

BITs and Trade Patterns: New Perspectives on Vertical Integration

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Abstract

The recent decades have witnessed a remarkable growth in the number of Bilateral Investment Treaties (BITs) that are signed and ratified across the world. Several studies have explored the impact that BITs carry on Foreign Direct Investment (FDI) in an effort to explain the popularity of BITs. This thesis, in contrast, attempts to elucidate their average impact on trade patterns. In particular, the aim of the paper is to clarify whether the effects of BITs on trade patterns is consistent with the current literature on vertical integration under the assumption that BITs indeed promote multinational enterprise (MNE) activity. The effects of BIT policy on trade is analyzed within the framework of a stylized model of vertical integration, and it is then demonstrated that panel data on bilateral exports for 224 countries during the period 1995-2012 is consistent with several implications of this model as well as with implications of previous research on MNEs and international trade. In particular and according to the main specifications, it is estimated that i) BITs exert a positive impact on total bilateral exports, ii) the impact from BITs on exports in intermediate goods depends positively on the relationship-specificity of the broad economic category (BEC); iii) the impact from BITs on exports in intermediate goods depends positively on increases in the skilled labour endowment of the exporter. These results are robust under most of a variety of specifications employed in the paper. Moreover, the thesis finds some support for the notion that the impact from BITs depends positively on the per capita capital stock of the exporter, but this result is not robust for most specifications. Taken as a whole, the findings support the view that BITs facilitate MNE activity related to vertical integration. Other interpretations are discussed and suggestions for future research are offered.

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LIST OF ABBREVIATIONS

BEC: *Broad Economic Categories*

BIT: *Bilateral Investment Treaty*

ECT: *Energy Charter Treaty*

EFTA: *European Free Trade Association*

EU: *European Union*

FDI: *Foreign Direct Investment*

FE: *Fixed Effects*

IV: *Instrumental Variable*

MNE: *Multinational Enterprise*

NAFTA: *North American Free Trade Agreement*

PTA: *Preferential Trade Agreement*

TEU: *Treaty of the European Union*

SITC: *Standard International Trade Classification*

WIOT: *World Input Output Tables*

1 Introduction

Is the impact on trade patterns from the signing and ratification of a BIT between two state parties consistent with contemporary models of vertical integration? This is the central question of the present thesis. It is motivated by a gap in previous research regarding the average impact from bilateral investment treaties (BITs) on trade between the states that are parties to the treaty.

A BIT is an international agreement concluded between two states with the purpose of facilitating investments between the countries. The shared characteristic of all BITs is that they protect investments made by private investors from one contracting state (the source state) in the other contracting state (the host state). Specifically, this is achieved by stipulating substantive standards of protection (e.g. fair and equitable treatment and guarantees in case of expropriation). Moreover, most BITs provide consent to dispute settlement by means of international arbitration between foreign investors and the host state. Provisions of the latter kind allow foreign investors to eschew domestic courts and associated costly and lengthy arbitration (Dolzer & Schreuer, 2012, p.13).

The prevalence of BITs has increased rapidly since the end of the Cold War, and more than two thirds of the 2 100 BITs that were in force as of 2014 have been signed after 1995 (UNCTAD, 2015). As can be inferred from the name, BITs are concluded between separate state entities. Legal scholars have described BITs as the most important source of contemporary investment law. Considering the number of BITs that have been negotiated and the related expenditures incurred in the negotiating processes, it is a question of substantive importance whether BITs are on average *effective*. This is even more so when accounting for the surrender of host state sovereignty that follows from ratifying a BIT. Previous empirical research has explored the effect of BITs on foreign direct investment (FDI) and other measures of multinational enterprise (MNE) activity, either at the aggregate level (e.g. Neumayer & Spess, 2005) or on the microlevel (e.g. Egger & Merlo, 2012). The majority of recent studies find a robust positive correlation between BITs and FDI, although a number of papers have also failed to establish a significant relationship (UNCTAD, 2014; see section 2.1.2).

The *purpose* of this paper is to explore whether the impact of BITs on trade patterns is consistent with the current state of knowledge regarding trade and multinational enterprises. While the focus of previous empirical research on the effects of BITs on FDI has been consistent with the fact that most BITs explicitly state the promotion of FDI as a goal, the impact of BITs on trade has been largely ignored (cf. section 2.1.2). This paper addresses the knowledge gap and explores the effects of BITs on *trade patterns*. The subject has, with singular exceptions, eluded academic research. By investigating the impact on trade patterns, the paper improves the understanding of the rationale of the widespread use of BITs. This is a matter of substantive importance considering, in particular, the mentioned curtailment in host state sovereignty that the BIT regime imposes.¹ Moreover, the very result that BIT policy has an impact on trade patterns through MNE activity would point to novel avenues for future research on MNEs and trade. In particular, trade economists could use data on the prevalence of BITs to test different aspects of contemporary trade theory. In summary, this paper contributes to the literature on the impact of BITs and its research focus is relevant both for future

¹ It should also be seen in the light of recent actions by e.g. the states of Ecuador, Venezuela and South Africa to terminate BITs to which they were previously committed.

research on BITs and future research on MNEs and trade.

Why would we expect BITs to influence trade patterns? If it is assumed that BITs facilitate FDI, as both intuition and the main body of previous economic research seem to indicate, the current international trade literature points to important implications for bilateral trade from BITs. This contention is closely related to the literature on the boundaries of the firm. As emphasized by Coase (1937), firm boundaries are difficult to explain in a world without transaction costs. Williamson (1975; 1985) elaborated Coase's argument that the firm will internalize transactions whenever the transaction cost of relying on the market exceeds the costs of internalization. He further demonstrated the so-called *hold-up problem* which arises whenever either party undertakes a relationship-specific investment before the transaction and contracts are incomplete. *Relationship-specificity* captures the notion that the parties cannot costlessly switch to alternatives after the conclusion of the contract (i.e. the investment undertaken ex ante has a higher value inside the relationship). Whenever the contract remains incomplete or not fully enforceable and the transaction requires nontrivial relationship-specific investments, costs of renegotiation are likely to arise. Conventional models predict that this will result in inefficiencies such as *underinvestment* in relationship-specific assets. According to a particular branch of the literature, the so-called property-rights approach, efficiency requires that ownership is assigned to the party that undertakes the most significant relationship-specific investment (e.g. Grossman & Hart, 1986, Hart & Moore, 1990 and Hart, 1995).

The contemporary literature on international trade has integrated the theory concerning relationship-specific investments and hold-up inefficiencies in order to explain intra-firm trade. The hold-up problem has predominantly been viewed as a rationale for *vertical integration*, which is defined as the decision of an MNE to produce some parts of the final good in an owned facility abroad rather than to operate the entire production chain in the home country. Vertical integration must be viewed separately from *vertical fragmentation*, which is the fragmentation of the production chain across countries without internalization of the different stages within the boundaries of an MNE.

One important implication from this literature on MNEs is that the acquisition of ownership and control of foreign suppliers should alleviate problems of underinvestment in the presence of relationship-specificity and incomplete contract enforcement. Under the assumption that BITs indeed facilitate FDI between the parties, one may hypothesize a link between BITs and a lower cost of vertical integration. This could in turn induce increased exports of relationship-specific goods as a consequence of alleviated problems of underinvestment. There is also previous empirical research which supports a link between facilitated vertical integration and increased trade in relationship-specific goods (see Nunn, 2007). That this effect should be observed for the average BIT is the more likely when considering that BITs should predominantly be operational between country pairs where factor endowment differences are large and hence the drivers of vertical integration strong. This is the crucial logic which informs the thesis.

As indicated above, the *research question* of this paper can be stated as follows:

Is the impact on trade patterns from the signing and ratification of a BIT between two state parties consistent with contemporary models of vertical integration?

In particular, the signing and ratification of a BIT is assumed to entail a decrease in the

fixed cost of *business integration* between the contracting states (i.e. the cost for an MNE to establish or purchase a facility abroad). Based on the international trade literature, the lower fixed cost of integration is analyzed within a stylized model in which vertical integration becomes more profitable with a higher degree of relationship-specificity of the (typically intermediate) good imported from the host state. Thus, BITS are hypothesized to facilitate vertical integration. In section 3.3 three hypotheses are presented. The common denominator is that a bilateral trade outcome that is positively related to vertical integration is hypothesized to also depend positively on the existence of a BIT between the countries.

In summary, the thesis draws on the legal literature regarding BITS, previous empirical research on the impact from BITS on FDI and the literature on international trade integration and MNEs in order to establish the three enumerated hypotheses. The central method in the paper is to employ several regression specifications in order to test the hypotheses and explore the robustness of the results. Panel data sets comprising 224 countries and the period 1995-2012 are used and the hypothesized complementarity between BITS and relationship-specificity is captured through interaction terms. The *findings* are that the existence of a BIT between two states can be characterized by the three following statistical properties in the sample. It is positively correlated with total bilateral exports between the state parties to the treaty. Further, it exerts a disproportionately large, positive impact on bilateral exports of intermediate goods which are relatively relationship-specific compared to the average that pertains to intermediate goods. Finally, its impact on bilateral exports in intermediate goods depends positively on the skilled labour endowment and also the capital stock of the exporter. The latter results, however, is not robust for most of the specifications (see section 4.)

The central *conclusion* from this paper is that there is considerable evidence for a connection between BITS and vertical integration as the estimated impact from BITS is consistent with the anticipated impact from a lower cost of vertical integration. In particular, there is substantial evidence that the impact from BITS on trade patterns in intermediate correlates positively with relationship-specificity. The results hence offer indirect evidence for a positive impact from BITS on FDI *driven by vertical motivations*.

The remainder of the paper proceeds as follows. Section 2 accounts for the current state of knowledge and presents the research focus and research question. Section 3 contains the model used to capture the connection between relationship-specific products and vertical integration, presents the hypotheses of this paper and also outlines the research methods and data used to test these hypotheses. The empirical results are presented in section 4, while section 5 provides an analysis and interprets the results. Section 6 concludes and section 7 contains a list of references.

2 Current state of knowledge, research focus and research question

2.1 Current state of knowledge

The hypotheses of this paper are related to two main strands in the economic literature, namely previous research concerning BITs and the international trade literature on MNEs. It also builds on legal research regarding the content of BITs and their significance for current investment law. The purpose of the literature review is to answer the following questions.

How prevalent are BITs and what is their typical legal content? (section 2.1.1)

What is the estimated impact from BITs on FDI and bilateral trade according to the economic literature? (section 2.1.2)

What is the relation between MNE integration and trade? (section 2.1.3)

For reasons that will become apparent, the emphasis in the last section is placed on the connection between transaction costs arising from hold-up problems and vertical integration within MNEs. However, alternative drivers of integration are also be considered. Section 2.1.4 provides a summary.

2.1.1 How prevalent are BITs and what is their typical legal content?

International investment law is fundamentally based on the notion that alien property within a host state is entitled to a minimum level of protection regardless of national law. In the absence of a specific agreement to the contrary, the only protection of this nature is that provided by customary international law (Dolzer & Scheuer, 2012, p. 6). BITs have become the most important legal instruments for enhancing the security of foreign investors beyond this minimum level. The predominant provisions in BITs concern the standard of treatment from the host state that the foreign investor is due and consent by the host state to international arbitration for dispute settlement purposes.

The first BIT was signed between Germany and Pakistan in 1959 and entered into force in 1962. Several European nations subsequently concluded BITs. From 1982 onwards the practice was adopted by the United States and China and later by India and other major Asian economies. The rapid growth of the number of BITs occurred from the mid 1990s. The number of BITs signed between 1995 and 2000 numbered approximately 900, while the equivalent figure for subsequent five years was about 600 (Adlung & Molinuevo, 2008). As of February 2015, the number of BITs that have been signed is 2 923 while 2 220 have been ratified and are currently in force.² These figures dwarf the sum of other international investment agreements that have been signed or are in force, which number no more than 345 and 274 respectively (UNCTAD, 2015). In recent years, a number of BITs have been terminated by consent of the state parties or have been unilaterally abrogated. Examples of BITs that have been terminated by

² China, France, Germany and the United Kingdom have each concluded more than 100 BITs.

consent include some intra-EU BITs; the Czech Republic terminated BITs with seven other EU states following the Treaty of Lisbon (UNCTAD, 2009). Ecuador and South Africa are the most prominent examples of states that in recent years unilaterally have denounced BITs. The number of BITs terminated remains small in 2015, however, and so the vast majority of treaties remain fully relevant.³ Contracting states are obliged not to counteract the purpose of a signed treaty, but it is only when the BIT is in force that dispute settlement may be invoked (see further below; UNCTAD, 2005).

In short, BITs have become the most significant mode of regulation within contemporary international investment law, especially considering the absence of a comprehensive multilateral governance of international investments (Dolzer & Scheuer, 2012, p. 10 ff.). Recently, the growth rate of the number of BITs has declined. This can be attributed to either a saturation effect or a substitution effect as preferential trade agreements (PTAs) have become an alternative mechanism for regulating bilateral investments as well as trade (Adlung & Molinuevo, 2008). Some multilateral trading agreements, such as the NAFTA (North American Free Trade Agreement) or the ECT (Energy Charter Treaty), also address investment issues (Dolzer & Scheuer, 2012, p. 15). As of 2014, the majority of BITs apply between a developed country on the one hand and a developing country or a country in transition on the other hand (UNCTAD, 2015). There is, however, an increasing trend of BITs concluded between pairs of developed countries as well as between pairs of developing countries (Adlung & Molinuevo, 2008). Within the framework of the European Union (EU) and the European Free Trade Association (EFTA), investment issues are governed by the principles of free movement of persons, capital, goods and services. Following the enlargement of the EU in 2004, a number of BITs between the new member countries and longer-standing EU members were terminated in order to avoid regulatory overlap of intra-EU investment (UNCTAD, 2009; cf. above). Nevertheless, several intra-EU BITs remain in force as of February 2015. Generally, it can be said that the principles of free movement outlined in the Treaty of the European Union (TEU) and applied within EU and EFTA are much more far-reaching than the requirements typically found in BITs (Adlung & Molinuevo, 2008; Eilmansberger, 2009).

In order to benefit from the substantive standards and the consent to international arbitration, the investor must show himself as being of the nationality of a state party to the treaty. It should also be emphasized that BITs primarily encompass activities of private investors but that governmental entities may also be covered provided that their investments are conducted in a commercial capacity (Dolzer & Scheuer, 2012, p. 44 ff.).

Recurrent substantive standards in favour of the investor include: admission of investments, fair and equitable treatment, full protection and security, guarantee against arbitrary and discriminatory treatment, as well as guarantees concerning national treatment, most-favoured-nation treatment (MFN), expropriation and free transfer of payment (Dolzer & Scheuer, 2012, p. 13). The key word is 'guarantee': the host state commits to certain minimum level of treatment of foreign investments by private investors from the other state party. Regarding *provisions of admission*, important differences prevail across BITs. The United States, Canada and Japan have generally concluded treaties designed to guarantee the market access of private investors in the host state. In contrast, BITs concluded by European and most developing countries tend

³ A number of 47 seven BITs had been terminated without being replaced by new BITs as of April 2015 (UNCTAD, 2015).

to be limited to non-binding commitments to promote investments by investors of the contracting parties (Adlung & Molinuevo, 2008; Dolzer & Scheuer, 2012, p. 89). BITs that stipulate a binding right to admission virtually always contain sector exclusion from the scope of the BIT, e.g. telecommunication services in most BITs concluded by the United States (Adlung & Molinuevo, 2008).

Fair and equitable treatment requires the host state to observe legal consistency, stability, transparency and predictability in order to safe-guard the legitimate expectations of investors from the other contracting state. Specific examples of violations of this standard from case law include state decisions with impact on foreign investments made outside of the legal framework and denial of the investors right to be heard in domestic administrative proceedings (Dolzer & Scheuer, 2012, p. 145 ff.). *Full protection and security* refers to the obligation of the host state to exercise due diligence in protecting foreign investments from physical violence and harassment as well as to guarantee access to the judicial system. The standard does possibly also include the obligation to ensure commercial and legal stability (Dolzer & Scheuer, 2012, p. 160 ff.). A *guarantee against arbitrary and discriminatory measures* covers actions on the part of the host state which are based on discretion and personal preference or show deliberate disregard of due process and measures that have a discriminatory effect (Dolzer & Scheuer, 2012, p. 191 ff.). *National treatment* is the requirement that foreign investors are treated no less favourably than their domestic counterparts in a comparable situation (Dolzer & Scheuer, 2012, p. 198 ff.). *MFN clauses* are relative standards that require the parties to treat each other's nationals at least as favourably as they treat nationals of any third party in a comparable situation (Dolzer & Scheuer, 2012, p. 206). In this context, the relation between BITs and PTAs should be observed. BITs frequently, but not always, exclude obligations to a third party in a PTA as a basis for invoking MFN. Guarantees against expropriation typically addresses the right to compensation in the case of an illegal direct or indirect expropriation (Adlung & Molinuevo, 2008). *Transfer of funds* refers to the right of the investor to transfer funds related to the investments. This right is generally subject to a variety of restrictions, e.g. limited to broad categories such as profits or dividends (Dolzer & Scheuer, 2012, p. 212 ff.). There is no absolute uniformity of BITs in respect to these standards, but insofar as such standards are upheld they can be expected to facilitate foreign private investment and lower their political risk (and thus the expected cost).

Importantly, BITs usually offer consent to international arbitration in disputes between a host state and investors from the other contracting state. This was not the case for the very first generation of BITs (the first BIT to offer such arbitration was the treaty of 1969 between Italy and Chad). However, in recent decades the practice has been adopted in the great majority of BITs (Dolzer & Scheuer, 2012, p. 7 & p. 258). Although unequivocal consent to international arbitration is dominant practice, it should be observed that some BITs offer only conditional consent or limit consent to disputes concerning certain sectors (Adlung & Molinuevo, 2008; Dolzer & Scheuer, 2012, p. 258 ff.). International arbitration usually takes place within the framework of ICSID (International Center of Dispute Settlement), an institution dedicated to solving international investment disputes, or in front of another international tribunal (e.g. the London Court of International Arbitration). If dispute settlement remains unregulated, investment disputes are normally addressed by domestic courts. From the investor's point of view, several disadvantages relating to such proceedings have been identified. Firstly, the impartiality of domestic courts may be doubted. Secondly, domestic law

may be applied which is unfamiliar and disadvantageous from the point of view of the investor. Thirdly, domestic court proceedings may be lengthy and costly (Dolzer & Scheuer, 2012, p. 235 ff.). For these reasons, a binding commitment to international arbitration may lower the expected fixed cost of the investment and strengthen the credibility of substantive standards of protection.

For the purpose of this paper, a number of *broad conclusions* may be drawn from the above summary of the legal literature. Firstly, it is plausible that the existence of a BIT promotes investment by lowering the associated non-commercial risk and by facilitating market access for a foreign investor. Secondly, BITs are heterogeneous and differ concerning e.g. scope of coverage, substantive standards and consent to international arbitration. Ideally, controls for this heterogeneity should be applied in an empirical analysis of the impacts of BITs. Thirdly, while BITs remain the most important source of international investment law, other policy instruments may also impact foreign investment. These include PTAs and other international investment agreements. In order to empirically estimate the independent effect of BITs, such additional policy instruments should be controlled for. This reasoning is supported by e.g. Medvedev (2012) and Bütte & Milner (2014). Dual membership of the EU or the EFTA should also be controlled for considering the principles of free movement for *inter alia* capital that apply within these entities.

2.1.2 What is the estimated impact from BITs on FDI and bilateral trade according to the economic literature?

a) The impact from BITs on FDI

Previous economic research has predominantly concerned the validity of the claim that BITs contribute to increased FDI. Frequently, economic theory has been used to justify the hypothesis that BITs indeed have a positive impact on FDI. The typical line of argument is that the investment usually involves a long-term commitment of resources (Dolzer & Scheuer, 2012, p. 22 ff.). As soon as the investor has incurred substantial sunk costs, the host state may renege on previous promises of e.g. fair and equitable treatment and take measures detrimental to the foreign investor. Economic theory predicts that underinvestment will occur in anticipation of this (Williamson, 1975). In a BIT, states can agree to be bound by protective standards and submit to international arbitration concerning policies which affect foreign investors of the other state party. Thus, the hold-up problem may be alleviated and the political risk of the investment lowered.

It is useful to remember the consensus definition of FDI, which encompasses investments aimed to establish a long-term and substantial interest in an enterprise active in a foreign economy. Equity capital, reinvestment of earnings and both long-term and short-term capital are included in this definition, as long as the *purpose* is to acquire a controlling interest in the company. Ownership of 10 percent or more of the voting shares is the accepted indicator used as evidence of this kind of relationship (cf. the OECD benchmark definition; OECD, 2008).

The purpose of this paper differs from this body of research as the aim is to theoretically motivate and investigate effects of BIT policy on trade patterns. Nevertheless, as will be elaborated in section 3, this paper assumes that BITs indeed facilitate MNE activity.

The most important justification for this assumption is previous findings that BITs carry a positive impact on FDI. It is hence appropriate to present the general conclusions of empirical research on BITs and FDI.

A recent survey of such empirical studies found that a *majority* of the studies found a positive correlation between signing or ratifying BITs on the one hand and FDI flows on the other. This correlation has been considered to reflect a causal relationship in most recent studies (UNCTAD, 2014). This survey highlighted some generally recognized difficulties inherent to such studies. Insofar as this paper is concerned, two of the caveats are particularly relevant. Firstly, data availability is low on the content differences across BITs. Consequently, the signing and ratification of treaties are often represented by binary variables regardless of the arguably nontrivial differences in the scope and strength of provisions across BITs (cf. section 2.2.1 above). Secondly, there is a potential problem of reverse causality between increasing FDI inflows into the host country and the signing or ratification of BITs. For example, foreign investors already active in a host state (or who wish to invest there) may lobby their government to sign a BIT with that particular state. This implies that BITs may be signed with states *as a consequence of* the increase in FDI from the opposing party rather than that the increase in FDI follows from the conclusion of the BIT. Alternatively, BITs may tend to be disproportionately signed with countries that appear attractive for investment purposes.

The studies which concluded the existence of a causal, positive impact on FDI include Egger & Pfaffermayr (2004), Neumayer & Spess (2005), Salacuse & Sullivan (2005), Egger & Merlo (2007), Haftel (2010), Egger & Merlo (2012) and Berger et al. (2013). Additionally, Trevino (2005), Siegmann (2008), Guerin (2010) and Tortian (2012) can be mentioned.

The vast majority of these studies have worked with country-level data (Egger & Merlo, 2012, who used industry-level data for outward German FDI is an exception). Substantial differences exist regarding the choice of research methods. Some authors, e.g. Egger & Pfaffermayr (2004) and Egger & Merlo (2007), have used bilateral panel data sets where each observation corresponds to a country pair and the dependent variable is the bilateral FDI flow between the countries in the pair whereas the BIT is captured by a binary variable (a so-called dyadic approach). Neumayer & Spess (2005) criticized this specification strategy *inter alia* on the grounds that it aggravates the capture of spill-over effects from the cumulative number of BITs signed by the host country. An alternative specification strategy has been to rely on data sets wherein each observation corresponds to the total FDI inflows into a country in a given year.

Examples of the predicted impact on FDI that have been reported are a 30 percent increase in bilateral FDI (Egger & Pfaffermayr, 2004), an increase of 77-85 percent in aggregate FDI inflows from signing a BIT with the United States (Salacuse & Sullivan, 2005), a long-run increase from ratifying a BIT on bilateral FDI of 8.69-10.13 percent (Egger & Merlo, 2007) and an increase in the share of FDI from all source countries of 37 percent (Berger et al, 2013).

Several interesting effects have been observed in the above studies beyond the robust and positive correlation between BITs and FDI. For example, several studies have found a positive impact from the ratification of a BIT but not from the mere signing of a treaty (e.g. Egger & Pfaffermayr, 2004, and Haftel, 2010). It has also been estimated that a BIT signed with the United States has a larger impact on total FDI inflows into

a developing country than that of the average BIT (e.g. Salacuse & Sullivan, 2005). Berger et al. (2013) is among the few studies to attempt to differentiate BITs by their content. The authors found a statistically significant, substantial and robust effect of the extent of national treatment prescribed in the BIT. The effect of provisions concerning international dispute settlement was much weaker.⁴ There is some evidence for a negative interaction effect between improved institutional quality and the BIT-variable, i.e. that BITs are substitutes for good institutional quality (e.g. Neumayer & Spess, 2005, and Tobin & Rose-Ackerman, 2005).

In contrast to the above, a number of studies have largely or completely failed to establish a robust and positive correlation between BITs and FDI. They include Hallward-Driemeir (2003), Tobin & Rose-Ackerman (2005) and Yackee (2007). Hallward-Driemeir (2003) also found that BITs appeared to be complements to rather than substitutes for good governance (i.e. BITs were more effective in relation to host countries with comparatively good governance than for host countries with comparatively bad governance).

