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THREE ESSAYS ON THE ROLE OF EXTENSIVE AND INTENSIVE MARGIN IN INTERNATIONAL TRADE

DISSERTATION

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the College of Business and Economics at the University of Kentucky

By
Rishav Bista
Lexington, Kentucky

Director: Dr. Josh Ederington, Professor of Economics
Lexington, Kentucky 2012

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ABSTRACT OF DISSERTATION

THREE ESSAYS ON THE ROLE OF EXTENSIVE AND INTENSIVE MARGIN IN INTERNATIONAL TRADE

This dissertation consists of three essays that examine the impact of various trade policies on the extensive (new trading relationships) and intensive (increase in trade of existing relationships) margins of trade, whereas past studies have been limited to aggregate trade flows. An inquiry into the extensive and intensive margins of trade reveals that total aggregate trade masks the heterogeneous trade creating effect of policy variables. Furthermore, this dissertation also takes into account the econometric issues that have plagued the traditional empirical model that analyzes the impact of these policies on trade.

The first chapter examines the impact of hosting and bidding for mega-events on exports. Rose & Spiegel (2011b) find that hosts and unsuccessful bidders (candidates) experience a similar positive impact on total aggregate exports. They attribute the Olympic effect to the signal a country sends when bidding to host the games. This chapter inquires whether this Olympic signal leads to new trading relationships or an increase in trade in existing relationships. The results indicate that only hosts (not candidates) experience a permanent increase in exports at the intensive margin. While hosting the Olympics is consistently correlated with a permanent deepening of existing trade relationships, it is at the expense of the number of trading relationships.

The second chapter examines the impact of the World Trade Organization (WTO) membership on the extensive and intensive margin of imports. Accounting for several estimation issues that have plagued the literature, results indicate that the benefit of the WTO is realized entirely through the extensive margin. The results are in line with the literature that attributes WTO to reducing market uncertainty through tariff binds rather than reduction, thus increasing entry in the export market even when the applied protection is unchanged.

The third chapter examines the impact of fiscal episodes (fiscal stimuli and consolidation) on the extensive and intensive margins of exports. The results indicate that fiscal consolidation leads to an increase in total exports, while a fiscal stimulus leads to a decrease in total exports. Furthermore, fiscal consolidation leads to an increase in exports solely through the extensive margin.

KEYWORDS: extensive margin, intensive margin, gravity model, poisson specification, trade

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Date: July 30, 2012

THREE ESSAYS ON THE ROLE OF EXTENSIVE AND INTENSIVE MARGIN IN INTERNATIONAL TRADE

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Date: July 30, 2012

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1 Introduction

Past studies in international trade have analyzed the impact of various policies such as trade liberalization and membership in multilateral organizations on total aggregate bilateral trade (or total volume of trade) flows. In my dissertation, using disaggregated product level trade data, I examine the impact of these variables by disaggregating total trade into two margins of trade - extensive and intensive margin. The extensive margin is defined as the change in number of products traded or changes in the number of trading partners; hence it measures trade diversification or new trading relationships. The intensive margin is defined as the change in volume of trade of existing products between two countries; hence it measures whether trade of a given product is more or less intense.

In recent years, the theoretical models of trade have ushered into the "new trade theory" that emphasizes firm-level productivity differences in trade structure. Recent studies such as Helpman *et al.* (2008) incorporate firm-level heterogeneity and advocate for the decomposition of trade volume into the extensive and intensive margin. Theoretical predictions of Melitz (2003) and Chaney (2008) indicate that decline in variable trade costs (e.g. reduction in tariffs) increase the extensive as well as the intensive margin. Furthermore, Chaney (2008) mentions that a reduction in fixed costs (e.g. information costs) affects only the extensive margin. Disentangling total trade into the extensive and intensive margin, I argue and find that the impact of these variables on total aggregate trade masks the heterogeneous trade creating effect, and hence underestimates the impact of these policy variables or trade agreements. Hence there might be a need of reassessment of trade agreements or policies directed towards international trade.

Recent studies indicate the importance of the intensive margin of trade for long-run export growth. Besedes & Prusa (2010) argue that the survival of trading relationships is important for long-run export growth, implying that a critical part of improved export growth for developing countries may be focusing on existing relationships. On the other hand, increases in the extensive margin or export diversification reduces the risks of balance of payments crises and large fluctuations in domestic output after-shocks that can negatively affect the performance of the external sector, such as price fluctuations in international markets or output swings in trading partners (Agosin (2007), Lederman & Maloney (2003)). Feenstra & Kee (2008) suggest that increases in sectoral export variety boost country productivity as the new exporting basket can improve the use and allocative efficiency of the economy.

Furthermore, I take into account the econometric issues that have plagued the traditional empirical model that analyzes these trade policies. The log-linear gravity model of trade has been extensively employed to analyze trade flows. However, recent empirical trade literature indicates that the traditional log-linear gravity model leads to inconsistent estimates in the presence of heteroskedastic residuals. Under heteroskedasticity, the parameters of log-linearized models estimated by OLS lead to biased estimates of the true elasticities (see Liu (2009), Silva & Tenreyro (2006), and Felbermayr & Kohler (2010a)). Various studies have proposed the Poisson regression as an alternative solution, notably Flowerdew & Aitkin (1982) and more recently by

Silva & Tenreyro (2006). Hence, in this dissertation I implement the Poisson Pseudo-Maximum Likelihood (PPML) estimation proposed by Silva & Tenreyro (2006) as an appropriate methodology to estimate the impact of various trade policies on the extensive and intensive margin of trade.

In my first chapter, I examine the impact of hosting and bidding for mega-events (e.g. Olympics, World Cup) on international exports. Utilizing the traditional log-linear gravity model, Rose & Spiegel (2011b) find large effects of hosting and bidding (unsuccessful candidates) for mega-events on international exports. They attribute the Olympic effect to the signal a country sends when bidding to host the games, rather than the act of actually hosting the game itself. Utilizing product level data, I inquire whether this Olympic signal leads to new trading relationships (the extensive margin) or an increase in trade in existing relationships (the intensive margin). In addition, I implement alternate specifications such as a Tobit specification with zero trade flows and the PPML estimation to examine the Olympic effect.

In my second chapter, I examine the impact of the WTO membership on product level extensive and intensive margin of imports. In addition, I also take into account the role of product heterogeneity and heterogeneity of the WTO members based on their level of development and its impact on the two margins of import. Furthermore, I utilize the PPML estimation and account for several estimations issues that have plagued the literature.

