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Do the WTO and RTAs Promote Food Trade?

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Abstract

In addition to multilateral trade agreements under the World Trade Organization (WTO), the world has seen a remarkable proliferation of regional trade agreements (RTAs) in the last two decades. This study investigates the impacts of these multilateral and regional trade institutions on food trade. The Gravity model of international trade is used for the empirical analysis. The model is developed in a large panel data setting and attempted to address some potential problems in the estimation including multilateral trade resistances and zero trade values. The results suggest that both the WTO and RTAs have delivered significant positive effects on bilateral trade among the participant countries, but not food. Only RTAs are found to have increased bilateral food trade among the members. However, although no evidence can be found that the WTO enhances food trade among the members, it promotes food trade of the developing countries more than the developed ones.

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1. Introduction

After for more than a decade of deadlock in the negotiations of Doha Development Agenda, the World Trade Organization (WTO) has gained a noteworthy momentum by the success of the Ninth Ministerial Meeting at the end of 2013. The first ever multilateral trade agreements since the formation of the WTO and approved by all member countries have been reached in Bali Indonesia. However, member countries are still struggling to find permanent solution on public stockholding for food security issues, confirming that food remains a very sensitive sector in the agreement.[1]

On the other hand, the world has seen a remarkable proliferation of regional trade agreements (RTAs) in the last two decades, growing from only less than 40 in 1990 to nearly 400 that were in force in 2013. The data suggest that almost all WTO members are participating in one or more regional trade agreements. These figures result in very complicated overlapping trade relations among countries (figure 1). The term "Spaghetti Bowl" has been widely used by trade researcher and practitioner to describe global trade relations.

[Figure 1 here]

One issue often raised is whether these agreements can play a positive role in strengthening food security at the worldwide level. "*Food security exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*"[2]. An important key factor relates to this definition of food security is physical availability of food at all times in all places. Economic means to access food will be meaningless when food is not available. Certain geographies in the global world are endowed by natural resources needed to produce surplus food, while some others deficit because they have more demand than food that they can produce. Global imbalances occur since high population is

[1] At the 9th WTO ministerial meeting in Bali, December 2013, member countries agreed on an interim solution of public stockholding for food security purposes until permanent solution is found by 2017. In the post-Bali work, India blocked Trade Facilitation Agreement (TFA) requesting to delete the time limit of 2017. In November 2014, member countries agreed that if the permanent solution cannot be found by 2017, the interim solution remains.
[2] 1996 World Food Summit

not associated with high food production (figure 2). Food security at the global level is only possible when food can move freely from areas of surplus to areas of deficit.

[Figure 2 here]

In the light of the recent excessive food price volatility since 2007-08, in which international trade distortions have been found to be among the main key drivers of the food price crises (Martin and Anderson, 2012; von Braun and Tadesse, 2012; World Bank, 2010), it is highly important to analyze whether trade agreements may contribute to reduce trade distortions and can bring the world to a freer flow of food by increasing food trade among countries.

Trade agreements are usually based on the commitments to reduce market barriers for all trade sectors among participant countries. Food is an integral part of these agreements as usually no important sector to be omitted. However, as these agreements are subject to negotiation, they are substantially varied in scope and depth. The agreements to reduce the so called bound tariff rates may or may not affect market access, depending on the gap between the bound rates and the tariffs that a country actually applies to imports. In addition, non-tariff measures are often used to protect countries' interests in some sectors including food. Therefore, the impact of trade agreements on food trade is an empirical question. Despite that this appears to be a very relevant issue, to date there is rather poor empirical evidence on the impact of trade agreements on food trade. Most studies on trade agreements both multilateral and at the regional level are usually based on aggregate trade, without exclusively looking at the food sector.

Many studies on trade agreements have come naturally to the use of gravity model, one of the most successful trade analysis device offered in the literature (Anderson, 1979). Rose (2004), Subramanian and Wei (2007), Grant and Boys (2011), Baier and Bergstrand (2007) and Sun and Reed (2010) are among the few careful empirical studies that analysed the impact of multilateral and regional trade agreements on trade of the participant countries. While the first three studies mentioned above focused on the WTO, the interests of the latter two are on regional trade agreements.

This paper contributes to the literature in two-folds. First, although Sun and Reed (2010) and Grant and Boys (2011) have addressed the agricultural trade sector in their study, none of them

nor the studies mentioned above have exclusively analysed the impact of trade agreement on food trade, which will be the main focus of this paper. Second, unlike most papers which usually focusing on one of the multilateral or regional institutions, this paper brings WTO and RTAs together in one analysis to compare their impacts on food trade. Using gravity model of international trade, the discussions framework built in this paper is simply to answer whether the establishments of the WTO and RTAs have facilitated food trade among the participant countries.

The remainder of this paper is organized as follows. The next section provides the background information of trade agreements, market access and food trade. The third section discusses the theoretical framework followed by section on model specification, data description and results discussion. The last section concludes.

2. Trade Agreements, Market Access and Food Trade

Before discussing the theoretical framework of the gravity model used in the analysis and presenting the results, this section provides background information for the study. It provides some information on the development of trade agreements both multilateral and at the regional level, followed by the market access of food and global food trade.

2.1. Trade Agreements

Trade Agreements in the global world trade system can be distinguished by multilateral and regional trade agreements. The WTO is the one and only recognized body in the multilateral trading system that intends to supervise international trade. The organization officially exists since 1995, replacing its predecessor the General Agreement on Tariffs and Trade (GATT) which embarked in 1948. The WTO has been struggling for more than a decade to complete the Doha Development Agenda which was launched in 2001[3]. The negotiations have been deadlocked because of many differences between developed and developing countries mainly in

[3] Doha Development Agenda is the current WTO trade negotiation round launched at the fourth ministerial meeting in Doha, Qatar November 2001

view of some major issues including agricultural trade restriction and facilitation. Only at the end of 2013 significant progress was made by the negotiation. Trade facilitation agreement known as "Bali Package" was adopted in the 9th ministerial meeting hosted by Indonesia and thus the first multilateral agreements approved by all member countries have been finally reached in the history of the WTO.

While the principle of non-discrimination in trade is central to multilateral trade system under the GATT/WTO system, member countries are permitted to enter RTAs to promote free trade among members as long as these agreements do not raise barriers to non-members[4]. However, RTAs have had controversial role, some argue that the enormous number of RTAs have been hampering multilateral trade negotiation (Levy, 1997) while some others believe that RTAs have positive effects toward freer multilateral trade (Freund, 2000; Ornelas, 2005).

RTAs come in variety of types and forms based on the scope and depth. The most common type of the agreement is Free Trade Agreement which is a commitment among participant countries to remove tariffs across members while continuing to maintain their own tariff regimes to other countries that are not members of the agreement. Another type of the agreement is customs union which goes one step further by uniting tariff regimes. Beyond customs union is a common market which allows not only free flow of goods but also other factors of production i.e. labor and capital. A common market with monetary union is generally referred as an economic union. Even though there are some distinctions between these agreements, the borderlines between those definitions are somehow blurred in practice and depend on the settings agreed by all participant countries.

As of January 2014, there have been 583 regional trade agreements notified to the WTO, 377 of them were in force[5]. Figure 3 shows that the numbers of regional trade agreements have been growing sharply since early 1990s, and even more accelerated since early 2000s. The agreement formation among countries has gone beyond only with neighboring countries and their only natural trading partners, they are often cross continents. European Union – Papua New Guinea, US – Australia, Japan – Switzerland are among a few mentioned trade agreements that have been formed among countries or entities from different continents.

[4] GATT, Article XXIV
[5] http://www.wto.org/english/tratop_e/region_e/region_e.htm, accessed on March 17th 2014

[Figure 3 here]

2.2. Market Access

Most of trade agreements are based on the commitments of member countries to reduce market barriers. For example, the 1995 Agreement on Agriculture (AoA) of the WTO required 36 percent average tariff reduction by developed countries with a minimum per tariff line reduction of 15 percent over six years. Developing countries are required to reduce their tariffs by 24 percent on average with a minimum per tariff line reduction of 10 percent over ten years. Least Developed Countries were exempted from tariff reductions, but either have to convert their non-tariff measures to tariffs or bind their tariffs and creates a ceiling which cannot be increased in the future.[6]

Tariff reduction schedules of RTAs are varied depend on their settings. However, most of these agreements have contributed to tariff reductions across products and countries. Fulponi et al., (2011) discover that in addition to WTO-AoA, regional trade agreements have a significant impact on tariffs elimination in agricultural products. Their investigation found that on average over products and concessions, 90 percent of tariff lines are duty-free at the end of RTAs implementation period.

