Vertical Trade Specialization and PTA Formation

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Abstract

During the last two decades, the number of preferential trade agreements has grown almost exponentially to reach over 270 by early 2010. In contrast to earlier periods, when countries of similar levels of economic development tended to form trade agreements, today’s PTAs bring together countries of different size and level of development. The economic rationale of such PTAs, however, is not obvious.

To explain this last wave of PTAs, this paper presents a general framework based on a model of vertical production specialization. The globalization of manufacturing leads to the rapid growth of vertical intra-industry trade, or the exchange of similar goods differentiated by unit values. Countries with a relatively higher income per capita export more capital-intensive goods, while more labor-intensive goods are exported by relatively poorer countries. This kind of specialization, I argue, creates incentives for governments to support bilateral trade agreements.

I test this model using a new measure of vertical intra-industry trade calculated on the basis of highly disaggregated trade flows. The findings provide strong evidence that growing vertical trade specialization promotes PTA formation. Many agreements formed since the end of the Cold War should therefore be seen as part of the movement of manufacturing beyond the developed world.¹

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1 The Post-Cold War Proliferation of PTAs

The explosive growth of preferential trade agreements since the early 1990s, concurrent with stalled negotiations at WTO, suggest that regionalism has replaced multilateralism as the principal venue of trade liberalization. By 2010, more than 270 agreements, counting only those dealing with trade in goods, covered a majority of world trade. Remarkably, the most common form of agreement signed since the early 1990s and the majority of those under negotiation are either agreements that include a developed and one or more developing countries, or agreements between a developed and a formerly communist transition economy, a category referred to as “asymmetrical PTAs” in this paper. Although recent research has offered much insight into the factors that promote trade agreements in general, the conspicuous popularity of deals between economically unequal countries has attracted less scholarly attention. What, then, explains the explosive growth of these PTAs?

This study argues that a central driving force is the specialization of manufacturing exports according to the level of economic development of a country. More specifically, when intra-industry trade is shaped by different factor endowments, it creates incentives to form PTAs. Comparative advantage implies that the gains from trade should be greatest between countries with very different factor endowments exporting entirely different goods. And yet, decades of research in political economy tell us that liberalizing trade between countries with very different endowments should be particularly difficult. Mutual trade liberalization would expose the least competitive sectors in capital-abundant countries to imports, so unless these sectors can retain protection, liberalization with labor-abundant countries may not be feasible. The stark asymmetries between developed and developing countries in bilateral negotiations make it even less likely that sunset industries in the North will be forced to shut down. A typical instance of such protection are the quotas for

\[\text{Crawford and Fiorentino (2005, 7)}\]
textiles retained in NAFTA to protect inefficient producers in the United States (Cameron and Tomlin 2000, 35).

At the same time, developing countries with low per-capita incomes are often relatively small markets for exporters of goods produced in high-cost locations. Developed-country exporters are therefore often uninterested in joining a political coalition to support trade liberalization. Such coalitions are essential to provide a counterweight to protectionist forces.³ While developed countries may be important markets for individual developing countries, the reverse is rarely the case. This also implies that small and often distant economies do not enlarge the export markets of developed country producers to an extent that allows them to achieve greater economies of scale, an important driving force of regional trade liberalization in cases of more economically similar countries.⁴ Clearly, countries often “form trade blocs for noneconomic reasons, such as national security, peace, and assistance in developing political and social institutions.”⁵ However, this leaves the majority of PTAs between countries of unequal economic development without an economic rationale, and provides no explanation for the role of trade itself in these agreements. Unsurprisingly, some studies find only a substantively weak and statistically insignificant effect of aggregate bilateral trade on the likelihood of forming a PTA.⁶ Could it be that the wave of asymmetrical PTAs has no relation to trade?

This paper argues that trade does indeed play a central role in motivating PTAs, but not primarily trade based on comparative advantage. Instead, the economic interests underpinning asymmetrical PTAs are the result of a mutual specialization of industrial production. The resulting trade is therefore driven by a combination of differences in factor prices and trade in the same industry—in short, vertical intra-industry trade (VIIT).

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⁴ Milner (1997); Chase (2005).
⁵ Schiff and Winters (2003, 187).
⁶ Mansfield et al. (2007).
In simplest terms, VIIT is trade in similar goods produced by the same industry, but differentiated by the unit value of the goods.

Such mutual specialization makes liberalization politically much more feasible than potential gains from inter-industry trade based on comparative advantage. Investment in export-oriented manufacturing, by foreign firms as well as by domestic entrepreneurs, creates employment and generates foreign exchange earnings. At the same time, it poses no danger to previously protected industries that make up the legacy of import-substitution industrialization in many countries. In the best case, vertical specialization also limits off-shoring of jobs by increasing exports. Yet even in the worst case for workers in the country with higher per-capita income (and hence usually wages), labor will often be split, since high-paying specialized workers actually benefit as capital-intensive production expands.

The argument made in this paper contributes to several debates. First, it expands on the recently emphasized link between trade liberalization and FDI. A growing number of studies shows that international agreements can act as commitment devices to help attract foreign investment. Much theorizing in political economy, however, still assumes that the gains offered by comparative advantage is the motivation of trade liberalization, and pays too little attention to the political interests related to foreign direct investment and the broader shift of manufacturing industries from the developed to the developing world. Second, the argument engages the debate over the integration of developing countries into the world economy and the use of PTAs as a developmental policy. Vertical specialization is an essential part of such a developmental strategy. This paper shows that it promotes the convergence of interests between countries of different income levels and the formation of preferential trade agreements. This convergence is most prominent in East and Southeast

