mid-1990s, surpassed the value of world trade by 27 percent.

The growing globalization of production process associated with an surge in flows of foreign investment and the rise in growth and prominence of MNEs has drawn attention to the relationship between trade and FDI. As described by Rosa Forte (2004), "this relationship is relatively complex since FDI supplies one of the means through which an MNE assures control over international production and, in order to assure that control, the transfer of capital resources is just one part of a wider package". Hence, it is reasonable to believe that FDI can complement or substitute international trade.[2]

Theoretically, the explanatory approaches of FDI, namely the "internalization theory" and "Dunning's eclectic paradigm theory", and general equilibrium models of trade that integrate horizontal MNEs[3] (Hortsman and Markusen, 1992; Brainard, 1993) suggest the existence of a substitution relationship between trade and FDI. In contrast, the general equilibrium models of trade that integrate vertical MNEs[4] (Helpman, 1984; Markusen, 1984; Helpman and Krugman, 1985) suggest the existence of a complementary relationship (Forte, 2004). More recently, there has been emergence of trade models that embed both types of MNEs, designated as the "knowledge capital model" (Markusen et al., 1996; Markusen, 2000; Carr et al., 2001), which support both the relationship types.

However, we cannot determine theoretically whether trade and FDI are complements or substitutes. The nature of the relationship is basically an empirical issue. There could be unobserved factors such as size of host countries, income of host countries, tariffs, proximity and transport costs and organization of firm activity that could influence outcomes (Fontagne, 1999). Moreover, FDI has large and dynamic effects in the host nation, for example, spurring competition, expanding efficiency, enhancing savings and capital formation which are vital and can impact the level of a country's exports and imports and their respective product composition (Blackhurst and Otten, 1996). The relationship between trade and FDI is therefore markedly

[2] In a quantitative sense, trade and FDI are complements when an increase in level of FDI flows increases the trade volume. Similarly, trade and FDI are substitutes when an increase in level of FDI flows decreases the trade volume.
[3] Markusen and Maksus (2003) define horizontal MNEs as "firms that replicate roughly the same activities in many locations".
[4] Markusen and Maksus (2003) define vertical MNEs as "firms that geographically fragment the production process into stages, typically on the basis of factor intensities".

more complicated than what is often advocated. Most of the existing empirical work on this topic suggests a complementary relationship, particularly between exports and FDI (Lipsey and Weiss, 1981 and 1984; Grubert and Mutti, 1991; Clausing, 2000).

Despite theoretical and empirical work on this topic, the impact of FDI on trade still remains debated. The key question is whether trade and FDI are two alternative or complementary ways of servicing the foreign market? Are trade and FDI two sides of the same coin?

This is an important issue as the process of globalization entails key roles played by both trade and FDI and is dependent upon their continual interaction. Studying the trade-FDI relationship can enable a better comprehension of the internationalization process and its probable impact on the economies, of both the host and home country (Liu, 2013). This topic has been of interest to academia, researchers and policymakers for many years now. The importance of understanding this relationship was even underscored at the Singapore Ministerial Conference, World Trade Organization (1996).[5] It was recognized that while the impact of trade policy changes on trade patterns is seen over the medium term, changes in flows of capital usually have instant consequences for year-to-year trade developments. The WTO annual report on trade and investment concluded investment to be generally supportive or complementary to trade (WTO, 1998a).

Given the growing inseparability of economic developments and formulation of policies in these two areas, Blackhurst and Otten (1996) emphasize that "it is not surprising that many of the current issues arising out of the interlinkages between trade and FDI have to do with policy coherence". Countries are now faced with a policy choice- do they treat FDI policy as they have till now or should they integrate it in arrangements under an overall comprehensive framework that acknowledges the inter-linkage between trade and FDI?

[5] During the Singapore Ministerial Conference in 1996, a Working Group was established to examine the relationship between trade and investment. This group had a four-point agenda: (i) the implications on development and economic growth of the relationship between trade and FDI; (ii) the economic relationship between trade and FDI; (iii) existing international trade and FDI arrangements and initiatives; and (iv) issues relevant to future initiatives (Fontagne, 1999). The Working Group submitted its report in 1998 (WTO, 1998b).

This chapter is organized as follows. Section 1.2 discusses the research context and objective of the study. Section 1.3 outlines the approach to the study. Section 1.4 presents the structure of the thesis.

1.2 Research Context and Objective of the Study

One of the most prominent characteristics of the global economy in recent decades has been the expansion in FDI flows to and from developing countries which has underpinned the remarkable expansion of MNEs production process internationally. The share of developing countries in total FDI inflows has risen from 26 percent in 1980 to 47 percent in 2017 and their share in total FDI outflows has risen from 3 percent in 1980 to 29 percent in 2017 (UNCTADStat, 2018). While MNEs located in developed countries continue to remain the primary source of FDI, investment flows from developing countries have increased dramatically since the mid-1980s (Mallampally and Sauvant, 1999).

The significance of FDI for developing countries is not only in terms of an important source of private external finance, but also as a medium of "transferring production technology, skills, innovative capacity, and organizational and managerial practices between locations, as well as of accessing international marketing networks" (Mallampally and Sauvant, 1999). Foreign investment has the potential to enhance capital formation and supplement investible resources in the developing host country (Mallampally and Sauvant, 1999). The growing role and significance of FDI and recognition of the enormous benefits associated with it have been accompanied by a sea change of outlook of developing countries towards FDI. Till the 1970s, developing countries were generally hostile towards FDI and sought to control MNEs activities through domestic regulations. However, during the last two decades, this has changed considerably into a more cooperative and welcoming policy towards FDI (Eden and Lenway, 2001).

India, one of the world's fastest-growing developing economies, has made significant progress in creating a policy environment to encourage inward flows of FDI and facilitate outward flows of investment (OECD, 2009). This advancement has been a fundamental component of the package of market-oriented economic reforms that India undertook to deepen its integration with the world in the early 1990s. Domestic industry was freed from licensing and other state controls and the external sector was opened up to let in foreign capital and other resources. Together, these policy reforms led to a significant improvement in the 'investment climate' making India one of the leading foreign investment destinations. As per UNCTAD's World Investment Report 2018, India is the tenth-most attractive destination for FDI globally. In terms of developing countries, it is ranked fifth (after China, Hong Kong, Brazil and Singapore). Apart from being an important destination for inward FDI flows, outflows from India have also been increasing.

India has also pursued several trade policy reforms to become a major player in world trade. Most Favored Nation (MFN) tariff rates have been lowered, tariff and quota regimes have been simplified and rationalized, quantitative restrictions have been eliminated and several import restrictions have been removed (Singh, 2017). The share of India in global merchandise exports has increased from 0.6 percent in early 1990s to 1.7 percent in 2018. India's share in global merchandise imports has also increased from 0.6 percent to 2.3 percent in the same time period (World Bank, 2018a).

Over the last few years, India has undoubtedly benefitted from the globalization process depending to a major extent on trade and FDI as its core engine for economic growth and development. As India continues to liberalize its policies in order to deepen its engagement with the world economy, it is imperative to examine the inter-linkages between trade and FDI. The relationship between trade and FDI constitute an important aspect of India's internationalization process and has implications for both policymakers and MNEs.

The importance of FDI and its impact on the host economy has attracted substantial academic interest until now. There is a fairly comprehensive literature on the general topic of the economics of foreign investment (Markusen, 1995; Blomstrom and Kokko, 1998; Hanson, 2001; Alfaro and Rodríguez-Clare, 2004; Gorg and Greenaway, 2004; Lipsey, 2004; Caves, 2007; Alfaro et al., 2009; Yeaple, 2013; Antràs and Yeaple, 2014; Alfaro, 2015; Alfaro and Chen, 2016). However, the most interesting and relevant aspect of FDI is its inter-linkages with trade which remains a rather less explored area, especially in the context of India. Owing to limited data availability on FDI and activities of MNEs most of the empirical work on this topic has been undertaken for developed countries such as the United States, Sweden and Japan (Swedenborg, 1979 and 1982; Lipsey and Weiss, 1981 and 1984; Grubert and Mutti, 1991; Clausing, 2000; Head and Ries, 2003). Moreover, examining the trade and FDI relationship empirically requires dealing with the potential issue of simultaneity, reverse causality and endogeneity. Most of the studies have relied on usual panel data estimation techniques and have not paid much attention to the possible issue of endogeneity. In the case of India, majority of the existing empirical studies have tried to establish causation only wherein they try to determine whether FDI inflows cause exports to be larger than what they would otherwise be or if growing exports attract increased flows of FDI (Dash and Sharma, 2010; Cho, 2013; Dash and Parida, 2013; Sharma and Kaur, 2013; Pant and Srivastava, 2015; Babu, 2018). However, there is limited literature that has examined whether an increase in trade/FDI is systematically related to an increase or decrease in FDI/trade. This is an important aspect of the inter-linkage between international trade and foreign direct investment that has been neglected in the literature so far.

It is in this context that this thesis attempts to address this gap in the literature by empirically investigating the relationship between trade and FDI for India. In particular, we seek to answer whether trade and FDI are complements or substitutes in the case of India.

1.3 Approach to the Study

Empirical investigation of the relationship between trade and FDI for India is at the core of the thesis. We conduct the empirical investigation in a systematic manner. First, the relationship is examined using aggregate data at the country-level for India and its 15 major trading partners for the period 2000 to 2016. We augment the new-trade theory specification of gravity model developed by Helpman (1987) and Bergstrand (1990) to include the important role that activities of MNEs (proxied by FDI) can play in affecting trade flows for India. We also analyze if there has been a change in the determinants of trade for India and examine the empirical validity of the Linder hypothesis for India’s trade with its 15 major trading partners. In order to address the potential issue of endogeneity that may arise while examining the relationship between trade and FDI, we utilize Fixed-Effect 2-Stage Least Square Instrument Variable (FE-2SLS IV) method of estimation to obtain the empirical results. We instrument FDI using the institutional distance between host and home country and value of last year’s FDI. To the best of our knowledge, this is the first time this technique has been employed to analyze the relationship between trade and FDI for India.

Second, in order to provide a comprehensive analysis, we further examine the relationship between trade and FDI using disaggregated data at the industry-level for the Indian manufacturing sector. In addition to FDI, we have also attempted to understand the important role of industry heterogeneity in determining industry-level trade flows for the manufacturing sector. For the analysis, the study has attempted to develop a harmonized database covering disaggregated industry-level information on trade flows, investment flows and industry characteristics for 10 selected manufacturing industries that have received a cumulative share of 75 percent of inward FDI in the Indian manufacturing sector over the period 2000-01 to 2014-15. To the best of our knowledge, this is one of the very few studies that has developed and utilized such a harmonized database for examining the relationship between trade and investment for the Indian manufacturing sector. Industry-level trade flows are modeled as a function of industry characteristics such as size of the industry, wages paid to all employees in the industry, labor productivity, capital intensity, skill intensity, economies of scale and inward FDI received by the industry. We use the Prais-Winsten regression with Panel Corrected Standard Errors (PCSE) to estimate our model and obtain the empirical results.

To the best of our knowledge, this is one of the very few, if not the only, contribution to the literature on the relationship between trade and FDI for India that has been conducted in a systematic and comprehensive manner undertaking analysis both at the country- as well as the industry-level. The main contribution of this thesis to the existing literature comes from the empirical methodology used in the aggregate country-level analysis and the comprehensive and harmonized dataset constructed for the disaggregated industry-level empirical analysis. Both the country- as well as industry-level of analyses has its own strengths and shortcomings and provide us different, yet valuable, insights into the relationship between trade and FDI. Our research stresses upon the importance of consolidating the two perspectives together in order to understand the dynamics of the trade-FDI relationship in a better manner.

1.4 Structure of the Thesis

The thesis is organized as follows. In chapter 2 we briefly review the evolution and liberalization of India's trade and foreign investment policies. We also discuss the objectives and underlying institutional framework of the trade and foreign investment policies. The broad objective of this chapter is to understand whether these two policies have evolved separately or are inter-linked.

Chapter 3 presents a review of the existing theoretical and empirical literature on this topic and helps us identify the gaps in the existing literature. Chapter 4 examines the relationship between trade and FDI using aggregate data at the country-level for India and its 15 major trading partners for the period 2000 to 2016. This chapter discusses the theoretical specification and application of the gravity model to our analysis and describes the model specification, dataset construction and definition of variables used. This is followed by a detailed discussion on the methodology and estimation technique adopted and analysis of the results. Chapter 5 examines the relationship between trade and FDI using disaggregated data at the industry-level for the Indian manufacturing sector. The chapter discusses the model specification, steps involved in constructing the harmonized and unique dataset covering disaggregated industry-level information on trade flows, investment flows and industry characteristics for 10 selected manufacturing industries that have received a cumulative share of 75 percent of inward FDI in Indian manufacturing sector over the period 2000-01 to 2014-15. We also analyze some key trends in India's manufacturing sector with a special focus on the 10 selected industries. This is followed by a detailed discussion on the methodology and estimation technique adopted and analysis of the results. Finally, chapter 6 concludes the thesis by providing a summary of the main findings and discussing the main policy implications emanating from our research. This chapter also discusses some of the limitations of the study along with suggestions for future research on this topic.

Chapter 2

India's Trade and Foreign Investment Policies

2.1 Introduction

Until the early 1990s, India's economy was largely closed with "one of the most complicated and protectionist regimes in the world" (IMF, 1998). The average import-weighted tariffs exceeded 80 percent, quantitative restrictions were imposed on over 90 percent of tradable goods and FDI was subjected to stringent limits (Chadha et al., 2003; Alessandrini et al., 2009). As part of the economic reforms package that India undertook in 1991 to deepen its integration with the world economy, the country witnessed a major liberalization of its trade and investment policy regimes. India's applied most favored nation import tariffs (simple average) have come down from 84.11 percent in 1990 to just 13.72 percent in 2016. India's applied most favored nation import tariffs (trade-weighted average) have also declined from 56.56 percent in 1990 to 7.57 percent in 2016 (World Bank, 2018b). As part of India's engagement with the World Trade Organization (WTO), quantitative restrictions on imports have been phased out and majority of the tariff lines (over 70 percent) have been bound under WTO. To attract higher levels of FDI, the Government of India has put in place a liberal policy on FDI which allows up to 100 percent foreign direct investment, under the automatic route, in most sectors/activities (DIPP, 2017).[6] Since 1992, the government has allowed Foreign Institutional Investors to undertake investment in the country. During the mid-1990s, the Indian rupee was also made convertible in the current account. The capital account is being opened up progressively including a gradual liberalization of the regulations outward FDI from India. All these economic reforms pursued by India in the last few years have resulted in "industrial restructuring" with emphasis on increasing competitiveness of the domestic industry and deepening global economic integration with the world (Kumar, 2014).

Trade and foreign investment policies have played and continue to play a vital role in deepening India's engagement and integration with the global economy. In this chapter, we will briefly review the evolution and liberalization of India's trade and foreign investment policies. We will also discuss the objectives and underlying institutional framework of the trade and foreign

[6] Sectoral ownership limits apply in service sectors.

investment policies. The broad objective of this chapter is to understand whether these two policies have evolved separately or are inter-linked.

This chapter is organized as follows. Section 2.2 discusses the trade policy. Section 2.3 discusses the foreign investment policy. Section 2.4 concludes the chapter by discussing whether the trade and investment policies are interlinked.

2.2 Trade Policy

2.2.1 Evolution of India's Trade Policy

Prior to the economic reforms, India's trade policy was defined by high tariff protection and quantitative import controls. Though India has had a long history of high tariff protection, it was in May 1940 when quantitative import controls were introduced for the first time to preserve foreign exchange and shipping at the time of the Second World War (Bhagwati and Desai, 1970). Beginning 1947, managing the balance of payments turned out to be the key worry for India. As a response to this, Panagariya (2004) mentions that "the government introduced explicit restrictions on the rate at which foreign exchange could be run down". Since then till 1951 when the First Five Year Plan was introduced, India's trade policy wavered between strict controls and liberalization. During the time-period of India's First Five Year Plan, the country witnessed "progressive liberalization" (Panagariya, 2004).

However, from the mid-1950s, there was a major reversal of this liberalization and India moved towards protectionism and resorted to comprehensive import controls. This shift was prompted by the foreign exchange crisis of 1956. Panagriya (2004) notes that during this period "quantitative restrictions on imports, industrial licensing and foreign exchange controls were progressively tightened and expanded". The import of manufactured consumer goods was entirely banned. While the import of some list of goods under the category of raw materials, intermediates and capital goods was permitted without any restrictions, for most goods whose indigenous alternatives were being manufactured, imports were allowed only with licenses. The process of issuance of licenses was crippled with delays and corruption. The criterion for granting of licenses was also not transparent (Ahluwalia, 2002). The intent of the restrictive import policy was virtually to eliminate "consumer goods imports" and replace them with domestically-produced goods (or to prevent their consumption in the case of items classified as luxury goods).

Starting in 1976, the Indian Government put in place a system whereby goods that were not produced domestically were put on an "Open General Licensing" (OGL) list. This system was based on a positive-list approach which meant that if an item was not on the OGL list its import needed a license from the Ministry of Commerce (Panagariya, 2004).[7] Initially, there were only 79 capital goods on the OGL list but by April 1988 the list comprised of 949 intermediate inputs and 1,170 capital goods items. By April 1990, thirty percent of India's total imports were accounted for by OGL imports (Pursell, 1992). Consumer goods were by and large on the banned list except those that were deemed to be "essential". The import of essential consumer goods and other products such as petroleum products and important minerals continued to remain the monopoly of the government "canalizing" agencies specially established for this purpose.

The evolution of India's trade liberalization policies since then have been embodied by two policy approaches that the Indian government had been following since the 1980s. First is the "pro-business" approach pursued in the 1980s and second is the "pro-market" approach pursued in the 1990s (Rodrik and Subramanian, 2004; Kohli, 2006a and 2006b; Alessandrini et al., 2009). These two approaches assigned contradictory roles to foreign trade. While the former pro-business approach targeted at strengthening the domestic industry through a rise in its profitability and productivity under state protection from competition from foreign imports, the latter pro-market approach prioritized international trade, increasingly opening up the Indian economy and exposing the national domestic firms to global competition.[8] The attitudinal shift in the government from a pro-business to a pro-market one paved the path for full trade liberalization.

[7] Inclusion in the OGL list did not necessarily imply that the good could be imported freely as the importer applying for the license would normally have to be the actual user and in the case of machinery imports could be subjected to clearance from the industrial licensing authority if the sector in which the machinery was to be used was subject to industrial licensing (Panagariya, 2004).

[8] Some examples of pro-business policies which took place in 1980s are easing restrictions on capacity expansion for incumbents, removing price controls, and reducing corporate taxes. The most standard example of market-oriented policy is trade liberalization which did not take place in any substantial form until the 1990s (Alessandrini et al., 2009).

The pro-market strategy was encapsulated by the "New Industrial Policy" ratified in July 1991. Trade liberalization policies in India have generally been in tandem with the industrial policies followed over the years (Banga and Das, 2012). With the purpose of facilitating imports and boosting exports, the Government of India, in April 1992, formulated the first Export-Import (EXIM) Policy for a period of 5 years. According to Panagariya (2004), the main purpose of the government's new economic policy was to liberalize foreign trade and deregulate the domestic industry. To liberalize trade, the trade policy reduced the role of export and import control systems, the system of import licensing was demolished on nearly all intermediate inputs and capital goods[9], tariff rates were lowered, Rupee was devalued against the Dollar, a dual exchange rate was introduced[10] (Hasan et al., 2003; Alessandrini et al., 2009). In order to deregulate industry, the system of industrial licensing was mostly rescinded, the monopoly of the public sector was limited to only a few strategic activities, limits on foreign direct investment were raised and special economic zones were created (Alessandrini et al., 2009). Since then the Indian government through successive foreign trade policies has continued to liberalize its trade regime.

India has been an original member of the General Agreement on Tariffs and Trade (GATT) since 8 July 1948 and World Trade Organization (WTO) since 1 January 1995 and provides Most Favored Nation (MFN) treatment to all WTO members and other trading partners. Multiple rounds of trade liberalization under the ambit of GATT and WTO have resulted in the reduction of MFN tariffs, simplification and rationalization of tariff and quota regimes and elimination of numerous import restrictions (Singh, 2017). On April 2001, India eliminated all quantitative restrictions that were preserved earlier on account of concerns related to the balance of payment[11]. Since 2002, India's use of anti-dumping and countervailing measures has declined. The Indian government has tried to harmonize national standards with international norms (WTO Trade Policy Review, 2007). While on one hand barriers to imports have been lowered, on the other hand the government has launched several schemes to boost exports from India such as Export Promotion Capital Goods (EPCG) scheme, Market Access Initiative (MAI) scheme,

[9] Apart from goods in the negative list, all goods could be imported without licenses (Goldar, 2002)

[10] In February 1992, the Indian government introduced a dual exchange rate system that allowed exporters to sell 60 percent of their foreign exchange in the free market and 40 percent at a lower official price to the government. Importers were allowed to buy foreign exchange at a higher price in the open market (Panagariya, 2008).

[11] India maintains quantitative restrictions only on items permissible under Article XX and XXI of GATT which are necessary for reasons related to security, health, safety, environment and public morals permissible under (WTO Trade Policy Review, 2007).

sectoral initiatives in the agricultural and village industries, handicrafts, leather and footwear, gems and jewelry and schemes for Export Oriented Units (EOUs), free trade zones, technology parks and Special Economic Zones (SEZs) amongst others (Department of Commerce, 2017a).

Overall, the trade liberalization reforms that commenced in the 1990s have succeeded in progressively opening up India's economy over the years. India's applied most favored nation import tariffs (simple average) reduced to half from 84.11 percent in 1990 to 36.56 percent in 2000 and have further declined to 13.72 percent in 2016. India's applied most favored nation import tariffs (trade-weighted average) have also halved from 56.56 percent in 1990 to 23.36 percent in 2000 and further reduced to 7.57 percent in 2016 (World Bank, 2018b). India's trade openness (defined as the ratio of total trade to gross domestic product) has improved significantly over the last few years. The ratio has doubled from 16 percent in 1990 to 27 percent in 2000 and up to 40 percent in 2016 (World Bank, 2018b). The trade reforms pursued by the Indian government have also led to an expansion of trade flows. From exports of US$ 18 billion and imports worth US$ 24 billion in 1990-91, India's total trade with the world increased to US$ 768.9 billion in 2017-18. India's major trading partners include Australia, Belgium, China, Germany, Hong Kong, Indonesia, Japan, Korea, Saudi Arabia, Singapore, South Africa, Switzerland, United Arab Emirates, United Kingdom and United States of America. The average growth rates of India's exports and imports were around 8 percent during the 1990s and have steadily increased to an average of 14 percent in the period of 2000-01 to 2017-18 (RBI Handbook of Statistics on Indian Economy, 2017-18). In 2017-18, India's top 5 exports at HS-2 classification of items included pearl, precious and semi-precious stones; mineral fuels and oils; petroleum products; nuclear reactors, boilers, machinery and mechanical appliances; vehicles; and organic chemicals. In the same year, India's top 5 imports at HS-2 classification of items included mineral fuels and oils; pearl, precious and semi-precious stones; electrical machinery and equipment; nuclear reactors, boilers and machinery and mechanical appliances and organic chemicals (DGFT, 2018a). The share of India in global merchandise exports has increased from 0.6 percent in early 1990s to 1.7 percent in 2018. India's share in global merchandise imports has also increased from 0.6 percent to 2.3 percent during the same period (World Bank, 2018a).

2.2.2 India's Foreign Trade Policy- Objectives and Institutional Framework

The objectives of India's trade policy are laid down in its "Foreign Trade Policy" (FTP) which is brought out every 5 years and revised occasionally to take internal and external factors into account. India's FTP is formulated, implemented and monitored by the Department of Commerce, Ministry of Commerce and Industry, Government of India, with support from various other ministries and agencies, such as the Ministry of Finance, Ministry of Agriculture and Farmer's Welfare, Ministry of Consumer Affairs, Food and Public Distribution, Ministry of Textiles and the Reserve Bank of India (WTO Trade Policy Review, 2015). It is administered by the Foreign Trade (Development and Regulation) Act, 1992. The key objective of the Foreign Trade (Development and Regulation) Act is "to provide for the development and regulation of foreign trade by facilitating imports into and augmenting exports from India".

The Directorate General of Foreign Trade (DGFT), attached to the Department of Commerce, is closely involved in the "regulation and promotion of foreign trade". In alignment with the objective of increasing Indian exports, the role of DGFT has advanced from the controller of exports and imports to "facilitator" of foreign trade (DGFT, 2018b).

Foreign trade policy has always been considered by India as a tool for achieving its overall economic policy goals of self-sufficiency, economic development and growth. While increasing exports have continued to be a key focus of all recent foreign trade policies, the importance of facilitating imports has also been acknowledged in the trade policies. The trade policies have recognized the importance of aiding imports that are necessary to stimulate the economy and have often called for streamlining and rationalization of import procedures, reducing the barriers to imports, as well as uniformity and coherence between trade and other economic policies (WTO Trade Policy Review, 2011).

The objective of India's most recent Foreign Trade Policy (2015-20) is to transform India into a major participant in global trade and increase its share in world exports to 3.5 percent by 2020.[12] The government hopes to accomplish this objective by furnishing a viable, balanced and steady policy environment for international trade; associating the trade guidelines, incentives and processes with other new initiatives such as "Make in India", "Digital India" and "Skill India";

[12] As per World Bank (2018a), India's share in global merchandise exports is 1.7 percent.

endorsing the diversification of exports from India by supporting important sectors in raising their competitiveness and building a framework for India's external engagement (WTO Trade Policy Review, 2015; Department of Commerce, 2017a). The policy has two export promotion schemes- “Merchandise Exports from India Scheme” (MEIS) to promote manufacture and export of specified goods and “Services Exports from India Scheme” (SEIS) for increasing exports of notified services. The benefits of both these schemes are applicable to units located in Special Economic Zones. Apart from these two schemes, measures have also been adopted to facilitate import of capital goods under the EPCG scheme by decreasing specific export obligation to 75 percent of the normal export obligation. This is intended to enhance the manufacturing sector’s competitiveness (Press Information Bureau, 2015).

Improving the ease of doing business and trade facilitation by reducing the transaction cost and time of trading have also been key focus areas of India’s foreign trade policies. In 1995, to speed up the process of customs clearance, the Indian government introduced the system of “Electronic Data Interchange” (EDI). In 2005, a “Risk Management System” (RMS) was also introduced as a trade facilitation measure to “selectively screen only high and medium risk cargo for customs examination” (WTO Trade Policy Review, 2015). Together the system of EDI and RMS has substantially cut down the time taken for customs clearance. The latest FTP also mentions various new provisions and measures undertaken in the direction of trade facilitation.

Over the years, regionalism has also become an important component of India’s trade policy objective of achieving greater market access for its exports. As per the FAQs on FTA published by the Department of Commerce, “India has preferential access, economic cooperation and Free Trade Agreements (FTA) with about 54 individual countries. India has also signed bilateral trade deals in the form of Comprehensive Economic Partnership Agreement (CEPA)/ Comprehensive Economic Cooperation Agreement (CECA)/FTA/Preferential Trade Agreements (PTAs) with about 18 groups/countries” (Department of Commerce, 2018a).

An important policy initiative undertaken by the Indian government for export promotion and with a vision of attracting larger foreign investments has been the scheme for the Special Economic Zones.[13] With the purpose of boosting confidence in foreign investors and indicating

[13] India was one of the first countries in Asia to recognize the efficacy of the Export Processing Zone (EPZ) as a trade policy instrument in promoting exports. Asia’s first EPZ was set up in Kandla in 1965. Seven more zones were

the government's commitment to a steady and secure SEZ policy regime, the "Special Economic Zones Act, 2005" was enacted. On 10th February 2006, backed by SEZ Rules, the SEZ Act, 2005 came into effect and provided for simplification of processes and single window clearance on issues involving the central and state governments. The key objectives of the SEZ Act are "generation of additional economic activity, promotion of exports of goods and services, promotion of investment from domestic and foreign sources, creation of employment opportunities and development of infrastructure facilities" (SEZ Act, 2005). A number of incentives and amenities are given to units located in SEZs for attracting greater investment into SEZs (including FDI) and to SEZ developers. The government occasionally reviews the policy and operational framework of SEZs and takes required actions to aid the swift and effective implementation of SEZs in order to encourage investment in SEZs leading to the production of economic activity, employment creation, and growth of employment and boosting SEZ exports (Press Information Bureau, 2014a). Corresponding to the SEZ scheme is the Export-Oriented Units (EOUs) scheme whose main objective is to boost exports, earn foreign exchange, promote technology transfer and FDI and generate additional employment. EOUs adopt the same production regime as SEZs but can be situated anywhere in the country.

Despite India's focus on increasing exports, trade policy has often also been used "as a means to regulate domestic supply and to address short-term objectives such as containing inflation and fluctuations in commodity prices" (WTO Trade Policy Review, 2015). The Indian government often implements export taxes and minimum export price and adjusts import duties on an ad-hoc basis. For example, onions are a principally sensitive item and minimum export prices are often used to control exports. As per the Notification No. 73 (RE-2010)/2009-2014 issued by the Department of Commerce, exports of onions were banned on 9th September 2011 (Department of Commerce, 2011a). Exports of onions were then allowed but subject to a Minimum Export Price of US$ 450 per metric tonne on 20th September 2011 (Department of Commerce, 2011b). This was reduced to US$ 350 per metric tonne on 18th November 2011 (Department of Commerce, 2011c), US$ 250 per metric tonne on 28th November 2011 (Department of Commerce, 2011d),

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set up after that. However, the zones were not able to emerge as effective instruments for export promotion on account of the multiplicity of controls and clearances, the absence of world-class infrastructure and an unstable fiscal regime (Press Information Bureau, 2009). The EXIM Policy statement of 1997-2002 called for a 'qualitative transformation' of the conventional EPZs of the country (DGFT, 2000). Subsequently, correcting for the shortcomings of the EPZ model, some new features were incorporated in the Special Economic Zones (SEZs) Policy which was announced in April 2000.

US$ 150 per metric tonne on 11th January 2012 (Department of Commerce, 2012a) and US$ 125 per metric tonne on 15th February 2012 (Department of Commerce, 2012b). The requirement of a Minimum Export Price was then removed via Notification No. 116 (RE – 2010)/2009-2014 on 8th May 2012 (Department of Commerce, 2012c). However, on 14th August 2013, Minimum Export Price of US$ 650 per metric tonne was again reinstated via Notification No. 35 (RE-2013)/2009-2014 (Department of Commerce, 2013a). This was raised to US$ 900 per metric tonne on 19th September 2013 (Department of Commerce, 2013b) and further increased to US$ 1,150 per metric tonne on 1st November 2013 (Department of Commerce, 2013c). The Minimum Export Price was subsequently reduced to US$ 800 on 16th December 2013 (Department of Commerce, 2013d) and US$ 350 per metric tonne on 19th December 2013 (Department of Commerce, 2013e). The series of notifications and frequent changes in Minimum Export Prices suggest that the Indian government, from time to time, has used the imposition of Minimum Export Price as an instrument to ensure domestic availability, restrict commodity exports or contain domestic price rise (Chandrashekhar, 2018).

Similarly, India's import policy has also mostly been guided by concerns related to domestic supply. For instance, in the case of sugar, through the 2008-09 and 2009-10 sugar seasons several measures were undertaken to enhance the domestic availability of sugar and regulate its prices. The government allowed sugar mills to import raw sugar under the "Advance Authorization Scheme" at zero duty on tonne-to-tonne basis from February 2009 up to September 2009 (Department of Revenue, 2009a; Ministry of Consumer Affairs, Food and Public Distribution, 2012). On 17th April 2009, the government permitted sugar mills to import raw sugar at zero duty under OGL. Select state trading enterprises were also permitted to import white sugar at zero duty (Department of Revenue, 2009b). Subsequently, on 31st July 2009, imports of white sugar was permitted duty free by traders and processors till 30th November 2009 (Department of Revenue, 2009c). In addition to the existing specified agencies, duty-free import of white / refined sugar under OGL was also opened to other central and state agencies and private trade. The duty-free import period for refined, white and raw sugar continued till 30th June 2012. On 13th July 2012, owing to rise in domestic prices, the government imposed a 10 percent import duty on raw and refined sugar (Department of Revenue, 2012a; Balasaheb, 2013).which was increased to 15 percent in July 2013 (Department of Revenue, 2013). Due to surplus stocks of sugar and in order to check for any possible imports, the government subsequently increased the import duty to 25 percent in August 2014, 40 percent in April 2015 and 50 percent in July 2017 (Department of Revenue, 2014; 2015, 2017). These kind of frequent changes to trade policy are disruptive, reduce predictability in India's trade policy and create uncertainty for the industry players and adversely affect the long-term strategic development of the sector (Department of Food and Public Distribution, 2013).

2.3 Foreign Investment Policy

2.3.1 Evolution of India's Foreign Investment Policy

Historically, in pursuit of "self-reliance" and "import-substitution", India had followed a very guarded, careful and selective approach while developing its foreign investment policy. The policy was conditioned broadly by two factors: the Industrial Policy Resolution of 1948 and 1956[14] and the foreign exchange crisis (Pant, 1995). Until the 1960s, the FDI policy was being determined on a case by case basis. The outlook was that the IPR 1956 was disadvantageous for FDI.[15] However, this changed when the foreign exchange crisis developed in the late 1950s and India's foreign exchange reserves reduced to nearly half. That is when some degree of "pragmatism" settled in and MNEs began to be viewed as proprietors of technology and earners of net foreign exchange through exports (Kidron, 1965). Consequently, in 1969 a more specific policy towards FDI was developed which involved "setting three groups of industries where there would be-(a) FDI without technical collaboration; (b) only technical collaboration; and (c) no foreign participation" (Pant, 1995).[16]

In the 1970s, India embraced a more restrictive approach towards foreign investment. The scope of FDI was limited to industries demanding "sophisticated technology". There was a conscious and purposeful endeavor to move towards capital and intermediate goods and dissuade it away from consumer goods (Martinussen, 1988). This restrictiveness towards FDI was a part of the approach meant for extending government control in different economic sectors and was

[14] The Resolution emphasized the importance of securing a continuous increase in production and its equitable distribution, and pointed out that the State must play a progressively active role in the development of industries.
[15] Except in the case of oil companies
[16] In India, collaboration was expected to serve the purpose of bringing in foreign technology not available domestically. This was clearly specified in the foreign collaborations policy as defined in the 1950s. However, this requirement was usually violated so that the same technology could be available under different brand names (Chitale, 1973). Therefore there was pressure from domestic interests to alter this. After 1969, the policy on foreign collaborations was made more specific and integrated into the overall policy on foreign investment.

coherent with annunciation of several restrictive regulations such as Monopolies and Restrictive Trade Practices (MRTP) Act (1969)[17], the Patent Act (1970)[18], the Industrial Licensing Policy (1970)[19] and related steps such as nationalization of banks, general insurance companies, coal mines and oil companies. The key motivation underlying the implementation of this kind of restrictive outlook to foreign investment was the necessity to safeguard the developing domestic industries from the perceived risk and danger imposed by private capital in India.

The regulatory framework determining FDI was cemented through the ratification of the Foreign Exchange Regulation Act (FERA), 1973[20] in which up to 40 percent foreign equity holding in a joint venture was permitted. Foreign corporations involved in export-oriented businesses and areas of high technology and high priority were offered concessions. For example, for firms exporting more than 60 percent of their output, 74 percent of equity could be held abroad. In the case of firms with 60 percent of their turnover in core sector activities and exporting 10 percent of their production, then up to 51 percent of equity was permitted to be held abroad. This was also applicable to firms exporting more than 40 percent of their turnover. For a firm that was 100 percent export-oriented, 100 percent equity could be held abroad (Pant, 1995). The government also issued an “Industrial Policy Resolution of 1973” which restricted foreign participation to industries that were export-oriented and advantageous to the country’s long term development prospects, but outside the purview of items earmarked for exclusive manufacturing by the public sector and the small-scale sector. The intent was to limit foreign companies to sectors manufacturing basic intermediate and capital goods and keep it out of consumer goods (Martinussen, 1988; Pant, 1995).

In the 1980s, the declarations of Industrial Policy (1980 and 1982) and most importantly Technology Policy (1983) laid down a liberal approach to FDI. The policy changes adopted

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[17] The MRTP Act was introduced in 1969 to allow the Government of India to effectively control economic power concentration (Pant, 1995). The MRTP Act stipulated that all companies with a capital base of over 20 million rupees should be classified as MRTP companies and allowed to enter only selected industries on a case-by-case basis as well. In addition to industrial licensing, all investment proposals by these firms required separate approvals from the Department of Company Affairs (Sen, 2010).

[18] The Patent Act (1970) aimed at facilitating the creation of indigenous technological capabilities, confining patent granting only to processes (and not products) and deciding to grant patents only to 'new' products produced in India, not imported. It also reduced the duration of patents granted to seven years. The adoption of this Act reduced the protection available to foreign firms ' intellectual property (Gupta and Mehra, 1995; Palit, 2004).

[19] The Industrial Licensing Policy of 1970 limited the role of large businesses and foreign firms to the core, heavy and export-oriented sectors (Palit, 2009).

[20] FERA came into force in 1974.

included liberalization of industrial licensing (approval) rules, reversing the negative effects on growth and competition of the IPRs of 1948 and 1956, restrictive features of the MRTP Act were sought to be done away with, foreign collaboration was encouraged which could take place in the form of a financial collaboration, technical collaboration or both, multitude of incentives and immunity from foreign equity restrictions under FERA to 100 percent export-oriented firms and some amount of resilience regarding foreign ownership (Kumar, 1990; 2005).

