Complexity and Trade Restrictive Consequences of PTAs: Number and Depth of PTAs and the Margins of Trade

Moonhawk Kim
University of Colorado Boulder
Moonhawk.Kim@colorado.edu

September 22, 2015
Abstract

Increasing number of analyses demonstrate that preferential trade agreements (PTAs) increase trade to varying degrees among member countries. In this article, I argue that countries confront a more complex environment with respect to PTAs. Countries are increasingly forming numerous overlapping agreements with their trade partners and deeper ones requiring more extensive regulatory cooperation. Higher numbers of overlapping PTAs and deeper PTAs increase the fixed costs of international trade. The higher costs in turn reduce the number of products a country exports to its partners (the extensive margin of trade), although they increase average amount per product a country exports to its partners (the intensive margin). Accordingly, more numerous and deeper PTAs generate an unintended consequence of limiting diversification and greater competition in trade.

Keywords: international political economy; international cooperation and organization
In addition to the World Trade Organization (WTO), to which an overwhelming majority of the countries in the world belong, countries have been signing various smaller trade agreements. Some such agreements are regional and contain numerous member countries, such as the European Union (E.U.), while others are bilateral involving only two countries, such as the U.S.–Chile Free Trade Agreement. Research reveals that preferential trade agreements (PTAs) such as these increase trade among member countries (e.g., Baier and Bergstrand 2007; Goldstein, Rivers, and Tomz 2007). Moreover, not only do pairs of countries with shared PTAs trade more than those without PTAs but also that PTAs promoting deeper cooperation lead to greater increases in trade than those promoting shallower cooperation (e.g., Dür, Baccini, and Elsig 2013; Hicks and Kim 2012).

The outcomes of interest for scholars examining the trade consequences of PTAs, however, have been fairly limited. Most of the analyses on the topic examine the effects on bilateral trade volume in within pairs of countries (“dyads”) or the amount of export from one country to the other in dyads. One exception is Mansfield and Reinhardt (2008), which examines volatility in trade volumes and the role that trade agreements have in mitigating the volatility rather than increasing the volumes of trade.

In this article, I examine the consequences of PTAs on more disaggregated trade outcomes. The extensive margin of international trade tracks the number of products a country exports to its trade partners, whereas the intensive margin tracks the average value per product a country exports to its trade partners. While economists have long examined these two outcomes, political scientists have done so decidedly less.

However, the rationale for focusing on these two measures of trade flows are twofold and compelling. First, analysts and policymakers would benefit from knowing the composition  

---

1 Economists prefer the term free trade agreements (FTAs). Some political scientists prefer the term regional trade agreements (RTAs). I use the term PTAs synonymous and as a term that has the broadest coverage.
of changes in trade among countries. In particular, increases in the aggregate volume of a
country’s exports to another country can result from one or both of the following mechanisms:
the country expands the set of products it exports (changes in the extensive margin) or the
country exports more of the same set of products it exports (changes in the intensive margin).
While both increase total export volumes, the implications are different. Higher extensive
margins indicate greater diversification of an economy and—to the extent new products are
close substitutes of existing products—greater competition within an economy. By contrast,
higher intensive margins holding the extensive margin constant indicate trade liberalization
that benefits only the existing products, and by extension only the firms that export them.
Thus, well-rounded trade liberalization would increase the extensive margin as well as the
intensive margin.

Second, examining the effects of PTAs on the two margins helps distinguish the channels
through which the agreements promote trade liberalization. As the international trade
economics literature has developed (Bernard et al. 2003; Chaney 2008; Eaton and Kortum
2002; Melitz 2003), the extensive and the intensive margins respond differently to the changes
in trade costs. Whereas a reduction in the *variable costs* of trade increases both margins,
a reduction in the *fixed costs* of trade increases the extensive margin while decreasing the
intensive margin. Leveraging this divergence, analysis can reveal whether PTAs influence the
variable costs, the fixed costs, or both. For example, Dutt, Mihov, and Van Zandt (2013) find
that the WTO promotes trade by providing overall guarantee for market access, i.e., reducing
the fixed costs of trade, rather than through reducing the variable costs. Corresponding
findings about PTAs would contribute to better understanding the mechanisms through
which international institutions facilitate economic integration.

Given these rationales, I address the following question in this article: How do PTAs influence
the extensive and the intensive margins of trade? I propose and test an argument that
highlights the increasing complexity of PTAs in which countries have been involved. Contrary
to what the extant literature implies, I argue that higher number and greater depth of PTAs
that countries share *increase* the fixed costs of trade. The greater costs result from the uncertainty of relevant rules and regulations in place when the number of shared PTAs rises and from the difficulty of implementing regulatory harmonization that deeper PTAs entail. The higher fixed costs in turn lead countries sharing such PTAs to have lower extensive margin of trade and higher intensive margin.

I carry out an analysis using PTA data from the Design of Trade Agreements (DESTA) (Dür, Baccini, and Elsig 2013) and trade margins calculated using trade data at the six-digit Harmonized System (HS) from the United Nations Comtrade database of trade statistics. Consistent with the state-of-the-art in analyzing the effects of trade institutions on trade flows, I model the margins using three sets of fixed effects—exporter-years, importer-years, and dyads. The results and various robustness checks consistently provide support for the proposed argument.

This research makes three important contributions to the literature on governance of international trade and on the study of political institutions. First, with the emergence of the “new-new” trade theory, analysts have increased the analysis of firm-level behavior in international trade. The popular refrain is that “Countries don’t trade and industries don’t trade: firms trade” (Ciuriak et al. 2011, 6). Although the analysis in this article is not at the firm-level, the proposed argument and the empirical tests are based on product-level—and by extension firm-level—dynamics. Second, the argument and the findings highlight the difficulty of extensive international cooperation, either through numerous overlapping agreements or through deep agreements that require substantial domestic regulatory changes. International attempts at regulatory cooperation and harmonization do not necessarily lead to convergence of national politics (Garrett 1998). Third, and more generally, institutions can generate unintended and unanticipated consequences (e.g., Martin and Simmons 1998, 749–751). Governments presumably sign PTAs in order to liberalize trade and increase trade flows. Numerous and deep agreements generate contrary effects at least in terms diversifying the number and variety of products that countries export.
In the next section, I briefly summarize and review the literature on the trade consequences of PTAs. In Section 3, I develop the argument of how higher numbers and deeper cooperative provisions of shared PTAs increase the fixed costs of trade and how those costs in turn lead to divergent effects on the extensive and the intensive margins of international trade. Section 4 presents the empirical analysis using data from DESTA and Comtrade and provides evidence consistent with the argument proposed. The last section concludes the article by summarizing the findings, discussing broader implications, and identifying potential avenues for future research.