Taken as whole, previous research points to a statistically significant and positive impact on FDI flows arising from in particular the ratification of BITs. It must however be stressed that no consensus prevails regarding the magnitude or even existence of this effect. Partially, the ambiguous findings may represent non-homogeneous effects for different groups of countries during different time periods. For example, Egger & Merlo (2007) specifically analyzed FDI flows between OECD countries and economies in transition in Eastern and Central Europe during the period 1980-2001. The lack of consistent methodology is certainly another important part of the explanation. Importantly, a large number of studies used data on bilateral FDI flows (e.g. Hallward-Driemeir, 2003) while another group of studies utilized panel data for aggregate FDI inflows in a panel of developing countries (e.g. Neumayer & Spess, 2005). The studies have also varied according to how the FDI variable is measured, which time-varying control variables that are included and in their use of generalized method of moments (GMM) analysis.⁵

Another caveat is that while FDI inflows is an important and widely available measure of MNE activity, it is limited in two ways. Firstly, important MNE activity may fail to be captured by the standard definition of FDI. For example, a foreign investor may acquire less than 10 percent of the voting shares in a company and yet in practice obtain a significant influence over the company's management. Secondly, research that relies on aggregate FDI flows cannot easily distinguish the impact from BITs on horizontal versus vertical integration (see section 2.1.3 below).

This paper will make the *assumption* that BITs facilitate MNE activity though FDI and other channels. Such an assumption is defensible but not incontestable against the background of previous research. The subsequent research strategy is to formulate alternative hypotheses regarding the consequences of BITs given this assumption, in part to eschew the two limitations described immediately above.

⁴Cf. section 2.1.1.

⁵ Egger & Merlo (2007) and Berger et al. (2013) are among the studies which implemented different GMM estimators.

b) Swenson (2008): the impact of BITs on bilateral trade

A common denominator of the research cited above is the focus on the effects of BITs on FDI flows. Swenson (2008) adopted the alternative approach of investigating the effects of signing and ratifying BITs on bilateral trade flows, using data on imports for the 1975-2000 period. Her results indicated that signing a BIT had a significant and positive impact on total imports. By comparison, the estimated overall impact was smaller than the effect associated with WTO membership. However, the effect was stronger in the case of capital and differential goods imports. The effects of signing a BIT was substantially larger for low income importers. Her results were approximately robust for different specifications, including fixed and random effects. The fact that the effects were strongest for trade in capital and differentiated goods lead the author to conclude that BITs facilitate MNE activity.

The present paper concerns the same broad topic as Swenson's (2008) contribution, namely the impact from BITs on bilateral trade. However, this paper seeks to improve on Swenson's research approach in two senses. Firstly, a more robust econometric treatment is employed, including a larger set of co-variates that affect MNE location and more advanced specifications to account for particular endogeneity problems, in particular so-called sluggish adjustment in the dependent variable. Secondly, and perhaps more importantly, the paper attempts to establish a clear link between economic theory on MNEs and expected effects on bilateral trade patterns from signing and ratifying BITs. In contrast, Swenson (2008) motivated her focus on trade in capital and differentiated goods with a simple reference to the important role played by MNEs in intermediating trade in these categories.

In order to derive hypotheses concerning the impact from BITs on bilateral trade patterns, a brief review of the current state of knowledge on international trade and MNEs is appropriate. For reasons that will become apparent, the part of the literature of greatest significance for this paper concerns the role of MNEs in internalizing transaction costs related to the so-called hold-up problem.

2.1.3 What is the relation between MNE integration and trade?

a) Background

An MNE is commonly defined as a firm that operates production facilities in two or more countries (e.g. Antràs & Yeaple, 2014, p. 56). The controlling entity, located in the source country, is called the *parent*, while the controlled entity in the host country is designated as the *affiliate*. The definition is closely related to the benchmark definition of FDI, as control normally is exercised through ownership (cf. section 2.1.2). The literature has investigated two related questions concerning the existence of MNEs. Firstly, the question of *location*: why is production fragmented across countries? Secondly, the question of *internalization*: why are facilities in different countries controlled by a common entity? A comprehensive model must answer both questions. Below, theory and evidence regarding the drivers of fragmentation will firstly be presented. Thereafter, drivers of internalization will be taken into account.

b) The question of location: horizontal replication

Two branches of economic theory have developed concerning the question of location. The first relates to the existence of transportation costs and economies of scale. Economies of scale prescribe that the production should be concentrated in one country. However, if transportation costs are sufficiently high, it becomes efficient to serve foreign markets through local production in order to eschew these transportation costs. This is called the proximity-concentration trade-off and involves a choice between lower fixed cost in the case of concentration and lower variable cost in the case of fragmentation. MNEs which adopt this approach are called “horizontal” as they *replicate* the production of the same goods in different countries, and related models are said to describe “horizontal integration”. Influential papers which have adopted this approach include Markusen (1984), Helpman (1984) and Markusen & Venables (2000).

As already mentioned and as will be further elaborated below, this paper will not focus on horizontal but on vertical integration. Nevertheless, it is important to note that alternative motivations for MNE activity exist. In this paper, both the choice of control variables and the interpretation of the results must be made against this background. It is particularly the case considering that FDI occurs most frequently between developed countries and that the majority of affiliates’ production in most sectors are sold in the host country (cf. stylized facts one and four above).

Pol & Antràs (2014, p. 68 continued) consider the body of research and derive which variables that affect the probability of MNE activity in horizontal, two-country models. The variables they consider include trade and transportation costs, firm and plant level economies of scale and the wage differential between the home and host countries.⁶

For clear reasons, higher transportation costs induce horizontal replication while high plant level economies of scale discourage this practice. Higher firm level economies of scale are expected to induce horizontal replication since it makes the associated exploitation of lower variable cost more profitable for the average firm. Lastly, the attractiveness of horizontal integration decreases in the wage differential between home and host country. The intuition is that a MNE will incur higher costs in comparison to an exporter based in the low wage country. Thus, the cost of operating in both the high wage and the low wage country is increasing in the wage difference in standard horizontal models.

Empirical research has broadly confirmed the role and importance of the enumerated factors for the propensity of American firms within different industries to serve foreign markets through exports rather than through affiliates (cf. Brainard, 1997, and Antràs & Yeaple, 2014, p. 77). For example Ekholm (1995, 1997, 1998) also found evidence of a positive correlation between bilateral MNE activity and similarity in economic size and factor endowments.

c) The question of location: vertical fragmentation

A second motivation for fragmentation of production across borders is to take advantage

⁶ They also consider the elasticity of substitution which is a measure of the sensitivity to marginal costs of the profits of the average firm. Firms which attach more importance to variable costs will be more prone to engage in horizontal replication, and this practice is hence induced by a higher elasticity of substitution.

of lower factor prices in foreign countries. This practice is called “vertical integration”, as the value chain is fragmented across different countries. Concretely, a MNE headquartered in a country abundant in capital or in skilled labour may have incentives to locate the stages of the production process which are intensive in unskilled labour in countries that are relatively abundant in this latter factor of production. Helpman (1984) and Helpman & Krugman (1985) made seminal contributions to this strand of theory. Within their models, country differences in factor endowments must be sufficiently large in order for vertical fragmentation to be profitable. Otherwise, factor price equalization would occur even if no vertical integration took place and the incentive would not arise. The larger factor endowment differences between the countries are, the larger is the amount of vertical integration that can occur without factor price equalization (see in particular Helpman, 1984). As a corollary, intra-firm trade between the countries is increasing in the factor endowment difference in Helpman’s (1984) model.

A very important observation in American data is that the top countries from which affiliates export back to the United States differ substantially in terms of development (Antràs & Yealpe, 2014, p. 93). Such evidence indicates that a two factor model may not suffice to capture the full dimension space in which a country can enjoy a comparative advantage. The findings of Alfaro & Charlton (2009) also point to the need to consider additional drivers of vertical integration. Using highly disaggregated firm-level data, they showed that many subsidiaries that appear to be horizontal at a higher level of aggregation are unveiled as vertical subsidiaries that produce highly specialized inputs for the parent company when more detailed data is considered. In particular, their results point to prevalent vertical fragmentation across countries of a similar level of development.

Yealpe (2003) nuanced the concept of comparative advantage by proposing to test for an interaction effect between the skill-intensity of an industry and the relative skill-abundance of a country. His hypothesis was that firms in the United States will export more to countries scarce in human capital in industries which are relatively skill-intensive. Antràs & Yeaple (2014, p. 93 ff.) replicated this analysis and found robust evidence for a positive interaction effect. Nunn (2007) found that improved institutional quality offers countries a comparative advantage in goods which are relatively relationship-specific (i.e. have a disproportionately high value inside the particular business relationship). This particular result will be discussed at greater length below.

d) The question of location: the knowledge-capital model and other extensions

In order to combine horizontal and vertical motivations for MNE activity, the knowledge-capital model was developed (cf. Markusen et al., 1996, and Markusen, 1997). The model contains two industries (knowledge creation and physical production) and assumes that these activities can be separated. The motivation for vertical fragmentation in this framework arises from the efficiency gains in locating R&D, etc. in countries that are intensive in skilled labour while locating physical production in countries that are intensive in unskilled labour. The assumption that knowledge can be transferred within a firm in combination with trade costs is the motivation for horizontal replication, as multi-plant economies of scale is assumed (i.e. the cost of one headquarter producing knowledge-generating services and two plants producing physical goods is less than the fixed costs of two single plant firms).

The knowledge-capital model predicts that MNE activity across country pairs will

depend on a number of co-variates. They include the sum of bilateral GDP, which is expected to have a positive effect on MNE activity since horizontal integration is encouraged by a larger total market share. In contrast, the squared GDP-difference between the countries is expected to have negative impact since it discourages horizontal integration. To account for drivers of vertical fragmentation, the skill difference between home and host country is included in the model and it is expected to exert a positive influence on MNE activity. For reasons analogous to what has been stated above, higher costs of importing to the host country are expected to induce horizontal integration over exporting. Higher investment costs in the host country are expected to discourage multinational activity.⁷ Carr et al. (2001) found that the expected correlations were reflected in the data for all co-variates except the interaction of host trade costs and the squared skill difference between the countries.

The literature has also considered multicountry models, which allow the decision of an MNE company to be active in one particular country to affect its propensity to be active in neighbouring countries. The models may focus on locations as substitute. In these models, the decision of a MNE to be active in one country typically lowers the probability that it will be active in other locations. Examples include Eaton & Kortum (2002), Ramondo and Rodríguez-Clare (2013) and Tintelnot (2012). One important reason that locations arise as substitutes in these models is the presence of fixed costs and the consequent desire to concentrate production. Other models have focused on locations as complements. This literature is comparatively smaller (Antràs & Yeaple, 2014, p. 100). Models of this type incorporate the idea that horizontal replication of the MNE in one country may exhibit a positive relationship with vertical fragmentation to utilize cheap factors of production in neighbouring countries. Such strategies by MNEs are sometimes called *complex strategies*. Contributions include Yeaple (2003), Grossman et al. (2011) and Antràs & Yeaple (2014, p. 101 ff.). For the purpose of this paper, it is important to note that MNE activity in different countries may be interdependent. This has bearing on both the methods and the interpretation of the results.

In summary, economies of scale in combination with trading costs on the hand and comparative advantage on the other hand have been emphasized in previous research as drivers of production fragmentation across national borders. However, a comprehensive model of MNEs must also address internalization. Why are activities internalized into an MNE rather than conducted through arm's length transactions? The current state of knowledge on this question is considered below.

e) The question of internalization and the transaction cost approach

The importance of firm boundaries in economic research can be traced back to Coase's (1937) seminal contribution. The crucial insight of Coase was that firm boundaries may be explained by *transaction costs* which in certain cases make open market transactions more expensive than the alternative of internalizing the function within the boundaries of the firm. Hence, transaction cost minimization has an important impact on the determination of firm boundaries. The insight was developed by e.g. Williamson (1975; 1985). A key component in the literature on firm boundaries is the existence of *contract incompleteness*. If contracts could be used as perfect enforcement mechanisms, firm boundaries would essentially become irrelevant.

⁷ A number of interaction terms of the enumerated variables are also generally included in econometric specifications of the knowledge-capital model (cf. e.g. Carr et al. (2001). Some of these interaction terms are used in this paper (see section 3.4.1)

In order to explain the existence of MNEs, the international trade literature has incorporated insights from the literature on incomplete contracts and the boundaries of the firm. The standard models feature contracting situations, with an explicitly defined space of contract possibilities and time periods. The common denominator of all such models is that the probability of integration increases in the transaction costs of relying on the market mechanism. Antràs & Yeaple (2014, p. 103 continued) discuss two categories of transaction costs, namely *rent dissipation* and *hold-up inefficiencies*.

Rent dissipation is an inefficiency related to horizontal replication of an enterprise across national borders. The problem is often illuminated by assuming that the firm faces a choice between contracting a licensee to operate the plant abroad or alternatively integrate the plant located abroad within the boundaries of the firm. Under a licensing strategy, rent dissipation occurs whenever contract incompleteness inhibits the transfer of economic rents from the foreign licensee to the home firm. A frequently cited example of rent dissipation in the literature is related to technology transfer (see e.g. Ethier & Markusen, 1996, and Antràs & Yeaple, 2014, p. 104 continued). It is surmised that the licensee cannot be prevented from using the licensed technology outside the framework of contract and thus divert revenues (contract incompleteness). Difficulties in designing an incentive-compatible contract then naturally emerges.

In rent dissipation models which focus on technology transfer, the probability of horizontal integration naturally increases when the scope for using the technology outside the framework of the contract is larger. An important result under the standard assumptions in the literature is that a higher wage in the home country relative to the host country decreases the probability of horizontal integration (Antràs & Yeaple, 2014). The intuition is that a higher relative wage will make it more expensive for the home firm to deviate from a licensing contract by directly exporting to the host country. The knowledge-capital model also features technology transfer as a motivation for horizontal integration as the cost of one headquarter producing knowledge-generating services and two plants producing physical goods is less than the fixed costs of two single plant firms (Markusen et al., 2001).

In contrast to rent dissipation, hold-up inefficiencies have often been conceptualized as drivers of vertical integration (see for example Grossman & Helpman, 2002, and Antràs & Yeaple, 2014, p. 107 continued). In such models the motivation for vertical fragmentation of the value chain remains some source of comparative advantage, typically the wage differential between the countries. If the source of comparative advantage is sufficiently large, it will be optimal to offshore the production of some intermediate inputs. Firms then face a choice between merely *outsourcing* the production or directly assuming ownership over the production of intermediate inputs abroad (i.e. *vertical integration*).

In order to generate a trade-off between the alternatives, outsourcing is assumed to entail lower *governance costs*. This can be justified by appealing to diseconomies of scale, e.g. coordination difficulties inherent in running a very large company and slower learning due to less specialization within the organization. On the other hand, the intermediate inputs are surmised to be more or less *relationship-specific*. This entails that the intermediate inputs are more valuable inside the particular relationship. The assumption can be justified by the notion of intermediate goods that are customized to the buyer and by search costs associated with finding a new contracting partner if the business relationship breaks down.

Crucially, it is additionally assumed that the ex ante contract in the case of outsourcing is incomplete or not fully enforceable, implying that it cannot fully govern the relationship-specific behaviour of the producer of the intermediate good. In contrast, the headquarter can fully govern the behaviour of the producer in the case of vertical integration (although this assumption is relaxed within the framework of the property-rights approach; see below).

If it is costly for the producer to provide high rather than low quality, it follows that an ex ante agreement on price is infeasible as it would attenuate the incentives to produce an intermediate good of high quality. In short, the contract must be *renegotiated* ex post and hence the price must be determined after the relationship-specific investments have been undertaken.

In this context, hold-up inefficiencies arise naturally since the manufacturing costs are sunk ex post. In particular, the producer of the intermediate good has an incentive to provide less than the efficient quality or quantity of the intermediate input (underinvestment) since he or she realises the weak bargaining position that will materialize ex post if the intermediate input is less valuable outside the business relationship. Intuitively, a higher degree of specificity will aggravate the hold-up problem. The reason is that a more relationship-specific investment (i.e. intermediate inputs more tailored to a particular buyer) will be harder to recoup for the producer if negotiations break-down ex post.

f) The question of internalization: the property-rights approach

The transaction cost approach outlined above has been questioned on the grounds that transaction costs arguably occur also *within* firms (Grossman & Hart, 1986, Hart & Moore, 1990, and Hart, 1995). In other words, vertical integration of the supplier may not provide a resolution to the hold-up problem. According to the property-rights theory of the firm, the difference between outsourcing and vertical integration is not best thought of as a difference between incomplete contracts and complete contracts. Instead, the advantage of vertical integration should be conceptualized as arising from the *ownership* of the intermediate input. Ownership allows the firm to seize the intermediate input ex post if agreement is not reached concerning transfer price. In the literature it is often surmised that such involuntary transfers occur with a loss on part of the firm, reflecting that it cannot use the input as efficiently as if it had been transferred under cooperation (e.g. Antràs & Yeaple, 2014, p. 112 ff.).

An important proposition within property-right theory is that *the party that contributes most to the value of the relationship through a non-contractible investment should hold the ownership right*. This result arises naturally in models of vertical fragmentation where both the headquarter and the producer of the intermediate input undertakes relationship-specific investments. Specifically, it is expected that the probability of vertical integration will increase in the *headquarter intensity* of the industry. The headquarter intensity is defined as the elasticity of total revenues from the final good to investments undertaken by the headquarter (in practice such investments may concern e.g. R&D or various technical services). The intuition is that the allocation of ownership affects the division of surplus ex post and hence the incentives ex ante. If the non-contractible investment of the producer of the intermediate good is more important, outsourcing rather than vertical integration is required as the incentives of the producer are relatively more important and because these incentives are maximized if he or she

retains ownership rights (see also Antràs, 2003, and Antràs, 2005). In contrast, if only the producer of the intermediate input undertakes relationship-specific investment, the probability of vertical integration will decrease in headquarter-intensity for analogous reasons.

g) Empirical research on internalization decisions

As pointed out by Antràs (2014) and by Whinston (2003), it is difficult to capture notions such as headquarter intensity and relationship-specificity in measurable variables. Moreover, data on the internalization decisions of firms is sparse. In the face of these limitations, several researchers have used the varying *share of intra-firm imports* in total imports for different industries or from different countries as a proxy for the relative ubiquity of vertical integration. The idea behind this approach is to explore whether the share of intra-firm imports is systematically correlated to some of the theoretically motivated drivers of vertical integration. In particular, if the property-right models in the literature are correct, this share should be positively correlated with a valid proxy for headquarter intensity. According to the hold-up inefficiency approach, the share should be positively correlated with a valid proxy for relationship-specificity of the intermediate input but negatively correlated with a valid proxy of the headquarter-intensity of the industry.

Working with data on US imports, Antràs (2003) used the capital intensity of the exporting industry and the capital-labour ratio of the exporting country as proxies for headquarter intensity. The author formulated a property-rights model in which the transaction costs of using the market as opposed to intra-firm transfers increased in the capital-intensity of the imported good. Capital intensity as a proxy for headquarter intensity is logical within the stylized model with only two factors of production developed by Antràs (2003), but the approach has been criticized by e.g. Nunn & Treffer (2013). The chief critique was that several activities which are capital intensive may be fairly standardized and hence not particularly relationship-specific (see also Antràs & Yeaple, 2014, p. 118 ff.). Skill-intensity and R&D-intensity have therefore been suggested as alternative proxies for headquarter intensity as headquarter services are hypothesized to be intensive in these factors of production and as they may be more relationship-specific and non-contractible than capital.

Several empirical studies have found a positive correlation between the possible proxies for headquarter intensity and ubiquity of vertical integration as proxied by intra-firm imports (e.g. Antràs, 2003, and Antràs & Yeaple, 2014, p. 121 ff.). However, it remains unclear whether the property-rights models of international trade are valid since this evidence may also be consistent with models of hold-up inefficiencies and rent dissipation (for a further discussion see e.g. Antràs, 2014). Antràs & Yeaple (2014, p. 122) suggest that the distinct predicted effects of improvement in contractibility is a promising way to discern whether theories of hold-up inefficiencies or property right theories are more consistent with data. In particular, theories of hold-up inefficiencies imply that improvements in contractibility universally lower the incentive to vertically integrate. In contrast, property right models suggest that the effect of an improvement in contractibility for a particular input depends on which party that controls the input (Antràs & Helpman, 2008).

Nunn (2007) studied the impact of improved contract enforcement on exports of goods which are relatively relationship-specific. Based on the hold-up approach it was hy-

pothesized that improved contract enforcement would induce countries to specialize in the export of relationship-specific goods. The intuition should be obvious: if contracts can be better enforced, the hold-up problem is alleviated as no need for renegotiation arises. The relation-specificity of each good was approximated by a variable measuring the proportion of its intermediate inputs that require relationship-specific investments. Relationship-specific investments were approximated by whether the input, according to Rauch's (1999) classification, is typically sold on an organized exchange, reference priced or neither.⁸ This paper will use the same classification to capture the extent to which broad categories of goods require relationship-specific investments. Various indices of judicial quality were used as a proxy of the quality of contract enforcement (see section 3). Nunn (2007) also explored the importance of vertical integration as a substitute to good contract enforcement. The quality of contract enforcement had a positive and statistically significant impact on trade flows even for industries in which vertical integration was relatively easy. However, the impact was estimated to be almost twice as large for industries in which vertical integration was relatively hard.

h) In summary

In summary, contract incompleteness and relationship-specificity have been viewed as the primary determinants of internalization and firm boundaries in the literature. Horizontal integration has been explained by appealing to rent dissipation. An important theoretical prediction is that the probability of horizontal integration decreases in the relative wage-difference between the countries. Vertical integration, in contrast, has been explained by reference to relationship-specific investments. A higher degree of specificity induces underinvestment and opportunistic behaviour. Two alternative classes of models address contract incompleteness in vertical relationships, namely the hold-up inefficiency approach and the property-rights approach. The former approach assumes that the hold-up problem can be solved by vertical integration of the party that undertakes the relationship-specific investment, while the latter approach assumes that incomplete contracting will prevail even in the case of vertical integration. According to the property-rights approach, the right of ownership should be assigned to the party that undertakes the most important relationship-specific investment.

2.1.4 Summary

It is now possible to conclude the review of the current state of knowledge. The most important implications for this paper are the following. Firstly, it has been documented that BITs are designed to protect and promote foreign investment between the two state parties. The extent to which foreign investment is protected and promoted varies across BITs, yet the purpose should be common to all such treaties. Secondly, BITs are most ubiquitous between developing and developed countries. Thirdly, a majority of empirical studies have found a positive relationship between the signing or ratification of BITs and FDI flows. Fourthly, the current literature on international trade and MNEs suggest that economies of scale in combination with trading costs drive horizontal replication of business activity, while differences in factor endowments drive vertical fragmentation

⁸ Goods that are sold on an organized exchange can easily be purchased from an alternative source, while goods that are merely referenced price or not even referenced priced may be assumed to be more relationship-specific. Examples of industries which according to this classification are characterized by high and low relation-specificity, respectively, are photographic equipment and coffee & tee.

of business activity. Finally, the same literature point to different forms of contract incompleteness as the most important reason as to why business activities in different countries are integrated within the boundaries of MNEs. Against this background, the precise research focus and research questions of this paper will be stated and motivated immediately below.

2.2 Research focus and research question

The purpose of this paper is to explore whether the impact from BITs on bilateral trade patterns is consistent with the current state of the literature on international trade and MNEs. What, then, is the expected impact on trade patterns from the conclusion of BITs given the current state of the literature?

It should firstly be noted that the large majority of BITs in existence apply between a developed and a developing country, implying that large average factor endowment differences are to be expected between the parties to a BIT. From the canonical models in the literature it follows that the drivers of vertical integration should be substantial between the average parties to a BIT (cf. Helpman, 1984, and Helpman & Krugman, 1985, compare 2.1.3 above). In contrast, the literature imply that a large wage differential between the countries lowers the probability of horizontal integration between them.

Thus, the drivers of vertical fragmentation should be stronger than the drivers for horizontal replication between the countries in the average pair that signs or ratify a BIT. Recent research has indicated that vertical fragmentation may be prevalent also between countries of similar levels of development (cf. e.g. Alfaro & Charlton, 2009, and section 2.1.3 above). However, this does not weaken the case that vertical fragmentation is the most important driver of MNE integration between parties to BITs. After all, it only implies that vertical fragmentation may play a large role also between state parties which share an equal level of development. As indicated in section 2.1.2, this thesis makes the assumption that BITs on average facilitate FDI. Hence, it is expected that *the impact from BITs on bilateral trade patterns is consistent with the impact predicted to arise from lower costs of vertical FDI.*

On the basis of the above reasoning, it is natural to specify the research focus as the investigation of whether the impact from BITs on bilateral trade patterns is consistent with contemporary models of vertical integration. As stated in section 2.1.3 above, these are *hold-up inefficiency models* and *property-rights models*. In both types of models, vertical integration is motivated by incomplete contracting. One of the most fundamental insights from section 2.1.3 is that *vertical fragmentation* may occur without vertical integration. The existence of a BIT should primarily affect trade patterns that are dependent on vertical integration specifically, as vertical fragmentation can occur without FDI. The *research question* of this paper is the following:

Is the impact on trade patterns from the signing and ratification of a BIT between two state parties consistent with contemporary models of vertical integration?