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7 Büthe and Milner (2008); Elkins et al. (2006); Kerner (2009); Neumayer and Spess (2005).
8 Shadlen (2005).
9 Haggard (1997).
Asia and in Latin America, but also evident in North Africa (e.g. Morocco’s FTAs with the EU and the US) and South Africa. For the developing country partner, the ultimate goal is usually not trade in itself, except as a source of foreign exchange to avoid balance-of-payments problems. Rather, the objective is to attract more FDI. Finally, the argument laid out here has implications for whether PTAs should be seen as a possible substitute for a stalled multilateral liberalization process, thereby reaching global free trade on a different route.\footnote{Bhagwati (1992, 2008); Freund (2000a,b).} Unfortunately, if the reduction of trade barriers in PTAs privileges a relatively narrow range of goods, then the WTO may be left with the intractable issue of agricultural trade liberalization. By satisfying the interests of a narrow range of industries while maintaining protection against other imports, PTAs may therefore undermine the potential for issue-linkage that has been crucial in achieving agricultural market-opening in the past.\footnote{See Davis (2003, 2004) for a demonstration of the importance of issue-linkage.}

The paper proceeds as follows: Section 2 briefly surveys the existing literature on PTA determinants and then proceeds to present the theoretical foundations of this study. Section 3 presents the research design. Section 4 discusses the econometric analysis and results. Section 5 concludes with an outlook on further avenues of research.

\section{The Political Economy of Asymmetrical PTAs}

The proliferation of preferential trade agreements since the early 1990s has led to a flurry of publications that investigate their determinants, their effects on trade, and their interaction with the multilateral trade regime. The findings so far indicate that democratic countries are more likely to negotiate trade agreements,\footnote{Mansfield et al. (2002).} although this effect is tempered
by the number of veto players in their political systems.\textsuperscript{13} Governments may also use trade agreements to overcome domestic resistance to liberalization if they can obtain long-term benefits.\textsuperscript{14} Several forces work at domestic and international levels to promote trade agreement formation, among them worries about a stalled WTO and the fear to lose export market access if multilateral negotiations break down.\textsuperscript{15} In the past, countries have also formed trade agreements to strengthen ties with allied states,\textsuperscript{16} the most conspicuous example being the trade agreements between Israel and the US, Canada, and the EU. Finally, the “demonstration effect” of the benefits of PTAs explain much of their attractiveness: PTAs evidently reduce the volatility of the terms of trade and trade itself, and increase foreign direct investment inflows, so policymakers can realize substantial benefits that are not directly related to gains from trade.\textsuperscript{17}

Given their general thrust, however, these studies do not differentiate between PTAs according to the level of development of their participants.\textsuperscript{18} This is striking when considering that in the post-Cold War era, PTAs between countries of different levels of development and per-capita incomes are by far the most common type of agreement, as shown in table 2: Developed-developing, developed-transition, and transition-transition country PTAs outnumber developed-developed country PTAs. What, then, explains the proliferation of PTAs between countries of different levels of development? This paper argues that mutual vertical specialization of manufacturing trade creates political coalitions that support trade liberalization. Driving the vertical specialization are investment activities of multi-

\textsuperscript{13} Mansfield et al. (2007).
\textsuperscript{14} Maggi and Rodriguez-Clare (1998, 2007).
\textsuperscript{15} Mansfield and Reinhardt (2003); Dür (2007); Solís (2003); Manger (2005).
\textsuperscript{16} Gowa (1995); Mansfield and Reinhardt (2003).
\textsuperscript{17} See respectively Mansfield and Reinhardt (2008); Büthe and Milner (2008).
\textsuperscript{18} The exception is a widely cited paper by Baier and Bergstrand (2004) that incorporates differences in capital-per-worker ratios into its model, but then tests it on a dataset that consists of 70% intra-EU and EFTA observations.
national firms that disaggregate production across different location. The result is vertical intra-industry trade, a form of exchange explained in greater detail below.

<table>
<thead>
<tr>
<th></th>
<th>Developed-Developed</th>
<th>Developed-Developing</th>
<th>Developed-Transition</th>
<th>Developing-Developing</th>
<th>Developing-Transition</th>
<th>Transition-Transition</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958-89</td>
<td>10</td>
<td>6</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>1990-94</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>1995-99</td>
<td>3</td>
<td>7</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>2000-05</td>
<td>2</td>
<td>20</td>
<td>4</td>
<td>12</td>
<td>4</td>
<td>21</td>
<td>63</td>
</tr>
<tr>
<td>Total Post-Cold War</td>
<td>8</td>
<td>31</td>
<td>8</td>
<td>21</td>
<td>7</td>
<td>42</td>
<td>117</td>
</tr>
</tbody>
</table>

Note: Developed economies include Canada, the US, EU, EFTA, Japan, Australia and New Zealand; transition economies are the former Soviet Union, Eastern and Central Europe, the Baltic States and the Balkans; the remainder are classified as developing. Source: (Crawford and Fiorentino 2005, 7)

**Vertical Intra-Industry Trade Defined**

According to neoclassical trade theory, countries ought to specialize in the production and export of those goods in which they have a comparative advantage. For the theory to work, the origins of this comparative advantage are secondary, whether they are natural endowments such as arable land or the result of earlier policy choices such as an investment in education. Such specialization should result in one-way trade: For example, Australia exports beef to Japan, but imports cars. There is virtually no trade in either good flowing in the opposite direction. The gains from such trade are evident, its political economy well understood, and its political implications the subject of seminal works. However, most global trade is actually the exchange of similar goods produced in countries with comparable factor endowments, something that comparative advantage cannot explain.