[Table 1 here]

All countries have been found to reduce their tariffs on average for all sectors including food (table 1). However, food is always among the highly restrictive sectors in international trade. In 2012, the simple average applied tariff rate of food for all countries is 11.55 percent, which has been reduced from 14.55 percent in 1992. This tariff reduction is relatively lower compare to other sectors. Textiles for example, the tariffs on average have been reduced from 17.21 percent in 1992 to 10.06 percent in 2012.

[Figure 4 here]

[6] http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm3_e.htm, accessed March 17th, 2014.

Surprisingly, Low Income Countries (LIC) have contributed the most to the food tariff reduction. This country group has significantly reduced their tariffs on food from 24 percent in 1992 to 10 percent in 2012 on average. The fact is interesting since Least Developed Countries are exempted from tariff reduction in the WTO-AoA.

Average applied tariff rates of food are found to have decreased over years for all country groups, except for High Income Countries (HIC) which remain 8 percent in 1992 and 2012. Their applied food tariff rates have been already low compared to other country groups. Upper middle income countries (UMIC) have reduced their applied food tariff rates from 20 percent in 1992 to 15 percent in 2012 on average, while Lower Middle Income Countries (LMIC) are found to have reduced their applied food tariff rates from 24 percent in 1992 to 16 percent in 2012 on average.

There are also a number of policy measures other than tariffs that may affect trade flow between countries. These policy measures are usually categorized as non-tariff measures (NTMs) and can be described as the following:

[Table 2 here]

Although quantitative studies continue to evaluate trade based on tariffs as trade barriers, much attention has now shifted to NTMs. However, data on NTMs are less transparent compared to tariffs which make the evaluation on NTMs difficult. Most important is to analyze what have been the impacts of NTMs on the trade flow. Thus, the analysis can be directly addressed at the trade flows among countries.

4.2.3. Food Trade

Trade plays an important role in the food equation of most countries. It can be an alternative when supply of food from own production does not meet demand, because the inelastic nature of food production can only respond slowly to increasing demand (Haile et al., 2013). Food trade is also the source of income for many countries, especially for the main food producer countries.

[Figure 5 here]

The share of food in the total world trade is relatively small and remains stable over years at about 8 percent in 2001 and in 2012 (figure 5). The highest share of food in the total trade is found for LICs which accounted for 21 percent in 2001 and have decreased to 17 percent in 2012. The share decrease is not because LICs trade less food, but their trade in other sectors has increased more than the food sector. This is an indication that LICs are more connected to the world trade system. Change in share of food in the total trade is also the case for HIC where their food shares in 2012 is higher compare to 2001. Other country groups' shares remain stable across years at 8 percent and 13 percent for UMICs and LMICs respectively.

The total value of the world food trade in 2012 is USD 2.6 billion[7]. HIC have the highest share accounted for 66 percent of the total world food trade, followed by UMICs, LMICs and LICs (figure 6). The data show that share of country groups in world food trade are consistent with their income levels. The higher the income, their share in the world food trade is also higher. Although the share of food in the total trade of LICs is relatively higher compare to other country groups, their total value accounted only for 1 percent of the world food trade.

[Figure 6 here]

3. Theoretical Framework

The gravity framework that is employed in this study suggests that the patterns of trade are explained by the forces behind trade flows between two trading partners. The theoretical underpinning of the model was inspired by the Newtonian theory of gravitation, where countries are mutually attracted to trade just like planets are mutually attracted in proportion to their sizes and proximity. After being conceptualized for the first time by Jan Tinbergen[8] in 1962, gravity model is considered as the workhorse of international trade with fortunate empirical validity.

Initially there was no theoretical foundation behind the econometric model used as the ex-post analysis of trade pattern between the two countries. One of the very first theoretical explanations for the gravity model was the work of Anderson (1979) which based on a demand function using

[7] UN COMTRADE via WITS, Standard International Trade Classification (SITC) is use to categorize food
[8] Jan Tinbergen was an economist with physics degree. He was the first Nobel Prize winner in economic science which he received in 1969 together with Ragnar Frisch

Armington elasticity[9] where each country produces and sells goods on the international market that are differentiated from other goods produced in other countries. Later works have built gravity model in the monopolistic competition frameworks (Helpman and Krugman, 1985), Heckscher-Ohlin framework (Deardorff, 1998) and the Ricardian framework (Eaton and Kortum, 2002). The gravity models work well in these different approaches, each with different assumptions.

Gravity model in the Ricardian framework builds on the assumption that trade is beneficial due to comparative advantage. A country that is less productive in absolute terms can nevertheless have a comparative advantage in the production of a good by differing costs in production or production technologies. In the Heckscher-Ohlin, international trade occurs as a result of relative differences in factor endowments between countries. Countries tend to export goods which are produced by their abundant factor endowments and import goods which are intensively manufactured. Consequently, the exported goods are relatively cheap to produce, whereas the imported goods are relatively expensive in production due to factor scarceness. The Helpman and Krugman approach assumes increasing returns to scale and a state of monopolistic competition between firms. The approach is usually used to explain intra-industry trade which is the trade of products belonging to the same categories. Economies of scale incentivize the countries to produce selected products and trade with other countries producing some other products.

International trade is basically not so much different from domestic trade as the motivation and behavior of traders involved do not change fundamentally regardless of whether trade is across national border or within a nation. The main difference is that international trade is typically more costly as crossing national borders usually impose additional costs such as tariffs or other costs associated with country differences such as language and culture. These additional costs are usually well captured in the gravity equation. The gravity model essentially explains how countries attracted to goods produced in other countries and this attraction is reduced by costs related with geographical distance and other costs associated with countries' differences.

[9] Armington elasticity refers to the work by Paul Armington (1969) that products traded internationally are differentiated by country of origin

Bilateral trade flows are also heavily influenced by trade agreements. In a non-discriminatory trade, countries are able to export their products if they are the most efficient producers and to import from the lowest-cost suppliers. Trade agreements change this pattern by lowering barriers to trade among member countries. Member countries of an agreement which could be not the most efficient producers might be able to export their products to other member countries simply because they enjoy tariff preferences in the agreements.

Economic motivation is in particular important consideration in the choice of partner countries in establishing or joining an agreement. Welfare gains from trade are expected from expanding the market. Nevertheless economic motivation is not always behind the deal of countries to form an agreement. Empirical studies suggest that the welfare effects of trade agreements can be positive or negative, thus the expected benefit could be non-economic factors. Wonnacott and Lutz (1989) argue that political factors are also important for countries in determining with which countries they are likely to form trade agreements.

Standard method to evaluate the impacts of trade agreement on bilateral trade flows is usually to include trade agreement as dummy variable in the right-hand side of the gravity equation. The direction is clear, to what extent trade agreement influence trade flows between countries. However, trade agreement might not be purely exogenous when one considers these economic and political factors in driving countries' choices of partners in forming or joining trade agreement.

4. Model Specification

The basic formulation of the gravity equation that will be used in the study is the following:

$$(1) \qquad X_{ijt}^{k} = \alpha_1 Y_{it} + \alpha_2 Y_{jt} + \sum_{m=1}^{M} \beta_m Z_{ij(t)}^{m} + \gamma_a WTO_{ijt} + \delta_n RTA_{ijt} + \varepsilon_{ijt}$$

where X_{ijt}^{k} is unidirectional trade[10] nominal value at time t with the superscript k to note that the estimation will distinguish the value of total trade and food trade to allow for comparison between the two. Y_{it} and Y_{jt} are economic size represented by gross domestic product (GDP) of

[10] Unidirectional trade could be import of country i from country j or export of country i to country j, here import value is used.

country i and country j at time t respectively. $Z_{ij(t)}^{m}$ is a vector of observable trade cost or trade promotion which include bilateral distance, tariffs[11] and five dummies denoting whether any of the country pair is landlocked country, shared border, shared common language, have colonial link and were colonized by the same country. WTO_{ijt} and RTA_{ijt} are dummy variables take the value of 1 if the two countries are members of the world trade organization and if the two countries are ever in the same regional trade agreements at time t respectively and take the value of 0 otherwise. ε_{ijt} is error term. The standard independent variables in the gravity model and the expected signs are described in table 3. The main interest in this study is the coefficient γ and δ which show the estimation of the impact of WTO and RTA on members' food trade respectively.