In order to formulate precise, testable hypotheses, the effects of signing or ratifying a BIT are analyzed within the framework of a stylized versions of the hold-up inefficiency and the property-rights models below.

3 Model, hypotheses, methods and sources

The first purpose of this section is to illustrate the expected effect of signing or ratifying a BIT on bilateral trade patterns within a stylized version of contemporary models of vertical integration. To this end, section 3.1 incorporates the anticipated effect of BITs into a benchmark model of international trade, wherein vertical integration may be driven by either classical hold-up inefficiencies or inefficient property rights allocation. The implications from this model of concern to the purpose of this paper are summarized in section 3.2. In section 3.3, and on the basis of the models, three testable hypotheses are formulated. Section 3.4 presents the methods used to test the stated hypotheses. Finally, section 3.5 gives an overview of the source material used.

3.1 The incorporation of BITs into stylized models of vertical integration

The effect of signing or ratifying a BIT will throughout be conceptualized as a decrease in f_{FI} , which denotes the fixed cost of vertical integration between a country pair. This variable measures the cost of establishing a subsidiary and operating in the foreign country. Given the typical content of a BIT, it may be assumed that the non-commercial risk inherent in investing abroad is lowered when a BIT is signed or ratified between the source and host country. In particular, the assumption can be defended in two ways. Firstly, the existence of a BIT should lower the probability that the host state engages in measures detrimental to foreign investors without the investor receiving adequate compensation. Secondly, the BIT empowers foreign investors from the other state party to eschew costs related to relying on the domestic court system. Intuitively, and as formalized below, the lowering of f_{FI} induces increased foreign investment between the countries.

We consider the vertical contracting model presented by Antras & Yeaple (2014; cf. Grossman & Helpman, 2002; Helpman, Melitz & Yeaple, 2004). It is a generalization of Krugman's (1980) model and may incorporate Melitz's (2003) extensions concerning firm heterogeneity.

The model features two countries, *H-country* and *M-country* where *H* denotes Head-quarter and *M* denotes Manufacturer. The countries produce goods in $J + 1$ sectors. One sector produces a homogeneous good, z , while the remaining J sectors produce differentiated goods. The only factor of production is labour, L , which is immobile across countries but freely mobile across sectors of production.

Both countries exhibit the same preferences, where an exogenous fraction β_z of income is allocated to consumption of the homogenous good. The remainder of income is allocated to consumption of the J goods.

$$U = \beta_z \log z + \sum_{j=1}^J \beta_j \log(Q_j) \quad (1)$$

The focus will be on one particular sector that produces a differentiated product j .

Preferences across varieties of any differentiated product j are given by CES (constant-elasticity-of-substitution). The elasticity of substitution is denoted σ , and it is surmised that $\sigma > 0$. Consequently, for variety k of product j :

$$Q_j = \left(\int_{k \in \Omega} q_k^{(\sigma-1)/\sigma} dk \right)^{\sigma/(\sigma-1)} \quad (2)$$

It follows, that the maximization of utility (given the implicit budget constraint) gives the following demand for variety k in industry j and country i .

$$q_j^i = A_j^i p_j^i(k)^{-\sigma} \quad (3)$$

where $A_j^i = \frac{\beta_j E^i}{\int_{k \in \Omega} p_j^i(k)^{1-\sigma} dk}$.

The sector that produces the homogeneous good z is perfectly competitive and z can be costlessly traded across countries. The good z is the numeraire in the model. The countries differ in productivity, as measured by a^i , which is the number of units of labour necessary to produce one unit of the homogeneous good z . It is assumed that $a^H < a^M$. The cost function for good z is $c_z^i = a_z^i w^i$. Since perfect competition prevails in this sector and since trade is costless, it follows that $w^H = 1/a_z^H > 1/a_z^M = w^M$ as long as good z is produced in both countries (this is true for a sufficiently large β_z , which is surmised). At these wages, the sectors that produce differentiated products face a perfectly elastic supply of labour.

In contrast to the production of the homogeneous good, the production of differentiated goods entails a fixed cost of production (f_i) as well as a constant marginal cost. The production function is linear and can be specified as follows:

$$C_j^i(w^i, q_j) = (f_i + (\frac{q_j}{\varphi(k)})c_j^i(w^i)) \quad (4)$$

The parameter $\varphi(k)$ denotes the productivity of the particular firm, and hence firms with higher productivity will enjoy lower marginal cost ($1/\varphi(k)$) when productivity differences are allowed. The existence of a fixed cost ensures economies of scale. The market structure is monopolistic competition, which arises naturally with differentiated products.

It is surmised that trade in differentiated goods is costly, and in particular is associated with an *ad valorem* trade cost of $\tau_j > 1$ units per unit transported between the two countries. Various forms of offshoring also entails an additional fixed cost of f_X units.

a) Classical hold-up inefficiency approach

Assume that $J = 1$ (i.e. there is only one sector producing a differentiated product). Further, it is assumed that two separate production processes exist for the differentiated good, namely headquarter services and manufacturing services. The services can be geographically separated, in which case the output of the manufacturing service providers must be shipped to the country in which headquarter services are provided. The total cost function is the sum of the cost functions for the two production stages.

As will become clear below, the lower wage in *M-country* creates an incentive on the part of firms in *H-country* to offshore manufacturing services. In the model, offshoring can be accomplished either through contracting a manufacturer (outsourcing) or through incorporating the manufacturer (vertical integration). In fact, the firms in *H-country* can choose between four alternative business organization models: “Domestic outsourcing” (*DO*), “Domestic Vertical Integration” (*DI*), “Foreign Outsourcing” (*FO*) and “Foreign Vertical Integration” (*FI*).

Possible examples of headquarter services include R&D and financing as well as the combination of intermediate inputs and the headquarter services into final goods. Manufacturing services entails production of intermediate inputs and other goods used in the production of the final good. The headquarter services can be utilized by many manufacturers within the firm simultaneously, and are in this sense non-rival, but have no value for manufacturers outside the firm. While the headquarter stage uses labour to produce headquarter services, the manufacturing stage uses labour and headquarter services to produce goods. The provision of headquarter services incurs fixed costs, as elaborated below, while manufacturing services only entails the marginal cost in terms of wages to labour.

Further, it is assumed that firms in the differentiated sector J display heterogeneous productivity (φ). Firms that supply headquarter services incur a fixed cost of entry (f_E) and subsequently learn their productivity which is a draw from the distribution $G(\varphi)$. With this knowledge, firms may either exit the market or continue production. Firms that produce headquarter services will incur an additional fixed cost f_D . Because of much lower f_E and much higher productivity in the provision of headquarter services in *H-country* than in *M-country*, headquarter services are always produced in *H-country*.⁹

Both manufacturing services, m , and headquarter services, h , are produced by labour according to a one-to-one relationship (i.e. one unit of labour can be used to produce one unit of either service). Given the technology and wage differences between the countries, *H-country* obviously enjoys a comparative advantage in the provision of headquarter services while *M-country* enjoys a comparative advantage in the provision of manufacturing services.

In order to produce a final good, headquarter and manufacturing services must be combined. This is done by firms producing headquarter services according to the production function:

$$q^i(\varphi) = \varphi \frac{h^{i\eta}}{\eta} \frac{m^{i^{1-\eta}}}{1-\eta} \quad (5)$$

$0 < \eta < 1$ is a measure of headquarter intensity in the particular industry.

Importantly, the above model contains incentives for specialization according to comparative advantage (i.e. that firms in *H-country* provide headquarter services and offshore provision of manufacturing services to *M-country* where the wage is lower). However, offshoring entails costs. An *ad valorem* trade cost $\tau > 1$ exists for transporting m from *M-country* to *H-country*. Moreover, offshoring involves an additional fixed cost f_O which exceeds f_D . On the contrary, it is surmised that final goods can be traded without cost.

⁹ D is short for “Domestic” and E is short for “Entry”.

In short, there is a trade-off between the lower wage in *M-country* and the increased trade costs inherent to any form of offshoring.

To complicate matters, vertical integration also entails a trade-off. Vertical integration involves higher governance costs due to diseconomies of scale (e.g. governance costs). To capture this, marginal costs are surmised to be lower under outsourcing by a factor $\lambda > 1$ and in addition the fixed cost is assumed to be higher under vertical integration ($f_{DO} < f_{DI} < f_{FO} < f_{FI}$)¹⁰ The advantage of integration is that the hold-up inefficiency problem is alleviated.

The hold-up inefficiency problem is modeled as follows and for reasons outlined below it is only relevant under outsourcing. There are three time periods, namely $t = 0$, $t = 1$ and $t = 2$. Additionally, there are two parties, namely “Headquarters” and “Manufacturers”, located in *H-country* and in *M-country*, respectively. At $t = 0$ the parties may conclude an outsourcing contract according to which *M* produces a manufactured good *m* for *H*. Subsequently, at $t = 1$ the manufacturer produces the good *m* if a contract has been concluded. Finally, at $t = 2$ the transaction price is renegotiated. The need for renegotiation arises from contract incompleteness, as the contract is surmised to be *totally incomplete*, i.e. it is impossible at $t = 0$ to specify any aspect of the production undertaken at $t = 1$. Hence, the price is renegotiated as *H* would not agree to a binding price at $t = 0$ in the absence of an enforceable agreement on production specifications. The assumption of total contract incompleteness is obviously not realistic, but it captures the problem that arises from contract incompleteness. It is assumed that any agreement reached between the parties is a Nash bargaining solution, implying that the gain from an agreement is the outside option of each party and a share of the surplus generated through the agreement.

If the parties can reach an agreement regarding price and if they are located in *H-country* and *M-country* respectively, *m* is exported from *M-country* to *H-country* at $t = 2$. Subsequently, the final good is produced and sold and the sale revenues are divided between the parties according to the agreement. In contrast, if the parties fail to reach an agreement, *H* gains nothing while *M* can sell the produced good *m* at a secondary market. However, because of the specificity of *m*, the price that *M* can obtain is a $1 - \phi < 1$ fraction of the total revenue from selling the final good, where ϕ is a measure of the specificity of *m*. This reflects the underlying assumption that the produced good is less valuable outside the business relationship. Consequently, the price that *M* will demand in the renegotiations at $t = 2$ will increase in ϕ .

Alternatively, *H* may choose to engage in vertical FDI and acquire ownership of *M*. In this case, the good *m* can be fully specified at $t = 0$ and no hold-up inefficiency arises.

For the moment, ignore the question of internalization and consider the position of the firms in *H-country*, and in particular the trade-off they face between domestic production and offshoring. When both headquarter and manufacturing services are produced domestically, the profit of firms in *H-country* is given by:

$$\pi_D(\varphi) = \varphi^{\sigma-1}(D^H + D^M)(w^H)^{1-\sigma} - w^H f_D, \quad (6)$$

where D^H and D^M represent demand in *H-country* and in *M-country*, respectively. If

¹⁰ *D* denotes “Domestic”, *F* denotes “Foreign”, *O* denotes “Outsourcing” and *I* denotes “Integration”.

manufacturing services are offshored to *M-country*, the profit of firms in *H-country* is instead given by:

$$\pi_O(\varphi) = \varphi^{\sigma-1}(D^H + D^M)((w^H)^\eta(\tau w^F)^{1-\eta})^{1-\sigma} - w^H f_O \quad (7)$$

It follows that if $w^H > \tau w^F$, firms with sufficiently high productivity (φ) will find it profitable to offshore despite the higher fixed cost involved. More and more firms will find it profitable to offshore as the technology and thus the wage gap between the two countries widen. In this way, the model is consistent with the finding that more productive firms engage in offshoring.

Now, to illustrate the trade-off between outsourcing and integration, it is surmised that all firms in *H-country* have the same productivity (φ). In other words, all firms are homogeneous. Further, it is assumed that the wage difference is so large that the firms choose to offshore the production of manufacturing services. Finally, it is surmised that an exogenous fraction δ of outsourcing contracts break down, implying that nothing is traded and that *H* gain zero. The fraction δ , which can be thought of as an additional transaction cost of using the market, is a linear and strictly increasing function of the specificity of the product, i.e. $\delta = a\phi$, where $0 < a < 1$.

Hence, the relevant alternative modes of business organization are “Foreign Outsourcing” and “Foreign Vertical Integration”. The expected profits associated with these alternatives, from the point of view of the firms in *H-country*, are:

$$\pi_{FO}(\varphi) = \varphi^{\sigma-1}(D^H + D^M)((w^H)^\eta(\tau w^F)^{1-\eta})^{1-\sigma} \lambda^{(\sigma-1)} \Gamma(1 - \delta) - w^H f_{FO} \quad (8)$$

$$\pi_{FI}(\varphi) = \varphi^{\sigma-1}(D^H + D^M)((w^H)^\eta(\tau w^F)^{1-\eta})^{1-\sigma} - w^H f_{FI} \quad (9)$$

Γ is a measure for the transaction cost associated with the hold-up problem and is equal to:

$$\Gamma = \left(\frac{\sigma - (\sigma - 1)(1 - \frac{1}{2}\phi)(1 - \eta)}{\sigma - (\sigma - 1)(1 - \eta)} \right)^{(\sigma - (\sigma - 1)(1 - \eta))} \left(1 - \frac{1}{2}\phi \right)^{(1 - \eta)(\sigma - 1)} < 1 \quad (10)$$

The lower is Γ , the higher is the transaction cost of using the market. As is clearly seen, Γ is strictly decreasing in the degree of specificity ϕ . It can also be shown that Γ is strictly decreasing in headquarter intensity η . In other words, the cost of outsourcing increases in product specificity ϕ and decreases in headquarter intensity η .

Given the assumption that all firms are homogeneous (i.e. have the same productivity), all firms will choose the same organizational form. This form will be vertical integration whenever:

$$\frac{f_{FI}}{f_{FO}} \lambda^{\sigma-1} \Gamma(1 - \delta) < 1 \quad (11)$$

Under the stated assumptions, the model thus predicts that the probability of vertical integration *decreases* in the ratio of the fixed cost of foreign vertical integration to the fixed cost of foreign offshoring $\frac{f_{FI}}{f_{FO}}$ as well as in governance cost λ . In contrast, the probability of vertical integration *increases* in specificity ϕ and in headquarter intensity $1 - \eta$. The effect of increasing specificity comes partially from the lower Γ and partially from the higher fraction of failed outsourcing contracts (δ).

So far, the model is identical to the one presented by Antràs & Yeaple (2014), with the exception that an exogenous fraction of the outsourcing contracts are assumed to fail. In order to incorporate the impact from BIT policy in this stylized model, consider the assumption that the conclusion of a BIT between the countries will lower the fixed cost of vertical integration (f_{FI}). It follows that the existence of a BIT is expected to lower $\frac{f_{FI}}{f_{FO}}$ and hence increase the probability of vertical integration. Given the assumption that a fraction δ of outsourced contracts fail, the existence of a bilateral investment treaty is expected to increase trade. Moreover, *if* vertical integration becomes profitable as a result of a BIT, the positive impact on trade flows is expected to be larger the higher is product specificity ϕ (since δ depends positively on ϕ).

The important caveat is of course that industries with a high degree of product specificity will disproportionately be subject to vertical integration already in the absence of a BIT as a result of the positive impact on the probability of vertical integration from ϕ . If the highly specialized industries are already vertically integrated before the conclusion of a BIT, the impact on trade flows would chiefly occur in less-specialized industries wherein vertical integration was hitherto unprofitable.

A very parsimonious way of closing the model is to assume that $f_{FI} = \infty$ if no BIT exists between the parties and that, in contrast, $f_{FI} < \infty$ if a BIT is concluded by the country pair. This indicates that the condition in equation 11 will never hold unless a BIT exists between the parties. It is further assumed that if a BIT exists, f_{FI} is below some threshold value such that vertical integration is profitable in at least some industries. It follows that the conclusion of a BIT will result in vertical integration predominantly in the industries subject to a higher product specificity and that bilateral exports of intermediate goods will increase chiefly within these industries.

The assumption is clearly an abstraction but captures the idea that for high fixed costs of business integration in the absence of a BIT, the impact from BITs will predominantly occur within industries characterized by high relationship-specificity.

b) Property-rights approach

The property-rights approach may be captured in the same model as above, but it is additionally surmised that a hold-up problem arises even within an integrated firm. In the version developed by Antràs & Yeaple (2014, p. 112 ff.) this is captured by assuming totally incomplete contracts even for within firm transactions. If the negotiations at $t = 2$ fail, H may appropriate the good m that has been produced by M since H retains ownership of M . However, the value of doing so will be only a fraction $\alpha < 1$ of the income generated from selling the final good in the case when the negotiations do not break down. It is thus assumed that there is a cost of non-cooperation.

The formal analysis become involved with this assumption and it will be omitted here.¹¹

¹¹ The interested reader is referred to Antràs & Yeaple (2014, p. 112 ff.).

The results, however, can still be understood in light of the framework considered above. The key new feature is that both outsourcing and vertical integration involve transaction costs (Γ_O and Γ_I , respectively). The fraction $\frac{\Gamma_O}{\Gamma_I}$ is a measure of the transaction cost of relying on the market relative to the transaction cost of integration. If this fraction increases, the relative prevalence of vertical integration to outsourcing decreases. Antràs & Yeaple (2014) assume that both H and M undertake non-contractible investments and demonstrate the following result.

The ratio $\frac{\Gamma_O}{\Gamma_I}$ is i) decreasing in the headquarter intensity η , which represents the importance of the non-contractible investment undertaken by H ; and is ii) increasing in the manufacturing intensity $1-\eta$, which represents the importance of the non-contractible investment undertaken by M .

In short:

$$\eta \uparrow \implies \frac{\Gamma_O}{\Gamma_I} \downarrow \implies P(\text{integration}) \uparrow \quad (12)$$

The intuition is that incentives are attenuated for the party which does not hold ownership. The more important the contribution of H , the more important are the incentives of H relative to the incentives of M and the stronger is case for giving ownership of the manufactured good m to H . Conversely, the more important is the contribution of M (i.e. the lower is η), the stronger is the case for allowing M to retain ownership of m .

The property-rights approach does not contradict the result that a decrease in f_{FI} (e.g. from the conclusion of a BIT) will increase the probability of vertical integration. The chief implication of property-rights models is that vertical integration will be more prevalent in industries with relatively high headquarter intensity. If the assumptions that a fraction of outsourced contracts fail at $t = 2$ and that $f_{FI} = \infty$ in the absence of a BIT are retained, the positive impact on trade flows from concluding a BIT should be larger in industries with higher headquarter intensity (η).

3.2 Implications from the model and from previous research

Section 3.1 highlights two modeling approaches concerning vertical integration within which the effect of BITs can be conceptualized and studied. Both models explain vertical integration as a result of relationship-specific and non-contractible investment on behalf of either party. One implication is then that the prevalence of vertical integration is related to the ubiquitousness of non-contractible and relationship-specific investments. Property-rights models predict, in particular, that the prevalence of vertical integration will increase with the headquarter-intensity of the industry. In contrast, classical hold-up inefficiency models predict that vertical integration will decrease in headquarter-intensity.

Regardless, the predicted effect of a lower f_{FI} is that the prevalence of vertical integration will increase between countries that differ sufficiently in factor endowments. One may ask the question: how does the impact from a BIT on trade vary across industries and categories of commodities on the basis of specificity? From a theoretical perspective, the answer appears as somewhat ambiguous. If it is assumed that a fraction of outsourced

contracts fail and that this fraction is increasing in the transaction cost of using the market, it is expected that BITs will have a larger effect in industries with a high degree of specificity *insofar* as these industries are not subject to vertical integration even the absence of a BIT. As vertical integration may already be profitable in industries with a high degree of specificity, it is also possible that the increase in vertical integration will occur in industries in which specificity is lower and wherein vertical integration was hitherto unprofitable. However, if the fixed cost of integration is prohibitively high in the absence of a BIT and otherwise surmountable for some industries, the impact from the conclusion of a BIT should be observed predominantly in industries characterized by high relationship-specificity. This notion is reflected in the model in section 3.1 by assuming that the fixed cost of FDI is infinity in the absence of a BIT, but this assumption may easily be relaxed. The important assumption is that the industries where vertical integration has the largest impact on trade remain closed to FDI in the absence of a BIT.

The notion that vertical integration particularly promotes exports of relationship-specific goods also commands empirical support. As mentioned in section 2.1.3, Nunn (2007) found and in that the ease of vertical integration is a substitute for a country's institutional quality and positively influence its comparative advantage in exporting relationship-specific goods.

A related and important area of intellectual indebtedness to previous research is ways of conceptualizing and measuring relationship-specificity. *The essence of relationship-specificity is that either party undertakes an investment which is disproportionately valuable inside the relationship.* This implies that standardized goods that e.g. can be sold and bought on a homogeneous and standardized exchange are unlikely to be relationship-specific. After all, if the contract breaks down, the good can easily be sold or bought somewhere else and neither party undertakes a great deal of risk through investing in the business relationship. The more specialized and tailored a good typically is, the more substantial would we expect problems of relationship-specificity to within that industry.

Two distinct approaches in previous research for conceptualizing relationship-specificity appear particularly appealing. The first is to rely on a measure of how thin the market for the industry or good typically is (as in Nunn, 2007). A smaller market size for the product, e.g. as measured by the extent to which it is neither sold on an organized exchange nor reference priced, is a potential proxy for its average relationship-specificity. The second approach is to use intensity in e.g. capital, skilled labour or R&D as proxies for headquarter-intensity (as in Antràs, 2003). Recall from section 2.1.3 that a higher headquarter intensity, i.e. that the non-contractible investment undertaken by the headquarter is relatively more important, is expected to increase the profitability and probability of integration.

Below, it will be tentatively assumed that BITs disproportionately facilitate exports of relationship-specific intermediate goods. This notion will underly the hypotheses H_2 and H_3 in section 3.3 which concern the interaction effect between the conclusion of BITs and relationship-specificity. The paper will rely on both the above methods to measure the potential complementarity between BITs and relationship-specificity.

A final lesson from previous research is that BITs may be correlated with bilateral trade through other channels. It is, in particular, plausible that factors which correlate

positively with trade integration and MNE activity induce countries to conclude BITs. This implies a possible reverse causality problem. On a related note, one should also keep in mind that no pair of countries exist in isolation as in the stylized and analytically simple two-country models that so often feature in the literature. In contrast, trends in trade and FDI integration with regard to the outside world may well be systematically correlated with both the existence of a BIT between two countries and the level of bilateral trade between them (compare for example Eaton & Kortum, 2002, and the notion of complex integration according to which the benefit of vertical integration in one country may depend positively on the benefits from horizontal integration with respect to a neighbouring country). In order to mitigate the mentioned sources of bias, the paper will employ econometric methods presented in section 3.4.

In summary, contemporary theory and previous research support the view that BITs facilitate business integration and that increased vertical integration should be associated with a number of distinct outcomes for bilateral trade. This insight forms the basis for the hypotheses below.

3.3 Hypotheses

It is plausible that the effect of BITs is more pronounced in highly disaggregated data. For example, capital goods can be more or less relationship-specific depending on the level of standardization. The production of a car should involve a more significant relationship-specific investment than the production of specialized machinery equipments. Yet, since no previous research exists concerning the impact from BITs on trade patterns, a first priority is to test the consistency with models of vertical integration using aggregated data which is available for a large number of countries. Future research may then take the implications of the literature to more disaggregated data. This has the additional advantage that the study may attain a greater external validity. Disaggregated data is not available for as many states. Moreover, the conclusions are at greater risk of being limited to a particular context and the particular countries that are subject to such a study. This consideration will inform the hypotheses and methodology of the paper.

In the literature, the prevalence of vertical integration has often been approximated through the share of intra-firm trade. This data is only available for a subset of countries, however, and this paper will rely on other methods to identify vertical integration.

In the above models, it was assumed that a fraction of outsourced contracts fail to be renegotiated, implying that trade in some cases will not occur according to the contract. Under vertical integration, in contrast, either contracts always hold (as in classical hold-up inefficiency models) or the owner can, albeit at a loss, appropriate the contracted output even if the contract breaks down (as in the property-rights model). This reflects the general notion that BITs exert a positive effect on vertical integration and thus on trade flows. The models above directly concern specialized intermediate goods but the logic could also apply to e.g. capital goods. In contrast, models of horizontal integration intuitively involve a decrease in total trade flows between the countries as the motivation is to serve the foreign market through local production rather than through exports (compare section 2.1.3). As already stated, it is a defensible assumption that vertical fragmentation is on average the most important driver of MNE integration between parties to BITs (section 2.1.4). Consider now that vertical

integration in the models above is associated with an increase in trade, while horizontal integration intuitively is associated with decreased total trade flows. Insofar as BITs facilitate MNE integration between the parties to the treaty, the integration should primarily be vertical rather than horizontal. This is especially true for country pairs characterized by large differences in factor endowments.

The above logic underlies the first hypothesis:

H₁: The signing and ratification of BITs induce increased total bilateral exports between the parties to the treaty.

The relevance of H_1 to vertical integration is admittedly weak in the sense that a positive correlation between the existence of a BIT and total exports is consistent with vertical integration but not inconsistent with other explanations. In particular, the probability of concluding a BIT is likely positively correlated with general trade integration, implying a significant risk for spurious positive correlations. Total exports is a circumstantial way of measuring vertical integration and the estimated impact should be interpreted cautiously, in particular in the absence of valid control variables.