In my third chapter I examine the impact of fiscal episodes (fiscal stimuli and consolidation) on total exports and product level extensive and intensive margin of exports. Hence, this paper provides evidence on the mechanism by which such fiscal episodes stimulate exports. This chapter also analyzes whether the impact of fiscal episodes on exports is contingent upon importers' fiscal policy stance.

2 Revisiting the Olympic Effect

2.1 Introduction

According to Rose & Spiegel (2011a), Qatar reportedly pledged to spend more than $50 billion on infrastructure and stadiums in preparation to host the 2022 World Cup. Brazil acquired the right to host the 2016 Olympic Games with a $15 billion bid, which amounts to $2000 per citizen (more than two months of GDP per capita). These imposing costs on the hosts might not be compensated by the revenues earned or legacy of large facilities that are left behind, engendering economists' skepticism of these mega-events. Nonetheless, countries fiercely compete to acquire the rights to host these mega-events.

Rose & Spiegel (2011b) are the first to examine the economic impact of hosting mega-events (e.g. Olympics, World Cup) in terms of international trade. Utilizing the log-linear gravity model of trade, they find that hosting a mega-event has a positive impact on national exports (results also extend to bilateral imports). The effect is statistically robust, permanent, and large; exports are, on average, around 20% higher for countries that have hosted the Olympics. Surprisingly, they find that countries that were unsuccessful candidates (henceforth *candidates*) to host the Olympics have a similar (in magnitude) positive impact on exports.[1] They provide numerous robustness checks for their results.[2] They conclude that the Olympic effect on trade is attributable to the signal a country sends when bidding to host the games, where such a signal is used by countries wishing to liberalize. They further postulate that hosting the game in and of itself has no impact on a nation's trade fundamentals or a big-push type of process (e.g. Murphy *et al.* (1989)). Rose & Spiegel (2011a) claim that while hosting the games is sufficient to boost trade, it is not necessary. Unsuccessful bids for Olympics generate similar benefits (in terms of trade) to those of hosts at a substantially lower cost, comparable to the notion of "winner's remorse". Hence, in line with many economists, they corroborate the skepticism of the actual hosting of a mega-event.

This paper builds upon the literature in several ways. First, this study utilizes disaggregated product-level trade data to analyze whether the Olympic effect leads to new trading relationships (the extensive margin) or an increase in trade in existing relationships (the intensive margin). The extensive margin is measured as the number of product-country trade relationships that a country engages in. Hence, the measure of the bilateral extensive margin is the count of the number of products exported by country i to country j at time t (e.g., U.S. exports 24 different products to Zambia

[1] The rationale for estimation for unsuccessful candidates, according to Rose & Spiegel (2011b), is to form a valid quasi-experimental counter factual control group for Olympic hosts.

[2] They perform matching methodology for issues associated with selection bias and endogeniety (whether more open countries are more likely to bid for, or obtain hosting rights to the Olympics). Based on their Probit tests controlling for openness, country size and per capita income, they find that openness enters insignificantly throughout, suggesting that reverse causality is not an issue. They perform two kinds of matching - matching actual Olympic hosts (treatments) to candidates and matching union of hosts and candidates to non-candidates. Their results confirm that selection bias or endogeneity is not an issue.

in year 2000). The intensive margin is defined as the average volume of trade in these existing product-country trade relationships. Hence, the bilateral intensive margin is defined as the exports per product (e.g., if U.S. total exports to Zambia in year 2000 is $24,000 and it exports 24 different products, then the intensive margin is $1,000 per product). Recent literature indicates the intensive margin as the most important factor for long-run export growth (Felbermayr & Kohler (2006a), Helpman *et al.* (2008), Besedes & Prusa (2010)). Furthermore, it is found to be more important for the survival of trading relationships, especially for developing countries (Besedes & Prusa (2010), Amurgo-Pacheco & Pierola (2008)). The log-linear estimation with product level trade data reveals that the Olympic effect leads to a permanent increase in exports solely through the intensive margin of trade. In other words, hosting and bidding for mega-events leads to deepening of existing trade relationships at the product level. However, I find that the effect of hosting the Olympics on the extensive margin of exports is negative and statistically significant, implying that the Olympic effect actually leads to a decrease in new trading relationships at the product level.

Second, this chapter accounts for the presence of zero trade flows and analyzes the impact of the Olympic effect on exports. It is common in empirical analyses utilizing the gravity specification (including Rose & Spiegel (2011b)) to only use positive trade flows. However, excluding zero trade observations implies loss of information, particularly on new trading relationships (the extensive margin). The literature indicates that the presence of zero trade flows in trade data is not random (countries do not trade because the cost might be high). According to Liu (2009), this is the classic problem of sample selection bias. The coefficients obtained using only positive trade flows are estimated inconsistently. A traditional means of dealing with the presence of zero trade flows has been the Tobit model. I show, using the random effect Tobit model, that the Olympic effect with aggregate export data is not robust to accounting for zero trade flows. In fact, I find that hosts and candidates of mega-events actually experience a permanent decrease in exports.[3]

Third, this paper implements the Poisson Pseudo-Maximum Likelihood (PPML) estimation proposed by Silva & Tenreyro (2006) as an appropriate methodology to estimate the impact of the Olympic effect on trade. When the errors are heteroskedastic, the transformed errors will generally be correlated with the covariates violating an assumption of OLS. Under heteroskedasticity, the parameters of log-linearized models estimated by OLS lead to biased estimates of the true elasticities (see Liu (2009), Silva & Tenreyro (2006), and Felbermayr & Kohler (2010a)).

Utilizing the PPML estimation technique with positive trade flows, results indicate that the impact of hosting or bidding for mega-events in Rose & Spiegel (2011b) log-linear specification is highly exaggerated. Using aggregate trade data, I find that the impact of hosting for Summer Olympic Games on exports is statistically insignificant, while for *candidates* it is negative and statistically significant. In addition, while the impact on hosting the World Cup is positive and significant, the magnitude is minimal

[3]However, the Olympic effect on total exports with the disaggregated product level data manifests itself differently. I find a permanent increase in total exports for hosts and candidates. In line with Liu (2009), the random effect Tobit model is very sensitive to small differences in data or specifications.

compared to the log-linear model. The results indicate that the the Olympic effect is not robust to alternate specifications (both including and excluding zero-trade flows).