A key transformation happened in 1991 when India commenced its economic liberalization and reforms program. As part of the industrial policy reforms, limitations on investment projects and business expansion were gradually eliminated. Improved access to foreign funding and technology was enabled. For the first time, the Industrial Policy of 1991 stated that "Direct Foreign Investment has always been preferred to loans and other forms of assistance" (Department of Industrial Development, 1991). As noted by RBI(2012), the main features of the New Industrial Policy with respect to foreign investment included "(i) introduction of dual route of approval of FDI – RBI's automatic route and Government's approval (SIA/FIPB) route; (ii) automatic permission for technology agreements in high priority industries and removal of restriction of FDI in low technology areas as well as liberalization of technology imports; (iii) permission to Non-resident Indians (NRIs) and Overseas Corporate Bodies (OCBs) to invest up to 100 percent in high priorities sectors; (iv) hike in the foreign equity participation limits to 51 percent for existing companies and liberalization of the use of foreign brands name; and (v) signing the Convention of Multilateral Investment Guarantee Agency (MIGA) for protection of foreign investments". The July 1991 'Statement on Industrial Policy' permitted FDI up to 51 percent under the automatic route in thirty-five high priority industries. Subject to certain limits, foreign technical collaboration was also put under the automatic route. For all sectors, a dividend-balancing condition was enforced (DIPP, 2011). This was later limited to 22 notified consumer items (DIPP Press Note 12, 1992). The automatic route for FDI was expanded in 1996 from 35 to 111 industries which were placed in four separate groupings (Part A–up to 50 percent, Part B–up to 51 percent, Part C–upto 74 percent and Part D-up to 100 percent). A "Foreign Investment Promotion Board" (FIPB) was established to consider cases coming under the government approval route (DIPP, 2011).

In 1992, the "automatic route" was also introduced for overseas investments and cash remittance s were allowed for the first time (Khan, 2012).[21]

The most significant move in the evolution of India's investment policy was to replace the Foreign Exchange Regulation Act (FERA), 1973 with Foreign Exchange Management Act (FEMA), 1999 which was less stringent and expanded the scope of FDI. This was followed by an array of reforms in the financial sector which paved the way for greater capital account liberalization in India.

The year 2000 witnessed a paradigm shift in which excluding a small negative list, all other activities were put under the automatic route (DIPP Press Note 2, 2000a). The dividend balancing condition was abolished (DIPP Press Note 7, 2000b). Subsequently, several relaxations in FDI policies and procedures have been announced. The restrictions on foreign equity investments have been lowered, the number of sectors in which FDI is permitted has increased, sectoral restrictions have been reduced and several incentives to encourage both inward and overseas FDI have been undertaken. In May 2002, India's FDI definition was standardized and its reporting system was aligned with international best practices. The revised definition of FDI includes three types of capital flows: (i) equity capital; (ii) reinvested earnings and (iii) other direct capital (Ministry of Finance, 2004). In 2009, another noteworthy change took place, by means of distinguishing between "ownership" and "control", for computing the total value of foreign investment (both direct and indirect) received by an Indian enterprise (DIPP Press Note 2, 2009a). Downstream investments were allowed by Indian companies having overseas FDI without any government approval (DIPP Press Note 2, 2009a; DIPP Press Note 4, 2009b). Limits on royalty payment were also eliminated (DIPP Press Note 8, 2009c).

At present, India has an investor-friendly investment policy, wherein 100 percent FDI under automatic route is allowed in almost all sectors/activities except a small list of sectors/ activities where FDI is subject to government approval. Overseas investment is also permissible in any

[21] In 1992, the total value was limited to US$ 2 million with a cash component not exceeding US$ 0.5 million in a block of 3 years. A fast track route was adopted in 1995 in which the limits were raised from US$ 2 million to US$ 4 million and linked to previous three years' average export earnings. Cash remittance remained limited to 0.5 million dollars. The upper limit for automatic approval per year was raised to US$ 100 million in 2002. The automatic route for outward FDI was further liberalized in March 2003, discontinuing this upper limit. Indian parties were permitted to invest 100 percent of their net worth. The outward FDI limit has since then gradually increased to 400 percent (Khan, 2012).

bona-fide activity apart from real estate[22] and banking business. However, there are some conditions listed by the Reserve Bank of India that need to be adhered to for undertaking activities in the financial services sector (RBI, 2019).

Overall, the FDI liberalization reforms pursued by the Indian government have been successful in making India a significant source and attractive destination for foreign investment. As per UNCTAD's World Investment Report 2018, India is the tenth-most attractive destination for FDI globally. In terms of developing countries, it is ranked fifth (after China, Hong Kong, Brazil, and Singapore). As per DIPP (2018a) "Fact Sheet on Foreign Direct Investment", India attracted US$ 44.86 billion of FDI equity inflows in 2017-18. In sharp contrast, FDI in India was a meager US$ 132 million in 1991-92. The services sector absorbed the highest equity inflow of US$ 6.71 billion in 2017-18. This was followed by telecommunications sector and computer software and hardware receiving equity inflows worth US$ 6.21 billion and US$ 6.15 billion respectively. Among the manufacturing sector, the automobiles industry attracted the highest FDI equity inflows worth US$ 2.09 billion. Mauritius was the largest source of FDI in 2017-18 with equity inflows worth US$ 15.94 billion accounting for a share of 35 percent of total FDI equity inflows received that year. Singapore, Netherlands, and USA followed suit with investments of US$ 12.18 billion (27 percent), US$ 2.80 billion (6 percent) and US$ 2.09 billion (4 percent) respectively. As per Department of Economic Affairs "Fact Sheet on Overseas Direct Investment", cumulative ODI flows from India (April 2014-December 2017) were US$ 39.54 billion. In terms of sectoral composition, we find that about 30 percent of India's cumulative ODI has gone to the manufacturing sector. This is followed by financial, insurance and business services (with a share of 29 percent) and wholesale, retail trade, restaurants, and hotels (with a share of 12 percent). For the same period, the majority of India's overseas investment went to Singapore (30 percent), Mauritius (20 percent) and the USA (14 percent).

2.3.2 India's Foreign Investment Policy- Objectives and Institutional Framework

India's foreign investment policy is embodied in the Circular on "Consolidated FDI Policy" brought out by the Department of Industrial Policy and Promotion (DIPP), Ministry of

[22] As defined in Notification No. FEMA 120/RB-2004 dated July 7, 2004

Commerce and Industry, Government of India and updated annually.[23] The policy document not only specifies the FDI policy but also specifies the degree to which it is restricted, allowed or encouraged. The most recent version available has been updated up to August 28, 2017. The objective of the latest “Consolidated FDI Policy 2017” is to “attract and promote foreign direct investment in order to supplement domestic capital, technology, and skills for accelerated economic growth” (DIPP, 2017).

Foreign investors can set up operations in India via various ways: as a liason/branch/representative/project/branch office, as joint venture with Indian partners, as a wholly-owned subsidiary or as a limited liability company. There are two main routes through which FDI is allowed in India: the “automatic route” that does not require any government approval of the investment and the “government route” where prior government approval is required. Till 2017, the Foreign Investment Promotion Board (FIPB) in the Department of Economic Affairs, Ministry of Finance was the official body to give approval to proposals for foreign investment that required government approval. With the purpose of simplifying the process of approvals for the inward FDI flows under government approval, the Union Cabinet decided to abolish the FIPB (Press Information Bureau, 2017). Following the abolishment of the FIPB vide O.M No. 01/01/FC12017 -FIPB dated 5th June 2017, the concerned administrative ministries/departments have been authorized to grant government approval for foreign investment under the existing FDI Policy and FEMA regulations.[24]

Majority of the sectors are now open for FDI through the automatic route.[25] Foreign investment is banned in some sectors such as lottery business, gambling and betting, chit funds and real estate. Sectors which require government approval include mining, food product retail trading, defence (above 49 percent), print media, pharmaceuticals (brownfield), telecommunications

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[23] The DIPP makes policy pronouncements on FDI through Press Notes/Press Releases which are notified by the RBI (2000) as amendments to the Foreign Exchange Management (Transfer or Issue of Security by Persons Resident Outside India) Regulations, 2000 (Notification No. FEMA 20/2000-RB dated May 3, 2000).

[24] In the Consolidated FDI Policy 2017, the DIPP has also issued the Standard Operating Procedures (SOP) giving comprehensive and in-depth procedure and timeline for applications as well as the list of “competent authorities” for the handling of foreign investment approvals in India. According to the SOP, proposals that do not require security clearance would be cleared in eight weeks and applications that require security clearance would take a cumulative time period of ten weeks. In order to facilitate FDI, the government has also launched a Foreign Investment Facilitation Portal (FIFP) which is intended to serve as the new online single point interface of the Government of India for investors. The portal is being administered by the DIPP and enables the single window clearance of FDI applications which are through approval route.

[25] Except for investment by citizens of Bangladesh and Pakistan, which are subject to Government approval.

(above 49 percent), private banks (above 49 percent), and air transport services-scheduled and regional air transport service (above 49 percent).[26]

A number of FDI liberalization reforms have been carried out in the last few years. These include allowing FDI in limited liability partnerships; FDI in defence increased from 26 percent to 49 percent under automatic route, FDI up to 100 percent is allowed in pharmaceuticals (greenfield and brownfield, the latter being subject to government approval), FDI up to 100 percent is allowed under automatic route for railways, single brand retail trading, construction development and e-commerce, FDI upto 51 percent is allowed under the government approval route for multi-brand retail sector, FDI above 26 percent in pensions and insurance allowed via automatic route (DIPP Press Note 1, 2012; DIPP Press Note 1, 2013; DIPP Press Note 1, 2014a; DIPP Press Note 7, 2014b; DIPP Press Note 8, 2014c; Press Notes 1, 2016a; Press Notes 2, 2016b; Press Notes 5, 2016c; Press Note 1, 2018b; Press Note 2, 2018c).

In recent years, the government has also introduced several programmes, schemes and incentives to encourage investment in certain regions or activities. In November 2011, the DIPP announced the "National Manufacturing Policy" (NMP) with the overall objective of raising the "share of manufacturing in GDP to 25% within a decade and creating 100 million jobs" (Press Information Bureau, 2011). National investment and manufacturing zones (NIMZs) have been established to implement the policy by providing infrastructure, zoning land use, technology that is both clean and energy-efficient, social infrastructure and skills development facilities (WTO Trade Policy Review, 2015). In September 2014, the Government of India also launched the "Make in India" programme with an endeavor to make India a global manufacturing hub by boosting investment in industry and services (Press Information Bureau, 2014b).

The rules and procedures pertaining to Overseas Direct Investment (ODI) have been notified by the RBI vide Notification No. FEMA 120/RB-2004 dated July 7, 2004 and are revised from time to time. A comprehensive document by RBI titled, "Master Direction on Direct Investment by Residents in Joint Venture (JV) / Wholly Owned Subsidiary (WOS) Abroad" compiles all important directives on rules and regulations formulated by the RBI under various Acts, circulars, and notifications relating to ODI policies in India. The RBI also publishes guidelines

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[26] Full list of sectors where government approval is required (as on July 2016) is available at https://dipp.gov.in/sites/default/files/Sectors_Where_Government_Approval_Is_Required.pdf

via AP (DIR series) to Authorized Persons listing the procedure for conducting foreign exchange business within the regulatory framework. According to RBI (2018) direct investment outside India is defined as "investments, either under the Automatic Route or the Approval Route, by way of contribution to the capital or subscription to the Memorandum of a foreign entity or by way of purchase of existing shares of a foreign entity either by market purchase or private placement or through stock exchange, signifying a long-term interest in the foreign entity (JV or WOS)". It can take place either under the automatic route wherein there is no need for an investor to obtain any prior approval from RBI for making ODI in a Joint Venture or Wholly Owned Subsidiary abroad[27] or approval route which necessitates prior approval by RBI.

In order to encourage FDI into the country and provide a safe business environment for its investors abroad, India has also entered into Bilateral Investment Promotion and Protection Agreements (BIPAs) with more than 80 countries (UNCTAD, 2018b).

2.4 Concluding Remarks: Are India's Trade and FDI Policies Interlinked?

Based on the above discussion, we can say that India's pre-liberalization development policy was that of self-reliance, inward-looking and emphasized the significance of government intervention and regulation of the economy. In particular, the trade policy was described by high tariffs and extensive import restrictions. The foreign investment policy was described by numerous restrictions over private investment which limited the areas where private investors were allowed to operate and determined the location of new investment and the technology to be used (Ahluwalia, 2002). The scope of FDI was limited to industries requiring "sophisticated technology". The orientation of both trade and investment policies was to encourage least private intervention and provide protection to domestic industries from foreign imported goods.

As part of the reforms that began in the 1990s, India moved away from the inward-oriented strategy that prevailed in the country for several decades and liberalized the trade and investment regimes deepening India's engagement with the world. Tariff structure was rationalized, quantitative restrictions were phased out and FDI was promoted. Post the economic reforms, the

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[27] Under automatic route, the Indian Party should approach an Authorized Dealer Category – I bank with an application in Form ODI and the prescribed enclosures / documents for effecting the remittances towards such investments. However, in case of investment in the financial services sector, prior approval is required from the regulatory authority concerned, both in India and abroad.

broad focus of India's trade policies has been on increasing exports which is supplemented by a combination of policy measures comprising of fiscal incentives, export promotion schemes, institutional changes, streamlining of procedures, improved market access and diversification of export markets. Trade policymakers in recent times have been concerned about the rising trade deficit and have often introduced stricter forms of trade protectionism by imposing restrictions on imports of several commodities.[28]

The broad focus of India's foreign investment policy has been on attracting inward flows of FDI, particularly in the manufacturing sector. The government has established a favorable environment for FDI by eliminating the system of industrial licensing, setting up institutions, reducing restrictions on foreign equity investments, expanding the number of sectors in which foreign investment is allowed, lowering sectoral restrictions, liberalizing foreign exchange regulations providing incentives, launching programmes to boost the manufacturing sector and simplifying procedural requirements.

The basic policy issue facing India today is not, primarily, one of more or less trade liberalization, but it is about how best the country can integrate the FDI liberalization such that its international trade participation promotes economic development. While the liberalization of trade and FDI policies have been successful in increasing India's trade flows and investment into the country respectively, the most obvious inference emanating from the above discussion is the lack of integration between these two policies. Even in terms of an institutional framework, the domestic policies, rules, and regulations underpinning trade and FDI in India have remained distinct and fragmented. Though there do exist certain forms of policy coordination mechanisms, the degree to which the trade and FDI policies are really synchronized and the extent to which they are formulated through inclusive discussions and deliberations seems to be very low in case of India.

As noted by Park (2016), India's trade policy seems at odds with its investment policy which aspires for deeper engagement with the world economy. While on the one hand, India wants to liberalize its industry, attract FDI and woo investors; on the other hand it also wants to restrict

[28] For instance, in September 2018, the government imposed restrictions on the import of non-essential commodities in order to check the rising current account deficit (The Hindu, 2018).

imports and shelter its industries. It is inevitable that MNEs operating in a country like India, which is still in the budding stage of developing its manufacturing sector, will import intermediate goods and parts that may be necessary to manufacture products. Internal incongruity within the Ministry of Commerce and Industry is partially responsible for India's erratic, unclear and confusing trade and investment policies. The Department of Industrial Policy and Promotion, which is responsible for FDI policy wants to liberalize and open up the country. But the Department of Commerce, which is responsible for trade policy, is more cautious. Needless to say, in order to make the most of FDI, we need complementary trade policies that support linkages and spillovers and foster integration in global value chains.

The only policy initiative undertaken by the Government of India that has established a limited intersection of the trade and investment policies has been the SEZ policy. As mentioned earlier also, the primary aim of the SEZ policy was to attract export-oriented FDI through a multitude of tax and other concessions given to investors. It is important to check whether setting up of SEZs have actually resulted in the hypothesized increased exports from SEZ and resultant increased FDI in India. This would also throw light on whether the current level of intersection between the two policies has been successful in achieving its expected outcomes. As per the "Fact Sheet on Special Economic Zones as on 31.07.2018", the number of SEZs functioning in India are 223 (Department of Commerce, 2018c). The numbers of notified SEZs are 373 (out of which 7 are central government and 11 are state or private SEZs). The value of exports from functioning SEZs has increased more than 5 times from US$ 14.81 billion in 2007-08 to US$ 78.07 billion in 2016-17, registering a CAGR of 20.28 percent per annum over this time period. The share of SEZ exports in total exports (an important measure of the efficacy of SEZs as instruments of export promotion) increased from 10 percent in 2007-08 to 27 percent in 2016-17 (Department of Commerce, 2019). In terms of investment, SEZs attracted a cumulative investment of Rs 4,74,917 crores in 2017-18. Mukherjee et al. (2016) note that the share of SEZ investment in total investment was a mere 5.4 percent in 2007-08 and reached 10.6 percent in 2011-12. This is much below the anticipated volumes of FDI that the government expected while introducing the SEZ policy. India's experience with SEZ is not even close to China's experience with SEZs. As per Zeng (2015), in recent years SEZs in China have contributed to 60 percent of total exports and 45 percent of total FDI, both of which are many times higher than corresponding figures for India. The Indian SEZ model has failed to emulate the success story of the Chinese SEZ model which has achieved high volumes in FDI in its export-oriented manufacturing sector. It is safe to conclude that Indian SEZs have failed to attract FDI due to their small size, poor and inadequate infrastructure, issues related to taxation, low level of skills, inflexible and stringent labour market etc (Mitra, 2007; Arunachalam, 2010; Mukherjee. et al., 2016).

To conclude, we can say that as India strives to be a global leader in a world where trade and investment flows have become increasingly globalized, integrated and interdependent, the issue of whether the existing architecture of India's trade and FDI policies adequately reflects the reality of an increasingly interconnected world economy is worth examining. This brings us to investigate the economic relationship between trade and FDI-Are trade and FDI complements or substitutes? Before we conduct an empirical exercise to investigate the relationship between the two for India, it is important to look at how FDI has been integrated into the theory of trade and review the existing empirical literature on this topic.

The next few chapters build on this and help us answer the following questions- Should India's trade and foreign investment policies be interlinked? Should there be coherence and harmonization of trade and investment policies? Is there a need to rethink our external engagement strategy? Should the Government of India evaluate the prevailing institutional mechanisms in place for trade and FDI policy making and revise them to warrant more unified, coherent and inclusive trade and FDI policies?

Chapter 3

Literature Review

3.1 Introduction

Traditionally, trade and FDI were treated as two separate issues with FDI generally explained as part of capital theory. Until 1950s the literature on international economic development comprised of "a well-developed formal theory of international trade" supplemented with a "less well-developed theory of capital movements" (Dunning, 1988). However, after the 1960s and 1970s when the theory of international capital movements failed to explain international production, efforts were made to explain the increasing international production from the trade-theorist point of view. The early 1980s saw the genesis of industrial organization approach to trade theory and growing convergence and overlapping of trade and FDI theories (Markusen and Maskus, 2003). Subsequent advances in theory have showed that it is possible for FDI to either be a substitute for or complement to international trade, typically depending on the nature of investment.

Broadly, the explanatory approaches of FDI, namely the "internalization theory" and "Dunning's eclectic paradigm theory", and general equilibrium models of international trade that integrate horizontal MNEs (Hortsman and Markusen, 1992; Brainard, 1993) suggest existence of a substitution relationship between trade and FDI (Forte, 2004). In contrast, general equilibrium models of international trade integrating vertical MNEs (Helpman, 1984; Markusen, 1984; Helpman and Krugman, 1985) suggest existence of a complementary relationship between trade and FDI. More recently, there has been emergence of trade models that incorporate both types of MNEs, designated as the "knowledge capital model", which support both the relationship types (Markusen et al., 1996, Markusen, 2000; Carr et al., 2001).

Empirical studies on examining the trade-FDI relationship have looked at two possible linkages- Are trade and FDI complements or substitutes? Are there any causal relationships between trade and FDI? (Liu et al., 2001). Previous studies on examining this relationship have been conducted at multiple levels of aggregation. Studies have been conducted at the country-level, industry-level, firm-level and even at the product-level. It has been observed that most empirical work points towards a complementary relationship. However, this relationship is complex and depends on a host of factors.

This chapter presents a review of the existing theoretical and empirical literature on the link between trade and FDI. Section 3.2 discusses the theoretical literature. Section 3.3 discusses the empirical literature. Section 3.4 concludes the chapter by identifying the gaps in the literature and discussing how this study attempts to bridge this gap.

3.2 Theoretical Literature

3.2.1 Explanatory Approaches of FDI

The FDI explanatory approaches view exports and FDI as two alternate means of serving an international market. Either firms can produce in the domestic country and export to the international market or they can undertake production in the international market and substitute exports with local sales of foreign affiliates (Fontagne, 1999).

Buckley and Casson (1976) applied the notion of "internalization" to describe the emergence of MNEs. Internalization refers to the process by which transactions that are external to the firm are internalized by conducting them within the structure of the firm itself. The origin of internalization theory can be traced to Coase (1937) and his "theory of the firm" which treated firms and markets as alternate means of organizing production activities. According to this theory, there are different levels of efficiency involved in executing transactions within the firm (intra-firm) and in the market. The firm assumes a greater role whenever transactional costs of using external market mechanism are higher than costs of organizing the same activities within the firm. According to Buckley and Casson (1976), an MNE will internalize its activities if internationalization cost is lower than the cost related to export or any other form of entry to a market. So, internalized transactions will arise in the presence of market failure or market imperfections. This theory of internalization demonstrates that foreign direct investment substitutes for exports whenever there are huge costs corresponding with external transactions (Forte, 2004).

Dunning (1980) developed an eclectic paradigm theory that explains the magnitude, location, composition and pattern of overseas production undertaken by multinational enterprises to be governed by the interaction of three sets of inter-related variables. These are "ownership (O) advantages, location (L) advantages and internalization (I) advantages". Therefore, the eclectic paradigm theory of Dunning is also well-known as the "OLI theory". Ownership advantages address the question of why some and not all firms go overseas and suggest that successful MNEs have certain advantages specific to the ownership of the investing enterprise that enable them to overcome the costs of functioning in a foreign country. Ownership specific endowments are "internal" to the MNE and consists of "tangible and intangible resources, including technology, which itself dictates the efficiency of resource usage" (Dunning, 1981). These are competitive advantages which enterprises of one country have compared to those of another country while supplying to any particular overseas market. These advantages may arise either from the "possession or exploitation of monopoly power" (Bain 1956; Hymer 1960) or "possession of bundle of scarce, unique and sustainable resources which essentially reflect the superior technical efficiency of a particular firm relative to those of its competitors" or from the "competencies of the managers of firms to identify, evaluate and harness resources and capabilities from throughout the world, and to coordinate these with existing resources and capabilities under their jurisdiction" in a way that is beneficial to them relatively more their competitors (Dunning, 2000).

The location (L) advantages address the question of where an MNE chooses to carry out foreign production based on the advantages of the alternative countries or regions. In order to set up production facility in a foreign country, it must be in the interests of the MNE to exploit the ownership advantages in combination with the use of at least some immobile factor resources in that country. This is important or else domestic markets would be served completely by national production and foreign markets by exports. Some location specific advantages that make a location favorable to foreign investment are the spread of natural and created resource endowments and marketplaces, prices of inputs, efficiency, and costs related to international transportation and communication. The internalization (I) advantages as mentioned earlier are associated with the way a firm organizes its operations. In order to undertake international production, the third condition is that it must be in the "best interests" of MNEs enjoying the ownership-specific advantages to transfer them internally across domestic boundaries within their own organizations instead of selling them or their right of use to foreign-based MNEs

(Dunning, 1988). This also implies that MNEs consider that it is best to conduct transactions within the firm and not in the international market.

The eclectic paradigm theory is one of the most well-known frameworks for analyzing the determinants of international production. It builds on the earlier lines of explanation of MNE activity. It can be used to explain all types of FDI. It suggests which route of foreign entry (exports, licensing and franchising agreement, or FDI) is likely to be exploited by MNEs and under what circumstances. For each mode of entry, ownership advantages are a pre-requisite. However, the existence of internalization advantages suggests that MNEs will exploit these advantages by way of exports or FDI rather than contractual agreement; whereas FDI is chosen over exports where location advantages are favorable towards a foreign rather than domestic production base.

While the internalization theory and eclectic paradigm theory considered exports and FDI as alternate means of serving an overseas market and subsequently arguing that one substitutes the other, Vernon's (1966) product life cycle (PLC) theory considered trade and FDI to be part of the same foreign market exploitation process and is known to be the "first dynamic interpretation of the determinants of, and the relationship between international trade and foreign production" (Dunning, 1993). Vernon suggests that there is a life cycle in a typical manufactured product and that the link between trade and FDI is typically dependent on what stage of the life cycle the product is. According to PLC theory, in the first stage a new product originates in an advanced economy with abundant capital, specialized labor and R&D capabilities. Enterprises located in the domestic advanced country produce this product primarily for domestic consumption and any surplus production is exported to foreign markets. With increased demand for these products in the foreign market, the enterprises located in the domestic market start exporting more making use of the technological advantage that they have over their foreign competitors. With time as the product starts to mature, there is a "certain degree of standardization" that takes places and demand of the product begins to surface in different markets (Essays, 2018). With increased demand, foreign enterprises also start imitating these products at a cheaper labor and overall cost. Over time, the domestic enterprises move their production facilities in overseas markets to maintain their market shares. This is essentially a shift from exporting to FDI. However, with maturing of the markets and standardization of the product, the developments of the product cycle changes again. With more demand from and cheaper labor costs available in overseas countries, cost-effectiveness becomes more important (Essays, 2018). The producers who were based in other foreign countries now start exporting back to the original domestic country. This also leads to under-developed countries which have competitive advantage in terms of location of production to start exporting. This suggests that the more a product gets standardized; it is more likely that its location of production will change. The PLC theory describes how a product may begin as an export product from a country and work through its life cycle to ultimately become an import product in the same country.

3.2.2 Models of Trade that Integrate MNEs

Traditionally, models of trade and FDI theories have been formulated separately. The Heckscher-Ohlin (H-O) model dominated theory of international trade for many years, emphasizing the importance of difference in factor endowments as the main reason for international specialization and trade. The H-O theory suggests that given certain conditions are met, countries would specialize in the production of goods requiring relatively large quantities of factors of production with which that country is comparatively well endowed, and export them in exchange for goods requiring relatively large quantities of factors of production with which they were comparatively poorly endowed (Heckscher, 1919; Ohlin, 1933; Dunning, 1977).

The standard H-O theory assumed two homogeneous goods, perfect product and factor markets, constant returns to scale in production, identical production functions, factor immobility among countries, perfect competition, absence of factor reversals, identical and homothetic preferences and absence of transportation costs. Technology was assumed to be a free good and instantaneously mobile across countries. The H-O model suggests that international trade entails an indirect exchange of factors of production between countries (Liu et al., 2001). For example, if a capital abundant country is exporting capital intensive goods in exchange for labor intensive goods, then that country is indirectly exporting net amount of capital in exchange for a net amount of labor.

However the restrictive assumptions of the model began being questioned since it is not in congruence with the economic reality of the world. The assumptions of the model, namely perfect competition, immobility of factors of production across countries and identity of production function imply that all markets function efficiently, information is costless, there are no external economies of scale in production and that there are no trade barriers or barriers to competition (Dunning, 1977). This suggests that in such circumstances, trade is then the only possible method of international economic engagement; production must be undertaken by a country's enterprises in the domestic country to serve the foreign market through exports; and access to location specific endowments is equal across all enterprises (Dunning, 1988).

One of the biggest shortcomings of the H-O theory was its inability to explain the growing trade between countries with similar endowments of production factors or intra-industry trade (Hanink, 1988). According to the H-O theorem, the pattern of trade is fundamentally a supply-side phenomenon (Bukhari et al., 2005). However, several studies have challenged the empirical validity of H-O model (Leontief, 1953; Bharadwaj, 1962; Deardorff 1984; Bowen et al., 1995). Staffan Linder (1961) proposed an alternative theory to explain the pattern of trade which was essentially demand-oriented. Linder hypothesized that "trade will be most intensive among countries with similar demand" (1961, p.17). The basic proposition of Linder (1961) was that in case of manufactured goods, it is internal demand that defines the array of potential export goods for a country. For a product to be a potential export product, "it is a necessary but not a sufficient condition that a product must be consumed (or invested) in the home country" (Linder 1961, p.87). Similarly, potential imports are the defined by range of goods for which domestic demand exists at international prices. Linder asserts that "the range of potential exports is identical to, or included in, the range of potential imports" (1961, p.91). For both exports and imports, it is internal demand that determines "potential trade". The theory therefore advocates that trade flow between countries that have similar demand structures will be stronger, as opposed to being determined by differences in factors of production (Viciu et al., 2016).

Another important deduction of the H-O theory was that international trade would lead to "factor price equalization" (Samuelson, 1949). Substituting the assumption of immobility of factors with immobility of goods, it has been shown that movement of factors also react to differences in relative factor endowments (Tiwari and White, 2014). International capital movements have also been explained in terms of relative factor prices or differences in interest rate across countries (Nurkse, 1933; Ohlin, 1933; Iversen, 1935).

Until the 1950s the literature on international economic development comprised of “a well-developed formal theory of international trade” supplemented with a “less well-developed theory of capital movements” (or interest-rate theory) which assumed that when there are no risks, uncertainties or obstacles to movement, capital will move from low-interest countries to high-interest countries until interest rates are equalized (Dunning, 1988). Investment was understood as a response to differential in the rates of return on capital between countries with investor’s maximizing their profits by investing in countries with the highest rates of return (Mundell, 1957). The theories of trade and capital paralleled each other, with it being acknowledged that “trade in goods was at least a partial substitute for trade in factors” (Dunning, 1981).

However, this approach had several shortcomings. Hymer (1976) claimed that the differential rate hypothesis was not consistent with the observed empirical results. He argued that if interest rates are higher in a foreign country than in the home country, an investor would do well to lend money abroad, but there is no need for him to control the companies that he lends money. Further, Caves (1982) noted that an international difference in expected rates of return is not enough to stimulate investment flows. Also, the most important shortcoming of this approach was that the interest-rate theory could not explain control. In order to explain direct investment, it is important to explain control.

Hymer (1960) was among the first who developed a systematic approach towards the study of investment from the perspective of industrial organization (I-O) theory. Hymer in his seminal paper (1960) explained the circumstances that cause a firm to “control” an enterprise in an overseas country. Controlling enterprises in more than one country may be advantageous in order to eliminate competition between them. It may also be the case that firms may have an advantage in a particular operation and may find it profitable to set up foreign operations to exploit these advantages. When a firm sets up its operations in a foreign country, it has to compete with national firms operating in that country that have an advantage in terms of their knowledge about the local language, culture, legal system and preferences of consumers. The disadvantage to foreign firms must be offset by some form of advantage or market power that makes it worthwhile for them to enter foreign market. This advantage may be that the foreign firm can procure factors of production at a lower cost than other firm or in the form of strategic assets that foreign firm owns. This could also be in the form of superior technology, economies of scale, brand names, marketing and management, etc. These assets give a strategic advantage to foreign firms in foreign markets over indigenous firms(Nayak and Choudhury, 2014).

By extending Hymer's theory of FDI on the basis of "monopolistic power", Kindleberger (1969) asserted that the advantages enjoyed by MNEs in foreign countries are beneficial only when there are market imperfections. A firm will invest abroad by exploiting its advantages only when the chances of earning monopoly profits are high. However, Hymer and Kindleberger's theories do not provide a complete justification for FDI because they give an explanation for "why" FDI takes place, and not "where" and "when" it takes place. This has been sought in the work by Vernon's PLC theory (1966), Dunning's eclectic paradigm theory (1977, 1979 and 1988) and Buckley and Casson's internalization theory (1976) which have been explained in the previous section.

After 1960s and 1970s when the international capital theory could not explain international production, there was an increasing interest in FDI among trade theorists. Starting from 1980s new trade theory began to incorporate models of trade and FDI. Firstly, it is imperative to note that any model of FDI must be based out of condition of imperfect competition (Krugman, 1983 p. 53). This is not the case with conventional trade models that are built on the assumption of perfect competition. Secondly, the primary difficulties arising from integrating FDI in trade theory lies in incorporating the decision of internalization in response to market imperfections. Krugman (1983) introduced two types of models, one involving product differentiation and other one involving vertical integration. Further advances in this area have been an extension of this analysis only. The key developments in this sphere concerns the introduction of specialized inputs or "firm-specific know-how" and other "intangible income-producing assets" which are related to proprietary technology and equivalent to public goods within the firm (see Coase, 1937; Caves, 1971; Buckley and Casson 1976; Hirsch 1976). Unlike tangible assets, intangible assets neither get exhausted nor amortized as a result of their use. They can be transferred between different units of the firm without losing their revenue-generating capacity. Hirsch (1976) pointed out that FDI "takes place only in a world which admits revenue-producing factors which are firm specific on the one hand and information, communication, and transaction costs, which increase with economic distance, on the other".

The very first attempt to incorporate MNEs in general equilibrium models of trade was made by Batra (1986).The author utilizes the ownership feature of the OLI framework and develops a general equilibrium model of MNEs functioning in Least Developing Countries (LDCs). Batra (1986) develops a two-country, two-sector model (with one sector in which MNEs compete with each other and the other in which local firms supply goods). There are total three factors considered in the study, out of which labor and capital are two non-specific factors and there is one specific factor accessible only to MNEs. This specific factor illustrates several ownership advantages available to the MNE such as some specific equipment or entrepreneurship. Other usual assumptions of the standard two-sector model hold, namely “perfect competition in product markets, linearly homogeneous and concave production functions, full employment of in-elastically supplied capital” (Batra, 1986). The author assumes an institutionally fixed real wage and hence labor is not fully employed. The host country is taken to be a small country that takes the relative prices as determined by rest of the world to be given. The author assumes that the capital markets in the host country may be imperfect, in the sense that banks and other capital owners may prefer to lend to the MNE and may charge them lower interest rates, resulting in higher capital costs for local firms than MNEs.

The author also assumes that in the host country, MNEs invest only to the extent that the specific factor is transferred and used in production. The global MNE needs to undertake only little additional investment over and above the costs of transplantation of equipment accompanying the transfer of managerial / technical expertise (Batra, 1986). All the other types of capital that the MNE may need (such as simple machinery, buildings, infrastructure, etc) are non-specific in nature and the MNE can tap the local capital markets for the same.

Based on these assumptions, the author discusses how broad conclusions of the traditional models of trade theory do not hold in presence of MNEs operating in LDCs, which by assumption are characterized to be capital-short and labor-surplus economies. An increase in MNE activity in the host country signifying “a greater use of more efficient technology” in the sector where MNEs operate leads to rise in the marginal products of labor and capital in that sector (Batra, 1986). Consequently, capital moves from the sector where local firms operate to the sector where MNEs operate. A decline in capital in the local firms sector leads to a decline in labor employment in that sector. An increase in the MNE sector results in an increase in labor employment in that sector. The effect on total employment is however dependent upon the capital-labor ratios in the two sectors. Batra (1986) concludes that “if the multinational sector is relatively capital-intensive sector, then the emergence of the MNCs causes a decline in total employment in the labor-surplus host country”. This is because MNEs transfer technology but invest only a small amount of their own capital causing a decline in total employment opportunities in the host LDC country. When this is accompanied by capital market imperfections making domestic firms pay a higher cost of capital, the author concludes a total negative impact of MNEs on the LDC’s real income.

Subsequent developments in theoretical literature have provided a set of new trade theory models which by applying the I-O approach to trade theory integrate dimensions of increasing returns, imperfect competition, strategic firm behavior and product differentiation.

The new trade theory models firm to be National Enterprises (NE) having a single productive infrastructure and export. On the other hand, MNEs dominate the industries with scale economies and imperfect competitions and “endogenously choose the number and location of production facilities, making both horizontal and vertical investment decisions in foreign markets” (Markusen and Venables, 1998). Consequently new trade theory started integrating theories of trade and FDI through development of trade models that incorporate multinational enterprises. In these types of models, firm’s activities are usually divided into two categories-firm-specific activities or headquarter activities[29] and plant-specific activities[30] generating firm-specific and plant-specific fixed costs respectively (Forte, 2004). In the initial attempts to include multinational enterprises in general equilibrium models of trade, only one type of FDI was permitted-either vertical or horizontal. As defined by Aizenman and Marion (2001), “vertical FDI takes place when the multinational fragments the production process internationally, locating each stage of production in the country where it can be done at the least cost” and “horizontal FDI occurs when the multinational undertakes the same production activities in multiple countries”.

Ensuing developments in the theory have revealed that it is possible for FDI to be a substitute for or complement to international trade, typically depending on the type of investment. Vertical and

[29] Firm-specific or headquarter activities are those related to research and development, marketing, etc.
[30] Plant-specific activities are those related to the production process.

horizontal FDI are two main aspects in studying this relationship. Theoretical literature on this topic can be studied within the partial and general equilibrium framework.

3.2.2.1 Partial Equilibrium Studies

Krugman (1983) discussed the emergence of MNE and its possible linkage with trade within a partial equilibrium framework. The author considered two types of investment-horizontal FDI related to product differentiation which arises owing to difference in labor productivity and vertical FDI related to backward integration into raw materials production. In his model the essential explanation of horizontal MNE is the presence of fixed costs in production which limits the variety of goods that any country can produce. "The asset acquired by the fixed cost might be technology in the usual sense, or it might be less easily specified 'know-how' in management, marketing, etc" (Krugman, 1983 p. 61). This implies that once the fixed costs have been incurred, they do not have to be incurred again, even if production takes place at multiple locations. In this sense, they are not tied to location. Krugman thus concluded that in case of horizontal investment, trade in commodities offers alternative to FDI and that trade and FDI are substitutes. This relationship changes in the case of vertical FDI. Krugman's model of vertical FDI is based on Perry's (1978) model of vertical integration due to monopsony. The essential explanation for the existence of vertical MNE is that the profits of the firm that is integrated vertically across countries must be larger than the combined profits of independent upstream and downstream firms. The source of the gain is the correction of monopsony power of independent input suppliers in any industry. Vertical integration therefore allows for higher profits. In this model, vertical FDI leads to trade creation and Krugman concluded that when FDI is vertical in nature, trade and FDI are complements.