**PTAs and Trade Flows**

Two groups of literature on PTAs are relevant for the current research. One is on the consequences of trade institutions on trade flows among countries. The other is on the design and characteristics of PTAs. I briefly review both in order to establish the importance of examining the effects of PTAs provisions on the two margins of international trade.

**Trade Institutions and Trade Flows**

A thriving literature has developed around the question of what effects international institutions have on trade flows. In particular, political scientists as well as economists have engaged in both theoretical and empirical debates on the mechanisms through which the GATT/WTO has affected trade and the appropriate ways to model the relationship (e.g., Bagwell and Staiger 2009; Goldstein, Rivers, and Tomz 2007; Gowa and Kim 2005; Rose 2004; Subramanian and Wei 2007). The debate has centered around the theoretical issue of the conditions under which countries’ membership in the GATT/WTO generates a positive effect on trade flows and the methodological issue of how to specify and test the gravity model of international trade.
In contrast to theses works, whose main dependent variable is the aggregate bilateral trade, Dutt, Mihov, and Van Zandt (2013) specifically examines the GATT/WTO’s effects on the extensive and the intensive margins of trade. The authors find that the shared GATT/WTO membership increases the extensive margin of exports by about 25%, whereas it decreases the intensive margin. The results lead the authors to conclude that the membership in the institution works primarily by lowering the fixed rather than the variable costs of trade.

A corresponding analysis on the effects of PTAs on the margins of trade has not yet been done. Baier and Bergstrand and coauthors (2002, 2007; 2008), who have steadily advanced the literature by accounting for the endogeneity of preferential trade agreements among countries, have analyzed bilateral export flows. Similarly, other works on the trade effects of PTAs have focused on the aggregate bilateral trade flows, just as much of the research on the GATT/WTO’s effects has. One exception to this is Mansfield and Reinhardt (2008), who examine the multilateral and preferential trade agreements’ effects on the stability or volatility of trade flows. Accordingly, in the absence of an analysis on the margins of trade, the literature has not yet established what trade costs—fixed or variable—PTAs affect and whether and how they influence those costs.

Variation in PTAs

Prior to the more recent emphasis on the consequences of PTAs, scholars—especially political scientists—focused on explaining the variations in PTAs. A commonly used, although simple, classification of PTAs divided the institutions into three or four types: partial scope trade agreements, preferential trade agreements, free trade agreements, and customs unions (Magee 2008; Mansfield, Milner, and Pevehouse 2008).

More fine-grained conceptualizations of PTA characteristics have looked to the variation in both the types of substantive issue-areas covered by PTAs and the extent of cooperation in each of those substantive issue-areas (Estevadeordal, Suominen, and Teh 2009). Other
scholars have focused on more specific aspects of variations in PTA. For example, Smith (2000) codes the variation in the dispute settlement procedures of PTAs, whereas Kucik (2012) codes provisions in PTAs that govern flexibility. Jo and Gawande (2012) code PTAs according to the sectors they exclude (“carve-outs”) and the gradualism of tariff reductions over time (“phase-outs”) in addition to cuts in tariffs.

Analyses of trade flows using variations in PTA design have generally assumed that all features of PTAs contribute to liberalization and increases in trade among partner countries. For example, Hicks and Kim (2012) code dimensions of PTAs that potentially facilitate credible commitment in promoting and maintaining open trade. They aggregate the coding into a “credibility index,” which helps explain trade volumes among countries with PTAs. Dür, Baccini, and Elsig (2013) also begin with the assumption that deeper PTAs increase trade.

In short, analysts have made the assumption that design characteristics of PTAs vary along the “less liberalization” to “more liberalization” spectrum without closely heeding the complexity involved in implementing the agreements. The complexity in fact may have stifling effects on certain aspects of trade flows among member countries. In the next section, I develop an argument that highlights such complexity of numerous and deep PTAs. The argument generates expectations for divergent effects on the extensive and the intensive margins of trade, which addresses the deficiency in the literature heretofore analyzing the trade consequences of PTAs.

**Number, Depth and Increasing Trade Costs under PTAs**

**Variable and Fixed Costs in PTAs**

The overarching goal of trade agreements is to decrease the costs of trade among countries carrying out exchanges. Lower trade costs in turn would increase trade volume, which is the
presumptive goal of PTAs. More specifically, PTAs can alter two types of trade costs—one is variable costs and the other is fixed costs.

One set of policies that affect flows of trade among countries affect the ease of access to the markets of the countries. Policies affecting market access discriminate imports based on the origins of the goods. Countries can use the barriers to provide better access to products from some trade partners but not to others. Or countries can use the barriers to provide better treatment to domestic products than for any foreign products. Classic examples of such policies are tariffs, quotas and subsidies. Contemporary examples include discriminations against provision of services or establishment of foreign direct investment (FDI), e.g., differential tax rates.

The nature of these types of barriers in turn implies that the barriers impose per-unit—either by value or by volume—costs on products exported to the countries with the barriers. The total amount barriers that products confront increases as a function of the volume of exports. Accordingly, these types of barriers shape the variable costs on international trade. In the literature on deep economic integration, reduction or elimination of these barriers constitutes “negative integration” (Tinbergen 1954, 122) and involves deregulation/liberalization of policies that discriminate against foreign goods.

A different group of policies affecting trade flows among countries affect the ease of presence in their markets. These policies and regulations influence how easily firms can establish commercial relationships in other countries’ economies, either physically through FDI or at arm’s-length through trade. Examples at the multilateral level go back to the Technical Barriers to Trade (TBT) negotiated during the Tokyo Round of the GATT negotiations and the more recent agreement on Sanitary and Phytosanitary measures (SPS) at the WTO.