Utilizing the PPML technique for the disaggregated product level trade data, the Olympic effect on total exports remains insignificant. However, disentangling total trade at the extensive and intensive margin reveals that the total trade (at aggregate level) masks the heterogeneous impact on trade. The Olympic and World Cup hosts experience a permanent increase in exports at the intensive margin; however, they do so at the expense of the extensive margin. In other words, the Olympic effect intensifies export volume for existing product relationships while reducing the number of products exported. However, the *candidates* do not experience increases in exports at either margin (in fact the coefficients are negative for both margins).

Finally, this paper analyzes the gravity model with the fixed-effect quantile regression to examine whether the Olympic effect has heterogeneous impact on different levels of exports between country-pairs. The results obtained for the Olympic hosts are robust. The Olympic effect on total exports is insignificant at different levels of exports. The Olympic effect on the extensive margin is negative and statistically significant only for the 50th percentile or above. The results further confirm that the Olympic hosts experience a permanent increase in exports only at the intensive margin. More importantly, the Olympic effect leads to an increase in the intensive margin of exports for higher as well as lower level of exports between country-pairs.

The argument that both hosts and candidates send signals of liberalization and thereby experience a permanent increase in exports is not supported by the results. Rose & Spiegel (2011b) end with a cautious note: their argument does not explain why countries appear to vigorously compete to win the bids. This study provides some answer to the puzzle: only hosts experience a permanent increase in exports, solely through the intensive margin of trade. This implies that there might be other influences besides signaling that increases exports, or the signal that candidates send might not have been strong enough to be perceived by their trade partners.

The remainder of the paper is organized as follows: Section 2 estimates the Rose & Spiegel (2011b) empirical specification with aggregate trade data. Section 3 discusses the role of the Olympic effect on the extensive and intensive margin with positive trade flows and the log-linear model. Section 4 takes into account the presence of zero trade flows and utilizes the random effect Tobit model. Section 5 utilizes the PPML technique to estimate the Olympic effect on trade with positive trade flows and the full sample (including zero trade flows). Section 6 utilizes the fixed-effect quantile regression to assess the impact of the Olympic effect across export levels. Section 7 summarizes the main findings of the paper.

2.2 The Olympic Effect on Aggregate Exports - Positive Trade Flows

Utilizing the log-linear gravity model, Rose & Spiegel (2011b) formally analyze the impact of hosting and bidding for mega-events in terms of international trade. In this section, I implement their empirical specification analyzing aggregate trade data with various estimation strategies.

2.2.1 Empirical Specification: Log-Linear Gravity Model

Rose & Spiegel (2011b) empirically examine the two sides of the argument associated with hosting of a mega-event. Economists' skepticism about the public provision of infrastructure for sporting events arises from the notion that these events usually end up imposing large costs on their hosts that are not nearly compensated by subsequent revenues.[4] In line with Siegfried & Zimbalist (2000) and Coates & Humphreys (2003), Rose & Spiegel (2011b) state that the projects associated with mega-events are comparable to "white elephants" (e.g. poorly used facilities associated with idiosyncratic sports), built to accommodate a one-time peak in demand. Furthermore, they assert that any benefits derived from infrastructure investments could be achieved independently of the games. Proponents of the mega event argue that national reputations are affected by the experience of hosting the Olympics as they greet more tourists or gain exposure on the international stage. Preuss (2004) argues the Seoul games in 1988 were designed to raise international awareness of Korean manufactured goods, so as to promote Korean exports. Some refer to the non-pecuniary benefit of hosting mega-events, such as civic pride (e.g. Rappaport & Wilkerson (2001), Carlino & Coulson (2004), and Maennig & du Plessis (2007)).

The Rose & Spiegel (2011b) specification of the gravity model estimated by OLS is of the following form:

$$lnT_{ijt} = \beta_0 + \beta_1 Host_{it} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t + \gamma Z_{ijt} + \epsilon_{ijt} \quad (1)$$

where i denotes the exporter, j denotes the importer, and t denotes time. T_{ijt} denotes real exports value of country i to j at time t. $Host_{it}$ is a binary variable which is unity if i hosted a post-war Summer Olympic games at or before time t, and zero otherwise.[5] This variable represents the permanent export effect associated with hosting of a Summer Olympic game.[6] Imp_a are the list of importer dummies that take the value of one if a=j, and zero otherwise. Exp_b are the list of exporter dummies that take the value of one if b=i, and zero otherwise. These dummies are comprehensive sets of exporter and importer fixed effects that take into account any time-invariant country-specific factors. $Year_t$ is a year-specific fixed effect implemented to take into account any time-specific common trends or effects (e.g. business cycles, oil price shocks). The row vector Z_{ijt} represents a list of common gravity control variables (or proxies) between the bilateral country pair that are not absorbed by the fixed effects. It includes the natural logs of variables such as the bilateral distance (D_{ij}), population (Pop_{it}, Pop_{jt}), annual real GDP per capita ($GDPpc_{it}$, $GDPpc_{jt}$) and product of

[4] According to Rose & Spiegel (2011b), the opening ceremonies of the 2008 Beijing Olympic games are estimated to have cost at least $100 million when around 100 million Chinese live on less than $1/day.

[5] Dummies for the effect of hosting the World Cup are constructed the same way as the Olympic hosts.

[6] In their working paper version, Rose & Spiegel (2011b) find no consistent pattern for the significance of coefficients for the Olympic hosts when the variable was redefined to be unity only in the year of actual games, and zero otherwise. Refer to table 26 for the complete list of Summer Olympic/World Cup hosts and candidates.

the areas of the countries ($Area_{ij}$). It further includes bilateral pair dummies such as country pairs using the same currency at time t (CU_{ijt}), country pairs i and j sharing a common language ($ComLang_{ij}$), country pairs i and j having a regional trade agreement at time t (RTA_{ijt}), country pairs sharing a common land border ($ComBorder_{ij}$), number of island countries in the country pair ($Islands_{ij}$), country pairs colonized by the same country ($ComCol_{ij}$), country i colonized j at time t or vice versa (Col_{ijt}) and if country i ever colonized j or vice versa ($EverCol_{ij}$). All the gravity control variables are similar to Rose & Spiegel (2011b) specification. ϵ represents the omitted influences, assumed to be well behaved.