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19 The Heckscher-Ohlin model focusing purely on factor endowments is used by Rogowski (1989), while most recent work on the political economy of trade policy draws on the Ricardo-Viner model that introduces factor specificity (Alt et al. 1996).
This observations led to the development of “modern” trade theory based on increasing returns to scale and monopolistic competition.\textsuperscript{20}

Drawing on such models, political economists have investigated the implication of scale economies and monopolistic competition for firm lobbying and the demand for protectionism and liberalization.\textsuperscript{21} The focus of these models, however, has been what is sometimes called intra-industry trade by horizontal firms. Horizontal firms aim to achieve economies of scale in their production facilities, effectively replicating their activities in different countries. Accordingly, these firms produce in separate plants in different countries if the gains from selling locally, avoiding tariffs and reducing transport costs outweigh the plant-specific fixed costs. If tariffs and transport costs are low, but fixed costs in building a plant are high, they will instead export from their home base. This will often be the case in countries with similar GDPs\textsuperscript{22} and factor prices. Exports and imports of these firms’ products are hence referred to as horizontal intra-industry trade.

The emphasis in the literature on North-North trade and FDI is understandable, since it has historically dominated flows of goods and capital. Since the early 1990s, however, developing countries have not only attracted a growing share of global FDI, but have also captured a greater share of global manufacturing based on domestic investment. A large portion of such manufacturing activities are export-oriented. The incentive to spread production across countries is created by differences in factor prices and labor intensity. Since labor costs are higher in the North, only more capital-intensive production remains viable, while less capital-intensive production moves to middle-income, advanced developing countries. Truly labor-intensive, light-goods manufacturing in turn migrates towards

\textsuperscript{20} The standard work is still Helpman and Krugman (1985).
\textsuperscript{21} Milner (1997); Chase (2005); Gilligan (1997).
\textsuperscript{22} Markusen and Venables (1998); Markusen and Maskus (2002). Different GDPs determine market size. Accordingly, in the case of the Canada-US FTA, firms from the smaller country objected to liberalization because they would be less able to compete with firms already operating in a larger market and hence producing at more efficient scales.
low-income countries, e.g. in the case of textile manufacturing that has moved from other Asian locations to Bangladesh and Sri Lanka. This process tends to occur within industries, so that the bilateral trade is referred to correspondingly as *vertical* intra-industry trade (VIIT), first so defined by Falvey (1981). As Krugman (1981), Greenaway (1992) and Abd-el Rahman (1991) stress, it is essential to distinguish between horizontal and vertical intra-industry trade, as the economic determinants are quite different.

VIIT operates at the level of final products as well as intermediate goods, as firms specialize in the production of inputs as well as finished goods in different locations. Often, high-end goods are manufactured in developed countries for the home market and exported in smaller numbers to developing countries, where lower GDP per capita implies that the market for such high-unit value goods is small. Mass-market or entry-level goods with a lower individual unit value are produced in developing countries for the export to the North as well as consumption in the South. Yet also between developing countries, different levels of capital intensity lead to further specialization of production. The different characteristics of the three trade types are summed up in table 2.

Table 2: Characteristics of Trade Types

<table>
<thead>
<tr>
<th></th>
<th>Returns to scale</th>
<th>Monopolistic competition</th>
<th>Trade in the same goods</th>
<th>Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-way</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>few</td>
</tr>
<tr>
<td>Horizontal intra-industry</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>many</td>
</tr>
<tr>
<td>Vertical intra-industry</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>many</td>
</tr>
</tbody>
</table>

A special case of such trade results from regional production-sharing\textsuperscript{23} by firms referred to as *vertical* multinationals.\textsuperscript{24} Production is “shared” across borders by outsourcing in-

\textsuperscript{23} Chase (2003).

\textsuperscript{24} Helpman (1984).
termediate, often labor-intensive stages to a country with lower wages, sometimes within
the firm, at other times to firms acting as suppliers. Several developed countries operated
specific tariff-relief programs to support such operations, among the most prominent the
former US tariff codes 9802.00 and 9803.00, specifically created to allow US firms to move
partially-finished goods to Mexico, employ Mexican labor for further processing, and then
ship the goods back to the US. Duties would then be only charged on the value-added
abroad. While production-sharing within a firm has expanded over the last two decades, it
generally requires geographic proximity to be profitable to multinational firms, whereas
especially for finished goods, VIIT remains feasible even for geographically distant produc-
tion locations as long as transport costs remain low.

Although firms undertake vertical specialization “on the ground,” they are working in
an environment in which factor prices differ by country. The actual ownership of the pro-
duction facilities is secondary. Sometimes, multinational firms will expand production and
turn a country into an export platform. This has been the case in the auto industry, where
developing country brands have made limited inroads in mature markets. At other times,
multinational firms will procure goods designed and branded in a developed countries, as
in parts of the computer and consumer electronics industry—consider the example of Ap-
ple computers manufactured in Taiwan. Taiwanese producers in turn procure many parts
for these devices from mainland China. Finally, in some product categories, multinational
firms are less important, as producers from developing countries have become successful
exporters to developed countries, although rarely at the high end of prices. One such case
is the success of Korean white goods in Europe coexisting with luxury products of cor-
responding industries in Sweden and Germany. Given this diversity of firm reactions, it

is most useful to think of vertical specialization as a country-level rather than firm-level phenomenon, and to analyze the attendant trade using the same degree of aggregation.

**Vertical Trade Specialization and PTA Formation**

To understand how the rise in vertical intra-industry trade contributes to the formation of preferential trade agreements, we need to consider the convergence of interests between developed and developing countries that occurs as its result. Let us start with the assumption made by Grossman and Helpman\(^{26}\) that elected politicians care about three things: raising aggregate national welfare, obtaining special favors from specific constituents (i.e. lobbies), and raising government revenue. Tariffs affect the latter, but for all but least-developed countries, they represent a negligible share of taxes. Hence governments will grant favors to special interests as long as it does not work against the first goal to the extent that voters are moved into action.\(^{27}\)

The most obvious constituency in favor of trade liberalization are the firms that engage in VIIT. For these firms, PTAs offer an opportunity to liberalize *their own trade*. Since they are the sellers and, in the case of intermediate goods, also the buyers of the traded goods, they are in the best position to lobby for tariff reductions in *both* countries involved in the deal. Whether firms in an industry are united or split in favor and against a PTA largely depends on whether they have invested in the (less-developed) partner country and vertically specialized their operations. Having invested in the developing country, multinational firms can therefore often lobby on both sides of the border. Whether multinational firms directly own and operate production plants in the partner country is again secondary. Firms that procure from OEM producers would support trade liberalization because they pay tariffs on the import of intermediate or finished, but “unbranded” goods.