A clear motivation for testing H_1 is however that it facilitates an interpretation of the results regarding hypotheses of direct relevance to vertical integration. Specifically, insignificant results regarding H_2 or H_3 below could be explained by the contention that BITs do not affect MNE activity on a sufficiently large scale to affect trade (compare the doubts regarding the effectiveness of BITs recounted in section 2.1.2). If it can be established that BITs exert an independent impact on total bilateral trade flows, however, and if the hypotheses H_2 and H_3 are rejected, it points to either econometric specification error or a theoretical inconsistency.

As stated in section 3.2, if investment barriers are prohibitively high in the absence of a BIT, the increase in trade flows from concluding a BIT should be especially large in industries characterized by a high degree of relationship-specificity. However, it is also possible that vertical integration has occurred in the relationship-specific industries even in the absence of a BIT. If this is the case, the BIT may have the largest effect on trade flows in less relationship-specific industries, where vertical integration was hitherto unprofitable. Despite the above ambiguity, the following hypothesis may be postulated regarding trade in intermediate goods, where BEC denotes Broad Economic Categories (see section 3.4). It is consistent with the methodological principle adopted above to initially test the implications of the model against highly aggregated BEC data.

H₂: The average impact from BITs on bilateral exports of intermediate goods depends positively on the relationship-specificity of the broad economic category.

A clear result to the contrary (i.e. that BITs have a larger effect for goods which are less specialized) could be interpreted as meaning that vertical integration has on average largely occurred in the relationship-specific industries even in the absence of a BIT between the parties. As noted in section 2.1.3, the literature has recognized the difficulties inherent in finding suitable proxies for relationship-specificity. Insofar as this particular hypothesis is concerned, the paper will follow Nunn (2007) and measure relationship-specificity on the basis of Rauch's (1999) classification.

Property-rights models predict that vertical integration will be more profitable and

prevalent in headquarter-intensive industries. Previous research have used capital intensity (e.g. Antràs, 2003) or skilled labour intensity (e.g. Antràs & Yeaple, 2014) of the exporter as proxies for head-quarter intensity. The intuition is that an increased prevalence of these factors on part of the producer, indicates that the intermediate good is increasingly used in an industry wherein headquarter investments are important. Based on the same logic that informed hypothesis H_2 , the third and final hypothesis is stated as follows:

H_3 : The average impact from BITs on bilateral exports of intermediate goods depends positively on the skilled labour endowment and the capital stock of the exporter.

In analogy to the case of H_2 , a clear result to the contrary of the hypothesis could indicate that vertical integration in relationship-specific industries have on average occurred already in the absence of a BIT.

3.4 Methods

The purpose of the methods is to enable a valid empirical investigation of the postulated hypotheses. It should be repeated that the hypotheses have been formulated with the purpose of estimating the aggregate impact from BITs for as large a sample of countries as possible. This enables a broad inference regarding the impact from BITs but limits the number of methods available due to low data availability for many countries. This will be discussed in more detail in section 3.5.

The present section is organized as follows. Firstly, the particular regression specifications in the paper are presented and the time-varying controls that will be used are described and motivated and general issues regarding the regression estimation are discussed (3.4.1). Subsequently, and with the identified endogeneity problems especially in mind, different approaches to robustness checks and sensitivity analysis are presented and discussed (3.4.2).

3.4.1 Regression specifications and control variables

a) The identification strategy and general econometric specification

The first hypothesis, H_1 , is comparatively easy to translate into a distinct regression model. The issue is whether the existence of a BIT is independently correlated with increased bilateral trade, and this can be estimated using Ordinary Least Squares (OLS) Without loss of generality, this paper focuses on the impact on exports so as to avoid double counting.

It is necessary, however, to critically assess any estimated correlation between the existence of a BIT and increased trade volumes. To observe contractual outcomes is impossible and it cannot be assumed that country pairs are randomly assigned to BITs (in particular given the large number of country pair characteristics that figure in the literature as drivers of MNE activity). The zero conditional mean assumption, that unobservables in the error term must on average be uncorrelated with the explanatory variables, is likely to fail.

Hence, controls must be introduced to mitigate the anticipated spurious correlation between BITs and bilateral trade. Several distinct sources of bias can be identified. Firstly, country pair characteristics may influence both the probability that a BIT is concluded and bilateral trade. For example, countries which differ markedly in factor endowments may tend to trade more in certain commodities but may also be more likely to conclude a BIT (which in turn may have further consequences for trade). Some country pair characteristics are time-invariant and may be controlled for through Fixed Effects (FE), e.g. distance, while others are time-varying and must be controlled for by means of time-varying control variables, e.g. GDP.

Another type of bias arises through the inter-linkages between the country pair and the outside world. For example, both bilateral trade and the probability of concluding a BIT may be influenced by economic activity in the region(s) where the countries are located. Just as in the case of time-varying characteristics, aspects that are (approximately) time-invariant during the sample period can be controlled for using country pair FE, e.g. the location of a country relative to various geographical centers of economic activity. Other influences from the world are time-varying and thus require time-varying controls to be held constant, e.g. the average level of FDI inflows into the country pair.

The paper utilizes panel data sets for country pairs and for country-commodity-pairs, in which data exists for each cross-sectional observation for several time periods. It is therefore possible to use country pair or country-industry-pair fixed FE (i.e. dyadic FE). This specification eliminates the unobserved time-invariant individual effect by time-demeaning the data with respect to mean of each variable for each pair in data set. It is most plausible that factors which pertain to each country pair and which are time-invariant exert an impact on both BIT policy and trade (for example the distance between the countries, shared colonial history and contiguity). The dyadic FE estimation is therefore naturally appealing. The panel data set also allows the application of time FE to control for time-varying factors that similarly affect all cross-sectional observations (e.g. the general tendency of bilateral trade-flows to increase during the sample period). A consequence of a FE estimation is that each coefficient expresses the average effect of an increase in the independent variable for a given country during the sample period (the so-called within estimator).

All the above concerns are applicable to hypotheses H_2 and H_3 , and for similar reasons the FE estimator is used here as well. These latter hypotheses are different from H_1 , however, as they concern how the impact from a BIT *depends* on variables used to capture relationship-specificity. Within the framework of a regression analysis, such interdependencies can be captured by creating interaction terms, in this case variables that are the product of BIT dummy and the chosen measure of relationship-specificity. By controlling for both the existence of a BIT and the relevant interaction term, it is possible to estimate what the additional impact is from a BIT given a higher value of relationship-specificity. To this end, equations (14), (15) and (16) below contain different interaction terms to capture such additional effects.

b) Regression specifications

Consider first H_1 according to which total bilateral exports between two countries on average should increase if they sign or ratify a BIT. This can be directly tested by regressing the value of total bilateral exports ($TotTrade_{it}$) on $BITSIG_{it}$ or $BITRAT_{it}$. As indicated above, country pair and time FE are applied together with a vector of con-

trols for time-varying country pair characteristics (X_{it}). Consequently, the econometric specification can be stated as follows:

$$TotTrade_{it} = \beta_0 + \beta_1 BIT_{it} + \beta_k X_{it} + u_{it} \quad (13)$$

β_0 corresponds to the intercept, β_1 is used to estimate the impact of BITs as BIT_{it} is either equal to $BITSIG_{it}$ or $BITRAT_{it}$.¹² β_k represents a vector of coefficients for the corresponding control variables in vector X_{it} . Finally, u_{it} is the error term. As country pair FE apply, all variables are time-demeaned. H_1 can be succinctly stated as implying that $\beta_1 > 0$.

Next, consider H_2 , which stipulated that $BITSIG_{it}$ and $BITRAT_{it}$ disproportionately and positively affect bilateral exports in intermediate goods which are relationship-specific. The dependent variable of interest is now $IntermedTrade_{it}$, which is defined as the value of exports of intermediate goods between the two countries. The most straightforward way to test the hypothesis is to divide intermediate goods in broad categories and define an index variable $Index_i$ which measures the (time-invariant) degree of relationship-specificity across the different categories. FE now apply to country-commodity-pairs, so that observations of exports between two particular countries in a particular category of intermediate goods constitutes one group. The specification then reads as follows:

$$InterTrade_{it} = \beta_0 + \beta_1 BIT_{it} + \beta_2 BIT_{it} * Index_i + \beta_k X_{it} + u_{it} \quad (14)$$

The interpretation of the variables and the coefficients is the same as in equation (13), but the interaction term $BIT_{it} * Index_i$ now captures the additional effect of the BIT-variable for the respective categories of intermediate goods that are considered. According to H_2 , it is expected that $\beta_2 > 0$ as $Index_i$ increases in relationship-specificity. The interaction term is time-varying since BIT_{it} is time-varying and it can thus be included in a FE estimation. As already indicated, the classification developed by Rauch (1999) will be used to define the Index variable (see section 3.5 below). The coefficient β_1 expresses the estimated impact from a BIT in the hypothetical case when the index is equal to zero, which is not very interesting in itself. In order to assess the net impact from the BIT on exports in intermediate goods, however, one must sum the coefficients.

The variable $Index_i$ only varies over eight different BEC of intermediate goods (see section 3.5 below). It is thus also possible - although less parsimonious - to estimate the regression specification separately for each BEC. The advantage of this approach is that it facilitates interpretation. By motive of that virtue, separate estimations are indeed reported for some specifications in section 4.2.

Finally, H_3 holds that the impact on bilateral exports of intermediate goods from $BITSIG_{it}$ and $BITRAT_{it}$ should depend positively on the skilled labour endowment and the capital stock of the exporter during the sample period. As above, the dependent variable of interest is $IntermedTrade_{it}$. To estimate the interaction effect of the BIT variable and the endowment variables, the two following interaction terms are defined: $BIT_{it} * Skille$ and $BIT_{it} * CapE$. $Skille$ measures the endowment of skilled labour

¹² As indicated above, the specification is estimated separately for the two dummy variables.

in the exporting country, defined as the gross tertiary enrollment, and $CapE$ measures the capital stock per worker in logarithmic form. The below specifications are then estimated:

$$IntermedTrade_{it} = \beta_0 + \beta_1 BIT_{it} + \beta_2 BIT_{it} * Skille_{it} + \beta_3 Skille_{it} + \beta_k X_{it} + u_{it} \quad (15)$$

$$IntermedTrade_{it} = \beta_0 + \beta_1 BIT_{it} + \beta_2 BIT_{it} * CapE_{it} + \beta_3 CapE_{it} + \beta_k X_{it} + u_{it} \quad (16)$$

The coefficients on $Skille$ and $CapE$ represent the impact from increased skilled labour and capital endowment on part of the exporter, while the interaction terms measure the additional impact on bilateral exports in intermediate goods when a BIT applies between the parties. Phrased differently, the coefficients express the estimated additional impact from a BIT given a higher skilled labour endowment and capital stock, respectively, on part of the exporter. Due to concerns of multicollinearity, the different interaction terms are not used in the same regression specification. According to H_3 , it is expected that $\beta_2 > 0$ in both regression specifications.

c) The interpretation of the BIT variable and standard errors

The dependent variables that correspond to different bilateral trade flows are in their original form stated as dollar values. For the purpose of the regression analysis, the variables are used in their logarithmic form. This is appropriate since the dependent variable is a large integer number and since no zeros are contained in the data set. Note that missing values are not treated as zeros (see the discussion regarding the treatment of missing values above). The advantages of using the logarithmic form are that the skewness of the dependent variable is reduced and that the BIT variable can be given a percentage interpretation (Wooldridge, 2009, p. 189 ff.). The impact on bilateral trade as measured in number of dollars may vary substantially across country pairs but the percentage change can be expected to exhibit less variation. For similar reasons, independent variables which correspond to large integer values enter the regression in logarithmic form (see section 3.5).

The independent variable of primary interest in the regressions below is a binary variable indicating whether a BIT has been concluded between the two countries. In particular, two binary variables are used to measure the existence of a BIT. The first variable ($BITSIG$) is equal to one if a BIT is signed between the two countries and is zero otherwise. On the other hand, the second variable ($BITRAT$) is unity if a BIT is both signed and ratified between the two countries and zero otherwise. High multicollinearity between the two binary variables prevents the simultaneous use of both in any particular specification. When the dependent variable, below the dollar value of trade flows, enters the specification in logarithmic form, while the independent variable is in linear form, the precise interpretation of the coefficient is somewhat involved. This paper follows the same approach as in Egger & Merlo (2007) and estimates the percentage effect of the BIT variable on bilateral trade flows as $100(e^{\hat{\beta}_k - 0.5\hat{V}_k} - 1)$. $\hat{\beta}_k$ is the estimated coefficient for the BIT-variable and $\hat{V}_k$ denotes the estimated variance of $\hat{\beta}_k$. For a dummy variable, this estimation technique is more appropriate than $100(e^{\hat{\beta}_k} - 1)$ (cf. Kennedy, 1981, and

van Garderen & Shah, 2002). A reasonable estimate can however normally be obtained by multiplication of the reported estimate with 100.

I want to allow for the possibility of heteroskedasticity, i.e. non-constant variance in the error term. Moreover, the error term may exhibit serial correlation for country pairs, i.e. $E(u_{it}, u_{is}) \neq 0$ for $t \neq s$. In order to treat these potential biases, Eicker-White standard errors that are clustered by country pairs are used for all estimations. This treatment mitigates both the problem of heteroskedasticity and the problem of serial correlation in the error term (Wooldridge, 2002).

d) Time-varying co-variates

From section 2.1.3, it is evident that several time-varying country pair characteristics can be expected to affect both bilateral trade flows and MNE activity. Through their impact on MNE activity, these variables may affect the probability of a BIT being signed or ratified, if it assumed that countries sign and ratify BITs with other countries that already have or are expected to become more attractive for FDI on behalf of their investors. In particular and for the below cited reasons, the following time-varying controls are used.

The sum of bilateral GDP (*GDPsum*) measures the combined market size of the two countries. In the knowledge-capital model, this variable has a positive impact on the probability of MNE activity. This effect has been confirmed in previous empirical research, and virtually all dyadic studies of the impact of BITs on FDI have used bilateral GDP as a control variable.¹³ It is also expected that the sum of bilateral GDP will exert a positive influence on aggregate trade flows.

In the knowledge-capital model, differences in GDP are expected to exert a negative influence on FDI (holding the relative skill-abundance between the two countries constant). Therefore, the squared difference in bilateral GDP is used e.g. by Carr et al. (2001). This paper follows the same approach and includes the variable *GDPdiffsq* to capture this effect.

The sum of bilateral populations measures the effect of increases or decreases in the sum of country pair populations *holding bilateral GDP constant* as the latter variable is included in the regression. To account for this effect, the variable *Popsum* is included in the regressions.

In the models presented in section 2.1.3, a crucial driver of vertical fragmentation is differences in factor endowments. It is well known that factor endowment differences also have an impact on trade flows through other mechanisms. For example, models of horizontal integration predict that horizontal integration will decrease in factor endowment differences (see section 2.1.3). To account for country differences in the skill-level of the labour force, the variable *Skilldiff* is included in the regressions. There is no uncontested measure for *Skilldiff*, but rather several proxy variables are possible. In the baseline case, the absolute value of the difference in the ratio of gross tertiary enrollment to the population is used as a proxy for *Skilldiff* (see section 3.5 below). The sensitivity to an alternative measure of *Skilldiff* is tested as a robustness check for some specifications (see section 3.4.2). As another measure of differences in factor endowments, the variable *Capitaldiff* captures the absolute value of the differences in

¹³ See for example Egger & Pfaffermayr (2004) and Egger & Merlo (2007).

capital stocks between the two countries.

As highlighted in the knowledge-capital model, it is also likely that FDI is affected by investment costs, in particular investment costs that arise from poor institutional quality. It is possible that BITs are partially concluded in order to mitigate such investment costs.¹⁴ As demonstrated by Nunn (2007), differences in institutional quality also carry a significant impact on trade patterns. Hence, it is relevant to include a measure of institutional quality. However, no acceptable proxy that was available for the entire sample period could be found. For this reason, controls for institutional quality are not introduced in the main regression specifications but implemented as a robustness check (see section 3.4.2 below).

The knowledge-capital model predicts that trade costs will induce horizontal FDI since horizontal fragmentation becomes more attractive if it is more expensive to serve the foreign market through exports. This insight is consistent with other models of horizontal replication (see section 2.1.3). In contrast, higher trade costs of the host country are expected to discourage vertical fragmentation as it becomes more expensive to fragment the value chain across countries. For this reason, the average tariff of the importing country *TariffI* and of the exporting country *TariffE* are used as proxies for the trading costs that pertain to the country pair.

It is plausible that the propensity to conclude a BIT is affected by the general trends of trade and FDI relative to the overall economy. To control for these influences, *Tradeopenavg* measures the average of bilateral trade openness (i.e. the average percentage of trade to GDP across the country pair) while *FDIopenavg* measures the average of bilateral FDI openness (i.e. the average of the analogous ratio of net FDI inflows to GDP).

The difference in real interest rates (*Realratediff*) is included in order to capture the potential comparative advantage of local financing, which may affect both trade and the probability of MNE activity.

It is possible that BITs are systematically concluded in conjunction with other instruments of trade policy. If so, the estimated effect of the BIT variable may reflect other effects than the effect of the BIT itself. For this reason, a binary variable *EU* is included which is unity in the case of common EU membership. With the 2004 and 2007 EU enlargements, twelve new countries joined the EU during the sample period. Given the comprehensive regulation of free movement within the EU, it is important to control for this change. It is even more imperative since a number of BITs between previous and new EU members were terminated following the EU enlargements (see section 2.1.1). For the same reason, four different binary variables are included to capture the effect of PTAs. They are unity if at least one PTA, Custom Union, Free Trade Area or Other Trade Instrument, respectively, exist between the country pair in a given year.

Finally, two interaction terms are used that have been derived within the framework of the knowledge-capital model. Firstly, the interaction of the absolute values of the GDP-difference and the skill-difference is included as *GDPdiffxSkillediff*. This term is expected to have a negative impact on MNE activity according to the knowledge-capital model (Carr et al, 2001).

¹⁴ Cf. Neumayer & Spess (2005) who found that BITs function as substitutes to good institutional quality.

Secondly, the interaction of the tariff of the importer and the squared country pair difference in skilled labour endowment is included as $TariffI \times Skilldiffsq$. The impact of this interaction term on MNE activity is expected to be negative according to the knowledge-capital model. The reason is that a higher cost of importing is expected to encourage horizontal MNE activity but not vertical MNE activity, and a higher skill-level difference implies that vertical motivations are more important relative to horizontal drivers.

A problem with the time-varying controls is that they are not available for each year and country pair, implying that observations inevitably will be lost as more time-varying variables are introduced in the regression. For this reason, in section 4, the results from the panel data regressions will in the main specifications be reported i) without any of the listed time-varying variables (*SpecI*), ii) with only the time-varying controls that correspond to GDP-terms, skilled labour endowment and PTA dummies (*BasicI*), and iii) with all time-varying control variables listed in this section except *InQdiff* (*BasicII*). In this way, the robustness of the results can be more thoroughly illuminated.

3.4.2 Robustness check and sensitivity analysis

If the estimated effects are robust across different empirical specifications, it strengthens the case that the coefficients reflect a real relationship. Hence, it is customary in empirical work to test alternative specifications. In this paper, five methods are devised to explore the robustness of the main regression specifications presented above. The robustness checks are specifically designed to mitigate the various endogeneity concerns.

Before proceeding any further, we should highlight the significant concern regarding possible reverse causality. It is for example possible that MNE:s lobby their governments to conclude BITs with countries wherein they have already made or purpose to make significant investments. In other words, the estimated impact from signing or ratifying a BIT may be biased since the effect partially corresponds to BITs being concluded with countries in which MNEs have already made or plan to make investments. One way to proceed is to use an instrumental variable (IV). Various IVs based on the number of BITs signed by neighbouring countries have been proposed (e.g. by Busse et al., 2008). But a valid IV must be both *relevant*, i.e. strongly correlated with the BIT-variable, and *exogenous*, i.e. satisfy the condition $Cov(z, \epsilon) = 0$ and not affect the dependent variable through a correlation with the error term. Assume that the decision of neighbouring countries to sign BITs influence country X 's propensity to do the same. If so, the effect should however also apply in the opposite direction so that the former variable is affected by other factors that have an independent impact on the propensity of country X to sign a BIT. In other words, it seems inevitable that this proposed IV is endogenous and that $Cov(z, \epsilon) \neq 0$. It is hard to imagine a measurable variable which is strongly correlated with the existence of a BIT between the two countries and otherwise is strictly exogenous with regard to trade patterns.

However, that the reverse causality problem is without remedy in the form of an adequate IV does not imply that it should be without regard. In particular, it is arguable that the problem can be mitigated by using lagged control variables as regressors. For example, by controlling for the lagged value of bilateral GDP it is possible to estimate the impact from the existence of a BIT holding past values of GDP constant. If the

decision to conclude a BIT is endogenous to the prior preferences of investors and their governments, these preferences should arguably be correlated with lagged values of GDP and other drivers of multinational activity. In other words, past realizations of these variables may influence both the conclusion of BITs and the dependent variable. Several of the below robustness checks thus involve lagged values of the dependent variable or independent variables. A limitation is that there are no clear a priori reasons for choosing a particular number of yearly lags. The results are robust to the inclusion of other lagged values, however. Due to the large number of missing values in the data set, the sample size decreases markedly if several lagged values are included simultaneously. The results appear to be unaffected by the simultaneous inclusion of several lags or by the inclusion of lags of greater magnitude than five, other than through smaller sample size. Considering that the data set only comprises eighteen years and after experimenting with various number of lagged years, it was decided to report the results when using one and five year lagged values. Further estimation results are provided by request from the author.

The five robustness checks are as follows.

a) Spill-over effects from the average number of BITs concluded by the two countries and alternative specifications of the BIT variable

Firstly, controls are introduced for the average total number of BITs that have been signed and ratified, respectively, by the two countries for each country pair and year. This is measured through the variable *BITAVG*. The rationale for this robustness check is that the decision to conclude a BIT between the two countries may be part of a broader trend in BIT policy which has an independent effect on MNE activity and trade. In particular, it is conceivable that a country can signal its commitment to the protection of foreign investments by concluding more BITs, regardless of whether the treaties are directly applicable to the particular investor (cf. Neumayer & Spess, 2005). It is also possible that a larger total number of BITs concluded by a country will spur economic activity which is beneficial to further MNE investments. The inclusion of *BITAVG* allows a preliminary assessment of such between country pair effects and the estimation of the effect of a bilateral BIT holding the average total number of BITs applicable to the country pair constant. However, the results must be interpreted with caution considering the likely strong correlation between *BITAVG* on the one hand and *BITSIG* or *BITRAT* on the other.

The regression is also run using lagged values of the BIT variable. This enables an assessment of whether the impact from the signing or ratification of a BIT remains positive and statistically significant over time. However, the likelihood of serial correlation in the idiosyncratic error term implies that the coefficient of the latter variable should be interpreted with caution. In particular, it may be the case that past values of the realizations of the independent variables are correlated with the error term in that period. If the error terms exhibit serial correlation, this effect will impact the dependent variable in future periods. Hence, one shall for example not infer that the impact from a BIT is causal if its lagged value can be established to have a statistically significant effect on the dependent variable in the present period.

b) Different effects depending on OECD-membership

Secondly, the paper also explores whether the regression results are sensitive to which

country pairs that are included in the regression estimation. In particular, three categories of country pairs are considered: pairs in which both countries are OECD members, pairs in which only one country is an OECD member and pairs in which no country is an OECD member. It is plausible that the results are dependent on whether the included country pairs differ substantially in factor endowments, as OECD and non-OECD members disproportionately should (cf. section 2.1.3 and the drivers of vertical fragmentation discussed in that section). As outlined in section 3.5, a further motivation for this robustness check is that data for the control variables is systematically missing for the pairs featuring non-OECD countries to a larger extent than for other country pairs.

c) Sensitivity to the inclusion of lagged control variables

Thirdly, lagged values of the control variables are introduced in order to mitigate the problem of reverse causality. As stated above, if the BIT-variable carries an impact on bilateral trade flows even when past values of e.g. *GDPsum* are controlled for, it speaks to the robustness of the result.

d) Dynamic model estimation

In addition to lagged values of the independent variables, one may test the robustness of the results by introducing lagged values of the dependent variables (so-called dynamic model estimation). In the regressions which this paper features, the dependent variable is a measure of bilateral exports. The rationale for testing the effect of the BIT-variable while holding past values of bilateral exports constant is that the latter variable may affect both current exports and the propensity to conclude a BIT between the countries in the pair. Concretely, countries that trade more in a past period may be more likely to trade extensively in the present period and also more likely to conclude a BIT.

