

Review Article

Preferential Trade Agreements: Development Trends and their Effects

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Received: 08 March 2022

Revised: 15 April 2022

Accepted: 22 April 2022

Abstract - Tremendously increasing PTAs attract many researchers to find out the reasons to form and their effects. This work has a long history. Beginning with the Vinerian question, the theory and empirical works related to this area are massive and perfect. This report provides an overview of the PT development trend, some stylized facts, purposes, and determinants to impact PTA formation, especially methods to find out the effects of PTAs on trade, economic growth, social welfare, etc., and the techniques to deal with the endogenous problems in analyzing process. The last but not least, this report also provides the recent trend in analysis related to PTAs' effects.

Keywords - PTAs' effects, PTAs' trends, PTA analysis.

I. INTRODUCTION

Over thirty years, the world has witnessed a big transformation of trade relationships; the preferential trade relationships truly began. The change in perception of the US towards the preferential relationships, which was remarked by the US signing a free trade agreement with Israel in 1985, is one of the four forces dragging the booming in preferential relationships some years later, from only 15 RTAs in 1980 to 461 in 2018 (WTO). This phenomenon has attracted a lot of researchers to find out why so many countries and territories have joined in preferential trade agreements (PTAs). Their works created the literature which includes both theory and empirical for the PTAs formation and their effects on trade, economics, society, military, etc.

Starting with the Vinerian question, first mentioned by Viner (1950), many researchers have joined this area and afforded to find the answers related to PTAs. In reality, the integration levels are very different among PTAs. Some PTAs only relate to tariff concession for some specific goods (shadow PTAs). Still, the others relate to tariff concession and external trade policies, labor movement, standards of the environment, fiscal and monetary policies, and even military securities (deep PTAs). Some PTAs only have a member (unilateral PTAs), some have two (bilateral PTAs), and some have more than two (multilateral PTAs).

Although the PTAs have increased by 1316% since 1991, countries' willingness to join PTAs varies tremendously across countries and territories. Baier and Berstrand's data show that some countries have many PTA relationships, but others have no PTA relationships. The difference in willingness to join has increased across countries. Joining many PTAs leads to the overlapping (the noodle of trade agreements) PTAs between two countries. Trading between two countries can use many schemes as Thai and Laos firms can use one of their seven PTAs to trade besides the MFN principles, which leads to firms' confusion and needs to pay more to use those schemes. However, PTAs still attract so many countries to participate. The fact that integration levels in PTAs have been deeper and deeper.

The literature shows that countries join PTAs not only because of economic and social welfare reasons but also because of political and security reasons. Forming new PTAs or joining the existing ones plays a shield in preventing trade wars and small countries' voices, and large countries' influence. In the case of the US or Japan, they realize that forming PTAs helps themselves achieve more purposes besides economic reasons.

There are many determinants impacting the formations of a PTA. Still, in general, those determinants are related to economic and economic-political factors such as trade flows, distance, economic size, etc., between two countries. Some determinants impact positive PTA formation, and some impact negative PTA formation.

Researchers build the theory and empirical models to determine the effects of PTAs on trade, economics, and other reasons. The theory models build up the models to explain in theories the effects of PTAs such as the trade creation (TC), trade diversion (TD), cost-reduction effect, trade suppression effect, etc. The empirical works use the real data combined with models to explain the effects of PTAs. And two remarkable methods are ex-ante and ex-post techniques. However, literature also suggests that finding out the true



effects of PTAs is not easy. Researchers need to deal with the endogenous problem. Some approaches being used to face this problem are instrumental variables/2sls approach with cross-section data and fixed effect and first difference with panel data.

The main remainders of this paper include: Part II is PTA development trends and influencing factors; Part III approaches to research the effect of PTAs; Part 4 is analysis trends, and the last part is conclusions.

II. PTA DEVELOPMENT TRENDS AND INFLUENCING FACTORS

A. *The Evolution of PTAs*

In 1995, WTO was founded to replace the General Agreement on Tariffs and Trade GATT. The creation of the World Trade Organization (WTO) in 1995 (General Agreement on Tariffs and Trade, GATT, is the precursor) has brought opportunities to promote global trade liberalization and attracted more and more countries to participate. Since 29 July 2016, WTO has had 164 members. Members in WTO relate to each other under the Most Favored Nation (MFN) principle, which means a non-discriminative mechanism a member has to apply to all other members.

However, Article XXIV for trade in goods, Article V for trade in services, and the Enabling Clause for developing countries offer a chance for members to have a discriminative mechanism against each other if they join a preferential trade agreement together (PTA). What is a PTA? Frankel (1997) defined a PTA as "a group of two or more customs territories in which the duties or other restrictive regulations of commerce (with some exceptions) ...are eliminated on substantially all the trade between the constituent territories...". Mansfield and Milner (2012) defined "PTAs are international agreements that aim to promote economic integration among member-states by improving and stabilizing the access that each member has to other participants' markets." Limão (2016) defined "a PTA is an international treaty with restrictive membership and including any articles that (i) applies only to its members and

(ii) aim to secure or increase their respective market access" (p. 4). The nature of PTAs is that the discriminative treaty is applied only to members in a PTA to secure easier members' market access. The PTA, defined by Frankel (1997), only covers the duties or other commercial regulations. However, a PTA defined by Limão (2016) covers the duties and commercial regulations and "any articles" to access participants' markets easier.

The key differences between PTAs and WTO are the principles that members treat each other, the non-discriminative verse discriminative principles, and the covered issues, trade integration verse economic and economic-political cooperation (Mansfield and Milner, 2012).

The liberalization based on joining PTAs violates the non-discriminative principle of the WTO (GATT). However, the WTO (GATT) allows countries or territories to form a PTA if they commit to satisfy some requirements (Frankel, 1997). The first requirement asks for participants in PTAs to reduce or remove "substantially" all trade barriers, which is not just in the short run or excluding major sectors (except the transition economies). The second requirement is that the trade restrictions of participants against non-participants are not higher than ones before joining PTAs. If those new barriers hurt non-participants, they can request compensation for the loss. The last requirement is that coming PTAs need to set up the schedule and notify WTO of their relationship. Normally, this process does not exceed 10 years.

To tie the trade and other relationships, under the principles of WTO, more and more countries and territories have joined PTAs. Since 1990, the number of PTAs has increased tremendously. From 25 regional trade agreements (RTAs) and 27 Notifications of RTAs in force in 1991, it now increased to 354 and 547 RTAs. That means RTAs and Notifications of RTAs in force have increased by 1316% and 1926%, respectively. More details about the PTAs' development are provided in Fig. 1.