Within the partial equilibrium framework, Ethier and Markusen (1996) focus on internalization decision of a MNE. The authors develop a simple multi-period model in which an enterprise aspires to exploit knowledge capital in an overseas market either by setting up a subsidiary or by licensing a foreign firm. The model assumes entry of a new good every two periods. Since there are costs associated with serving a foreign market, maximum possible rents can be generated from a licensing arrangement. In the first period, a foreign firm or licensee can earn the knowledge and master the technology and then in the second period "defect to start a rival firm". Similarly, in the second period, the MNE can also defect by allotting a license to a new firm. As another option, to preserve the contract, the MNE must share its rents with the foreign firm in the second period. The underlying assumption here is that "no binding contracts can be written to prevent either firm from undertaking such a defection" (Markusen, 1995). The emphasis is on modeling the costs of arm's-length transaction arising from information asymmetries, contractual frictions, dissipation of knowledge and costs of search (Antras, 2005). The essential motivation behind this lies in the public goods and non-excludability characteristic of knowledge-based assets. Public good characteristic means that once knowledge based assets are created, they can be used in multiple production facilities without decreasing its worth in any single production facility. This incentivizes firms to use the same knowledge at no additional cost to expand operations to multiple production plants abroad. The non-excludability characteristic implies that any foreign enterprise, whether an owned subsidiary or arm's length contractor, can never be averted from learning and using the knowledge (Markusen and Xie, 2014).

3.2.2.2 General Equilibrium Studies

3.2.2.2.1 MNEs and Vertical FDI

The theoretical models of vertical FDI are typically driven by differences in factor endowments. Helpman (1984) was the first to introduce MNEs in a general equilibrium model of international trade built on differences in relative factor endowments. With close to zero transport costs, foreign investment will take the form of separation of headquarters (firm-level activity such as R&D) and production plant so as to benefit from the difference in relative factor prices. These two activities have different factor intensities. The absence of transport costs or tariffs implies that the firm will certainly not build more than one production facility thereby making this the model of a "vertically integrated firm". The model was based on the extended Heckscher-Ohlin trade theory with two countries, two sectors-one perfectly competitive producing a homogeneous good (Y) using a standard linear homogeneous production function with constant returns to scale and the other producing differentiated good (X) under increasing returns to scale production function and two immobile factors of production (labor-L and general input-H).

The model also assumes that "the homogeneous product is labor intensive relative to the differentiated product". To produce the preferred variety of the differentiated good (X), the general input (H) has to be adapted. Once this is done, the general input develops to be a "firm-specific asset" which can be provided, at no additional cost, to different plants situated in different countries. Helpman (1984) also assumes that differentiated product sector is also characterized by "Chamberlinian-type monopolistic competition" and increasing returns to scale. The main point here is that the location of the different production stages is based on the difference in factor endowments and factor prices across countries. Absence of factor price equalization is the main driving force of this model. If there are no substantial differences in factor endowments then international trade will lead to factor prices equalization between countries and there would be no motivation for cross-border flows of FDI. If however differences in factor endowments are substantial, then international trade does not equalize factor prices. Firms expand vertically to take advantage of difference in factor prices, locating different stages of production on the basis of difference in factor endowments and factor prices across countries. In this case, firms in the differentiated product sector locate production of the input (via adaptation of factor H) in the country with relatively abundant factor H and production of the final good in the country with relatively abundant supply of labor. In this way, the firm becomes a "vertically integrated MNE" (Forte, 2004).

The theoretical models of vertical FDI have shown that the degree of specialization is positively related to the difference in relative factor endowments (Helpman, 1984 and Helpman and Krugman, 1985). These models explain that when there are no substantial differences in factor endowments, then a country with relatively abundant endowment of capital will tend to produce capital-intensive differentiated goods and exchange them for the labor-intensive homogeneous good from a country with relatively abundant endowment of labor. However, if differences in factor endowments are substantial, then the country with relatively abundant endowment of capital will tend to export headquarters services to the country with relatively abundant endowment of labor (intra-firm trade) in exchange for a variety of finished differentiated goods (intra-industry trade) and a homogeneous good (inter-industry trade), rather than purely exporting the differentiated good (Forte, 2004). In this way, these models explain simultaneous co-existence of intra-firm, intra-industry and inter-industry trade.

The theory of vertical FDI, therefore, explains cross-border investment as a response to factor price differentials. FDI leads to complementary trade flows from the labor-intensive country.

Helpman (1984) concludes that "in some sense the larger the difference in relative factor endowments the larger is the volume of trade".

Markusen (1984) formulated a model centered on the notion of multi-plant economies. Assuming countries have identical factor endowments, the author shows how multi-plant scale economies affect the production and trade patterns. In his model, headquarters' activity is modeled as a "joint-input" such that it can be utilized in multiple plants without decreasing its value in existing plants. The model suggests that joint input enhances technical efficiency and can make multinational enterprises centralize their "firm-specific activities" and decentralize "plant-specific activities" for greater efficiency and profits. Under this setting, "if factors are then permitted to move internationally, factors will flow in a manner that increases the degree of international specification and the volume of commodity trade" (Markusen, 1984 p.224). Markusen mentions about two equilibrium types- (i) a duopoly amongst two NEs where there is no trade owing to the identical factor endowments; and (ii) a MNE monopoly having two plants, one in each country. The production of the good is monopolized by the MNE. If the multinational enterprise thinks that it is efficient to locate certain activities (such as headquarter activities) in the domestic home country, then the two countries will produce different goods and specialize in different activities. This model suggests that MNEs can lead to creation of trade.

It is important to note here that both Helpman (1984) and Markusen (1984) assume an exogenously specified market structure, where multi-nationality is assumed. These models are important in explaining one-way flows of FDI among countries with similar endowment differences but do not explain the existence of two-way intra-industry FDI flows between countries with similar factor proportions. The assumption regarding exogenous market structure changes when we discuss models with horizontal MNEs which consider the market structure to be endogenously determined as a result of plant location decisions made by firms. These models are important in explaining intra-industry investment flows (Forte, 2004).

3.2.2.2.2 MNEs and Horizontal FDI

In more recent studies based on the theory of horizontal FDI, the relationship between international trade and FDI is based upon firm-specific and plant-specific activities. Built upon the assumption that countries are symmetric in terms of market size, factor endowments and technology, the theoretical models of horizontal FDI assume that an MNE is typically faced with a trade-off between concentration and proximity to customers (Horstmann and Markusen, 1992; Brainard, 1993). Proximity implies that multinational enterprises have a motivation to overcome trade barriers by undertaking FDI and establishing subsidiaries in an overseas market. Concentration relates to increasing returns to scale at the plant-level. The model assumes transportation costs that increase with distance. While increasing returns to scale restrict the number of efficient plants, transport costs and other barriers to trade work in the opposite direction. In cases where there are low trade costs and high economies of scale in production, a firm will find it profitable to concentrate production in a single plant in the home country and serve overseas markets by exports. In cases where trade costs are high and economies of scale in production are low, a firm will choose to serve each market through establishing a plant in it. That means, if proximity advantages outweigh concentration advantages, foreign investment substitutes trade that increases with trade costs. This is called the "proximity-concentration tradeoff" (Brainard, 1993). Even though Horstmann and Markusen (1992) consider the case of homogeneous goods and Brainard (1993) considers the case of differentiated goods, the results are similar.

Horstmann and Markusen (1992) develop a simple model and show "how imperfectly competitive market structures can be endogenized in trade models". Based on the assumptions outlined above and that decisions to serve foreign market is a two-stage game, the model assumes that a firm in each country selects amongst three options in stage one -i) becoming a multinational enterprise by maintaining a plant in both the countries, specified as the "two-plant strategy"; ii) serving both markets by maintaining a single plant in domestic country, specified as the "one-plant strategy"; and iii) not entering the market, specified as the "zero-plant strategy". Given their first stage decision about the choice of entry mode, if firms enter in both markets and play a "Cournot-Nash game in outputs" in the second stage, the study identifies three types of equilibrium that will arise: (i) export duopoly with two-firm, single plant NEs when "plant-specific costs are larger relative to firm-specific costs and tariff/transport costs"; (ii) one-firm, two plant MNE monopoly when "firm specific costs and tariff/ transport costs are raised such that maintaining a duopoly generates negative profits"; and (iii) two-firm, two-plant MNE duopoly which is obtained by "lowering plant-specific costs (relative to equilibrium (1)) so that

MNE duopoly is both profitable and dominated the exporting duopoly" (Horstmann and Markusen, 1992). In this model, technology endogenously determines the market structure.

Similarly, under the assumption of differentiated goods being produced by an industry facing monopolistic competition and enjoying increasing returns to scale, Brainard (1993) identifies three types of equilibrium:

(i) Pure trade equilibrium: When there are only NEs with a single plant and headquarter situated in the same market, there exists two-way trade in differentiated final goods. When the factor proportions are equal, then all trade will be intra-industry (Helpman and Krugman, 1985);

(ii) Pure multinational equilibrium: When there are only MNEs which have plants in both markets. This type of equilibrium is likely when the transportation costs and trade barriers are higher and the increasing returns at the corporate level are greater as compared to the plant-level. There exists two-way trade in headquarter services (or "invisible" corporate services) which substitutes for trade in differentiated sector; and

(iii) Mixed equilibrium: Some firms have a "single production facility and exports" and the remaining firms have production facilities in both markets. Brainard (1993) mentions that in this mixed equilibrium, "there is both two-way trade in final goods and two way multinational production". The existence of the type of equilibrium depends on the relative size of transportation costs and economies of scale at the firm-level as compared to plant-level scale economies.

Based on the results of the theoretical models of horizontal FDI, Rosa Forte (2004) in her study concludes that "for intermediate levels of transport costs, MNEs exist, in equilibrium, when the firm level fixed costs, tariffs and transport costs are high relative to plant specific fixed costs". When there are no costs of transportation, then only national enterprises exist which export to the other country. If costs of transportation are high, then only multinational enterprises exist which means lower fixed costs per market and eventually removing NEs.

As an extension to Hortsman and Markusen (1992) and Brainard (1993), studies by Markusen and Venables (1995, 1996, 1998) and Markusen (1998) focus on asymmetries between countries as an important factor determining the choice between trade and FDI. They analyze the interval of parameters where the convergence in relative endowments and country size can lead to existence of more MNEs relative to NEs. They consider horizontal two-plant firms only and not vertical firms that have plant and headquarter situated in different countries. They consider four types of firms-single plant national firms that are located in either domestic or foreign country and two-plant MNE located in either domestic or foreign country. Consistent with the earlier results, their study findings also suggest that multinational enterprises can be found in equilibrium when there are high transport and tariff costs and large economies of scale at the firm-level as compared to economies of scale at the plant-level. They suggest that initially firms tend to be "national" and situated in the "advantaged" home country. As there is development in the "disadvantaged" country in terms of size of the market, factor endowments and technological efficiency, more and more firms from the "advantaged" country will set up subsidiaries in the "disadvantaged" country (Liu et al., 2001). "Multinational production will tend to displace national firms and trade as the two countries converge in (a) relative size, (b) relative factor endowments, and (c) relative production costs" (Markusen and Venables, 1996). This is known as "convergence hypothesis". In contrast, when countries are dissimilar in terms of market size, factor endowments or production costs then NEs are more important relative to MNEs. Suppose one country is relatively large compared to the other country, then the national firm will be the dominant firms which would be serving the small market with exports. It would not pay the firm to enter the small country and establish production plant there incurring high plant-specific fixed costs. Similarly, if the countries are dissimilar in terms of relative factor endowment, then also again the dominant firm would be national firms situated in the country that has abundant endowment of the factor used intensively in MNE industry. So, relative to a model with only NEs, addition of MNEs shifts production in favor of the country which is smaller in size and/or has factor endowments used scarcely in the multinational enterprise industry. In such a case, the country with production base always benefits from multinational enterprises and in general both countries gain. Trade volumes also differ compared to the usual predictions of a standard oligopoly model. This is more so in the case of similar countries and growing world income.

Similarly, Pain and Wakelin (1998) suggest that when there is similarity between countries in terms of market size and factor endowments and transportation costs are high, MNEs tend to substitute for NEs as they have lower marginal costs per market since they acquire knowledge based assets. Thus, the inclination for countries to move in the direction of similarity implies intra-industry trade to be substituted by horizontal investment, further pointing to a substitution relationship between international trade and FDI.

In sum, these models conclude that when the countries are very similar, then MNE's dominate. In cases where there is a moderate degree of difference, then MNE's co-exist with NE's of the "advantaged" country, where advantage is defined in terms of relative factor endowments or lower unit costs of labor in the other country. In cases where there is a huge difference, then only national firms exist (Markusen, 1995).

As an extension to the study of horizontal investment, Helpman et al. (2004) incorporate heterogeneous firms into a simple multi-country, multi-sector model wherein firms face a " proximity-concentration tradeoff". Each firm chooses whether it should serve an overseas market, and it decides whether to do so by exporting or by engaging in horizontal FDI. The model suggests that it is firm heterogeneity, with respect to its productivity level, which is the main determining factor behind the decision of the firm to serve overseas markets either through exports or investment. This also implies that firms "self-select" themselves into exporting and FDI. There are certain fixed costs in serving overseas markets. In the case of exports, these usually include costs related to information collection on product compliance, distribution and servicing networks, advertising and transport costs (Greenaway and Kneller, 2007). The costs related to FDI are associated with distribution and servicing networks costs and also the costs of establishing a subsidiary in a foreign market and replicating production facilities abroad. Helpman et al. (2004) assumes that costs accompanying with foreign investment are greater than costs accompanying exporting and that the method of serving the foreign market will depend on productivity levels of different firms. Owing to the presence of fixed costs in serving overseas markets, only the most productive firms (or the firms that expect sufficiently high profits from serving foreign market) will export or undertake FDI (Helpman et al., 2004; Yeaple, 2005).The firms that are least productive will close their operations as they cannot produce a positive operating profit (Nayak and Choudhury, 2014). Other firms with low productivity levels will sell only in the domestic market.

As far as the decision between FDI and exports, the most productive firms will choose to serve the overseas market through foreign investment, while the firms that are comparatively less productive will serve the overseas market by way of exports. The productive firms that undertake

FDI would do so when the benefits from avoiding transportation costs exceed the costs of maintaining operations abroad (Nayak and Choudhury, 2014). This is what we earlier referred to as the "proximity-concentration tradeoff". The authors thus conclude that it is differences in productivity levels across firms along with trade-off between proximity to customers and concentration advantages that decides the mode of penetration into the foreign market. The study suggests that the more productive the firm becomes, the more multinational it will become and concludes that horizontal investment will substitute for trade when proximity advantages outweighs concentration. The role of heterogeneity was also shown to be important for explaining the choice between trade and FDI and determining organizational structures in an earlier study by Melitz (2003). He built a formal theoretical model of Krugman (1979) monopolistic competition framework which incorporated heterogeneous firms to describe the relation between productivity and multi-nationality of firms. Similar to what Helpman et al. (2004) suggested, Melitz model is also derived from the interaction between firm-level productivity differences and fixed export costs.

3.2.2.2.3 Knowledge-capital Models of MNE

The theoretical literature discussed so far comprises mostly distinct theories of MNEs, focussing on one investment type, either vertical or horizontal. Only recently, attempts have been made to integrate two investment types in one model, known as the "knowledge-capital model" (Markusen et al., 1996; Markusen, 2000; Carr et al., 2001). This model is based on the idea that MNEs have knowledge-based assets that create economies of scale at the firm level. This model permits existence of positive trade costs amongst countries and differences in factor intensities across activities, as a result of which both horizontal and vertical FDI are likely to exist. In this kind of a scenario, firms have the option of either having plants in different locations or geographically separating headquarter activity and production plant. So, firms can decide whether to become a horizontally integrated multinational enterprise, vertically integrated multinational enterprise or to undertake production in the domestic country and serve foreign market through exports.

There are three defining hypotheses for this model (Markusen and Maskus, 2001):

(i) Fragmentation: The services of firm specific headquarter activities can be fragmented from production and can be provided at a low cost to production facilities (Anghel, 2007).

(ii) Skilled-labor intensity: Firm-specific headquarter activities (or knowledge based assets) are relatively more skill-labor intensive as compared to production. This characteristic gives a vertical dimension to the activities of MNEs such that they have an incentive to fragment production process and situate activities as per factor price differences.

(iii) Jointness: Headquarter activities have a public good characteristic implying they can be used simultaneously by several plants. This characteristic gives a horizontal dimension to the activities of MNEs such that they can produce same goods and services in multiple locations.

As a result of these hypotheses, different groupings of enterprises (vertical MNEs, horizontal MNEs and national enterprises) can arise endogenously depending on country characteristics such as size of the country, difference in sizes of two countries, trade and investment costs, factor endowment differences, investment barriers etc. These attributes in turn then predict the relationship between international trade and FDI.

3.3 Empirical Literature

As is clear from the theoretical literature, it is tough to envisage whether international trade and FDI are substitutes or complements. The relationship between international trade and FDI is complicated and cannot be determined theoretically; this is basically an empirical matter. Unobserved factors such as the size of the firm, organization of firm activity, and income of host countries, proximity, trade costs such as transport costs, and tariffs influence outcomes. The empirical literature on international trade and foreign direct investment is vast, but the literature that examines the link between the two is limited. There are largely two aspects of likely links between foreign investment and trade-the first is whether foreign investment is a substitute for or a complement to trade; and the second is whether foreign investment causes trade or vice versa (Kiran, 2011). There are studies conducted at multiple levels of aggregation: country-level, industry-level, firm-level and product-level. Every level of analysis has its own qualities and shortcomings, and offers different comprehension and understanding of the relationship between trade and FDI (Fontagne, 1999). The studies use different methods and data to evaluate the economic relationship between the two and have reached different conclusions. The primary difficulty in establishing an empirical relationship between the two arises from the fact that both trade and FDI are jointly determined by common economic factors. For instance, more productive firms would undertake FDI and exports at the same time. It is also possible that changes in exchange rate or tariffs simultaneously impact FDI and exports. This leads to possibility of endogeneity in a regression of FDI on trade or trade on FDI. Also, in the case of trade and FDI we could have a causality running in both directions-trade causes FDI and FDI causes trade.

Majority of the studies have paid attention to developed countries as they are a major source of FDI and also due to the easy data availability associated with them. Studies have used both cross-sectional as well as time-series analysis. However most of the analysis is done using cross-sectional data to capture the relationship and the causal relationship between trade and FDI.

3.3.1 Country-level Studies

Grubert and Mutti (1991) examined the relation between American controlled MNE operations overseas and America's trade (exports and imports) using data for 1982 on a cross-section of 33 countries. In order to avoid endogeneity problem, the authors use average effective tax rate as an exogenous indicator of the relative attractiveness of operations abroad. The results support the existence of a complementary relationship i.e US imports more from and exports more to low-tax countries where US FDI is higher. The authors note that the complementarity is obtained in a bilateral perspective. A more complete analysis would require a multilateral perspective. It is possible that exports from US to a country increases when US establishes operations in that country. But it could also be the case that the final output produced is exported to some other third country displacing exports from the US. The authors note that in such a case, total net exports would not have increased because exports to third countries may fall and imports may increase.

Using a modified gravity model, Eaton and Tamura (1994) controlled for country determinants to examine the relationship between exports and foreign investment for Japan and the US with a sample of around 100 other countries over the time period 1985-90. Every trade and FDI variable was explained by its per capita income, its human capital endowment, its partner country's population and dummies to account for "natural regions of integration". The study finds that trade and FDI are jointly determined by some factors. For example, both trade and investment flows rise with the per capita income of the partner country. The impact of regionalism on on bilateral relations between trade and FDI is also positive. The study concluded that for both Japan and the US there is a positive relationship between outward FDI and exports and outward FDI and imports. The study found that this did not hold true in the case of inward FDI.

A study by OECD (1998) examined the macro-level relationship between trade and FDI for 21 OECD countries. The time period considered was from 1980 to 1995. In the study, "bilateral FDI flows were integrated, and simulated trade flows with FDI relationships driven to zero". Separate equations were estimated for exports and imports. A comparison of observed bilateral trade flows with simulated bilateral trade flows (analogous to a world with no FDI) were made to provide an estimate of the amount of "FDI-induced" flows of trade. The biggest surge in FDI-induced flow of trade was related to the US and Japan. The results suggest that Japan's exports to the US "increase" by 150 percent corresponding to a situation without FDI. The next closest bilateral relationships were found for US-UK, US-Canada, UK-Netherlands, US-France and Sweden-Netherlands.

Clausing (2000) examined the relationship between trade and FDI based on two groups of panel data (1977-94). The first set of data pertaining to operations of US-based multinational enterprises in 29 host countries and data on US exports is used to examine the relationship between outward FDI from US and US exports. The second set of data pertaining to operations of affiliates of MNE headquartered in 29 countries in America and data on US imports is used to examine the relationship between inward FDI received in US and US imports. The study investigates the relationship between MNE activity and international trade using a gravity model specification that relates trade flows to variables including FDI and other usual variables such as exchange rate, distance and trade barriers. Affiliate sales are used as a measure of MNE activity. The empirical analysis suggests that multinational operations of US firms and exports have a complementary relationship. The study finds no statistical evidence supporting a substitute relationship between imports and inward FDI by foreign firms. Further the study also finds that there exists a strong complementary relationship between intra-firm trade and FDI and a weaker complementary relationship between inter-firm trade and FDI. The author explains the results suggesting that operating abroad may increase demand for intermediate products and thus their exports. Operating abroad, however, may also decrease exports to other firms, particularly if exports of other products do not increase sufficiently to offset the effect of substitution.

Hejazi and Safarian (2002) examined the relationship between exports and outward FDI from Canada on a bilateral basis for 27 countries. The time period considered in the study was from 1970 to 1998. The authors explain the determinants of trade and FDI patterns simultaneously using a standard gravity model to explain trade and an augmented gravity model to explain FDI. There are separate equations for imports, exports, inward FDI and outward FDI. To account for the interaction between trade and FDI, lagged outward FDI is included in the export regression and lagged exports is included in the outward FDI regression. Similarly, lagged inward FDI is included in the import regression and lagged imports is included in the inward FDI regression. The trade and FDI models are estimated simultaneously utilizing the Seemingly Unrelated Regression (SUR) framework. The parameters on the lagged endogenous variables determine the relationship between trade and FDI. The findings of the study suggest that inward FDI increases imports to Canada and outward FDI increases exports from Canada.

Seo and Suh (2006) analyze the effects of outward FDI from Korea to four Association of Southeast Asian Nations (ASEAN) countries namely Indonesia, Malaysia, Philippines and Thailand (ASEAN-4) on home country's exports and imports. The authors use export and import demand functions with the partner and home country incomes, export and import prices (Goldstein and Khan, 1985), home country's investment flows to host country and home country's cumulative investment in host country lagged by one period and a dummy variable to capture the effect of "Asian financial crisis" in Korea between 1998 and 2000 as key independent variables. The study uses two FDI variables, i.e. FDI stock and FDI flows. The reason for using FDI stock is so that it can proxy either the level of international production or the means of reducing transaction costs. The reason for using FDI flows is that the flow of FDI usually involves the transfer of goods, particularly capital goods. This has an impact on exports of the home country and in general on the trade balance. Even if FDI flow is assumed to be purely flow of financial capital, that capital is also then used for trading purposes, for example importing machines and equipment from the investing firm's home country. Based on these arguments, the authors hypothesize that FDI flows positively affect a home country's exports. The authors pool the yearly data for the period 1987-2002 by cross-country. The model is estimated using fixed-effects specification. The study finds that FDI stocks in ASEAN-4 do not have any discernible trade substituting effects on either exports or imports from Korea. Though, the study also finds that flows of FDI do marginally contribute to exports from Korea to ASEAN-4.

Bojnec and Ferto (2014) examine whether there exists a direct relationship between outward FDI flows and bilateral merchandise exports among European Organization for Cooperation and Economic Development (OECD) countries. Using a gravity model technique, the authors test whether outward FDI substitutes or complements exports. To specify the gravity model, apart from including usual variables such as GDP and distance, they also include some additional variables such as outward FDI and related attributes of the sample of OECD countries and country pairs. Their model contains both time-variant as well as time-invariant variables as control variables. While GDP of host and home country, outward FDI and trade openness are included in the model as time variant variables, distance and dummies for language, contiguity and landlocked-ness of the host country are included as time invariant variables. The authors note that the possible correlation between explanatory variables and country-specific unobserved effects suggests use of fixed effects panel data model for estimation. However, since the identification of the parameters depends on the time variation within each cross section, the authors also recognize that the impact of time-invariant variables on merchandise exports cannot be estimated using the typical fixed effects estimator. Therefore, the authors use "Fixed Effects Vector Decomposition (FEVD)" estimator technique (Plümper and Troeger, 2007). FEVD decomposes the fixed effects into explainable components, that are correlated with the time-invariant variables and an unexplainable component. Using the conventional fixed effects model, the authors first estimate the country-fixed effects, which are then regressed on the time-invariant variables to obtain the unexplained component. Then the authors obtain a model which includes time-invariant variables, time-varying variables and the unexplained component of the fixed effects vector which is then estimated using pooled OLS technique. The study finds that outward FDI has a negative effect on bilateral exports between OECD countries and therefore, concludes that outward FDI substitutes exports.

Carr, Markusen and Maskus (2001) was the first study to empirically examine the hypotheses of the knowledge-capital model. The authors constructed an empirical specification where sales of the affiliate in a host country were modelled to be a function of sum of GDP of the two countries, squared difference in GDP of the two countries, costs of investing in the host country, costs of exporting to the host country, factor endowments differences between the two countries labeled as "skill differences"[31] and an interaction term between differences in skill endowments and economic size. The hypotheses supporting horizontal motives of FDI under the "knowledge capital model" predicts a positive coefficient associated with the sum of GDP term and host trade cost variable and a negative coefficient associated with the GDP difference term. The hypotheses supporting vertical motives of FDI under the "knowledge capital model" predicts a positive coefficient associated with the skill difference variable. Using a panel data of bilateral country-level US outbound and inbound affiliate sales for the time period 1986-1994, the authors find empirical evidence consistent with the hypotheses of the "knowledge-capital model", supporting both the horizontal and vertical motives for FDI. The regressions are estimated using weighted-least squares and Tobit procedure. The authors establish that affiliate sales increase when skill difference and market size of both countries are large. Affiliates sales decrease when the size of the countries is different. They also find that affiliate sales are larger, if the home country of the MNE is small and skilled labor abundant at the same time.

Extending the study of Carr et al. (2001), Markusen and Maskus (2001) estimate the empirical model only for US outward affiliate sales. They observe a negative relationship in the home country between affiliate sales and the abundance of skilled labor and reject the "knowledge-capital model" in support of horizontal FDI. In another study, Markusen and Maskus (2002), again using the same set of data as in Carr et al. (2001), suggest another empirical model that differentiates between the "knowledge-capital model", vertical model and horizontal model. This study supports both the knowledge-capital model and the horizontal model, but finds no support for the vertical model. The three studies described so far for the empirical testing of knowledge-capital model are based on the assumptions of the knowledge-capital model and use the same set of data, but exhibit mixed evidence.

[31] Carr, Markusen and Maskus (2001) define "skill differences" as the difference in ratio of skilled employment to total employment between the parent and host countries.

However, Blonigen, Davies and Head (2003) contend that the empirical specifications of the "knowledge-capital model" used in the study by Carr et al. (2001) may possibly be mis-specified, particularly for the proxy for relative skilled labor endowment. By using same data set employed by Carr et al. (2001), but using the absolute skill difference instead of relative skill difference the study suggests that there is a negative correlation between skill difference and affiliate sales. The results reject the knowledge capital model and show support towards horizontal motives of FDI.

3.3.2 Industry-level Studies

Lipsey and Weiss (1981 and 1984) examined the relation between US outward FDI and exports using data for 44 destination countries in 1970 for 14 industries using the gravity model. The study found that production by an affiliate in a foreign country increases demand for goods from the home country. These goods can either be intermediate goods required for assembling products in host country or final goods. Presence of an enterprise manufacturing good in a foreign country can increase demand and eventually sales for all the products through a well-organized and competent distribution system, brand advertisement and sales services. This leads to greater exports from the home country. The study concluded that a complementary relationship exists between outward FDI and exports from US and that local production of US-based affiliates is positively correlated to total exports of the parent firm. The results of the analysis also revealed that while US affiliates manufacturing activity abroad increased the exports of their own parent firm, they tended to reduce exports of other countries to the same destination country. The model also accounts for certain host country characteristics such GDP, manufacturing imports, distance and membership in a trade bloc. However, the study uses an OLS regression of trade on MNE activity and fails to account for the issue of endogeneity.

For seven Austrian industries, Pfaffermayr (1996) studied the relationship between outward FDI and exports for the time period 1980-1994. FDI stock is used as a measure of "multinational activity" in the study. Considering outward FDI and exports as endogenous variables and using other common determining factors like capital intensity of work and R&D, the author utilizes a system of simultaneous equations and reports a significant and stable complementary relationship between outward foreign investment and exports

Brainard (1997) was the pioneer study to match the theoretical predictions of general equilibrium models of horizontal FDI to actual data. Using data for 1989 of 63 industries and 27 countries, the study examined the relationship between US outward foreign investment and exports and inward foreign investment and imports. The author derives an equation for the export share as the dependent variable and freight cost, tariff barriers (to represent openness to trade), trade costs, FDI (to represent openness to FDI), absolute value of difference in per-worker gross domestic product between the host and destination county, plant-scale and industry-scale economies as independent variables. The estimated equation also investigates how destination country and industry characteristics affect the choice between exporting and producing in a foreign country. The proximity-concentration hypothesis predicts a negative coefficient for freight factor and tariffs and corporate-level economies of scale and a positive coefficient for plant-level economies of scale. By controlling for simultaneity amongst trade flows and sales of affiliate using an instrumental-variables technique, Brainard (1997) concludes that "affiliate production rises as a share of total foreign sales the greater are transport costs and foreign trade barriers and the lower are foreign investment barriers and scale economies at the plant level relative to the corporate level". The study finds support for the "proximity-concentration tradeoff" as a robust explanation for the importance of production in overseas market as compared to exporting as alternate means of access into the foreign market. Overall, the results advocate complementarity between trade and FDI.

Banga (2003) assesses the impact of foreign direct investment on trade and evaluates whether it differs according to the source of investment. In particular, the study examines if there is a difference between the impact of FDI received from Japan and US on the Indian manufacturing sector's exports. The author conducts an empirical analysis for 74 disaggregated industries for the time period 1995-96 to 1999-2000. The data sources used for the analysis include Capitaline 2000, several issues of Annual of Survey of Industries (ASI), several issues of National Accounts Statistics and certain Ministry of Industry publications. Using panel data estimation (random and fixed effect models), separate empirical analysis is conducted for traditional and non-traditional export sectors.[32] The study finds that foreign investment has a significant impact on the export intensity of non-traditional export sector industries, thereby leading to

[32] The author also estimates spillover effects in the non-traditional export sector on 1,448 domestic firms using the Tobit model estimates.

diversification of India's merchandise exports. The findings also suggest that the impact of foreign investment on exports varies according to the source of FDI. While foreign direct investment from the US is shown to have a positive and significant effect on export-intensity of non-traditional export sector industries, foreign direct investment from Japan does not have any significant impact.

Egger and Pfaffermayr (2004) analyze the effects of "distance as a common determinant of exports and FDI" using bilateral industry-level data on outward FDI stocks and exports from US and Germany to other economies between 1989 and 1999. They specify a gravity model with exports and outward FDI being determined by common factors such as country size, relative factor endowments, and similarity in country size and distance which is used to measure transport costs and fixed costs for establishing a foreign plant. The theoretical underpinning of the model is that distance, as a proxy of trade costs, has an impact on both exports and FDI. The assumption is that distance increases the cost of trade and set-up for foreign plants simultaneously. Establishment of a foreign plant entails fixed costs that are larger than those required for maintaining a national plant and catering to the foreign market through exports. There are two possible cases: (i) distance can have a negative impact on FDI, if the former is important for plant setup costs and (ii) distance can have a negative impact on exports, if the former is associated with higher trade costs. However, in a general equilibrium framework, it may be the case that "the direct negative effect on exports is outweighed by an indirect one induced by the pronounced reduction of stocks of outward FDI through higher distance." The impact of distance on exports and foreign investment also rests on the kind of FDI. In models of trade and horizontal FDI, transportation costs are expected to have a positive impact on foreign investment and a negative impact on trade. In these models, outward foreign investment and exports are substitutes with respect to transport costs. The association between transportation costs and MNE activity is not very clear in the models of trade and vertical FDI as vertical MNEs participate in trade too. The actual effect, therefore, becomes an empirical question where trade and FDI may either be substitutive or complementary in nature. The expected effects on both exports and outward foreign investment is dependent on the relative importance of distance for FDI vis-a-vis exports and the relative importance of horizontal or vertical multinational enterprises. To assess the relative importance of vertical enterprises, the authors include a time-variant interaction term between distance and relative factor endowments differences.

The authors use a “Seemingly Unrelated Regression Hausman-Taylor” (HTM-SUR) model specification as their methodology, noting its several advantages over fixed-effects model. Firstly, through HTM-SUR, it is possible to obtain parameter estimates of time-invariant variables which is not possible through the usual fixed-effects model. Secondly, unlike the random-effects model, HTM-SUR gets rid of any bias in parameter estimates resulting from endogenous unobserved effects. Thirdly, HTM-SUR is more efficient than the fixed-effects estimator. The findings for US exports and outward FDI suggest that bilateral outward FDI increases significantly with distance, but has a negative impact on exports. However, more dominant the vertical multinational enterprises are, less evident is the positive impact of distance on FDI. The findings for German exports and FDI also suggest that bilateral outward FDI increases significantly with distance, but does not have any significant impact on exports. Regarding unobserved time-invariant determinants in the United States, the study concludes that exports and FDI are complementary. In case of Germany, the relationship is found to be marginally substitutive. The time-variant interaction term between relative factor endowments differences and distance is found to be negative and significant for US and insignificant for Germany. This points towards relatively low importance of distance for plant setup costs than for exports and suggests that vertical MNEs are more important for US. The time-variant interaction term between distance and relative factor endowments differences is found to be insignificant for Germany, suggesting that horizontal MNEs are more important in Germany.

Goldar and Banga (2007) examine the impact of trade liberalization undertaken by India in the 1990s on foreign direct investment in Indian industries. The study also analyzes the differential effects of trade related to intra-industry trade and international vertical integration on investment flows. The empirical analyses are undertaken at three levels. First, at the industry-level using panel data for 78 industries at 3-digit level of industrial classification for the time period 1991-92 to 1997-98, the authors estimate econometric models that associate the “extent of foreign investment in an industry in a particular year to intra-industry trade in that industry, level of materials import intensity and, a set of other variables that are expected to influence the degree of foreign presence” and associate “intra-industry trade and materials import intensity to trade barriers facing that industry and a set of other variables that are expected to influence materials imports and intra-industry trade”. Second, the authors conduct a cross-sectional analysis at the inter-firm level to describe the variations in foreign equity share within different firms and relate it to the trade performance of the firms. Third, the authors conduct an "inter-state analysis of FDI and trade flows" in which trade intensity of firms in a particular state are related to the amount of investment inflows received in that state. For the empirical analyses, the data for industry characteristics are drawn from ASI and data on exports and technology are obtained from Prowess, Centre for Monitoring Indian Economy Pvt. Ltd (CMIE). The share of foreign firms in total industry sales as reported in Prowess, CMIE has been taken as the proxy of the "level of FDI". A concordance exercise is conducted to match the three-digit level industries in ASI with industries in Prowess. The quantitative measures of the trade liberalization process used in the study include tariff rates and non-tariff barriers (import coverage ratio). The authors calculate the intra-industry trade intensity using the Grubel-Lloyd (1975) index. India's trade data (both exports and imports) at the 4-digit levels of International Standard Industrial Classification (ISIC), extracted from the World Bank, is mapped with the ASI industrial classification and trade intra-industry trade intensity indices for the 78 industries are then consequently obtained.

Overall, the results demonstrate that trade liberalization has had a favorable impact on foreign investment flows in the Indian manufacturing sector. The industry level analysis results show that trade liberalization has caused an increase in intra-industry trade and materials import intensity indicating that the cross-border vertical integration process has had a favorable impact on FDI inflows. The results of the cross sectional analysis conducted at the inter-firm level show that export intensity and import-availability ratios have had a noteworthy and favorable impact on foreign equity share. The inter-state analysis results show that there exists a positive connection between the level of trade carried out by the plants of companies situated in a state and the amount of foreign investment flows received in that state.