As shown by Nickell (1981), a FE estimation containing a lagged dependent variable (LDV) gives rise to an inconsistency because of the correlation between the LDV and the individual FE. For this reason it may be of interest to consider the alternative GMM estimator which has been developed by Arellano and Bond (1991), but this estimator requires that there is no autocorrelation in the idiosyncratic error. This requirement is rejected at the one percent level in the sample. Given this, the OLS estimator is implemented. It should also be kept in mind that data set features a fairly long sample period of eighteen years (see section 3.5 below). The bias of the ordinary FE estimator is decreasing in a larger T.

e) Institutional quality and different proxy variables for Skilldiff

Finally, it is tested whether the results are sensitive to the introduction of a control for country pair differences in institutional quality *InstitutionalQ*, the measure for the latter variable is the *Rule of law index* as reported in Worldwide Governance Indicators of the World Bank. The *Rule of law index* is designed to capture the extent to which society's rules enjoy confidence and compliance. The perceived quality of property rights, contract enforcement, the police and courts carry great weight in the construction of the index. In order to improve the representativeness of the index, it is based on surveys of firms and households as well as assessments of various private and public sector entities. It is strongly positively correlated with the other indicators of governance quality in the Worldwide Governance Indicators (Kaufmann et al., 2010).

The rationale for including the country pair difference in the *Rule of law index* should be clear. Governance quality, in particular contract enforcement, is likely to influence the non-commercial risk faced by MNEs. The selection of this particular index was largely made on the basis that it accounts specifically for contract enforcement. It should also be recalled, as stated above, that other measures of governance correlate strongly with the index. Hence, the measured country pair difference in the index may influence both the probability of vertical integration and the probability of the conclusion of a BIT. In fact, it might be argued that the measure is so important that it should be included among the control variables of the main specification. The problem is that the index is only available for every second year for the period 1996 to 2002 and not for 1995. Even though the variable is available for a large number of countries, its inclusion in the main regressions would induce a large loss of observations since four out of eighteen years would disappear from the sample (and even more in specifications that employ lagged values of the variables). It should also be considered that institutional quality differences which are time-invariant are controlled for due to the FE estimation technique. Balancing these different factors, it was decided to omit the *InstitutionalQ* variable from the main specifications and only use it in this robustness check. The regression results from this robustness check indeed indicate that the results are fairly stable to the inclusion of this control variable when the loss of observations is disregarded (compare tables 11, 22, 34 and 35).

For the regressions that pertain to the interaction effect between the existence of a BIT and the skilled labour endowment of the exporter, it is also tested whether the interaction effect is robust to using net secondary enrollment (*Skilldiff*₂) instead of gross tertiary enrollment (*Skilldiff*₁) as a measure of human capital endowment. This robustness check is implemented with the consideration that no measure of institutional quality can be identified as the most representative on a priori grounds. If the results are robust to the choice of proxy variable, it strengthens the case for their robustness.

3.5 Data and sources

This section provides an overview of the data which is used to measure the different variables that are required in the econometric specifications as defined in section 3.4. Summary statistics are also provided together with a discussion regarding missing values.

a) Data sources

It has already been indicated that the existence of a BIT is measured through whether a BIT is signed (*BITSIG*) or signed and ratified (*BITRAT*) between the two countries in a given year. The average number of BITs that a country pair is subject to in a given year is measured in an analogous manner, and two variables are defined for the number of signed and ratified BITs, respectively, *BITAVG* and *BITAVGrat*. The underlying data is extracted from UNCTAD's International Investment Agreement Navigator (UNCTAD, 2015). A small number of BITs (specifically, 47) have been terminated without being superseded by a new BIT between the parties. Those BITs which merely have been unilaterally denounced, as opposed to terminated by consent, have been counted as remaining in force as investments remain protected by the treaty during a grace period.

The dependent variable of relevance for the three hypotheses concern country-level

data on bilateral commodity exports. Given the nature of H_2 and H_3 , the trade data must be possible to disaggregate into broad categories. The classification that is used in this paper and that allows such disaggregation is Broad Economic Categories (BEC). BEC was developed by the United Nations Statistics Division and the first classification was issued in 1971. It has since been revised four times, most recently in 1988 (UN, 2002). BEC contains seven main categories, namely (1) food and beverages, (2) industrial supplies not elsewhere specified, (3) fuels and lubricants, (4) capital goods (except transport equipment) and parts and accessories thereof, (5) transport equipment and parts and accessories thereof, (6) consumer goods not elsewhere specified and (7) goods not elsewhere specified. Each top category is subdivided into further categories depending on end-use. Data concerning bilateral trade flows, designated according to the BEC categories, is available for most countries for the period after 1995. It can be easily extracted from the United Nations Commodity Statistics Database (United Nation, 2015a).

In the data sets used to test H_1 , H_2 and H_3 , each observation corresponds to the exports from one country to another in a given year during the sample period 1995-2012. For each year, any pair of two countries occurs twice. A first pair features country A as exporter, while a second pair features country B in that capacity. In this way, two-way trade flows between the countries are captured. FE pertain to each such pair in each commodity type.

From BEC data, the dependent variables of concern for the first three hypotheses are defined as follows. $TotTrade_{it}$, the dependent variable when testing H_1 , is measured as the sum of all BEC categories. $IntermedTrade_{it}$ incorporates the BEC categories in table 1 below. These are the categories classified as “Intermediate” by the United Nations (2011). Both $TotTrade_{it}$ and $IntermedTrade_{it}$ enter the regression specifications in logarithmic form. Because of the high level of aggregation, all the reported values the trade variables are larger than zero. For several country pairs, data for exports (as reported by the exporter) is missing due to e.g. lack of reporting on behalf of the states (United Nations, 2015a). Given the high level of aggregation of the trade statistics, it is obvious that the large number of missing values correspond to positive trade flows. It is hence not appropriate to replace missing values with a very low positive value, as one may do when the missing value concern a very specific goods category and can be assumed to be approximately equal to zero. In order to mitigate the problem of non-random missing values, exports have in such cases whenever possible been measured as the imports reported from the opposite country.

As a proxy for the relationship-specificity of the enumerated broad categories of intermediate goods, the paper relies on the extent to which they are sold on an organized exchange, reference priced in trade publications or neither according to the classification developed by Rauch (1999). The reasoning is analogous to that of Nunn (2007), who argued that the hold-up problem is alleviated if the buyer or seller can turn to an alternative party (cf. the model in section 3.1). This is easily done if the good is sold on an organized exchange and price re-negotiations are not likely under such circumstances. If it thus reasonable to view goods sold on an organized exchange as possessing a low level of relationship-specificity. Goods that are not sold on an organized exchange but referenced priced can arguably be characterized as partially relationship-specific since the market for such goods must be of a certain size for a trade publication to be issued. A relatively high degree of relationship-specificity is assumed for goods that are neither sold on organized exchange nor referenced priced. The intuition is that goods in this

category are expected to be more differentiated and the space for relationship-specific investments thus larger.

Rauch's (1999) classification pertained to 1,189 industries at the 4-digit SITC (Standard International Trade Classification) Revision 2. Each of the industries was designated as belonging to category e for sold on an organized exchange, r for being referenced priced and n for being neither. The categories are mutually exclusive.

For the purpose of this paper, these industries have been related to the different BECs in table (1).¹⁵ The index of relationship-specificity ($Index_{1i}$) utilized in order to test H_2 is defined as the fraction of all industries pertaining to the specific BEC category which is coded as being neither sold on an organized exchange nor reference priced. For the purpose of sensitivity analysis, an alternative $Index_{2i}$ variable is defined as the fraction that is not sold on an organized exchange.¹⁶ Consequently, each of the eight categories of intermediate goods is assigned a value representing the share of industries which pertain to the category that is considered relationship-specific. The values range from 27.1 percent to 100 percent and are displayed in the table below.

Table 1 **Broad Economic Categories of Intermediate Goods**

BEC number	Category	$Index_1$	$Index_2$
111	<i>Food and beverages, primary, mainly for industry</i>	27.59	44.83
121	<i>Food and beverages, processed, mainly for industry</i>	42.86	62.86
21	<i>Industrial supplies not elsewhere specified, primary</i>	27.63	60.53
22	<i>Industrial supplies not elsewhere specified, processed</i>	50.56	90.53
31	<i>Fuels and lubricants, primary</i>	33.33	66.67
322	<i>Fuels and lubricants, processed (other than motor spirit)</i>	33.33	66.67
42	<i>Parts and accessories of capital goods</i>	93.67	98.73
53	<i>Parts and accessories of transport equipment</i>	100	100

The below table details the sources of the country pair and country time-varying characteristics used as co-variates. The underlying data is obtained from familiar sources. The sum of bilateral GDP ($GDPsum$) is measured as the logarithm of the sum of country pair GDP.

The bilateral population sum ($Popsum$) is measured as the logarithm of the sum of the country pair populations in a given year and counts all country residents regardless of legal status. The underlying data is obtained from the World Bank Indicators. The difference in bilateral capital stock ($Capitaldiff$) is measured according to PPP in millions 2005 dollars. The underlying data is obtained from the *Penn World Table* (Feenstra et al., 2015). Regarding the difference in real interest rates ($Realratediff$), the underlying data is from the World Bank and concerns the per country lending interest rate adjusted for inflation according to the GDP deflator. The trade openness for the country pair ($Tradeopenavg$) is measured as the average share of trade (the sum of

¹⁵ The official conversion table available on the United Nations Statistics Division website has been used for this purpose (United Nations, 2015b).

¹⁶ Following Nunn (2007), and in order to save space, the paper uses the "liberal" version of Rauch's (1999) classification for the regressions; however the results are equivalent when the "conservative" version is used.

exports and imports) to GDP. The underlying data is collected from the World Bank. Similarly, the FDI openness for the pair ($FDIopenavg$) is defined as the average share of FDI net inflows into the countries. For the PTA variables, the source used by this paper is DESTA (Design of Trade Agreements), which provides data on the existence of the various types of PTAs (Dür et al., 2014).

Table 2 **Time-varying control variables**

Variable	Description	Source
$GDPsum$	Log of the sum of GDP	<i>World Bank</i>
$GDPdiffsq$	Squared difference in GDP	<i>World Bank</i>
$Skilldiff_1$	Difference in gross tertiary enrollment	<i>World Bank</i>
$Skilldiff_2$	Difference in net secondary enrollment	<i>World Bank</i>
$Popsum$	Log of the sum of country pair populations	<i>World Bank</i>
$TariffI/E$	Applied, weighted mean tariff rate for all products	<i>World Bank</i>
$Capitaldiff$	Log of difference in capital stocks	<i>Penn World Table</i>
$Realratediff$	Difference in real interest rates	<i>World Bank</i>
$InQdiff$	Difference in rating according to Rule of Law index	<i>World Bank</i>
$Tradeopenavg$	Average share of trade to GDP	<i>World Bank</i>
$FDIopenavg$	Average share of FDI net inflows to GDP	<i>World Bank</i>
PTA	Dummy for shared membership in a PTA	<i>DESTA</i>
CU	Dummy for shared membership in Custom Union	<i>DESTA</i>
FTA	Dummy for shared membership in Free Trade Agreement	<i>DESTA</i>
$OtherPTA$	Dummy for shared membership in another Trade Agreement	<i>DESTA</i>
EU	Dummy variable for shared EU membership	<i>World Bank</i>

b) Summary statistics and missing values

It is valuable to illustrate the data availability for the bilateral trade variable and for the different control variables as well as their respective statistical properties in the sample. To this end, summary statistics are provided in tables (3), (4) and (5). As indicated above, three different datasets are used to test the three hypotheses. It follows that the summary statistics are different for each hypothesis and the tables present summary statistics for each hypothesis in turn. As can be seen, the number of observations is much larger for the datasets which concern H_2 and H_3 . The reason is, of course, that these data sets contain country commodity pairs for the different categories of intermediate goods and not just country pairs. It should moreover be noted that the data sets used to test H_2 and H_3 are virtually identical.

As is clear from the tables, due to missing values the number of observations differ quite substantially on the basis of which variable we consider. Missing values imply a lower number of useful observations and hence larger standard errors. This is not necessarily very problematic in the present context as the number of observations is very large. A more serious problem is that values may be missing non-randomly, so that data availability is lower for particular categories of countries. This may be illuminated by comparing the data availability on the basis of OECD membership, a country type classification on which I have data. As mentioned in section 3.4.1, three

Table 3 Summary statistics with regard to H_1

Variable	Obs	Mean	Std.Dev.	Min	Max
<i>TotTrade</i>	430 700	13.792	4.137	0	25.320
<i>GDPsum</i>	834 724	24.870	2.042	17.433	30.891
<i>GDPdiffsq</i>	834 724	2.00e+24	1.59e+25	0	2.82e+26
<i>Skilldiff₁</i>	317 380	25.787	20.290	0	117.81
<i>Popsum</i>	905 058	16.744	1.615	9.931	21.674
<i>TariffI/E</i>	474 767	7.453	9.730	0	254.58
<i>Realratediff</i>	429 106	12.567	25.504	0	583.033
<i>InQdiff</i>	503 580	1.143	0.826	0	4.626
<i>Tradeopenavg</i>	725 322	86.354	36.785	7.170	423.518
<i>FDIopenavg</i>	709 108	4.404	7.374	-57.620	233.408
<i>Capitaldiff</i>	538 824	12.361	2.228	-0.476	17.628

Table 4 Summary statistics with regard to H_2

Variable	Obs	Mean	Std.Dev.	Min	Max
<i>IntermedTrade</i>	1 374 947	12.137	3.885	0	25.284
<i>GDPsum</i>	1 256 790	26.549	1.682	19.611	30.829
<i>GDPdiffsq</i>	1 256 790	6.27e+24	2.89e+25	0	2.64e+26
<i>Skilldiff₁</i>	689 791	28.725	20.784	0	114.5
<i>Popsum</i>	1 327 834	17.624	1.386	10.969	21.674
<i>TariffI/E</i>	914 489	5.684	7.009	0	254.58
<i>Realratediff</i>	781 067	10.331	24.099	0	583.033
<i>InQdiff</i>	1 005 294	1.241	0.870	0	4.626
<i>Tradeopenavg</i>	1 228 485	87.692	40.695	8.557	423.518
<i>FDIopenavg</i>	1 235 816	4.738	7.833	-41.803	233.408
<i>Capitaldiff</i>	996 772	13.701	1.941	1.026	17.628

main specifications are employed. The first (*SpecI*) utilizes no time-varying control variables, while *BasicI* and *BasicII* include different sets of control variables. In section 4 below it becomes apparent that a large number of observations are lost when including progressively more control variables (which is not surprising considering the data on variable availability presented in this section). In order to investigate which countries that we lose, I compute the percentage of observations where less than both countries are OECD members for each specification and each data set. The percentages for the second and third data sets are identical to the second decimal and hence not presented separately. For the first data set, used to test hypothesis H_1 , I find that the percentage is 0.96 for the regression pertaining to *SpecI*, 0.93 for the regression that utilizes *BasicI* and 0.88 for the regression that utilizes *BasicII*. For the data sets used to test H_1 and H_3 , the corresponding percentages are 0.92, 0.87 and 0.81.

This indicates that data availability is systematically worse for low income countries and that country pairs that contain such countries are progressively less represented

Table 5 **Summary statistics with regard to H_3**

Variable	Obs	Mean	Std.Dev.	Min	Max
<i>IntermedTrade</i>	1 377 053	12.136	3.885	0	25.281
<i>GDPsum</i>	1 258 821	26.549	1.683	19.611	30.829
<i>GDPdiffsq</i>	1 258 821	6.27e+24	2.89e+25	0	2.64e+26
<i>Skilldiff₁</i>	690 808	28.751	20.804	0	114.5
<i>Skilldiff₂</i>	334 081	21.690	20.668	0.002	97.183
<i>Popsum</i>	1 329 940	17.624	1.385	10.969	21.674
<i>TariffI/E</i>	916 283	5.680	7.004	0	254.58
<i>Realratediff</i>	781 067	10.331	24.099	0	583.033
<i>InQdiff</i>	1 007 400	1.243	0.872	0	4.626
<i>Tradeopenavg</i>	1 228 485	87.698	40.681	8.557	423.518
<i>FDIopenavg</i>	1 237 916	4.737	7.849	-41.803	233.408
<i>Capitaldiff</i>	998 785	13.709	1.941	1.026	17.628

in the sample as more control variables are introduced. This is the more problematic as low income countries are of specific interest to the analysis due to the role of factor endowment differences as a driver of integration. The paper will partially address this problem by estimating the regressions for different segments in the sample on the basis of OECD membership (see section 3.4.2 above).

4 Results

In this section, the methods outlined in section 3.4 are implemented and the results obtained from the various specifications are presented. Sections 4.1, 4.2 and 4.3 concern H_1 , H_2 and H_3 respectively. For each hypothesis, the results from both the main specification and the various robustness checks are reported.

The regression tables should be read with the following in mind. The p-values associated with statistical significance have been chosen conservatively. Given the large number of observations, it is expected that robust correlations in the data should be very significant and accordingly high p-values should be required. Specifically, one star in the regression tables denote a p-value below 0.05, two stars denote a p-value below 0.01 and three stars denote a p-value below 0.001. In order to enable a straightforward evaluation of the statistical significance under less restrictive p-values, the t-values are provided in parentheses directly below the corresponding coefficients. In order to give a more comprehensive picture of the precision of the estimates, standard errors are provided in a second parentheses under the corresponding coefficient. In order to save space, standard errors are only reported for the BIT variables and not for control variables, however. All standard errors are robust to heteroskedasticity and clustered by country pairs.

In order to save space, the estimates for time-varying control variables are omitted in most of the regression tables. However, the estimated coefficients for the control variables are reported in the regressions that concern the main specification for each hypothesis. This is done in order to give a picture of the extent to which the control variables correlate with the dependent variable.

Whenever the coefficients for control variables are omitted, columns are labeled *SpecI*, *BasicI* or *BasicII*. This designates three different econometric specifications, namely a specification without any time-varying control variables (*SpecI*) and the specifications which apply the time-varying controls contained in the sets *BasicI* and *BasicII* respectively (cf. section 3.4.1). Time and dyadic FE apply to all regression results reported in this section. *BasicII* is the preferred specification as it includes the largest set of time-varying controls. It is hence used consistently for the robustness checks. For the robustness checks that involve lagged values of the dependent variable, results for *BasicI* are however also reported in footnotes due to the bias demonstrated by Nickell (1981) which increases in a lower number of time periods.

For reasons of typographical convenience, the dependent variable *IntermedTrade* is abbreviated as *IntTrade* in the below regression tables.

4.1 The impact from BITs on aggregate bilateral exports

4.1.1 Main specification

Table (6) below presents the regression results that concern the main specification pertaining to H_1 . The dependent variable (*TotTrade*) is total bilateral exports in logarithmic form. Each observation corresponds to trade between a country pair in a

given year, and exports in the respective directions are recorded as separate observations.

The BIT variable is *BITSIG* in the first three columns, while the three latter columns report the estimated effect for *BITRAT*. The estimation results indicate a positive impact from the signing and ratification of BITs on total bilateral exports, ranging from 16.6 to 47 percent when estimated according to the formula $100(e^{\hat{\beta}_k - 0.5\hat{V}_k} - 1)$ (cf. section 3.4.1). A more straightforward method, which gives an acceptable approximation, is however to simply multiply the estimated coefficients in the tables with 100. Notice that columns (1) and (4) only apply time and dyadic FE, while columns (2) and (5) feature the time-varying controls in *BasicI*; columns (3) and (6) contain the larger set of time-varying control variables in the set *BasicII*.

The very large estimated impact from a BIT when no time-varying controls are applied indicates a substantial correlation between the conclusion of BITs and increased bilateral trade. Due to the endogeneity concerns discussed in section 3.4, however, one should be careful in rendering such results a causal interpretation. Indeed, the estimated coefficient is substantially smaller when no time-varying controls are applied.

4.1.2 Robustness check

The five robustness checks described in section 3.4.2 are now implemented for the estimation of the impact of the BIT-variable on total bilateral exports.

a) Alternative specifications for the BIT-variable

It is firstly tested whether the results are robust to the inclusion of the variable *BITAVG* and *BITAVGrat*, using the control variables in the set *BasicII*.¹⁷ As discussed in section 3.4, it is a matter of concern that on average BITs between a country pair may have been concluded in conjunction with BITs pertaining to third state parties. This is potentially problematic as the total number of BITs concluded by the country pair may, in turn, have spill-over effects on bilateral investment and trade. Table (7) reveals that the estimated impact from a BIT between two countries and their bilateral trade is substantially smaller when the controls for *BITAVG* and *BITAVGrat* are used (cf. columns 3 and 6 in table 6). It should also be pointed out that these variables themselves are predicted to exert a positive impact on total bilateral exports equal to about one percent.

Table (7) also reports estimates for the impact from a BIT between the country pair when the BIT is specified as a one year (*BitsigLag1*/*BitratLag1*) or a five year (*BitsigLag5*/*BitratLag5*) lagged variable. The coefficients of columns (2), (3), (5) and (6) express the estimated impact on bilateral exports from a BIT that was signed and ratified, respectively, one or five years earlier. One should remember in this context that virtually all BITs that have been signed or ratified remain operational or have been replaced by new BITs in the sample. Hence, the coefficients for these lagged variables can approximately be interpreted as the impact from the conclusion of a BIT one and

¹⁷ Recall that *BITAVG* represents the average number of BITs signed by the country pair in specifications that concern *BITSIG* and that *BITAVGrat* represents the average number of BITs in force for the specifications that concern *BITRAT*.

Table 6 Regression results of the impact from BITs on total exports

	(1)	(2)	(3)	(4)	(5)	(6)
	TotTrade	TotTrade	TotTrade	TotTrade	TotTrade	TotTrade
BITSIG	0.392*** (15.76) (0.0249)	0.268*** (8.83) (0.0304)	0.184*** (3.87) (0.0476)			
BITRAT				0.338*** (14.62) (0.0231)	0.256*** (9.58) (0.0267)	0.154*** (3.78) (0.0407)
GDPsum		0.785*** (24.26)	0.808*** (14.04)		0.793*** (24.50)	0.810*** (14.05)
GDPdiffsq		1.13e-27* (2.17)	-8.38e-29 (-0.10)		1.10e-27* (2.11)	-1.10e-28 (-0.14)
Skilldiff		0.000392 (0.53)	-0.00334 (-0.24)		0.000502 (0.68)	-0.00325 (-0.23)
EU		0.280*** (7.95)	0.133** (2.66)		0.273*** (7.77)	0.130** (2.61)
PTA		0.987 (1.80)	-0.354* (-2.31)		0.986 (1.79)	-0.359* (-2.34)
FTA		0.0332 (0.84)	0.0151 (0.27)		0.0270 (0.68)	0.0148 (0.26)
CU		0.874** (2.99)	1.914** (2.75)		0.862** (2.95)	1.914** (2.75)
OtherPTA		0.0808* (2.56)	0.0496 (1.14)		0.0731* (2.31)	0.0475 (1.10)
GDPdiffxSkilldiff			0.000102 (0.19)			0.000102 (0.19)
TariffI			-0.0221*** (-4.86)			-0.0223*** (-4.89)
TariffE			-0.0181*** (-4.35)			-0.0183*** (-4.40)
TariffExSkilldiffsq			0.00000499* (2.47)			0.00000491* (2.43)
Capitaldiff			0.0103 (0.35)			0.0110 (0.38)
Realratediff			-0.00122 (-1.19)			-0.00117 (-1.14)
Popsum			-0.984** (-2.60)			-0.981** (-2.59)
Tradeopenavg			0.0110*** (8.41)			0.0109*** (8.36)
FDIopenavg			0.000869 (0.40)			0.000878 (0.41)
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Observations	430700	180497	45130	430700	180497	45130
R ²	0.078	0.129	0.166	0.078	0.129	0.166

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 **Regression results of the impact from BITs on total exports: robustness check, different specifications of the BIT variable**

	(1)	(2)	(3)	(4)	(5)	(6)
	TotTrade	TotTrade	TotTrade	TotTrade	TotTrade	TotTrade
BITSIG	0.143** (2.97) (0.0482)					
BitsigLag1		0.138** (3.21) (0.0429)				
BitsigLag5			0.106** (3.23) (0.0329)			
BITRAT				0.114** (2.75) (0.0415)		
BitratLag1					0.102** (2.61) (0.0392)	
BitratLag5						0.0732* (2.34) (0.0312)
BITAVG	0.0132*** (4.44) (0.00296)	0.0131*** (4.43) (0.00296)	0.0134*** (4.58) (0.00294)			
BITAVGrat				0.0108*** (4.01) (0.00269)	0.0109*** (4.05) (0.00268)	0.0112*** (4.21) (0.00266)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	6.583 (0.96)	6.568 (0.95)	5.841 (0.85)	5.115 (0.73)	4.904 (0.7)	4.426 (0.63)
Observations	45130	45130	45130	45130	45130	45130
R^2	0.167	0.167	0.167	0.166	0.166	0.166

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

five years ago which remains in effect today. The estimated positive impact from a BIT is robust to these modifications, although the coefficient is smaller in magnitude when a lagged specification of the BIT variable is applied.

b) Different effects depending on OECD-membership

The regression analysis is now replicated separately for the observations which concern country pairs where one, both or none of the countries are OECD members. The time-varying co-variables in *BasicII* are retained. As stated in section 3.4, it is consistent with the current literature to expect that BITs have a larger average impact on bilateral trade between countries that differ substantially in factor endowments.