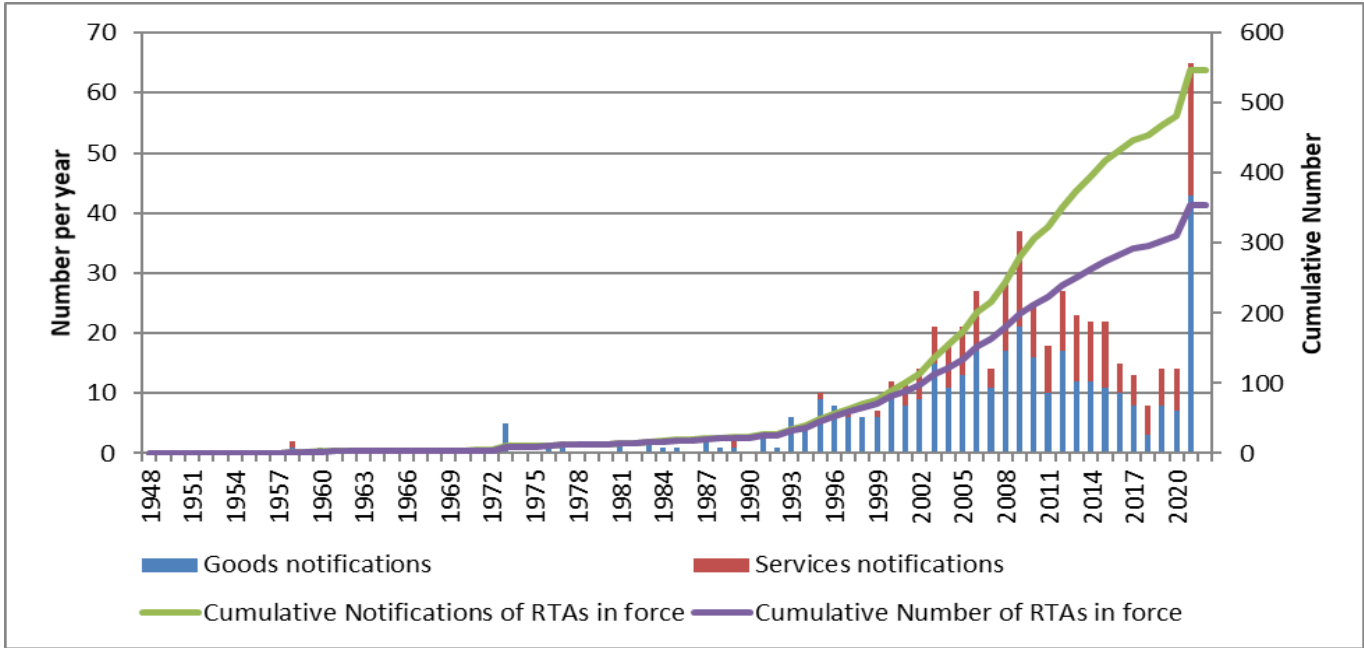


Fig. 1 Evolution of RTAs, 1948 - 2022

B. PTAs Development Trends

Although there are so many PTAs signed, they are different in level integration. For example, European Union has the common fiscal and monetary policies besides the common trade policies and other features; ASEAN does not have the common external trade policies or fiscal and monetary policies. Based on the level of integration, the literature separates the PTAs into some types.

Frankel (1997), Mansfield and Milner (2012), Baier et al. (2014), and Limão (2016) sort PTAs into six categories as followings:

- Non-reciprocal preferential trade agreements (OWPTAs) are one-way trade agreements; GSPs lie in this type, instituted in 1971 (UNCTAD). The developed countries provide opportunities for the LDCs to grow and climb out of poverty by exempting the tariffs for goods imported from them. Thirteen countries, including Australia, Belarus, Canada, the European Union, Iceland, Japan, Kazakhstan, New Zealand, Norway, the Russian Federation, Switzerland, Turkey, and the United States of America, have offered OWPTAs for LDCs.
- Preferential trade agreements (TWPTAs) are reciprocal trade agreements where members offer preferential regimes to each other but less than 100 percent in eliminating tariffs.
- Free trade agreements (FTAs) are also reciprocal agreements where members eliminate the substantial parts of trade barriers, such as tariffs and import quotas, to increase the trade flows in goods and services. Members in FTAs keep their external trade policies

independently. ASEAN, ASEAN–Australia–New Zealand Free Trade Area (AANZFTA), and ASEAN–Korea FTA are some examples of FTAs.

- Customs Unions (CUs) include the commissions as in FTAs, but members in CUs perform the common external trade policies together. For example, Southern Common Market (MERCOSUR), Central American Common Market (CACM), Caribbean Community (CARICOM), etc., are CUs. In addition to facilitating and increasing trade and economic efficiency, CUs are established for members to tie their political and cultural issues.
- Common markets (CMs) have the issues integrated as the CMs plus freer movement of labor and capital among members. The European Union is known for the framework of the CMs.
- Economic unions (EUs) are the deepest integration. In addition to the issues integrated as the CMs (members also evolve harmonizing taxation policy with the external side, freer movement of labors and capitals), members use the common currency and fiscal policies. The European area is one of the EU.

WTO separates the preferential trade agreements into two types, the OWPTAs (unilateral trade preferences or non-reciprocal) and the RTAs, two-way agreements. The OWPTAs in WTO include GSPs and others granted by the General Council, while RTAs include FTAs, CUs, CMs, and EUs.

Other researchers such as Horn (2010), Dür et al. (2014), and Limão (2016) categorize PTAs based on the breadth of the items covered in PTAs in more detail. Horn et al. (2010) analyze the endogeneity in the formations of PTAs from incomplete contracts. They divided the PTAs based on the 52 provisions and the date they were in enforcement. Firstly, their data have 28 PTAs; after that, WTO includes up to 100 PTAs. From Horn (2010), 36% of PTAs were in force before 2000 and 64% after 2000. Most provisions that are in the current mandate of the WTO are mentioned in that PTAs, such as provisions of the industrial sector (its mean equals two) or the agricultural sector (its mean equals 1.98). However, the provisions which do not fall into the current WTO's mandate are shortened in some agreements, even though some provisions are not mentioned in all 100 PTAs, such as nuclear safety and human rights. Dür et al. (2014) designed the new PTAs dataset in which they not only included more item codes but a larger number of PTAs than in WTO. WTO set out the 100 PTAs based on 52 items, but Dür et al. (2014) set out the 587 PTAs based on 100 items. For example, in WTO, a binary dummy variable takes the value of one for PTAs which have technical barriers to trade (TBT) commitments and zero otherwise; At the same time, Dür et al. (2014) classify PTAs with 7 items of TBT, or they classify PTAs based on the depth of the cooperation with 8 items such as the depth in full FTAs, the depth in investments, in standards, or services, etc. Limão (2016) categorizes PTAs based on their depth and width of PTAs. Four groups are arranged as follows: the shallowest group only offers the commitments relating to reducing trade barriers (the importing tariffs). The next group adds the commitments to reducing trade barriers and non-trade barriers (such as contingent protections, product standards, customs procedures, etc.). The third group adds the government policies such as aid, government procurements, and competition policies. And the deepest group includes other policies such as financial assistance, agricultural cooperation, etc. In terms of breadth of effects, Limão (2016) divides the PTAs based on the issues covered, such as goods only, both goods and services, technologies (innovations or intellectual property rights, IPRs), or factors of products (labors, capital).

In the wave of booming development of PTAs, many countries and territories do not want to be left behind but to strengthen their trade, economic, cultural, and even military relationships, they join one or more PTAs, and the level of integration is deeper. From Baier and Bergstrand's data, it is easy to know that although OWPTAs dominate among six types of PTAs, their fraction has reduced. Accounting for 66% in the 1970s and 68% in the 1980s, it only accounted for 49% in the 2000s. On the contrary, the proportion of deeper PTAs has increased. In the case of FTAs, their fraction increased from 5.57% in the 1980s to 20.63% in the 2000s. Especially, the deepest FTAs, including CMs and EUs, from zero percent in the 1800s, account for 5.47% and

3.23% in the 2000s, respectively. To have more advantages to access the members' markets, the countries and territories bust their relationship by expanding the integration in many aspects. More details are provided in Table 1.

From Fig. 1 and Table 1, more and more countries and territories have joined PTAs. However, the willingness to join PTAs among countries is uneven. While some countries are not ready to participate in any PTAs, other countries own many PTAs. From Baier and Bergstrand's PTA data, the willingness to participate PTAs of all countries can be constructed as followings:

Some years are chosen, including 1980, 1990, 2000, and 2012 (Baier and Bergstrand PTA data only constructed to 2012). Then, the paper calculates the number of PTAs relationships a country owns each year. Finally, the paper compares the change in the number of PTAs a country has owned over time. And the results are provided in Table 2.

In 1980, the greatest number of PTA relationships owned by an exporter was 36, while the smallest was zero; this deviation was more extreme in the case of an importer: 153 versus 0. And the total PTA relationships were 174 at that time. The uneven was more tremendous in 1990 and 2000. The deviation of PTA numbers owned by an exporter and importer was 0-44 and 0-156 in 1990, and 0-63 and 0-180 in 2000, respectively. However, in 2012, all exporters had at least 9 PTA relationships, but the deviation of the willingness to join in the case of an importer was 0-183. The reason to explain some importers own many preferential relationships is that they offer OWPTAs for LDCs through GSPs.

From the exporter perspective: Japan is one of the countries which joined "this game" lately. Until 2000 Japan still did not have any PTA relationships if Japan was an exporter. The first PTA Japan signed with Singapore was in 2003, and by 2012 Japan-only upheld 14 PTA relationships. Opposite Japan, Portugal is one of the countries most willing to participate. It owned 87 PTA relationships in 2012. This number also was the greatest number of PTA relationships an exporter had from 1962-to 2012.