The use of unidirectional trade nominal value is to avoid typical mistakes in the gravity model because of averaging reciprocal trade flows and inappropriate deflation of trade flows (Baldwin and Taglioni, 2006). Many gravity models work with the average of two way exports i.e. average of country i imports from country j and country i export to country j. Baldwin and Taglioni show that unidirectional bilateral trade value is more theoretically well founded since the gravity model is a modified expenditure function which explains the value of spending by one country on the goods produced by another country.

[Table 3 here]

There are several issues that need to be addressed related to the potential problems in estimating the standard gravity equation. First, sample selection bias which can be addressed by including importer and exporter specific fixed effects as suggested by Baier and Bergstrand (2007) and the equation can be written as:

$$(2) \qquad X_{ijt}^{k} = \emptyset_i + \emptyset_j + \emptyset_t + \alpha_1 Y_{it} + \alpha_2 Y_{jt} + \sum_{m=1}^{M} \beta_m Z_{ij(t)}^{m} + \gamma_a WTO_{ijt} + \delta_n RTA_{ijt} + \varepsilon_{ijt}$$

where $\emptyset_i$, $\emptyset_j$ and $\emptyset_t$ denote importer, exporter and time dummies respectively. All other variables are as described in the equation (1).

[11] Total tariff is used for total trade and food tariff is used for food trade.

Including importer and exporter specific fixed effects as in equation (2) can also address another potential problem related to relative trade cost or "multilateral trade resistance" as called by Anderson and van Wincoop (2003). They emphasized that the propensity of trade between two countries is not simply determined by absolute trade cost between the two, but also on each country's trade cost toward its partners relative to their partners in the rest of the world. For instance, relative trade cost between two countries surrounded by oceans is different from country pair surrounded by other exporting or importing countries. Ignoring multilateral trade resistance (MTRs) could lead to biased estimation results (Anderson and van Wincoop, 2003; Feenstra, 2004). However, multilateral trade resistances are difficult to measure as they are not directly observable. Importer and exporter fixed effects are included to control all unobserved characteristic for both importer and exporter countries.

In a panel setting, it is also possible to include time varying fixed effects to control all characteristic of importer and exporter countries that may vary over time. Including these importer and exporter time varying fixed effect yields the equation as the following:

$$X_{ijt}^{k} = \emptyset_{it} + \emptyset_{jt} + \emptyset_{t} + \sum_{m=1}^{M} \beta_m Z_{ij(t)}^{m} + \gamma_a WTO_{ijt} + \delta_n RTA_{ijt} + \varepsilon_{ijt} \quad (3)$$

where $\emptyset_{it}$ is country i fixed effect at time t and $\emptyset_{jt}$ is country j fixed effect at time t. Variables that are country and time specific, including importer and exporter GDP (Y_{it} and Y_{jt}) are absorbed by $\emptyset_{it}$ and $\emptyset_{jt}$. All other variables are as defined previously.

Moreover, it may be the case that countries are likely to form trade agreements with their partners which already trade a lot which can lead to bias estimation results. To address this issue, we will use country-pair fixed effect which can rule out all unobserved bilateral characteristics between the pair countries. The equation including the country-pair fixed effect can be written as:

$$X_{ijt}^{k} = \emptyset_{ij} + \emptyset_{t} + \alpha_1 Y_{it} + \alpha_2 Y_{jt} + \sum_{m=1}^{M} \beta_m Z_{ij(t)}^{m} + \gamma_a WTO_{ijt} + \delta_n RTA_{ijt} + \varepsilon_{ijt} \quad (4)$$

where $\emptyset_{ij}$ is country-pair fixed effect and $\emptyset_t$ is time effect. All other variables are as defined previously.

Applying gravity model into a sector level of trade such as food is not entirely straightforward. The reason is that there are more differences between countries when one aims to analyze a specific sector. For instance, not all countries are categorized as food producers. These differences, however, can be well captured by including country specific fixed effects in the estimation. Another consideration that needs to be specially addressed in analyzing sectoral trade is zero trade values. It is likely that zero trade values are more frequent when estimating specific sector of trade. The use of logarithmic transformation in the standard gravity model creates immediate problem when trade value is zero, since log of zero is undefined. Omitting zero variables may result in bias estimation (Santos Silva and Tenreyro, 2006). As an alternative, Santos Silva and Tenreyro suggest to use Poisson Pseudo maximum Likelihood (PPML) estimator. They show that PPML provides robust estimation in the presence of heteroskedasticity. PPML estimation can be estimated by solving the following first order condition:

$$\sum_p (X^p - \exp(Z^p \hat{\beta})) = 0 \quad (5)$$

where p denotes country pairs, X^p is unidirectional trade (i.e. imports) between the country pairs expressed in levels not in logarithms and Z^p is the full vector of the gravity equation as defined in equation (1).

5. Data Description

Bilateral food and total trade data are derived from the United Nations Commodity Trade Statistics Database (UN COMTRADE) via World Integrated Trade Solution (WITS). The definition of food uses standard product in the Standard International Trade Classification (SITC, revision 1) 0+1+22+4. Specifically it includes food and live animal, beverages and tobacco, oil seeds, oil nuts, oil kernels, animal and vegetable oils/fats.

The database developed in this study consists of 162 countries around the globe over the period 1991 – 2012 with three years intervals (1991, 1994, …, 2012). There are maximum 208656 (162x161x8) observations with the number of zero trade observations are 90867 (43.5%) and 144240 (69%) for total trade and food trade respectively.

Gross domestic product (GDP) in nominal US dollars comes from World Development Indicators[12] of the World Bank. Data on total tariffs and food tariffs come from Trade Analysis and Information system (TRAINS) database and derived via WITS[13]. Data on distance, landlocked, contiguous border, common language, colonial link and common colony are taken from *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII). WTO database is the main source for data on WTO membership and regional trade agreements. There are 188 RTAs included in the sample covering all regional trade agreements involving sample countries in the analysis that enter into force from 1960 to 2012. Countries' level of development is represented by income level; high income countries is categorized as developed countries, middle and low income countries are categorized as developing countries. The levels of income are according to GNI per capita, taken from the World Bank database.

[Table 4 here]

[Table 5 here]

6. Results Discussions

The basic estimation results are presented in table 6. We first estimate the model using Ordinary Least Squares (OLS) with time, importer and exporter fixed effects. On the total trade as dependent variable, all coefficients are statistically significant and show the correct signs as expected. Economic size (GDP) both importer and exporter positively impact total trade. Tariff, Distance and landlocked negatively impacts trade, while sharing border, language and colonial ties stimulate trade. For food trade, statistically significant coefficients are found for GDP

[12] In some cases, data are taken from national statistics to supplement World Bank data when it is missing or incomplete.

[13] When data on tariffs is missing in some years of a particular country, the tariffs of the nearest year is used and the earlier year comes at the first place.

importer, tariff, distance and shared border. Other variables are not statistically significant. Unexpected sign is food tariff which positively impacts food trade with the coefficient of 0.0266 and statistically significant at 1 percent.

[Table 6 here]

The main interests of the estimation are the coefficients of WTO and RTAs that show to what extent both agreements, at the multilateral and regional levels, impact trade flow among participant countries. For total trade as dependent variable, the membership of the WTO results in a coefficient 0.216 that is positive and statistically significant; suggesting that trade among WTO members is about 22 percent higher relative to non-members. The result for RTA membership is also positive and statistically significant with the coefficient 0.250, suggesting that joining RTA increase members' trade about 25 percent on average compared to other countries trade without RTAs. The key question is whether WTO and RTAs have facilitated food trade among the participant countries. However, no statistically significant results are found from the estimations. the coefficient of WTO is negative (-0.0557) and the coefficient of RTAs is positive (0.0269), both are statistically insignificant.

The results of the estimation when controlling for all characteristics of the importer and exporter that may vary over time by including time varying fixed effects do not change a lot from the previous estimation. Nearly all coefficients of the standard gravity model explanatory variables consistently show the same signs and significance level as in the previous estimation. Only tariff is much different but with the same sign with the previous specification with the coefficient of (-0.102) and statistically significant at 1 percent. In this estimation, GDP importer and GDP exporter are absorbed by the time varying fixed effects. However, this does not really matter since our main interest is on the coefficient of WTO and RTA. We found the coefficient of the WTO is 0.231 which is positive and statistically significant, suggesting that the WTO have increased trade among its member countries by 23 percent on average compared to non members. The coefficient of RTA is 0.169, positive and statistically significant, suggesting that trade among RTA members is relatively 17 percent higher compared to countries without RTAs.