Table (8) presents the estimated impact from *BITSIG* and *BITRAT* for the separate categories of country pairs. Columns (1) and (4) report the results for country pairs where only one party is an OECD member, columns (2) and (5) correspond to country pairs where both countries are OECD members and columns (3) and (6) present results for country pairs where neither country is a member of the OECD. The estimated impact from merely signing a BIT is not statistically significant for any of the three groups. In contrast, the effect of ratifying a BIT is statistically significant for country pairs in which only one state is an OECD member. Another result that merits recognition is that the impact from *BITAVG* and *BITAVGrat* is estimated as being negative with statistical significance for country pairs in which both states are OECD members. In other words, bilateral trade is predicted to decrease when such country pairs sign or ratify more BITs with third parties.

Table 8 **Regression results of the impact from BITs on total exports: different impact depending on OECD membership?**

	(1)	(2)	(3)	(4)	(5)	(6)
	TotTrade 1 OECD	TotTrade 2 OECD	TotTrade 0 OECD	TotTrade 1 OECD	TotTrade 2 OECD	TotTrade 0 OECD
BITSIG	0.110 (1.87) (0.0588)	0.155 (1.89) (0.0817)	0.138 (1.44) (0.0963)			
BITAVG	0.0146*** (3.69) (0.00396)	-0.0148*** (-4.69) (0.00316)	0.0335*** (4.19) (0.00801)			
BITRAT				0.149** (2.96) (0.0504)	0.0283 (0.51) (0.0554)	0.0366 (0.40) (0.0924)
BITAVGrat				0.0164*** (4.72) (0.00347)	-0.0124*** (-3.93) (0.00315)	0.0221** (2.85) (0.00775)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	27.77** (2.96)	9.252 (0.46)	-1.148 (-0.10)	23.89* (2.49)	4.618 (0.23)	-4.495 (-0.37)
Observations	21225	5608	18297	21225	5608	18297
R^2	0.178	0.400	0.155	0.179	0.398	0.154

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

c) *Sensitivity to the inclusion of lagged control variables*

In table (9), it is tested whether the estimated impact from concluding a BIT is robust to the inclusion of lagged values of the control variables in *BasicII*. Columns (1) and (4) show the results when including one year lagged values of the controls, while columns (3) and (6) include five year lagged values. Since the inclusion of five year lagged variables involve a large loss in number of observations, columns (2) and (5) estimate the regressions without the lagged control variables for the same observations. In this way the reader may infer whether the inclusion of the lagged control variables is significant in its own right or merely through the loss of observations in the sample. In each of the enumerated regressions, the estimated impact from *BITSIG* remains positive, while the estimated impact from ratifying a BIT becomes insignificant at the five percent level when applying the one or five year lagged values of the control variables. However, the estimated impact remains positive at the ten percent level, as can be inferred from the t-value.

Table 9 **Regression results of the impact from BITs on total exports: robustness check, lagged control variables**

	(1)	(2)	(3)	(4)	(5)	(6)
	TotTrade	TotTrade	TotTrade	TotTrade	TotTrade	TotTrade
BITSIG	0.148*	0.186**	0.157*			
	(2.21)	(2.66)	(2.34)			
	(0.0671)	(0.0700)	(0.0669)			
BITAVG	0.00273	-0.00277	-0.00184			
	(0.64)	(-0.58)	(-0.40)			
	(0.00427)	(0.00473)	(0.00463)			
BITRAT				0.109	0.135*	0.106
				(1.92)	(2.10)	(1.68)
				(0.0569)	(0.0645)	(0.0631)
BITAVGrat				0.00229	-0.00449	-0.00385
				(0.63)	(-1.11)	(-0.95)
				(0.00363)	(0.00403)	(0.00404)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Lagged control variables	1 year	NO	5 year	1 year	NO	5 year
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	17.92	21.14	9.940	17.72	22.39	11.42
	(1.54)	(1.63)	(0.73)	(1.52)	(1.72)	(0.83)
Observations	25073	16067	16067	25073	16067	16067
R^2	0.199	0.280	0.288	0.199	0.280	0.288

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

d) *Dynamic model: lagged dependent variable*

In order to further test the robustness of the coefficients, the one and five year lagged values of the dependent variable, i.e. total bilateral exports *TotTrade*, are introduced in

the regression. As can be seen in table (10), the results remain statistically significant. The one year lagged value of the dependent variable is strongly statistically significant and economically large, while the five year lagged value is negative and statistically significant. When the regressions were run with the control variables in *BasicI*, the coefficients were smaller in magnitude but qualitatively similar.¹⁸

Table 10 **Regression results of the impact from BITs on total exports: robustness check, lagged values of the dependent variable**

	(1)	(2)	(3)	(4)
	TotTrade	TotTrade	TotTrade	TotTrade
BITSIG	0.144** (3.19) (0.0451)	0.181** (2.97) (0.0610)		
BITAVG	0.0108*** (3.34) (0.00324)	0.00734 (1.51) (0.00486)		
BITRAT			0.105** (2.64) (0.0396)	0.116* (2.00) (0.0579)
BITAVGrat			0.00647* (2.20) (0.00294)	0.00193 (0.43) (0.00449)
TotTradeLag1	0.199*** (14.18)		0.199*** (14.25)	
TotTradeLag5		-0.0517*** (-4.57)		-0.0515*** (-4.55)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	-5.967 (-0.88)	8.465 (0.87)	-6.147 (-0.89)	9.186 (0.93)
Observations	40559	31379	40559	31379
R^2	0.209	0.162	0.209	0.162

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

e) Sensitivity to controls for institutional quality

It is finally tested whether the results are robust to controls for the difference in

¹⁸ When the control variables in *BasicI* were used, the following results were obtained. The coefficients for *BITSIG* were equal to 0.106 and 0.125, while the coefficients for *BITRAT* were 0.089 and 0.098. The coefficients in the regressions involving one year lagged values of the dependent variables were significant at the $p < 0.001$ level, while the coefficients in the regressions involving five year lagged values of the dependent variables were significant at the $p < 0.01$ level.

institutional quality between the countries (as measured by the variable *InQdiff*).¹⁹ Table (11) reports the estimated coefficients for the regression specification that contains the control variables in *BasicII* when *InQdiff* is included as compared to the estimated coefficients otherwise when the regression is applied to the same observations. The results are roughly robust to this modification. The variable *InQdiff* is strongly negatively correlated with total bilateral exports. It should however be remembered that *InQdiff* ranges from 0 to 4,6 in the sample (section 3.5).

Table 11 **Regression results of the impact from BITs on total exports: robustness check, the difference in institutional quality**

	(1)	(2)	(3)	(4)
	TotTrade	TotTrade	TotTrade	TotTrade
BITSIG	0.140* (2.38) (0.0586)	0.142* (2.42) (0.0587)		
BITAVG	0.0122** (2.96) (0.00412)	0.0117** (2.84) (0.00411)		
BITRAT			0.115* (2.31) (0.0500)	0.117* (2.35) (0.0500)
BITAVGrat			0.00797* (2.12) (0.00376)	0.00786* (2.09) (0.00375)
InQdiff		-0.217*** (-3.89)		-0.221*** (-3.96)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	-0.848 (-0.09)	-2.308 (-0.26)	-1.274 (-0.14)	-2.842 (-0.31)
Observations	33562	33562	33562	33562
R^2	0.161	0.162	0.161	0.162

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.1.3 Summary

The reported results offer considerable support for a positive correlation between the conclusion of BITs and total bilateral exports during the sample period. The validity and relevance of the findings will be discussed in greater depth in section 5, but it should

¹⁹ The reader is referred to section 3.5 and table (2) for the exact definition of this variable.

already be emphasized that the very large estimated impact from a BIT when only dyadic and time FE are used likely is most endogeneous (cf. table 3, column 1 and 4). When further controls are applied, the estimated impact is much smaller.

It should also be noted that the variables *BITAVG* and *BITAVGrat* are predicted to exert a positive influence on bilateral exports in the majority of the specifications, indicating positive spill-over effects from the total number of BITs applicable to the country pair on their bilateral exports. Moreover, the estimated impact from a BIT on bilateral trade is typically substantially reduced when *BITAVG* or *BITAVGrat* is included, which indicates that the estimated impact from a BIT between two countries spuriously captures the impact from concluding BITs with third parties unless controls are introduced for the latter phenomenon.

4.2 The impact of BITs on bilateral exports in intermediate goods and relationship-specificity

Before testing the main specification in equation (14), it is interesting to illustrate the average impact from the existence of a BIT on trade flows in intermediate goods, as well as to illuminate the differences between various broad categories of intermediate goods. Table (12) below shows the estimated impact from the existence of a BIT on bilateral exports in intermediate goods²⁰ where all country-commodity pairs are pooled. The first three columns refer to the effect from *BITSIG* while the subsequent three apply to the impact from *BITRAT*. All regressions predict a positive impact from the existence of a BIT, i.e. that BITs on the aggregate induce increased bilateral exports in intermediate goods. The estimated magnitude of this effect, however, decreases substantially when more control variables are introduced. This was also the case when total exports was the dependent variable (table 6).

In order to illuminate how the impact from the existence of a BIT varies depending on commodity type, one may decompose the pooled regression and apply the same specifications to data pertaining only to certain broad categories of intermediate goods. Tables (13), (14) and (15) below present the estimated impact on bilateral exports for each of the eight categories of intermediate goods, using *BITSIG* and *BITRAT* as independent variables and *BasicII* as time-varying controls. The relationship-specificity of the respective categories is given by the rows labeled *Index1* and *Index2*. Processed industrial supplies, which has a relatively high relationship-specificity according to both indices, is the one category for which the coefficient for both BIT variables is positive and statistically significant. The estimated impact on bilateral exports of parts of capital goods, a highly relationship-specific category, is positive and large for *BITSIG* but interestingly not for *BITRAT*. Other remarkable results are that parts of transport equipment, the most relationship-specific category, commands no impact from the BIT variable while the impact from the ratification of a BIT on exports of primary fuels is statistically significant and economically large.

Taken as whole, the results in tables (13), (14) and (15) indicate that the conclusion of BITs is positively correlated with bilateral exports in categories of intermediate goods which tend to be more relationship-specific than the average, specifically processed

²⁰The variable *IntermedTrade*, here abbreviated as *IntTrade*.

Table 12 **Regression results of the impact from BITs on total bilateral exports in intermediate goods: pooled regression**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.215*** (14.49) (0.0148)	0.103*** (5.37) (0.0192)	0.0872* (2.48) (0.0351)			
BITRAT				0.211*** (14.94) (0.0141)	0.128*** (7.43) (0.0172)	0.107*** (3.64) (0.0295)
Control variables	SpecI	BasicI	BasicII	SpecI	BasicI	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	11.82*** (839.23)	-4.665*** (-8.76)	16.75*** (3.75)	11.83*** (849.80)	-4.705*** (-8.83)	16.63*** (3.72)
Observations	1373462	681780	202194	1373462	681780	202194
R^2	0.046	0.070	0.079	0.046	0.070	0.079

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

industrial supplies. This is consistent with hypothesis H_2 , but it must also be noted that in this particular specification the impact on the two most relationship-specific categories is either not significant for any of the BIT variables (parts of transport equipment) or only for *BITSIG* (parts of capital goods). The discrepancies justify the main specification as they indicate that the impact from BITs on bilateral exports in intermediate goods varies over different categories of goods.

4.2.1 Main specification

Table (16) presents the estimated interaction effect of a BIT and the relationship-specificity (as measured by *Index1*) of the eight BEC of intermediate commodities on bilateral exports. Just as in table (6), columns (1) and (4) only apply time and dyadic FE, while columns (2) and (5) feature the time-varying controls in *BasicI*; columns (3) and (6) contain the larger set of time-varying control variables in the set *BasicII*. The coefficients for variables *BITSIGxIndex1* and *BITRATxIndex1* represent this interaction effect, which is consistently predicted to be positive and statistically significant.

Table (17) features the estimated coefficients when the analysis is replicated using *Index2* as the measure of relationship-specificity. Analogous interaction terms are defined as *BITSIGxIndex2* and *BITRATxIndex2*. As seen, the estimated interaction effects are persistently predicted to be positive although they are smaller in magnitude than

Table 13 **Regression results of the impact from BITs on bilateral exports in intermediate goods: separate regressions I**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade Food, primary (111)	IntTrade Food, processed (121)	IntTrade Fuels, primary (31)	IntTrade Fuels, processed (322)	IntTrade Industrial, primary (21)	IntTrade Industrial, processed (22)
BITSIG	-0.0906 (-0.73) (0.124)	0.0475 (0.41) (0.116)	0.140 (0.70) (0.200)	0.158 (0.94) (0.167)	0.135 (1.66) (0.0812)	0.188** (3.08) (0.0608)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	49.77** (3.22)	8.995 (0.58)	-13.74 (-0.46)	78.96** (3.28)	20.99 (1.95)	27.22*** (3.38)
Index1	27.59	42.86	33.33	33.33	27.63	50.56
Index2	44.83	62.86	66.67	66.67	60.53	90.53
Observations	20992	21882	10032	15722	31051	38646
R^2	0.054	0.062	0.071	0.110	0.073	0.123

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14 **Regression results of the impact from BITs on bilateral exports in intermediate goods: separate regressions II**

	(1) IntTrade Capital, parts (42)	(2) IntTrade Transport, parts (53)	(3) IntTrade Food, primary (111)	(4) IntTrade Food, processed (121)	(5) IntTrade Fuels, primary (31)	(6) IntTrade Fuels, processed (322)
BITSIG	0.163* (2.28) (0.0713)	-0.0918 (-1.11) (0.0828)				
BITRAT			0.0157 (0.15) (0.106)	0.0570 (0.58) (0.0985)	0.333* (2.00) (0.167)	0.238 (1.77) (0.134)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	-8.890 (-0.92)	0.0109 (0.00)	50.35** (3.27)	8.964 (0.58)	-13.97 (-0.47)	79.14** (3.29)
Index1	93.67	100	27.59	42.86	33.33	33.33
Index2	98.73	100	44.83	62.86	66.67	66.67
Observations	34415	29454	20992	21882	10032	15722
R^2	0.149	0.137	0.053	0.062	0.072	0.111

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15 **Regression results of the impact from BITs on bilateral exports in intermediate goods: separate regressions III**

	(1)	(2)	(3)	(4)
	IntTrade Industrial, primary (21)	IntTrade Industrial, processed (22)	IntTrade Capital, parts (42)	IntTrade Transport, parts (53)
BITRAT	0.0862 (1.23) (0.0704)	0.179*** (3.56) (0.0504)	0.0598 (1.04) (0.0576)	0.0662 (0.96) (0.0686)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	20.85 (1.94)	27.00*** (3.36)	-8.972 (-0.93)	0.158 (0.01)
Index1	27.63	50.56	93.67	100
Index2	60.53	90.53	98.73	100
Observations	31051	38646	34415	29454
R^2	0.073	0.123	0.149	0.137

t statistics in first parentheses and standard error in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the interaction effects presented in table (14). This quantitative difference can likely be explained by the smaller spread in estimated relationship-specificity in *Index2* as compared to *Index1* (cf. table 1 in section 3.5).

As a remainder, the correct interpretation of the coefficients associated with the interaction terms is that they capture the additional impact from the existence of a BIT that depends on the value of the Index variable. Specifically, these coefficients represent the predicted additional impact from the existence of a BIT as the corresponding index variable increases by one unit. The coefficients for *BITSIG* and *BITRAT* are the predicted impact from the existence of a BIT on bilateral exports in the hypothetical case when the index value of the category is equal to zero. The latter coefficients are of limited interest in themselves, but by comparing them to the coefficients of the corresponding interaction terms, one may infer how relationship-specific a category must be before a BIT is predicted to exert a positive impact. The fact that the coefficient for the interaction term consistently is positive indicates that the BIT variable on average has a larger positive impact for intermediate goods which are considered as more relationship-specific according to the indices (cf. section 3.4.1).

4.2.2 Robustness check

The same robustness checks as in section 4.1 are implemented in order to evaluate the robustness of the results derived from the main specification. It turns out that the results for *Index1* and *Index2* are virtually identical. In order to make this section more lucid, only the results pertaining to *Index1* are reported. Generally speaking, the coefficients for the interaction terms that pertain to *Index2* remain of smaller magnitude.

a) Alternative specifications for the BIT-variable

It is firstly tested whether the estimated interaction effects are sensitive to the inclusion of *BITAVG* and lagged values of the BIT variables. In the specifications where the one year lagged values of the BIT variables are used, it is also explored whether the one year lagged interaction effect is positive.

The results are presented in tables (18) below. Columns (1) and (4) show the estimated contemporaneous effects when the *BITAVG* variables are included. The other columns show the impact from the BIT variable and from the interaction terms when these variables enter the regression as one and five year lagged values. The contemporaneous interaction effect remains statistically significant and positive when *BITAVG* and *BITAVGrat* are included, respectively, while the lagged values of the interaction terms also attain statistical significance.

b) Different effects depending on OECD-membership

Table (19) below displays the estimated interaction effects for different groups of country pairs. Just as in section 4.1, the decomposition of country pairs is done on the basis of whether one, both or none of the countries are OECD members. Columns (1) and (4) report the results for country pairs where only one party is an OECD member, columns

Table 16 Regression results of the impact from BITs on exports in intermediate goods: the interaction effect between the BIT variable and *Index1*

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.260*** (-7.88) (0.0330)	-0.453*** (-10.63) (0.0423)	-0.277*** (-3.45) (0.0792)			
BITSIGxIndex1	0.00831*** (17.23) (0.000483)	0.00958*** (15.35) (0.000622)	0.00640*** (5.47) (0.00116)			
BITRAT				-0.244*** (-7.81) (0.0311)	-0.369*** (-9.78) (0.0375)	-0.272*** (-4.06) (0.0658)
BITRATxIndex1				0.00798*** (17.41) (0.000456)	0.00859*** (15.50) (0.000550)	0.00659*** (6.81) (0.000950)
GDPsum		0.651*** (32.31)	0.707*** (17.93)		0.651*** (32.36)	0.707*** (17.90)
GDPdiffsq		1.01e-27** (3.28)	4.99e-28 (1.08)		1.03e-27*** (3.34)	4.88e-28 (1.06)
Skilldiff		-0.00158*** (-3.56)	-0.0156 (-1.81)		-0.00155*** (-3.49)	-0.0158 (-1.83)
EU		0.463*** (18.41)	0.255*** (7.15)		0.463*** (18.43)	0.255*** (7.13)
PTA		0.0771 (0.15)	0.0814 (0.09)		0.0805 (0.16)	0.0820 (0.09)
FTA		0.169*** (6.88)	0.0582 (1.52)		0.164*** (6.70)	0.0552 (1.44)
CU		0.373* (2.02)	0.164 (0.29)		0.362* (1.97)	0.165 (0.29)
OtherPTA		0.142*** (7.59)	0.0594 (1.91)		0.139*** (7.41)	0.0598 (1.92)
GDPdiffxSkilldiff			0.000423 (1.32)			0.000429 (1.34)
TariffI			-0.0148*** (-4.97)			-0.0147*** (-4.96)
TariffE			-0.00162 (-0.63)			-0.00173 (-0.67)
TariffExSkilldiffsq			0.00000385** (3.06)			0.00000379** (3.01)
Capitaldiff			0.0388* (2.42)			0.0390* (2.43)
Realratediff			0.00233*** (3.34)			0.00237*** (3.40)
Popsum			-1.296*** (-5.30)			-1.288*** (-5.27)
Tradeopenavg			0.0118*** (13.94)			0.0117*** (13.85)
FDIopenavg			-0.00434** (-3.17)			-0.00435** (-3.18)
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Observations	1373462	681780	202194	1373462	681780	202194
R ²	0.046	0.071	0.079	0.046	0.071	0.079

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 17 Regression results of the impact from BITs on exports in intermediate goods: the interaction effect between the BIT variable and *Index2*

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.916*** (-14.76) (0.0620)	-1.172*** (-14.53) (0.0807)	-0.830*** (-5.54) (0.150)			
BITSIGxIndex2	0.0143*** (19.45) (0.000737)	0.0160*** (16.78) (0.000956)	0.0117*** (6.64) (0.00177)			
BITRAT				-0.879*** (-15.09) (0.0583)	-1.054*** (-14.82) (0.0711)	-0.781*** (-6.18) (0.126)
BITRATxIndex2				0.0139*** (20.02) (0.000693)	0.0149*** (17.68) (0.000845)	0.0113*** (7.61) (0.00149)
GDPsum		0.650*** (32.29)	0.707*** (17.93)		0.651*** (32.34)	0.706*** (17.90)
GDPdiffsq		1.02e-27*** (3.31)	5.04e-28 (1.09)		1.04e-27*** (3.37)	4.96e-28 (1.07)
Skilldiff		-0.00161*** (-3.62)	-0.0158 (-1.83)		-0.00158*** (-3.55)	-0.0160 (-1.85)
EU		0.463*** (18.41)	0.256*** (7.15)		0.463*** (18.43)	0.255*** (7.14)
PTA		0.0776 (0.15)	0.0809 (0.09)		0.0809 (0.16)	0.0817 (0.09)
FTA		0.169*** (6.91)	0.0582 (1.53)		0.165*** (6.72)	0.0555 (1.45)
CU		0.381* (2.05)	0.165 (0.29)		0.371* (2.01)	0.165 (0.29)
OtherPTA		0.142*** (7.58)	0.0589 (1.90)		0.138*** (7.40)	0.0592 (1.91)
GDPdiffxSkilldiff			0.000429 (1.34)			0.000435 (1.36)
TariffI			-0.0148*** (-4.98)			-0.0147*** (-4.95)
TariffE			-0.00168 (-0.65)			-0.00179 (-0.69)
TariffExSkilldiffsq			0.00000387** (3.08)			0.00000379** (3.02)
Capitaldiff			0.0386* (2.41)			0.0389* (2.43)
Realratediff			0.00232*** (3.33)			0.00236*** (3.38)
Popsum			-1.286*** (-5.26)			-1.280*** (-5.24)
Tradeopenavg			0.0118*** (13.95)			0.0117*** (13.86)
FDIopenavg			-0.00435** (-3.18)			-0.00435** (-3.18)
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Observations	1373462	681780	202194	1373462	681780	202194
R ²	0.046	0.071	0.079	0.046	0.071	0.079

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 18 Regression results of the interaction effect between BITs and and
Index1: robustness check, different specifications of the BIT variable

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.288*** (-3.63) (0.0791)					
BITSIGxIndex1	0.00628*** (5.42) (0.00116)					
BitsigLag1		-0.306*** (-4.28) (0.0714)				
BITSIGxIndex1L		0.00667*** (6.48) (0.00103)				
BitsigLag5			-0.349*** (-6.46) (0.0540)			
BITSIGxIndex1L5			0.00780*** (10.04) (0.000777)			
BITAVG	0.00226*** (8.64) (0.000261)	0.00225*** (8.62) (0.000261)	0.00225*** (8.66) (0.000260)			
BITRAT				-0.300*** (-4.55) (0.0659)		
BITRATxIndex1				0.00671*** (7.08) (0.000948)		
BitratLag1					-0.401*** (-6.22) (0.0644)	
BITRATxIndex1L					0.00799*** (8.75) (0.000913)	
BitratLag5						-0.340*** (-6.66) (0.0510)
BITRATxIndex5L						0.00776*** (10.72) (0.000724)
BITAVGrat				0.00211*** (7.67) (0.000275)	0.00214*** (7.76) (0.000275)	0.0021*** (7.60) (0.0003)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	11.16* (2.47)	11.17* (2.48)	10.50* (2.33)	9.252* (2.03)	9.054* (1.99)	8.408 (1.85)
Observations	202194	202194	202194	202194	202194	202194
R^2	0.080	0.080	0.080	0.081	0.080	0.080

t statistics in first parentheses and standard errors in the second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(2) and (5) correspond to country pairs where both countries are OECD members and columns (3) and (6) present results for country pairs where neither country is a member of the OECD. The estimated interaction effect remains positive and statistically significant for all groups of country pairs.

Table 19 **Regression results of the interaction effect between BITS and *Index1*: robustness check, different impact depending on OECD membership?**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade 1 OECD	IntTrade 2 OECD	IntTrade 0 OECD	IntTrade 1 OECD	IntTrade 2 OECD	IntTrade 0 OECD
BITSIG	-0.198 (-1.85) (0.107)	-0.495* (-2.58) (0.192)	-0.303* (-2.11) (0.144)			
BITSIGxIndex1	0.00468** (3.01) (0.00155)	0.0109*** (3.89) (0.00281)	0.00654** (3.13) (0.00209)			
BITAVG	0.00202*** (5.63) (0.000358)	0.000492 (0.85) (0.000577)	0.00340*** (6.55) (0.000520)			
BITRAT				-0.230** (-2.69) (0.0858)	-0.300 (-1.92) (0.156)	-0.404** (-3.07) (0.132)
BITRATxIndex1				0.00637*** (5.22) (0.00122)	0.00766*** (3.46) (0.00221)	0.00672*** (3.58) (0.00188)
BITAVGrat				0.00211*** (5.56) (0.000380)	0.000581 (1.07) (0.000542)	0.00378*** (6.19) (0.000610)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	41.59*** (6.43)	12.88 (0.76)	-14.43 (-1.73)	39.28*** (6.03)	13.05 (0.77)	-18.43* (-2.18)
Observations	104386	38582	59226	104386	38582	59226
R^2	0.072	0.069	0.103	0.072	0.069	0.103

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

c) Sensitivity to the inclusion of lagged control variables

Whether the estimated positive interaction effects are sensitive to the inclusion of lagged values of the control variables in *BasicII* is tested in table (20). Columns (1) and (4) report the results when including one year lagged values and columns (3) and (6) report the results when including five year lagged values. Columns (2) and (5) report the estimated results when running the regressions without lagged control variables

for the same observations that are used in the estimations in columns (3) and (6). All estimated interaction effects with regard to *BITRAT* are statistically significant, while the interaction effect between *BITSIG* and *Index1* is not statistically significant when using five year lagged values of the control variables. However, this effect is not significant in the regression analysis without lagged values of the control variables for the same observations (column 2 compared to column 3).