From the exporter perspective: The United Kingdom always is on top of countries tending to build PTA relationships with other countries. The number of PTAs the UK owned was 153, 156, 180, and 183 in 1980, 1990, 2000, and 2012. Inversely, Aruba had no PTA members until 2012. The differences in willingness to participate in PTAs among countries are provided in Fig. 2 and 3.

In PTAs' development trend, the overlap in PTAs (the noodle of trade agreements) is remarkable. The overlapping means that two countries are simultaneously members of two

or more PTAs. For instance, ASEAN countries not only signed a PTA together but also signed with other countries, including China (2004), Korea (2006), Japan (2008), India (2010), Australia and New Zealand (2010), usually called ASEAN six plus (including 10 ASEAN countries and those 6 countries).

Furthermore, most ASEAN countries also signed bilateral trade agreements with some of those 16 countries, likely Thailand-Lao (1991), Thai-Japan (2007), Thailand-Australia (2005), etc. Although each of the PTAs has different provisions in trade and non-trade regulations (such as rules of origins, RoOs), it is clear that Thai and Laos firms can use one of their seven PTAs to pay the trade costs or satisfy the regulations besides the MFN principles.

C. Purposes of Participation in PTAs

One of the most important reasons that encourage countries to negotiate and participate in PTAs is that they expect to increase economic development, measured by trade growth, aggregate productivity, and social welfare. The preferential treatments create opportunities for members to access their markets easier. The reduction of trade and non-trade barriers (trade costs reduce) offers new and lower productivity firms the chance to become exporters. One the one hand, the integration of production processes (chain supply) is expected much more deeply across members after PTAs are formed. The fragmentation of the production structure is expected to provide more details to help members achieve the benefits of scale. Trade of intermediate goods tremendously increases across members.

On the other hand, liberalization, and integration more support the increase of the competition and innovation of domestic firms. While more productive firms can pay the trade costs and enter foreign markets, the lowest productive firms remain out of the domestic markets. As a result, resources move to higher productivity firms, leading to more efficient reorganization of the production process within countries and finally increasing gate productivity. In addition, consumers can consume various products at lower prices. Members' welfare potentially increases. However, the formations of PTAs also trade-off with the losses for both members and the third parties, such as tariff revenues of imports, the inequality distribution of income, and trade diversion (TD) for the third parties. Overall the formation of PTAs is "good or bad" who gets a loss and who gets gains still needs to be analyzed in PTA trade literature.

The second reason countries have signed more and more PTAs during the past three decades is the political issues. The US changed its perspective to preferential treaties because it realized that the PTA formations served as insurance against the trade wars between Germany and France. The PTA establishments potentially insure the policy

ties in the liberalization process, which is against the centralization of the economy. And participating in PTAs also serves as a tool for large countries to increase their effects on small countries and reduce the small markets' ties with the third parties.

Last but not least, more countries participate in PTAs because they want to strengthen their security capacities. The diversifications in institutions, the economic development levels, and the complementary after members sign and extend their initiatives also explain the variant in the scope and depth of integration and the effect on the economic growth.

To get the discriminative treatments from the members, the providers need to prove the origin of products or the original certificate (RoOs) necessary in any PTA. Their roles are to ensure only eligible products originating from members get tariff concessions or other advantages and prevent trade deflection. The trade deflection occurs when a product produced from third countries (non-preferred countries) is re-directly shipped to members to avoid the payment of customs duties. Getting an RoO certificate is easy if a member completely produces a product. However, it is more complex and difficult if a product undergoes some steps in some countries before completion (substantial transformation). Three main criteria for determining the origin at which producers' products are eligible are value-added, specific manufacturing processes, and changes in tariff classifications. A product is considered to be of origin from a country if the percentage of value-added made by that country exceeds a specified percent. Two approaches can determine the percentage of value-added from a country. The first is based on the minimum percentage of the profit, labor cost, and the depreciation cost which that country adds to the product. And the other is the maximum percentage of imported inputs that that country uses to produce the product. The criterion to change the tariff classifications requires producers that use non-original imported inputs to change the tariff classifications of the final products.

The last criterion for the specific manufacturing process consists of positive and negative tests. The former is applied for a product or product group defining the origin clearly and the latter for those that do not determine the origin. RoOs play as a shield to protect members' benefits. However, RoOs is also known as an instrument of trade policies to restrict trade flows. For example, the restriction of materials used to produce clothes exported to the EU prevents Cambodia from applying preferential schemes for her exports to the EU. RoOs' principles vary across the PTAs and create costs of custom services in many countries. Many producers do not apply the preferential schemes because it is too complicated to obtain RoOs, and the cost of RoOs might be greater than the benefits (Hayakawa et al. 2009).

D. The Determinants Impacting on PTAs' Formations

a) Economic Factors

Krugman (1991. a and b) discuss the determinants (pure economic and pure political factors) that impact the PTAs' formations. This paper only mentions those determinants that are tested by empirical works. Baier and Bergstrand (2002) suggest five determinants affecting the probability of the PTAs' formation, including the distance, nominal GDPs, remoteness, the relative factor-endowment differences, and the relative factor-endowment differences with the rest of the world (ROW). The remoteness takes zero if two countries (called country *i* and *j*) do not lie in the same continent; otherwise, it is measured by the average of the mean of the distances between *i* and all *i*'s partners except *j* and the mean of distances between *j* with all *j*'s partners except *i*. The relative factor-endowment difference between country *i* and *j* are defined as the absolute value of the difference between the capital-labor ratio of the pair ($DKL_{ij} = K_i/L_i - K_j/L_j$). The relative factor-endowment difference with the ROW is defined as the average difference between the capital-labor ratio of the ROW and country *i* and the ROW and country *j*. Where the first and the last factors are expected to be negatively correlated, the three other factors are expected to be positively correlated with the probability of forming a PTA. The trade flows of a pair also are the factor that possibly affects the probability of PTAs' formation, as Magee (2003) suggests. If their trade in the past increases, the probability of the PTA's formation increases.

The economic determinants affecting the formation of PTAs are analyzed systematically by Baier and Bergstrand (2004) with a qualitative choice model. They divide the determinants into three categories: the economic, geographical factors (distance), the intra-industry trade determinants (the similarity in size of economies), and the inter-industry trade determinants (the similarity in factor endowments). The probability of forming a PTA depends on the members' net welfare gains. They test 8 hypotheses to conjecture net welfare effects on trade agreements. Eight hypotheses include two members' distance, and/or the similarity in their economic sizes, and/or the larger their economic sizes, and/or the farther from the ROW (two members' remoteness is constructed as Baier and Bergstrand, 2002), the smaller economic sizes of the third parties, their relative factor endowments (it might be reduced if transportation costs are low, two countries specialize their productions), and the difference in relative factor endowments between the pair and the ROW.

Chen and Joshi (2010) figure out that the three countries' PTA relationship plays an important role in their PTA formation. According to them, three capacities of PTA relationships among a triad are generated: no FTA among three countries, one of them has a PTA relationship with the third country, and both have PTA relationships with the third

country. The other determinant impacting the probability of an FTA formation is "other FTAs" analyzed by Baier et al. (2014). This probability possibly interdepends both on "own-FTA" and "cross-FTA" effects, where the own-FTA is either country *i* or *j* owning its PTAs (with the third country), and cross-FTA is other pairs' existing FTAs. The former impacts the potential probability of establishing a PTA. more than the latter.

b) The Economic Political Factors

In addition to economic factors, the economic policy analysts suggest that the economic-political factors also affect the probability of PTA establishments. Baier and Bergstrand (2002) mention six economic and political factors: the short-run adjusted costs due to the specialization, the income distribution, the common legal systems, the labor standards, the security aims, and the environmental standards. To proxy for those six factors, they use the differences in the share of labor in some sectors (agriculture, mining and manufacturing, transport and non-transport services); the Gini index; the common legality; the fraction of the children arrange from 10 to 14 in the labor force; the average share of gross domestic products (GDPs) in the expenditure of securities; and the average per capita of CO2 emission or the differences in absolute values of these shares. The first variable is expected to negatively affect the probability of forming a PTA, and the rest are expected to affect it positively.