\(^{26}\) Grossman and Helpman (1994).
\(^{27}\) Voters hardly ever care, as the literature on endogenous tariff theory predicts.
Accordingly, to these firms we can add some of their suppliers, although here again vertical specialization will play an important role. To the extent that a supplier in one country produces parts with a high capital intensity and sells them at a relatively high unit value, the firm will likely see export opportunities to provide inputs for the expanded production in the other, less economically developed country. Conversely, suppliers in the lower-income country will support liberalization because it promises more exports. Who benefits from liberalization is in this case much more determined by production location and procurement choices of the multinational firm than by e.g. factor specificity. Baron refers to such lobbying interests as “rent chains.”

Since the constituency in favor of liberalization often comprises only a narrow range of multinational firms and their rent chains—and trade agreements to serve their interests have almost private-goods character—it is at first glance surprising that their support should be enough to guarantee the success of PTAs. However, the benefits for governments are evident, while potential opposition is often either divided or can remain protected.

For government of the less-developed country, the main benefit of vertical specialization is foreign direct investment that is primarily oriented towards exports. Because some of the exports will be finished goods, these countries therefore capture more value-added than if they are merely processing locations with cheap labor. In turn, this improves their balance of payments. Overcoming frequent balance-of-payments crises has been among the central objectives of economic reforms in countries that abandoned import-substitution industrialization in Latin America as well in Asia after the 1998 Financial Crisis. More specifically, vertical specialization increases the number of jobs provided by foreign firms, often offering better pay and working conditions. Most importantly, however, it can be shown that vertical specialization will lead to an increase in demand for less-skilled labor in

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28 Baron (1997).
the country with a lower capital intensity of production, and intriguingly, increased demand for highly-skilled labor in the country with the relatively higher capital intensity. Hence, wages for both groups will rise.\textsuperscript{30} Providing jobs for the many young people entering the workforce is often an important goal for developing country governments. Correspondingly, the government of the country with the relatively higher per-capita income may not have any objections to mutual trade liberalization if no jobs are lost, or at least few among highly-skilled and therefore often better-organized workers. Moreover, if job losses are going to be limited or concentrated among small groups within a firm or industry, then labor’s position towards trade liberalization may be ambivalent—who would object to a policy that promises greater exports? Indeed, labor organizations have rarely had strong views on PTAs. The exception is clearly the US, but this picture may be skewed due to the weight of unions from the primarily import-competing auto industry.

For developed country governments, it then remains to avoid rapid opening of the home market to imports from developing countries that would compete with industries at home. Yet given the stark asymmetries in the negotiations between the partners, developing countries will rarely achieve real concessions in market access.\textsuperscript{31} But it is worth remembering these are the imports that would create the greatest gains from trade.

Accordingly, we can expect the emergence of a coalition that “asymmetrical” PTAs, and that more specifically supports narrow liberalization of a small range goods within these agreement. This coalition will consist of multinational firms, their suppliers to the extent that they are part of the rent-chain and not displaced, and labor in relatively less-developed country. We will also an “opportunistic” coalition of exporters in competitive sectors as predicted by comparative advantage. But there is no intrinsic benefit of PTAs for these

\textsuperscript{30} Feenstra (2003, 386).
\textsuperscript{31}See Cameron (1997) for a case study of the NAFTA negotiations and Ethier (1998) for a general argument. Katada et al. (2007) argue that it is precisely the ability to control the agenda and exclude import-competing sectors from liberalization that makes asymmetrical PTAs attractive.
exporters compared to multilateral negotiations. If they are based in the relatively smaller partner, asymmetries work against their interests, they will not obtain much liberalization.

**An Illustrative Case: The Japan-Thailand FTA**

A case helps illustrate the link between vertical specialization and the subsequent formation of a PTA: The Japan-Thailand Economic Partnership Agreement that became effective in 2007. Vertical specialization played an essential role in the free trade agreement negotiated between Japan and Thailand. Japanese FDI in the country was originally oriented towards the Thai domestic market, as well as neighboring ASEAN countries.\(^{32}\) Besides the auto industry, manufacturing of light consumer goods such as appliances featured prominently.

Although Thailand was initially successful in achieving growth, the experience of the Asian Financial Crisis brought home the message that protectionist policies and an over-valued currency risked creating balance-of-payments crises. The rapid depreciation of the baht and the liberalization sought by successive Thai governments after the crisis (some of it in response to IMF demands) turned Thailand into an important export platform for Japanese firms. As a landmark shift from pre-Crisis Japanese corporate strategy,\(^{33}\) finished goods were now exported back to the home market, among them “micro” cars for which there is no significant market outside Japan.

Once restructuring of production was under way, Japanese firms began lobbying the Thai government and the Japanese Ministry of Economy, Trade and Industry specifically for the reduction of tariffs on high-value parts and luxury vehicles. First voiced prior to any FTA negotiation plans, they quickly became the central objective for the Japan Automobile Association JAMA and the peak industry association Keidanren,\(^{34}\) during the bargaining

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\(^{33}\) See especially Hatch and Yamamura (1996).

\(^{34}\) Yoshimatsu (2005, 2006).
phase. Specialized industry associations such as the Japan Business Council for Trade and Investment Facilitation raised very specific issues with METI. With reference to Thai tariffs on inputs, the association wrote that “[Regarding electronics parts, ball bearings and rubber products] it is requested that a further cut in tariff rates be undertaken […]], focusing on those materials that cannot be produced in Thailand. Furthermore, tariffs on cutting tools ought to be reduced rapidly. […] On auto parts, the duty ranges from 5 to 42 percent, necessitating a significant reduction.”