Chow (2012) examine the effect of outward FDI on exports of Taiwan using data of 15 sectors in the manufacturing industry in 11 host countries for the time period 1989-2006. The study uses a modified gravity model where outward FDI is included as an independent variable after controlling for other factors usually used in the gravity model (market size, income differential, exchange rate, country dummy and language dummy). The author runs regressions for two types of models-first with Taiwan's bilateral trade with each of its major host countries and the second with Taiwan's total trade with all of its host countries as a group. The author conducts unit- root and co-integration tests to avoid the problem of spurious regression. Recognizing the possibility of endogeneity between outward FDI and exports resulting in a simultaneous bias in the regression, the author estimates the bilateral trade model first using the technique of “Two-Stage Least Squares” (2SLS) regression and supplements this with a simple “Ordinary Least Squares” (OLS) estimation with one-year lag of FDI. The regression results suggest that outward FDI has a positive and complementary effect on Taiwan’s exports to the selected host countries. For the second set of regression, outward FDI by 15 sectors of manufacturing industries in 11 host countries are grouped as a pool for the period 1989-2006. There are three sets of regressions for the pooled group model-2SLS, OLS and the 2-step system “Generalized Method of Moments” (GMM) estimation. The results again advocate the positive and complementary effect of outward FDI on Taiwan’s exports to host countries as a group.

Chiappini (2013) examines the relationship between Japanese outward FDI in the manufacturing sector and trade (both exports and imports). The study uses data for nine industries and thirty trading partners of Japan for the time period 2005-2011 and investigates the relationship using a gravity model specification. Outward FDI is included as an independent variable along with other traditional variables such as sum of GDP, similarity in GDP, absolute value of the difference between GDPs, absolute value of the difference between per-capita GDPs, real exchange rate and a FTA dummy variable. In order to avoid the problem of having zero-value observations in data which could lead to a selection bias and “mis-specification of the gravity equation”, the author uses a “Poisson Pseudo-Maximum Likelihood” (PPML) method of estimation. The estimation results suggest that there exists a positive and complementary effect of overseas investment on trade for Japan. As Chiappnini (2013) concludes “an increase of $1 billion invested abroad by Japan, entails an average increase of only 2.8 % in Japanese exports and an average increase of only 2.1 % in Japanese imports for each industry and each trading partner considered”.

3.3.3 Firm-level Studies

In a pioneering study, Lipsey and Weiss (1984) examined the relationship between US affiliate production and exports using cross-section firm-level data for 1970. The authors related the exports of each firm with the parent firm’s characteristics and examined it with the output of its foreign affiliates and the market size in each area. The study showed that US affiliate production in the host country and the parent firm’s exports to that country are complements. The findings of a complementary relationship is also reaffirmed between overseas production and the export of intermediate goods.

Using Swedish firm-level data, Svensson (1996) finds that FDI displaces exports of final goods and complements the exports of intermediate goods and the net effect on exports is negative i.e there exists a substitution relationship between FDI and exports. In a previous study for Swedish multinational firms, Swedenborg (1979, 1982) used OLS equations with the ratio of exports to home production to the ratio of foreign to home production as dependent variable to show that there exists a positive and significant influence of foreign production on parent firm's exports, and of foreign production in a country on firm's exports to that country. However, a two-stage least square estimation found this relationship to be insignificant, although the coefficients across all firms did not change a lot. In Swedenborg (1979), the author uses a sample of 100 Swedish manufacturing enterprises with over 300 foreign affiliates in the year 1974. The findings of the study indicate that foreign production had no significant effect on the exports of Swedish parent. The author notes that the aggregate results conceal two, opposite yet extremely noteworthy, effects. While foreign production appears to substitute certain exports to affiliates and non-affiliate customers in the host country, there is a greater positive effect on the exports of goods to affiliates. These goods include both intermediates and finished products (Blomstrom and Kokko, 1994).

Combining data from four Swedish surveys and using 2SLS, Swedenborg (1982) finds similar results. Even though the effect on total exports is still not found to be statistically significant, a pattern exists when substituting and complementary exports are inspected individually. A one-dollar rise in production overseas resulted in a twelve-cent rise in exports to affiliate production, and just a 2-cent decrease in exports to other non-affiliate customers in the host country. This approximated to a net export rise of 10 cents. These results were corroborated using a panel data analysis in a later study by Swedenborg (2000) which covered the time period 1965-1994.

Using data for 421 French firms for 1993, Mucchielli et al. (2000) finds a complementary relationship between global exports and FDI. The number of the affiliate's employees is used as an FDI indicator. The study analyzes trade volumes of the investing firm in two cases-one when they trade with their own affiliates (intra-firm trade) and second when they trade with other firms (inter-firm trade). The study points out that there exists a strong complementary relationship between foreign investment and intra-firm trade, while there exists a substitutive relationship between foreign investment and inter-firm trade.

Head and Ries (2003) study the effect of FDI on exports by using a panel data comprising of 932 Japanese firms during 1966-90. The authors differentiate production affiliates from distribution affiliates. The number of investments in production and distribution has been used as an indicator of FDI. They find that a complementary relationship exists between FDI and exports in the sense that firms that increase investment overseas correspondingly increase their exports. Controlling for size of the firm, productivity of the firm, capital intensity, number of overseas distribution investments and fixed effects also reaffirms these results. However, the relationship varies across firms. The study also suggests that the sale of intermediate goods is also a source of complementarity. For a set of firms that are not integrated vertically, there exists a negative relationship i.e foreign productive facilities seem to substitute for its exports.

Acharyya and Chaudhuri (2016) analyze the key determinants of foreign market entry-mode decisions of Indian manufacturing firms using RBI monthly firm-level outward FDI data for the years 2008-12. The authors aggregate the monthly data in order to obtain yearly data. Company level data like salaries, wages, bonus, ex-gratia, provident fund, export sales, borrowing, equity, sales, and profit before interest, depreciation, tax and amortization, year of incorporation have been taken from Prowess, CMIE database. The RBI data is then matched with Prowess data and is deflated to take into account inflationary changes. The export and FDI decision determinants are examined using a multinomial logit model incorporating time and firm-specific characteristics like productivity, size of the firm, age of the firm, R&D intensity, credit constraint, international experience, etc. The authors test for several research hypotheses: level of firm productivity positively affects the probability of the firm to undertake export and FDI; both size of the firm and R&D intensity have a positive impact on the firm's probability of exporting and FDI and the probability of undertaking FDI rather than exporting; high debt-equity ratio has a negative impact on the firm’s probability of exporting and undertaking FDI; firms with prior international experience with the host market have a higher probability of undertaking foreign investment rather than exporting. The results provide support for all hypotheses except the one related to the role of R&D in case of FDI v/s exports decision. It is found that more expenditure

R&D relative to sales increases the probability of Indian firms choosing to export over undertaking foreign investment.

3.3.4 Product-level Studies

Belderbos and Sleuwaegen (1998) examined the role of trade policy measures on FDI decisions by Japanese firms in Europe. The authors tested the proposition that Japanese FDI in Europe is “tariff jumping” and substitutes exports. Using product-level data for 35 products in the electronics industry, the authors developed a logit model which related the probability that a firm has invested in Europe to firm and product characteristics. Estimation results suggest that firms are more likely to set up manufacturing facilities for products facing export barriers in Europe. These barriers could be in the form of voluntary export restraints or antidumping actions or higher tariff barriers (Wakasugi, 1994). The results support the study hypothesis and reaffirm the tariff jumping nature of Japanese outward FDI in the electronics sector. Following this, the study also examines whether Japanese investments in Europe substitute Japanese firms’ exports. Based on an analysis of exports of 86 Japanese electronics firms’ to Europe in the year 1989, the study finds evidence of a substitutive relationship between exports and overseas production. After taking into account industry- and firm-specific characteristics that are expected to influence export intensity as well as manufacturing presence of Japanese firms in the Europe in 1985, the study reported that an increase in the number of products manufactured by Japanese affiliates in Europe had a significant negative impact on Japanese firm-level exports to Europe. Firms with higher R&D, marketing and human capital intensities and relatively higher capital-labor cost ratios were found to have higher export intensities. Interestingly, the study also found that the firms which had invested in distribution subsidiaries and the ones that had acquired a European firm had higher exports to Europe. These findings point to the important role inter-firm relationships have to play in determining export behavior of a firm. This also indicates that while manufacturing FDI substitutes for exports of the investing firms, this may not be the case for vertically integrated firms.

Blonigen (2001) explored the possibility that trade in finished products may be substitutes for the products manufactured by a multinational affiliate in that country or intermediate inputs that a multinational affiliate could use to produce a finished product. Using data relative to production of Japan in US and exports to US of two types of products-automobile components and final consumer products for the period 1978-1991, the author shows that Japanese FDI in US increases exports of intermediate inputs for these products (complementarity effect) and decreases exports of the same finished products (substitution effect). Using SUR technique, the author finds evidence for existence of a strong complementary relationship between Japanese production of automobiles in the US and Japanese exports of automobile components to the US. The author also finds substitution effects in 9 of the 10 product lines he examined. The production of Japanese automobile parts in the US has a statistically significant and negative relationship with imports of Japanese automobile parts in US. Examining data for final consumer goods shows that 9 of the 11 products show a negative relationship between Japanese production in US and Japanese exports of these products to US.

From the review of the empirical literature it is clear that it is hard to establish the relationship between trade and FDI. The relationship between the two is not simply substitute or complementary. The empirical work mostly points to a complementary relationship between trade and foreign direct investment, though there are some exceptions. The mixed empirical results are not surprising. Different empirical studies demonstrate that the nature of investment, level of aggregation, choice of country, size of the market, openness of the market, endowment of factors of production, technology advances and other factors also have an influence on the final results (Fontagne, 1999).

3.3.5 Testing of Causality

Compared to examining the substitute/complement relationship between trade and FDI, examining the causal link between the two is rare. The limited evidence of empirically examining the causal relationship between trade and FDI is based around "Granger (1969) causality" testing. The studies on this topic usually follow three stage procedures for estimation. First is to determine whether each time-series data are stationary. This is usually tested through unit-root tests. The second is to investigate whether there exists a long term relationship between variables, usually using the "Johansen's Co-Integration test" within a vector autoregressive (VAR) framework.[33] Co-integration test based on the Maximum Likelihood method of Johansen (1988 and 1991) suggests the trace test and the maximum eigenvalues test statistics to determine

[33] The purpose of this test is to determine whether a group of non-stationary series is co-integrated or not.

the co-integration rank. Based on the results of unit root and co-integration test, the final step then is to investigate the causality direction by applying the Granger causality test using Vector Error Correction Models (VECM). However, this is also as complex as the cases of substitution and complementary.

Using a time series data for the period 1969-90, Pfaffermary (1994) investigated the causal relationship between Austrian outward foreign investment and exports. Using a Granger causality test, the study finds a bi-directional causality between Austrian outward foreign investment and exports. Liu et al. (2001) examined the causal relationship between international trade and foreign investment for China. Using a panel data for China and nineteen home countries/regions, the authors conduct unit root and causality tests for the period 1984-98. On a standard vector auto regression model, multivariate Granger causality tests are carried out to inspect the causal relationship between exports, imports and FDI. The study finds that growth of imports into China causes the growth of inward flows of FDI from the home country/region, which then causes growth of Chinese exports to the home country/region. Growth of Chinese exports, in turn, causes Chinese imports to grow.

Using Spanish quarterly data for the period 1977–1998, Bajo-Rubio and Montero-Muñoz (2001) conduct Granger causality tests within a co-integration framework to analyze the relationship between outward FDI and exports. The study finds the existence of a complementary relationship between the two variables. In the short-run, the study finds existence of uni-directional causality running from outward FDI to exports and in the long-run the study finds existence of bi-directional causality between outward FDI and exports.

Aizenman and Noy (2005) inspect the inter-temporal links between FDI and disaggregated measures of international trade. The study proposes a new channel to explain positive inter-temporal feedbacks between foreign investment and trade and suggests that “a developing country experiencing rapid improvement in its productivity, due to accumulation of human capital, learning by doing, or better institution will attract growing inflows of vertical FDI, increasing thereby its international trade”. When the MNE operating in the developing country employs more skilled workers then the rise in trade volumes associated with vertical FDI will further raise the demand for skilled workers. This will tend to increase the return to human capital in the host developing country and increase the supply of skilled workers, possibly increasing FDI flows in the future. Using data for 205 countries, the study finds that stronger feedback effects between trade and foreign investment are found in developing countries than in developed countries. In particular, the study notes that "strongest feedback between the sub-accounts is between FDI and manufacturing trade." The study utilizes "Geweke (1982)'s decomposition method" and finds that about 81 percent of the linear feedback between trade and foreign investment can be accounted for by Granger-causality running from foreign investment to trade openness (50 percent) and from trade to foreign investment (31 percent). The remaining linear feedback can be attributed to simultaneous correlation between the two sets of yearly series.

Hanh and Anh-Dao (2009) estimate the causal relationship between foreign direct investment and exports for Vietnam using the VAR model. The analysis is based on panel quarterly data for the time period 1995-2006 comprising FDI inflows into Vietnam and exports from seven economic sectors namely heavy industries, light industries, agriculture, food industries, oil and gas, forestry and fisheries, services and other sectors. The authors begin the analysis by first testing the order of integration of FDI and trade to check for the existence of unit roots in the sector panel. Then they check for the existence of long run co-integrated relationship between the two variables using the Pedroni (1999) co-integration technique for heterogeneous panels. For a dynamic heterogeneous panel, the General Method of Moments (GMM) is executed to evaluate the short-run co-integration. Heterogeneous panel causality tests are performed to check the direction of causality between FDI inflows and exports. The study finds there is bidirectional causality between FDI inflows and exports. For each sector, granger causality tests are conducted between FDI and exports. The results indicate a strong long-run causal relationship running from FDI to exports in heavy industries, light industries, agriculture, food industries, oil and gas, forestry and fisheries.

Using panel causality based on an error correction model, Simionescu (2014) analyze causality between FDI, exports, imports and trade in G7 countries[34] over the period 2002-13. Granger causality test results suggest existence of short-run two-way causality between FDI and exports and FDI and imports.

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[34] The G7 countries include Canada, France, Germany, Italy, Japan, UK, and US.

Other studies such as Liu and Graham (1998), Ahmed et al. (2007) and Iqbal et al. (2010) have examined the linkages between foreign direct investment inflows, exports and economic growth in Taiwan and South Korea, five Sub Saharan African economies (Ghana, Kenya, Nigeria, South Africa and Zambia) and in Pakistan respectively. These studies suggest a long-run relationship among the variables and have reported bidirectional causality between foreign direct investment and exports.

In the empirical literature, there are some studies that have investigated the causal links between international trade and foreign direct investment for India. Based on a VAR model, Dash and Sharma (2007) examined the relationship between trade and FDI for India using data from 1996 to 2007. The authors use the maximum likelihood approach of Johansen and Juselius (1990) to determine whether there exists a long-term relationship between trade and FDI. The results suggest that there exists a long-term relationship between FDI, exports, imports and GDP. Using the Toda and Yamamoto (1995) procedure, the authors then estimate Granger causality.[35] The results of causality between exports and FDI indicate existence of a unidirectional causality running from FDI to exports. The results of causality between imports and FDI indicate existence of a two-way causality between the two variables. The authors after establishing causality use the "Geweke's (1982) decomposition method" to determine the extent of linear dependence between FDI and trade.[36] The results suggest that about 67 percent of the linear feedback between exports and foreign investment can be accounted for by Granger causality from foreign investment to export (46 percent) and from exports to foreign investment (21 percent). The residual 33 percent is due to instantaneous causality. For imports, most of the linear dependence can be accounted for by Granger causality running from FDI to imports (55 percent) and from imports to FDI (27 percent). The residual 18 percent can be attributed to simultaneous correlation between the sets of yearly series.

In a similar study, Sharma and Kaur (2013) study the causal relationship between trade and inward FDI for India and China. The authors again conduct Granger causality tests for the period

[35] Toda and Yamamoto (1995) proposed an alternative procedure for testing granger causality in a possibly integrated and co integrated system. This methodology is useful because it bypasses the need for potentially biased pre-tests for unit roots and co integration which are common for formulations such as the vector error correction model. This methodology also makes estimation of parameters valid even when the VAR system is not co-integrated.

[36] The measure of linear dependence is the sum of the measure of linear feedback from trade to FDI, linear feedback from FDI to trade, and instantaneous linear feedback.

1976-2011. The study finds that for China there exists a unidirectional causality running from inward FDI to both exports and imports. Also, bidirectional causality exists between exports and imports. The findings are different for India. The study finds existence of bidirectional causality between inward FDI and both exports and imports, and between exports and imports.

Employing co-integration and VECM causality test, Dash and Parida (2013) investigate the causal links between inward foreign investment, trade in services (export and import) and economic output for India. The causal linkages have been examined at two levels-one at the aggregate level and second at the sector levels. The sector levels include both manufacturing and services. Empirical analysis is done using quarterly data from 1996-97 to 2010-11. The findings suggest existence of a long-run relationship amongst these variables. Based on the causality test results, the study concludes existence of bi-directional causality between foreign direct investment and economic output and between services exports and economic output. The findings also indicate feedback relationship between services export and FDI, validating the existence of complementary relationship between the two variables. The study finds existence of one-way causality running from FDI and services exports to both manufacturing and services output at the sectoral level. There is also evidence of spillover effects across-sectors i.e from services output to manufacturing output and vice versa.

Cho (2013) studied the causal relationship between trade and FDI in India and four East Asian Countries namely Korea, Japan, Singapore and China. The study utilized quarterly data from the third quarter of 2004 to the fourth quarter of 2012. Like earlier studies, a bi-variate vector auto-regression format was employed. This was followed by Johansen co-integration tests to check the existence of co-integration between trade and FDI. The estimation results show that India and the East Asian countries had no causality between trade and FDI. A comparison with US, UK, Germany and Netherlands showed existence of a causal relationship. For India and UK, the study found a bi-directional causal relationship trade and FDI. For India-US and India-Germany, the causal relationship was unidirectional with causality running from FDI to trade and trade to FDI respectively.

Pant and Srivastava (2015) using country-level data suggest a positive relationship between trade and foreign direct investment for two developed countries (US and France) and two developing countries (India and China). The authors conduct Granger causality tests to check for existence of causal links between trade and FDI for China, US, Germany, France and Japan. They find that in the case of US there is uni-directionality causality running from FDI to trade and in the case of Japan there is bi-directional causality between trade and FDI. In the case of China, France and Germany they do not find any significant result.

A recent study by Babu (2018) investigated the relationship between FDI and exports from India for the period 1990-1991 to 2014-2015 using co-integration technique. The study utilized data from various issues of RBI Handbook of Statistics on Indian Economy. The results suggest that there was no long-run relationship between FDI and exports in the case of India. In the long-run FDI does not lead to higher exports from India. Using Granger causality tests, the study found existence of short-run bi-directional causality between FDI and exports.

As we can understand from the above discussion, the causal relationship between trade and FDI is complicated. Most of the studies have found evidence in favor of existence of a causal relationship between FDI and trade with some studies finding a unidirectional causality running from FDI to trade and some studies finding a bidirectional causality running between trade and FDI. Overall, there exists lack of general consent amongst the researchers. This suggests the relationship between trade and FDI to be country specific and depending on a host of other factors.

3.4 Conclusion

In conclusion, theoretically there are reasons to believe that FDI may be a substitute for or complement to trade. The explanatory theories of FDI and general equilibrium models of horizontal FDI suggest a substitutive relationship while general equilibrium models of vertical FDI suggest a complementary relationship. Knowledge capital models of FDI support both the relationship types. Thus, from the theoretical literature it is clear that it is tough to predict whether trade and FDI are substitutes or complements. This is essentially an empirical issue. The empirical literature tends to endorse a complementary relationship between trade and FDI.

The literature survey conducted in this chapter brings forth the following key points. First, the theory provides only limited direction to the empirical work which makes it “risky” to draw policy inferences from individual studies (Blackhurst and Otten, 1996). Second, most of the research has focused on goods since data pertaining to services sector is hard to obtain. Given the growing prominence of services in production, trade and investment, the dearth of empirical research on trade and FDI in the services sector is a matter of concern. Third, owing to limited data availability on FDI and activities of MNEs most of the empirical work has been undertaken for developed countries such as the United States, Sweden and Japan. Fourth, examining the trade and FDI relationship empirically requires dealing with the potential issue of simultaneity, reverse causality and endogeneity. Most of the studies have relied on usual panel data estimation techniques and have not paid much attention to the possible issue of endogeneity. Fifth, in the case of India, majority of the existing empirical studies have tried to establish causation only wherein they try to determine whether FDI inflows cause exports to be larger than what they would otherwise be or if growing exports attract increased flows of FDI. However, there is limited literature that has examined whether an increase in trade/FDI is systematically related to an increase or decrease in FDI/trade. This is an important aspect of the inter-linkage between trade and FDI that has been neglected in the literature so far.

We contribute to the existing literature by examining the relationship between trade and FDI for India. We conduct the empirical analysis of the relationship between trade and FDI in a systematic manner. First, the relationship is examined using aggregate data at the country level for India and its 15 major trading partners for the period 2000 to 2016. Second, in order to provide a more complete and inclusive analyses, we further examine the relationship between trade and FDI using disaggregated data at the industry-level for the Indian manufacturing sector. Both the levels of analyses have its own strengths and weaknesses and provide different comprehension and understanding of the relationship between trade and FDI. By combining the two aspects, the dynamics of the relationship can be understood in a better manner.

The study makes methodological advances in terms of examining the relationship between trade and FDI. For the country-level analysis, we address the potential issue of endogeneity that may arise while examining the relationship between trade and FDI and utilize Fixed-Effect 2-Stage Least Square Instrument Variable (FE-2SLS IV) method of estimation to obtain the empirical results. We instrument FDI using institutional distance between host and home country and value of last year’s FDI. For the industry-level analysis, we construct a harmonized and unique dataset covering disaggregated industry-level information on trade flows, investment flows and industry characteristics for the industry-level analysis and then develop a model to understand the important role of industry heterogeneity and FDI inflows in determining industry-level trade flows in Indian manufacturing. In terms of estimation technique, we utilize the Prais-Winsten regression with Panel Corrected Standard Errors (PCSE) to estimate the model and obtain the empirical results. To the best of our knowledge, this is the first time such a detailed and comprehensive empirical study has been undertaken on this topic for India. The next two chapters discuss the empirical analysis conducted at the country- and industry-level respectively.

Chapter 4

Empirical Analysis at the Country-level

4.1 Introduction

This chapter attempts to empirically examine the relationship between trade and FDI for India and its 15 major trading partners at the aggregate country-level. We augment the new-trade theory specification of the gravity model developed by Helpman (1987) and Bergstrand (1990) to include the important role that activities of MNEs (proxied by FDI) can play in affecting trade flows for India. This chapter evaluates the relationship based on the theoretical models developed by Helpman (1984), Helpman and Krugman (1985), Horstmann and Markusen (1992), Brainard (1993), Markusen et al. (1996), Carr et al. (1998) and Markusen (2000) which were discussed in the previous chapter. Based on the theory, we hypothesize trade and FDI to be complements at the country-level for India.

Through the empirical exercise conducted in this chapter, we also analyze if there has been a change in the determinants of trade for India. Traditionally, the abundance of factors of production and the subsequent differences between countries provided the basis of international trade as per the Heckscher-Ohlin (H-O) theorem (Heckscher, 1919 and Ohlin, 1933). The theorem suggested that countries will export products that uses its most abundant factor intensively. According to this theorem, the pattern of trade is fundamentally a supply-side phenomenon (Bukhari et al., 2005). However, the empirical validity of H-O model has been challenged in many studies (Leontief, 1953; Bharadwaj, 1962; Deardorff 1984; Bowen et al., 1995). As described in the previous chapter, an alternative theory to explain the pattern of trade was proposed by Staffan Linder (1961). Contrary to the HOS model's supply-side orientation, Linder's theory was essentially demand-oriented. Linder hypothesized that "trade will be most intensive among countries with similar demand" (1961, p.17). The basic proposition of Linder (1961) was that in case of manufactured goods, it is internal demand that defines the array of potential export goods for a country. For a product to be a potential export product, "it is a necessary but not a sufficient condition that a product must be consumed (or invested) in the home country" (Linder 1961, p.87).

The reasoning for this proposition is as follows. A firm's decision to take up production of a particular good in a country is likely to be generated by clearly apparent economic needs which are likely to emerge from domestic demand. As firms become successful their growth opportunities become limited by the domestic market and they look for foreign markets thereby gradually lifting their trade horizon. According to Linder, "international trade is nothing but an extension across national frontiers of a country's own web of economic activity" (1961, p.88). Another rationale for internal home demand to be a necessary condition centers around inventions which is, in all likelihood, the result of endeavors to take care of certain domestic problems. Therefore any exploitation of the invention will be first adjusted to cater to the home market. Similarly, potential imports are the defined by range of goods for which domestic demand exists at international prices. Linder asserts that "the range of potential exports is identical to, or included in, the range of potential imports" (1961, p.91). For both exports and imports, it is internal demand that determines potential trade. It thus follows that trade flow between countries that have similar demand structures will be stronger, as opposed to being determined by differences in factors of production (Viciu et al., 2016).

Through the empirical model developed in this chapter, we determine if the pattern of trade conducted by India is demand driven. We basically examine the empirical validity of the Linder hypothesis for India's trade with its 15 major trading partners.

The application of Linder hypothesis to developing countries has been an area that has received less attention in spite of the growing need to comprehend the rising levels of trade flows occurring in these countries. Testing for this will also bring to the fore the importance of new trade theory determinants of trade.

Using panel data for India's bilateral relationship with 15 of its major trading partners for the period 2000 to 2016, we test for the following two hypotheses:

Hypothesis 1: Trade and FDI are complements at the aggregate country-level for India
Hypothesis 2: India trades more intensively with countries having similar per-capita incomes

The share of intra-industry trade between pairs of countries and the similarity in average income expressed in GDP per capita has been found to be systematically correlated in previous empirical studies (Bergstrand, 1990). Support to Linder hypothesis will therefore point towards the predominant role of intra-industry trade, generated by similarities in demand structure. Empirical evidence also suggests that much of the intra-industry trade usually takes place in the form of cross-border trade between multinational enterprises and their affiliates, often referred to as "intra-firm" or sometimes "related party" trade (OECD, 2002). This trade is mostly in intermediate goods that link the various stages of value chains and supports the hypothesis of trade and FDI being complements.

Examining the empirical validity of both these hypotheses together will help us establish whether with globalization, FDI and growing prominence of MNEs the pattern of trade and the manner in which international production is organized has evolved in the case of India.

This chapter is organized as follows. Section 4.2 explores the relationship graphically between trade and FDI based on India's bilateral relationship with 15 of its major trading partners. Section 4.3 discusses the theoretical specification and application of the gravity model. Section 4.4 discusses the model specification, dataset construction and definition of variables. Section 4.5 describes the estimation technique. Section 4.6 reports the regression results obtained from the model and analyzes the same. Section 4.7 provides key concluding remarks.

4.2 Graphical Analysis

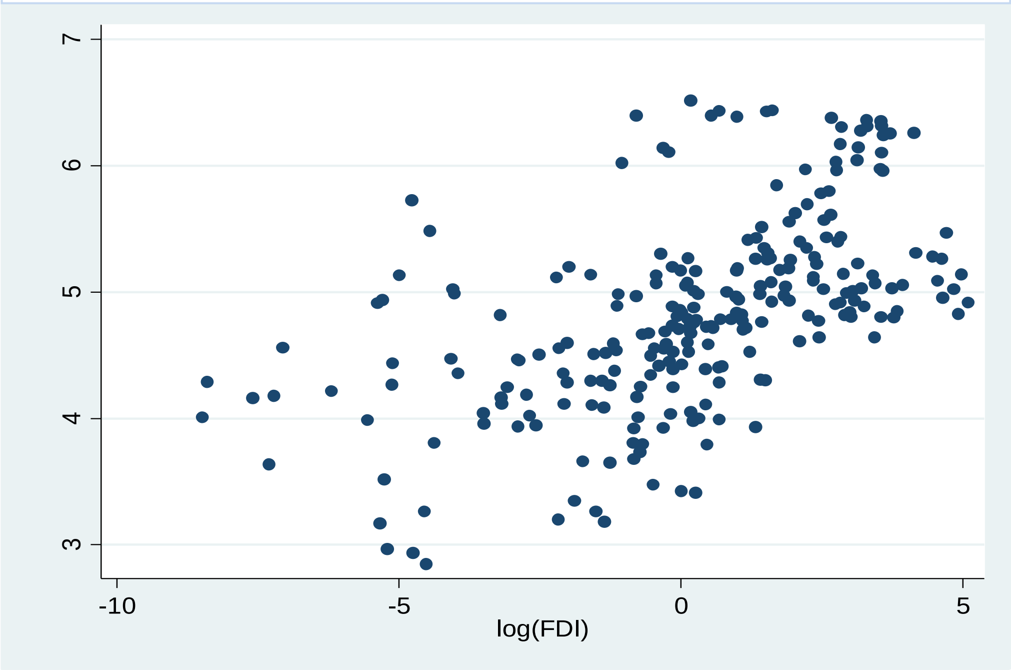
Before turning to the main empirical analysis entailed in this chapter, it would be useful to graphically analyze the relationship between trade and FDI for India and its top 15 trading partners in order to put the subsequent analysis in perspective. One of the most useful graphs for displaying the relationship between two variables is a scatter plot. Figure 4.1 shows us the scatter plot for trade and FDI based on our dataset of 15 countries[37]. The scatter plot indicates a positive relationship between trade and FDI. As the values of FDI increase, the values of trade also tend

[37] Trade is defined as the sum of exports and imports (excluding crude oil). FDI is defined as the sum of inward and outward flows of FDI. Both values are in US$ million. The 15 countries selected for analysis based on the values of their total trade (excluding crude oil) with India include Australia, Belgium, China, Germany, Hong Kong, Indonesia, Japan, Korea, Saudi Arabia, Singapore, South Africa, Switzerland, United Arab Emirates, United Kingdom and United States of America. Even though Mauritius has remained one of the top sources of FDI into India, we have not selected Mauritius for our analysis since its trade value with India is very low. India's trade with Mauritius accounts for less than 0.5 percent of India's trade with the world (DGFT, 2018). On the investment front as well, there is ample literature to suggest that Mauritius has been used as a route for "round-tripping" for investment benefits. A significant proportion of FDI coming from Mauritius is sourced from other countries and routed through Mauritius to get the benefits of a double-tax treaty (Bera and Gupta, 2009; Aykut et al., 2017). Therefore, FDI from Mauritius should be interpreted as aggregate FDI of several countries, rather than being originating from a single source country of FDI into India (Rastogi and Sawhney, 2013).

to increase. Using the Pearson correlation coefficient, we can also calculate the strength of the positive association between the two variables. The value of the correlation coefficient (r) ranges between -1 and +1 and measures the strength and direction of the linear relationship between two variables. The Pearson correlation coefficient gives a statistically significant value of 0.58 which indicates that there is a positive, linear relationship of moderate strength between trade and FDI for India.

Figure 4.1: Trade-FDI Relationship: India and its Top 15 Trading Partners

Time Period: 2000-16



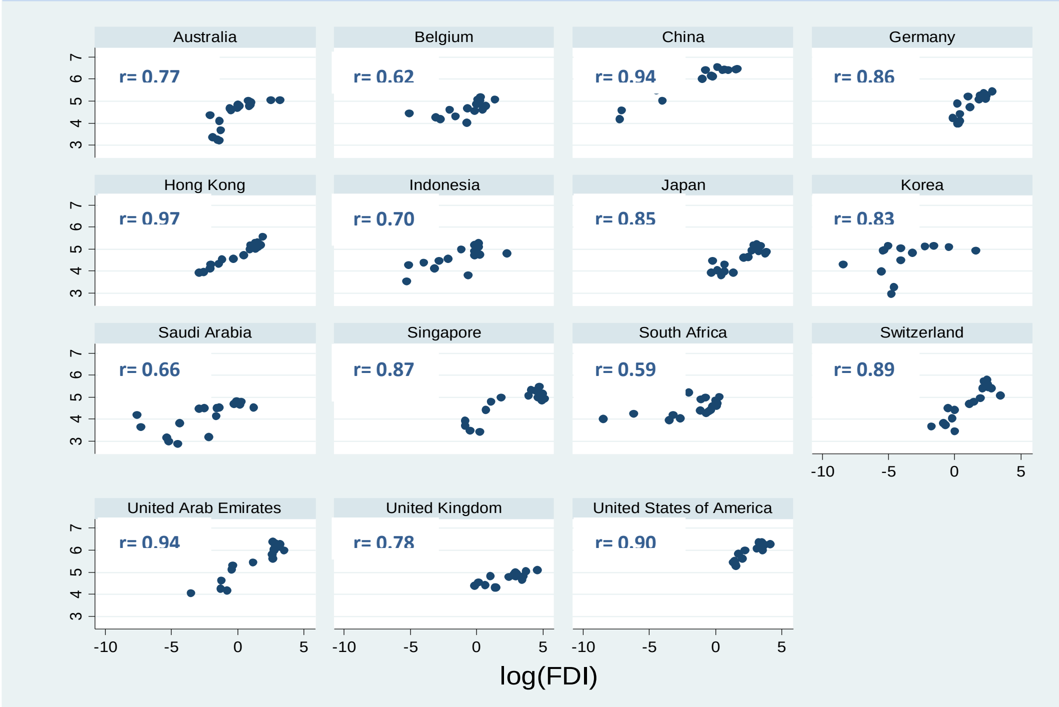
Source: Own calculations using trade data from WITS, World Bank and FDI data from DIPP, Ministry of Commerce and Industry and RBI

We get similar results upon examining this relationship with each partner country. From Figure 4.2 we see that though there is a positive relationship between trade and FDI with each of India's major trading partner countries, the strength of association varies across countries. The Pearson correlation coefficient is the highest for India's bilateral relationship with Hong Kong (r=0.97) indicating a very strong and statistically significant relationship between trade and FDI for India and Hong Kong. Recent years have seen trade and investment relationship between India and

Hong Kong expand rapidly. In 2016, the bilateral trade between India and Hong Kong was approximately US$ 20.3 billion (a growth of 13 percent over the previous year). Both exports and imports have been rising. While exports from India to Hong Kong increased to US$ 13.2 billion in 2016 (an increase of 9 percent over the previous year), India's imports from Hong Kong have also increased to US$ 7.12 billion in 2016 (an increase of 19 percent over the previous years). In line with trade, even the investment relationship is two-way and rising. In terms of country-wise rankings of top investing countries in India (in terms of FDI equity inflows), Hong Kong occupied 16th position with cumulative FDI amount of US$ 2.041 billion (till December 2016). Outward FDI from India to Hong Kong is also on a rise reaching a cumulative FDI amount of US$ 2.077 billion (till December 2016). Several Indian companies and professionals in banking, IT and shipping are based in Hong Kong. A large number of public and private sector banks from India are also currently operating in Hong Kong. The country has also become an important sourcing centre for Indian companies. Over the years, Hong Kong has emerged as a major re-exporter of goods that it imports from India and further exports to China (Dawra, 2018). All these factors have contributed to a strong and positive relationship between trade and FDI.

Figure 4.2: Trade-FDI Scatter Plots by Partner Country

Time Period: 2000-16



Source: Own calculations using trade data from WITS, World Bank and FDI data from DIPP, Ministry of Commerce and Industry and RBI
Note: Correlation coefficient between trade and FDI for China is calculated for the period 2002-16. This is because India started receiving FDI from China only post 2002. Outward FDI to China also started getting recorded 2007 onwards.

The association between trade and FDI with UAE is also very strong with a correlation coefficient of 0.94. The association between trade and FDI, though positive, is somewhat weak in the case of South Africa, Belgium and Saudi Arabia. While trade volumes with these countries are high, the FDI volumes are still comparatively at low levels.

4.3 The Gravity Model of International Trade

Our empirical analysis is based on the gravity model which is defined as the workhorse for empirical studies on international trade. The ability of the gravity model to correctly approximate bilateral flows of trade between countries has made it "one of the most stable empirical relationships in economics" (Leamer and Levinsohn, 1995).

The origin of gravity model can be traced to Isaac Newton's law of universal gravitation which states "every particle of matter in the universe attracts every other particle with a force that is directly proportional to the product of masses of the particles and inversely proportional to the square of the distance between them" (Newton, 1687). This relationship can be applied to any situation which requires the modeling of flows or movements.

In 1962, Jan Tinbergen for the first time applied the gravity equation to international trade flows. He assumed the following relationship:

$$X_{ij} = A\frac{Y_i^{\alpha}Y_j^{\beta}}{D_{ij}^{\gamma}} \text{……………………………...(4.1)}$$

Tinbergen (1962) postulated that bilateral trade between two countries or regions (represented by X_{ij}) is a positive function of their respective economic sizes (represented by Y_i and Y_j) and a negative function of their spatial distance (represented by D_{ij}). He justified incorporation of economic sizes by stating that the capability of exporting country i to supply goods to importing country j depends on country i's production capacity which is determined by its economic size. Likewise, the amount of goods that can be sold to the importing country j is also determined by country j's purchasing power/ income. In this way, economic size characterizes both the supply and demand force that impact each country's market. In the gravity equation, economic size is usually defined using indicators such as Gross Domestic Product (GDP), Gross National Product (GNP), income per capita (GDP per capita or GNP per capita) and size of the country's population. The exponents α, β and γ in equation 4.1 refer to the elasticity of trade with respect to exporting country's economic size (α), the elasticity of trade with respect to importing country's economic size (β) and the elasticity of trade with respect to distance (γ).

In the gravity equation, distance is used as a proxy for various factors that can have an impact on trade flows, for example, transportation costs, transaction costs, time lapsed in the course of shipment, synchronization costs, communication costs or cultural distance (Head, 2003; Yeshineh, 2016). Since it is tough to gauge these factors and they are subject to high complexity, most of the studies use geographical distance as an approximation to these costs.

The model of Tinbergen has been extended in various ways and attempts have been made to provide a theoretical basis for the model. The first pioneer attempt was provided by James

Anderson in 1979. He offered a theoretical justification of the gravity equation built on a demand function with "constant elasticity of substitution (CES) a la Armington (1969)". The basis of the gravity model is that all goods are differentiated by the country of origin and that each country specializes in the production of only one good. In this setting, consumers have distinct preferences over all the differentiated goods (WTO-UNCTAD, 2012).