Unlike barriers affecting access, regulations influencing firms’ presence in foreign markets impose costs that are independent of the value or volume of products exported. For example, learning the relevant regulatory rules in the destination market and retooling equipment to
produce products that are compliant with the rules imposes one-time costs, even if the costs might be quite high. Once firms incur the costs and make the necessary adjustments, the volume of production and export would not further affect these costs. In this manner, such regulatory barriers and attempts to reduce them involve *fixed costs* of international trade. In “new-new” trade theory that highlights the importance of firms in international trade, fixed costs in trade constitute an important factor for firms’ decision to enter/exit a foreign market in addition to variable costs that scholars have long recognized (e.g., Ciuriak et al. 2011; Melitz and Trefler 2012).

Countries can reduce or eliminate these barriers through coordinating on or harmonizing regulatory rules. Accordingly, such “positive integration” involves “supplementary measures” and “certain adjustments” to “remove inconsistencies that may exist between the duties and taxes of different countries” (Tinbergen 1954, 122). In this manner, positive integration—or liberalization of such barriers—is best conceived as *reregulation*. Although his work is at the national level, Vogel (1996) defines it as “the reformulation of old rules and the creation of new ones” (3).

**Number and Depth of PTAs**

A single PTA can potentially affect both variable and fixed costs of trade among its member economies. However, the PTA context in which countries are situated is far more complex in two ways. First, over time, countries have increased the number of *overlapping* PTAs to which they belong with their trade partners. The maximum number of shared PTAs between two countries doubled from 25 in 1988 to 50 in 2013. The mean number of shared PTAs over the same time more than tripled from .46 to 1.6. Second, the nature of trade integration provisions in agreements has changed over time, moving beyond “at-the-border” measures to

---

2 These numbers are among members of the E.U., which has PTAs with numerous third-party countries.
include “behind-the-border” measures of regulatory harmonization. According to the DESTA data on PTA depth, the maximum depth index of PTAs increased from 4 in 1988 to 7 in 2013. The mean depth index increased from .25 to .70 over the same time period. While countries seek to lower trade costs by forming PTAs, I argue that the number and the depth of PTAs affect the costs in non-intuitive ways. I elaborate on each mechanism below.

**Number of PTAs**

Although each PTA may lower the variable and the fixed costs of trade among countries, I argue that the effects of each subsequent overlapping PTA among the countries are not additive. In fact, each additional agreement can *increase* the overall trade costs that the member countries confront.

Countries may endeavor to ratchet down the trade costs by incorporating provisions for lowering at-the-border trade barriers and for harmonizing behind-the-border regulatory barriers. In this respect, the total amount of *nominal* reduction in trade costs resulting from a high number of PTAs may be large. However, as the number of PTAs that govern countries’ trade increases, private actors seeking to engage in cross-border economic exchanges increasingly confront difficulties in resolving precisely which agreements govern the transaction and how.

This complexity creates an unintended meta-barrier to trade. The World Trade Organization’s 2011 *World Trade Report* summarizes numerous firm-level surveys that demonstrate the difficulties that firms have in navigating the trading system characterized by the “spaghetti bowl” of numerous overlapping PTAs among countries (World Trade Organization 2011). Firms frequently even forgo the preferential treatment that a PTA enables due to the complexity of criss-crossing trade agreements.

In this manner, the complexity resulting from a high number of shared PTAs between two countries increases the fixed costs of trade. Regardless of the amount or value of the goods
or services that the actors are looking to export, they need to invest additional resources into unscrambling PTAs and deciding how best to proceed in carrying out the international trade. Importantly, this fixed cost of entry offsets the substantive provisions of PTAs that lower the trade costs. When a large number of shared PTAs creates complexity, private actors need to bear an upfront cost for deciphering the relevant agreements and will not be able to exploit the benefits that the agreements are designed to provide until they do so. Accordingly, the complexity creates gate-keeping fixed costs that increases the costs of engaging in trade, contrary to the countries’ intention behind signing PTAs and regardless of how much trade integration the agreements seek to implement.

**Depth of PTAs**

Pomfret (2007) identifies that the “third-wave RTAs”—agreements signed since the early 2000s according to his categorization—has taken up deep integration issues more extensively. Similar to the number of overlapping PTAs, depth of PTAs has unanticipated effects on trade costs that private actors confront as well. Although countries intend to reduce trade costs by designing and implementing deep PTAs, the provisions for pursuing deep integration—positive integration as discussed above—ultimately increase the fixed costs involved in international trade.

A more general political challenge exists with deep positive trade integration, and Rodrik (2000) provides a framework for analyzing this difficulty. Building on the Mundell-Fleming paradox in international economics, in which the economists posited constraints that countries face in the international economy, Rodrik created a corresponding political dilemma. In his augmented version, countries can have at most two of the following three: integrated national economies; independence and autonomy to make and administer the law within their territories; and democratic politics in which franchise is universal and political institutions respond to mobilized groups (180-184). Rodrik labels the combination of integrated economies
and nation states as the “golden straitjacket,” nation states and democratic politics as the “Bretton Woods compromise,” and integrated economies and democratic politics as “global federalism” (181).

Within this framework, PTAs with deep integration imply two choices by countries—integrated national economies in conjunction with foregoing of autonomous nation states, at least in the issue areas they pursue deep integration. These in turn suggest that deep PTAs create global federalism among the members, in which countries couple integrated economies with democratic politics. This is consistent with other analysts who have pointed out the necessity of political integration to accompany economic integration (Bhagwati 1996). For example, the European Union, which started as an economic project, increasingly confronted demands for social and political integration.

This relationship between economic and political integration highlights two resulting political difficulties. First, international institutions—especially the minimal ones created by PTAs—are not sufficient governance bodies that can administer harmonized regulatory rules. Second, democratic politics in different countries likely demand different regulatory rules, perpetuating the regulatory conflict and hampering the harmonization process. In short, although deep PTAs may implicitly attempt to create global federalism to strengthen integration of national economies with harmonized rules, the reality is that countries do not fully give up their sovereignty.