In Thailand, suppliers joined with other interest groups in favor if they were partly or wholly owned by Japanese firms or sold primarily Japanese producers, while others who feared competition from Japanese producers or who primarily supplied European and American producers remained opposed.

Although vertical specialization in manufacturing played an essential role in nurturing support for the Japan-Thailand agreement, the import-competing agricultural sector in Japan prevented any significant opening to Thailand’s most competitive exports, i.e. rice and sugar. The pattern of very modest concessions for agricultural imports is repeated in other Japanese FTAs, suggesting that traditional gains from trade are not the driving force of these agreements.

3 Research Design

This section tests the conjectures on the role of VIIT as a determinant of PTA formation, using a dataset of pairs (dyads) of 133 countries for the years 1995-2005 and the PTAs they have formed in this period. The dataset includes developed, developing, and transition country pairs, since vertical specialization also plays an important role in trade between developing and transition countries countries with different per-capita incomes and capital

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35 Hideya (2003).
36 Mulgan (2006, 9). See Manger (2009) for further discussion of these and other cases of North-South-PTAs.
intensity of production.\footnote{Chirathivat (2002) describes this for the case of the China-ASEAN free trade agreement.} The relatively fine-grained trade data required for the calculation of VIIT shares, based on at least 6-digit disaggregation according to the Harmonized System (HS) of tariffs, are only available from 1994 on and therefore constrain the analysis to this relatively short period. Nonetheless, the eleven-year span comprises over 75 percent of the PTAs that have entered into force since 1948.

4 Estimation

Two problems arise when estimating the effect of vertical intra-industry trade on trade agreement formation. First, VIIT presupposes a selection effect, since logically only country pairs that have at least some vertically specialized trade can experience any effect on bilateral PTA formation. What’s more, some of the variables that make vertical specialization more likely are also known to influence the formation of trade agreements—geographic distance (Frankel et al. 1995) and differences in the capital intensity of production (Baier and Bergstrand 2004) are obviously in this category. Second, PTA formation is a binary variable, requiring in a dynamic panel estimation. Selection effects are often modeled using canonical model proposed by Heckman (1979). However, not only are the required strong “instruments” often lacking, but so far no selection models for binary dependent variables that take time-dependence into account have been developed.

A relatively straightforward solution to this problem is a two-stage estimation approach. For the first stage, I use a standard gravity model to estimate the volume of vertical intra-industry trade between two countries.\footnote{The use of a gravity model to estimate intra-industry trade has been theoretically justified by Bergstrand (1989)} The predicted values from this model then become the independent variable of interest in the second stage estimation with a binary dependent variable, for which I use a standard logit model. However, given the two-stage
setup, the standard errors from the logit estimation will be incorrect. I therefore use a bootstrapping procedure to resample from the individual panels to obtain correct standard errors.\footnote{A readable introduction to the bootstrap is Efron and Tibshirani (1994).} Bootstrap methods perform well when the sample is a good approximation of the actual population, which is likely to be the case here with 133 countries and the corresponding dyads in the sample.

Using a panel bootstrap, resampling from \( N \) panels with replacement to perform the bootstrap sampling, also addresses the additional problem of time dependence in a short panel and the presence of slow-moving variables as well as, in the first stage, of heteroskedastic residuals. All three can obviously lead to biased results. Recent work by Kapetanios (2008) shows that panel resampling performs best when \( N > T \), since bootstrapping relies on asymptotics in \( N \). This is precisely the most common panel setup in international relations applications, and optimal for the present problem where \( N \) is approx 8000 panels but \( T \) only 11 years. Specifically for the case of a binary dependent variable, detailed Monte Carlo studies by Bischof (2009) show that the bootstrap performs much better than common parametric methods in the presence of rarely changing variables and temporal dependence. The panel bootstrap is the only method that largely avoids false positives, while standard methods can lead to misleading inferences. In Bischof’s Monte Carlo “placebo” studies, error rates are 3-5 times higher for time dummies and Taylor series approximations (Carter and Signorino 2007) and 4-6 higher when using cubic splines (Beck et al. 1998), perhaps the most widely used method in political science when faced with duration-dependent data and a binary dependent variable. By contrast, the panel bootstrap comes within 1-2 percent of true error rates regardless of the time dependence. In other words, a 5 percent significance level is really what it is. This should give greater confidence in the results obtained with this method: a significant coefficient is far less
likely to be uncorrelated with the outcome, positives are more likely to be positives, and the inference is generally more conservative.

**Key Variables**

For the first-stage equation, the independent variable of interest is the (log of the) value of vertical intraindustry trade in the total bilateral trade of a country dyad in a given year, shortened to $\ln\text{VIIT}$. Measuring VIIT across a broad set of countries is challenging, since highly disaggregated data in individual product categories is essential to avoid an overestimation. Moreover, while vertically differentiated finished goods are often traded intra-firm, intermediate goods are often exported by different companies. The definition of the central independent variable $\text{VIIT}$ follows the algorithm established by Fontagné and Freudenberg:  

As my theoretical framework applies only to manufacturing trade, I begin by eliminating all trade observations with 6-digit Harmonized System tariff code (HS) lower than 4XXX. I then check if there is significant two-way trade within a particular product category, again defined by the 6-digit Harmonized System. I define trade as one-way (OWT) if the smaller flow in a given category is less than 10 percent of the larger flow in terms of value. Such OWT is fundamentally based on comparative advantage, and the 10 percent cutoff eliminates flows that are not a structural feature of bilateral trade. For example, while France imports some cars from Russia, the value is so small that we cannot consider it a defining characteristic of commerce.