The other economic-political factors, which are the same size of the ratio of capital to labor, the similar GDP per capita, the intra-industry trade, trade balance, and democracy, are expected to impact the formation of a trade deal (Magee, 2003).

III. APPROACHES TO RESEARCH THE EFFECT OF PTAS

A. Theory Methods

The Vinerian question was firstly mentioned by Viner (1950) to conjecture whether the PTA's formation is good or bad and who gains and who loses from it. To answer those questions, he introduces two conceptions of trade creation (TC) and trade diversion (TD) effects. TC means that trade flows move from the low-productivity (high-cost) domestic producers to high-productivity (low-cost) producers in member countries. At the same time, TD refers to trade flows that move from the high-productivity (low-cost) non-member countries to the high-cost member countries.

The theories analyze the TC and TD among countries being the members that offer and receive the preferential schemes and the non-members. The model supposes three countries, A, B, and C, where countries A and B are prospective to form a PTA and C is the ROW. Country A is

the importer, and countries B and C are the exporters. Country A has the least productivity, and country C has the best productivity. The price of product X traded from B and C to A in three countries is $P_A > P_B > P_C$. The demand and supply curves in country A are D_A and S_A , as in Fig. 4, where their elasticity is non-zero. The supply curves of countries B and C are S_B and S_C , representing that the supply elasticity is infinite (countries B and C can provide any quantities of their products at given prices). The market equilibrium at a price equals $P_A = P_C + t$, where t is the tariff of product X country A applies to all its partners (the ROW). Country A imports $Q_m Q_a$ from the ROW before A and B sign a PTA, and the tariff revenue is the area $A_1 A_2 D_1 D_2$. Now suppose that countries A and B form a PTA where country A grants the tariff concession for product X imported from country B. The price of product X is now P_B which is lower than P_A . At the lower price, the demand for imported product X in country A increases to $Q'_m Q'_a$, but its supply is lower, moving from Q_m to Q'_m . The price is lower from the change of product X's tariff under the preferential regime, and both no trade and new trade are created. No new trade means the imported product of country A switches from country C to country B, where country C's production costs are lower than country B's ones. This switch is called TD. And the new trade means that instead of using product X produced in domestic Q_m , country A's consumers change to purchase product X imported from country B, which provides lower production costs than country A does. This switch is called TC. The net change of country A's welfare from the PTA formation is W given by $A_1 B_1 C_1 + A_2 B_2 C_2 - D_1 D_2 C_1 C_2$ (the change of consumer surplus and loss of tariff revenue). This net area is possibly either positive, negative, or zero. $A_1 B_1 C_1$ plus $A_2 B_2 C_2$ benefits from saving the resources in domestic markets (country A is in this case) and an increase in the consumption of products from the higher productivity country (TC), and $D_1 D_2 C_1 C_2$ is the tariff revenue loss from signing a PTA (TD). The sign of W depends on factors such as the difference in P_B and P_C , the initial trade level between countries A and B, and the market power of country B.

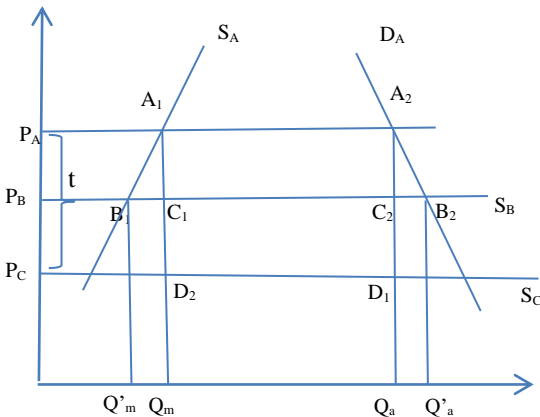


Fig. 4 Trade creation and trade diversion

The larger initial trade leads to the higher TD, and the larger difference in production costs between country B and the ROW also leads to the higher TD. Therefore, in the case of constant costs in country B and the ROW, if net trade-in volume or value is positive after signing the PTA, it is still a weak test to conclude the welfare improved in the importer. However, the welfare effects might still be positive in the case of the complete TD if country A's demand curve is downward instead of a vertical demand curve (Panagariya, 2000).

In case both country B and the ROW's costs are constant, as shown in Fig. 4, their welfare remains unchanged before and after country A and B's PTA is signed. However, if we now suppose that country B has the market power or the less-perfect-competitive market (relaxing the assumption for the model in Fig. 4.), then country B can increase the price of product X to P_A after the PTA is formed, the net change of country A's consumer surplus disappears, and country B's net gains are the tariff revenue which is equal to country A's tax revenue before their PTA is signed. As mentioned in Panagariya (2000), those results depend on the PTAs' type (FTAs or CUs) formed by countries A and B.

The welfare effects of tariff preferences in case of the constant international prices were also analyzed by Mundell (1968). The terms of trade (TOT) effects are improved unambiguously in the tariff-receiving country but might rise or fall (with respect to the third country) in the tariff-reducing members. If both members are tariff-receiving and reducing, the effects on members' TOT can be improved, and the third party's TOT is unambiguously worse. However, those results depend on the level of tariffs reduced. For instance, if the two members reduce the same level of tariffs, their TOTs will be improved.

Corden (1972) introduces two concepts, the cost-reduction effect and trade suppression effect, in the economies of a scale model in which the producers can get a lower average cost of production. The cost-reduction effect occurs when the producers from an exporter can take over the whole importer's market and reduce the production cost in the domestic market after the union is formed. While trade suppression effect occurs when the consumers in the importer exchange to purchase the product at higher costs (TD) or consume the domestic products whose costs are higher than the third party's costs (trade suppression effect) after the union is formed.

The first wave theories have adopted the comparative-static models to analyze the members' and the third party's welfare effects of the PTA formations. The results are impossible to be sure of the gains for all members, whereas the TC might be eroded if the exporting members in PTAs have the market power and the initial tariff level is high.

In the second wave, the theoretical works mainly focus on the dynamic effects of PTAs. The researchers analyze the incentives that support or prevent the new entry from acceding to the existing PTAs, or the existing members strengthen the multilateral trade liberalization, such as Krugman (1993) or Zissimos and Vines (2000). Krugman's analysis supports the regional trading blocs, and a small number of members are a better way for regional trade blocs to cooperate more. Zissimos and Vines (2000) argue that Article XXIV is a factor of a stumbling block. The third wave of the theoretical works adds the non-trade provisions to analyze the effects of PTAs on welfare, which can be found in Pomfret (1997).

B. The Empirical Methods

From Adam et al. (2003) onward, the literature mostly focused on the specific PTAs and used the cross-section data to determine the effects of PTAs on trade and welfare. After that, the literature focused on many PTAs, countries, and products and used the panel data to estimate the effects of PTAs. Later, the literature has exploited the effects of PTAs by designing PTA data in more detail based on the depth, width, and items covered in PTAs.

Two techniques used to investigate empirically the trade and welfare effects of PTAs are *ex-ante* and *ex-post* techniques. The *ex-ante* technique is used to evaluate entirely the impacts of a PTA on trade, production, and welfare before a PTA is established. And the common tool is the computable general equilibrium (CGE) and, recently, is to combine the general computable equilibrium trade policy with the structural gravity model (GCE). *Ex post* is used to investigate the partial effects of a PTA on actual trade flows after it is established. And the gravity model plays a role as the workhorse of this technique.

a) Ex Ante Technique

The *ex-ante* technique evaluates the effects of PTAs on trade, welfare, and economic growth before PTAs are formed. Suppose that the UK intended to leave the EU in March 2019. To measure how this event affects the UK and its partners' welfare, the model in general used is the CGE and, recently, the GCE.