For food trade, we found that the coefficient of food tariff is statistically insignificant. All other variables are consistent with the previous specification in terms of signs and significance levels. The magnitudes of the coefficient are also not much different. For the variable of interests, like in the previous specification, the coefficient of WTO membership is negative (-0.219) and statistically insignificant. However, RTAs is positive and statistically significant with coefficient 0.113 which suggests that food trade among RTA members are relatively 11 percent higher than non-members on average.

In the estimations of OLS with bilateral country pair fixed effect to control for all unobserved country-pair characteristics, we found that both GDP importer and exporter positively impacts trade with the coefficient of 1.002 and 0.526 that are statistically significant. The coefficient of tariff is negative (-0.0065) but statistically insignificant and all other country-pair specific variables are absorbed by the country-pair fixed effects. For the variable of interests, the coefficient of WTO is 0.193, positive and statistically significant, suggesting that the WTO have increased trade among its member countries by 19 percent on average compared to non members. RTAs is also positive and statistically significant with coefficient 0.176 which suggests that food trade among RTA members are about 18 percent higher than non-members on average. For food trade, the two coefficients of WTO and RTAs are statistically insignificant.

We further estimate the gravity model using Poisson Pseudo-Maximum Likelihood (PPML). In this specification, we use bilateral country-pair fixed effect to control all unobserved bilateral country-pair characteristics. For total trade, we found GDP importer and GDP exporter are positive and statistically significant as expected with the coefficient of 0.734 and 0.696 respectively. For tariff, the coefficient is statistically insignificant, while all other country-pair specific variables are absorbed by the bilateral fixed effect. For food trade, as in the previous estimations using OLS, we found only GDP importer of the standard gravity variables that is positive and statistically significant. For the variables of interest, the WTO and RTAs are positive and statistically significant for total trade with the coefficients of 0.108 and 0.0698 respectively, suggesting that the trade of WTO members and RTAs members are higher about 11 percent and 7 percent respectively compared to non members. For food trade, we found the coefficient of WTO is statistically insignificant, while RTA is positive and statistically significant with the coefficient of 0.222.

Our results show that nearly all signs and significance levels of the variables estimated are consistent with slightly different magnitudes in all different specifications. However, interesting result comes from tariff, especially for food trade, which shows positive sign suggesting that the increase of tariff increases food trade. We further check this result by estimating the effect of WTO and RTA membership on tariff. This is important since the purpose of trade agreements is basically to reduce trade barriers including through tariff reduction. Moreover, the test is conducted to find out whether higher tariff reduction in one sector such as food discourage trade in other sector or vice versa.

[Table 7 here]

The effects of the WTO and RTAs on tariff are tested using three categories; total tariff, food tariff and food tariff relative to total tariff. On the third category, we divide the food tariff by total tariff to analyze the increase/reduction of food tariff relative to total tariff. We found only RTAs that have significantly reduced tariff and food tariff, while the WTO is found to have positive impacts on tariff. The results are not as expected and that are questioning the tariff reduction effects of the memberships of the WTO. On the food tariff relative to total tariff, we found negative signs for both WTO and RTAs. This indicates that the WTO and RTAs memberships result in higher food tariff reduction relative to total tariff.

Further investigation is conducted to analyze possible asymmetries in trade agreements especially between developed and developing countries and countries in different regions. Since all specifications in the previous estimations show consistent results, the following estimations only employ PPML with considerations that addressing zero trade values in analyzing sector trade such as food is highly important. We include bilateral country pair fixed effect in the estimation to control all unobserved variables that are country-pair specific.

[Table 8 here]

The results suggest that WTO negatively impacts trade when both countries are developed but positively impacts trade when trade involves developing countries. While for food trade, positive impacts are found when both counties are categorized as developing countries. RTAs are also found to have positive impacts when trade is between developed and developing countries or

both parties are developing countries. We found statistically insignificant effect of the RTAs on trade when both countries are developed countries. While for food trade, positive and statistically significant effect is found when food trade is between developed and developing country.

[Table 9 here]

From the estimation of the WTO based on regions, we found that the WTO has different impacts in different regions (table 9). The highest positive impact of the WTO on trade is found for trade between African countries with the coefficient of 0.608. For food trade, the highest positive impact is found for food trade between European countries with the coefficient of 0.895. The results also indicate that food is traded more within a region rather that traded across regions.

We further analyse several specific RTAs around the globe (table 10). RTAs analysed are selected from different continents to see their impacts on food trade. For Asia, this include ASEAN Free Trade Area (AFTA) and Pan Arab Free Trade Area (PAFTA). In Africa, RTAs analyzed are Common Market for Eastern and Southern Africa (COMESA), Economic Community of West African States (ECOWAS) and Southern African Development Community (SADC). North American Free Trade Agreement (NAFTA) and Southern Common Market (MERCOSUR) are taken for American countries, and European Union (EU) for Europe.

[Table 10 here]

We found that COMESA, ECOWAS, EU, MERCOSUR and SADC positively impacts trade among the members with ECOWAS being the highest with the coefficient of 1.608. Among these RTAs, only EU is found to also positively impacts food trade among its members with the coefficient of 0.940 which suggests that food trade among its members is about 94 percent higher compare to non members. Another RTA that found to have positive impacts on food trade is NAFTA. However, no statistically significant result is found that NAFTA has also positive impacts on total trade among its members.

7. Conclusions

The fast increase and excessive volatility of food prices in recent years are a significant indication of change in the global food market and a strong signal of resource scarcity (von Braun et al., 2014). Therefore, global food security is only possible when food can move freely from countries of surplus to countries of deficit and should not be prevented by international trade distortions.

This chapter is questioning the contributions of the enormous number of trade agreements in the world trade system in strengthening food security at the worldwide level. The focus of the study is investigating whether trade agreements, both multilateral i.e. the WTO and at the regional level enhance food trade among the participant countries and bring the world into a freer flow of food.

Empirical results suggest that the multilateral and regional trade institutions indeed have delivered significant positive impacts on trade but not necessarily in the food sector. The findings suggest that only RTAs enhance food trade among their member countries whereas no evidences can be found that the WTO membership increase food trade among the members. Surprisingly however, contrary to general believes where the WTO is often criticized by benefiting the developed countries more than the developing ones, we found that the WTO has facilitated trade as well as food trade of the developing countries more than of the developed countries. We found positive impacts of the WTO on trade when trade involves developing countries. The negative sign of trade between developed countries also indicates that the developed countries trade more with the developing countries than with the other developed ones. The results indicate that developing countries are more connected to the global trade than before.

The findings also suggest that trade among countries is likely to have gone beyond only with traditional partners and beyond only with partner country in the same region. Food trade however, is still concentrated based on regions. We found that the WTO has stronger effects on food trade when the country-pair belongs to the same region than food trade between countries in different regions. Our analysis on selected RTAs around the globe also supports the evidences.

Trade agreements, both at multilateral and regional level, are intended to reduce trade barriers including through tariff elimination. However, our results suggest that no evidences are found that the WTO has reduced tariffs among the member countries. Only RTAs are found to have reduced tariffs among the members. Nevertheless, the positive effects of the WTO on trade show that the cooperation in the multilateral trade institution is more than only reducing tariffs. The member countries seems to prefer trade more with other members compared to trade with non-members even without tariff facilitation. On the other hand, no tariff reduction effect of the WTO on food trade confirms the findings that the food sector in the cooperation is still left behind.

Stronger cooperation and coordination among countries is still needed to ensure the delivery of food to the people at all times in all places. The success of the 9th ministerial meeting of the WTO which has delivered the Bali Package can be an important momentum in strengthening international trade cooperation at the multilateral level including in the food sector and bring the world to a freer flow of food. Way forward is to ensure that the agreements can be implemented and bring benefits to global food security.