This difficulty of regulatory cooperation and harmonization places the provisions in deep PTAs in abeyance. Chauffour and Maur (2011) lay out the logic concisely:

Relative to negative integration, positive integration entails substantial differences in the drafting of language in agreements (the instruments of implementation being more complex) and therefore in negotiations and, probably, in the predictability of implementation (18).

The unpredictability of implementation in particular leads to uncertainty among firms about
the precise regulations in place that govern their exports. This uncertainty—akin to exchange rate uncertainty adversely affecting trade flows (Hooper and Kohlhagen 1978; Perée and Steinherr 1989)—in turn increases the costs that the firms face in exporting. Even when the reregulation relies on standards established outside a PTA, such as the WTO agreements, the uncertainty is not mitigated. It is simply redirected at the difficulty and the unpredictability of implementing the WTO agreements.

This uncertainty resulting from attempted regulatory harmonization is worse for private actors in carrying out international trade than the certainty in regulatory divergence the actors would confront in the absence of the attempted harmonization. Even when regulatory rules diverge, as long as traders know and can rely on the stability of that dissimilarity, they can plan accordingly. When the rules are in limbo and harmonization faces hurdles, the uncertainty causes difficulty of accessing foreign markets. Moreover, deeper PTAs pursuing greater positive integration and regulatory harmonization create greater uncertainty and higher costs for private actors. They do so by specifying greater policy change away from the status quo policies, thereby increasing the range over which PTA member countries’ regulatory rules can vary.

In short, although countries may seek to reduce fixed costs through coordination and harmonization of their regulations through deep PTAs, the difficult and unpredictable process of such reregulation leads for the costs to increase for private actors. Moreover, deeper PTAs create greater difficulty and increase the fixed costs of trade more than shallower PTAs.

**Hypotheses**

Changes in fixed costs resulting from PTAs have specific effects on the extensive margin (number of products exported) and the intensive margin (average export value per product). Economic theories generate the link between the costs and the two margins (Bernard et al. 2003; Chaney 2008; Eaton and Kortum 2002; Melitz 2003). The expectations are
straightforward (Dutt, Mihov, and Van Zandt 2013, 205). A reduction in fixed costs leads to new products to export that were previously not able to engage in trade because they were not productive enough to overcome the costs. The entry in turn increases the extensive margin of trade. By contrast, a reduction in fixed costs typically reduces the intensive margin, as it increases entry by less productive firms, which dilutes the market share of firms already engaged in trade and brings down the average amount of exports per product. However, since I expect fixed costs to increase from numerous or deep PTAs, the changes I expect in the margins of trade are in the opposite directions: Higher fixed costs lead to lower extensive margin of trade and higher intensive margin of trade.

The argument I propose above in conjunction with the economic mechanism generates the following testable hypotheses:

1. Number of Overlapping PTAs:
   
   (a) Extensive Margin: If pairs of countries have more numerous overlapping PTAs, the resulting complexity increases the fixed costs of trade, and the countries will have smaller extensive margin of trade than those with fewer overlapping PTAs.
   
   (b) Intensive Margin: If pairs of countries have more numerous overlapping PTAs, the resulting complexity increases the fixed costs of trade, and the countries will have greater intensive margin of trade than those with fewer overlapping PTAs.

2. Depth of PTAs:

   (a) Extensive Margin: If pairs of countries have deeper PTAs, the resulting regulatory uncertainty increases the fixed costs of trade, and the countries will have smaller extensive margin of trade than those with shallower PTAs.
   
   (b) Intensive Margin: If pairs of countries have deeper PTAs, the resulting regulatory uncertainty increases the fixed costs of trade, and the countries will have greater intensive margin of trade than those with shallower PTAs.
In the next section, I carry out an empirical analysis that tests these four hypotheses against the evidence.

**Effects of PTAs on the Margins of Trade**

**Research Design and Data**

In the analysis, I follow Dutt, Mihov, and Van Zandt (2013) closely for the research design. The unit of analysis is directed-dyad-year. The analysis covers the 26-year period from 1988 to 2013, 194 exporters, 243 importers and 20,160 dyads among them.

**Dependent Variables**

The analysis contains two dependent variables, one for the extensive margin and the other for the intensive margin. The extensive margin counts the total number of products one country exports to another. To get the counts, I obtain bilateral trade at the six-digit level of Harmonized System (HS) tariff codes. Within the sample, the raw count varies from 1 to 4,907, with a mean of 272 and a standard deviation of 605. In the analysis, the measure is logged and ranges between 0 and 8.5 with a mean of 3.4 and a standard deviation of 2.3.

The intensive margin captures the per-product value of exports from one country to another. To measure this concept, I divide the total value of exports from one country to another by the count of total products that the extensive margin captures. The resulting measure is the average value per product exported. The raw value in U.S. dollars in the data ranges from zero to 25 billion. In the analysis, the measure is logged and ranges between 0 and 24 with a mean of 11 and a standard deviation of 2.2.
Independent Variables

Even though the basic empirical specification that I use to model the extensive and the intensive margins of trade is the gravity model, given the modeling strategy I use (discussed below), I include only five independent variables. Three variables capture whether observations (dyad-years) have a PTA at all and how many. Because the PTA depth variable can be zero due either to the depth being zero or dyad-years not having any shared PTAs, I include an indicator variable capturing presence of PTAs (PTA). It is 1 in 33% of the observations in the sample. The second PTA measure captures the total number of PTAs in each dyad-year (Total PTA). The measure varies between 0 and 59, with a mean of 1.3 and a standard deviation of 3.6. The last PTA measure is a squared term of the total PTA count (Total PTA (squared)). Methodologically, the polynomial term would capture any nonlinear effects of the count of PTAs for dyad-years with a high number of shared PTAs. Substantively, this group of observations—those with 20 or more shared PTAs in force—consists of European Union members, who have signed numerous PTAs with third-party countries. Accordingly, the unusually high number of shared PTAs among these countries may capture a dynamic unique to the E.U. independent of the argument I propose above. The squared term varies between 0 and 3481 with a mean of 14. All of the PTA and membership information is from DESTA.