To ensure that the results are robust, I also implement the specification of the following form:

$$lnT_{ijt} = \beta_0 + \beta_1 Host_{it} + \sum \alpha_1 a_{ij} + \sum \alpha_2 Year_t + \gamma Z_{ijt} + \epsilon_{ijt} \tag{2}$$

where a_{ij} are a list of country pair dummies that take the value of one if i exports to j, and zero otherwise. These country pair dummies are a comprehensive set of dyadic-specific fixed effects that absorb any time-invariant characteristics common to a country pair. Inclusion of year fixed effects and country/dyadic-specific fixed effects, according to Rose & Spiegel (2011b), can be viewed as a difference-in-differences estimator. Z_{ijt} includes all the other control variables mentioned in equation (1) pertinent to the gravity model of trade. The paper further tests if the effects on trade for candidates is similar to those for hosts. Dummies for permanent effects of the candidates are constructed the same way as the Olympic and World Cup hosts. Rose & Spiegel (2011b) explain that failed candidacies form a valid quasi-experimental counter-factual control group for Olympic hosts after the inclusion of conditioning variables.

2.2.2 Data

The bilateral export (aggregate trade) data are retrieved from Rose's website. This study utilizes a panel data set that consists of observations for every 5 years beginning in 1950 and ending in 2000 for 193 countries. The countries are listed in table 28. The gravity variables, however, are retrieved from Liu's dataset.[7] According to Liu (2009), the GDP and population data are retrieved from several standard sources including the PWT 6.1, PWT 5.6, WDI 2003, Maddison Historical Statistics, International Financial Statistics (IFS) and the United Nations Yearbooks (UNSYB). Refer to table 25 for the complete description of data sources.

[7] Dr. Xuepeng Liu graciously provided me with his dataset, which is not publicly available. Liu (2009) utilizes this dataset to analyze the impact of WTO membership on aggregate imports accounting for zero trade flows. Rose's website also provides the gravity variables. However, large amount of observations are dropped in the Rose & Spiegel (2011b) analysis due to missing GDP data. Dropping of observations due to missing GDP data might not be random. Primarily, missing GDP data are associated with developing countries. Liu's dataset also contains missing GDP data, however the missing GDP data are much smaller compared to Rose dataset.

2.2.3 Empirical Results

The results from the log-linear gravity model utilizing Rose's export data, with only positive aggregate trade flows, are shown in table 1. Rose & Spiegel (2011b) utilize annual observations for 196 countries from 1950-2005 while this paper utilizes five-year intervals for 193 countries between 1950-2000. The results are presented with year effects along with two different sets of fixed effects (exporter and importer or dyadic-country pair). The coefficient of Summer Olympic host (permanent effect) on exports is statistically significant and positive.[8] Taken literally, countries that have hosted the Summer Olympic Games have exports that are permanently higher by 27% ($e^{0.24} - 1 = 27\%$) with exporter and importer fixed effects and 21% ($e^{0.19} - 1 = 21\%$) with dyadic fixed effects. These findings are consistent with that of Rose & Spiegel (2011b). They find that the exports are permanently higher by 35% with exporter and importer fixed effects and 27% with dyadic fixed effects for Summer Olympics hosts. Table 2 reports the results with the inclusion of the World Cup hosts. The effect of the Olympics host remains positive and statistically significant for both of the estimation strategies as can be seen in columns (1) and (2). The coefficient for the hosting of a World Cup is positive and statistically significant, and is higher than for the Olympics hosts.[9] Thus, the notion that hosting a mega-event permanently enhances exports is intact and is in line with the Rose & Spiegel (2011b) results. Table 3 compares trade patterns of host countries with the inclusion of the candidates. The impact of both hosts and candidates on permanent exports are statistically significant, positive and large.

Based on similar permanent increase in exports experienced by hosts and bidders alike, Rose & Spiegel (2011b) argue that a country that wishes to liberalize its trade might want to signal this by bidding to host a mega-event. In doing so, they postulate that it generates extra trade-related investment. They argue that these bids are good signals because it creates a political atmosphere where back-sliding on either trade liberalization or mega-events becomes difficult. In their paper, Rose & Spiegel (2011b) consider a signal of a "burning money" type, not informative in its own sense, but informative due to the fact that sending a signal is only attractive to a set of countries that sincerely intends to pursue liberalization.

[8] In their working paper version, Rose & Spiegel (2011b) also estimate the impact of hosting Winter Olympic games. However, they do not find strong effects of hosting the Winter games on exports as the coefficients are small and statistically insignificant (especially after including either of the fixed effects). They mention that this result is not particularly surprising as the scale of the Winter Games has always been dwarfed by those of the Summer games, and the geographic requirements of the Winter games place more constraints on potential hosts. Furthermore, they mention that with a few exceptions, the Winter games have tended to be held in relatively small towns, often those considered to be winter resorts (especially early on). Hence in their current paper and mine, only the impact of Summer Olympics on exports is taken into account.

[9] Since there is a considerable amount of overlap between Olympics and the World Cup hosts, perhaps some impact of hosting the Olympics on exports might have been captured by the World Cup hosts. For example, Mexico, Germany, U.K., Spain, Italy and the U.S. have hosted both of the mega-events by 2000.

2.3 The Extensive and Intensive Margin : Log-Linear Gravity Model

In recent years, the theoretical models of trade have ushered into the "new trade theory" that emphasizes firm-level productivity differences in trade structure. Recent studies such as Helpman *et al.* (2008) incorporate firm-level heterogeneity and advocate for the decomposition of trade volume into the extensive and intensive margin. This chapter builds on the Rose & Spiegel (2011b) specification by inquiring whether this Olympic effect leads to new trading relationships (the extensive margin) or an increase in trade in existing relationships (the intensive margin). Various studies have analyzed the impact of trade liberalization on these two margins, notably Melitz (2003) and Chaney (2008). Theoretical predictions of Melitz (2003) and Chaney (2008) indicate that decline in variable trade costs (e.g. reduction in tariffs) increases the extensive as well as the intensive margin. Furthermore, Chaney (2008) shows that a reduction in fixed costs (e.g. information costs) affects only the extensive margin. Hence, if the Olympic effect is purely a signaling effect, as argued by Rose & Spiegel (2011b), where trade liberalization leads to the reduction of variable costs, we should see an increase in the extensive as well as the intensive margin. Proponents of mega-events (such as Preuss (2004) and International Olympic Committee) argue that hosts receive exposure on the international stage. This exposure supposedly increases international awareness of their product and market, also known as the visibility effect, leading to increased exports. This argument implies a reduction in fixed costs due to a decrease in information costs for exporters. In this case, we should see an increase solely on the extensive margin.