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Table 1. Average tariff rates of different sectors

Sector	Tariff Rates	
	1992	2012
All Sectors	13.06	6.74
Manufactures	13.21	6.49
Agriculture	13.28	10.24
Textiles	17.21	10.06
Food	14.55	11.55

Note: Average tariff rates not weighted, classification based on standard product in SITC
Source: TRAINS database accessed via WITS

Table 2. International classification of non-tariff measures

A	Sanitary and phytosanitary measures
B	Technical barriers to trade
C	Pre-shipment inspection and other formalities
D	Price control measures
E	Licenses, quotas, prohibitions ad other quantity control measures
F	Charges, taxes and other para-tariff measures
G	Finance measures
H	Anti-competitive measures
I	Trade-related investment measures
J	Distribution restrictions
K	Restrictions on post-sales services
L	Subsidies (excluding export subsidies)
M	Government procurement restrictions
N	Intellectual property
O	Rules of origin
P	Export-related measures

Source: UNCTAD

Table 3. Standard gravity independent variables and expected signs

Independent Variables Descriptions	Expected Signs
Gross domestic product of the importer country i	+
Gross domestic product of the exporter country j	+
Geographical distance	-
Tariffs	-
Landlocked	-
Shared border	+
Common language	+
Colonial link	+
Common colony	+

Table 4. List of sample countries

Albania (WTO, 2000)	Greece (WTO, 1995)	Papua New Guinea (WTO, 1996)
Algeria (Non WTO)	Grenada (WTO, 1996)	Paraguay (WTO, 1995)
Antigua and Barbuda (WTO, 1995)	Guatemala (WTO, 1995)	Peru (WTO, 1995)
Argentina (WTO, 1995)	Guinea (WTO, 1995)	Philippines (WTO, 1995)
Armenia (WTO, 2003)	Guinea-Bissau (WTO, 1995)	Poland (WTO, 1995)
Australia (WTO, 1995)	Guyana (WTO, 1995)	Portugal (WTO, 1995)
Austria (WTO, 1995)	Honduras (WTO, 1995)	Qatar (WTO, 1996)
Azerbaijan (Non WTO)	Hungary (WTO, 1995)	Romania (WTO, 1995)
Bahamas, The (Non WTO)	Iceland (WTO, 1995)	Russian Federation (WTO, 2012)
Bahrain (WTO, 1995)	India (WTO, 1995)	Rwanda (WTO, 1996)
Bangladesh (WTO, 1995)	Indonesia (WTO, 1995)	Samoa (WTO, 2012)
Barbados (WTO, 1995)	Iran, Islamic Rep. (Non WTO)	Saudi Arabia (WTO, 2005)
Belarus (Non WTO)	Ireland (WTO, 199)	Senegal (WTO, 1995)
Belgium (WTO, 1995)	Israel (WTO, 1995)	Seychelles (Non WTO)
Belize (WTO, 1995)	Italy (WTO, 1995)	Sierra Leone (WTO, 1995)
Benin (WTO, 1996)	Jamaica (WTO, 1995)	Singapore (WTO, 1995)
Bhutan (Non WTO)	Japan (WTO, 1995)	Slovakia (WTO, 1995)
Bolivia (WTO, 1995)	Jordan (WTO, 2000)	Slovenia (WTO, 1995)
Botswana (WTO, 1995)	Kazakhstan (Non WTO)	Solomon Islands (WTO, 1996)
Brazil (WTO, 1995)	Kenya (WTO, 1995)	South Africa (WTO, 1995)
Brunei Darussalam (WTO, 1995)	Kiribati (Non WTO)	Spain (WTO, 1995)
Bulgaria (WTO, 1996)	Korea, Rep. (WTO, 1995)	Sri Lanka (WTO, 1995)
Burkina Faso (WTO, 1995)	Kuwait (WTO, 1995)	St. Lucia (WTO, 1995)
Burundi (WTO, 1995)	Kyrgyz, Rep. (WTO, 1998)	St. Vincent and the Grenadines (WTO, 1995)
Cambodia (WTO, 2004)	Latvia (WTO, 1998)	
Cameroon (WTO, 1995)	Lebanon (Non WTO)	Sudan (Non WTO)
Canada (WTO, 1995)	Lesotho (WTO, 1995)	Suriname (WTO, 1995)
Cape Verde (WTO, 2008)	Lithuania (WTO, 2001)	Swaziland (WTO, 1995)
Central African Rep. (WTO, 1995)	Luxembourg (WTO, 1995)	Sweden (WTO, 1995)
Chad (WTO, 1996)	Macedonia (Non WTO)	Switzerland (WTO, 1995)
Chile (WTO, 1995)	Madagascar (WTO, 1995)	Syrian Arab Rep. (Non WTO)
China (WTO, 2001)	Malawi (WTO, 1995)	Tajikistan (WTO, 2013)
Colombia (WTO, 1995)	Malaysia (WTO, 1995)	Tanzania (WTO, 1995)
Comoros (Non WTO)	Maldives (WTO, 1995)	Thailand (WTO, 1995)
Congo, Rep. (WTO, 1997)	Mali (WTO, 1995)	Togo (WTO, 1995)
Costa Rica (WTO, 1995)	Malta (WTO, 1995)	Tonga (WTO, 2007)
Cote d'Ivoire (WTO, 1995)	Mauritania (WTO, 1995)	Trinidad & Tobago (WTO, 1995)
Croatia (WTO, 2000)	Mauritius (WTO, 1995)	Tunisia (WTO, 1995)
Cyprus (WTO, 1995)	Mexico (WTO, 1995)	Turkey (WTO, 1995)
Czech Republic (WTO, 1995)	Moldova (WTO, 2001)	Turkmenistan (Non WTO)
Denmark (WTO, 1995)	Mongolia (WTO, 1997)	Tuvalu (Non WTO)
Dominica (WTO, 1995)	Morocco (WTO, 1995)	Uganda (WTO, 1995)
Dominican Rep. (WTO, 1995)	Mozambique (WTO, 1995)	Ukraine (WTO, 2008)
Ecuador (WTO, 1996)	Namibia (WTO, 1995)	United Arab Emirates (WTO, 1996)
Egypt, Arab Rep. (WTO, 1995)	Nepal (WTO, 2004)	
El Salvador (WTO, 1995)	Netherlands (WTO, 1995)	United Kingdom (WTO, 1995)
Ethiopia (Non WTO)	New Zealand (WTO, 1995)	United States (WTO, 1995)
Fiji (WTO, 1996)	Nicaragua (WTO, 1995)	Uruguay (WTO, 1995)
Finland (WTO, 1995)	Niger (WTO, 1996)	Vanuatu (WTO, 2012)
France (WTO, 1995)	Nigeria (WTO, 1995)	Venezuela, RB (WTO, 1995)
Gabon (WTO, 1995)	Norway (WTO, 1995)	Vietnam (WTO, 2007)
Gambia, The (WTO, 1996)	Oman (WTO, 2000)	Yemen, Rep. (Non WTO)
Georgia (WTO, 2000)	Pakistan (WTO, 1995)	Zambia (WTO, 1995)
Germany (WTO, 1995)	Palau (Non WTO)	Zimbabwe (WTO, 1995)
Ghana (WTO, 1995)	Panama (WTO, 1997)	

Note: WTO memberships including year of joining and level of income are in parentheses
Source: WTO database