To choose the trade policies: whether the Asia-Pacific Economic Cooperation (APEC) be formed under the non-reciprocal regime or reciprocal regime, and whether or not APEC was more liberalization of the food products in the cooperation, Scollay et al. (2001) used the CGE model to find the answers. They find that APEC gains greater benefits if they include the agricultural trade liberalization in the cooperation. Still, they do not find a big difference in APEC members' welfare between the case of non-reciprocal and reciprocal treaties. Instead of focusing on a specific RTA, as

Scollay et al. (2000), Robinson and Thierfelder (2002) use the multi-country CGE to compare the net welfare effects of RTAs. The results support both the formation of RTAs and global liberalization. Especially if the model adds the aspects of the new trade theories, the welfare effects of the RTAs are greater. Anderson and Yotov (2016) use an endowment general equilibrium model to investigate the effects of FTAs on TOT. They find that global efficiency increases by 0.9%, some individual countries gain over 5% of the real output and others lose less than 0.3%. Using the new model (the structural gravity model), Limão (2016) proves the effects of PTAs beyond the tariff concession effect. He also summarizes the incentives for forming modern PTAs across the world. These researchers above evaluate the expansion or the new formations of PTAs on the existing members or new members' welfare. However, in the case of Oberhofer and Pfaffermayr (2017) or Lee and Itakura (2017), they evaluate the welfare effect of PTA contraction. The former evaluates the trade and welfare effect of the UK and the EU if the UK leaves the EU under four scenarios by using the general equilibrium suggested by Yotov et al. (2016). Both bilateral trades between the UK and the EU reduce in all scenarios, but only the UK's welfare is suffered. The latter measures the US welfare in both cases; the US withdraws from the Trans-Pacific Partnership (TPP) or delays joining the system. Using GCE, they conclude that the US loses its welfare in both scenarios, whereas the former is greater. This approach is difficult to do because it depends on many parameters we must estimate and assume.

b) Ex Post Technique

The *ex-post* studies of PTAs use econometric estimations to find the causality between PTA formations and actual trade flows, controlling other important determinants of trade in the literature. And the gravity model is a workhorse for this purpose. The pioneering work of the gravity model was proposed by Tinbergen (1962). The basic gravity model includes the dependent variable and the positive trade flows between any country pairs (non-zero trade flows), the explanatory variables, the economic sizes of exporters and importers, and a rough transportation cost index proxied by their distance.

The main interesting variables can be estimated by adding them to the basic gravity model's right-hand side (RHS), such as the border between pairs of countries, their common language, and/or a dummy variable to present trade policies. After taking the logarithm of both sides, we get the elasticity of the trade flow with respect to explanatory variables in RHS. The common form of the model is as in Eq. 1 (using cross-section data).

$$\ln Trade_{ij} = \beta_0 + \alpha_1 \ln M_i + \alpha_2 \ln M_j + \alpha_3 \ln D_{ij} + \alpha_4 AJD_{ij} + \alpha_5 V_{ij} + \varepsilon_{ij} \quad (1)$$

Where $Trade_{ij}$ is the trade flow from i to j ; β_0 is the constant; M_i and M_j are the economic sizes of i and j , respectively; D_{ij} is the distance between them; AJD_{ij} is a dummy variable taking the value of one if i and j share the border, and zero otherwise; V_{ij} is a political or semi-economic factor taking unity if i and j belong to a PTA, and zero otherwise.

Also employing the gravity model to investigate the effect of PTAs on trade, Aitken (1973) adds two dummy variables for two PTAs, the EEC and the European Free Trade Association (EFTA). The dummy variables take the value of one if both trading partners are members of EEC or EFTA. Using cross-sectional data, the study shows that EEC and EFTA improve trade growth among member countries. However, the foundation of EFTA impacts negatively on the exports of the five EEC countries. Also adding two dummy variables in the gravity model, Frankel (1997) estimates for both TC and TD. The first dummy variable takes the value of one if both countries are members in a PTA representing the TC and zero otherwise. The second variable takes the value of one if either country is a member of a PTA. If the former is positive, then the intra-PTA trade increases. And if the latter is negative, the extra-PTA trade decreases. Also investigating TC and TD, instead of setting dummy variables as other researchers, Adam et al. (2003) use dynamic and antimonide PTA specific indexes to estimate the effects of 20 RTAs. The Member Liberalization Index (MLI) measures the difference in provisions across PTAs. The dynamic index equals the MLI when PTAs are formed and zero otherwise. The antimonide takes a non-zero MLI value for all years in the sample, notwithstanding whenever the pair's PTA is formed. With two specifications, with and without fixed effects (exporting country, importing country, and time), combined with the dynamic or antimonide index, they find that the estimated results of the dynamic PTA-specific index are mostly negative effects. At the same time, the antimonide one is positive effects. They also distinguish the deep and shallow cooperation of PTAs based on the trade and non-trade provisions in each PTA.

Baier et al. (2017) judge "only recently have economists been able to provide more precise and unbiased ex-post estimates of the effects of PTAs on members' international trade flows, in contrast to the highly variable and often economically implausible estimates generated over 45 years from 1962 to 2007". Baier and Bergstrand (2007) introduce the techniques to capture PTA effects more precisely by separating the effects of PTAs from other explanatory variables. To retrieve the consistent and unbiased estimated results, they recommend using the fixed effects or the first difference to deal with endogeneity in estimating PTA effects.

Using the panel data with the first difference in a sample with a large number of PTAs, country pairs, and products, Foster et al. (2011) examine the TC effect of PTAs in the period 1962-to 2000. By setting a PTA dummy variable that equals one if a pair has a PTA and zero otherwise, they find that forming PTAs raises trade values between member countries, and much of this comes from the extensive margin. Baier et al. (2014) examine how trade costs vary to impact the formations of PTAs by using the same data as Forster et al. (2011). They provide the first evidence of the trade share and trade margin effects of different types of PTAs. They find that agreements with the deeper levels of integration have greater impacts on aggregate trade flows, and the intensive margin mainly drives trade growth. They also provide the first evidence of the heterogeneous "timing" effect of PTAs between intensive and extensive margins, where intensive margin responds to the effects of PTAs sooner than extensive margin. Kohl et al. (2016) classify trade agreements by 17 trade-related policy domains and legally enforceable commitments to examine the possible heterogeneous trade effect. Dür et al. (2014) establish a new data set of trade agreements that show the difference across these agreements in terms of their contents and design. They find that deep agreements drive the positive effect of PTAs on trade flows. Baier et al. (2019) use a two-stage estimation strategy to investigate the heterogeneous trade effect within FTAs. They find an asymmetric trade effect among different country pairs within the same FTAs.

In addition to the TC effect, the literature also analyzes the TD and TOT effects of PTAs. TC and TD are found in Carrère (2006). Carrère (2006) recommends, as in Footnote 9, that the analysis of TC and TD would be failed if authors exclude enough dummy variables to distinguish between importing and exporting diversions. To capture the TC, Carrère (2006) defines a dummy variable that takes unity if both the exporter and importer belong to an RTA and zero otherwise. To distinguish between exporting and importing TD, Carrère (2006) defines that the TD-M dummy variable takes unity if the importer belongs to the other RTAs and the exporter to the ROW, and TD-X takes unity if the exporter belongs to the other RTAs and the importer to the ROW. Also, evaluating the TD effect of FTAs, which have been in force from 1990-to 2002, Dai et al. (2014) add the internal trade instead of only external trade. FTAs divert trade away from non-member countries and even more for internal trade (domestic sales) in member countries. They also include two binary variables in the models to estimate the TD effect.

The dummy variable takes the value of one exporter (importer) signed any FTA with other countries other than the importer (exporter) and zero otherwise. Yang and Zarzoso (2016) analyze TD generated by the ASEAN-China

FTA. TD is used to address whether the importers or exporters were ASEAN-China FTA. They tested the data from 31 countries from 1995-to 2010; TD was only found in some import manufacturing sectors. After the euro was introduced, Esposito (2017) found TC and TD in intra-EMU trade (where EMU is European Monetary Union). The author uses trade data for the whole EU and other countries (38 countries) from 1999-to 2013 and used the gravity model to estimate TC and TD. Surprisingly, the only financial opening was the factor creating TC intra-EMU trade, while the other factors such as GDP growth and the change in technology production created TD. Mattoo et al. (2017) show that the deep integrations lead to greater TC and weaker TD than the shallow integrations. Investigating the different effects on trade across types of PTAs also found by Cheong et al. (2018) to analyze the effect of tariff and non-tariff changes on extensive and intensive margins for 90 importers and 149 exporters from 1996-to 2010. The effect on trade of the deeper PTAs was mostly through the non-tariff changes.

c) Matching Method

To estimate the long-run effects of PTAs and deal with the fragility of estimated results, Baier and Bergstrand (2009) use the matching method and run the cross-section data for 96 countries in 9 years with five-year intervals from 1960 to 2000. The ex-post effects of PTAs were more stable across years than OLS estimates.