Recent studies indicate the importance of the intensive margin of trade for long-run export growth. Besedes & Prusa (2010) argue that the survival of trading relationships is important for long-run export growth, and that the majority of growth in exports occurs at the intensive margin. Moreover, there is relatively less export persistence in developing countries, implying a critical part of improved export growth for developing countries may be focusing on existing relationships. Felbermayr & Kohler (2006a) postulate that the intensive margin historically explains the majority of export growth, leaving room for the extensive margin to increase in importance for future export growth. Helpman *et al.* (2008) find that the majority of the growth in trade since 1970 occurred between countries that had an existing trade relationship, implying the intensive margin is the most important component of export growth. Amurgo-Pacheco & Pierola (2008) also find that export growth is primarily determined along the intensive margin, especially for developed economies. Given the importance of the intensive margin for long-run growth, if bidding for or hosting mega-events increases the intensive margin significantly then it could be an appealing avenue for long-run export growth, especially for developing countries.

Recent studies have also illustrated the importance of the extensive margin or export diversification. Export diversification, or a broader export basket, reduces the risks of balance of payments crises and large fluctuations in domestic output aftershocks that can negatively affect the performance of the external sector, such as price fluctuations in international markets or output swings in trading partners (Agosin (2007), Lederman & Maloney (2003)). Feenstra & Kee (2008) suggest that increases

in sectoral export variety boost country productivity as the new exporting basket can improve the use and allocative efficiency of the economy. Hummels & Klenow (2005) indicate that export growth, based solely on the intensive margin can have terms-of-trade effects, especially for large economies which can be reduced by broadening the exporting base of the country.

In terms of aggregate trade data, the extensive margin of trade can only be captured by accounting for zero trade flows in the data. For example, assume that the U.S. never exported to Zambia until 1985, and starts exporting from 1986 onwards. This generally constitutes an increase in the country-level extensive margin of trade (or increase in trading partners). However, with disaggregated data one can calculate the extensive margin even with positive trade flows. For example, an increase in the extensive margin could also be realized, if the U.S. exported 24 different products to Zambia compared to 15 products the previous year.

2.3.1 Empirical Specification

In this section I utilize disaggregated data at the four-digit Standard International Trade Classification (SITC) Revision 2 product level to construct a measure of the two margins. The methodology applied in this paper to analyze the two margins of exports is commonly referred to as the count method. Previous studies, such as those of Nitsch & Pisu (2008), Bernard *et al.* (2007), Flam & Nordstrm (2006), and Dutt *et al.* (2011), have adopted a similar methodology to decompose total trade into the extensive and the intensive margin. In the traditional log-linear form, the decomposition of total exports can be expressed as follows:

$$ln(T_{ijt}) = ln(N_{ijt}) + ln(\frac{T_{ijt}}{N_{ijt}}) \tag{3}$$

where T_{ijt}, the real aggregate bilateral exports (sum of total exports for all products for a given year) or total exports between a country pair is decomposed into two different dependent variables (N_{ijt} and $\frac{T_{ijt}}{N_{ijt}}$). N_{ijt} (the extensive margin) is the number of products exported per year per country pair and $\frac{T_{ijt}}{N_{ijt}}$ (the intensive margin) is the average volume of exports per product per year. Utilizing the log-linear gravity model specification, total exports can be expressed by the following estimation equation :

$$lnT_{ijt} = \beta_0 + \beta_1 Host_{it} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t + \gamma Z_{ijt} + \epsilon_{ijt} \tag{4}$$

The estimation equation for the extensive margin of exports (or the number of products exported) is given as :

$$lnN_{ijt} = \beta_0 + \beta_1 Host_{it} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t + \gamma Z_{ijt} + \epsilon_{ijt} \tag{5}$$

and for the intensive margin (or the average volume of exports per product) is given as :

$$ln(\frac{T_{ijt}}{N_{ijt}}) = \beta_0 + \beta_1 Host_{it} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t + \gamma Z_{ijt} + \epsilon_{ijt} \quad (6)$$

I further estimate the role of the extensive and the intensive margin with a comprehensive set of dyadic-specific fixed effects similar to equation (2) .[10]

There are alternative means of constructing the extensive and the intensive margin of trade, but these methods require data at the firm level.[11] This study acknowledges that there might be some limitations to the count method of constructing the two margins. According to Baldwin & Nino (2006), each of the product categories encompass a range of individual goods, so one cannot hope to pick up the full extensive margin. Hence, this measure cannot ascertain the full link between the Olympic effect and the number of varieties as some changes in the intensive margin may capture changes in the extensive margin.

2.3.2 Data

The disaggregated product level export data is based on the 4-digit Standard International Trade Classification (SITC), Revision 2. SITC is a system that encodes all internationally traded products. The system makes it easier for compiling and also promoting the comparability of international trade statistics. There are 1,249 tradable product categories under this classification. The data is retrieved from the World Integrated Trade Solution (WITS) database. Within WITS, the dataset is retrieved from the United Nations Statistics Division (UNSD) Comtrade database. This dataset is used in the analysis for the extensive and the intensive margins of trade. The level of disaggregation affects the extensive margin between countries as there are data available at finer level of classification. However, there are measurement errors associated with finer level of disaggregation and furthermore the choice of the 4-digit classification was made to ensure that the data coverage is the longest possible (e.g. 1962 onwards). The data set consists of exports for 193 countries spanning from 1965-2000 for every five years.[12] The rest of the data for gravity variables are retrieved from the Liu dataset.

[10] Variable Z includes all the pertinent control variables for the gravity model of trade.

[11] An alternative measure of the margins at the product level is used by Hummels & Klenow (2005). They define the extensive margin as a weighted count of the categories in which a country exports relative to the categories exported by the rest of the world. The intensive margin is defined as the nominal exports from a country, relative to the nominal exports from the rest of the world in the categories that the country also exports. Hence, the extensive margin can be viewed as a measure of diversification and the intensive margin as a measure of trade volume. Dutt *et al.* (2011) mention that the count method and the Hummels & Klenow (2005) method of extensive and intensive margins are comparable with each other. In their study they find the correlation of the extensive margin between the count and the Hummels & Klenow (2005) method to be around 0.86, and the correlation between the intensive margins to be around 0.88.