Table 5. List of sample regional trade agreements

EFTA (1960)	Georgia-Kazakhstan (1999)	Japan-Mexico (2005)	Peru-Chile (2009)
CACM (1961)	Chile-Mexico (1999)	Ukraine-Moldova (2005)	Australia-Chile (2009)
PACTRA (1977)	EFTA-Morocco (1999)	EFTA-Tunisia (2005)	Chile-Colombia (2009)
SPARTECA (1981)	Georgia-Turkmenistan	Pakistan-Sri Lanka (2005)	MERCOSUR-India (2009)
LAIA (1981)	(2000)	Turkey-Tunisia (2005)	Panama-Guatemala (2009)
ANZCERTA (1983)	WAEMU (2000)	Thailand-New Zealand	EFTA-Canada (2009)
US-Israel (1985)	EU-South Africa (2000)	(2005)	Canada-Peru (2009)
CAN (1988)	EU-Morocco (2000)	India-Singapore (2005)	Peru-Singapore (2009)
GSTP (1989)	EU-Israel (2000)	Jordan-Singapore (2005)	Japan-Switzerland (2009)
MERCOSUR (1991)	EU-Mexico (2000)	EU-Algeria (2005)	Japan-Vietnam (2009)
ASEAN/AFTA (1992)	Israel-Mexico (2000)	SAFTA (2006)	EU-Cameroon (2009)
ECO (1992)	EAC (2000)	US-Morocco (2006)	India-Nepal (2009)
EFTA-Turkey (1992)	SADC 2000)	Turkey-Morocco (2006)	Colombia-Northern
European Union (1993)	Turkey-Macedonia (2000)	CAFTA_DR (2006)	Triangle (2009)
EFTA-Israel (1993)	New Zealand-Singapore	Korea-Singapore (2006)	Panama-Nicaragua (2009)
Russia-Azerbaijan (1993)	(2001)	TPSEP (2006)	EU-PNG (2009)
Russia-Turkmenistan	EU-Macedonia (2001)	Japan-Malaysia (2006)	ASEAN-Korea (2010)
(1993)	EFTA-Mexico (2001)	Panama-Singapore (2006)	ASEAN-India (2010)
Russia-Tajikistan (1993)	Ukraine-Macedonia (2001)	India-Bhutan (2006)	AANZFTA (2010)
Russia-Belarus (1993)	Dominican Rep.-Central	US-Bahrain (2006)	Korea-India (2010)
Kyrgyz, Rep-Russia (1993)	America (2001)	EFTA-Korea (2006)	Peru-China (2010)
Russia-Kazakhstan (1993)	India-Sri Lanka (2001)	Chile-China (2006)	Chile-Guatemala (2010)
ECOWAS (1993)	US-Jordan (2001)	Ukraine-Belarus (2006)	New Zealand-Malaysia
MSG (1994)	APTA-China (2002)	EU-Albania (2006)	(2010)
NAFTA (1994)	Chile-Costa Rica (2002)	EFTA-Lebanon (2007)	EFTA-Albania (2010)
Ukraine-Russia (1994)	EFTA-Macedonia (2002)	Turkey-Syria (2007)	Turkey-Jordan (2011)
Georgia-Russia (1994)	EU-Jordan (2002)	Egypt-Turkey (2007)	Turkey-Chile (2011)
COMESA (1994)	Chile-El Salvador (2002)	Pakistan-China (2007)	EU-Korea (2011)
CIS (1994)	Ukraine-Tajikistan (2002)	EFTA-Egypt (2007)	India-Japan (2011)
Colombia-Mexico (1995)	EFTA-Jordan (2002)	Chile-India (2007)	India-Malaysia (2011)
Ukraine-Turkmenistan	Canada-Costa Rica (2002)	Chile-Japan (2007)	EFTA-Peru (2011)
(1995)	Japan-Singapore (2002)	Japan-Thailand (2007)	EFTA-Colombia (2011)
Kyrgyz, Rep.-Kazakhstan	EFTA-Singapore (2003)	Pakistan-Malaysia (2008)	China-Costa Rica (2011)
(1995)	GCC (2003)	Panama-Chile (2008)	Peru-Korea (2011)
SAPTA (1995)	EU-Chile (2003)	Turkey-Albania (2008)	Canada-Colombia (2011)
EU-Turkey (1996)	EU-Lebanon (2003)	EFTA-SACU (2008)	Peru-Mexico (2012)
Georgia-Ukraine (1996)	Panama-El Salvador (2003)	Japan-Indonesia (2008)	Chile-Malaysia (2012)
Georgia-Azerbaijan (1996)	PICTA (2003)	Chile-Honduras (2008)	Japan-Peru (2012)
Ukraine-Azerbaijan (1996)	Singapore-Australia (2003)	Brunei-Japan (2008)	Korea-US (2012)
Canada-Israel (1997)	US-Chile (2004)	China-New Zealand (2008)	Panama-Peru (2012)
Turkey-Israel (1997)	US-Singapore (2004)	EU-CARIFORUM (2008)	EU-EPA (2012)
Canada-Chile (1997)	Korea-Chile (2004)	Turkey-Georgia (2008)	US-Colombia (2012)
EAEC (1997)	CEZ (2004)	Panama-Costa Rica (2008)	EFTA-Ukraine (2012)
Russia-Belarus-Kazakhstan	EU-Egypt (2004)	ASEAN-Japan (2008)	Mexico-Central America
(1997)	Mexico-Uruguay (2004)	Japan-Philippines (2008)	(2012)
PAFTA (1998)	SACU (2004)	EU-Cote d'Ivoire (2009)	Canada-Jordan (2012)
Kyrgyz-Ukraine (1998)	EFTA-Chile (2004)	China-Singapore (2009)	Chile-Nicaragua (2012)
EU-Tunisia (1998)	ASEAN-China (2005)	US-Oman (2009)	US-Panama (2012)
Ukraine-Kazakhstan (1998)	US-Australia (2005)	Panama-Honduras (2009)	
CEMAC (1999)	Thailand-Australia (2005)	US-Peru (2009)	

Note: Years of entry into force are in parentheses, the analysis takes into account different years of joining of some member countries into the agreement but their years of joining are not shown in the table to save space, further information can be found at http://rtais.wto.org/UI/PublicAllRTAList.aspx
Source: WTO database

Table 6. Basic results

	OLS (1)		OLS (2)		OLS (3)		PPML	
	Total Trade	Food Trade	Total trade	Food Trade	Total Trade	Food Trade	Total Trade	Food Trade
GDP Importer	0.967***	0.776***			1.002***	0.831***	0.734***	0.791***
	(0.0263)	(0.0396)			(0.0265)	(0.0402)	(0.0321)	(0.0705)
GDP Exporter	0.503***	-0.00995			0.526***	-0.000150	0.696***	0.0521
	(0.0287)	(0.0358)			(0.0292)	(0.0366)	(0.0315)	
Total Tariff	-0.0108*		-0.102***		-0.00650		0.00222	
	(0.00567)		(0.0121)		(0.00573)		(0.00959)	
Food Tariff		0.0266***		0.00664		0.0261***		0.00681
		(0.00895)		(0.0110)		(0.00917)		(0.00912)
Distance	-1.600***	-0.329***	-1.613***	-0.317***				
	(0.0207)	(0.0335)	(0.0208)	(0.0340)				
Landlocked	-0.916***	0.287	-2.068***	-0.311				
	(0.197)	(0.347)	(0.330)	(0.407)				
Shared Border	0.337***	0.467***	0.333***	0.462***				
	(0.113)	(0.170)	(0.114)	(0.173)				
Common Language	0.737***	0.0667	0.747***	0.0612				
	(0.0432)	(0.0718)	(0.0434)	(0.0727)				
Colonial Link	1.111***	-0.165	1.100***	-0.155				
	(0.102)	(0.177)	(0.103)	(0.183)				
Common Colony	0.948***	-0.00262	0.936***	-0.0124				
	(0.0557)	(0.0882)	(0.0560)	(0.0895)				
WTO	0.216***	-0.0557	0.231***	-0.0122	0.193***	-0.0510	0.108***	0.107
	(0.0264)	(0.0366)	(0.0677)	(0.111)	(0.0270)	(0.0375)	(0.0299)	(0.119)
RTA	0.250***	0.0269	0.169***	0.113**	0.176***	-0.0428	0.0698**	0.222***
	(0.0231)	(0.0466)	(0.0258)	(0.0475)	(0.0266)	(0.0567)	(0.0355)	(0.0765)
t dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
i and j dummies	Yes	Yes	No	No	No	No	No	No
it and jt dummies	No	No	Yes	Yes	No	No	No	No
ij dummies	No	No	No	No	Yes	Yes	Yes	Yes
Observations	117,789	64,416	117,789	64,416	117,789	64,416	178,128	116,856

*Note: All variables are in logarithm, except the dummies and the dependent variables in ppml estimations. Total tariff is used for total trade and food tariff is used for food trade, both using 1+tariff specification. Robust standard errors clustered by country pairs are in parentheses, * p<0.1, ** p<0.05, *** p<0.001.*

Table 7. Impacts of WTO and RTAs on Tariff

	Total Tariff	Food Tariff	Food Tariff/Total Tariff
WTO	0.107***	0.136***	-0.0289***
	(0.00743)	(0.00685)	(0.00584)
RTA	-0.240***	-0.0727***	-0.168***
	(0.0136)	(0.0126)	(0.0107)

*Total tariff is used for total trade and food tariff is used for food trade, both using 1+tariff specification. Time and bilateral country-pair effects are included but not reported. Robust standard errors are in parentheses, * p<0.1, ** p<0.05, *** p<0.001.*

Table 8. Results of developed and developing countries

	Total Trade	Food Trade
WTO both developed	-0.189***	0.0283
	(0.0408)	(0.0893)
WTO both developing	0.587***	0.398***
	(0.0711)	(0.125)
WTO developed and developing	0.161***	0.0387
	(0.0374)	(0.125)
RTA both developed	-0.0582	-0.0129
	(0.0656)	(0.143)
RTA both developing	0.141**	0.321
	(0.0714)	(0.215)
RTA developed and developing	0.0819*	0.234**
	(0.0468)	(0.0932)
Country-pair and Year dummies	Yes	Yes
Observations	178,128	116,856

*Note: variables included but not reported: gdp importer, gdp exporter, distance, landlocked, shared border, common language, common colony, colonial link. Robust standard errors are in parentheses, * p<0.1, ** p<0.05, *** p<0.001.*