Hur and Park (2012) use the data from 1971 to 2003 from 88 countries and a non-parameter matching model to evaluate how PTAs affect the aggregate growth (measured by the real GDP) and per capita GDP (measured by the sum of weighted GDP per capita of bilateral partners, weight equal the share of the population of each partner with a total population of two countries). As a result, they found the uneven per capita GDP effect across countries within a PTA.

$$Trade_{ij} = \beta_0(GDP_i)^{\beta_1}(GDP_j)^{\beta_2}(POP_i)^{\beta_3}(POP_j)^{\beta_4}(DIST_{ij})^{\beta_5} e^{\beta_6(LANG_{ij})} e^{\beta_7(AJD_{ij})} e^{\beta_8(FTA_{ij})} \varepsilon_{ij} \quad (2)$$

Where i and j are country i and country j; GDP is the gross domestic products; POP is the population; DIST is the distance; LANG is language; AJD is share of the border; FTA is free trade agreements, and ε is the error term.

They argued over the reasonable hypothesis that distance, common language, adjacent of a pair, and their population were exogenous in Eq. 2. One potential endogeneity in Eq. 2 is that GDP is correlated with bilateral trade flows. GDP is a function of exports and imports. Frankel (1997) used the instrument variables (IVs) to solve this problem. The IVs used were labor forces and human and physical capital. The estimated results changed

C. Endogenous Problem in Analyzing the Effects of PTAs

The estimated results of trade effects of FTAs are fragile in the literature. Baier and Bergstrand (2007, 2009) suggest some reasons that arise from the FTA dummy variable. Firstly, the FTA dummy represents more factors than observed by researchers, and they are omitted in the gravity model. Secondly, the effects of PTAs depend on the interaction between the levels of gravity variables and PTA dummy variables. For example, the probability of an FTA formation depends not only on eliminating tariffs but also on other domestic regulations of becoming members. Suppose bilateral trade flows are enhanced by liberalizing domestic regulations (conditions of working environments, competition policies, product standards, environmental protections, provisions of financial institutions, etc.). In that case, the PTA and error terms are negatively correlated. If we estimate the trade effect of PTAs and omit a variable presenting for domestic regulations, the estimated results are underestimated. Another example is that researchers predict that import flows are negatively correlated with trade barriers. However, the import penetration is potentially positively correlated with trade barriers under political pressure. If we ignore this simultaneity, the estimated coefficient of the trade barrier is underestimated. There are some approaches we can use to deal with the endogenous problems as follows:

a) Instrumental Variables/2SLS Approach with Cross-section Data

The endogeneity occurring in the gravity model is mentioned in Krugman (1991. b). Krugman (1991. b) analyzed TC and TD relaxation to the formations of FTAs and argued that overall the formation of a free trade zone might suffer the world economy if TD overweight TC. However, a free trade zone often selected countries sharing borders as the main trade partners, so TD was limited. Baier and Bergstrand (2002) point out the possibility of endogeneity in PTA estimate if the gravity model was used as Eq. 2.

insignificantly and differed slightly between with and without including IVs in their model.

Baier and Bergstrand (2002) use two-stage least squares (2SLS) estimation to deal with the selection bias. In the first stage, they estimated the probability of forming a PTA that was affected by the economic variables. And IVs they use included three variables: the pair's weighted remoteness, the same capital-labor ratio, and the difference in their capital-labor ratio with the ROW. Their outcome showed that the trade effect of FTAs was different between traditional ordinary least squares (OLS) and 2SLS. With the same idea,

Magee (2003) argues that a PTA dummy was endogenous because of the simultaneity between trade flows and a PTA, and he uses the 2SLS to prove it. The log of GDPs, landlocked, waterways, and airports in the trade equation are the IVs. And in the probit PTA equation, he used democratic, log difference in GDP, intra-industry trade, trade surplus, and the same ratio of capital to the labor of a pair as IVs. The estimated results changed in four specifications in the second stage if he applied cross-section data in 1998 and panel data from 1980-to 1998.

However, Baier and Bergstrand (2007) argue that the IVs used in Baier and Bergstrand (2002) and Magee's (2003) potential correlate with the error term, so it was not a reliable method to deal with unobservable variables, and the FTA coefficients varied from positive to negative values.

b) Fixed Effect and First Difference with Panel Data

Although Anderson and van Vicoop (2003) do not estimate the trade effect of PTAs, they pointed out that the estimated trade effect using gravity suffered from omitted variables. They introduced the multilateral resistance (MR) variables that depended on all bilateral resistances. These variables usually were omitted in the gravity model, which leads to inconsistent estimates. The MR of a country rises if trade barriers with one and/or all trading partners rise. They divided the trade resistance into three components: trade barriers between i and j, trade barriers between i and all other partners, and trade barriers between j and all other partners. The MR term of country j is measured as in Eq. 3.

$$P_j^{1-\sigma} = \sum_i P_i^{1-\sigma} \theta_i t_{ij}^{1-\sigma} \quad (3)$$

Where $P_j^{1-\sigma}$ is MR of country j, θ_i is the share of income of country i, and $t_{ij}^{1-\sigma}$ is the trade barrier between country i and country j. They simultaneously solved 41 equations to find the MR term in their works. However, they also suggested using country-year fixed effects for accounting for the MR in the gravity equation.

Baier and Bergstrand (2007) used the country-year fixed effects and ran five cross-section equations to find the effects of PTAs on trade. However, the estimated results still varied across the years. They suggest country-year fixed effect specification only accounted for the endogeneity bias created from prices between countries i and j and did not account for endogeneity from selection bias (two countries do not form a PTA randomly). They suggested two other methods combined with panel data to deal with the endogeneity in evaluating the effects of PTAs: fixed effects and the first differencing. They use some of the fixed effect specifications

such as bilateral-country fixed effects combined with time fixed effects where country-pair fixed effects accounted for the time-invariant variables, country-pair fixed effects combining country-specific fixed effects where the latter accounted for importer-exporter characteristics, or bilateral-country fixed effects combining country-year fixed effects where latter accounted for MR variables. And they use the first difference for the robustness check. They suggest the final fixed effect specification accounted for those endogenous problems arising from theoretical developments and the estimated results are consistent and unbiased.

Many studies afterward use fixed effects and the first difference techniques to deal with the endogeneity in TC or TD estimation created by a PTA. Magee (2008) uses fixed effects to estimate the TC and TD of RTAs in the short-run and long-run effects. In the gravity model, he added exporter-year, importer-year, and country-pair fixed effects to account for country time-variant and pair-time-invariant factors. The estimated results provide a piece of evidence for TC among members, and those effects of their PTAs last up to 11 years. However, he also pointed out the drawback of the fixed effect approach: the effects are generally reduced if the agreement can raise the members' income sufficiently to increase imports from all partners. Dai et al. (2014) also use the fixed effects suggested by Baier and Bergstrand's (2007) estimation of the TD effect of PTAs. Foster et al. (2011) and Baier et al. (2014) use the first difference to deal with the endogeneity in estimating the effect of PTAs on trade.

IV. ANALYSIS TRENDS

A. Extensive and Intensive Margins

Finding the sources of trade growth is also one of the main topics in international trade. Researchers developed different models to explain how trade grows, as summarized in Bernard et al. (2007). Firstly, Ricardo and Heckscher and Ohlin's models (the old trade theories, see more in the Krugman et al., 2015) explain the trade growth through "inter-industry" trade. A country exports a good and imports another good. Each country specializes in comparative-advantage goods, determined by the relative productivity or the relative factor intensive-relative factor abundance. For example, China has relative labor abundance, whereas the US has a relative capital abundance. China produces and exports labor-intensive products, while the US produces and exports products that are capital intensive. Both countries' welfare gains arise from their specialization in producing comparative-advantage products. Products traded are different from their original countries (the Armington model).