The next independent variable captures the depth PTAs. The data for the measure also comes from DESTA. While the data set contains two different measures of depth—one an additive index and the other a latent trait measure—I use the index as the measure of PTA depth. It consists of dichotomous coding on seven dimensions of PTAs. The dimensions are whether PTAs 1) aim for full free trade agreements 2) contain intellectual property rights provisions 3) contain government procurement provisions 4) deal with standards 5) address

---

3 Although technically these are bilateral agreements between the E.U. on the one hand and a third-party countries on the other, in the data, the agreements are coded at the member-country level.
trade in services 6) address investment and 7) contain competition provisions. Accordingly, the depth measure varies between 0 and 7.

I alter this underlying measure in two ways. First, because each observation can have more than one PTA, I aggregate across the multiple PTAs by taking the average of different depths across agreements shared within each dyad-year. For robustness checks, I also report results using different aggregation schemes, such as the minimum, the maximum, and the median values of PTA depths in each dyad-year. Second, analysts can conceptualize over-time depths of PTAs in two ways. One approach is to assume that countries fully and immediately implement all the provisions of the agreements, which then remain constant for the life of the agreements. Another approach is to assume that countries progressively implement the provisions—whether or not the agreements intended them to do so—and that countries reach the intended depth over time. In the analysis below, I use both approaches. In the second approach, I multiply the PTA depth measure by the natural logarithm of the number of years since agreements’ entry into force before aggregating the resulting measure across multiple PTAs, if applicable. While interactions with other functional forms of time may also be possible—e.g., linear time or exponential time—a logarithmic function is best theoretically justified to capture the initial steep increase in depth that increases at a slower rate in the subsequent years. The two resulting variables are *Average PTA Depth* and *Average PTA Depth (log-time)*. The raw measure varies between 0 and 7 with a mean of .55 and a standard deviation of 1.1. The measure interacted with logged time varies between 0 and 22 with a mean of 1.2 and a standard deviation of 2.4.

The last right-hand-side variable is a control for each observation’s membership status in the GATT/WTO. The GATT/WTO variable (*Both GATT/WTO*) is coded 1 if both parties of a dyad are members of the GATT/WTO and 0 otherwise. The data is from the WTO website.

---

Jo and Gawande (2012) analyze in part the phase-out of trade barriers over time that countries explicitly incorporate. However, full implementation may be delayed due to unintended difficulties that countries confront as well.
Alternative measure of the variable that incorporates information about entities’ informal participation status (Goldstein, Rivers, and Tomz 2007), does not substantively alter the results. Accordingly, I use the more conventional measure based solely on formal membership. 64% of dyad-years in the sample share membership in the GATT/WTO, whereas 36% do not.

**Modeling Strategies**

Following the recent development in the economics literature on the trade consequences of GATT/WTO and PTAs (e.g., Baier and Bergstrand 2007; Dutt, Mihov, and Van Zandt 2013), I include three sets of fixed effects: exporter-year, importer-year and dyad fixed effects. The two sets of country-year fixed effects most importantly capture multilateral trade resistance, namely the *global* trading environment that an exporter or an importer faces in each year beyond merely the bilateral trading environment between them. Exclusion of the multilateral resistance terms will bias estimates of trade costs downward. The inclusion of the fixed effects addresses potential endogeneity of GATT/WTO membership as well as reduces the omitted variable bias (Dutt, Mihov, and Van Zandt 2013, 208).

Dyad fixed effects absorb all time-invariant relational factors between the countries in dyads. This implies that the models need not include any of the traditional gravity variables, such as distance, contiguity, colonial history and linguistic connections. Moreover, the dyad fixed effects in conjunction with country-year fixed effects account for selection of countries and dyads into WTO and PTA membership (Baier and Bergstrand 2007), as well as capture all the other unobservable dyadic factors influencing trade flows between countries.

Although the unit of analysis is *directed*-dyad-years, the dyad fixed effects I include in the models are *undirected*. While time-invariant dyadic factors may in fact be directional—e.g., a relational factor that affects exports from $i$ to $j$ but not from $j$ to $i$—most relational gravity variables lack such directional characteristics. Moreover, *undirected* dyad fixed effects reduce the number country-pair fixed effects in the models by half. I similarly cluster the standard
errors by undirected dyads, precluding unwarranted deflation of standard errors that would result from clustering on directed dyads.

This model specification results in 3,175 fixed effects for exporter-years, 5,689 fixed effects for importer-years, and 20,155 dyad fixed effects. Procedures built into Stata are not capable of handling models with multiple sets of high-dimensional fixed effects. Accordingly, I use `reghdfe` (regression with high-dimensional fixed effects) (Guimaraes and Portugal 2010).

Results

In the first pair of models, I only include the count measures, without the depth variable. Table 1 summarizes the results, with the extensive margin as the dependent variable in Model 1a and the intensive margin as the dependent variable in Model 1b.

[ Table 1 about here ]

The GATT/WTO variable, capturing whether both partners in a dyad belong to the multilateral institution, has a positive and significant effect on the extensive margin and an insignificant effect on the intensive margin. In other words, shared membership in the institution increases trade by expanding trade in goods that the partners did not previously trade. The approximate contribution of the measure to the margin—22% increase—is also consistent with the extant research (Dutt, Mihov, and Van Zandt 2013).

As anticipated by hypotheses 1a and 1b, the count of PTAs has opposite effects on the extensive and the intensive margins of trade. Whereas higher number of shared PTAs within dyads increases the intensive margin—the average volume of trade per product—it decreases the extensive margin—the total number of products that one partner exports to the other. The squared term also has opposite effects on the two margins. It is positive on the extensive

---

5 The command is written by Sergio Correia and is available through author’s Github repository at https://raw.githubusercontent.com/sergiocorreia/reghdfe/master/package/.
margin and negative on the intensive margin. For substantive interpretations of the combined effects, I plot the non-linear predicted effects on each margin as a function of PTA count. Figure 1 plots the extensive margin and Figure 2 the intensive margin.