Expenditure on a good that is produced in country i and imported and consumed in country j is given by following equation:

$$\frac{X_{ij}}{E_j} = \beta_i \left(\frac{p_{ij}}{P_j}\right)^{1-\sigma} \quad \text{where } \sigma>1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (4.2)$$

where p_{ij}/P_j is the consumer price in country j of good produced in country i relative to country j's CES price index, $\beta_i > 0$ is a "distribution parameter"[38] and σ is the parameter for elasticity of substitution[39]. As the expenditure on each origin country's goods add up to the total expenditure and the sum over origin country i of expenditure shares from equation 4.2 equals 1, the CES price index is given by:

$$P_j = \left(\textstyle\sum_i \beta_i \, p_{ij}^{1-\sigma}\right)^{1/_{1-\sigma}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (4.3)$$

where $p_{ij} = p_i t_{ij}$ and p_i is the exporter's supply price, net of trade costs and t_{ij} is the trade factor between country i and country j. The reason behind difference in prices between two countries is these trade costs.

Trade frictions are assumed to be of "iceberg" type. They increase the delivered price of good i in destination country j by a constant "iceberg melting"' factor $t_{ij} > 1$ (Anderson, 1979). In simple terms, it means that if 1 unit departs country i then $1/t_{ij}$ unit arrives in country j (which is less than 1). For every good transported from country i to country j, the exporter incurs costs equal to $t_{ij}- 1$ of country i's goods[40]. The nominal value of exports from country i to country j is $x_{ij} = p_i c_{ij}$, the sum of the production value at the origin country, $p_i c_{ij}$ and the trade cost $(t_{ij}- 1)p_i c_{ij}$.

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[38] β_i is one for goods from each origin i. The summation of β across all i is equal to 1 to ensure that sum of shares is equal to 1.

[39] To accord with observed behavior, $\sigma > 1$, meaning that a rise in the relative price of good i in destination country j will reduce country i's expenditure share in j (Anderson, 2016).

[40] The form of transportation cost is such that a fraction $(t_{ij} - 1)/t_{ij}$ of goods shipped is lost in transport while exporting from country i to country j.

Country i's total income is then defined as

$$Y_i = \sum_j X_{ij} = \sum_j \beta i \left(\frac{p_i t_{ij}}{P_j}\right)^{1-\sigma} E_j \text{ ……….(4.4)}$$

Using equations 4.3 and 4.2 we get the following structural gravity equation 4.5-4.7:

$$X_{ij} = \frac{Y_i E_j}{Y}\left(\frac{t_{ij}}{\pi_i P_j}\right)^{1-\sigma} \text{………………………..(4.5)}$$

where

$$\pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} \frac{E_j}{Y} \text{…………………......(4.6)}$$

If we replace $\beta_i p_i^{1-\sigma}$ in price index equation number 4.3 using 4.6 we get,

$$P_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{\pi_i}\right)^{1-\sigma} \frac{Y_j}{Y} \text{……………….…….(4.7)}$$

The structural gravity equation can be decomposed into two terms. First the size term (Y_iE_j/Y) and second the trade cost term $\left(\frac{t_{ij}}{\pi_i P_j}\right)^{1-\sigma}$.

The size term is the hypothetical level of frictionless trade between two countries as if there were no trade costs. This means that if there were no trade costs, consumers will face the same price for a given variety regardless of its origin and that expenditure share on goods from another country will equal to share of production in the source country. The larger is the size of a source country, more will that country produce and larger is the size of the destination country, more will it import.

The trade cost term reflects the effect of total trade cost which is like a divide between actual trade and frictionless trade. Bilateral trade cost between two countries (t_{ij}) is usually proxied by geographic and trade policy variables (such as distance, tariffs, presence of trade agreements etc). As defined by Anderson (2016), the structural variable π_i is an "index of the outward trade frictions facing shippers from origin i" and the price index P_j (rewritten using π_i as expression 4.7) is an "index of inward trade frictions facing shipments to destination j". These indices of bilateral resistance are known as "multilateral resistance" in Anderson and van Wincoop (2003). An increase in trade barriers with a country's trading partners will raise this index. Anderson and van Wincoop (2003) advocate that the gravity equation explains that after controlling for economic size, bilateral trade between two countries is dependent upon the bilateral trade barrier between them relative to the product of the indices of their multilateral resistance.

In subsequent years, a new wave of development in the form of "new trade theory" emerged as another way of presenting a theoretical basis to the gravity model (Helpman, 1987; Bergstrand, 1990). Here, the main advancement is that the assumption of product differentiation amongst producing firms replaces the assumption of product differentiation by country of origin (Gómez-Herrera, 2013). Helpman (1987) provided a foundation centering the gravity model on the key assumption of monopolistic competition among firms and increasing returns to scale, wherein products were assumed to be differentiated by firms, not only by country of origin.

The new trade theory version of the gravity model, as estimated by Helpman (1987), is given below:

$$T_{ij} = \alpha + \beta_1 TGDP_{ij} + \beta_2 SGDP_{ij} + \beta_3 DGDPPC_{ij} + \varepsilon_{ij} \text{.................................}(4.8)$$

where trade flows T_{ij} is a function of sum of both countries GDP ($TGDP_{ij}$), similarity between both countries GDP ($SGDP_{ij}$) and difference between two countries per capita incomes($DGDPPC_{ij}$). The intuition behind including these variables is the following: size of the country GDP determines the number of varieties produced which in turn determines trade. However, if the size of the two countries is dissimilar, this tends to reduce trade. Therefore, a dis-similarity index is used. Similarity of per-capita GDP levels is expected to enhance trade based on Linder hypothesis (1961).

The more recent theoretical contributions on gravity are models of international trade incorporating heterogeneous firms (Bernard et al., 2003; Melitz 2003). Though there are critical differences among the types of gravity derived by each of these models, they all maintain some fundamental similarities with the basic model set out earlier in this section (Shepherd, 2016).

Therefore over the years, the gravity model has evolved and developed to become a more systematic model with a strong theoretical economic foundation. Its robust analytical abilities have made it into a successful tool in explaining the determinants of international trade. Due to its strong economic foundation and econometric success, a number of studies have extended the gravity equation to include other variables that may facilitate or impede bilateral trade.

For example, Hans Linnemann (1966) added population as an additional variable in the basic gravity equation to reflect an additional measure of the country's size. It is also common to augment the gravity equation by using per capita GDP to reflect the level of economic development. Pfaffermayr (1994) added FDI as an additional variable impacting bilateral flow of trade between countries. Anderson and Wincoop (2003) emphasize on the inclusion of multilateral resistance factors like language, remoteness etc. Nguyen (2010) included bilateral exchange rate and regional trade preference in the gravity equation. Recent studies based on NTT specification include variables such as sum of both countries GDPs, difference in GDP per capita and similarity index between two countries per capita GDP (Egger 2000, 2002; Baltagi et al., 2003; Serlenga and Shin 2007; Stack 2009; Stack and Pentecost 2011, Pant and Paul, 2018).

4.4 Model Specification, Dataset Construction and Definition of Variables

Model Specification

Building on the econometric specification of Egger (2000, 2002), Baltagi et al. (2003), Serlenga and Shin (2007) and Kabir and Salim (2010), we augment the gravity specification of new trade theory determinants to include the important role that FDI can play in impacting trade volumes for India. The augmented gravity equation takes the following form:

$$VT_{ij}^{t} = \alpha + \beta_1 SUMGDP_{ij}^{t} + \beta_2 SIMGDP_{ij}^{t} + \beta_3 DIFFGDPC_{ij}^{t} + \beta_4 TC_{ij}^{t} + \beta_5 FDI_{ij}^{t} + \varepsilon_{ij}^{t} \quad \ldots\ldots\ldots\ldots(4.9)$$

where the dependent variable VT is the real value of bilateral trade volume between country i and country j which depends on various country characteristics, trade costs and FDI. The key country characteristics included in the model drawn from theoretical literature (Helpman and Krugman, 1995; Markusen et al., 1996; Carr et al., 1998) are sum of bilateral real GDP of country i and country j (SUMGDP), the similarity index of real GDP of country i and country j (SIMGDP) and difference in the real per capita GDP between country i and country j (DIFFGDPC). The variable TC represents trade costs between country i and country j and FDI is the bilateral flow of investment between country i and country j (FDI).

Most of the earlier studies on the determinants of bilateral trade using gravity model have used distance or international transport/freight costs (either using actual costs of shipping a standard container to a number of destinations or using more aggregate CIF/FOB trade data[41]) as a measure for trade costs (Limao and Venables, 2001; Baltagi et al., 2003; Márquez-Ramos et al., 2006; Venables, 2006; De, 2006; Disdier and Head, 2008). However, these approaches have several shortcomings. For instance, distance does not vary over time nor does it reflect the reduced costs that occur on frequently used routes. Freight costs on the other hand have also come down over time. Any measure of trade cost considering only these aspects does not provide a complete and inclusive measure of international trade costs. Therefore, for the purpose of our study, we use a more comprehensive measure of trade costs developed by ESCAP-World Bank that includes "not only international transport costs and tariffs but also other trade cost components discussed in Anderson and van Wincoop (2003), such as direct and indirect costs associated with differences in languages, currencies as well as cumbersome import or export procedures" (UNESCAP, 2017).

We transform all the time-variant series level of variables into natural logarithms due to several advantages associated with using this logarithmic form over using the level definition of variables (Wooldridge, 2013).

We expect a positive coefficient for SUMGDP. This is based on the usual theory of gravity model which suggests that an increase in market size increases the volume of trade. Helpman and Krugman (1985) emphasize the importance of difference in country size in determining bilateral trade. They suggest that bilateral flow of trade will be lower between countries of dissimilar size as compared to bilateral flow of trade between countries of equal size. That is, intra-industry trade is maximized when countries are of equal size. We therefore expect coefficient of similarity of size index, SIMGDP, to be positive.

The variable DIFFGDPC is included in the model to provide an indirect way of testing the Linder hypothesis (Stack and Penstecost, 2011). The demand based theory of Linder (1961) explains bilateral flow of trade between two countries in terms of the similarity of demand

[41] An exporter usually declares a Free on Board value (FOB), which is the value at the exporter's border. On the other hand, the importer declares a CIF mirror value which includes additional costs of insurance and freight. The ratio of the two values provides a CIF/FOB ratio.

characteristics between the two countries. The theory suggests that "if the aggregated preferences for goods by the importing country j are similar to the consumption patterns of the exporting country i, then country j will develop industries that are similar to country i" (Stack, 2009). The resultant exchange of certain goods between the two countries will then be determined by the continuous production of and demand for similar, yet differentiated goods. Following Gruber and Vernon (1970), we include the absolute difference in per capita incomes as an independent variable in our gravity equation. Inclusion of this variable is a way to capture the differences in patterns of consumption between the trading countries. A negative coefficient suggests that trade flow is positively linked to consumers having similar per capita incomes and therefore similar patterns of consumption thereby indicating support for Linder hypothesis. This variable can also be treated as a test of the Heckscher-Ohlin-Samuelson (HOS) factor endowment model. That is, a dissimilar per capita income level would signify differences in factor endowments which should promote trade. Thus, if HOS model prediction holds true, we could expect to get a positive coefficient for this variable. With regard to the TC variable, we expect a negative sign. This is based on the theory of gravity model which suggests that an increase in trade costs between two trading countries decreases the volume of bilateral trade between them (Anderson, 1979).

The main relationship that we are interested in is between trade and FDI. The expected sign of the parameter estimate associated with FDI is not clear *a priori*. According to the theory, if FDI is horizontal the relationship between trade and FDI is that of substitution (in which case we expect a negative sign of the parameter estimate). If FDI is vertical in nature, then the relationship between trade and FDI is complementary (in which case we expect a positive sign of the parameter estimate).

Dataset Construction

The dataset covers India's bilateral relationship with 15 of its major trading partners for the period 2000 to 2016. The selection of the countries is based on the values of total trade (excluding crude oil) with India for the year 2013. The countries selected for analysis are: Australia, Belgium, China, Germany, Hong Kong, Indonesia, Japan, Korea, Saudi Arabia, Singapore, South Africa, Switzerland, United Arab Emirates, United Kingdom and United States of America.

The data sources are as follows. Nominal trade flow data, calculated as the combined sum of exports and imports (excluding crude oil) between India and each partner country, is obtained from World Integrated Trade Solution (WITS), World Bank. The trade data is expressed in real terms based on GDP deflator.[42] Data on GDP, GDP per capita and GDP deflator are obtained from the World Development Indicators (WDI), World Bank. Data on trade cost is obtained from ESCAP-World Bank database. Data on inward FDI is obtained from Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, Government of India. Data on outward FDI is obtained from Reserve Bank of India (RBI).[43] The FDI data is also expressed in real terms based on GDP deflator.

Definition of Variables

The dependent variable VT is calculated as the combined sum of real exports and imports (excluding crude oil) between India (country i) and each partner country j. To calculate real exports, we deflate the exports value by India's GDP deflator. Similarly, to calculate real imports, we deflate the imports value by partner country's GDP deflator. This approach is similar to studies like OCED (1997) and Amiti et al. (2000).

The first independent variable i.e. SUMGDP which is used to proxy market size, is calculated as the sum of real GDP of India and real GDP of partner country given by $SUMGDP_{ij}^{t} = \ln(GDP_i^t + GDP_j^t)$. To calculate real GDP of India, we deflate its GDP in current US$ by its GDP deflator. Similarly, to calculate partner country's real GDP, we deflate its GDP by its respective GDP deflator.

[42] In this study, GDP deflator is used to allow for the effects of changes in price (inflation) to be removed from a time series. We use the GDP deflator to express a given time series set in real terms by removing price changes. Unlike the Consumer Price Index (CPI) which reflects movements in the prices of consumer goods and services only, the GDP deflator also covers price changes related to government consumption, investment, and exports and imports of goods and services.

[43] While it would have been ideal to use data for FDI in manufacturing sector, we use aggregate FDI data, by country for our study. For inward FDI, disaggregated data country-wise, sector-wise was not available. For outward FDI, while data disaggregated by sectors and by countries was available for some years, this type of disaggregated data was not available for the complete time-period under analysis.

The second independent variable which is similarity of size index is based on India and the partner countries shares of GDP and is calculated as $SGDP_{ij}^{t} = \ln\left\{1 - \left[\frac{\mathrm{GDP_i^t}}{(\mathrm{GDP_i^t}+\mathrm{GDP_j^t})}\right]^2 - \left[\frac{\mathrm{GDP_j^t}}{(\mathrm{GDP_i^t}+\mathrm{GDP_j^t})}\right]^2\right\}$.[44] The third independent variable to proxy for difference in country size is DIFFGDPC which is defined as absolute difference in the log values of real GDP per capita between India and each partner country j and is given by $DIFFGDPC_{ij}^{t} = \left|lnGDPC_i^t - lnGDPC_j^t\right|$. The way in which we define SUMGDP, SIMGDP, DIFFGDPC is similar to studies by OECD (1997), Stack (2009) and Martinez et al. (2012).

Trade costs (TC) are defined as the geometric average of trade costs between India and each partner country j. The measure of trade cost as developed by Novy (2012) is derived from the gravity equation which is consistent with the theory and is essentially a ratio based on bilateral trade and gross output data. As described by Duval and Utoktham (2011), this trade cost measure is comprehensive in the sense that it "captures all additional costs involved in trading goods bilaterally relative to those involved in trading goods intranationally (domestically)". As mentioned earlier, it includes international logistics and shipping costs, tariff and non-tariff costs as well as costs related to trade procedures and regulations, costs from differences in language, culture and currencies (UNESCAP, 2017).

[44] The Similarity Index (SI) is constructed in the following way (WTO-UNCTAD, 2012):

$SI_{ij}^{t} = \left\{1 - \left[\frac{\mathrm{GDP_i^t}}{(\mathrm{GDP_i^t}+\mathrm{GDP_j^t})}\right]^2 - \left[\frac{\mathrm{GDP_j^t}}{(\mathrm{GDP_i^t}+\mathrm{GDP_j^t})}\right]^2\right\}$ where the value of SI is bound between 0 and 0.5.

If the value is closer to 0, we infer that the similarity of the two countries is low. Conversely, if the value is closer to 0.5 then the similarity of the two countries is high. A value of 0.5 indicates that the two countries have the same GDP. However, following Breuss and Egger (1999); Egger (2000, 2002); Serlenga and Shin (2007); Stack (2009) and Stack and Pentecost (2011), in our empirical model we define similarity of size index in the following way:

$SGDP_{ij}^{t} = \ln\left\{1 - \left[\frac{\mathrm{GDP_i^t}}{(\mathrm{GDP_i^t}+\mathrm{GDP_j^t})}\right]^2 - \left[\frac{\mathrm{GDP_j^t}}{(\mathrm{GDP_i^t}+\mathrm{GDP_j^t})}\right]^2\right\}$

There are two points to be noted here. First, defining SGDP in the way we do is valid since after working through the index we find that its logarithmic transformation is linear in nature. Second, if we log transform the index and find the maximum in logs and transform it back, the maximum is at the same point as if we had maximized the original index variable. The maximum value of log of SI is log(0.5) and if we transform it back we obtain the value of 0.5 (which is the maximum value SI can take). In order to verify the robustness of our empirical results, we also calculated SI and used it in place of SGDP in the regression equation. The use of SI made no significant difference to our main empirical results for the impact of FDI on trade flows.

The trade cost measure is given by the following formula[45]:

$$\tau_{ij} = \tau_{ji} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{1/2} - 1 = \left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)^{1/2(\sigma-1)} - 1$$

where τ_{ij} refers to the geometric average of trade costs between county i and country j

t_{ij} refers to the cost of international trade from country i to country j

t_{ji} refers to the cost of international trade from country j to country i

t_{ii} refers to the cost of intranational trade of country i

t_{jj} refers to the cost of intranational trade of country j

X_{ij} refers to the international trade flows from country i to country j

X_{ji} refers to the international trade flows from country j to country i

X_{ii} refers to intranational trade of country i

X_{jj} refers to intranational trade of country j

σ refers to intra-sectoral elasticity of substitution

The Novy (2012) methodology of calculating trade costs has been utilized in several empirical papers such as Jacks et al. (2008) and Chen and Novy (2011).

The variable of interest in our study i.e FDI is defined as the combined sum of inward and outward FDI between India and partner country j. The values of FDI are expressed in real terms deflated by GDP deflator. To calculate real outward FDI, we deflate the value of India's outward FDI by India's GDP deflator. Similarly, to calculate real inward FDI, we deflate the inward FDI into India by partner country's GDP deflator.

Appendix B (Tables B.1-B.3) mentions the details of the data definitions and sources, descriptive statistics of and correlation matrix between the variables used in the study.

[45] Detailed derivation of trade cost measure is given in Appendix A.

4.5 Estimation Technique

Panel data (also known as longitudinal or Time Series Cross Section or "TSCS" data) comprises of "repeated observations on fixed units" observed over a specified time period (Beck and Katz 1995). The use of panel data sets in applied empirical work has increased dramatically since the pioneering research of Mundlak (1961), Nerlove (1971) and Maddala (1971), among others. Panel data models have many advantages over cross-sectional approaches (Hsiao, 1986 and Baltagi, 1995). An important benefit of using panel data is the possibility of controlling for unobservable individual heterogeneity. According to Baltagi (1995), "panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency". The use of panel data makes it possible to identify and measure effects that cannot be detected in pure cross-section or pure time series data. Using such data also reduces biases which result from aggregation across firms or individuals (Blundell, 1988; Klevmarken, 1989; Baltagi, 1995).

Panel data models are typically estimated through least-squares based inference estimates such as Ordinary Least Squares (OLS), Fixed Effects (FE) or Random Effects (RE) provided that certain assumptions in the regression model hold. These include linearity in parameters, random sampling, zero conditional mean, homoskedasticity, no-autocorrelation and exogeneity of explanatory variables (Woolridge, 2009).

In our model, there may be a problem of potential endogeneity. This can arise since trade and FDI are jointly determined by common economic factors such as those present in the original model equation. For instance, an increase in host country GDP would tend to not only increase trade but also FDI. Also, the gravity model of trade pre-assumes one-sided causality running from independent variable to dependent variable. However, in the case of trade and FDI there is a growing body of literature that has recognized the existence of two-way feedback effects between the two. Therefore while examining the relationship between trade and FDI we could have a causality running from trade to FDI or from FDI to trade or in both directions (Bajo-Rubio and Montero-Muñoz, 1999; Liu, Wang and Wei, 2001; Aizenman and Noy, 2005; Sharma and Kaur, 2013).

Both simultaneity and reverse causation imply that the FDI variable is endogenous in our model. This means that the FDI variable at a given time period is correlated with the idiosyncratic errors at any given time period thereby violating the OLS assumption of exogeneity of independent variables. The endogenous nature of the FDI variable also implies that if the model is estimated by any least-square based inference method (OLS, FE or RE), the estimates obtained will be biased and inconsistent (Woolridge, 2008 and 2012).

Examining the relationship between trade and FDI empirically requires dealing with the issue of simultaneity, reverse causality and endogeneity. In spite of the abundance of papers on this topic, the fundamental issue in examining the relation between trade and FDI, which is endogeneity, is seldom addressed. Dealing with endogeneity, while examining the relationship between trade and FDI, is at the center of our empirical strategy.

A possible solution to this problem of endogeneity is to fit an instrumental variable model in a two-stage least-square setting. The fundamental tactic in instrumental variable estimation is to find an exogenous variable (instrument) that is both contemporaneously uncorrelated with the error term from the original model and is strongly correlated with the potentially endogenous independent regressor (Baum, 2006). The requirement that the instrument is exogenous and contemporaneously uncorrelated with the error terms is known as "instrument exogeneity". The requirement that the instrument must be correlated with the endogenous explanatory variable is known as "instrument relevance" (Woolridge, 2009). Moreover, the instrument cannot have a direct influence on the dependent variable.

Finding a valid and relevant instrument for FDI is challenging and tricky. At the macro level, earlier studies have used real exchange rates and lagged values of FDI as instruments (Wheeler and Mody, 1992; Klein and Rosengren, 1994; Blonigen, 1997). Due to its empirical success in determining FDI flows, we choose lagged value of FDI as one instrument. It has been shown in the literature that FDI is self-reinforcing in nature since the existing investment in a country is a significant determinant of new investment in that country (Wheeler and Mody, 1992, Borensztein et al., 1998). Existing investment in a country can also be seen as a signal to potential foreign investors, also known as the demonstration effect (Barry et al., 2004). This is consistent with the theory of "agglomeration effect" which is that investments flow in to countries with higher levels of existing investment which have the potential to create positive externalities generated by localization of investing firms in a country (Smith and Florida, 1994; Head et al., 1995; O'Huallachain and Reid 1997).

In an endeavor to capture the influence of institutional quality on determining FDI flows, we utilize institutional distance between home and host economy as the second instrument. In recent years, the relationship between institutions and FDI flows has received significant attention. There are broadly three main reasons why quality of institutions is of importance for foreign direct investment. Firstly, empirical evidence suggests that differences in the quality of institutions across countries are the key determining factor for differences in economic development and differences in FDI flows received by different countries (Talbott and Roll, 2001; Acemoglu and Robinson, 2010). The performance of foreign investors is better in foreign markets that are similar to their own domestic home markets than in markets that are dissimilar. Studies argue that investors find similarities in markets easier to manage. Differences between host and source countries in terms of corruption, legal rules, regulations pertaining to credit market, legal restrictions in hiring and firing and decentralization of wage bargaining reduce bilateral FDI flows (Habib and Zurawicki, 2002; Bénassy-Quéré et al., 2007; Johanson and Vahlne, 2009; Guiso et al., 2009). Second, institutions play an important role as "humanly devised constraints that structure political, economic and social interactions" in creating incentives for economic activity, lowering transaction costs and thus attracting FDI (North, 1991). Poor institutions can add extra costs to foreign investment, for example in the case of corruption (Wei, 2000). Third, high sunk costs of FDI make it "vulnerable to any form of uncertainty, including uncertainty stemming from poor government efficiency, policy reversals, graft or weak enforcement of property rights and of the legal system in general" (Bénassy-Quéré et al., 2007).

It is now well established in the empirical literature also that institutional quality is a significant factor in determining FDI (Wang and Swain 1995; Billington, 1999; Rueda-Sabater, 2000; Habib and Zurawicki, 2002; Imhoff, 2003; Preobraganskaya and McGee, 2003; Berglof and Pajuste, 2005; Mueller, 2006).

Building on the above literature of new institutional economics, we introduce institutional distance as the second instrument for FDI flows in our empirical model. Institutional distance is defined as the absolute difference in the average country governance index of the two countries.

In spite of the fact that policymakers and researchers generally talk about the notion of governance, there is as such no solid agreement on a single definition of governance or institutional quality. Following Kaufmann, Kraay and Mastruzzi (2010), we define governance as "the traditions and institutions by which authority in a country is exercised. This includes (a) the process by which governments are selected, monitored and replaced; (b) the capacity of the government to effectively formulate and implement sound policies; and (c) the respect of citizens and the state for the institutions that govern economic and social interactions among them."

The average country governance index is calculated as a composite index covering six dimensions of governance namely voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption.[46] The data for governance indices is taken from Worldwide Governance Indicators (WGI) published by the World Bank.

Using the composite index, we then calculate the institutional distance between country i and country j ($INST_{ij}$) which equals the absolute value of the difference between two countries' governance indices:

$$INST_{ij} = \left|GOV_i - GOV_j\right|$$

The average country governance indices are denoted by GOV_i and GOV_j.

Before understanding application of the method of two stage least squares, let us look at our original equation (equation 4.9):

$$VT_{ij}^{t} = \alpha + \beta_1 SUMGDP_{ij}^{t} + \beta_2 SIMGDP_{ij}^{t} + \beta_3 DIFFGDPC_{ij}^{t} + \beta_4 TC_{ij}^{t} + \beta_5 FDI_{ij}^{t} + \varepsilon_{ij}^{t} \ldots\ldots(4.9)$$

This is a standard linear panel data model with 5 explanatory variables (SUMGDP, SIMGDP, DIFFGDPC, TC being exogenous and FDI being endogenous as it is assumed to be correlated with the error term). We call equation 4.9 a "structural equation" to stress upon the fact that we are interested in β_j i.e the coefficients associated with the explanatory variables[47] (Woolridge, 2009).

[46] The definitions of the six dimensions of governance are available in Appendix C.

[47] This simply means that equation 4.9 is supposed to measure a causal relationship.

From our earlier discussion, we know that if equation 4.9 is estimated by OLS, then we will get biased and inconsistent estimators. Therefore, we follow the method of two stage least squares estimation which is essentially a method involving two sequential applications of OLS. In the first stage of the process, the endogenous variable is regressed on all the predetermined (exogenous) variables in the whole system. We have two exogenous variables *L1.FDI* (lagged value of FDI) and *INST* (institutional distance) excluded from original structural equation 4.9. Our assumptions that *L1.FDI* and *INST* do not appear in equation 4.9 and are uncorrelated with the error term are known as "exclusion restrictions" (Woolridge, 2009). Since each of the exogenous variables is uncorrelated with the error term, any linear combination will also be uncorrelated with the error term. We can then infer that any linear combination of the exogenous variables is a valid IV.

First Stage Regression

In order to find the best IV, we choose the linear combination that is most highly correlated with FDI which is given by the following reduced form equation for FDI:

$$FDI_{ij}^{t} = \pi_0 + \pi_1 SUMGDP_{ij}^{t} + \pi_2 SIMGDP_{ij}^{t} + \pi_3 DIFFGDPC_{ij}^{t} + \pi_4 TC_{ij}^{t} + \pi_5 INST_{ij}^{t} + \pi_6 L1.FDI_{ij}^{t} + ¥_{ij}^{t} \text{.....(4.10)}$$

Once we assume that all right-hand side explanatory variables are exogenous, the key identification condition is that atleast one of π_5 and π_6 should be different from zero. The original structural equation (equation 4.9) will not be identified if both $\pi_5 = 0$ and $\pi_6 = 0$. That is, after partialling out other exogenous variables, the instruments chosen for analysis are still meaningfully correlated with the endogenous FDI variable. We can test the null hypothesis that $\pi_5 = 0$ and $\pi_6 = 0$ using an F statistic. We estimate the reduced form (4.10) by OLS and obtain the fitted value of FDI:

$$\widehat{FDI}_{ij}^{t} = \hat{\pi}_0 + \hat{\pi}_1 SUMGDP_{ij}^{t} + \hat{\pi}_2 SIMGDP_{ij}^{t} + \hat{\pi}_3 DIFFGDPC_{ij}^{t} + \hat{\pi}_4 TC_{ij}^{t} + \hat{\pi}_5 INST_{ij}^{t} + \hat{\pi}_6 L1.FDI_{ij}^{t} \text{..............(4.11)}$$

In the second stage, the original structural equation is estimated by OLS using the fitted value of FDI ($i.e\ \widehat{FDI}$) obtained in the first stage as the IV for the endogenous FDI variable.

Second Stage Regression

$$VT_{ij}^{t} = \delta_0 + \delta_1 SUMGDP_{ij}^{t} + \delta_2 SIMGDP_{ij}^{t} + \delta_3 DIFFGDPC_{ij}^{t} + \delta_4 TC_{ij}^{t} + \delta_5 \widehat{FDI}_{ij}^{t} + \nu_{ij}^{t} \text{....................(4.12)}$$

The fitted value of FDI is the estimated value obtained from first stage regression equation and is uncorrelated with the error term.

The way 2SLS works is the following: it first "purges" FDI of its correlation with the error terms (equation 4.11) and then runs the OLS regression in the second stage (equation 4.12). The 2SLS estimators are consistent in the sense that as the sample size increases indefinitely the estimators converge to their true values (Wooldridge, 2002).

4.6 Empirical Analysis and Discussion of Results

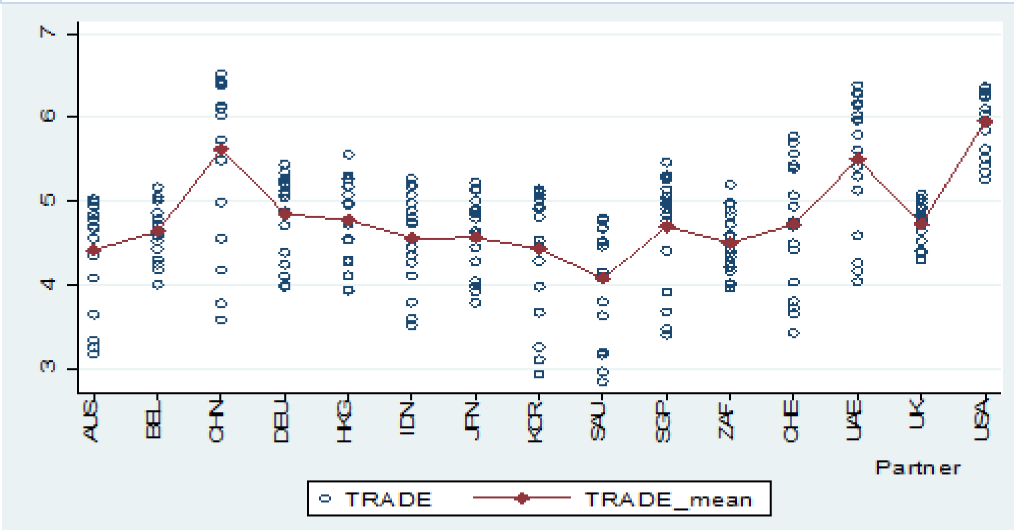
The empirical analysis procedure follows four steps. In the first step, we check for stationarity of each of the variable series in our panel data. The unit root test is usually conducted to check for the stationarity of a series. For the purpose of our study, we employ Levin- Lin- Chu (2002) test to check whether the panel data is stationary or contains unit root (non-stationary). The null hypothesis of non-stationary (unit root) is tested against the alternative hypothesis of stationarity. All the variables except SIMGDP and TC were found to be stationary at levels. We transform the series of SIMGDP and TC variables by taking their first difference to make them stationary.

In the second step, we undertake the estimation with usual panel data estimation techniques such as pooled OLS, FE and RE. To decide between fixed and random effects, we conduct the Hausman test. The test rejects the null hypothesis of no correlation between explanatory variables and unobserved individual effects and therefore fixed effect model is preferred over random effects model (Greene, 2008).

In the third step, given the possibility of existence of endogeneity in the model, we run the "Durbin-Wu-Hausman (DWH) test" to check for endogeneity of the FDI variable. The DWH test checks for "presence of endogeneity by comparing ordinary least squares (OLS) estimate of the structural parameters in the IV regression to that of the two-stage least squares" (Guo et al., 2016). This test also enables us to decide which method of estimation should be used between OLS and IV. The test results indicate that FDI variable is endogenous and that IV is the preferred method of estimation. In cases when the included probable endogenous variable in the IV regression is "truly endogenous", then the analysis conducted using IV has a lower bias while the analysis conducted using standard OLS has smaller variance of the error term (Davidson and MacKinnon, 1993).

We finally estimate the model using fixed-effect transformation and then apply two-stage least-squares instrument variable estimation technique (FE-2SLS IV). The advantage of using the FE estimator is that it takes into account unobserved heterogeneity across panels (i.e partner countries). A graphical representation of heterogeneity across panels (i.e partner countries) is shown in the below graph (Figure 4.3).

Figure 4.3: Fixed Effects: Heterogeneity Across Partners



Source: Own calculations using Stata 14
Note: AUS-Australia, BEL-Belgium, CHN-China, DEU-Germany, HKG-Hong Kong, IDN-Indonesia, JPN-Japan, KOR-Korea, SAU-Saudi Arabia, SGP-Singapore, ZAF-South Africa, CHE-Switzerland, UAE-United Arab Emirates, UK-United Kingdom and USA-United States of America

As mentioned earlier, the two instruments used for FDI are institutional distance between host and home country (*INST*) and lag of FDI (*L1.FDI*). The first stage regression results suggest that larger is the distance between India and its partner country in terms of institutional quality, lower is the volume of bilateral FDI. The self-reinforcing nature of FDI is also validated by our first stage regression results. The coefficient on the lagged value of FDI is both positive and statistically significant. In order to test for the validity and relevance of the instruments, we perform several ancillary tests such as F-test of excluded instrument and tests for under-identification and weak identification after the first stage regression.[48] The test results validate the use of our instruments. The summary results for the first stage regression of FDI are reported in Table 4.1.

Table 4.1: Summary Results for First-stage Regression of FDI

Variable Name	**OLS**
SUMGDP	5.4263*** (0.4982)
SIMGDP	1.3407 (1.0066)
DIFFGDPC	-0.9543** (0.4288)
TC	-0.2731 (0.5147)
INST	-0.2543** (0.1196)
L1.FDI	0.1827*** (0.0509)
F-test of Excluded Instruments	F(2,14)=12.90***
Under Identification Tests	
Sanderson-Windmeijer (SW) Chi-sq statistic	Chi-sq (2)=28.39***
Kleibergen-Paap rk LM statistic	Chi-sq(2)=9.90***
Weak Identification Tests	
Sanderson-Windmeijer (SW) F statistic	F(2,14)=12.90***
Kleibergen-Paap rk Wald F statistic	12.90

Source: Own estimation using Stata 14

Note:

1) All variables are in logs.

2) Coefficients are reported with their robust standard errors in parentheses

3) ***, ** and * indicate that the particular coefficient or test statistic is significant at 1, 5 and 10 percent level respectively

4) The Sanderson-Windmeijer (SW) first-stage chi-squared and F statistics are tests of under-identification and weak identification, respectively, of individual endogenous regressors. In the case of a single endogenous regressor, the SW statistic reported is identical to under- identification statistics reported as per the Kleibergen-Paap rk Wald statistic in the first stage regression.

[48] The under-identification test is an LM test of whether the equation is identified, i.e., the excluded instruments are "relevant" (correlated with the endogenous regressors)."Weak identification" arises when the excluded instruments are correlated with the endogenous regressors, but only weakly.

Table 4.2 presents the results for the augmented gravity specification of new trade theory determinants of trade flows between India and its 15 major trading partners over the time period 2000-16, estimated by the OLS, FE and FE-2SLS IV estimator.

Table 4.2: Estimation Results for Impact of FDI on Trade for India

Dependent Variable: Real Value of Bilateral Trade (VT)

Variable Name	**OLS** (I)	**FE** (II)	**FE-2SLS IV** (III)
SUMGDP	0.2278***	2.0289***	1.5635***
	(0.0058)	(0.1761)	(0.0411)
SIMGDP	-0.0543	0.9613**	0.9032**
	(0.6987)	(0.3657)	(0.3546)
DIFFGDPC	-0.2215***	-0.3292**	-0.2942**
	(0.0453)	(0.1252)	(0.1325)
TC	-0.7508**	-0.4484**	-0.4692**
	(0.3893)	(0.2109)	(0.2249)
FDI	0.1597***	0.0152	0.0781**
	(0.0172)	(0.0155)	(0.0411)
adj R^2	0.99	0.85	0.80
F-stat	3715.89***	64.03***	79.64***
Hansen J statistic			1.72
No of Observations	205	205	190

Source: Own estimation using Stata 14

Note:

1) All variables are in logs.
2) Coefficients are reported with their robust standard errors in parentheses.
3) ***, ** and * indicate that the particular coefficient or test statistic is significant at 1, 5 and 10 percent level respectively.
4) Institutional distance and lagged value of FDI are the two instruments for the FDI variable
5) The Sargan-Hansen test is a “test of over-identifying restrictions”. The joint null hypothesis is that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated equation. With robust, bw and/or cluster, Hansen's J statistic is reported.