However, countries not only exchange inter-industry but intra-industry (within industries, trading two goods quite similar between two partners), which old trade theories cannot explain. New trade theories are developed by

Krugman (1980) to explain the within-industry trade. This model is based on the economies of scale and the loving varieties of consumers where the identical firms produce the different horizontal products. An integrated model of Helpman and Krugman (1985) combines old and new trade theories in a model. In their model, inter-industry trade is exchanged firstly, and intra-industry comes after that.

The three above models assume that firms are identical within an industry and that any firm can export its products. Because only a fraction of firms can export, firms are heterogeneous in productivity even before self-selection into foreign markets (Melitz, 2003, Bernard et al., 2007). The exporters are more productive than non-exporters. If a foreign market is more liberalizing (trade costs reduce), on the one hand, it creates opportunities for lower productive firms to access its market; on the other hand, the highly productive firms will reduce the price in the domestic market. That creates results in increasing the domestic demand and the factor demand. The production costs of domestic firms finally increase. Firms that are non-sufficiently efficient exit the market, the resources are reallocated to higher productive firms, and the average aggregate outcome overall increases. Melitz model allows firms endogenously choose the subset of varieties from the total range of varieties produced to serve a given export market. Trade exchanges only occur in intra-industry, not inter-industry, and net change in employment cross-industry does not occur in the Melitz model.

Bernard et al. (2007) introduced the integrated heterogeneous firm model. Based on the statistics of the fraction of firms that participate in serving in foreign markets and the US firm data, Bernard et al. 2007 find the difference in allocation of resources across industries such as only two percent of firms that export in the miscellaneous manufacturing industry while five percent of firms that exported in printing and related support in the US 2002. They argue that inter-industry trade still exists, and the US exported all products from all industries. Besides the difference in scale and productivity between exporters and non-exporters, Bernard et al. (2007) find the remarkable differences in factor intensive between exporters and non-exporters. That suggests old trade theories work within industries.

The sources of trade growth arise from inter-industry and intra-industry, and international trade potentially reallocates the resources in the market to increase aggregate productivity. Trade growth increasing through the average value of a product is called the intensive margin, and through new products and/or new markets is called the extensive margin.

The numerous researchers analyze how to trade growth occurs through the intensive or extensive margins, such as Hummels and Klenow (2005), Bernard et al. (2007), Helpman et al. (2008), Besedeš and Prusa (2011), Dutt et al. (2011), Foster et al. (2011), Bingzhan (2011), Kehoe and Ruhl (2013), Türkcan (2014), Baier et al. (2014), and Cheong et al. (2016), etc. However, trade growth dominated by extensive or intensive margin varies across the studies. For instance, Hummels and Klenow (2005) find that trade growth is driven by the extensive margin (that margin explains 60% of greater exports of larger countries), and the extensive margin also drove trade growth in Foster et al. (2011). While the intensive margin predominating trade growth is found in Helpman et al. (2008), Besedeš and Prusa (2011), Bingzhan (2011), and Baier et al. (2014).

One reason that explains the diversification of results, as suggested in Besedeš and Prusa (2011), is the different definitions of the extensive and intensive margins those authors used. Two methods used to measure trade margins are the count and share methods.

a) Count Method

The extensive and intensive margins measured depend on each analyst's definition. Some definitions of trade margins in the literature are provided in Table 3.

The pros and cons of the count method are easy to be measured but give them equal weight to every partner and product regardless of the value that product exports to. Suppose Vietnam exports to two partners, one of which is with large quantities and the other with the small one, and then the count method gives an equal extensive margin for both.

Table 3. Definitions of the Extensive and Intensive Margins by Count Method

Extensive margin	Intensive margin	Author(s)
The number of products exported and exporters (firms)	The average value per product per firm	Bernard et al. (2007)
The number of sectors or goods traded	The average value per good or sector	Helpman et al. (2008)
The number of firms, products, and density of trade	The average value per observation	Bernard et al. (2010)

Trading firms exit and enter, the switching of country-product relationships of existing firms (applied for time series)	The change of trade value of existing firms in the existing country-product relationships (applied for time series)	Bernard et al. (2010)
Number of exporting firms	The average export value per firm	Lawless (2010)
Establishing new partners and new markets (three dimensions used: an old/new product exported to a new destination, new products exported to "old" destination)	The survival of relationships and the depth of existing relationships	Besedeš and Prusa (2011)
The number of products or the number of markets to which a country exports	The average value per product or per market	Dutt et al. (2011)

b) Share Method

The sharing method is proposed by Hummels and Klenow (2005). Using data from 126 exporting countries and 59 importing countries in 5,000 product categories in 1995, they decompose the trade volume into the extensive margin and intensive margin; and intensive margin then is decomposed into quantity and price indexes. To calculate the intensive and extensive margins, Eqs. 4-11 are used.

$$EM_{jm} = \frac{\sum_{i \in I_{jm}} P_{kmi} x_{kmi}}{\sum_{i \in I} P_{kmi} x_{kmi}} \quad (4)$$

$$IM_{jm} = \frac{\sum_{i \in I_{jm}} p_{jmi} x_{jmi}}{\sum_{i \in I_{jm}} P_{kmi} x_{kmi}} \quad (5)$$

$$X_{jm} = \frac{\sum_{i \in I_{jm}} p_{jmi} x_{jmi}}{\sum_{i \in I} P_{kmi} x_{kmi}} = IM_{jm} EM_{jm} \quad (6)$$

$$P_{jm} = \prod_{i \in I_{ij}} \left(\frac{p_{jmi}}{P_{kmi}} \right)^{w_{jmi}} \quad (7) \quad s_{jmi} = \frac{P_{jmi} x_{jmi}}{\sum_{i \in I_{jm}} P_{jmi} x_{jmi}} \quad (8)$$

$$s_{kmi} = \frac{P_{kmi} x_{kmi}}{\sum_{i \in I_{jm}} P_{kmi} x_{kmi}} \quad (9) \quad w_{jmi} = \frac{\frac{s_{jmi} - s_{kmi}}{\ln s_{jmi} - \ln s_{kmi}}}{\sum_{i \in I_{jm}} \frac{s_{jmi} - s_{kmi}}{\ln s_{jmi} - \ln s_{kmi}}} \quad (10)$$

$$IM_{jm} = P_{jm} Q_{jm} \quad (11)$$

Where P_{jm} is the price index; p_{jmi} is the price of product i country j exports to country m ; P_{kmi} is the price of product i that referent country k exports to country m , and w_{jmi} is the logarithmic mean of s_{jmi} and s_{kmi} (the share of category i in country j and k 's export to m).

This method accounts for the importance of products with respect to their market shares in the importing market. However, the drawback of the method is contrary to the count model that might be assigned overweight for those products exported by an exporter, but the value imported from the reference country is very high (the extensive margin is over-weighted); or in case that an importer only imports a product from an exporter, do not import from the reference country, the intensive margin now is weighted one. For instance, Taiwan exports three products to the US; the referent country (suppose the ROW) also exports those products. Still, a very high fraction relative to other products, the extensive margin of Taiwan exports is overweighted.

In addition to the two methods above, Besedes (2008) introduces a new method to measure the extensive and intensive margins. The extensive margin is measured by exporting new products to new destinations, new products to old destinations, and old products to new destinations. While the depth of the existing relationships and survival or persistence is represented for intensive margin. They found that the deepening was long-term relationships if those relationships lasted from the beginning to the end (1975-2003).