Table 9. Impacts of WTO in different regions

	Total Trade	Food Trade
WTO both Asia	0.0762	-0.327***
	(0.0862)	(0.108)
WTO one Asia	0.170***	0.102
	(0.0369)	(0.0640)
WTO both Africa	0.608***	0.763***
	(0.164)	(0.202)
WTO one Africa	0.160***	0.0691
	(0.0577)	(0.0829)
WTO both America	0.0443	0.114
	(0.0891)	(0.0986)
WTO one America	0.202***	-0.00565
	(0.0643)	(0.0835)
WTO both Europe	0.122*	0.895***
	(0.0675)	(0.250)
WTO one Europe	(0.0354)	0.00265
	(0.0368)	(0.0672)
Country-pair and Year dummies	Yes	Yes
Observations	178,128	116,856

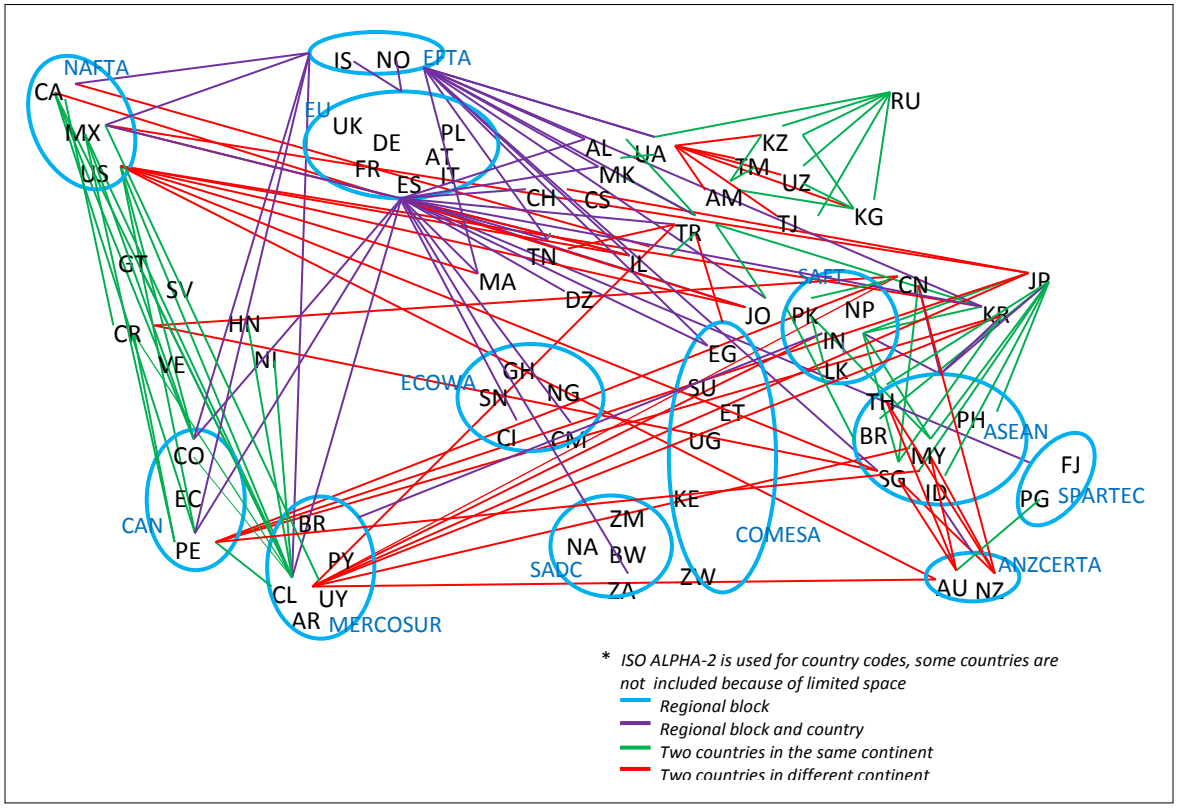
*Note: variables included but not reported: gdp importer, gdp exporter, Robust standard errors are in parentheses, * p<0.1, ** p<0.05, *** p<0.001.*

Table 10. Results of selected RTAs around the globe

	Total Trade	Food Trade
AFTA	-0.117	0.453
	(0.224)	(0.308)
COMESA	1.183***	0.459
	(0.377)	(0.689)
ECOWAS	1.608***	1.172
	(0.485)	(0.721)
EU	0.170***	0.940***
	(0.0391)	(0.0784)
MERCOSUR	0.466***	-0.267*
	(0.141)	(0.157)
NAFTA	0.0628	3.175**
	(0.112)	(1.324)
PAFTA	-0.197	-0.374
	(0.165)	(0.246)
SADC	1.045***	-0.151
	(0.404)	(0.189)
Country-pair and Year dummies	Yes	Yes
Observations	178,128	116,856

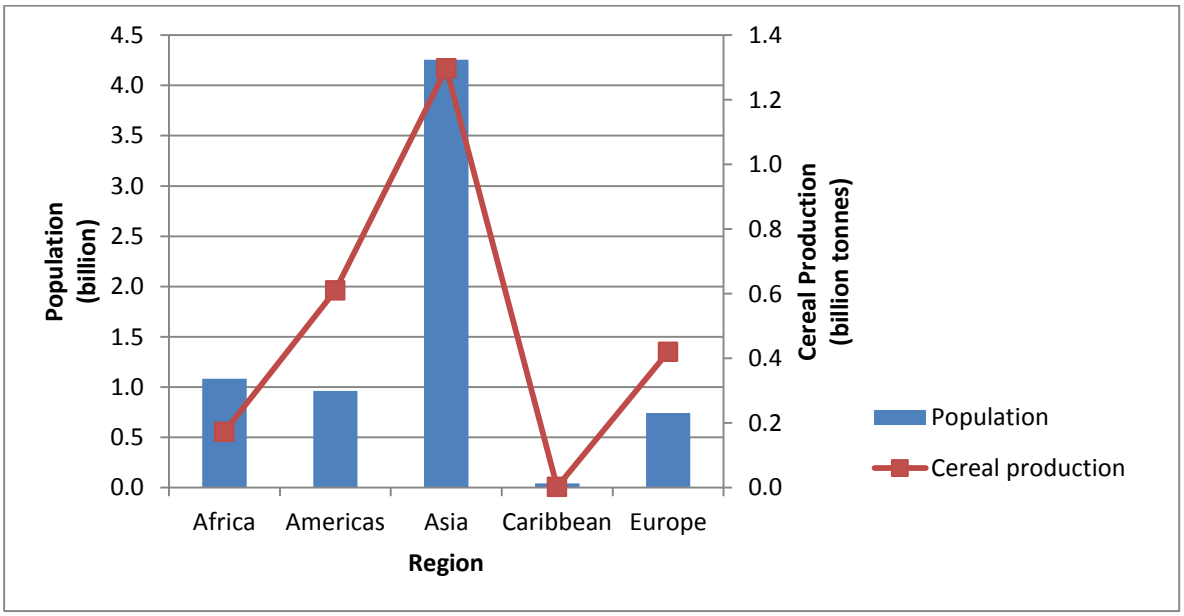
*Note: variables included but not reported: gdp importer, gdp exporter and tariffs. Distance, landlocked, shared border, common language, common colony, colonial link are absorbed by the country-pair fixed effects. Robust standard errors are in parentheses, * p<0.1, ** p<0.05, *** p<0.001.*