Overall the results suggest that, when estimated with FE-2SLS IV method, the performance of our augmented gravity model in terms of goodness-of-fit (80 percent) is highly satisfactory. The independent variables chosen in our model explain a high proportion of the variance of trade flows between India and its trading partners. Since all the regressions are run with variables in logarithmic form, the coefficients represent the elasticity of trade with respect to our independent variables. We briefly discuss the results obtained for the FE-2SLS IV regression.

The variable SUMGDP has an expected positive and significant sign. An increase in SUMGDP increases trade. A 10 percent increase in sum of India and its partner country's GDP will lead to a 15.63 percent increase in India's total trade with that country. The positive sign of SIMGDP is also in accordance with Helpman and Krugman (1985) and suggests that if similarity between India and its partner country's GDP increases by 10 percent, bilateral trade between the two countries will increase by 9.03 percent.

The negative sign of DIFFGDPC is in conformity with our expectation, which suggests that bilateral trade between India and its partner country is positively linked to consumers with similar per capita incomes and therefore having similar patterns of consumption. Trade will therefore be lower when the two countries are dissimilar in per-capita income. A negative coefficient of DIFFGDPC lends support to the Linder hypothesis (1961). Our results indicate that **India trades more intensively with countries having similar per-capita incomes (Hypothesis 2)**. This finding is supported by studies such as Breuss and Egger (1999), Egger (2000, 2002) and Baltagi et al. (2003). The statistical significance and expected signs of SUMGDP, SIMGDP and DIFFGDPC provide support to the New Trade Theory (Helpman, 1984).

With respect to the TC variable, we find that bilateral trade is decreasing in trade costs. A 10 percent increase in trade costs between India and its partner country results in a decrease of 4.69 percent in bilateral trade.

The variable of interest in our study, i.e. FDI has a positive and statistically significant effect on trade. Our empirical analysis supports our hypothesis that **Trade and FDI are complements at the aggregate country-level for India (Hypothesis 1)**. This means that FDI in India is serving as a channel through which trade is increasing. There can be broadly two ways through which

FDI is impacting trade flows positively. The first could be through increased intra-firm trade flows wherein an MNE established in India exports intermediate goods to its affiliate located in a foreign country so that the goods could be assembled abroad and vice-versa. The second could be the so-called proximity advantage wherein local production of a good from the foreign-owned MNE in India leads to increase in demand for foreign products and vice-versa.

Our finding of a complementary relationship between trade and FDI supports the theories of vertical MNEs such as Helpman (1984) and Helpman and Krugman (1985) and suggests that the nature of FDI is vertical in case of India. Our results are in line with results of other country-level studies conducted on this topic such as Grubert and Mutti (1991) and Clausing (2000).

It is important to note that the positive effect of FDI on trade for India is conditional on the institutional distance between India and its partner countries. Our results suggest that FDI flows decline as institutional distance between the home country and host country increases. When investors from countries with strong institutions invest in countries with weak institutions, they face higher costs as compared to investors from countries with weak institutions (Cezar and Escobar, 2015). This not only impacts the flow of FDI but also indirectly impacts its possible positive impact on trade.

4.7 Conclusion

This chapter empirically examined the relationship between trade and FDI for India and its 15 major trading partners using data from 2000 to 2016. The gravity specification of new trade theory determinants was augmented to include the important role that FDI can play in impacting trade volumes for India. Addressing the potential issue of endogeneity, Fixed-Effect 2-Stage Least Square Instrument Variable (FE-2SLS IV) method of estimation was utilized to obtain the empirical results. We have instrumented FDI in our analysis using institutional distance between host and home country and value of last year's FDI. In the case of analyzing trade-FDI relationship for India, this is the first time this technique has been employed. The results support the importance of new trade theory determinants in explaining the pattern of India's trade (Helpman,1985 and Krugman, 1981).

The following key conclusions can be drawn based on the empirical findings. First, the traditional patterns of specialization, as per which countries only export products in which they have a comparative advantage in terms of lower opportunity costs of production, are dwindling. Most trade by India is now being conducted with countries having similar factor proportions thus pointing to increasing intra-industry nature of trade (Krugman, 1981). The results also imply that India trades more intensively with countries having a similar per-capita income which reaffirms the Linder hypothesis. It is also safe to conclude that the Linder hypothesis has proven to be an effective means in determining the trade patterns between India and its partner countries.

Second, FDI is a complement to trade at the aggregate level for India. The results indicate that a 10 percent increase in FDI is associated with a 0.78 percent increase in trade. This finding indicates that the nature of FDI is vertical in the case of India. While we do not have data segregated by intra-firm trade, our results do indicate the existence of intra-firm trade flows resulting from fragmentation of production activities of MNEs. The increase in importance of intra-firm trade flows can be ascribed to the change in organization of multinational firms. There has not only been a quantitative change with a surge in the scale of operations of MNEs operating in India but there also seems to be a qualitative change. Multinational enterprises were initially companies operating in India with headquarter activities located in their home country. However, the growing internationalization of production process has resulted in the development of vertical FDI and the fragmentation of production.

Third, our results suggest that the positive effect of FDI on trade in the case of India is conditional on the quality of institutions in the host and home country. We find that larger is the distance between countries in terms of institutional quality, lower is the volume of bilateral FDI. An improvement in institutional quality can play a significant role in attracting FDI flows, which can in turn positively impact trade flows.

Before concluding this chapter, it is important to mention two caveats. First, we recognize that we may not have controlled for all factors that are correlated with FDI and affect trade and there could still be problems of endogeneity. Future research should delve deeper into this issue and attempt to minimize the endogeneity problem. It would be useful to include other relevant variables that might be appropriate for the model description and further inspect the validity of the proposed instruments.

Second, the evidence of support to Linder hypothesis and complementarity between trade and FDI can be due to presence of aggregation bias resulting from use of aggregate data. Aggregation across sectors can induce a "systematic bias" against finding support for the Linder hypothesis (Hallak, 2010). Several papers have contended that the Linder hypothesis should be developed at sector level in order to control inter-sectoral trade determinants (Schott, 2004; Hummels and Klenow, 2005). In the case of relationship between trade and FDI, Blonigen (2001) pointed out that aggregation bias can play a significant role and that one can expect to obtain substitution effects the more disaggregated is the nature of the data. For instance, it could be the case that for some firms FDI substitutes exports but indirectly increases exports for other firms. Therefore, it is important to undertake empirical examinations not just at the aggregate country-level, but also at the disaggregated industry-level and firm level (Forte, 2004).

To supplement the analysis conducted in this chapter, we further investigate the relationship between trade and FDI in the next chapter wherein we conduct an empirical analysis of the relationship between the two variables at the disaggregated industry-level for the Indian manufacturing sector.

Chapter 5
Empirical Analysis at the Industry-level

5.1 Introduction

In the previous chapter, we showed that trade and FDI are complements at the aggregate country-level for India. However, some extent of heterogeneity stays in the results at any level of empirical analysis (Fontagne, 1999). Despite the finding of a complementary relationship between trade and FDI at the aggregate country-level, we may not find a similar result at the disaggregate industry or firm-level. It might be the case that FDI may displace exports or imports from other firms or industries and the total effect on trade may be adjusted through general equilibrium effects. Additionally, the effect of FDI on exports and imports need not be symmetric. Therefore, in order to provide a comprehensive analysis and further examine the relationship between trade and FDI, this chapter attempts to empirically examine the relationship between trade and FDI at the industry-level for the Indian manufacturing sector. This chapter evaluates the relationship based on the theoretical models developed by Helpman (1984), Helpman and Krugman (1985), Horstmann and Markusen (1992), Brainard (1993), Markusen et al. (1996), Carr et al. (1998) and Markusen (2000) which were discussed in the earlier chapter. Based on the theory, we hypothesize trade and FDI to be complements at the industry-level for India.

Through the empirical exercise conducted in this chapter, we also investigate the relationship between industry heterogeneity and international trade for the Indian manufacturing sector. Traditional theories of international trade emphasize comparative advantage mostly to do with differences in opportunity costs of production between countries and industries as the basis for international trade. These traditional theories explain inter-industry trade. Conversely, new theories of international trade emphasize “increasing returns to scale” and “consumer love of variety” as the basis for international trade (Bernard et al., 2012). These theories explain intra-industry trade where countries export and import the goods within the same industry (Krugman 1980; Helpman 1981; Ethier 1982). A comparatively successful elucidation for patterns of international trade across countries and industries has been provided by Helpman and Krugman (1985) who combine these two theories. This strand of theoretical literature is based on the simplified assumption of a “representative firm” within each industry (Bernard et al., 2012).

Since the late 1980s and 1990s when micro datasets on firms and plants became increasingly available, the immense amount of heterogeneity that exists across producers within industries became evident. This kind of heterogeneity was in terms of size, productivity, wages, capital and skill-intensity. Besides several empirical studies began to investigate whether this heterogeneity was related to international trade process in ways that could be significant for overall results. In recent times, an emerging empirical literature has also recognized the superior attributes of plants and firms that engage in international trade relative to the plants and firms producing solely for the domestic market (Bernard and Jensen 1995, 1997; Aw and Hwang 1995; Richardson and Rindal, 1995; Bernard and Wagner 1997; Bernard et al., 1997). These studies have shown that exporters are larger in size, more productive, more capital-intensive, more technology- and skill-intensive and pay higher wages as compared to non-exporters. These findings indicate self-selection. As noted by Bernard et al. (2012), "exporters are more productive, not necessarily as a result of exporting, but because only the most productive firms are able to overcome the costs of entering export markets". The model on firm heterogeneity and international trade by Melitz (2003) has been successful in explaining this type of self-selection and has formed the basis for most recent research on this topic. Subsequently, Helpman et al. (2004) and Yeaple (2005) developed a monopolistic competition model to show how firm heterogeneity is linked to international entry decisions. Firms face sunk costs as well as uncertainty about their future productivity. Upon entry, each firm instantaneously learns about its productivity level, modeled as a draw from a known distribution. Due to the fixed costs in serving foreign markets, only the most productive firms (or the firms that expect sufficiently high profits from serving foreign market) will export or undertake FDI. This literature helps us understand why only a fraction of firms choose to enter the foreign market either through exports or by becoming multinational and operating foreign affiliates. Following the new strand in the new trade theory literature focusing on firm heterogeneity, this chapter investigates the determinants of industry-level trade flows in the Indian manufacturing sector.

Using panel data for 10 manufacturing industries that have received a cumulative share of 75 percent of inward FDI in the manufacturing sector in India during the time period 2000-01 to 2014-15, we test for the following three hypotheses:

Hypothesis 1: Trade and FDI are complements at the disaggregate industry-level for India

Hypothesis 2: Increase in capital intensity of production is associated with increase in industry-level trade flows across Indian manufacturing sector

Hypothesis 3: Increase in skill intensity of production is associated with increase in industry-level trade flows across Indian manufacturing sector

This chapter is organized as follows. Section 5.2 discusses the model specification, dataset construction and definition of variables. Section 5.3 analyzes some key trends in India's manufacturing sector with special focus on the 10 selected industries. Section 5.4 describes the estimation technique. Section 5.5 presents the regression analysis of the relationship between trade and FDI at the disaggregate industry-level for India. Section 5.6 provides key concluding remarks.

5.2 Model Specification, Dataset Construction and Definition of Variables

Model Specification

Motivated by the theoretical and empirical literature, we develop a model to explain the determinants of industry-level trade flows in India's manufacturing sector. Our model incorporates industry characteristics and industry-wise FDI inflows which have an impact on the pattern and determinants of trade flows. By explaining industry-level trade flows as a function of FDI and other control variables, the primary purpose of our study is to understand the important role that FDI inflows received by Indian manufacturing industries can play in impacting trade flows for the sector.

The model takes the following form:

$$T_i^t = \alpha + \beta_1 SIZE_i^t + \beta_2 WAGE_i^t + \beta_3 LPROD_i^t + \beta_4 CAPINT_i^t + \beta_5 SKILLINT_i^t + \beta_6 EOS_i^t + \beta_7 FDI_i^t + \varepsilon_i^t \quad \text{.....(5.1)}$$

where the dependent variable T is the real value of trade flow (total trade, exports or imports) of industry i at time period t which depends on various industry characteristics and FDI. The key industry characteristics included in the model drawn from theoretical and empirical literature (Melitz 2003; Helpman et al., 2004; Yeaple 2005; Bernard and Jensen 1995, 1997) are size of the industry (SIZE), wages paid to all employees in an industry (WAGE), labor productivity (LPROD), capital intensity (CAPINT), skill intensity (SKILLINT) and economies of scale (EOS).[49] The variable FDI represents total inward FDI flows received by the industry (FDI).[50] All the variables are expressed in natural logarithm form.

We expect a positive coefficient for SIZE. First, large sized industries are often considered to have a higher level of productivity than smaller-sized industries. They enjoy economies of scale in their operation which entitles them with lower average or marginal costs (Kumar and Pradhan 2003; Srinivasan and Archana 2011). Large size also helps them utilize specialized executives in a better way, provide opportunities to raise financial resources at a lower cost and offers large-scale purchasing benefits and own marketing and sales operations (Wagner 1995). Second, given that entry into a foreign market is often associated with high-level productivity, this suggests that productive industries which are larger in size find it profitable to sustain the costs of internationalization and therefore have a higher tendency to export and import their products compared to industries that are smaller in size (Krugman, 1979).

With respect to the WAGE variable, we expect a negative coefficient. The wage rate as a variable reflects the differences in marginal labor costs each industry faces. The lower is the real wage rate an industry pays; the greater is the industry's competitive advantage, which is expected to result in higher trade volumes (Srinivasan and Archana, 2011).

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[49] The model is built on the assumption that the industry data is representative of the average firm data. We understand that this is a "strong" assumption but owing to the unavailability of data on FDI flows at the firm-level for the manufacturing sector, we are using the FDI data at the industry-level for our analysis. Future research should try to use more detailed plant/firm-level data from the Indian manufacturing sector and examine the relationship between trade and FDI

[50] While it would have been ideal to examine the impact of both inward and outward FDI on industry-level trade flows in the Indian manufacturing sector, doing so was not possible due to data limitations. For inward FDI, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry, Government of India follows a sectoral classification under which it divides FDI sectors in about 60 main categories. Such kind of a disaggregated sector wise data is not available for outward FDI. The Reserve Bank of India provides data on outward FDI only for broad sectors namely-agriculture and mining; community, social and personal services; construction; electricity, gas and water; financial, insurance, real estate and business services; manufacturing; transport, storage, and communication services; wholesale, retail trade, restaurants and hotels.

Labor productivity (LPROD) is one of the main factors determining industry-level trade flows (Melitz, 2003; Arnold and Hussinger, 2005; Ghironi and Melitz, 2007).[51] The entry in the foreign market is expected to be positively related to labor productivity as firms in an industry can survive in the international market only if they can produce at a lower cost or higher labor productivity. We, therefore, expect a positive coefficient for LPROD. This is also in line with theoretical predictions of trade models involving heterogeneous firms, especially those of Melitz (2003) and Helpman, Melitz and Yeaple (2004) which "highlight the important role of within-sector productivity differences in explaining the structure of international trade and investment". There is recent empirical evidence also to suggest that the productivity of firms involved in international trade is usually more than that of firms serving only the home economy (Clerides et al., 1998; Bernard and Jensen, 1999, 2004; Head and Ries, 2003; Tomiura 2007).

The Capital Intensity (CAPINT) variable measures the relative importance of factor endowment of an industry that brings to it an element of comparative advantage (Bernard and Jensen, 1999). A more capital-abundant industry will specialize in the production of more capital-intensive product varieties within each product category, in which it has a comparative advantage relative to other industries, and will employ more capital-intensive techniques of production. This will have a direct impact on the industry's productivity which will positively impact its trade flows. We, therefore, expect a positive coefficient associated with this variable (Bernard and Wagner, 1996).

Existing literature on the linkage between skills intensity and propensity to trade suggests that exporters and non-exporters have different labor competencies and have found that exporters have higher skill levels compared to non-exporters (Verhoogen, 2008; Brambilla et al., 2012 and 2015). The possible reason could be because consumers in the foreign market value quality more than consumers in the domestic market and that skill are necessary to enhance quality (Verhoogen, 2008). It could also be the case that the export process by itself involves some

[51] Another alternative measure of productivity which could be used in place of Labor Productivity is Total Factor Productivity (TFP). In order to verify the robustness of our empirical results, we also estimated TFP using Levinsohn and Petrin (2003) technique and used it in place of Labor Productivity in the regression equations. The use of TFP made no significant difference to our main empirical results for the impact of FDI on trade flows. Analysis of the data revealed two things-1) Capital Intensity seemingly had motivations different from TFP and 2) TFP in Indian manufacturing was driven strongly by Labor Productivity. The correlation coefficient between Labor Productivity and estimated TFP was very high (r=0.64). Therefore, the study uses Labor Productivity as the chosen measure of productivity and the results reported in Section 5.5 are only for LPROD.

specific skills that may not be needed while selling similar goods in the home market (Matsuyama, 2007). There is another strand of literature that suggests that improvement in labor skills, through training, has a positive impact on productivity and wages (Dearden et al., 2006; Flores-Lima et al., 2014; Konings and Vanormelingen, 2015). Drawing on Melitz (2003), we, therefore, expect that employment of better skill by an industry (measured by variable SKILLINT) improves its productivity, increases its competitiveness in the foreign market, thereby positively impacting its trade flows.

We include the economies of scale variable (EOS) to examine the scale effects at the industry level which can explain variation in trade flows across industries (Lall, 2001). The scale economies in industry i are proxied by the ratio of the output of the industrial sector i to the total output of the manufacturing sector. The variable is primarily included in the regression equations as a measure of scale effects. Since in all the regression equations, the dependent variable is associated with the absolute levels of exports, imports or total trade, it becomes essential to control for the difference between those industry units that account for a larger share of total industry output and those that form a small share (Dias, 1998). Our expectation is that as the scale of the industry in terms of its share of manufacturing sector output increases, the industry enjoys economies of scale, a higher productivity level and has a greater propensity to engage in trade. Existing literature also suggests that higher industry output share can positively affect trade performance as dominant industries have the necessary resources to compete internationally (Guner et al., 2010). We, therefore, expect a positive coefficient with EOS variable.

The main relationship that we are interested in is between trade and FDI. The expected sign of the coefficient associated with FDI is not clear *a priori*. Several studies have derived general equilibrium models of trade involving FDI with different predictions about the relationship between the two variables. However, there is a broad consensus in theory that if FDI is horizontal the relationship between trade and FDI is that of substitution (Horstman and Markusen, 1992; Brainard, 1993; Markusen and Venables, 1998). In this case we expect a negative sign of the parameter estimate. If FDI is vertical in nature then the relationship between trade and FDI is that of complements (Helpman, 1984; Helpman and Krugman, 1985). In this case, we expect a positive sign of the parameter estimate.

Dataset Construction

We employ a panel of 10 selected manufacturing industries that have received a cumulative share of about 75 percent of inward FDI in the manufacturing sector in India during the time period 2000-01 to 2014-15. This is also the time period under consideration in this study. Selection of such a long time period enables us to control for unobserved fixed characteristics of the firms within each industry and certain measurable time-varying characteristics (Head and Ries, 2003).

The industries selected for analysis are (i) Automobile; (ii) Chemicals, Drugs and Pharmaceuticals; (iii) Metallurgical Industries; (iv) Food Processing and Fermentation; (v) Electrical Equipments; (vi) Cement and Gypsum; (vii) Industrial Machinery; (viii) Textiles; (ix) Electronics; and (x) Medical and Surgical Appliances.

Our empirical model requires data on trade, FDI and different industry-specific characteristics such as output, value-added, employment, emoluments, wages, value added, fixed capital stock, total persons engaged, etc. However, there is no single database available that provides data on all these variables in one place. Therefore, our study draws upon different data sources available to compile the existing databases into a harmonized final data set required for empirical estimation.

The main data sources used in the study are UN-COMTRADE, World Integrated Trade Solution (WITS), World Bank, Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, Government of India and Annual Survey of Industries (ASI), various issues.

Trade Data:

Industry-wise disaggregated level trade data as per the United Nations' International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3 has been obtained from UN-COMTRADE database from WITS, World Bank.

FDI Data:

The sector-wise FDI data has been obtained from DIPP, Ministry of Commerce and Industry, Government of India. Industries in the manufacturing sector in receipt of FDI inflows are categorized according to the modified sectoral classification provided by the Industries (Development and Regulation) Act (IDR Act), 1951 and published by the DIPP. The sectoral classification comprises of 43 main categories and 92 sub-categories. [52]

Industry Data:

For constructing all the industry-specific independent variables, we use data from the Annual Survey of Industries (ASI), which is the most detailed and wide-ranging yearly database on organized manufacturing in India. As described by MOSPI (2019), the database "covers all factories registered under Sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948".[53] The ASI database provides detailed information on various important aspects of the registered factories such as output, value added, fixed capital, total persons engaged and wages and salaries to all employees. The ASI database uses the standard National Industrial Classification (NIC) to classify the economic activities of the registered factories. The classification is based on NIC at 2-digit, 3-digit and 4- digit.

Concordance Exercise

In order to maintain the international comparability of data and also the time series of the national data, it is essential that the data compiled as per a particular classification is convertible to the corresponding international classification and also to the corresponding national as well as earlier version of the national classification.

[52] The sub-categories include some of the main categories that do not have further sub-divisions.
[53] For the purpose of ASI frame, this means it covers those factories which are employing 10 or more workers with power or 20 or more without power.

In order to build a harmonized database for the selected 10 Indian manufacturing industries, we conduct a four-step concordance exercise:

- *Step 1: Between DIPP FDI Sectors and NIC Classifications*

  The DIPP sectoral classification differs from India's latest NIC classification (NIC-2008) which is based on the ISIC Revision 4 and is commonly utilized by countries to compile FDI statistics. To make the data comparable, we conduct a concordance exercise between DIPP FDI sectors and NIC codes.

  For this purpose, we build on the study conducted by NCAER (2009) which made an important contribution by providing concordance between DIPP FDI sectors and NIC 2- and 3-digit industrial sectors to enable "adaptation and adoption for the DIPP data reporting according to the NIC-2008 classification"[54]. From the NCAER (2009) concordance table, the NIC-2008 3-digit industry codes for the selected industries are identified. A total of 36 3-digit NIC-2008 industry codes were identified by the end of step 1.

- *Step 2: Between Different NIC Classifications (NIC-1998, NIC-2004 and NIC-2008)*

  During the time-period under analysis of our study, there are three different industrial classifications used in the ASI dataset. NIC-1998 was followed for the time period between 1998-99 and 2003-04. NIC-2004 was followed from 2004-05 to 2007-08. The latest series of classification i.e. NIC-2008 is used to classify economic economies from 2008-09 onwards. In order to maintain the consistency in data and have compatibility between the classifications, we undertake a 2-step concordance exercise: first between NIC-1998 and NIC-2004 to permit conversion of NIC-1998 based data in terms of NIC-2004 and second between NIC-2004 and NIC-2008 to permit conversion of NIC-2004 based data in terms of NIC-2008.

[54] The NCAER (2009) concordance table has been previously used in studies such as Chaudhuri et al. (2013) and Rastogi and Sawhney (2018) to match 3-digit industries data at NIC-2008 with DIPP FDI sectors. While the study by Chaudhuri et al. (2013) focuses on determinants of manufacturing sector FDI in India, the study by Rastogi and Sawhney (2018) focuses specifically on the pattern of inbound FDI in India in dirty sectors.

For this purpose, we use the concordance tables between NIC-1998 and NIC-2004 and between NIC-2004 and NIC-2008 at 4- digit provided by the Ministry of Statistics and Programme Implementation (MOSPI), Government of India. All the 4-digit codes under each of the selected NIC-2008 3-digit industry codes are identified and these are matched with their corresponding NIC-2004 and NIC-1998 codes. Necessary aggregation and adjustment have been made to aggregate these 4-digit industry codes into 3-digit industry codes which have been then matched with the corresponding NIC-2008 3-digit industry codes identified in the first step.

- *Step 3: Between ISIC Revision 3 and NIC Classifications*

  The NIC classification of Indian industries abides by the principles and practices laid down in the United Nations' ISIC, as revised from time to time (MOSPI, 2008). The NIC-2004 industrial classification is based on ISIC Revision 3.1. Trade data obtained according to ISIC Revision 3 is matched first with NIC-2004 and using inter-industry classification concordance exercise conducted in step 2 subsequently matched with NIC-1998 and NIC-2008.[55]

- *Step 4: Between DIPP FDI Sectors and ISIC Revision 3*

  Building on the concordance exercise conducted in steps 1, 2 and 3, we finally conduct a concordance between DIPP FDI sectors and ISIC Revision 3.

The resultant concordance table for the 10 selected manufacturing industries is given in Appendix D.

Definition of Variables

The dependent variable T is calculated as the real value of trade flows (total trade, exports or imports) of the industry. To calculate the real value of exports, we deflate the nominal exports value by Unit Value Index for Exports with 2004-05 as base. Similarly, to calculate the real

[55] The structure of NIC- 2004 was found to be identical to the structure of ISIC Revision 3.1 up to 4-digit level of classification (except a few shadow classes).

value of imports, we deflate the nominal imports value by Unit Value Index for Imports with 2004-05 as base. Total trade is calculated as the combined sum of real exports and imports.

The first independent variable, SIZE, is calculated as total employment by the industry (Bernard and Jensen, 1997; Roberts and Tybout, 1997). The second independent variable WAGE is calculated as the ratio of the real value of emoluments to the number of total employees (Pandit and Siddharthan, 2006; Mitra and Ural, 2008). In the ASI database, emoluments include the salaries and wages, including bonus, paid during the year to persons in employment. To calculate the real value of emoluments, the time-series on the nominal value of emoluments have been deflated by the Consumer Price Index of Industrial Workers (CPI-IW) with 2004-05 as base.

Labor Productivity (LPROD) is calculated as real gross value added per worker (Kumar, 2016; Basole and Narayan, 2018). Gross value added (GVA) is estimated as the value of output minus the value of inputs (excluding depreciation) at current prices. The real gross value added is calculated by deflating the nominal gross value added using the Wholesale Price Index (WPI) for manufactured products with 2004-05 as base.

Capital Intensity (CAPINT) is calculated as the ratio of real fixed capital stock to total persons engaged (Kapoor, 2014). In the ASI database, capital is measured by fixed capital which represents the "depreciated value of fixed assets owned by the factory on the closing day of the accounting year" (MOSPI, 2018). The real fixed capital stock is calculated by deflating the nominal fixed capital stock using WPI for machinery and equipment with 2004-05 as base. In the ASI database, total persons engaged include all the persons engaged in the factory including workers (both directly employed and those employed through contractors), supervisory and managerial staff, other employees and unpaid family members/proprietor, etc.

Skill Intensity (SKILLINT) is calculated as the ratio of the real value of emoluments to all employees to the real value of wages (Pandit and Siddharthan, 2006). In the ASI database, employment, measured by total numbers of persons engaged in the factory, can be divided into two broad groups-first group being that of production workers and the second group being that of non-production workers. The first group of production workers can be further sub-divided into workers employed directly and those hired on contract. The second group of non-production workers can be sub-divided into supervisory and managerial staff. For the purpose of our study, we use the broad categorization to differentiate between unskilled labour (proxied by production workers) and skilled labour (proxied by non-production workers). Though it would have been ideal to define skills using classifications based either on educational characteristics or on working tasks and duties performed, such kind of detailed information was not available in the ASI database. Therefore, we have relied on this broad categorization to define skills (Kapoor, 2016). Evidence from other countries also suggests that there exists a close connection between education level and the production and non-production status of workers (Goldberg and Pavenik, 2007). In the ASI database, emoluments cover payments to all employees while wages cover only payments to workers. To calculate the real value of emoluments and wages, the time-series on the nominal value of emoluments and wages have been deflated by the CPI-IW with 2004-05 as base.

The variable EOS to proxy for scale economies is calculated as the ratio of the real value of the output of the industrial sector i to the real value of the total output of the manufacturing sector. In the ASI database, output comprises "the ex-factory value, (i.e., exclusive of taxes, duties, etc. on sale and inclusive of subsidies etc., if any) of products and byproducts manufactured during the accounting year, and the net value of the semi-finished goods, value of own construction and also the receipts for industrial and non-industrial services rendered to others, rent received for plant & machinery and other fixed assets, net balance of goods sold in the same condition as purchased and value of electricity generated and sold" (MOSPI, 2018). The real value of the output of a particular industrial sector and the total manufacturing sector is calculated by deflating the nominal output series using the WPI for manufactured products with 2004-05 as base.

The FDI variable is defined as the real value of FDI inflows received by each industry. We deflate the series on industry-wise FDI inflows using Gross Fixed Capital Formation (GFCF) deflator with 2004-05 as base.

The data sources for various deflators used in the study are as follows. The data on Unit Value Index for Exports and Imports has been taken from RBI Handbook of Statistics on Indian Economy, 2017-18. The data on CPI-IW has been obtained from Ministry of Labour and Employment, Government of India. The data on WPI of manufactured products and machine and machine tools has been obtained from the Office of Economic Advisor, Central Statistics Office, MOSPI, Government of India. The data on GFCF deflator has been obtained from National Accounts Statistics, Central Statistics Office, MOSPI, Government of India.

Appendix E (Tables E.1-E.3) mentions the details of the data definitions and sources, descriptive statistics of and correlation matrix between the variables used in the study.

5.3 Analysis of Key Trends in the Manufacturing Sector

The manufacturing sector in India is an important contributor to growth with the sector accounting for 18 percent of GVA in 2017-18 (RBI Handbook of Statistics on Indian Economy, 2017-18).[56] The sector witnessed a growth rate of 7 percent per annum between 2011-12 and 2017-18. In terms of Index of Industrial Production (IIP), a significant barometer of industrial activity, we find that manufacturing sector IIP registered a growth rate of 4.6 percent in 2017-18 (Central Statistics Office, MOSPI). A strong manufacturing sector helps in promoting domestic production, generates employment and exports and enables higher growth in the economy.

There exists heterogeneity in performance across industries. We examine some key characteristics of the organized manufacturing sector, particularly for the ten selected industries across the time-period 2000-01 to 2014-15.[57] In order to examine if the performance of industries has improved over this 15 year period, we also compare some performance indicators over two sub-periods i.e 2000-03 and 2012-15.

- ***Growth Performance***

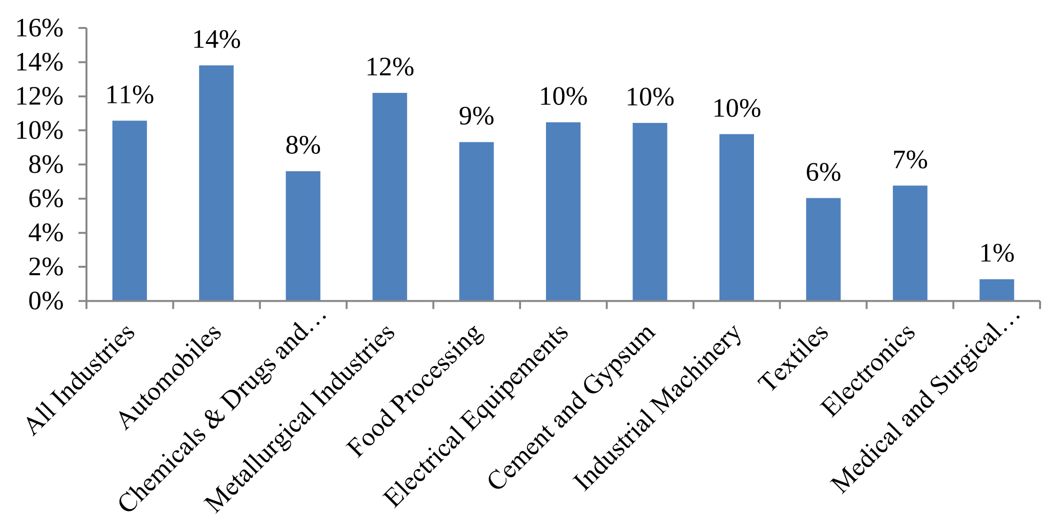
The manufacturing sector output expanded at 11 percent per annum between 2000-01 and 2014-15. All the selected industries showed positive growth in output during this period. The automobile industry's output showed the maximum growth rate of 14 percent per annum. This was followed by metallurgical industry growing at 12 percent per annum. Electrical equipments

[56] Share of manufacturing GVA is released at basic prices.

[57] An important caveat here is that when we mention the word "industries" in this section, we are referring to the DIPP FDI industries, as per the DIPP FDI sectoral classification. Though the trends are analyzed based on the concordance between DIPP FDI sectors and ASI 3-digit classification, the trends should not be inferred as applying to the whole industrial sector, as per the ASI detailed classification of the industrial activity. For example, when we refer to textiles, we include only NIC (2008) 3-digit code 131 which is "spinning, weaving and finishing of textiles". However, the textiles and apparel sector as per the ASI manual includes all 3-digit NIC (2008) codes falling under NIC 13 and 14 division.

industry, cement and gypsum and industrial machinery grew at 10 percent per annum respectively (Figure 5.1).

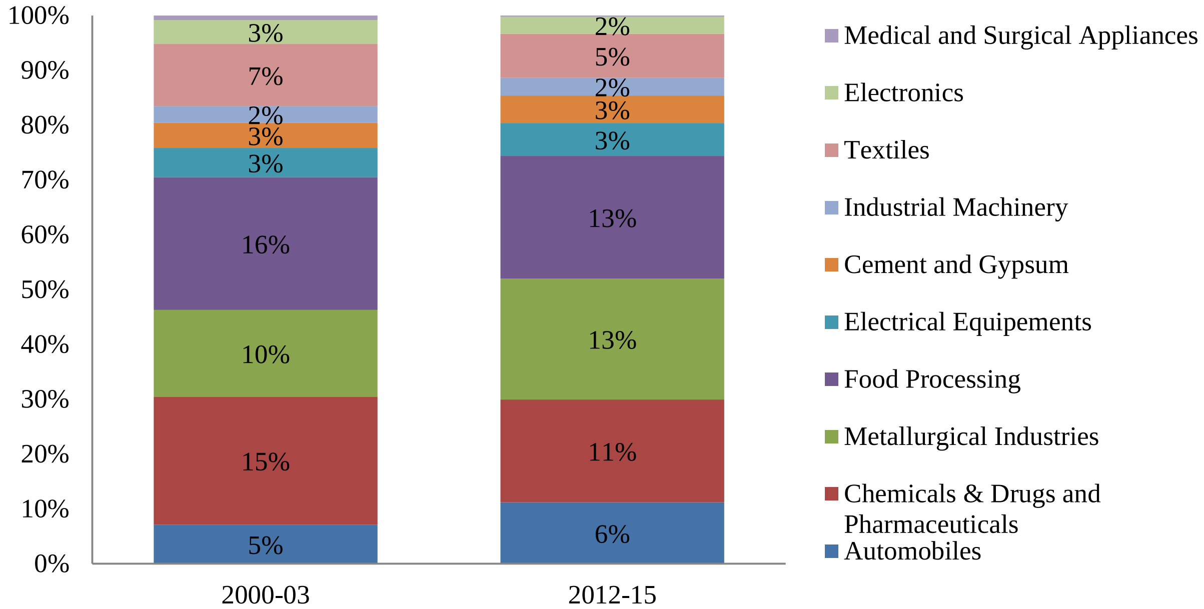
Figure 5.1: Annual Growth Rate of Ouput



Source: Own calculations using data from ASI published statistics, MOSPI

High levels of industrial concentration can be witnessed in the manufacturing sector, with the ten selected industries accounting for 64 percent of the total manufacturing sector output for the period 2000-01 to 2014-15. In terms of industry-wise contribution to the total manufacturing sector output, we find that food processing industries have contributed the most to the manufacturing sector output across the time period under analysis. The sector contributed on an average 16 percent in 2000-03 which decreased slightly to 13 percent in 2012-15. Second to this were the chemicals and drugs and pharmaceuticals industry which contributed about 15 percent in 2000-03 and this also decreased slightly to 11 percent in 2012-15. The contribution of metallurgical industries increased from 10 percent in 2000-03 to 13 percent in 2012-15. Similarly, the share of the automobile industry in manufacturing sector output increased from 5 percent in 2000-03 to 6 percent in 2012-15. The contribution of electrical equipments, cement and gypsum and industrial machinery remained the same across both sub-periods (Figure 5.2).

Figure 5.2: Industry-wise Contribution to Manufacturing Sector Output



Source: Own calculations using data from ASI published statistics, MOSPI

- ***Technical Coefficients and Structural Ratios***

We now analyze the performance of the selected industries in terms of some structural ratios and technical coefficients namely technical efficiency (defined as ratio of output to input), overall productivity (defined as ratio of GVA to output) and labor productivity (defined as ratio of GVA to workers). Surprisingly, we find that there is a decreasing trend in the technical efficiency level across industries and across time periods (Table 5.1). This suggests the failure of these manufacturing industries to achieve the maximum possible output for a given level of input. We see a similar decreasing trend in the overall productivity across industries.[58]

[58] There is a slight improvement in the technical efficiency and overall productivity levels of the medical and surgical equipments industry.