The remaining trade is two-way intra-industry trade that is then further differentiated into its vertical and horizontal variety. Horizontal intra-industry trade is here taken as trade in which the unit values differ by less than 25 percent. According to this algorithm,

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40 Fontagné and Freudenberg (1997).
the value of the variable VIIT is the value of trade that fulfills the following condition

\[
\frac{1}{1.25} \leq \frac{UV_{kk'}_{it}}{UV_{kk'}_{it}} \leq 1.25
\]

where \(UV\) is the unit value (or value per unit measure such as weight in kg), \(k\) and \(k'\) are the two countries in the dyad, and \(i\) is the product in year \(t\). The steps taken are shown in figure 1.

Is there two-way trade in the 6-digit tariff category?

More than 10% of trade is two-way

Is the two-way trade vertically differentiated in each tariff category?

More than 25% difference in unit value

Summing over all goods, what are the vertical and horizontal shares of IIT?

Figure 1: Disaggregating One-Way Trade, HIIT and VIIT

The cut-off of 25 percent is ultimately an arbitrary choice, so that even though it has been well-established in the literature,\(^{41}\) I re-estimate my model with different threshold values of 15 and 35 percent as robustness checks.

The trade data at the 6-digit tariff header level for this calculation is drawn from the BACI database\(^{42}\) and then aggregated by dyad-year. The variable measure is not equal to

\[^{41}\text{Abd-el Rahman (1991); Greenaway et al. (1994). Fontagné and Freudenberg (1997) find that by the measure used here, about 40 percent of intra-European trade is OWT, 20 percent HIIT, and 40 percent VIIT. However, the distribution is such that a 25 percent cutoff in unit value differences does not substantially alter this composition.}\]

\[^{42}\text{Gaulier and Zignago (2008).}\]
zero in about 12 percent of country-pair years in 1995, increasing to 37 percent by 2005. This reflects the global trend towards greater specialization in manufacturing trade. The central expectation is that *ceteris paribus*, higher values of VIIT increase the probability that two countries will form a preferential trade agreement.

The dependent variable in the second-stage equation PTA is binary and equals 1 if the two countries form a preferential trade agreement in that year, i.e. if a previously negotiated and signed agreement legally enters into force. The definition of PTA encompasses all free trade agreements and customs unions with at least one GATT/WTO member as party that follow Art. 24 or the Enabling Clause of the GATT, as well as any reciprocal trade agreement between members and non-members or non-members only. In line with the existing literature, it excludes partial scope and unilateral agreements, i.e. agreements such as as the Lomé Convention that only required one side to make concessions. The information on PTAs is drawn from the trade agreements databases of the WTO, the OAS, McGill University and the Tuck School.

In contrast to earlier work, this study considers the European Union (formerly the European Community) as a single actor. Since 1958, the Commission of the European Communities has negotiated all trade agreements on behalf of the EC’s member states. Moreover, the EU is itself a member of the WTO, the only supranational association to hold this status. Treating the member states of the EU separately not only ignores this fact, but also inflates the number of preferential trade agreements by more than 70 percent. For example, when Mexico concluded a PTA with the EU in 2000, it obtained preferential access to the markets of 15 member countries. A further 10 countries “formed” PTAs with Mexico in 2004 when these countries acceded to the EU. However, the agreement

43 These dyads subsequently drop out of the analysis, i.e. only the first PTA year is included.
is de facto bilateral. Even though individual member states obviously influence decision-making on trade policy at the Community level, the role of EU as a coherent actor in international trade is well-established in the literature.  

Including the EU members as separate countries also tends to overestimate statistical effects that are driven only by the uniquely dense integration among EU member states. In short, the EU is qualitatively different from a trade agreement and should not be counted as such.

Control Variables

For the first-stage equation, I use a standard gravity model in log-form that includes the products of the GDP of both countries, of their GDP per capita, of the total stock of FDI in the countries, and dummy variables for geographic location on the same continent and having a common language. The measures of the income variables are from the World Development Indicators and Penn World Tables, those of FDI from the UNCTAD FDI database, and the geographic and linguistic variables from Rose (2000). All monetary values are deflated to constant 2000 USD using the Bureau of Economic Analysis implied GDP deflator. In addition to these variables, the gravity equation includes distance, measured as the great circle distance between the capitals of both countries, except for a number of countries in which the capital is not identical with the biggest agglomeration of population (e.g. in Canada, the “center” is near Toronto instead of Ottawa, or in Germany, the Ruhrgebiet near Essen instead of Berlin).

In the second-stage equation, distance appears again as a key determinant of the likelihood of PTA formation, as does GDP per capita (now individually), since richer

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45 Meunier (2007, 2005); Meunier and Nicolaïdis (1999).
46 A fact that, even today, continues to dismay many British conservatives.
47 See stats.unctad.org/fdi/
49 Baier and Bergstrand (2004, 32).
countries are better able to shelter affected groups from trade liberalization and hence should have an easier time concluding trade agreements.\footnote{Mansfield (1998, 526).} I also include aggregate trade volume, since the more two countries trade, the more costly a possible closure of overseas markets, making PTAs as an insurance policy more attractive. At the same time, including this variable allows for a comparison with studies that have found that aggregate trade volumes are not statistically significant determinants of PTAs.\footnote{See e.g. Mansfield et al. (2007).} Data on bilateral trade is drawn from the BACI database and complemented with values from UN COMTRADE.