Figure 1. Global map of trade agreements as of 2013



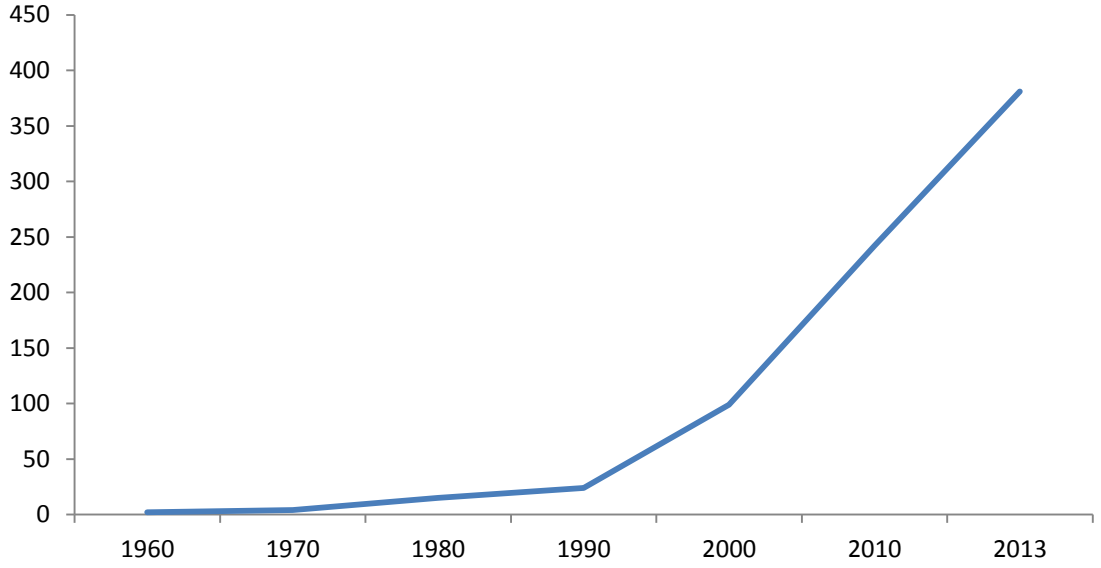
Note: Countries' geographical positions are placed as in normal map but without scaling, ISO alpha 2 codes can be accessed via http://www.iso.org/iso/country_codes
Source: Own illustration based on WTO database

Figure 2. Population and cereal production in 2012



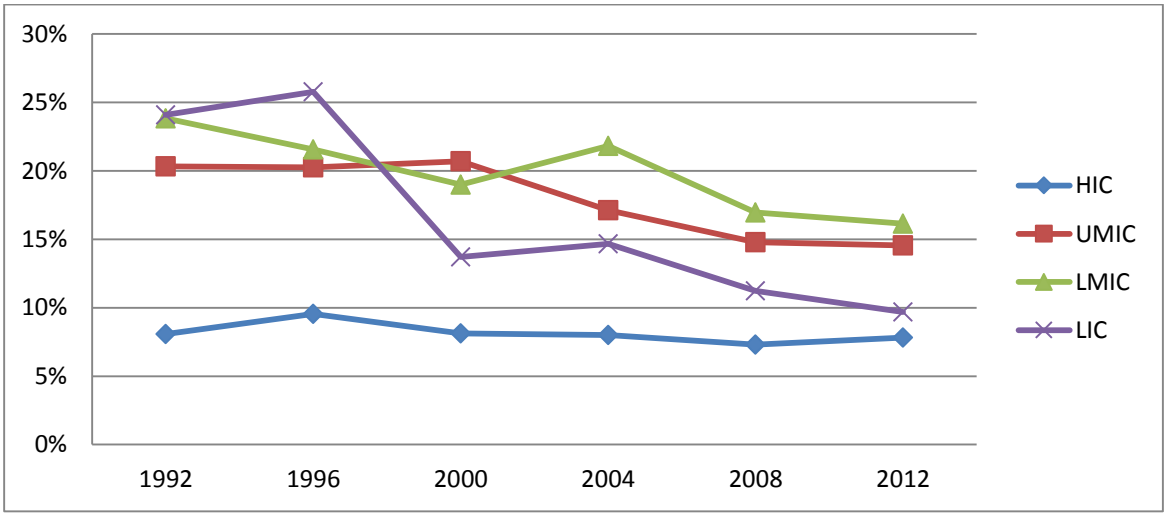
Source: FAOSTAT

Figure 3. Numbers of regional trade agreements 1960 – 2013



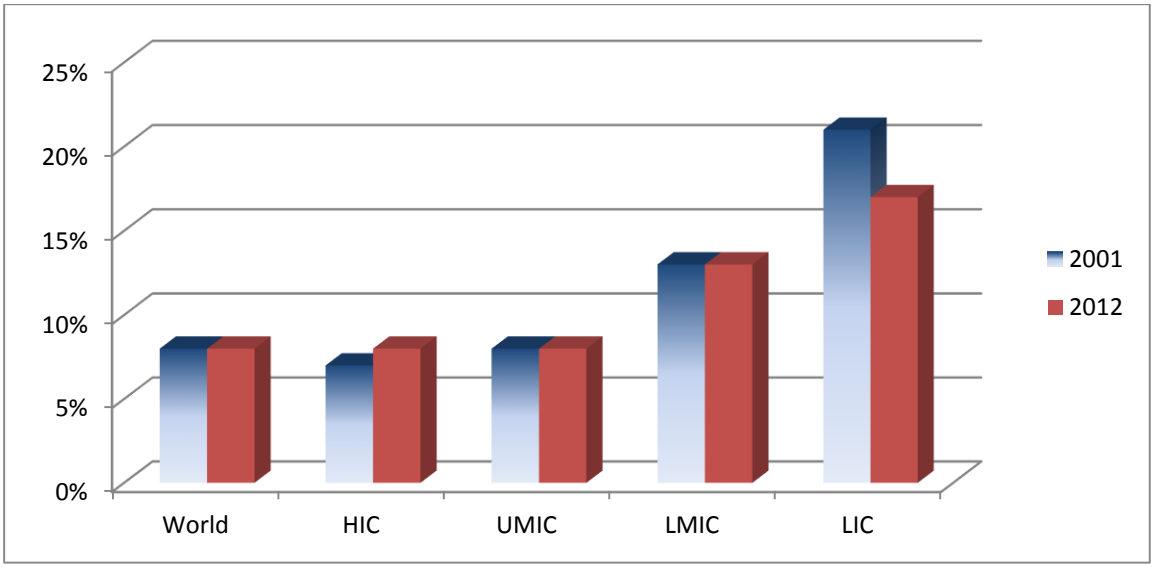
Source: Author illustration based on WTO database

Figure 4. Food tariff rates evolution 1992 - 2012



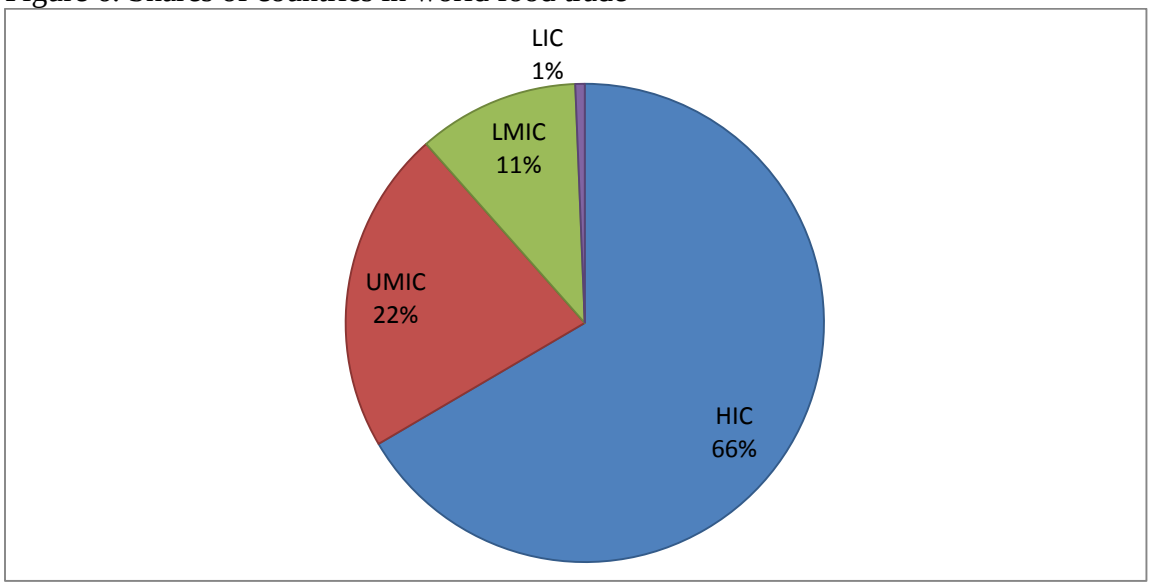
Note: Average tariff rates not weighted of country groups based on level of income facing all countries. HIC (High Income Countries); UMIC (Upper Middle Income Countries); LMIC (Lower Middle Income Countries); LIC (Lower Income Countries)
Source: TRAINS database accessed via WITS

Figure 5. Shares of food in total trade



Note: HIC (High Income Countries); UMIC (Upper Middle Income Countries); LMIC (Lower Middle Income Countries); LIC (Lower Income Countries)
Source: Author calculation based on UN COMTRADE

Figure 6. Shares of countries in world food trade



Note: HIC (High Income Countries); UMIC (Upper Middle Income Countries); LMIC (Lower Middle Income Countries); LIC (Lower Income Countries), Source: Author calculation based on UN COMTRADE