Table 5.1: Technical Coefficients and Structural Ratios, by Industry

	Technical Efficiency		Overall Productivity		Labor Productivity	
Industry	**2000-03**	**2012-15**	**2000-03**	**2012-15**	**2000-03**	**2012-15**
Automobiles	1.23	1.21	0.19	0.17	5.36	7.68
Chemicals &Drugs and Pharmaceuticals	1.31	1.29	0.24	0.23	8.35	12.71
Metallurgical Industries	1.24	1.17	0.19	0.15	4.82	10.52
Food Processing	1.14	1.11	0.12	0.10	2.21	4.22
Electrical Equipments	1.28	1.22	0.22	0.18	2.05	7.16
Cement and Gypsum	1.42	1.37	0.29	0.27	2.90	4.65
Industrial Machinery	1.32	1.31	0.24	0.23	4.52	8.84
Textiles	1.23	1.19	0.19	0.16	1.76	3.09
Electronics	1.26	1.24	0.20	0.20	7.22	10.31
Medical and Surgical Appliances	1.34	1.50	0.25	0.33	5.84	5.53

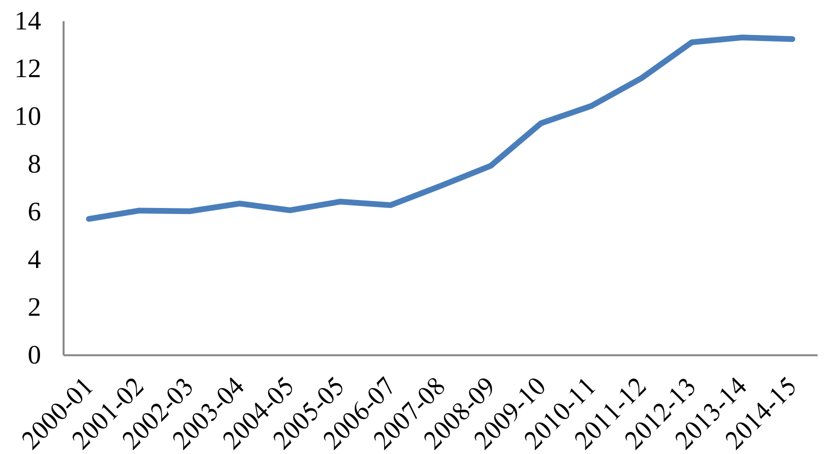
Source: Own calculations using data from ASI published statistics, MOSPI

On a positive front, there is improvement in labor productivity across 9 out of 10 selected industries. In fact, the electrical equipments industry witnessed a growth rate of 19 percent per annum in labor productivity during the time period 2000-01 and 2014-15. Even the growth rate in labor productivity in the metallurgical industries showed an increase of 11 percent per annum during the same time-period. The increase in labor productivity in Indian manufacturing is not surprising since India in the last decade has experienced improvements in terms of educational attainments, literacy rates and average years of schooling. Increase in labour productivity is good news for the manufacturing sector since it implies overall greater production potential.

- ***Increased Capital Intensity of Production***

The processes of production in the Indian manufacturing sector have progressively become more capital oriented (Goldar, 2000; Das and Kalita, 2009). Though the rise in capital intensity of production is indicative of “technological transformation” (with countries utilizing more capital intensive techniques of production as they get wealthier), in the case of India evidence suggests that the manufacturing sector uses techniques of production that are relatively more capital intensive than countries with similar factor endowments and at related level of development (Hasan et al., 2013; Kapoor, 2016). The rise in the average capital intensity of production in the Indian manufacturing sector can be seen from Figure 5.3. A point worth noting here is that this rise has been witnessed in all industries in the manufacturing sector.

Figure 5.3: All India Average Capital-Labor Ratio



Source: Own calculations using data from ASI published statistics, MOSPI

However, capital intensity of production varies widely across different industries. Capital intensity is highest in sectors like automobiles, chemicals and drugs and pharmaceuticals, metallurgical industries and electronics. Industries such as textiles and food processing tend to be low in terms of capital intensity of production.

It is also interesting to note the performance of industries in terms of capital intensity across two sub-periods i.e 2000-03 and 2012-15 (Table 5.2). While traditionally capital intensive industries such as automobiles and chemicals and drugs and pharmaceuticals continued to be highly capital intensive, the metallurgical industries and electrical equipments industry witnessed an increase in capital intensity of production by more than three times during the time period under analysis. These two industries witnessed an average annual growth rate of 15 percent and 18 percent per annum respectively in capital intensity of production during 2000-01 and 2014-15. Other industries such as industrial machinery and food processing industry also witnessed an average growth of 8 percent per annum between 2000-01 and 2014-15. The cement and gypsum industry also witnessed a modest-rise in capital intensity of production. In fact, not just in capital intensive industries, we find that capital intensity of production has improved in labour intensive industries as well. For example in the textiles sector, capital intensity of production increased from an average of 3.93 during 2000-03 to an average of 8.26 during 2012-15. The rise in capital intensity of production in labour intensive industries is a matter of concern since it "raises doubts about the capacity of the manufacturing sector to absorb labour and create jobs" (Kapoor, 2016).

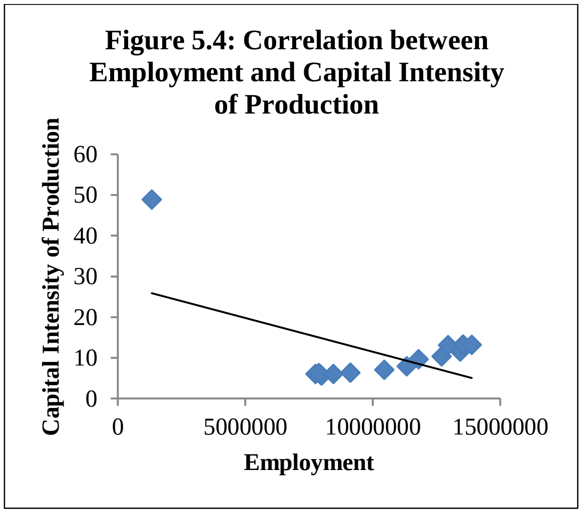
Table 5.2: Average Capital Intensity of Production, by Industry

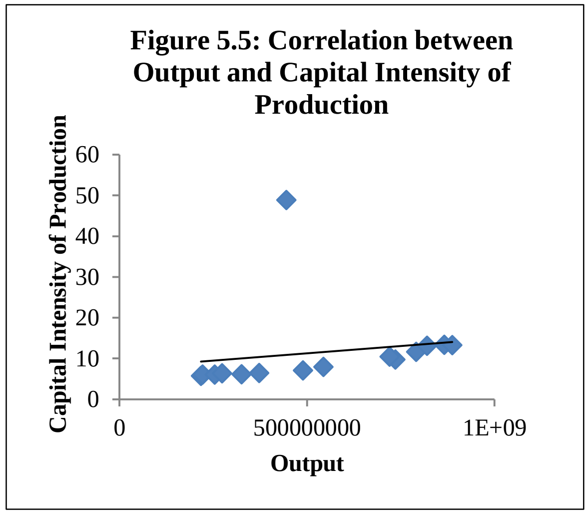
Industry	2000-03	2012-15
Automobiles	9.29	12.94
Chemicals & Drugs and Pharmaceuticals	11.89	12.94
Metallurgical Industries	11.87	40.24
Food Processing	2.88	7.57
Electrical Equipments	2.23	7.05
Cement and Gypsum	6.89	13.93
Industrial Machinery	3.50	7.75
Textiles	3.93	8.26
Electronics	7.02	9.65
Medical and Surgical Appliances	3.59	5.90

Source: Own calculations using data from ASI published statistics, MOSPI

- ***Employment Generation***

One of the most important aspects of India's economic development and increasing capital intensity of production is its disappointing performance in creating jobs in its organized manufacturing sector. The manufacturing sector employs about 22 percent of the total organized sector workforce (Ministry of Finance, 2018). However, during the period 2000-01 and 2014-15, employment in India's organized manufacturing sector registered a meager 4 percent per annum growth. What we seem to witness in India is a decade of "jobless growth" in Indian manufacturing (Kannan and Raveendran, 2009; Goldar, 2009; Thomas, 2013). This is mostly because the increase in output growth and increase in capital intensity of production has not been accompanied by adequate generation of employment. Using the data, it is therefore important to examine the link between capital intensity of production, output and employment (Figure 5.4 and 5.5). For the manufacturing sector, the correlation coefficients between output and capital intensity of production indicates that there is a positive relationship between the two. However, in contrast, data indicates that the capital intensity of production has a negative relationship with the size of labor force in the manufacturing sector.





Source: Own calculations using data from ASI published statistics, MOSPI

Nonetheless, looking at the performance of selected industries in terms of generation of employment, we find that in spite of having high capital intensity of production, all the selected industries have generated positive employment growth over 2000-01 to 2014-15.

Table 5.3: Trend Growth Rate of Employment across Industries

Industry	Growth Rate (%)
Automobiles	9
Chemicals & Drugs and Pharmaceuticals	4
Metallurgical Industries	4
Food Processing	2
Electrical Equipments	6
Cement and Gypsum	6
Industrial Machinery	3
Textiles	1
Electronics	5
Medical and Surgical Appliances	1
All Industries	4

Source: Own calculations using data from ASI published statistics, MOSPI

Table 5.3 shows that it is the automobile industry, one of the most capital intensive industries, which has generated the highest employment growth between 2000-01 and 2014-15. Second to this is the cement and gypsum industry generating employment at 6 percent per annum. Other industries such as chemicals and drugs and pharmaceuticals and industrial machinery generated employment at 4 percent and 3 percent per annum respectively during this time period. The performance of these industries also substantiates the fact that the growth of employment of these industries has been nonetheless slow.

- ***Skilled v/s Unskilled Workers***

From the above discussion, it is now established that in most of the industries capital intensity of production has increased. This increase in technical change associated with the increase in use of capital per worker is often assumed to be associated with decline in relative price of capital. Existing literature suggests that physical capital and skill are complements and an increase in capital intensity increases the demand for skilled labor relative to unskilled labor (Griliches, 1969). Put simply, technological change is not just associated with increase in use of machines or capital but also associated with employment of workers who have a particular type of skills to operate machines or utilize the capital. Across the world, increase in capital intensity and mechanization of production process has led to increase in importance of portfolio of occupations, in particular skilled labor. This in turn has led the skilled labor force get a larger share of wages compared to the production workers. Keeping this view, it is important to examine whether the shift to capital-intensive means of production has affected the allocation of tasks in the manufacturing sector in India. In other words, it is important to examine whether the impact of increasing capital intensity has been different on the various categories of workers.

We do this analysis by examining the difference in share of wages paid to unskilled workers (proxied by share of wages paid to production workers in the ASI dataset) and skilled workers (proxied by share of wages paid to supervisory and managerial staff in the ASI dataset) across the two sub-periods-2000-03 and 2012-15. For the manufacturing sector in India, the share of wages paid to production workers has decreased from 70 percent of the total wage bill in 2000-03 to 59 percent in 2012-15. In contrast, the share of wages to supervisory and managerial staff has increased from 17 percent in 2000-03 to 26 percent in 2012-15.

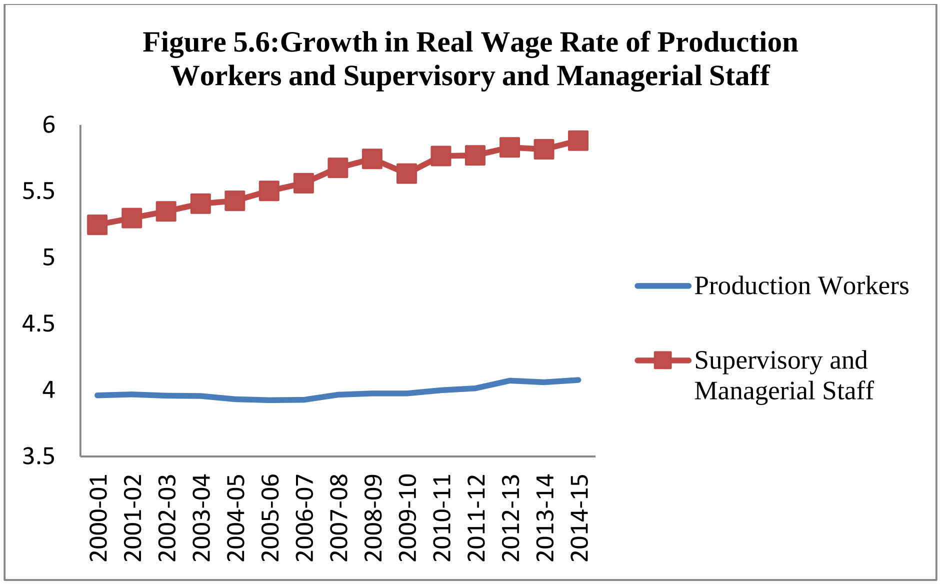
The industries selected for analysis also follow this trend. Among the industries selected for analysis, we witness a fall in the share of wages to production workers in all industries except the medical and surgical appliances industry. For the share of wages to supervisory and managerial staff, all industries have witnessed an increase except the medical and surgical appliances industry wherein the share has remained roughly around 40 percent across time period under analysis. Metallurgical industries and electrical equipments industry has witnessed an average rise of about 18-19 percent per annum in the share of wages paid to supervisory and managerial staff during the same time-period. In fact for the electrical equipments industry, the share of average wages paid to supervisory and managerial staff increased by nearly three times across the time-period under analysis (Table 5.4).

Table 5.4: Share of Wages to Production Workers and Supervisory and Managerial Staff

	Share of Wages to Production Workers		Share of Wages to Supervisory and Managerial Staff	
Industry	**2000-03**	**2012-15**	**2000-03**	**2012-15**
Automobiles	55	47	34	40
Chemicals & Drugs and Pharmaceuticals	44	35	35	45
Metallurgical Industries	59	53	17	34
Food Processing	59	52	19	29
Electrical Equipments	52	44	14	42
Cement and Gypsum	62	51	24	37
Industrial Machinery	47	35	37	46
Textiles	75	67	15	23
Electronics	39	28	45	54
Medical and Surgical Appliances	37	44	40	40
All Industries	70	59	17	26

Source: Own calculations using data from ASI published statistics, MOSPI

What is a matter of concern is the fact that for the manufacturing sector in general, the data indicates an increasing disparity between the wages paid to supervisory and managerial staff and the wages paid to production workers. If we plot the growth rate of real wages paid to these two categories of workers, the disparity is clearly visible. From Figure 5.6 it can be seen that while wages of the production workers have remained roughly flat in the period 2000-01 and 2014-15, wages of the supervisory and managerial staff have increased sharply. The ratio of the average real wage rate of supervisory and managerial staff to average real wage rate of production workers increased from 3.6 to 6.0 during the time period 2000-01 and 2014-15.



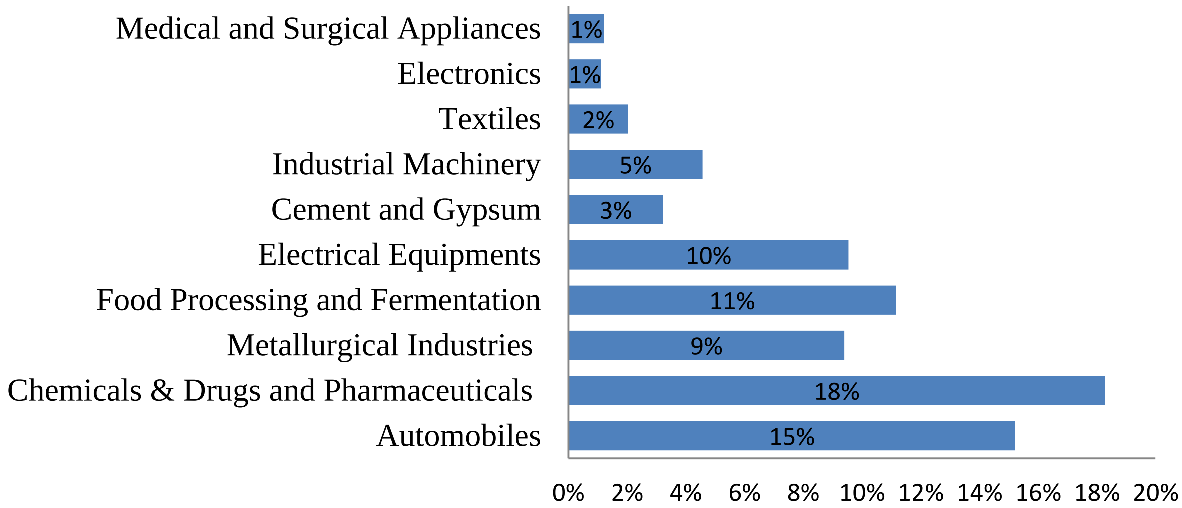
Source: Own calculations using data from ASI published statistics, MOSPI

- ***Foreign Direct Investment and Trade***

Investments in the Indian manufacturing sector have been on the rise accounting for a share of 35 percent in aggregate FDI inflows in India for the period 2000 to 2015 (DIPP, 2015). Amongst the various manufacturing industries in India, two main industries receiving huge volumes of foreign direct investment include automobile industry and chemicals, drugs and pharmaceuticals. The automobile industry has experienced a sharp increase in the inflow of FDI (US 14.47 billion in period 2000-2015) which is mainly the result of the gradual policy liberalization which has allowed upto 100 percent foreign direct investment in this sector (Rajeswari and Akilandeswari, 2015). The pharmaceutical industry has also experienced huge volumes of FDI inflow which is mainly due to the outsourcing of various tasks such as research and development by multinational pharmaceutical corporations (Sagar, 2013).

Other manufacturing industries receiving high volumes of FDI include metallurgical industries, food processing and fermentation, electrical equipments, cement and gypsum, industrial machinery, textiles, electronics and medical and surgical appliances. Together these ten industries account for a combined share of 75 percent of FDI in the Indian manufacturing sector during the period 2000 to 2015 (Figure 5.7).

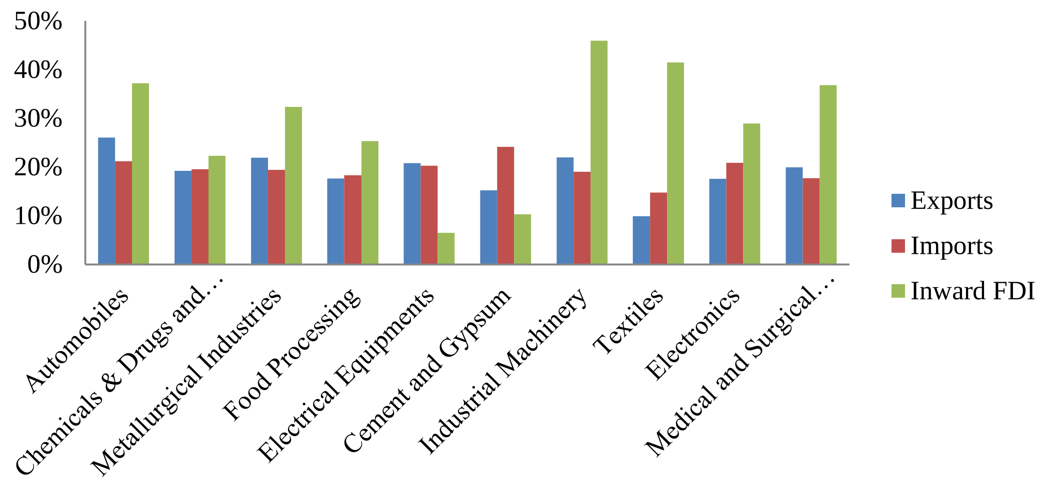
Figure 5.7: Industry-wise Share in Manufacturing FDI (2000-15)



Source: Own calculations using data from DIPP published statistics, Ministry of Commerce, Government of India

Large volumes of FDI in the manufacturing sector in India have been accompanied by increasing trade flows. The average share of manufacturing exports (in total merchandise exports) has been around 68.5 percent for the period 2000 to 2015. In the same time period, the share of manufacturing imports (in total merchandise imports) has been 52.7 (World Bank, 2018b). The selected industries have performed well not just with respect to increase in FDI inflows, but also with respect to increase in trade flows. Among the industries selected for analysis, the automobile industry emerged as the most dynamic sector with its exports growing at CAGR 26 percent, imports growing at 21 percent and FDI growing at 37 percent over the period 2000-15. The second major contributor to export performance is metallurgical industries registering a growth of 22 percent. This sector also witnessed 19 percent growth in imports and 32 percent growth in FDI. Two industries that have shown impressive growth in terms of FDI growth but not much in exports and imports are industrial machinery and textiles. The FDI in industrial machinery sector witnessed a massive growth of 41 percent but exports and imports of this sector grew by 22 percent and 19 percent respectively over the time period under analysis. In the textiles sector as well, the CAGR of FDI has been 41 percent but exports and imports have grown by 10 percent and 15 percent respectively. Electrical equipments and cement and gypsum industry are two sectors wherein the growth in export and import has been higher than the growth in FDI (Figure 5.8). The varied performance of industries in terms of growth in exports, imports and FDI indicates that there exists heterogeneity across industries that may be due to factors that are intrinsic to the nature of the particular sector.

Figure 5.8: Performance of Industries-CAGR Growth Rates of Exports, Imports and Inward FDI (2000-15)



Source: Own calculations using trade data from WITS, World Bank and FDI data from DIPP, Ministry of Commerce and Industry.

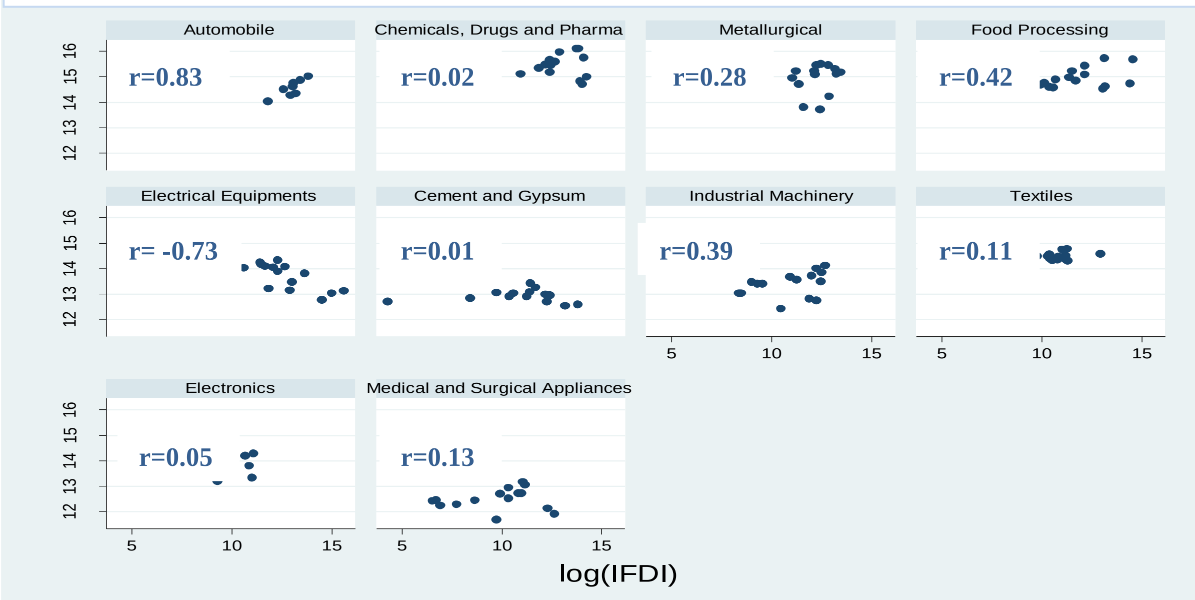
To better understand if there exists a relationship between trade and FDI, we visually inspect the relationship between exports and FDI and imports and FDI through scatter plots.

If we look at the relationship between exports and FDI, the scatter plots suggest that there exists a positive relationship between the two variables for all industries, except the electrical equipments industry (Figure 5.9). The Pearson correlation coefficient measuring the strength of a linear association between two variables is highest in the case of the automobile industry (r=0.83). The Indian automobile industry has been on a great growth trajectory with impressive numbers in sales, manufacturing and exports over the last years. The industry became the fourth largest in the world in 2017 (IBEF, 2018). In terms of FDI, the Government of India has undertaken numerous measures to attract foreign investment and further expedite the growth of the automobile industry. Presently the government allows 100 percent FDI in the automobile sector. The policy liberalization, cost advantage in terms of production and presence of skilled labor has attracted huge volumes of FDI in this industry. The huge presence of foreign manufacturing MNEs in India has transformed India into a hub for small car production which has in turn played a major role in expanding exports from the sector (Rajalakshmi.and Ramachandran, 2011).

Other industries displaying moderate strength of correlation between exports and FDI are food processing, industrial machinery and metallurgical industry. The correlation though positive is weak for other industries.

Figure 5.9: Exports-FDI Scatter Plots by Industry

Time Period: 2000-15

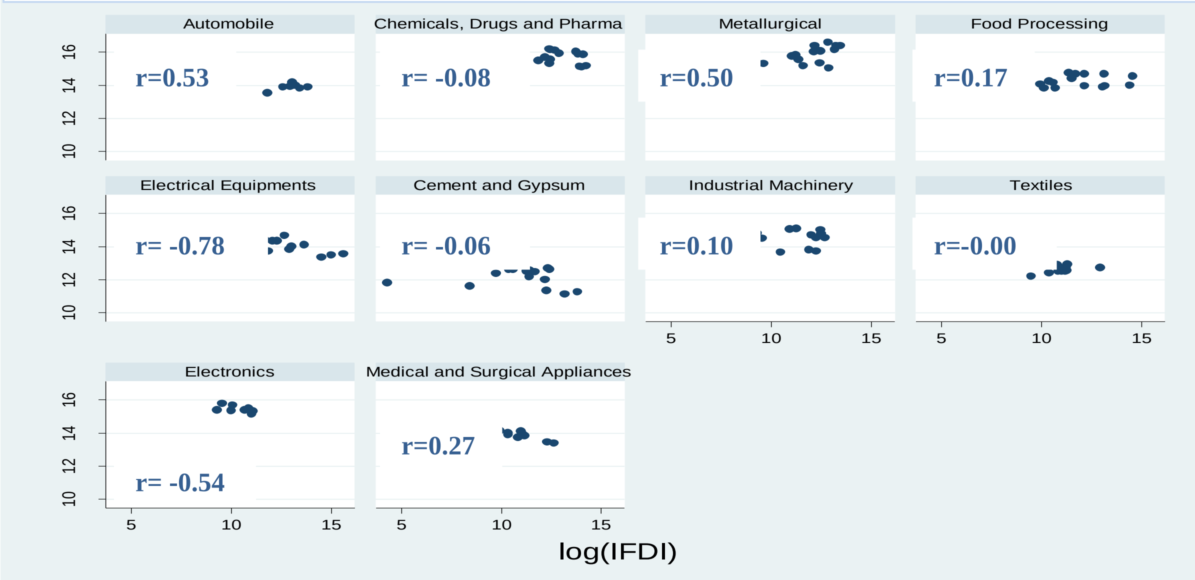


Source: Own calculations using trade data from WITS, World Bank and FDI data from DIPP, Ministry of Commerce and Industry.

If we look at the relationship between imports and FDI, we find different results. The scatter plots suggest a positive relationship between imports and FDI for 5 industries namely automobile, metallurgical, food processing, industrial machinery and medical and surgical appliances (Figure 5.10). The strongest correlation can be seen again for the automobile industry (r=0.53) followed by metallurgical industry (r=0.50). We find a negative relationship between imports and FDI for chemicals, drugs and pharmaceutical industry, electrical equipments, cement and gypsum, textiles and electronics.

Figure 5.10: Imports-FDI Scatter Plots by Industry

Time Period: 2000-15



Source: Own calculations using trade data from WITS, World Bank and FDI data from DIPP, Ministry of Commerce and Industry.

5.4 Estimation Technique

The critical assumption of panel data (also known as longitudinal or Time Series Cross Section or "TSCS" data) is that of "pooling," i.e., every unit is described by the same regression equation at all points in time (Stimson, 1985, Hsiao 2003). Based on this assumption, the general TSCS model can be written in the following form:

$$y_{i,t} = x_{i,t}\,\beta + \varepsilon_{i,t}\ ;\ \text{i=1, 2 ...N and t=1, 2 ...T} \quad \text{.................................(5.2)}$$

where x_{it} is a vector of one or more exogenous variables and observations are indexed by both cross-section unit (i) and time (t). For all observations, the matrix of independent variables can be denoted by "X". The vector of observations on the dependent variable can be denoted as "Y".

We also assume that the data is arranged in such a way that observation after unit i for time period t is the observation for unit i for time period t + 1. In other words, data is assumed to be stacked by unit (Beck and Katz, 1995).

The error covariance matrix is NT x NT in dimension with typical element E ($\varepsilon_{i,t}$, $\varepsilon_{j,s}$) and is denoted by **Ω**.

The method of Ordinary Least Squares (OLS) is optimal for estimating TSCS models when the error terms are presumed to be generated in a "spherical" manner. In other words, for OLS to be optimal it is essential to assume that all the error terms have the same variance (homoskedasticity) and are independent of each other. Beck and Katz (1995) point out that "the latter assumption can be broken down into the assumption that errors for a particular unit at one time are unrelated to errors for that unit at all other times (no serial correlation) and that errors for one unit are unrelated to the errors for every other unit (cross-sectional independence)". If these assumptions are met, then the method of OLS should be used to estimate the models of panel data which would then provide correct[59] and unbiased standard errors.

However, owing to the temporal and spatial characteristics of panel data it is difficult to apply the method of OLS for its estimation. Beck and Katz (1995) point out that panel data are typically characterized by complex and "non-spherical" error structures allowing for "temporally and spatially correlated errors, as well as for panel-heteroskedasticity". For example, one might expect the error terms to show "panel heteroskedasticity", where the variances of the error process differ from unit to unit. It is also possible that the error terms may show temporal dependence. Baltagi (2008) argued that unobserved shocks to economic relationships often tend to have an effect for more than one period thus making testing for serial correlation in the disturbance term important. The most archetypal assumption is that the error terms demonstrate "first-order serial correlation". One can also expect errors to be "contemporaneously correlated" which implies that errors for unit i at time t will tend to be linked with errors for unit j at time t (this is also referred to as Cross-Sectional Dependence or "CSD"). Hoyos and Sarafidis (2006) mention that cross-sectional dependence in the error terms can "arise because of the presence of

[59] The term "correct" standard errors is used to indicate that we have accurate estimates of the variability of parameter estimates. Correct standard errors allow for the correct computation of statistical tests and confidence intervals. Incorrect standard errors will lead us to be either "too confident or sufficiently confident" about whether the findings might be statistical artifacts (Beck and Katz, 1995).

common shocks and unobserved components that ultimately become part of the error term, spatial dependence, and idiosyncratic pairwise dependence in the disturbances with no particular pattern of common components or spatial dependence". The prevalence of cross-sectional dependence in panel data models has been documented in the literature as well (Robertson and Symons, 2000; Pesaran 2004; Baltagi 2005). The presence of these "non-spherical" errors can generate inefficiency in coefficient estimation and bias in the estimation of standard errors.

There are two ways to deal with a panel data suffering from panel-heteroskedasticity, serial correlation and cross-sectional dependence. One way is to use Feasible Generalized Least Squares (FGLS) and the other way is to use Panel Corrected Standard Errors (PCSE).

The panel data equation can be estimated using Generalized Least Squares (GLS) so long as the covariance matrix of the error terms (Ω) is known. If the covariance matrix is known then estimation using the GLS technique is efficient and produces consistent estimates of the standard errors (Kmenta 1986). GLS transforms the equation 5.2 with a general error covariance matrix to another linear equation with a covariance matrix with spherical error terms which then becomes suited for OLS estimation. The estimates of β produced by GLS is given by

$$(X' \Omega^{-1}X)^{-1} X' \Omega^{-1}Y \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.3)$$

where $(X' \Omega^{-1}X)^{-1}$ is the estimated covariance matrix with spherical error terms

The problem stems from the fact that in the real world covariance matrix of error terms is never known. Thus, its estimate is used i.e $\widehat{\Omega}$. This estimation technique is known as Feasible Generalized Least Squares (FGLS) which gives consistent estimates of β if $\widehat{\Omega}$ is estimated using residuals computed from the consistent estimates of β. The FGLS estimate of β is usually denoted by $\hat{\beta}$. This estimation method was first applied to panel data models with non-spherical errors by Parks (1967). The estimates provided by FGLS are dependent upon the disturbance covariance matrix estimates and on any autocorrelation parameters that are estimated (Greene 2012; Davidson and MacKinnon, 1993).

Linear regression with panel-corrected standard errors (PCSE) is another way of fitting linear panel data models with non-spherical error terms. In contrast to FGLS, PCSE follows a different estimation scheme for these type of models. Based on Beck and Katz (1995), we briefly describe the PCSE methodology.

If the error terms in equation 5.2 are non-spherical and meet one or more of the panel error assumptions, then estimation by OLS will yield consistent but inefficient estimates of β and standard errors thus obtained will also be inaccurate. However, the OLS inaccurate standard errors can be corrected for by taking into account the contemporaneous correlation of the errors (and per-force heteroskedasticity) and serial correlation of the errors. The corrected standard errors will then furnish accurate estimates of the variability of the OLS estimates of β.

The right formula for the sampling variability of the OLS estimates is given by the square roots of the diagonal terms of

$$cov(\hat{\beta}) = (X'X)^{-1}\{X'\Omega X\}(X'X)^{-1} \quad \text{.................................}(5.4)$$

If the error terms are spherical in nature, this formula boils down to the usual OLS formula. If the error terms are non-spherical in nature, then this formula gives incorrect standard errors.

Nevertheless, this formula can still be used in conjunction with the panel structure of the errors to provide panel-corrected standard errors (PCSE). In cases where the errors terms in the panel data models are contemporaneously correlated and panel heteroskedastic, then error covariance matrix takes the form of an NT x NT block diagonal matrix with an N x N matrix of contemporaneous covariances $\sum$ along the diagonal. Estimating equation 5.4 requires an estimate of $\sum$. As the OLS estimates of expression 5.2 are consistent, PCSE uses the OLS residuals from that estimation to get a consistent estimate of $\sum$. The typical element $\sum$ can be estimated by:

$$\hat{\sum}_{i,j} = \frac{\sum_{t=1}^{T} e_{i,t}e_{j,t}}{T} \quad \text{where } e_{i,t} \text{ is the OLS residual for unit i at time t}$$

Using this, an estimator of $\hat{\Omega}$ is formed which is essentially a block diagonal matrix with the $\hat{\sum}$ matrices along the diagonal. Panel corrected standard errors are consequently calculated by taking the square root of the diagonal elements of $(X'X)^{-1}\{X'\hat{\Omega}X\}(X'X)^{-1}$ (Beck and Katz, 1995).

In sum, when no autocorrelation is specified then PCSE yields OLS estimates of the parameters. When autocorrelation is specified PCSE yields Prais–Winsten estimates of the parameters which are conditional on the estimates of the autocorrelation parameter(s).[60]Under the assumed covariance structure of the disturbances, the estimate of the variance–covariance matrix of the parameters is "asymptotically efficient" and utilizes the FGLS estimate of the disturbance covariance matrix (Kmenta, 1997). Provided that the conditional mean is correctly specified both FGLS and PCSE estimators are consistent,

For the purpose of this study, we use the PCSE technique to estimate our industry-level model. The reason is threefold. Firstly, it has been shown by Beck and Katz (1995) using Monte Carlo methods that in a statistical environment characterized by non-spherical error terms, the full variance–covariance estimates provided by FGLS are "optimistic" when used with finite panel data models. In contrast, PCSE produces accurate coefficient standard errors. The authors show that in finite panel data models, the coverage probabilities based on OLS or Prais–Winsten estimates obtained using PCSE are closer to nominal levels than the coverage probabilities of the GLS estimators with associated model-based GLS standard errors (McNeal, 2012). Secondly, they also report that the FGLS is at best only "slightly more efficient" compared to PCSE in severe cases of cross-sectional correlation and that too only when the number of time periods is at least twice the number of cross-section units. Thirdly, the panels need not be balanced for using PCSE technique which is not the case while using FGLS. However, the expression for the covariance matrix of the disturbances will be more general if the panels are unbalanced.

5.5 Empirical Analysis and Discussion of Results

Recalling from section 5.2, the industry-model for estimation is given by the following equation:

$$T_i^t = \alpha + \beta_1 SIZE_i^t + \beta_2 WAGE_i^t + \beta_3 LPROD_i^t + \beta_4 CAPINT_i^t + \beta_5 SKILLINT_i^t + \beta_6 EOS_i^t + \beta_7 FDI_i^t + \varepsilon_i^t \qquad (5.1)$$

where the dependent variable T is the real value of trade flow (total trade, exports or imports) of industry i at time period t which depends on size of the industry (SIZE), wages paid to all employees in an industry (WAGE), labor productivity (LPROD), capital intensity (CAPINT), skill intensity (SKILLINT), economies of scale (EOS) and total inward FDI inflows received by the industry (FDI).

[60] The Prais-Winsten regression technique employs the GLS method to estimate the parameters in a linear regression model in which the errors are serially correlated. In particular, errors are assumed to follow a first-order autoregressive process (Prais and Winsten, 1954).