Past research has shown that allied countries are more likely to form PTAs. Trade creates a security externality, inducing states to trade more with allies than adversaries, which in turn promotes preferential trade agreements between allies.\footnote{Gowa and Mansfield (1993); Mansfield and Milner (1999).} I therefore include the variable ALLIANCE coded as 1 if two countries have a formal military alliance in that year, 0 otherwise, based on Correlates of War project data,\footnote{Gibler and Sarkees (2004).} with years after 2000 coded manually.\footnote{While the EU does not have formal military alliances since these remain in member state competence, I consider the EU to be in an alliance with a partner country if at least two of Britain, France and Germany each have such an alliance with that country.} A further variable is regime type, since past research has shown that democracies are much more likely to sign preferential trade agreements: Previous studies have found that the probability of a country pair having a PTA is doubled if one of the two governments is democratic, and four times as great when both are chosen in competitive elections.\footnote{Mansfield et al. (2002).} I therefore include the variable DEMOCRACY, measured on a scale from -10 to +10, based on the Polity IV dataset.\footnote{Marshall and Jaggers (2008).} For several other control variables, the analysis draws on the landmark article on PTA formation by Mansfield and Reinhardt (referred to as MR below),\footnote{Mansfield and Reinhardt (2003).} reproducing their variables for the later time period of this study for
all countries in the sample, not just those in the GATT/WTO as in the MR study. Of these variables, I include PTA density and PTA density squared, i.e. the proportion of dyads belonging to a PTA exclusive of those including i or j. This is to control for the general perception of the risk of being excluded from markets as PTAs spread, as well as the greater availability of institutional and legal “templates” as preferential agreements become more common in international affairs. PTA coverage of i and j captures the notion that states will try to avoid being shut out of key markets if its most important commercial partners form PTAs with each other. The variable is calculated as the proportion of i’s top ten trade partners, exclusive of j, that had a PTA with j in the previous year. The variable MTN round ongoing equals 1 if a formal multilateral trade negotiation occurred in a given year. No. of WTO members is the number of contracting parties to the WTO.

Following MR, all control variables except GDP per cap, MTN round ongoing and Distance are lagged by one year, since their effects have to work through the political systems of the countries in question and are therefore not instantaneous.\footnote{\hspace{1em}Not lagging these variables, however, changes nothing about the substantive results of the analysis.}

The Models

The two-stage estimation process used here requires the inclusion of variables in the first stage that are not part of the second equation. The gravity model in stage 1 follows the recommendations by Mátyás (1998, 1997) and Anderson and van Wincoop (2003) to include individual country fixed effects to approach a measure of “multilateral resistance,” that is the relative distance from all other countries not included in a particular country pair, as well as year fixed effects.

The first-stage equation is thus:
lnVIIT_t = \beta_0 + \beta_1(lnDist) + \beta_2(ln(GDP_{it} \times GDP_{jt})) + \beta_3(ln(GDPcap_{it} \times GDPcap_{jt})) \\
+ \beta_4(ln(FDI_{it} \times FDI_{jt}) + \beta_5 SameContinent + \beta_6 CommonLang \\
+ \mu_i + \delta_j + \gamma_t + \varepsilon_{ijt} (1)

where \mu_i and \delta_j are country-specific and \gamma_t year-specific fixed effects.

This equation is then used to predict the value of vertical intra-industry trade between the two countries in a pair in a given year. The predicted value \hat{z} becomes the independent variable of interest in the second-stage equation, in which the dependent variable is zero if a new PTA enters into force between two countries that do not already have such an agreement:

PTA = \beta_0 + \beta_1\hat{z}_{ij,t} + \beta_2\lnTrade_{ij,t-1} + \beta_3\lnDist + \beta_4 PolityIV_{i,t-1} + \beta_5 PolityIV_{j,t-1} \\
+ \beta_6 Alliance_{ij,t-1} + \beta_7 GATTWTOmemb_{t-1} + \beta_8 MTNround_t + \beta_9 \lnGDPcap_{it} \\
+ \beta_{10} \lnGDPcap_{jt} + \beta_{11} TradeCoverPTA_{i,t-1} + \beta_{12} TradeCoverPTA_{j,t-1} \\
+ \beta_{13} PTA_{density}_{t-1} + \beta_{14} PTA_{density}^2_{t-1} + \varepsilon_{ijt} (2)

The only common variables in the two stages are Distance and GDP per capita.

Results

Table 3 presents the parameter estimates. The first-stage estimation yields a relatively high $R^2$ due to the inclusion of fixed effects for years and countries and the well-established properties of the gravity model. The second-stage estimation shows the expected result:
the coefficient of \( \hat{z} \), the predicted value of VIIT between two countries, is positive and significant. While the effect of \( \hat{z} \) appears small in absolute terms, it is substantively more important than almost all other variables: As \( \hat{z} \) moves from its minimum to maximum with all variables held at the sample mean as shown in Figure 2, the change in predicted probability of PTA formation is larger than all other variables except Distance, No. of WTO members, and PTADensity. Alternatively, a change in the variable from its mean to its mean plus one standard deviation implies a increase in the probability of PTA formation of approximately 30 percent—but recall that the distribution of the original variable VIIT contains between 75 and 50 percent zero observations in a given year, so the effect of the moving the variables from one standard deviation below to one standard deviation above its mean is not a quantity that reflects real-world observations.

Figure 2: Effect of VIIT trade on the probability of PTA formation
To interpret the substantive contribution of a change VIIT, consider the counterfactual examples of Japan’s trade relations with Vietnam and Thailand. If Vietnam’s trade with Japan in 1999 had contained the same value of vertical intra-industry trade as that of Thailand and Japan (all else equal), the probability of the two countries forming a PTA would have increased by over 70 percent. Moving the value of vertical intra-industry trade between Japan and Vietnam to the value of the trade between Japan and Korea, again all else equal, effectively doubles the probability of PTA formation between the two countries.