[12] The data set for UN Comtrade begins from 1962 onwards. Refer to appendix table **??** for further description of the dataset.

2.3.3 Empirical Results

Table 2 tabulates results for the impact of hosting (and candidacy of) mega-events utilizing disaggregated exports data. Table 4 reports the results for the extensive and intensive margin of exports for Summer Olympic hosts. The coefficient on total exports is sensitive to different estimation strategies. With the exporter and importer fixed effect, the results indicate that the countries that have hosted the Summer Olympic games have exports that are permanently higher by 12%. With the country-pair fixed effects, the coefficient on Summer Olympic hosts is positive but statistically insignificant. However, the intensive margin of exports is positive, economically significant, and is robust to both estimation techniques. The hosting of the Summer Olympic Games leads to higher exports at the intensive margin on average by about 26%. In other words, the Olympic hosts experience an increase of 26% on the average volume of exports per product with existing relationships, indicating the deepening of trade relationships at the product level.

The coefficient on the extensive margin of exports is negative, statistically significant, and robust to both exporter and importer or country-pair fixed effects. Olympic hosts experience a permanent decrease in the extensive margin of exports on average by about 13%. In other words, the Olympics host exports on average 13% fewer varieties of products between country pairs. This result suggests that the Olympic effect does not induce (in fact it reduces) trade in products not previously traded by a country pair. Hence the visibility argument proposed by Preuss (2004) and the International Olympic Committee is not supported by the results. The results indicate that the Olympic effect on exports is realized entirely through the intensive margin at the expense of the extensive margin, which is at odds with the argument.

Rose & Spiegel (2011b) findings indicate that the trade-expanding effects of hosting an event like the Olympics are broadly comparable to those associated with hosting the FIFA World Cup. To test whether this finding extends to our data set and more importantly to the extensive and intensive margin of trade, I also include the World Cup hosts in the equation. Table 5 reports the results with the inclusion of the World Cup hosts. The coefficient on World Cup hosts is significant and positive and is robust to each estimation strategy. Similar to the Olympic hosts, the coefficient on the intensive margin of trade is positive and statistically significant, while the coefficient on the extensive margin of exports is negative and statistically significant.

Next I compare the trade patterns of Olympic hosts with candidates.[13] The results are tabulated in table 6 . The coefficient on total exports for candidates is positive and significant with the exporter and importer fixed effect, although insignificant with the country-pair fixed effect. In addition, the results indicate that the positive and permanent effect on trade is realized entirely through the intensive margin of trade, which is positive and significant with both estimation strategies. Similar to the hosts, the coefficient on the extensive margin is negative although statistically insignificant, for the candidates.

[13] Rose & Spiegel (2011b) mention that in contrast to the Olympics, there has been relatively little competition to host the World Cup, so one cannot plausibly compare hosts and unsuccessful candidates for the World Cup.

Hence, the result with the log-linear specification indicates that the Olympic effect leads to an increase in total imports, although it is insignificant with country-pair fixed effects. Furthermore, it leads to a permanent increase in the intensive margin of exports at the expense of the extensive margin of exports.

2.4 Olympic Effect on Trade: The Presence of Zero Trade Flows- Full Sample

Results from the log-linear regression with positive trade flows indicated a positive impact of the Olympic effect on the total and the intensive margin of exports with a negative impact on the extensive margin. With only positive trade flows, perhaps the failure to account for zero trade flows underestimated the role of the Olympic effect at the extensive margin. Similarly, the positive impact on total exports and the intensive margin might have been exaggerated. Selection bias occurs when a subset of the data is systematically excluded due to a particular characteristic. According to Liu (2009) and Helpman *et al.* (2008), the presence of zero trade flows in trade data is not random, as it is conditioned upon various factors such as distance and trade costs. According to Wooldridge (2006) and Heckman (1979), if the sample selection is based on the value of the dependent variable, then the parameters of the estimated model will always be biased if estimated with OLS. Hence, with only positive trade flows, the gravity model has endogenous sample selection issues.

In this section, I take into account the presence of zero trade flows in the data to correct for the sample selection issues. Coefficient estimates from log-linear regressions are inconsistent when a large number of zero trade flows are present in the data. Hence I implement an ad hoc modification of the gravity model where the zero trade flows are treated as a corner solution estimated by the random effect Tobit model.

2.5 Non-Linear Gravity Model of Trade - Full Sample

Traditionally when large numbers of zeros are present in the data, a standard Tobit model is applied, treating zero trade flows as a corner solution problem. This is a special case of censored regression (censored towards the left).

Assume a traditional gravity model where exports from country i to j are denoted by T_{ij}. To account for zero trade flows a common methodology is to substitute $ln(T)$ with $ln(T+1)$ to keep zero trade values after the logarithm transformation. As presented in Liu (2009), the standard censored Tobit model assumes that:

$$T^* = Z\beta + \mu, \mu|Z \sim Normal(0, \sigma^2) \tag{7}$$

where T^* is the latent exports variable and Z are the regressors. Based on the law of iterated expectations, we can express equation (7) as the following:

$$E(T|Z) = P(T > 0|Z) * E(T|Z, T > 0) \tag{8}$$

where $P(T > 0|Z)$ is the conditional probability based on the notion that we have positive trade flows. The classic problem of sample selection bias arises from the fact that most literature (such as that of Rose & Spiegel (2011b)) only considers

$E(T|Z, T > 0)$. The equation (8) can be further broken down, assuming that the conditional probability of positive trade follows a standard Probit model (e.g., $P(T > 0|Z) = \Phi(\frac{Z\beta}{\sigma})$), into:

$$E(T|Z, T > 0) = Z\beta \quad +\sigma \left[\frac{\phi\left(\frac{Z\beta}{\sigma}\right)}{\Phi\left(\frac{Z\beta}{\sigma}\right)} \right] = Z\beta + \sigma\lambda\left(\frac{Z\beta}{\sigma}\right) \tag{9}$$

Hence, we have

$$E(T|Z) = \left(\frac{Z\beta}{\sigma}\right) Z\beta + \sigma\phi\left(\frac{Z\beta}{\sigma}\right) \tag{10}$$

With only positive trade flows, according to Liu (2009), the classic OLS estimation of a log linear gravity model omits the variable $\lambda(\frac{Z\beta}{\sigma})$ in equation (9) . The correlation that exists between λ and Z is the reason for the inconsistent estimation of the parameters.[14]

2.5.1 Data

Past studies that account for zero trade flows typically assume that the country pairs not covered in the dataset have zero bilateral trade (e.g. Felbermayr & Kohler (2006a)). However, according to Liu (2009), on average for any given year, one third of countries have missing data. Hence, it is likely that more missing positive trade flows are incorrectly assigned as zero during the earlier years than latter years. The consequence of incorrectly assigning zero values to missing trade data is non-trivial and leads to biased estimates. Liu (2009) further mentions that if this error is positively correlated with the impact variable (Olympic host dummy in my case), it will lead to an overestimation of the role of the impact variable at the extensive margin.