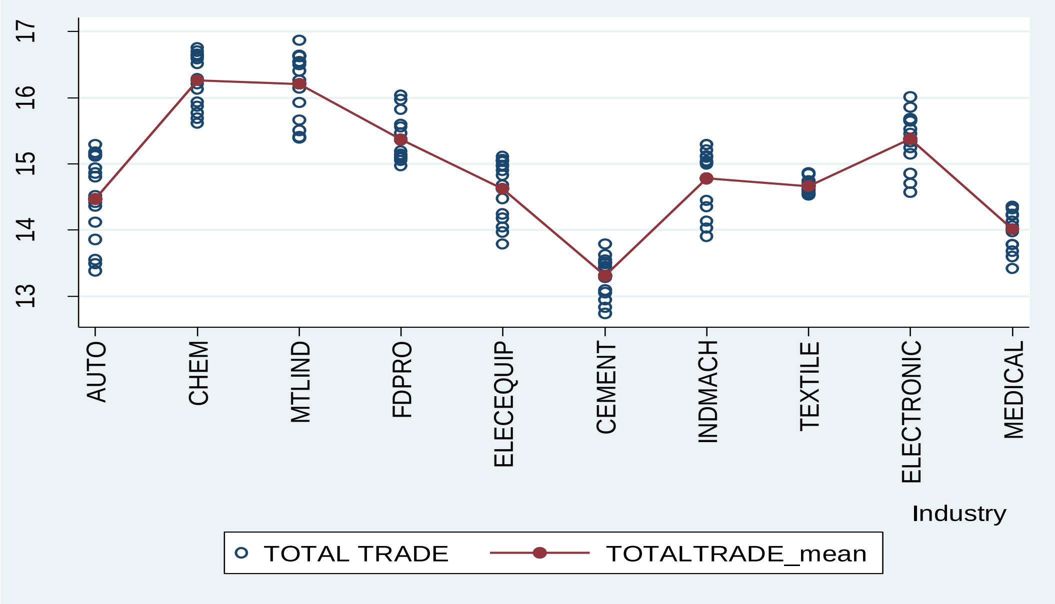
Before undertaking any empirical analysis, we first check for stationarity of each of the variable series in our panel data. The unit root test is usually conducted to check for the stationarity of a series. For the purpose of our study, we employ Levin- Lin- Chu (2002) and Fisher-type (Choi 2001) tests to check whether the panel data is stationary or contains unit root (non-stationary). We test the null hypothesis of non-stationary (unit root) against the alternative hypothesis of stationarity. All the variables except SIZE, WAGE and SKILLINT were found to be stationary at levels. We transform the series of these three variables by taking their first difference to make them stationary.

Since the existing literature on this topic has acknowledged the possibility of two-way links between trade and FDI (Bajo-Rubio and Montero-Muñoz, 1999; Liu, Wang and Wei, 2001; Aizenman and Noy, 2005; Sharma and Kaur, 2013), we also test for exogeneity of the FDI variable in our model using the "Durbin-Wu-Hausman (DWH) test". The test results reveal that there is no problem of endogeneity in our model.

Given the nature of panel data and the possibility of error-terms being non-spherical, we begin our analysis by testing for the different panel-error assumptions. We test the hypothesis of group-wise heteroskedasticity, auto-correlation and cross-sectional dependence in our panel data by conducting a series of diagnostic tests.

Following Greene (2003), we calculate a modified Wald statistic for group wise heteroskedasticity in the residuals of a fixed-effect regression model. The test results reject the null hypothesis of homoskedasticity and indicate existence of heteroskedasticity across panels for all equations. A graphical representation of heteroskedasticity across panels (i.e industries) in the total trade equation is depicted in Figure 5.11.

Figure 5.11: Fixed Effects: Heterogeneity across Industries



Source: Own calculations using Stata 14
Note: AUTO-Automobiles, CHEM-Chemicals and Drugs and Pharmaceuticals, MTLIND-Metallurgical Industries, FDPRO-Food Processing, ELECEQUIP-Electrical Equipments, CEMENT-Cement and Gypsum, INDMACH-Industrial Machinery, TEXTILE-Textiles, ELECTRONIC-Electronics, MEDICAL-Medical and Surgical Appliances.

We then use a Woolridge (2002) test of first-order (panel-specific and common) autocorrelation in our fixed-effect regression model and reject the null hypothesis of no first order autocorrelation. For testing cross-sectional dependence, we estimate CD statistics proposed by Pesaran (2004). Under the null hypothesis, the error term is assumed to be "independent and identically distributed" over time-periods and across cross-sectional units. Under the alternative hypothesis, error terms may be correlated across cross sections, but then the assumption of no serial correlation remains. According to Pesaran CD test results, cross-sectional dependence has been found to exist in the model when exports and imports are the dependent variable, but not when total trade is the dependent variable.

The statistics and results of these tests are presented in Table 5.5.

Table 5.5: Tests for Existence of Non-Spherical Errors in Panel Data

	Total Trade	**Exports**	**Imports**
Group-wise Heteroskedasticity	chi2(10)= 9.57*** Prob>chi2 = 0.0000	chi2(10) = 26.58*** Prob>chi2= 0.0030	chi2 (10) = 35.38*** Prob>chi2 = 0.0001
Serial Correlation	F(1,9) = 25.541*** Prob > F = 0.0007	F(1, 9) = 81.024*** Prob > F = 0.0000	F(1, 9) = 57.160*** Prob > F = 0.0000
Cross-Sectional Dependence	CD=0.960 Pr = 0.3373	CD=3.969*** Pr = 0.0001	CD = 5.632*** Pr = 0.0000

Source: Own calculations using Stata 14
Note: ***, ** and * indicate that the particular coefficient is significant at 1, 5 and 10% level respectively

Since the panel data suffers from non-spherical errors resulting in problems of group-wise heteroskedasticity, serial correlation and cross-sectional dependence, the estimation results using least square based inference methods (OLS, fixed-effect or random-effect) will give inefficient results. Therefore in order to obtain estimates that are statistically correct in the presence of the identified non-spherical error terms, we apply Prais-Winsten regression with Panel Corrected Standard Errors (PCSE) method for estimating the model.

Since industry units in our panel data are assumed to be systematically different from each other in ways that may be unobserved and which could affect our outcome of interest, we include industry fixed effects while estimating our model. The primary reason to include industry fixed effects in the model is to be able to remove all between-industry unit variation and produce an estimate of the average effect of a variable within industry units and over the time-period under analysis (Allison, 2009; Wooldridge, 2010; Mummolo and Peterson, 2018). Inclusion of industry-fixed effects also controls for any time-invariant effects that are specific to a particular industry such as differences in technology, extent of competition and market structure (Kapoor, 2016). In order to control for unobserved heterogeneity for variables that are constant across industry units but vary over time we also include time fixed effects while estimating the model (Arellano, 2003; Wooldridge 2010; Baltagi, 2013; Hsiao, 2014).

The Prais-Winsten PCSE estimation results showing the impact of FDI on trade for Indian manufacturing sector are presented in Table 5.6. The data seems to fit the model well with an R^2 above 99 percent in all three cases. All variables have their expected signs and are statistically significant.

Table 5.6: Estimation Results for Impact of FDI on Trade for Indian Manufacturing Sector

Variable Name	Total Trade (I)	Exports (II)	Imports (III)
SIZE	0.900*** (0.286)	0.927*** (0.309)	0.794*** (0.251)
WAGE	-2.544*** (0.574)	-2.483*** (0.650)	-2.284*** (0.546)
LPROD	0.867** (0.358)	0.872** (0.381)	0.777** (0.314)
CAPINT	2.099*** (0.313)	1.962*** (0.336)	1.975*** (0.279)
SKILLINT	1.291*** (0.488)	1.122** (0.552)	1.192*** (0.454)
EOS	0.439*** (0.143)	0.398*** (0.145)	0.401*** (0.126)
FDI	0.454*** (0.045)	0.449*** (0.047)	0.419*** (0.040)
No. of observations	120	120	120
No. of groups	10	10	10
R-sq	0.997	0.996	0.997

Source: Own estimation using Stata 14
Note: All variables are in logs. Coefficients are reported with their robust panel corrected standard errors in parentheses. ***, ** and * indicate that the particular coefficient is significant at 1, 5 and 10% level respectively. Industry and time fixed effects included in all regressions.

The results reported in columns I, II and III point to the conclusion that trade flows in the Indian manufacturing sector are positively determined by size of the industry, labor productivity, capital intensity, skill intensity, economies of scale and FDI. Real wages paid to employees of an industry have a negative impact on its trade flows. Since we run the regressions with all variables in natural logarithm form, the coefficients denote the elasticity of trade with respect to our independent variables. We briefly discuss the results.

The size of the industry (SIZE), measured by the total number of employees in the industry, exerts a positive influence on industry trade flows. A 10 percent increase in size of the industry leads to 9 percent increase in total trade, 9.27 percent increase in exports and 7.94 percent increase in imports of the sector.

The negative sign of WAGE is in consonance with our expectation that lower is the real wage an industry pays; the higher is its trade volumes. The national comparative advantage that India has in terms of a relatively abundant endowment of labour leads to cost competitiveness for industries at the micro-level resulting in higher volumes of trade flows (Srinivasan and Archana, 2011).

Labor productivity (LPROD) is a significant determinant of trade flows of the Indian manufacturing sector. A 10 percent increase in labor productivity of the industry leads to 8.67 percent increase in total trade, 8.72 percent increase in exports and 7.77 percent increase in imports of the sector. This finding is supported by several studies on firm heterogeneity, productivity and trade (Clerides et al., 1998; Bernard and Jensen 1999, 2004; Melitz, 2003; Head and Ries, 2003; Helpman et al., 2004; Arnold and Hussinger, 2005; Ghironi and Melitz, 2007; Tomiura 2007).

Our findings also indicate that **increase in capital intensity of production (CAPINT) and skill intensity of production measured by employment of better skills (SKILLINT) is associated with increase in industry-level trade flows across Indian manufacturing sector (Hypothesis 2 and 3).** The increase in capital intensity of production in Indian manufacturing industries associated with usage of modern technology and inputs has required employment of more skilled manpower to run the modernized units. This in turn has increased the competitiveness of Indian manufacturing industries in the foreign market which has further led to increase in industry-trade flows.

With respect to EOS variable, we find that industries with a larger share of manufacturing sector output tend to be associated with larger trade flows.

The presence of inward FDI in the Indian manufacturing sector (FDI), the main variable of our study, has a positive and statistically significant effect on total trade, exports and imports of the sector. Our empirical analysis supports our hypothesis that **Trade and FDI are complements at the disaggregate industry-level for India (Hypothesis 1)**. Although we do not have separate data on horizontal and vertical FDI in India, it is evident from the theoretical literature that trade and FDI are complements when FDI is vertical in nature (Helpman 1984; Helpman and Krugman, 1985). Our empirical findings of a complementary relationship between trade and FDI therefore suggest that FDI received by the Indian manufacturing sector is vertical in nature. As we have mentioned earlier, vertical FDI usually takes place in cases when an MNE fragments its production process geographically in different locations to gain from the differences in international factor prices between countries (Helpman, 1984; Helpman and Krugman, 1985; Carr et al., 2001; Hanson et al., 2005). Our empirical analysis therefore suggests that FDI in Indian manufacturing sector is working as a channel through which industry-level trade flows are expanding-both exports and imports. It is also important to note here that in both cases, the estimate of the parameter coefficient is positive, significant and very similar in value. A 10 percent increase in FDI flows in the manufacturing sector is associated with a 4.54 percent increase in total trade, 4.49 percent increase in exports and 4.19 percent increase in imports of the sector.

5.6 Conclusion

In this chapter, we have attempted to understand the important role of industry heterogeneity and FDI inflows in determining industry-level trade flows in Indian manufacturing. For the analysis, the study attempted to develop a harmonized database covering disaggregated industry-level information on trade flows, investment flows and industry characteristics for 10 selected manufacturing industries that have received a cumulative share of 75 percent of inward FDI in Indian manufacturing sector over the period 2000-01 to 2014-15. To the best of our knowledge, this is of the very few studies that has developed and utilized such a harmonized database for examining the relationship between trade and investment for Indian manufacturing sector.

Industry-level trade flows were modeled as a function of industry characteristics such as size of the industry, wages paid to all employees in the industry, labor productivity, capital intensity, skill intensity, economies of scale and inward FDI received by the industry. Owing to presence of panel heteroskedasticity, first-order serial correlation and contemporaneously correlated error terms, we apply Prais-Winsten regression with Panel Corrected Standard Errors (PCSE) to estimate our model. We find trade flows in the Indian manufacturing sector are positively determined by size of the industry, labor productivity, capital intensity, skill intensity, economies of scale and FDI. Real wages paid to employees of an industry have a negative impact on its trade flows. The following key conclusions can be drawn based on the empirical findings.

First, the Indian manufacturing sector has witnessed changes in the labor market share of unskilled workers relative to skilled workers, both in terms of employment and wage premium, where the categorization of workers according to whether or not they are engaged in production is used as a proxy for their skill-levels. Data analysis indicates an increasing disparity between the wages paid to supervisory and managerial staff and the wages paid to production workers. A major factor leading to increased demand for skilled labor in India is the increase in capital intensity of production associated with bias of technological change towards more educated or skilled labor (often referred to as the “skill-biased” technological change). Our study finds some evidence of increased capital-skill complementarity.

Second, industries in the Indian manufacturing sector are extremely heterogeneous and the process of internationalization depends on their characteristics. This finding provides support to the growing literature on the link between firm’s characteristics and their trade performance (Melitz, 2003; Tybout, 2003; Bernard and Jensen, 2004; Wagner, 2007, 2012).

Third, we find a complementary relationship between inward FDI and trade flows-total trade, exports and imports for the Indian manufacturing sector. A 10 percent increase in FDI flows in the manufacturing sector is associated with a 4.54 percent increase in total trade, 4.49 percent increase in exports and 4.19 percent increase in imports of the sector. For the time-period under analysis, inward FDI in the manufacturing sector has acted as a trade channel facilitating expansion of both exports and imports. The complementary relationship found at the industry level may reflect the motivations for undertaking FDI in India. It is safe to conclude that foreign investment in Indian manufacturing is largely driven by the factor price differences, including low labor costs. MNEs are investing in the Indian manufacturing sector to capitalize on low price factors of production and engage in vertical division of labor among production stages between their home country and India.

Fourth, our results lend support to the work of Aizenman and Noy (2006) which showed that a developing country whose productivity is rapidly improving will attract large inflows of vertical FDI, which in turn will increase its international trade.

There are two caveats to this research. First, owing to data limitation, we have only examined the effect of inward FDI into Indian manufacturing sector on industry-trade flows without differentiating the effect that may arise from receiving FDI from different origin countries. Future research should attempt to estimate the relationship at the bilateral level as there could be various factors that boost simultaneous movement in goods and factors (Fontagne, 1999). Second, again owing to data limitation, we have examined the impact of only inward FDI on trade flows. Future research should endeavor to examine the impact of both inward and outward FDI on industry-trade flows of the Indian manufacturing sector.

Future research could attempt at using more detailed plant-level data from the Indian manufacturing sector and analyze the differences in performance of units engaged in international trade and those that serve only the domestic market by controlling for plant-level characteristics and taking into account the role of foreign ownership. Future research could also extend our framework by studying the existence of any bi-directional causality relation between FDI and trade flows (both exports and imports).

Chapter 6

Conclusion

Since 1980s, the world economy has entered a phase of rapid integration, growth and development or 'globalization' driven largely by fast-expanding and mutually reinforcing trade and investment flows. The continuing globalization of production process has made the subject of the relationship between trade and FDI important. A key question that has often emerged in both the theoretical and empirical literature is whether trade and FDI are complements or substitutes?

Theoretically, there are reasons to believe that FDI may be a substitute for or complement to trade. The explanatory theories of FDI and general equilibrium models of trade that integrate horizontal MNEs suggest a substitution relationship (Hortsman and Markusen, 1992; Brainard, 1993), while the general equilibrium models of trade that integrate vertical MNEs suggest a complementary relationship (Helpman, 1984; Helpman and Krugman, 1985; Markusen, 1984). Knowledge capital models of FDI support both the relationship types. Thus from the theoretical literature, it is clear that it is tough to conclude whether trade and FDI are substitutes or complements. This is essentially an empirical issue. The empirical literature on the relationship between trade and FDI has found broad support for the complementary relationship as compared to the substitution relationship.

A major lacuna in the existing literature is that owing to limited data availability on FDI and activities of MNEs most of the existing empirical work on this topic has been undertaken for developed countries such as the United States, Sweden and Japan. There has been limited research for developing countries, even though this topic is of significant importance to them.

This thesis was an attempt to address this lacuna and examine the relationship between trade and FDI for India. Since trade and FDI are both handmaidens of economic growth and development for India, it was deemed imperative to understand the inter-linkages between them-particularly institutional and economic linkages. We hope that the findings of this study will assist the policymakers in their assessment of how India should respond to the growing importance of FDI and integrate it within the trade-policy framework.

To conclude this thesis, Section 6.1 summarizes the main findings of our work. Section 6.2 discusses the main policy implications emanating from this research. We then discuss the limitations of the thesis along with suggestions for further research on this topic in Section 6.3.

6.1 Summary of Main Findings

A review of the evolution and liberalization of India's trade and foreign investment policies in Chapter 2 brings forth the key issue that in terms of an institutional framework, the domestic policies, rules and regulations underpinning trade and FDI in India have remained distinct and fragmented. Though there do exist certain forms of policy coordination mechanisms, the degree to which the trade and FDI policies are really synchronized and the extent to which they are formulated through inclusive discussions and deliberations seems to be very low in case of India.

In order to investigate the economic relationship between trade and FDI, we conducted a 2 step empirical exercise. First, the relationship between trade and FDI was examined using aggregate data at the country-level for India and its 15 major trading partners for the period 2000 to 2016 (Chapter 4). Second, the relationship between trade and FDI was examined using disaggregated data at the industry-level for 10 selected manufacturing industries that have received a cumulative share of 75 percent of inward FDI in the Indian manufacturing sector over the period 2000-01 to 2014-15 (Chapter 5). The main findings of our empirical analyses reveal that trade and FDI are complements both at the aggregate country-level and disaggregate industry-level for India. Although we do not have separate data on horizontal and vertical FDI in India, it is evident from the theoretical literature that trade and FDI are complements when FDI is vertical in nature (Helpman 1984; Helpman and Krugman, 1985). Our empirical findings of a complementary relationship between trade and FDI, therefore, suggest that FDI received by India at an overall level and particularly in the Indian manufacturing sector is vertical in nature. Our research findings add to the existing empirical body of work which indicates a complementary relationship between trade and FDI (Lipsey and Weiss, 1981 and 1984; Grubert and Mutti, 1991; Clausing, 2000).

As part of the empirical exercise conducted in Chapter 4, we also analyzed if there has been a change in the determinants of trade for India and examined the empirical validity of the Linder hypothesis for India's trade with its 15 major trading partners. Our results support the importance of new trade theory determinants in explaining the pattern of India's trade (Krugman 1981; Helpman, 1985). The traditional patterns of specialization, as per which countries only export products in which they have a comparative advantage in terms of lower opportunity costs of production, are dwindling. Most trade by India is now being conducted with countries having similar factor proportions thus pointing to increasing intra-industry nature of trade (Krugman, 1981). Results of our empirical exercise suggest that India trades more intensively with countries having similar per-capita incomes which reaffirm the Linder hypothesis. Chapter 4 also highlighted the important role of institutions in determining FDI flows and showed that larger is the distance between countries in terms of institutional quality, lower is the volume of bilateral FDI. The finding of a positive effect of FDI on trade in the case of India is conditional on the quality of institutions in the host and home country. Improvement in the institutional quality can play a significant part in attracting FDI flows, which can in turn positively impact trade flows.

As part of the empirical exercise conducted in Chapter 5, we also attempted to understand the important role of industry heterogeneity in determining industry-level trade flows for the Indian manufacturing sector. We find that industries in the Indian manufacturing sector are extremely heterogeneous and the process of internationalization depends on their characteristics. Trade flows in the Indian manufacturing sector are positively determined by size of the industry, labor productivity, capital intensity, skill intensity, economies of scale and FDI. Real wages paid to employees of an industry have a negative impact on its trade flows. This finding provides support to the growing literature on the link between firm's characteristics and their trade performance (Melitz, 2003; Tybout, 2003; Bernard and Jensen, 2004; Wagner, 2007, 2012). Our results of a complementary relationship between trade and FDI in the Indian manufacturing also lends support to the work of Aizenman and Noy (2006) which showed that a developing country whose productivity is rapidly improving would attract large inflows of vertical FDI, which in turn will increase its international trade.

The main contribution of this thesis to the existing literature on the relationship between trade and FDI comes from the empirical methodology used in the aggregate country-level analysis and the comprehensive and harmonized dataset constructed for the disaggregated industry-level empirical analysis. In order to address to the potential issue of endogeneity that may arise while examining the relationship between trade and FDI at the aggregate country-level, we utilized

Fixed-Effect 2-Stage Least Square Instrument Variable (FE-2SLS IV) method of estimation to obtain the empirical results. We instrumented FDI using the institutional distance between host and home country and value of last year's FDI. To the best of our knowledge, this is the first time this technique has been employed to analyze the relationship between trade and FDI for India. For our industry-level empirical analysis, we required data on trade, FDI and different industry-specific characteristics such as output, value-added, employment, emoluments, wages, value added, fixed capital stock, total persons engaged, etc. There was no single database available that provided data on all these variables in one place. Therefore, we drew upon different data sources available to compile the existing databases into a harmonized final data set required for empirical estimation. To the best of our knowledge, this is one of the very few studies which has developed and utilized such a harmonized database for examining the relationship between trade and investment for the Indian manufacturing sector. Owing to the presence of panel heteroskedasticity, first-order serial correlation and contemporaneously correlated error terms in the data, we utilized Prais-Winsten regression with Panel Corrected Standard Errors (PCSE) to estimate our industry-model. Both the country- as well as industry-level of analyses have its own strengths and shortcomings and provide different comprehension and understanding of the relationship between trade and FDI. By combining the two aspects, we believe that we have been able to understand the dynamics of the trade-FDI relationship in a better manner.

6.2 Policy Implications

As India strives to be a global leader in a world where trade and investment flows have become increasingly globalized, integrated and interdependent, the existing architecture of its trade and FDI polices seem inadequate and does not reflect the reality of an increasingly interconnected world economy.

The empirical evidence of a complementary relationship between trade and FDI advocates a critical role of policy harmonization and coordination and warrants a re-thinking in the way India formulates its foreign trade and investment policy and in the way future economic cooperation agreements should be negotiated. The Indian government should take a holistic-based approach while developing its international trade and investment policy. Trade and FDI policies have usually been developed separately, time and again been affected by a different set of objectives and goals, and controlled by separate, often loosely related organizations. This historical and organizational separation is not suitable for an economy where trade and FDI are closely interlinked. There is a need to review and assess the existing institutional mechanisms in place for trade and FDI policy making and revise them to ensure more integrated, coordinated, and inclusive trade and investment policies (Duval, 2008). Policy coherence between trade and FDI policies would ensure that they are “mutually reinforcing in support of national growth and development” (UNCTAD, 1996).

India needs to recognize the significance of investment liberalization and its inseparable connection with trade liberalization. Since trade and FDI have been found to be complementary in the case of India, gains from trade can be enhanced by increasing the country's overall, and in particular manufacturing sectors’, competitiveness. Higher volumes of FDI inflows can boost the effectiveness and efficiency of the factors of production, thereby augmenting the competitiveness of the country. The closer is the link between trade and FDI, the higher is the possibility that India will be able to take advantage of investment and trade liberalization, especially with regard to improving its welfare. Liberalization of trade and investment should be undertaken in a manner that it bolsters, and not refutes, the openness that has until now been a distinguishing feature of India’s trade expansion and its integration into global markets (UNESCAP, 2007).

While pursuing economic integration and cooperation with other countries, it is important to have trade and investment agreements. The current procedure of trade agreements seems to concentrate majorly on trade liberalization, by decreasing tariff and non-tariff barriers to trade and seem to leave investment liberalization for later deliberation. It is important to recognize that there is a close and complementary relation between trade and investment. Integration with any country or region without proper trade and investment agreements can generate insecurity and ambiguity for businesses. In cases where India has separate agreements for trade and investment, uniformity between the liberalization offered under the two should be considered (UNESCAP, 2007). Moving ahead, the Indian government should pursue consolidated and comprehensive agreements involving trade in goods and services, FDI and other areas of potential economic cooperation in order to deepen engagement with its partners that seek to address these coherence and coordination issues within a common legal framework.

To conclude this section, in order to ensure and fortify the benefits gained from globalization, India needs to not only liberalize its trade and FDI policy regimes but also do so in a synchronized and coordinated manner. After all, trade and FDI are merely two sides of the same coin.

6.3 Limitations of the Study and Scope for Future Research

The evidence of a complementary relationship between trade and FDI could possibly be due to the manifestation of "aggregation bias" which arises as a result of using aggregate data (Fontagne, 1999). One can expect to obtain substitution effects the more disaggregated is the nature of the data. For instance, it could be the case that for some firms FDI substitutes exports but indirectly increases exports for other firms. Therefore, it is important to carry out empirical examinations not just at the aggregate country-level and disaggregated industry-level but also at the disaggregated firm-level (Forte, 2004).

It is also important to mention two main caveats regarding our empirical analysis. First, in our country-level empirical analysis we recognize that we may not have controlled for all factors that are correlated with FDI and affect trade and there could still be problems of endogeneity. Future research should delve deeper into this issue and attempt to minimize the endogeneity problem. It would be useful to include other relevant variables that might be appropriate for the model description and further inspect the validity of the proposed instruments.

Second, in our industry-level empirical analysis, owing to data limitations we have only examined the effect of inward FDI into Indian manufacturing sector on industry-trade flows without differentiating the effect that may arise from receiving FDI from different origin countries. Future research should attempt to estimate the relationship at the bilateral level as there could be various factors that boost simultaneous movement in goods and factors (Fontagne, 1999). Second, again owing to data limitation, we have examined the impact of only inward FDI on trade flows. Future research should also attempt to examine the impact of both inward and outward FDI on industry-trade flows of the Indian manufacturing sector which was not possible for us due to data limitations.

Another possible area of future research could be to extend our analysis using more detailed plant/firm-level data from the Indian manufacturing sector and analyze the differences in performance of units engaged in international trade and those that serve only the domestic market by controlling for plant-level characteristics and taking into account the role of foreign ownership. Future research could also extend our framework by studying the existence of any bi-directional causality relation between FDI and trade flows (exports and imports).

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Appendix A

Derivation of ESCAP-World Bank Trade Cost Measure

Using a simple methodology based on the typical gravity equation, Novy (2012) derives an "all-inclusive" trade cost measure based on the observed trading and production patterns (Anderson and Van Wincoop, 2003).

Building on the gravity equation derived in chapter 4 section 3, we can write the following 4 gravity equations representing intra-national and international trade between country i and country j.

$$X_{ij} = \frac{Y_i E_j}{Y}\left(\frac{t_{ij}}{\pi_i P_j}\right)^{1-\sigma} \text{.............................(A.1)}$$

$$X_{ji} = \frac{Y_j E_i}{Y}\left(\frac{t_{ji}}{\pi_j P_i}\right)^{1-\sigma} \text{.............................(A.2)}$$

$$X_{ii} = \frac{Y_i E_i}{Y}\left(\frac{t_{ii}}{\pi_i P_i}\right)^{1-\sigma} \text{.............................(A.3)}$$

$$X_{jj} = \frac{Y_j E_j}{Y}\left(\frac{t_{jj}}{\pi_j P_j}\right)^{1-\sigma} \text{.............................(A.4)}$$

Arvis et al. (2012) describe that "X represents trade between two countries (i to j or j to i) or within countries (goods produced and sold in i and goods produced and sold in j); Y represents total production in a country; E represents total expenditure in a country; and τ represents *iceberg* trade costs".

Using simple algebra, Novy (2012) shows that using simple algebra the multilateral resistance terms can be removed from the gravity equations, based on which an expression for trade costs can be derived.

Multiplying equation (A.1) with equation (A.2), and equation (A.3) with equation (A.4) we get the following:

$$X_{ij}X_{ji} = \frac{Y_i E_j}{Y}\frac{Y_j E_i}{Y}\left(\frac{t_{ij}t_{ji}}{\pi_i P_j \pi_j P_i}\right)^{1-\sigma} \text{...................(A.5)}$$

$$X_{ii}X_{jj} = \frac{Y_iE_i}{Y}\frac{Y_jE_j}{Y}\left(\frac{t_{ii}t_{jj}}{\pi_iP_i\pi_jP_j}\right)^{1-\sigma} \text{……………….(A.6)}$$

Diving equation (A.5) by equation (A.6), we get an expression for trade costs in terms of intra-national and international trade flows:

$$\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}} = \left(\frac{X_{ij}X_{ji}}{X_{ii}X_{jj}}\right)^{1/1-\sigma} \text{…………………………..(A.7)}$$

If we take the geometric average of trade costs in both directions and convert it to an ad valorem equivalent by subtracting unity, we get the following expression:

$$\tau_{ij} = \tau_{ji} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{1/2} - 1 = \left(\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}\right)^{1/2(\sigma-1)} - 1 \text{…………..(A.8)}$$

Arvis et al. (2012) note that the "final measure of trade costs t_{ij} thus represents the geometric average of international trade costs between countries i and j relative to domestic trade costs within each country". Therefore, if everything else is kept constant, the cost of trade is higher when countries tend to trade more with themselves (intranationally) than they do with each other (internationally), i.e. as the ratio $\frac{X_{ii}X_{jj}}{X_{ij}X_{ji}}$ increases. As the two countries trade more internationally than intranationally i.e. as ratio falls we assume that international trade costs must be decreasing relative to domestic trade costs.

For more detailed information on methodology, see Anderson and van Wincoop (2004) and the explanatory note on database coverage in Arvis et al. (2012) and UNESCAP (2017).

Appendix B

Table B.1: Data Sources and Definitions for Variables Used in Chapter 4

Variable Name	Definition	Source
VT	Sum of real exports and imports between India and each partner country j	World Integrated Trade Solution (WITS), World Bank
SUMGDP	Sum of real GDP between India and each partner country j	World Development Indicators, World Bank
SIMGDP	Similarity index of real GDP between India and each partner country j	World Development Indicators, World Bank
DIFFGDPC	Absolute difference in real per-capita GDPs between India and each partner country j	World Development Indicators, World Bank
TC	Trade Costs between India and each partner country j defined as: $$\tau_{ij} = \tau_{ji} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{1/2}$$ where τ_{ij} refers to the geometric average of trade costs between country i and country j t_{ij} refers to the cost of international trade from country i to country j t_{ji} refers to the cost of international trade from country j to country i	ESCAP-World Bank Trade Cost Database
FDI	Sum of real inward and outward FDI between India and each partner country j	Inward FDI flows: Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, Government of India Outward FDI flows: Reserve Bank of India

Table B.2: Descriptive Statistics of Variables Used in Chapter 4

Variable	Obs	Mean	Std. Dev.	Min	Max
VT	255	4.804	0.772	2.848	6.516
SUMGDP	255	24.061	0.705	22.999	25.953
SIMGDP	255	-1.083	.330	-2.127	-0.693
DIFFGDPC	255	3.028	0.999	4.333	0.563
TC	224	4.668	0.271	3.889	5.100
FDI	249	0.195	2.742	-8.485	5.096

Source: Own calculation using Stata 14
Note: All variables expressed in natural logarithm

Table B.3: Correlation Matrix of Variables Used in Chapter 4

	VT	SUMGDP	SIMGDP	DIFFGDPC	TC	FDI
VT	1					
SUMGDP	0.6182*	1				
SIMGDP	-0.3858*	-0.2637*	1			
DIFFGDPC	0.0005	0.0450	-0.1617*	1		
TC	-0.4639*	-0.0187	0.0111	-0.2356*	1	
FDI	0.5546*	0.4350*	-0.3470*	-0.4012*	-0.2589*	1

Source: Own calculation using Stata 14
Note: All variables expressed in natural logarithm. * represents that the correlation coefficients are significant at 5 percent level

Appendix C

Definition of Governance Indicators

The World Bank releases data on Worldwide Governance Indicators (WGI) which reports "aggregate and individual governance indicators for over 200 countries and territories over the period 1996–2017", for six dimensions of governance namely Voice and Accountability, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption.

The World Bank (2018c) defines these six dimensions of governance in the following manner:

Voice and Accountability

Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Political Stability and Absence of Violence

Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.

Government Effectiveness

Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Regulatory Quality

Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

Rule of Law

Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

Control of Corruption

Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests.

These aggregate governance indicators represent the combined views of a large number of enterprises, citizens and expert survey respondents covered in both developed and developing countries. The indicators are based on more than 30 individual data sources produced by a variety of international and non-governmental organizations, survey institutes, think tanks and private sector firms.

For more details on methodology, see Kaufmann et al. (2010).

Appendix D

Concordance between DIPP FDI Sectors and Industry NIC Codes

S. No.	DIPP FDI Sectors	DIPP FDI Codes	NIC-2008	ISIC Rev 3/NIC-2004/NIC-1998
1	Automobile Industry	701	291, 292, 293	341, 342, 343
2	Chemicals and Drugs and Pharmaceuticals	1900, 2200	201, 202, 210	241, 242, 233
3	Metallurgical Industries	0100	241, 242, 243	271, 272, 273
4	Food Processing and Fermentation	2600, 2700	101, 102, 103, 104, 105, 106, 107, 108, 110	151, 152, 153, 154, 155
5	Electrical Equipments	0501	271, 272, 273, 274, 275, 279	293,311,312, 313, 314, 315, 319
6	Cement and Gypsum	3500	239	269
7	Industrial Machinery	800	282	292
8	Textiles	2300	131	171
9	Electronics	0503	261, 262, 263, 264, 265, 266, 267, 268	300, 321,322,323, 332,333
10	Medical and Surgical Appliances	1400	325	331

Source: Authors own compilation based on NCAER (2009), MOSPI (2004) and MOSPI (2008)

Appendix E

Table E.1: Data Sources and Definitions for Variables Used in Chapter 5

Variable Name	Definition	Source
T	Real value of trade flows (total trade, exports or imports) of the industry. Real value of exports calculated by deflating nominal exports value by Unit Value Index for Exports. Real value of imports calculated by deflating nominal imports value by Unit Value Index for Imports	Trade flows-World Integrated Trade Solution (WITS), World Bank Unit Value Index for Exports and Imports-RBI Handbook of Statistics on Indian Economy, 2017-18
SIZE	Total employment by the industry	Annual Survey of Industries
WAGE	Ratio of real value of emoluments to the number of total employees Real value of emoluments calculated by deflating nominal value of emoluments by Consumer Price Index for Industrial Workers	Nominal value of emoluments and number of employees- Annual Survey of Industries, Ministry of Statistics and Programme Implementation, Government of India Consumer Price Index for Industrial Workers-Ministry of Labor and Employment, Government of India
LPROD	Real Gross Value Added per worker Real Gross Value Added calculated by deflating nominal gross value added by Wholesale Price Index for manufactured products	Nominal Gross Value Added- Annual Survey of Industries Wholesale Price Index for Manufactured Products-Office of Economic Advisor, Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India
CAPINT	Ratio of real fixed capital stock to total persons engaged	Nominal fixed capital stock- Annual Survey of Industries

	Real fixed capital stock is calculated by deflating nominal fixed capital stock using Wholesale Price Index for machinery and equipment	Wholesale Price Index for Machinery And Equipment-Office of Economic Advisor, Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India
SKILLINT	Ratio of real value of emoluments to all employees to real value of wages	Nominal Value of Emoluments and Wages- Annual Survey of Industries, Ministry of Statistics and Programme Implementation, Government of India
	Real value of emoluments and wages calculated by deflating nominal value of emoluments and wages by Consumer Price Index for Industrial Workers	Consumer Price Index for Industrial Workers-Ministry of Labor and Employment, Government of India
EOS	Ratio of real value of output of an industrial sector to real value of total output of manufacturing sector.	Nominal Value of Output- Annual Survey of Industries
	Real value of output calculated by deflating nominal value of output by Wholesale Price Index for manufactured products	Wholesale Price Index for manufactured products-Office of Economic Advisor, Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India
FDI	Real value of FDI inflows received by an industry	Inward FDI Flows-Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, Government of India
	Real value of FDI inflows calculated by deflating the nominal values of industry-wise FDI using Gross Fixed Capital Formation deflator	Gross Fixed Capital Formation deflator-National Account Statistics, Central Statistics Office, Ministry of Statistics and Programme Implementation, Government of India

Table E.2: Descriptive Statistics of Variables Used in Chapter 5

Variable	Obs	Mean	Std. Dev.	Min	Max
TOTALTRADE	150	14.908	0.969	12.743	16.864
EXPORTS	150	13.985	1.022	11.685	16.096
IMPORTS	150	14.162	1.233	11.113	16.584
SIZE	140	0.017	0.227	-1.917	0.676
WAGE	140	0.007	0.143	-1.100	0.417
LROD	147	1.785	0.562	0.506	2.941
CAPINT	149	1.971	0.665	-0.395	3.859
SKILLINT	130	0.004	0.129	-0.485	0.559
EOS	150	1.382	1.229	-2.377	3.215
FDI	136	11.522	1.776	4.290	15.593

Source: Own calculation using Stata 14
Note: All variables expressed in natural logarithm.

Table E.3: Correlation Matrix of Variables Used in Chapter 5

	TOTALTRADE	EXPORTS	IMPORTS	SIZE	WAGE	LROD	CAPINT	SKILLINT	EOS	FDI
TOTALTRADE	1.0000									
EXPORTS	0.8356*	1.0000								
IMPORTS	0.8970*	0.5356*	1.0000							
SIZE	0.0450	0.0880	0.0101	1.0000						
WAGE	0.0173	0.0382	-0.0018	0.3606*	1.0000					
LROD	0.4662*	0.1397	0.6807*	0.0892	0.0647	1.0000				
CAPINT	0.5331*	0.4826*	0.4677*	0.0058	-0.0224	0.6242*	1.0000			
SKILLINT	0.0199	0.0027	0.0182	-0.0938	0.6276*	-0.0034	0.0581	1.0000		
EOS	0.5438*	0.7136*	0.3134*	0.0290	0.0093	0.0324	0.3672*	0.0769	1.0000	
FDI	0.3147*	0.4066*	0.2343*	-0.1585	-0.1054	0.2230*	0.2433*	-0.0482	0.4066*	1.0000

Source: Own calculations using Stata 14

Note: All variables expressed in natural logarithm. * represents that the correlation coefficients are significant at 5 percent level