Consistent with the hypothesis, the PTA count has a negative effect on the extensive margin, however, only until approximately 30 shared PTAs. At PTA counts greater than that, higher number of shared PTAs has a positive effect on extensive margin. As discussed above, observations in this range consist entirely of E.U. dyads. Accordingly, the positive effect is limited only those countries. The corresponding pattern for the intensive margin is reversed. The positive effect of PTA count on the margin lasts through about 30 shared PTAs, after which the effect turns negative.

In short, while the effects of PTA counts on the margins of trade are fully consistent with the hypotheses over the bottom-half of the variable’s range, the effects of the variable are the opposite over the top-half of the variable’s range, i.e., for E.U. dyads. While I do not delve into the relationship, the results from the E.U. members likely reflect a confounding effect of time rather than that of the number of trade agreements they share. As the number of shared PTAs increased for E.U. dyads, the ongoing deepening within the E.U. has likely reduced the fixed costs of trade among the membership, leading to the rising extensive margin and the falling intensive margin of trade.

In Models 2a and 2b, I incorporate the PTA depth measure—the version that averages across agreements should dyad-years have more than one shared PTA. The PTA indicator is included to control for presence of PTAs with zero depth. Table 2 summarizes the results.

---

6Due to the model specification of including exporter-year and importer-year fixed effects, effects of an year variable cannot be estimated without completely altering the models.
The variables from the previous models maintain their pattern of estimates and significance from the previous models. Depth of PTAs has the effects anticipated by Hypotheses 2a and 2b. Deeper average depth of PTAs reduces the extensive margin, whereas it increases the intensive margin. The substantive effects are non-trivial. Each unit of PTA depth contributes to a 1.4% reduction in the extensive margin of trade but a 2% increase in the intensive margin. Given that the depth measure varies from 0 to 7, the changes in the trade amounts can be up to almost 10% and 14%, respectively.

[ Table 2 about here ]

As the results from Models 3a and 3b show (Table 3), allowing the effects of PTA depths to vary over time does not substantially alter the results. Even if the depth provisions are assumed to become fully implemented only over time, the effects on the margins of trade remain the same. The substantive interpretation of the measure is not straightforward given that the measure is a multiplicative term of PTA depth and logged time since agreements’ entry into force. Increases in the measure may result from increasing average depth of PTAs or increasing time since the entry into force of agreements. Each one-unit change in the measure, however, decreases the extensive margin by 1.1% and increases the intensive margin by 1.1%. Moving from the 10th percentile to the 90th percentile value—difference of 5.5 in the log-time average depth measure—leads to 6.1% decrease in the extensive margin. While I do not report the results here, depth interacted with linear—as opposed to logged—time does not alter the substantive results.

[ Table 3 about here ]

Robustness Checks

To provide greater confidence in the results so far, I carry out two sets of robustness checks. First, alternative aggregation methods of the PTA depth measure within dyads do not alter
the substantive results. I run models identical to 3a and 3b but with depth measures that are aggregated to the dyad-year level using the minimum, maximum, and median values among multiple agreements for each observation. An online appendix table summarizes the results for the three pairs of models, each with the extensive and the intensive margin as the dependent variables.

Second, I use an alternate measure of PTA from the DESTA database. In addition to the depth index based on seven dichotomous dimensions, DESTA has a measure based on a latent trait analysis that takes into account the high degree of correlation among the 48 components that capture depth. This alternate measure varies between -4.2 and 6.7 in the sample, with a mean of -.096. Table 4 summarizes the results of Models 4a and 4b.

[ Table 4 about here ]

The results diverge from those of the analysis thus far. The estimates on the controls remain largely the same as in Models 3a and 3b. However, the alternative measure of PTA depth has a negative and significant effect on the extensive margin and an insignificant effect on the intensive margin of trade. In other words, while deeper PTAs, measured in this manner, reduces entry of new products to become exports, they do not increase the volume of existing exports per product over time.

While the different results arise from the contrasting coding methodologies, one substantive interpretation for the difference is the following. The Rasch latent trait measure captures fixed costs that influence entry of new products into international trade but do not facilitate greater trade by existing exporters. In short, PTAs with greater depth measured in this manner freeze the export market in favor of the importing country and to the detriment of the exporting country. Deep PTAs protect the markets from their trade partners.
Effects of Depth Components on Margins of Trade

In the online appendix to their article, Dür, Baccini, and Elsig (2013) provide a chart summarizing the degree to which their 48 component variables measuring depth of PTAs are associated with the Rasch latent trait. Competition and IPR provisions are the regulatory areas most highly associated with the measure. Since the components of the measure potentially have varying effects on the trade margins, in the final analysis, I examine the effects of the seven regulatory areas of depth separately rather than combined as an additive or Rasch index.

Although I argue that the depth of PTAs in the aggregate influences the fixed costs of trade, the components may have effects on the variables costs as well as the fixed ones. Whereas the two margins of trade respond in opposite directions to changes in fixed costs, they respond in the same directions to changes in variable costs (Dutt, Mihov, and Van Zandt 2013, 205). Lower variable costs resulting from a PTA provision will increase both the extensive and the intensive margins of trade. Accordingly, the results from this analysis can illuminate which costs of international trade each depth component affects and in which direction. Table 5 summarizes the results, with the extensive margin as the dependent variable in Model 5a and the intensive margin as the dependent variable in Model 5b.

[ Table 5 about here ]

The results fall into two groups—one in which the two margins change in the same direction and the other in which the results diverge. PTAs that strive toward full free trade agreement, involve intellectual property rights (IPR) or liberalize government procurement affect the margins in the same direction and thus likely alter variable costs of trade. Full FTA and procurement provisions increase both margins and decrease variable costs. IPR provisions, however, decrease both and increase variable costs. Despite the attempts to internationally harmonize regulations over intellectual property rights, agreements with deeper IPR regulations increase the per-unit cost of exporting to PTA partner countries.
The remaining components have divergent effects on the two margins. Standards and competition provisions decrease the extensive margin without affecting the intensive margin. Services provisions decrease and investment provisions increase the intensive margin without affecting the extensive margin. Although the effects in each extensive-intensive pairs are significant for only one margin and not the other, the overall pattern of the results are consistent with the results from the preceding analyses. Three out of four of these deep PTA provisions influence trade flows in ways that indicate increased fixed costs. Technical and regulatory standards, investment provisions and competition regulations either decrease the extensive margin or increase the intensive margin. The only regulatory area that appears to decrease fixed costs is liberalization of services, which decreases the intensive margin.