B. Timing Effect

Forming a PTA, especially in multilateral PTAs, normally takes longer. So WTO allows members to notify their PTAs for around ten years. Countries joining PTAs also expect to take members' advantages for a long time. Researchers add the timing effect to know how long a PTA generally affects their work. They add the time lag in the model as lag 3, lag4, lag 5, or lag 10. Magee (2008) finds that the PTA effect is around 8 years. Baier et al. (2014) add the timing effect and found out the PTA effect is around ten years. And they also show the intensive margin effect sooner than the extensive margin after a PTA is formed. Chen and Nguyen (2019) analyze the effect of terminated PTAs. Some PTAs are terminated after some years. For example, in the debate of the first contest of the campaign in 2016, Donald Trump – the President of the United States of America,

criticized the development strategies that the US has followed during the past 30 years and longed to revise them. After Donald Trump became the president, the world witnessed an extreme change in the USA's strategies which withdrew from the Trans-Pacific Partnerships (TPP). In the meantime, during the US presidential election (2016), the UK also conducted the staying or leaving the EU referendum, and it was determined to leave. They also add the timing effect and find that after PTAs are ended, their effects do not last long, around 2 years later.

V. CONCLUSION

The analysis related to the effects of PTAs, the determinants influencing the PTA formation, and the analysis trend continues to develop and get better and better. To find out the trade and economic effects of PTAs, literature introduces two main approaches, theory and empirical works. Building up the models to explain the reasons and the effects of PTAs takes great research effort. Many new definitions are introduced, such as TC, TD, cost-reduction, trade suppression, or TOT. Many techniques are introduced. Ex-ante, ex-post, matching methods, and gravity model are the workhorse in this area. Many techniques are applied to deal with endogenous problems to obtain more precise results. IVs or fixed-effects or the first difference are remarkable.

The development of PTAs still grows concerning quantities and the level of integration. Therefore, researches related to this area are still an attractive topic. Many researchers still work in this area. However, knowledge of the literature and perceiving the experiences of the pioneers is useful for new research and getting better and more precise results.

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Table 1. The Frequency and Percent of Types of PTAs

Time	Frequency						Percent					
	OWPTAs	TWPTAs	FTAs	CUs	CMs	EUs	OWPTAs	TWPTAs	FTAs	CUs	CMs	EUs
<1980	20,004	5,748	2,970	1,716	0	0	65.72	18.88	9.76	5.64	0	0
1980-1990	29,086	8,730	2,374	2,402	0	0	68.29	20.5	5.57	5.64	0	0
1990-2000	31,672	10,094	5,554	2,718	1,606	132	61.17	19.5	10.73	5.25	3.1	0.25
>2000	52,070	18,986	22,010	4,234	5,824	3,442	48.86	17.82	20.65	3.97	5.47	3.23

Source: Baier and Bergstrand data

Note: OWPTAs, TWPTAs, FTAs, CUs, CMs, and EUs are one-way preferential trade agreements, two-way preferential trade agreements, free trade agreements, customs unions, common markets, an economic union, respectively.

Table 2. The number of PTA Relationships per Exporter and Importer

Number of PTA relationships	Obs	Mean	Std. Dev. Exporter	Std.Dev. Importer	Min Exporter	Min Importer	Max Exporter	Max. Importer
t=1980	174	20.32	9.00	43.31	0	0	36	153
t=1990	176	25.55	11.13	46.14	0	0	44	156
t=2000	194	31.67	11.90	50.77	0	0	63	180
t=2012	194	52.84	17.76	59.77	9	0	87	183

Source: The author calculates from Baier and Bergstrand data.

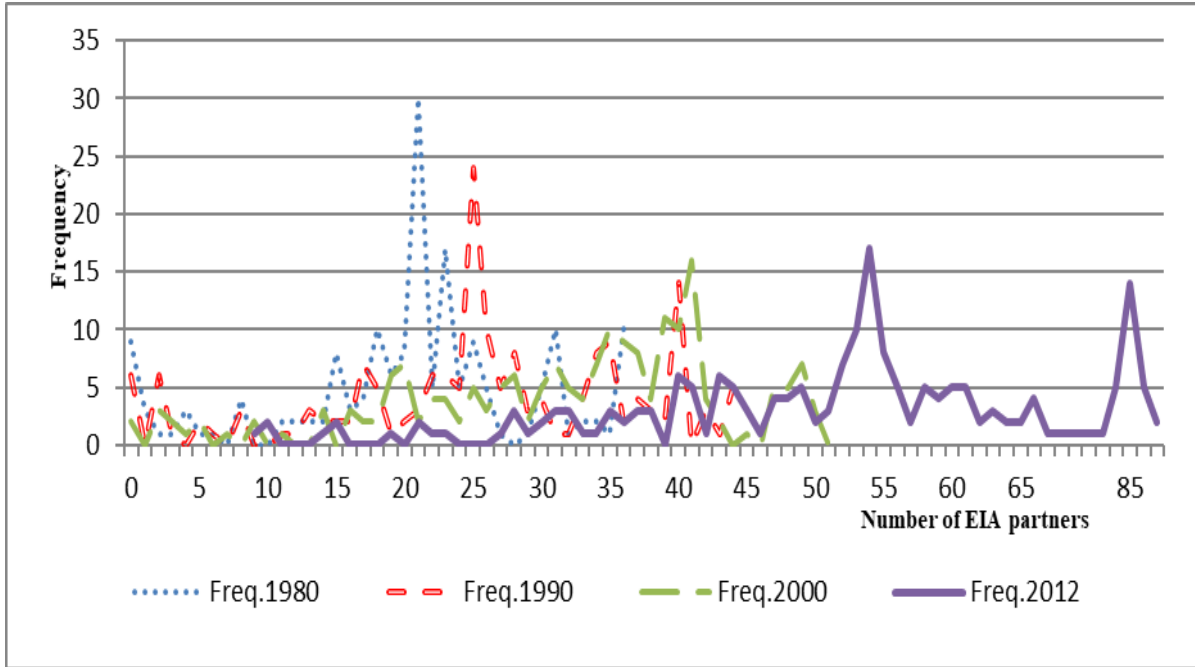


Fig. 2 The number of an exporter's PTA partners

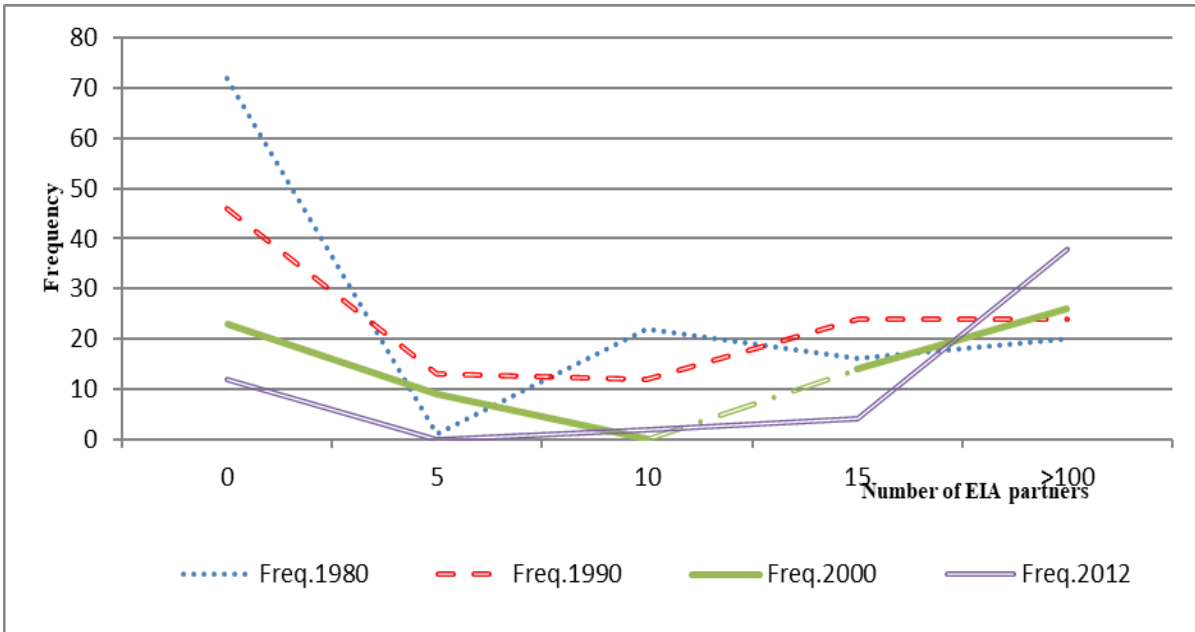


Fig. 3 Number of an importer's PTA partners