To minimize such errors while accounting for zero trade flows in the dataset (for both aggregate and disaggregated dataset), this study matches the zero trade flows with Liu's trade dataset. Liu (2009) mentions that zero observations in his dataset are systematically recorded accounting for more than 50% of the dataset. He retrieves trade data from various sources to minimize the error associated with incorrectly assigning zero values for missing data.[15] The trade data from UN Comtrade does not report zero trade flows but those categories are omitted from the trade data

[14] Another alternative to the Tobit model that has gained tract in recent empirics is the Helpman *et al.* (2008) two-stage estimation procedure. The estimation applies a Heckman-sample selection procedure. According to Liu (2009), even though this model is better suited to explain zero trade flows than the traditional gravity model, for identification purpose, however Helpman *et al.* (2008) assume that the common religion variable affects the probability of having positive trade flows (selection equation), but does not affect trade volumes (outcome equation). Liu (2009) mentions that the validity of this exclusion condition is often hard to justify and the difficulty to find good instruments might be a concern of their proposed two-stage procedure.

[15] He uses trade data retrieved from the World Export Data (WED); the World Trade Flows (WTF) dataset and the original IFS Direction of Trade Statistics (DOT) dataset.

altogether.[16] The positive trade data for aggregate and disaggregate trade flows are the same as described in Section 2.2 and Section 3.2, respectively.

2.5.2 Empirical Results : Random Effects Tobit Regression

Table 7 reports the results with the random effect Tobit regression for aggregate exports.[17] According to Liu (2009), as a rule of thumb, the coefficients from the Tobit model should be multiplied by the share of non-zero observations (43% in my sample) when compared with the coefficients from the OLS regressions. Taken literally, when a country hosts a Summer Olympic game, it experiences a permanent *decrease* in trade on average by 32% ($e^{-0.90*43\%} - 1$). In contrast, the results from the log-linear regression with positive trade flows (Table 1) indicate that hosting the Olympics permanently *increases* exports on average by 24%. Thus the result suggests that the Olympic effect on total aggregate exports is not robust with zero trade flows.

Table 8 reports the results with the inclusion of the World Cup hosts. Coefficients on both the hosts are negative and statistically significant. The results indicate that Olympics and World Cup hosts experience a permanent decrease in exports on average of 26%. The results obtained from the log-linear model (table 2) indicated that, on average, the hosts experienced a permanent increase in exports. Table 9 reports the results with the inclusion of the Summer Olympic candidates. In contrast to the log-linear gravity model with positive trade flows, the random effect Tobit regression indicates that hosting (and bidding for) mega-events actually results in a permanent decrease in exports. The general conclusion is that the Olympic effect on total aggregate exports is not robust to the inclusion of zero trade flows. In fact, the results from the random effect Tobit regression for aggregate exports indicates that the Olympic effect is actually negative and permanent.

Once we turn to the analysis using disaggregate trade data accounting for the extensive and intensive margin of trade, the coefficients on the variables for total exports become positive and statistically significant (tables 10, 11 and 12). Taken literally, countries that have hosted the Summer Olympic games have exports that are permanently higher by 9% compared to 12% for log-linear model (table 4). However, the effect on exports at the extensive and intensive margin turns out to be statistically insignificant. Table11 indicates that World Cup hosts experience similar increases in exports, with a minimal increase in exports at the intensive margin. Table 12 reports the results with the inclusion of the candidates. Both hosts and candidates experience a permanent increase in total exports. The results further indicate that the candidates actually experience a permanent decrease in the intensive margin of exports, with a permanent increase in the extensive margin.

These results indicate that the Olympic effect with Tobit regression is not robust. In line with the findings of Liu (2009), random effect Tobit regressions are very

[16] Liu dataset only has either positive or zero trade flows in his dataset. The rest are assumed to be missing trade. This paper matches the zero trade and missing trade flows according to Liu dataset to minimize error for attributing zeros to missing trade.

[17] Fixed effect Tobit estimation is not available. There is no sufficient statistic allowing the fixed effect to be conditioned out on the likelihood (Liu (2009)).

sensitive to small differences in data or specifications. He mentions that the Tobit model hinges crucially on the assumption of homoskedasticity and normality.[18] Hence according to Liu (2009) and Felbermayr & Kohler (2010a), the Tobit model might be even more inconsistent than the OLS in the presence of heteroskedastic and non-normal residuals. The test for normality and homoskedasticity on the residual from the Tobit regression cannot be performed, as one cannot observe the latent variable (T^* in equation (7)). Hence the paper reverts to the Poisson regression as a suitable means to deal with zero trade flows.

2.6 Gravity Model and Econometric Issues: An Alternative Specification - The Poisson Model

Recent empirical trade literature indicates that the traditional log-linear gravity model leads to inconsistent estimates in the presence of heteroskedastic residuals. Various literatures have proposed the Poisson regression as an alternative solution, notably Flowerdew & Aitkin (1982) and more recently by Silva & Tenreyro (2006). To illustrate the problem, assume a traditional gravity model of trade in its simplest form where exports from country i to j, denoted by T_{ij}, is proportional to the product of the two countries' GDP (indicated by Y_i andY_j) and inversely proportional to the distance (D_{ij}) between them. The stochastic version of the model takes the following form:

$$T_{ij} = \lambda_0 Y_i^{\lambda 1} Y_j^{\lambda 2} D_{ij}^{\lambda 3} \epsilon_{ij} \tag{11}$$

where ϵ_{ij} represents the random component of the specification with $E(\epsilon_{ij}|Y_i, Y_j, D_{ij})$ = 1 and assumed to be independent of the regressors. Hence, the expected value of the trade flow can be written as the following equation:

$$E(T_{ij}|Y_i, Y_j, D_{ij}) = \lambda_0 Y_i^{\lambda 1} Y_j^{\lambda 2} D_{ij}^{\lambda 3} \tag{12}$$