Conclusion

In this article, I advance a novel argument about the unintended consequences of PTAs on trade flows among member countries. I argue that the PTA environment in which countries increasingly find themselves is highly complex. Countries belong to multiple overlapping trade agreements with their trade partners. Countries have also been signing ever deeper PTAs, requiring more extensive regulatory cooperation, beyond liberalization of trade barriers. These complexities, rather than facilitating easier trade among the members, increase the fixed costs of international trade. Multiple PTAs reduces firms’ ability to figure out the relevant rules governing their trade. Deep PTAs create uncertainty about the actual extent regulatory harmonization. Although the resulting higher fixed costs increase the intensive margin of trade—the average value per product countries export—they decrease the extensive margin of trade—the number of products countries export to partners. The empirical analysis using data based on six-digit-level trade data and PTA count and depth data from DESTA provides consistent support for the argument.

While the two margins of trade are a bit abstruse, the substantive implications are important.
Although numerous and deep PTAs may increase the total value of exports from one member country to another, they do not expand the diversity and the level of competition. Countries reduce the number of products they export when they have numerous and/or deep PTAs with their importing partners. An interpretation of this finding is that more numerous and deeper PTAs work in favor of firms already engaged in exporting products and against firms that seek to enter the international market. The findings mirror those about high numbers of bilateral investment treaties (BIT) on investment flow (Tobin and Rose-Ackerman 2011).

The findings have broader implications for politics over international regulatory cooperation. When issue-areas deeply embedded in domestic political economies are concerned, such as technical and health standards, IPRs and competition, harmonization is a difficult endeavor. Even when international agreements provide the regulatory coordination point and the process for countries to reach that point, actual implementation remains unpredictable. Importantly, the uncertainty leads private actors to alter their behavior over international transactions and choose to exit the market (stop exporting) or to not enter the market (do not begin exporting). In the context of regulatory cooperation over competition, the outcome leads to an unanticipated and unintended consequence of a reduction in the amount of economic activities rather than an increase.

The argument and the findings from this article also generate potentially productive avenues for future research. First, a similar analysis can be carried out at the multilateral level using plurilateral WTO agreements, which are outside the boundaries of the “single undertaking” that shaped the Uruguay Round. Such an analysis can compare and contrast the effects of integration efforts between parties and non-parties. Second, if the argument proposed in this article is correct, then similar dynamic should play out in international regulatory arenas outside trade governance. Last, scholars should acknowledge and analyze the possibility of unintended consequences in international governance (Martin and Simmons 1998). Institutions may not accomplish the goals that governments set out for them—they may in fact generate effects not anticipated by governments.
Table 1: Baseline Models of Extensive and Intensive Margins

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef (SE)</th>
<th>Coef (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total PTA</td>
<td>-.018*** (.0028)</td>
<td>.043*** (.0040)</td>
</tr>
<tr>
<td>Total PTA (squared)</td>
<td>.00027*** (.00056)</td>
<td>-.00056*** (.000089)</td>
</tr>
<tr>
<td>Both GATT/WTO</td>
<td>.20*** (.030)</td>
<td>-.022 (.044)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.33*** (.020)</td>
<td>11.3*** (.028)</td>
</tr>
<tr>
<td>N</td>
<td>394,686</td>
<td>394,297</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Exporter-year, importer-year, and dyad fixed effects included.

* p<0.10, ** p<0.05, *** p<0.01
Table 2: Models of Extensive and Intensive Margins, with Average PTA Depth

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 2a (extensive)</th>
<th>Coef (SE)</th>
<th>Model 2b (intensive)</th>
<th>Coef (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTA</td>
<td>.032 (.021)</td>
<td></td>
<td>-.080** (.033)</td>
<td></td>
</tr>
<tr>
<td>Total PTA</td>
<td>-.016*** (.0028)</td>
<td></td>
<td>.042*** (.0041)</td>
<td></td>
</tr>
<tr>
<td>Total PTA (squared)</td>
<td>.00024*** (.000056)</td>
<td></td>
<td>-.00057*** (.000092)</td>
<td></td>
</tr>
<tr>
<td>Average PTA Depth</td>
<td>-.014*** (.0053)</td>
<td></td>
<td>.020** (.0087)</td>
<td></td>
</tr>
<tr>
<td>Both GATT/WTO</td>
<td>.20*** (.030)</td>
<td></td>
<td>-.020 (.044)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.32*** (.020)</td>
<td></td>
<td>11.3*** (.029)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>392,780</td>
<td></td>
<td>392,399</td>
<td></td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Exporter-year, importer-year, and dyad fixed effects included.

* p<0.10, ** p<0.05, *** p<0.01
Table 3: Models of Extensive and Intensive Margins, with Log-Time PTA Depth

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef (SE)</th>
<th>Coef (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTA</td>
<td>.032** (.016)</td>
<td>-.066*** (.023)</td>
</tr>
<tr>
<td>Total PTA</td>
<td>-.017*** (.0028)</td>
<td>.043*** (.0041)</td>
</tr>
<tr>
<td>Total PTA (squared)</td>
<td>.00026*** (.000057)</td>
<td>-.00060*** (.000093)</td>
</tr>
<tr>
<td>Average PTA Depth (log-time)</td>
<td>-.011*** (.0021)</td>
<td>.011*** (.0032)</td>
</tr>
<tr>
<td>Both GATT/WTO</td>
<td>.19*** (.030)</td>
<td>-.019 (.044)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.33*** (.020)</td>
<td>11.3*** (.029)</td>
</tr>
<tr>
<td>N</td>
<td>392780</td>
<td>392399</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Exporter-year, importer-year, and dyad fixed effects included.