Table 20 **Regression results of the interaction effect between BITS and *Index1*: robustness check, lagged control variables**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.303* (-2.53) (0.119)	-0.0447 (-0.35) (0.129)	-0.0378 (-0.29) (0.129)			
BITSIGxIndex1	0.00546** (3.19) (0.00171)	0.00149 (0.81) (0.00184)	0.00145 (0.80) (0.00182)			
BITAVG	0.00280*** (6.67) (0.000419)	0.00288*** (6.15) (0.000468)	0.00269*** (5.75) (0.000468)			
BITRAT				-0.312** (-3.19) (0.0976)	-0.155 (-1.30) (0.119)	-0.153 (-1.28) (0.119)
BITRATxIndex1				0.00594*** (4.26) (0.00139)	0.00382* (2.30) (0.00166)	0.00382* (2.32) (0.00165)
BITAVGrat				0.00262*** (6.20) (0.000423)	0.00228*** (5.01) (0.000456)	0.00213*** (4.66) (0.000457)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Lagged control variables	1 year	NO	5 year	1 year	NO	5 year
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	22.64** (2.90)	28.61*** (3.40)	13.96 (1.56)	20.90** (2.67)	27.32** (3.22)	13.36 (1.48)
Observations	125091	87047	87047	125091	87047	87047
R^2	0.093	0.109	0.111	0.093	0.108	0.111

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

d) *Dynamic model: lagged dependent variable*

Table (21) features the estimated interaction effects when controlling for the time-

varying controls in *BasicII* and one and five year lagged values of the dependent variable. The interaction effects remain highly statistically significant but attain a small magnitude. The estimated interaction effects are robust to this modification and remain fully statistically significant. When the regressions were run with the control variables in *BasicI*, the coefficients of the interaction terms were smaller in magnitude but qualitatively similar.²¹

e) Sensitivity to controls for institutional quality

It is finally tested whether the results are sensitive to the inclusion of *InQdiff*. The results are reported in table (22). All the estimated interaction effects remain positive and statistically significant.

4.2.3 Summary

The results generally provide support for the hypothesis of a positive correlation between the relationship-specificity of the BEC and the impact from a BIT on bilateral exports in intermediate goods. Two caveats should however be observed. Firstly, the estimated interaction effect is economically small, especially when considering *Index2*. Secondly, and more importantly, this section also presents evidence that the hypothesized link to relationship-specificity not always hold. The disaggregation of the data reveals that the interaction effect is small for some highly relationship-specific categories and in one regression specification very large for a category of intermediate relationship-specificity. The results are further discussed in section 5.

4.3 The interaction effect of BITs and the factor endowments of the exporter

In this section it is tested whether the impact from a BIT depends positively on the skilled labour endowment and the per capita capital stock of the exporter, which was postulated in H_3 . The difference in skilled labour endowment is measured in percentage points while the difference in per capita capital stock is measured in logarithmic form.

4.3.1 Main specification

Table (23) presents the estimated interaction effect of the BIT variable and the skilled labour endowment of the exporter, as measured by the gross tertiary enrollment ratio of the exporter (*Skille*). The results in columns (1) and (4) arise when using the specification *SpecI* with the addition of *Skille* as a control variable. Columns (2) and (5) present the results when using the control variables in *BasicI* are used together with (*Skille*). Columns (3) and (6) report the analogous results when adding *Skille* to

²¹ When the control variables in *BasicI* were used, the following results were obtained. The coefficients for *BITSIG* were equal to 0.009 and 0.007, while the coefficients for *BITRAT* were 0.008 and 0.006. All coefficients in these regressions were significant at the $p < 0.001$ level.

Table 21 **Regression results of the interaction effect between BITS and *Index1*: robustness check, lagged values of the dependent variable**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.285*** (-3.55) (0.0803)	-0.162 (-1.90) (0.0854)		
BITSIGxIndex1	0.00588*** (5.02) (0.00117)	0.00359** (2.88) (0.00125)		
BITAVG	0.00232*** (8.72) (0.000266)	0.00241*** (8.34) (0.000290)		
BITRAT			-0.293*** (-4.33) (0.0676)	-0.173* (-2.41) (0.0719)
BITRATxIndex1			0.00626*** (6.46) (0.000970)	0.00378*** (3.65) (0.00104)
BITAVGrat			0.00217*** (7.74) (0.000280)	0.00236*** (7.76) (0.000305)
IntermedTradeLag1	0.00934*** (7.46)		0.00937*** (7.48)	
IntermedTradeLag5		0.00792*** (6.12)		0.00793*** (6.12)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	11.91** (2.58)	12.32* (2.50)	9.948* (2.14)	10.09* (2.03)
Observations	199865	189964	199865	189964
R^2	0.081	0.085	0.081	0.085

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 22 **Regression results of the interaction effect between BITS and *Index1*: robustness check, the difference in institutional quality**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.177 (-1.80) (0.0981)	-0.178 (-1.81) (0.0982)		
BITSIGxIndex1	0.00357* (2.50) (0.00143)	0.00360* (2.52) (0.00143)		
BITRAT			-0.165 (-1.96) (0.0845)	-0.165 (-1.96) (0.0845)
BITRATxIndex1			0.00356** (2.95) (0.00120)	0.00358** (2.97) (0.00120)
InQdiff		-0.103** (-2.71)		-0.103** (-2.72)
Control variables variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	9.843 (1.78)	9.359 (1.69)	9.857 (1.78)	9.371 (1.69)
Observations	149597	149597	149597	149597
R^2	0.082	0.083	0.082	0.083

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the control variables in *BasicII*. The regressions predicts a positive interaction effect, indicating that the average exporter which experienced an increase in its gross tertiary enrollment ratio during the sample period also experienced a greater increase in bilateral exports to countries with which BITs have been concluded. Phrased differently, the positive coefficient also implies that for a given country pair, the estimated impact from concluding a BIT is larger if the exporter has increased its gross tertiary enrollment during the sample period.

Table (24) and (25) reports the corresponding interaction effect between the BIT variable and the log of the capital stock per worker in the exporting country. In table (24) it is shown that an a positive interaction effect is estimated when only dyadic and time FE or the time-varying controls in *BasicI* are used. As indicated in table (25), this interaction effect is no longer positive when using the control variables in *BasicII*, however. Column (3) shows the estimated interaction effect when the same observations are used for the regression specification that only utilizes the control variables in *BasicI*. The interaction effect becomes insignificant when expanding the set of control variables for this given set of observations, indicating that the estimated impact when only using the control variables in *BasicI* is spurious.

4.3.2 Robustness check

The same robustness checks as in section 4.1 and 4.2 are now performed in order to explore the validity of the results reported above.

a) Alternative specifications for the BIT-variable

Tables (26) and (27) below report the results when including *BITAVG* and lagged values of the BIT variables. As seen in table (26), the estimated interaction effect with regard to skilled labour endowment remains positive and significant for all specifications expect when the interaction effect of the BIT variable and skilled labour endowment enters the regression as a five year lagged value. The interaction effect with regard to per capita capital endowment of the exporter is statistically insignificant for all specifications except when the interaction effect enters the regression as a five year lagged value, in which case the estimated impact is negative (contrary to the hypothesis, see table 27).

b) Different effects depending on OECD-membership

Tables (28) and (29) show how the estimated interaction effects vary between the country pairs, as categorized by OECD membership. Columns (1) and (4) report the results for country pairs where only one party is an OECD member, columns (2) and (5) correspond to country pairs where both countries are OECD members and columns (3) and (6) present results for country pairs where neither country is a member of the OECD. The estimated interaction effect between the BIT variable and capital endowment remain insignificant, while the positive interaction effect between the BIT variable and skilled labour endowment of the exporter is positive for all categories of country pairs.

Table 23 Regression results of the interaction effect between BITs and the skilled labour endowment of the exporter: impact on exports in intermediate goods

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.133*** (-4.87) (0.0272)	-0.176*** (-5.58) (0.0315)	-0.112 (-1.83) (0.0615)			
BITSIGxSkille	0.00695*** (13.93) (0.000499)	0.00664*** (11.28) (0.000588)	0.00456*** (3.96) (0.00115)			
BITRAT				-0.160*** (-5.73) (0.0280)	-0.155*** (-4.94) (0.0313)	-0.0978 (-1.72) (0.0570)
BITRATxSkille				0.00687*** (13.59) (0.000506)	0.00624*** (10.70) (0.000583)	0.00428*** (3.98) (0.00108)
Skille	0.00288*** (5.55)	0.00145* (2.18)	0.00292* (2.18)	0.00331*** (6.53)	0.00200** (3.09)	0.00317* (2.42)
GDPsum		0.629*** (31.13)	0.660*** (16.49)		0.634*** (31.39)	0.662*** (16.56)
GDPdiffsq		1.00e-27** (3.22)	2.69e-28 (0.58)		9.80e-28** (3.15)	2.16e-28 (0.47)
Skilldiff		-0.00176*** (-3.80)	-0.0184* (-2.14)		-0.00169*** (-3.65)	-0.0185* (-2.16)
EU		0.391*** (15.36)	0.225*** (6.30)		0.385*** (15.12)	0.223*** (6.23)
PTA		0.251 (0.58)	0.111 (0.12)		0.248 (0.58)	0.109 (0.12)
FTA		0.162*** (6.57)	0.0648 (1.68)		0.162*** (6.56)	0.0655 (1.70)
CU		0.335 (1.69)	0.518 (0.90)		0.327 (1.65)	0.519 (0.90)
OtherPTA		0.124*** (6.58)	0.0670* (2.16)		0.120*** (6.41)	0.0647* (2.09)
GDPdiffxSkilldiff			0.000537 (1.69)			0.000542 (1.71)
TariffI			-0.0132*** (-4.41)			-0.0132*** (-4.42)
Tariff			-0.00418 (-1.62)			-0.00425 (-1.65)
TariffExSkilldiffsq			0.00000245 (1.95)			0.00000240 (1.91)
Capitaldiff			0.0386* (2.40)			0.0392* (2.44)
Realratediff			0.00239*** (3.40)			0.00239*** (3.40)
Popsum			-0.907*** (-3.61)			-0.910*** (-3.63)
Tradeopenavg			0.0111*** (13.06)			0.0111*** (12.97)
FDIopenavg			-0.00368** (-2.69)			-0.00368** (-2.69)
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Observations	995024	681780	202194	995024	681780	202194
R ²	0.059	0.071	0.079	0.059	0.071	0.079

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 24 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: impact on bilateral exports of intermediate goods I**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.691*** (18.19) (0.0380)	0.573*** (11.32) (0.0506)		
BITSIGxCapLog	0.148*** (14.79) (0.0100)	0.142*** (10.18) (0.0140)		
BITRAT			0.621*** (16.16) (0.0384)	0.568*** (11.54) (0.0492)
BITRATxCapLog			0.138*** (12.67) (0.0109)	0.139*** (9.92) (0.0140)
CapstockE	0.384*** (21.46)	0.353*** (14.07)	0.403*** (22.68)	0.369*** (14.88)
GDPsum		0.616*** (28.37)		0.620*** (28.55)
GDPdiffsq		8.03e-28* (2.36)		7.93e-28* (2.33)
Skilldiff		-0.00128** (-2.73)		-0.00121** (-2.58)
EU		0.378*** (15.05)		0.372*** (14.81)
PTA		0.153 (0.32)		0.149 (0.31)
FTA		0.144*** (5.69)		0.141*** (5.56)
CU		0.328 (1.71)		0.317 (1.66)
OtherPTA		0.115*** (6.07)		0.111*** (5.85)
Time and dyadic FE	YES	YES	YES	YES
Constant	13.47*** (190.89)	-2.437*** (-4.02)	13.56*** (193.38)	-2.497*** (-4.12)
Observations	1148500	612018	1148500	612018
R^2	0.050	0.071	0.050	0.071

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 25 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: impact on bilateral exports of intermediate goods II**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.343*** (3.59) (0.0955)	0.227* (2.39) (0.0949)		
BITSIGxCapLog	0.0775** (2.85) (0.0271)	0.0458 (1.70) (0.0270)		
BITRAT			0.415*** (4.72) (0.0879)	0.278** (3.16) (0.0878)
BITRATxCapLog			0.0912*** (3.61) (0.0253)	0.0562* (2.23) (0.0252)
CapstockE	0.476***	0.396***	0.475***	0.395***
GDPsum	0.604***	0.643***	0.604***	0.642***
GDPdiffsq	-6.39e-28	3.20e-28	-6.65e-28	2.91e-28
Skilldiff	-0.00336***	-0.0149	-0.00333***	-0.0149
EU	0.298***	0.216***	0.292***	0.214***
PTA	0.307	0.125	0.309	0.127
FTA	0.0765*	0.0691	0.0722	0.0660
CU	-0.170	0.0992	-0.167	0.100
OtherPTA	0.0801**	0.0439	0.0787*	0.0433
GDPdiffxSkilldiff		0.000415		0.000418
TariffI		-0.0144***		-0.0144***
Tariff		0.000595		0.000509
TariffExSkilldiffsq		0.00000325**		0.00000322**
Capitaldiff		0.0198		0.0202
Realratediff		0.00156*		0.00161*
Popsum		-1.262***		-1.242***
Tradeopenavg		0.0109***		0.0108***
FDIopenavg		-0.00325*		-0.00322*
Time and dyadic FE	YES	YES	YES	YES
Observations	202194	202194	202194	202194
R ²	0.077	0.080	0.077	0.080

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 26 **Regression results of the interaction effect between BITs and the skilled labour endowment of the exporter: robustness check, different specifications of the BIT variable**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.0713 (-1.17) (0.0612)					
BITSIGxSkille	0.00307** (2.68) (0.00115)					
BitsigLag1		- 0.0681 (- 1.13) (0.0601)				
BITSIGxSkillL1		0.00309** (2.69) (0.00115)				
BitsigLag5			0.0121 (0.26) (0.0473)			
BITSIGxSkillL5			0.00164 (1.52) (0.00108)			
BITAVG	0.00222*** (8.46)	0.00216*** (8.05)	0.00219*** (7.61)			
BITRAT				-0.0590 (-1.04) (0.0567)		
BITRATxSkille				0.00286** (2.66) (0.00107)		
BitratLag1					-0.0841 (-1.49) (0.0566)	
BITRATxSkillL1					0.00254* (2.31) (0.00110)	
BitratLag5						0.0806 (1.70) (0.0473)
BITRATxSkillL5						-0.000306 (-0.30) (0.00103)
BITAVGrat				0.00206*** (7.47)	0.00210*** (7.44)	0.00209*** (7.03)
Skille	0.00440*** (3.30)			0.00436*** (3.34)		
SkillElag		0.00516*** (3.86)			0.00546*** (4.19)	
SkillElag5			0.00379** (2.87)			0.00445*** (3.46)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Observations	202194	191555	180504	202194	191555	180504
R ²	0.080	0.083	0.084	0.080	0.083	0.084

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 27 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: robustness check, different specifications of the BIT variable**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.110 (1.16) (0.0948)					
BITSIGxCapLog	0.0168 (0.62) (0.0269)					
BitsigLag1		0.140 (1.54) (0.0906)				
BITSIGxCapLogL1		0.0240 (0.95) (0.0254)				
BitsigLag5			-0.139 (-1.78) (0.0783)			
BITSIGxCapLogL5			-0.0598** (-2.78) (0.0216)			
BITAVG	0.00213*** (8.16)	0.00213*** (8.17)	0.00224*** (8.63)			
BITRAT				0.170 (1.93) (0.0878)		
BITRATxCapLog				0.0323 (1.28) (0.0252)		
BitratLag1					0.0000809 (0.00) (0.0906)	
BITRATxCapLogL1					-0.0123 (-0.48) (0.0254)	
BitratLag5						-0.182* (-2.38) (0.0763)
BITRATxCapLogL5						-0.0725*** (-3.36) (0.0216)
BITAVGrat				0.00201*** (7.35)	0.00211*** (7.70)	0.00220*** (8.04)
CapstockE	0.373*** (6.91)			0.383*** (7.18)		
CapstockEL1		0.409*** (7.80)			0.442*** (8.48)	
CapstockEL5			0.380*** (7.52)			0.395*** (7.85)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Observations	202194	202194	202194	202194	202194	202194
R ²	0.080	0.081	0.081	0.080	0.080	0.080

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 28 **Regression results of the interaction effect between BITS and the skilled labour endowment of the exporter: robustness check, different impact depending on OECD membership?**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade 1 OECD	IntTrade 2 OECD	IntTrade 0 OECD	IntTrade 1 OECD	IntTrade 2 OECD	IntTrade 0 OECD
BITSIG	-0.113 (-1.25) (0.0904)	-0.132 (-0.93) (0.141)	-0.0935 (-0.88) (0.106)			
BITSIGxSkille	0.00399* (2.50) (0.00160)	0.00528* (2.10) (0.00252)	0.00500* (2.04) (0.00246)			
BITRAT				-0.0130 (-0.17) (0.0775)	-0.128 (-0.97) (0.132)	-0.159 (-1.45) (0.109)
BITRATxSkille				0.00301* (2.08) (0.00144)	0.00524* (2.22) (0.00237)	0.00457* (1.99) (0.00230)
Skille	0.00522** (2.67)	0.00552* (2.55)	-0.00243 (-0.84)	0.00594** (3.15)	0.00540* (2.52)	-0.00203 (-0.72)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	36.44*** (5.57)	-1.388 (-0.08)	-7.356 (-0.86)	36.73*** (5.63)	-0.927 (-0.05)	-6.920 (-0.81)
Observations	104386	38582	59226	104386	38582	59226
R^2	0.072	0.071	0.100	0.072	0.071	0.100

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

c) Sensitivity to the inclusion of lagged control variables

Tables (30) and (31) report on the robustness of the estimated interaction effects to the inclusion of lagged values of the control variables in *BasicII*. In order to separate the effect of including lagged values of the control variables from the effect due to loss of observations, the regressions are estimated separately without the five year lagged values of the control variables for the observations where these lagged values are available. A comparison between columns (3) and (4) in table (30) show that the interaction effect between the *BITSIG* variable and the skilled labour endowment of the exporter losses statistical significance when five year lagged values of the control variables are held constant. The same holds for the interaction effect between the *BITRAT* variable and the skilled labour endowment (columns 5 and 6 in table 30). In contrast, the interaction

Table 29 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: robustness check, different impact depending on OECD membership?**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade 1 OECD	IntTrade 2 OECD	IntTrade 0 OECD	IntTrade 1 OECD	vTrade 2 OECD	IntTrade 0 OECD
BITSIG	0.131 (1.15) (0.114)	0.455 (1.41) (0.323)	0.398 (1.69) (0.236)			
BITSIGxCapLog	0.0203 (0.59) (0.0343)	0.114 (1.08) (0.106)	0.0830 (1.44) (0.0577)			
BITRAT				0.165 (1.58) (0.104)	0.641* (2.28) (0.281)	0.322 (1.38) (0.234)
BITRATxCapLog				0.0122 (0.40) (0.0305)	0.170 (1.82) (0.0932)	0.0824 (1.38) (0.0597)
CapstockE	0.391*** (5.20)	0.339* (2.27)	0.288** (2.96)	0.396*** (5.33)	0.328* (2.23)	0.295** (3.07)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	45.88*** (7.10)	11.75 (0.69)	-3.375 (-0.40)	45.83*** (7.09)	13.09 (0.77)	-3.141 (-0.37)
Observations	104386	38582	59226	104386	38582	59226
R^2	0.072	0.070	0.100	0.072	0.071	0.100

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

term *BITRATxCapLog* is statistically insignificant in all specifications that employ lagged values of the control variables (table 31).

d) Dynamic model: lagged dependent variable

The results pertaining to this robustness check are reported in tables (32) and (33). All regression results for the interaction terms with respect to skilled labour endowment remain statistically significant while the interaction terms with respect to capital stock endowment are insignificant. When the regressions were run with the control variables in *BasicI*, the coefficients were larger in magnitude and the interaction effects with respect to capital endowment were clearly statistically significant.²²

e) Sensitivity to controls for institutional quality and alternative proxy variables for skilled labour endowment

It is firstly tested whether the results are robust to the inclusion of *InQdiff* (tables 34 and 35). The interaction term of the BIT variable and the skilled labour endowment of the exporter loses statistical significance when this control variable is added.

Further, table (34) report on the robustness to the use of *Skilldiff*₂ as a measure of the skilled labour endowment of the exporter. The estimated coefficients remain qualitatively and quantitatively similar to this modification. The alternative proxy variable for skilled labour endowment is of particular interest with regard to the present hypothesis, as it directly concerns an interaction effect in which skilled labour endowment is included. Therefore, table (34) reports the results from the estimation in table (23) when using this alternative proxy as a measure of the skilled labour endowment of the exporter. As can be seen, the estimated interaction effect is positive for all regressions involving *SpecI* and *BasicI* but not for regressions that account for *Basic II*.

4.3.3 Summary

Taken as a whole, the regression results presented in this section offer support for the view that the impact from a BIT on exports of intermediate goods depends positively on the skilled labour endowment and the capital stock per capita of the exporter. The results are more consistently estimated as positive for the interaction term concerning the skill level of the labour force. The significance and validity of these findings will now be discussed in section 5.

²² When the control variables in *BasicI* were used, the following results were obtained. The interaction coefficients with regard to skilled labour endowment were all equal to about 0.004 and were all significant at the $p < 0.001$ level. With regard to capital endowment, the coefficients of the interaction terms in the first three columns were approximately equal to 0.09 and the coefficient in the last column was equal to 0.07.