Most control variables have the expected signs and correspond to previous results in the literature: A increase in the number of WTO members and the general trend towards more PTAs in the international system makes individual country pairs more likely to form PTAs, as shown by the coefficient estimates of No. of WTO Members. The threat of exclusion from the markets of important trade partners as captured by the measure of PTA Coverage of the top-ten trade partners is another important motivation. By contrast, GDP per capita has an unexpected negative sign, and the coefficient of Democracy is estimated to be negative and significant or positive and insignificant. The random assignment of countries to be either i or j suggests that these results are not systematic, although a Wald test shows that they are jointly significantly different from zero. While these results are at odds with previous studies, a possible obvious explanation could be that rich countries that are in the vast majority democratic simply formed very few PTAs in the post-Cold War period, and that most such country combinations already had formed PTAs in earlier periods and are therefore not part of the sample. The coefficient estimate of PTA density is surprisingly negative, but this changes with a different coding of PTAs, as described below.

These results are robust to a variety of checks. As a first check, I drop all dyads from the sample in which the EU is a party. The EU is clearly an outlier with its active policy of
pursuing PTAs with neighboring countries and distant partners, and as mentioned before, previous work has often considered the EU as a large PTA between several countries. Although the coefficient estimate is halved in size, it remains significant at the 5 percent level.

Furthermore, the robustness of the results is not dependent on different threshold values, as shown in table 4. Columns 5 and 6 reproduce the same analysis for a unit value difference of 35 percent, showing the first and second stages respectively. Columns 7 and 8 show the same for a 15 percent unit value difference. The well-known good properties of the gravity model and the inclusion of fixed effects for individual countries and years in the first stage equations again lead to a very high $R^2$. Significance levels do not change much, although the marginal effect of the predict VIIT value becomes slightly smaller as the threshold value is reduced towards 15 percent, effectively including more and more of the horizontal component of VIIT. In short, the results are sensitive to the inclusion or exclusion of the European Union in the sample, or to a particular definition of the independent variable of vertical intra-industry trade.
Table 3: Results with a 25% unit value difference threshold and robustness test dropping the EU

<table>
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<tr>
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<th>1st Stage</th>
<th>2nd Stage</th>
<th>2nd Stage without EU</th>
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<td>ln of Product of FDI</td>
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No. of observations 36442 36442 35578  
\(R^2\) .78 .34 .33

\(*p < 0.05, **p < 0.01, ***p < 0.001. Two-tailed tests are conducted for all estimates. Standard errors (S.E.) are bootstrapped by resampling from panels with 1000 repetitions. PTA density is centered at the mean.\)
5 Conclusion

 Preferential trade agreements between countries of different levels of economic development have come to dominate the international trade regime in the post-Cold War era. Although the novelty of this phenomenon is widely acknowledged, comparatively less research has been devoted to investigating its causes and effects than to the spread of trade agreements in general. This study has argued that the mutual specialization of manufactured goods trade leading to vertically differentiated trade in goods in the same industry represents an important driving force of PTAs formation. While a number of studies have focused on the link with horizontal intra-industry trade, this paper is among the first to specifically investigate the role played by vertically specialized trade.

 Vertical specialization leads to the emergence of a political coalition in support of trade liberalization within the context of a preferential agreement. Less-developed country governments often seek PTAs as a policy to attract export-oriented FDI. Multinational firms from developed countries relocate the production of less capital-intensive production to these countries. The interests of countries with (often starkly) different per-capita incomes therefore converge on preferential liberalization, albeit with particular focus on the goods produced and exported by these firms and their suppliers.

 The statistical analysis in this paper shows that the greater the value of vertical intra-industry trade between two countries, the more likely they are to form a preferential trade agreement. The result is robust to changes to a more restrictive definition of PTAs and changes in the threshold value that defines vertical specialization. Other variables identified in the literature likewise contribute to an increased probability, but the character of the bilateral trade relation, beyond merely large trade volumes, clearly plays a central role and helps explain the growing popularity of PTAs in the post-Cold War era.
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*p < 0.05, **p < 0.01, ***p < 0.001. Two-tailed tests are conducted for all estimates. Standard errors (S.E.) are bootstrapped by resampling from panels with 1000 repetitions. PTA density is centered at the mean.
These findings have implications for the study of preferential trade agreements and economic integration in general. In particular, they suggest that preferential trade liberalization may negatively affect the prospects of trade liberalization in multilateral negotiation rounds. If the political constituents, i.e. multinational firms, that have in the past counterbalanced protectionist sectors\(^\text{59}\) are satisfied with preferential deals, then they are less likely to commit resources to support multilateral liberalization efforts. This implies that manufactured goods tariff reductions in less developed countries can no longer be traded off against agricultural liberalization in richer partners. Trade-offs between services liberalization and agriculture, the obvious alternative, are more difficult to achieve since services liberalization does not resolve balance-of-payments problems for developing countries (after a beneficial one-off effect of FDI inflows). Moreover, developing countries will be less inclined to open their financial services markets, a central interest of the North, after the recent global financial crisis, as it has become apparent that countries with relatively closed financial systems (e.g. Brazil) have fared better than more open countries (e.g. Mexico). Lastly, theoretical work suggests that countries that liberalize trade bilaterally and whose industries make relation-specific investments are less inclined to support multilateral liberalization later on.\(^\text{60}\) Given these political implications, PTAs driven by vertical specialization are (at the very least) unlikely to give multilateral efforts a boost.

The research presented in this paper can be extended in several directions. The illustrative case study suggests that in the context of a PTA, a high share of vertical trade in a particular tariff category should predict faster tariff liberalization for these goods than for manufactured goods that reflect comparative advantage, and far quicker than for agricultural exports from the developing country. It is also an open empirical question if developing countries that have concluded such PTAs remain active supporters of WTO-

\(^{59}\) Milner (1988).

\(^{60}\) McLaren (2002).
centred liberalization, or if they are content with the gains they have achieved. Neither is it clear why labor sometimes actively opposes PTAs (as in the US), while remaining largely passive in other cases (e.g. in the EU and Japan). As PTAs remain popular, more research into their determinants and effects is needed.
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