* p<0.10, ** p<0.05, *** p<0.01
Table 4: Robustness Checks with Latent Trait (Rasch) Measure of PTA Depth

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 4a (extensive)</th>
<th>Model 4b (intensive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Coef (SE)</td>
<td>Coef (SE)</td>
</tr>
<tr>
<td>PTA</td>
<td>.027* (.015)</td>
<td>-.015 (.020)</td>
</tr>
<tr>
<td>Total PTA</td>
<td>-.016*** (.0029)</td>
<td>.046*** (.0042)</td>
</tr>
<tr>
<td>Total PTA (squared)</td>
<td>.00024*** (.000057)</td>
<td>-.00062*** (.000094)</td>
</tr>
<tr>
<td>Average Rasch PTA Depth (log-time)</td>
<td>-.032*** (.0062)</td>
<td>-.012 (.0087)</td>
</tr>
<tr>
<td>Both GATT/WTO</td>
<td>.20*** (.030)</td>
<td>-.021 (.044)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.31*** (.020)</td>
<td>11.3*** (.029)</td>
</tr>
<tr>
<td>N</td>
<td>392780</td>
<td>392399</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Exporter-year, importer-year, and dyad fixed effects included.

* p<0.10, ** p<0.05, *** p<0.01
Table 5: Effects of PTA Depth Components on the Margins of International Trade

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coef (SE)</th>
<th>Coef (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 5a (extensive)</td>
<td>Model 5b (intensive)</td>
</tr>
<tr>
<td>PTA</td>
<td>.033** (.016)</td>
<td>-.070*** (.023)</td>
</tr>
<tr>
<td>Total PTA</td>
<td>-.021*** (.0029)</td>
<td>.041*** (.0041)</td>
</tr>
<tr>
<td>Total PTA (squared)</td>
<td>.00034*** (.000058)</td>
<td>-.00052*** (.000091)</td>
</tr>
<tr>
<td>Full FTA Indicator (log-time)</td>
<td>.026* (.014)</td>
<td>.13*** (.021)</td>
</tr>
<tr>
<td>IPRS Indicator (log-time)</td>
<td>-.14*** (.028)</td>
<td>-.13*** (.038)</td>
</tr>
<tr>
<td>Procurement Indicator (log-time)</td>
<td>.083*** (.020)</td>
<td>.054** (.026)</td>
</tr>
<tr>
<td>Standards Indicator (log-time)</td>
<td>-.024* (.013)</td>
<td>-.020 (.019)</td>
</tr>
<tr>
<td>Services Indicator (log-time)</td>
<td>-.017 (.025)</td>
<td>-.080** (.035)</td>
</tr>
<tr>
<td>Investment Indicator (log-time)</td>
<td>-.0057 (.018)</td>
<td>.11*** (.026)</td>
</tr>
<tr>
<td>Competition Indicator (log-time)</td>
<td>-.042* (.022)</td>
<td>-.042 (.030)</td>
</tr>
<tr>
<td>Both GATT/WTO</td>
<td>.20*** (.030)</td>
<td>-.013 (.044)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.33*** (.020)</td>
<td>11.3*** (.029)</td>
</tr>
</tbody>
</table>

N 392780 392399

Standard errors in parentheses. Exporter-year, importer-year, and dyad fixed effects included.

* p<0.10, ** p<0.05, *** p<0.01
Figure 1: Effects of PTA Count on the Extensive Margin of Trade
Figure 2: Effects of PTA Count on the Intensive Margin of Trade
References


phase-out, and tariff cuts.”


Table 6: Online Appendix — Robustness Checks with Alternate Aggregation Schemes for PTA Depth

<table>
<thead>
<tr>
<th>Variables</th>
<th>Model 6a (extensive)</th>
<th>Model 6b (intensive)</th>
<th>Model 7a (extensive)</th>
<th>Model 7b (intensive)</th>
<th>Model 8a (extensive)</th>
<th>Model 8b (intensive)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef (SE)</td>
<td>Coef (SE)</td>
<td>Coef (SE)</td>
<td>Coef (SE)</td>
<td>Coef (SE)</td>
<td>Coef (SE)</td>
</tr>
<tr>
<td>PTA</td>
<td>.033** (.016)</td>
<td>-.054** (.023)</td>
<td>.022 (.015)</td>
<td>-.061*** (.022)</td>
<td>.027* (.015)</td>
<td>-.058** (.023)</td>
</tr>
<tr>
<td>Total PTA</td>
<td>-.021*** (.0029)</td>
<td>.047*** (.0042)</td>
<td>-.011*** (.0029)</td>
<td>.036*** (.0043)</td>
<td>-.017*** (.0028)</td>
<td>.044*** (.0041)</td>
</tr>
<tr>
<td>Total PTA (squared)</td>
<td>.00033*** (.000059)</td>
<td>-.00065*** (.000096)</td>
<td>.00017*** (.000056)</td>
<td>-.00048*** (.000094)</td>
<td>.00027*** (.000057)</td>
<td>-.00060*** (.000093)</td>
</tr>
<tr>
<td>Minimum PTA Depth (log-time)</td>
<td>-.0098*** (.0019)</td>
<td>-.0073*** (.0029)</td>
<td>-.0094*** (.0019)</td>
<td>.012*** (.0029)</td>
<td>-.0090*** (.0020)</td>
<td>.0090*** (.0030)</td>
</tr>
<tr>
<td>Maximum PTA Depth (log-time)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both GATT/WTO</td>
<td>.20*** (.030)</td>
<td>-.020 (.044)</td>
<td>.20*** (.030)</td>
<td>-.019 (.044)</td>
<td>.19*** (.030)</td>
<td>-.019 (.044)</td>
</tr>
<tr>
<td>Constant</td>
<td>3.32*** (.020)</td>
<td>11.3*** (.029)</td>
<td>3.33*** (.020)</td>
<td>11.3*** (.029)</td>
<td>3.33*** (.020)</td>
<td>11.3*** (.029)</td>
</tr>
<tr>
<td>N</td>
<td>392780</td>
<td>392399</td>
<td>392780</td>
<td>392399</td>
<td>392780</td>
<td>392399</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Exporter-year, importer-year, and dyad fixed effects included. * p<0.10, ** p<0.05, *** p<0.01