Table 30 **Regression results of the interaction effect between BITs and the skilled labour endowment of the exporter: robustness check, lagged control variables**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.190*		-0.139	-0.0604		
	(-2.00)		(-1.26)	(-0.55)		
	(0.0953)		(0.111)	(0.110)		
BITSIGxSkille	0.00434*		0.00407*	0.00260		
	(2.48)		(2.12)	(1.36)		
	(0.00175)		(0.00192)	(0.00191)		
BITAVG	0.00272***		0.00270***	0.00255***		
	(6.52)		(5.71)	(5.39)		
	(0.000417)		(0.000472)	(0.000474)		
BITRAT		-0.187*			-0.156	-0.0756
		(-2.21)			(-1.51)	(-0.74)
		(0.0847)			(0.103)	(0.102)
BITRATxSkill		0.00457**			0.00467*	0.00314
		(2.87)			(2.53)	(1.71)
		(0.001592)			(0.00185)	(0.00184)
BITAVGrat		0.00239***			0.00206***	0.00198***
		(5.73)			(4.49)	(4.27)
		(0.000418)			(0.000460)	(0.000463)
Skille	0.00276	0.00262	0.00337	0.00386	0.00295	0.00350
	(1.40)	(1.37)	(1.56)	(1.77)	(1.40)	(1.64)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Lagged control variables	1 year	1 year	NO	5 years	NO	5 years
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	21.23**	20.78**	27.49**	13.59	26.14**	12.92
	(2.73)	(2.66)	(3.23)	(1.51)	(3.05)	(1.42)
Observations	126506	126506	87047	87047	87047	87047
R^2	0.093	0.093	0.109	0.111	0.108	0.111

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 31 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: robustness check, lagged control variables**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.136 (0.89) (0.154)		0.215 (1.27) (0.170)	0.167 (0.98) (0.169)		
BITSIGxCapLog	0.0445 (0.91) (0.0487)		0.0528 (0.98) (0.0541)	0.0352 (0.66) (0.0537)		
BITAVG	0.00254*** (6.05)		0.00247*** (5.26)	0.00241*** (5.09)		
BITRAT		0.343* (2.48) (0.138)			0.261 (1.58) (0.165)	0.196 (1.20) (0.163)
BITRATxCapLog		0.103* (2.43) (0.0424)			0.0603 (1.19) (0.0505)	0.0380 (0.76) (0.0500)
BITAVGrat		0.00237*** (5.59)			0.00196*** (4.30)	0.00192*** (4.16)
CapstockE	0.308*** (3.55)	0.303*** (3.56)	0.246** (2.61)	0.174 (1.78)	0.280** (3.03)	0.205* (2.15)
Control variables	BasicII	BasicII	BasicII	BasicII	BasicII	BasicII
Lagged control variables	1 year	1 year	NO	5 years	NO	5 years
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	23.40** (3.00)	21.34** (2.73)	30.70*** (3.63)	17.28 (1.91)	29.51*** (3.47)	16.88 (1.86)
Observations	125091	125091	87047	87047	87047	87047
R^2	0.093	0.093	0.108	0.111	0.108	0.110

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 32 **Regression results of the interaction effect between BITs and the skilled labour endowment of the exporter: robustness check, lagged values of the dependent variable**

	(1) IntTrade	(2) IntTrade	(3) IntTrade	(4) IntTrade
BITSIG	-0.0959 (-1.53) (0.0627)	-0.0865 (-1.30) (0.0665)		
BITSIGxSkill	0.00361** (3.08) (0.00117)	0.00298* (2.41) (0.00124)		
BITAVG	0.00219*** (8.18)	0.00234*** (8.03)		
BITRAT			-0.0884 (-1.52) (0.0582)	-0.0951 (-1.53) (0.0623)
BITRATxSkill			0.00340** (3.10) (0.00110)	0.00289* (2.49) (0.00116)
BITAVGrat			0.00206*** (7.33)	0.00227*** (7.36)
SkillE	0.00361** (2.65)	0.00311* (2.11)	0.00358** (2.68)	0.00299* (2.08)
IntermedTradeLag1	0.0100*** (7.93)		0.0100*** (7.95)	
IntermedTradeLag5		0.00921*** (7.20)		0.00923*** (7.21)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	6.391 (1.35)	6.642 (1.32)	4.719 (0.99)	4.720 (0.93)
Observations	199865	189964	199865	189964
R^2	0.081	0.085	0.081	0.085

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 33 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: robustness check, lagged values of the dependent variable**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.0918 (0.95) (0.0969)	0.0335 (0.33) (0.100)		
BITSIGxCapLog	0.00650 (0.23) (0.0278)	-0.00336 (-0.12) (0.0288)		
BITAVG	0.00212*** (7.95)	0.00225*** (7.71)		
BITRAT			0.150 (1.68) (0.0896)	0.0693 (0.74) (0.0940)
BITRATxCapLog			0.0234 (0.91) (0.0259)	0.00891 (0.33) (0.0272)
BITAVGrat			0.00197*** (7.03)	0.00217*** (7.08)
CapstockE	0.383*** (6.99)	0.384*** (6.65)	0.392*** (7.25)	0.392*** (6.89)
IntermedTradeLag1	0.00807*** (6.53)		0.00808*** (6.54)	
IntermedTradeLag5		0.0109*** (8.56)		0.0109*** (8.57)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	13.77** (2.98)	12.39* (2.51)	11.87* (2.55)	10.32* (2.07)
Observations	199865	189964	199865	189964
R^2	0.082	0.087	0.082	0.086

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 34 **Regression results of the interaction effect between BITs and the skilled labour endowment of the exporter: robustness check, the difference in institutional quality**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.112 (-1.41) (0.0791)	-0.100 (-1.27) (0.0790)		
BITSIGxSkille	0.00245 (1.74) (0.00141)	0.00220 (1.57) (0.00141)		
BITAVG	0.00247*** (7.36) (0.000335)	0.00245*** (7.29) (0.000335)		
BITRAT			-0.104 (-1.39) (0.0744)	-0.0904 (-1.22) (0.0743)
BITRATxSkille			0.00192 (1.43) (0.00135)	0.00168 (1.25) (0.00134)
BITAVGrat			0.00247*** (6.96) (0.000355)	0.00245*** (6.91) (0.000355)
Skille	0.00512** (3.04)	0.00534** (3.18)	0.00525** (3.19)	0.00547*** (3.33)
InQdiff		-0.108** (-2.85)		-0.110** (-2.91)
Control variables variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	2.813 (0.50)	2.385 (0.42)	0.655 (0.12)	0.232 (0.04)
Observations	149597	149597	149597	149597
R^2	0.083	0.083	0.083	0.083

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 35 **Regression results of the interaction effect between BITs and the capital stock endowment of the exporter: robustness check, differences in institutional quality**

	(1)	(2)	(3)	(4)
	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	0.137 (1.19) (0.115)	0.122 (1.06) (0.115)		
BITSIGxCapLog	0.0428 (1.27) (0.0338)	0.0379 (1.12) (0.0338)		
BITRAT			0.0356 (0.32) (0.112)	0.0208 (0.18) (0.112)
BITRATxCapLog			0.0155 (0.46) (0.0335)	0.0105 (0.31) (0.0334)
BITAVGrat			0.00223*** (6.30)	0.00221*** (6.25)
CapstockE	0.408*** (6.10)	0.405*** (6.05)	0.432*** (6.52)	0.428*** (6.46)
BITAVG	0.00216*** (6.48)	0.00214*** (6.43)		
lnQdiff		-0.0967* (-2.55)		-0.0994** (-2.62)
Constant	7.808 (1.40)	7.421 (1.33)	5.869 (1.05)	5.488 (0.98)
Control variables	BasicII	BasicII	BasicII	BasicII
Time and dyadic FE	YES	YES	YES	YES
Constant	7.808 (1.40)	7.421 (1.33)	5.869 (1.05)	5.488 (0.98)
Observations	149597	149597	149597	149597
R^2	0.083	0.083	0.083	0.083

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 36 **Regression results of the interaction effect between BITs and the skilled labour endowment of the exporter: robustness check, the skill level of the labour measured by *Skilldiff*₂**

	(1)	(2)	(3)	(4)	(5)	(6)
	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade	IntTrade
BITSIG	-0.354*** (-4.01) (0.0884)	-0.445** (-3.28) (0.136)	-0.231 (-1.03) (0.224)			
BITSIGxSkille	0.00654*** (6.29) (0.00104)	0.00676*** (4.23) (0.00160)	0.00370 (1.39) (0.00267)			
BITRAT				-0.334*** (-3.44) (0.0971)	-0.279* (-1.97) (0.141)	-0.0474 (-0.21) (0.227)
BITRATxSkille				0.00621*** (5.49) (0.00113)	0.00500** (3.02) (0.00165)	0.00165 (0.62) (0.00267)
Skille	-0.000248 (-0.25)	-0.00283 (-1.90)	-0.00260 (-0.88)	0.000273 (0.28)	-0.00214 (-1.46)	-0.00196 (-0.67)
Control variables	SpecI	BasicI	BasicII	SpecI	BasicI	BasicII
Time and dyadic FE	YES	YES	YES	YES	YES	YES
Constant	12.00*** (146.31)	0.135 (0.15)	19.91** (2.89)	11.97*** (147.83)	0.00220 (0.00)	20.14** (2.92)
Observations	682826	325113	109775	682826	325113	109775
<i>R</i> ²	0.046	0.046	0.047	0.046	0.046	0.047

t statistics in first parentheses and standard errors in second parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5 Analysis

This section is organized as follows. Firstly, the general implications and validity of the findings presented in section 4 are discussed (section 5.1). Secondly, the results pertaining to the three particular hypotheses are analyzed in more detail (section 5.2). Finally, the main points of the analysis are succinctly summarized (section 5.3).

5.1 General implications and validity

The three hypotheses of this paper were motivated by the purpose of investigating whether BITs exert the impact of trade patterns that one would expect from the contemporary literature on international trade and MNEs. Perhaps the most crucial insight that informed the research focus was the contention that BITs facilitate the activities of MNEs. Thus the existence of BITs could be expected to have the impact on trade patterns that would follow from lower costs of MNE operations.

The literature has identified two chief categories of MNE activity, namely horizontal integration driven by trade costs and scale economies on the one hand and on the other hand vertical integration driven by factor price differences. Since BITs chiefly exist between countries that differ in factor endowments, it is reasonable to assume that the drivers of MNE activity between the average parties to a BIT should be associated with vertical integration.

Three potential outcomes related to vertical integration were identified in the paper and it was hypothesized that the existence of a BIT should be positively related to each outcome. In particular, that BITs should be correlated with an increase in total bilateral exports (H_1) and exert a disproportionately positive impact on exports in intermediate goods that are relationship-specific (H_2). According to the last hypothesis, the impact from BITs should depend positively on increases in the skilled labour and capital stock endowments of the exporter (H_3).

Taken as a whole, the regression results pertaining to the main specifications indicated support for H_1 and H_2 . Regarding H_3 , a positive interaction effect was identified for the BIT variable and skilled labour endowment, while the interaction effect between capital endowment and the BIT variable was identified as positive only for those specifications which employed a parsimonious set of control variables.

Before proceeding with an assessment of the individual hypotheses, a few reflections regarding external validity are appropriate. This thesis focused on the broad impact from BITs and sought to include a large set of countries rather than to focus on individual countries for which more detailed data is available. The aim was thus to find the common denominator for the impact from BITs on trade patterns across all country groups. Nevertheless, it was tested whether the estimated impact differs on the basis of OECD membership of the countries in the pair. This was done partially since BITs were expected to have a larger impact for country pairs between which factor endowment differences are large. Another motivation was that data availability with regard to the control variables is systematically poorer for OECD countries.

Tables (8), (19), (28) and (29) present the results pertaining to this particular sensitivity

analysis for the different specifications. For the impact on total exports, given by table (8), it is interesting to note that estimated impact from merely signing a BIT is similarly insignificant at the five percent level for all country groups, although coefficients for the groups containing one and two OECD members border on statistical significance. The estimated impact from ratifying a BIT is strongly statistically significant for country pairs containing no OECD member and noway near significance for the other groups. This could be taken as evidence for the hypothesis that (at least ratified) BITs have disproportionate impact in relations between OECD and non-OECD members. The other tables do not support this narrative, however, and the interaction effects between BITs and relationship-specificity (table 19), skilled labour endowment of the exporter (table 28) and capital stock endowment (table 29) are actually stronger for pairs of OECD members. Even if the results are not fully consistent with the assumption that the impact from BITs should increase in factor endowment differences between the countries, one should be careful in reaching extensive conclusions from these regressions results as the impact from OECD membership is not tested in alternative specifications in the thesis. The main implication is that BITs appear to have statistical effects of a non-trivial magnitude also in relations between OECD countries and between two non-OECD countries.

It is of course of particular interest that the estimated impact from *BITAVG* on total bilateral exports was *negative* for country pairs where both states are OECD members. Potentially, this result could be explained by increased trade between OECD and non-OECD members as more BITs are concluded, leading to less trade between OECD members. Until further researched, this remains speculation however.

On a related topic, the remarkably high and positive estimates for the variables *BITAVG* and *BITAVGrat* merits particular attention. *BITAVG* was introduced to control for spill-over effects on bilateral trade from the total number of BITs that apply to the country pair. The estimated coefficient of *BITAVG* is, however, interesting on its own merits. Most estimations presented in section 4, indicated a positive correlation between bilateral exports and the average number of BITs signed and ratified, respectively, with the world by the country pair. It is known that many BITs have been negotiated in conjunction with a general increase in the number of BITs by which the states are bound, and the mentioned result points to positive spill-over effects from the average number of BITs that apply to the state parties. This result may be understood within the framework of theories of complex integration, where an MNE for example establishes intermediate or final goods production in one foreign country in order to serve customers in another proximate foreign country. Alternatively, the result may be explained as representing a signaling effect, i.e. the existence of a large number of BITs with other countries signal the commitment of the signatories to safe-guard foreign direct investment in general. Regardless, the clear implication is that specifications which are designed to capture the impact of a BIT between two countries and which do not take account of the mentioned spill-over effects likely overstate the average impact from BITs on bilateral trade.

The validity of the results pertaining to the three individual hypotheses are now discussed below.

5.2 An evaluation of the three hypotheses

a) The impact from BITs on total bilateral exports

In the case of horizontal integration, increased MNE activity is associated with the replacement of exports with production in the foreign market, implying diminished bilateral exports. Vertical integration, in contrast, is associated with the replacement of domestic production of *inter alia* intermediate goods by foreign production and imports, which implies an increase in total bilateral exports between the parties. The paper initially presented the hypothesis that BITs exert a positive impact on total bilateral exports, as drivers of vertical integration should be stronger than drivers of horizontal integration between the typical parties to a BIT.

The results that pertain to this hypothesis are presented in tables 6-11 in section 4.1. The estimated impact when only controlling for time and dyadic FE was very large (approximately 40 percent for the signing of a BIT, see table 6). Coefficients of this magnitude naturally makes one suspicious that omitted variable bias confounds the results. Indeed, the estimated coefficients progressively diminished in magnitude when applying a larger set of control variables, reaching values in the range of approximately 10-15 percent for the specifications that contained lagged control variables and lagged values of the dependent variable (e.g. tables 10 and 9).

Except for the regression which disaggregated the data on the basis of OECD membership (table 8), the statistically significant and positive impact was robust to all the different specifications explored in section 4.1, with the exceptions of *BITRAT* in columns (4) and (6) in table (9). Both of these latter cases concern specifications wherein lagged control variables are employed. It should be noted that the estimates in table (9) is on the borderline to statistical significance, however, and actually clearly statistically significant at the ten percent level with a t-value of 1.92. All the lagged values of the BIT variables in table (7) were also statistically significant, but of diminishing magnitude.

The results in section 4.1 clearly demonstrate a positive correlation between the conclusion of a BIT during the sample period and increased total bilateral exports. Moreover, the effect is quantitatively huge even according to the more conservative estimates. For example, even in table (9), where a large number of control variables are applied together with controls for the five year lagged values of these control variables, the estimated impact from signing a BIT is predicted to be in the vicinity of 15 to 20 percent. The estimates become all the more remarkable when seen in the context of the much smaller coefficients for some of the PTA variables obtained from DESTA (compare in particular the coefficients for PTA and FTA in table 6).

To what extent is the remaining positive correlation the result of a causal impact from BITs on total bilateral exports? There may be omitted variable bias due to events in the neighborhood of either or both members of the country pair, e.g. regional economic growth which could conceivably boost both trade growth and the popularity of BITs. Influences from the surrounding world have partially been controlled for using the average share of trade and FDI inflows to the combined GDP of the country pair. Yet, a future analysis specifically concerned with the impact from BITs on total exports may benefit from controlling for inter-linkages more comprehensively.

Regardless, for the purpose of this paper, the hypothesis H_1 is of secondary interest as it

does not directly concern vertical integration. From the above discussion, it may however be concluded that the conclusion of BITs is persistently and positively correlated with increased bilateral exports during the sample period.

b) The interaction effect of BITs and relationship-specificity of intermediate goods

The current international trade literature indicates that the impact from a BIT may vary across goods on the basis of average relationship-specificity. However, for reasons outlined in section 3.1 and 3.2, the precise connection between a higher relationship-specificity and the impact on bilateral trade from a BIT is unclear. This thesis postulated the working hypothesis that a higher degree of relationship-specificity of the broad economic category is positively correlated with the impact from a BIT. Within the framework of the model presented in section 3.1, a rejection of the null hypothesis in favour of a positive coefficient would indicate that the BITs on average lower the vertical cost of integration and induce firms to vertically integrate foreign production of intermediate goods which are relationship-specific.

Using Rauch's (1999) classification of intermediate goods, the interaction effect of BITs and relationship-specificity was evaluated in section 4.2 (tables 12-22). The results indicated a persistent and positive interaction effect, statistically significant across almost all specifications. Its magnitude was fairly small, however, especially when *Index2* was used as a measure of relationship-specificity, meaning that a high relationship-specificity was required before the predicted impact from the BIT would become positive.

Since no more than eight BECs of intermediate goods were used in the pooled regression analysis, it was possible to disaggregate the data and estimate the regressions separately for each category. In order to save space, the results are only presented with the set of time-varying control variables in *BasicII* (see tables 13-15). Unreported regressions analysis using other control variables, however, point to a similar conclusion. The positive interaction effect between the index and the impact from a BIT on total bilateral exports in intermediate goods is chiefly due to the fact that exports of the BEC categories processed industrial supplies and parts of capital goods, that are highly relationship-specific, depend positively on the existence of a BIT.

The results support the hypothesis H_2 to some extent, but one should be careful in drawing far-reaching conclusions from these findings. With only eight categories of intermediate goods, it is of course possible that exports of these particular intermediate goods depend positively on the existence of BITs for some other reason than the fact that they are considered as relationship-specific. Moreover, it should be cautioned that Rauch's (1999) indices may not perfectly capture relationship-specificity. There are finally some remarkable inconsistencies, most in particular that the most relationship-specific category of all, parts of transport equipment, exhibits no positive interaction effect with BITs when applying the control variables in *Basic II* and that exports of primary fuels depends so strongly and positively on a ratified BIT (although not on a signed BIT; see tables 13-15).

Nevertheless, on the balance, there indeed appears to be a positive interaction effect between relationship-specificity and BITs in this very aggregated dataset. The fact that this is what one would be lead to believe from theory is certainly indicative, and as further argued in section 6.2 future research should test whether this interaction effect is consistent with data at lower levels of aggregation. In short, the findings point

to a positive correlation between higher relationship-specificity of a broad economic category and the impact of a BIT on bilateral exports of intermediate goods. The result is consistent with the view that the impact of BITs depend positively on relationship-specificity, but does not necessarily rule out other interpretations.

c) The interaction effect of BITs and factor endowments of the exporter

A crucial result within the framework of property-rights models is that vertical integration should be especially profitable and prevalent within industries that are characterized by high relationship-specificity. The skilled labour endowment and the capital stock endowment of the exporter was used as indicators of relationship-specificity, the assumption being that countries which increase their endowments in these factors will tend to export intermediate goods in industries which are increasingly headquarter-intensive. Following e.g. Antràs (2003), and applying the same approach as that which informed H_2 , it was hypothesized that the average impact from a BIT for a given country pair depends positively on the skilled labour endowment and capital stock of the exporter.

The main specifications tested in section 4.3 (see tables 23-25) offered support for this hypothesis with regard to the skill level of the labour force, as the interaction effect of the BIT variable and the skilled labour endowment variable was estimated to be strongly statistically positive and of non-trivial magnitude. The interaction effect between BITs and the capital endowment of the exporter was also estimated as being statistically significant but it was not robust across a majority of the specifications. It should be emphasized that this interaction effect exists over and above the effect of increasing factor endowments. It is not surprising that a higher labour force skill level and a larger per capita capital stock on behalf of the exporter would induce increased exports in the country pair. It is however remarkable, and consistent with the literature, that this impact should depend positively on the existence of a BIT between the countries, which can be taken to imply facilitated vertical integration.

As stated an as can be seen above, the interaction effects were robust across many but not all specifications which were tested in section 4.3. For example, the interaction effect between the existence of a BIT and the skilled labour endowment of the exporter became insignificant when including five year lagged values of the control variables (column 6 in table 30).

While the findings correspond well to theory it must, however, be interpreted cautiously for two reasons. Firstly, as demonstrated in section 4.3, the results are not robust across all specifications. Secondly, and perhaps more importantly, the capital per worker and the gross tertiary enrollment are crude measures of factor endowments and consequently crude proxies for relationship-specificity.

5.3 Summary: is the impact from BITs consistent with the literature on MNE:s and international trade?

On the balance, the results presented in section 4 are consistent with the impact that one would expect from the conclusion of a BIT if the treaty is associated with a decrease in the cost of vertical integration between the parties. In particular, the impact from a BIT on exports in intermediate goods depends positively on the relationship-specificity

of the relevant BEC and on increases in the skilled labour endowment and capital stock of the exporter. Taken separately, none of the three results would convincingly show that BITs induce vertical integration. In conjunction, however, they make a positive connection plausible and demonstrate that the question merits more research. This is a strength of the thesis: the results are broadly consistent with not one but three hypotheses derived on a priori grounds under the assumption that BITs facilitate vertical integration.

An important weakness is that the data may not be disaggregated enough to fully support nuanced conclusions regarding the impact from a BIT. Data on the industry level which features a larger variation in relationship-specificity as well as richer information on capital, skilled labour and R&D intensity is better suited to such analysis. On the contrary, this paper has assumed a very broad approach and included data for a very large number of countries. The results presented above thus involve findings of high external validity, which may be generalized beyond the context of particular countries. This could not have been accomplished to the same extent if the study had relied on industry level data.

6 Conclusion

This section presents a summary of the findings of this paper (section 6.1) and implications for future research (section 6.2).

6.1 Summary

In this thesis, it has been tested whether the existence of BITs exerts an impact on bilateral trade patterns that is consistent with the contemporary literature on international trade and MNEs. The thesis presents evidence of a connection between the conclusion of BITs and three outcomes for bilateral trade which are surmised to relate to vertical integration. For most variables, the correlation is robust to dyadic and time FE and to the inclusion of a large set of time-varying control variables.

According to the main specifications employed in the paper, the conclusion of a BIT during the sample period exert a positive impact on total bilateral exports as well as a disproportionately large impact on bilateral exports of intermediate goods which are relatively relationship-specific. When the regression analysis is conducted separately for the different categories of intermediate goods, one discovers that the positive correlation chiefly is due to the fact that exports of processed industrial goods and parts of capital goods depend positively on the existence of a BIT between the countries. Moreover, according to the majority of specifications employed in this paper the impact from BITs on exports of intermediate goods depend positively on the skilled labour endowment of the exporter. According to relatively parsimonious specifications, the impact from BITs also depend positively on the per capita capital stock of the exporter.

Taken as a whole, the results are consistent with the view that trade in intermediate goods that are relationship-specific is facilitated by vertical integration and that vertical integration is facilitated by the existence of BITs. The identified potential biases require, however, that the estimated impact from BITs should be interpreted cautiously until the issue has been subject to further research. A few suggestions concerning such research are offered below.

6.2 Implications for future research

The findings of this thesis have implications both for future research on BITs and for future research on MNEs and international trade.

Previous research on BITs has predominantly attempted to explain their popularity by appealing to the impact on FDI in general. This thesis has demonstrated a likely connection between BITs and vertical integration, meaning that BITs may in particular be motivated by the wish to promote FDI in industries where vertical integration is profitable. Keeping this in mind, four avenues for future research on BITs appear particularly promising. Firstly, using industry level data sets, it should be evaluated whether BITs disproportionately promote FDI in order to acquire control of intermediate producers of relationship-specific supplies. The findings of this thesis indicate that this may be true for at least country pairs which differ largely in factor endowments.

Secondly, it should be tested to what extent the results presented in this thesis hold at a lower level of aggregation. Data at a more disaggregated level would further illuminate the validity of the above findings. In section 4, it was demonstrated that the impact of the existence of a BIT appears to vary e.g. depending on the level of development of the parties to the treaty and the relationship-specificity of the BEC of the intermediate good under consideration. It seems likely that the the impact of a BIT will vary substantially depending on the precise industry under consideration. If BITs indeed have a larger impact on exports of intermediate goods produced in industries characterized by relationship-specificity, one would expect that BITs exert a larger impact on exports of highly specialized processed industrial supplies than more standardized supplies that fall into the same broad economic category. An empirical study utilizing data on a lower level of aggregation could illuminate the interaction effect between the existence of a BIT and relationship-specificity.

In particular, two data sources are appropriate for the implementation of this research proposal, namely more disaggregated data of bilateral exports (e.g. according to the four digit SITC classification) and the World Input Output Tables (WIOT). The latter source directly documents vertical integration, by detailing the dollar value of one industry's output used as inputs in a particular foreign industry. This data source may be particularly useful for tests concerning the interaction effect of BITs and factor endowments, as the WIOT provide information on factor intensities concerning e.g. skilled labour and capital (see Timmer et al., 2015).

Thirdly, it should be explored to what extent BITs are positively correlated with the intra-firm share of bilateral trade. This is an alternative way to test for the impact from BITs on vertical integration and could enhance the understanding of whether the existence of BITs actually induce vertical integration.

Finally, if the quantitatively large impact from BITs on total bilateral exports estimated in this thesis is correct, it indicates that BITs exert a positive impact on bilateral exports in other categories than intermediate goods. For example, one could imagine that bilateral exports in capital goods does depend positively on the existence of a BIT as certain categories of capital goods which are relationship-specific would be more readily traded within MNEs. It is therefore recommendable that impact from BITs on trade flows in different categories of goods are systematically evaluated to give a more comprehensive picture on their significance for trade patterns.

Concerning future research on MNEs and international trade, the findings of this thesis point to the possibility of using BITs as a proxy for vertical integration. The share of intra-firm trade has often featured in the literature as a proxy for the prevalence of integration. However, data is not always available for this share and insofar as BITs are significantly correlated with the prevalence of vertical integration it may be defensible to use the existence of a BIT as a proxy for increased vertical integration. Before this approach is implemented, however, the robustness of the findings of this thesis has should be further evaluated, e.g. by implementing the three research proposals outlined in this section.

On a final note, two methodological implication for future research should be mentioned. Firstly, the overall number of BITs to which a country pair is subject appears to be correlated with both bilateral trade patterns and the existence of a BIT between the countries in that pair. The implication is of course that the conscientious researcher

should consider ways to control for general BIT policy in a dyadic specification. Secondly, the existence of a BIT exert an independent effect on bilateral trade patterns even when controls are introduced for the existence of PTAs between the state parties. In fact, the impact from BITs appear to vastly overshadow the impact from PTAs in magnitude! This result should certainly inform future research on the impact from PTAs on trade.

7 References

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