Traditionally, equation (11) is log-linearized and the parameters are estimated using the least-squares method. Hence, we have the specification of the following form:

$$lnT_{ij} = ln\lambda_0 + \lambda_1 lnY_i + \lambda_2 lnY_j + \lambda_3 lnD_{ij} + ln\epsilon_{ij} \tag{13}$$

According to Silva & Tenreyro (2006), the validity of this specification depends critically on the assumption that ϵ_{ij} and $ln\epsilon_{ij}$ are independent of the regressors. Jensen's inequality states that the expected value of the log of a random variable is not equal to the log of its expected value ($i.e., E(lnT) \neq lnE(T)$), but also depends on the higher-order moments of its distribution. Hence, if the variance of the error term ϵ_{ij} in equation (11) depends on GDP or distance, then the expected value of $ln\epsilon_{ij}$ will also depend on the regressors, violating the condition for consistency of OLS. Consistent with their argument, they find overwhelming evidence that the error term in

[18] Refer to equation(7) . See also Felbermayr & Kohler (2006a) about the crucial assumptions of the Tobit model.

the usual log-linear specification of the gravity equation are heteroskedastic, leading to inconsistent estimates of elasticities of the interest variables.

Silva & Tenreyro (2006) explore the property of ϵ_{ij} based on the characteristics of the trade data. They postulate that in a traditional log-linear gravity model where T_{ij} is non-negative, when $E(T_{ij}|Z(covariates))$ approaches 0, the probability of T_{ij} being positive must also approach 0. This implies that $V(T_{ij}|Z)$, the conditional variance of T_{ij}, tends to diminish as $E(T_{ij}|Z)$ approaches 0. In other words, when $E(T_{ij}|Z)$ is close to its lower bound it is highly unlikely that large values of trade are observed, and, as they cannot be offset by equally large deviations in the opposite direction (trade cannot be negative), the variance also tends to diminish accordingly (leading to small dispersion around the mean). Similarly, on the other hand, when the expected value of T_{ij} is far away from its lower bound, it is possible to observe large deviations from the conditional mean in either direction, leading to greater dispersion. Thus, according to Silva & Tenreyro (2006) in practice ϵ_{ij}, will generally be heteroskedastic and its variance will depend on the covariates. They mention that heteroskedasticity is critical not only for efficiency but also for its consistency, as regressions produce the estimate of $ln(T)$ rather than T itself. Hence, they suggest the gravity equation be estimated in the multiplicative form (without taking logarithm of T_{ij}) and allowing for heteroskedasticity. Using nonparametric tests, Henderson & Millimet (2008) confirm that the concerns over estimation in levels versus logs, posed in Silva & Tenreyro (2006), are well-founded.

The common assumption of the PPML estimation method is that the conditional variance is proportional to the conditional mean, i.e., $E(T_{ij}|Z) \propto V(T_{ij}|Z)$, although the Poisson model is consistent even when the variance function is mis-specified.[19] According to Silva & Tenreyro (2006), even if $E(T_{ij}|Z) \propto V(T_{ij}|Z)$ does not hold, the PPML estimator is likely to be more efficient than other estimators (i.e., non-linear least square estimators) when heteroskedasticity increases with the conditional mean. All that is needed for this estimator to be consistent is the correct specification of the conditional mean. Therefore, the data do not have to be Poisson at all, and the dependent variable need not be an integer for the estimator to be consistent. This is the well-known pseudo-maximum likelihood (PML) result first noted by Gourieroux *et al.* (1984). There are various alternatives to estimate the gravity equation multiplicatively, such as nonlinear least squares (NLS) and the Gamma Quasi-Maximum Likelihood estimator (GQMLE).[20]

[19] Silva & Tenreyro (2006) justify the hypothesis that conditional variance is proportional to the conditional mean for the Poisson Model. According to Winkelmann (2008), a maximum-likelihood estimator is called a pseudo maximum-likelihood estimator if it remains consistent even if the likelihood function is misspecified.

[20] According to Liu (2009), NLS provides more weight to large predicted trade observations in its first order condition. By contrast, GQMLE assumes that the conditional variance is proportional to the square of conditional mean and hence gives less weight to large predicted trade flows. According to Silva & Tenreyro (2006), there seems to be a substantial trade-off between the quantity of data and their variances since larger trade flows and GDP usually have smaller measurement errors with larger variances. The first order conditions of the Poisson model give the same weight to all observations. They suggest (based on a simulation study) that the Poisson model performs remarkably better than the other models under heteroskedasticity.

As emphasized by Wooldridge (2002), the dependent variable for PPML estimation does not have to be count data, and the fixed effect Poisson estimator works whenever the conditional mean assumption holds. Hence, the dependent variables could be a nonnegative continuous variable. The random effect Poisson model needs additional maintained assumptions for efficiency against the fixed effect Poisson model. The Hausman specification test, however, rejects the random effect model in favor of the fixed effect model. Hence, the fixed effect Poisson model is used in this analysis.

2.6.1 Empirical Specification: The Poisson Model

The gravity equation is now estimated multiplicatively (in levels) allowing for heteroskedasticity. Based on the commonly used conditional mean specification ($E(T_{ijt}|Z_{ijt})= exp(Z_{ijt}\beta)$) in the Poisson Model, I have the specification of the following form for the aggregate trade data:

$$T_{ijt} = exp(\beta_0 + \beta_1 Host_{it} + \sum \alpha_1 a_{ij} + \sum \alpha_2 Year_t + \gamma Z_{ijt}) + \epsilon_{ijt} \tag{14}$$

This paper employs the Poisson fixed effect estimator (country pair fixed effect), with robust clustered standard errors and year fixed effects. The coefficient can be explained as elasticity if the dependent variable (T_{ijt}) is in levels and the covariates are in logarithms. Compared to equation(2) , T_{ijt} represents real bilateral exports for a country pair in a given year in levels.[21] Furthermore, this paper also employs the Poisson specification with importer and exporter fixed effects to ensure that the results are not sensitive to different estimation strategies. Hence, I also implement specification of the following form:

$$\begin{aligned} T_{ijt} &= exp(\beta_0 + \beta_1 Host_{it} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t + \gamma Z_{ijt}) \\ &+ \epsilon_{ijt} \end{aligned} \tag{15}$$

To account for the role of extensive and intensive margin of trade (using disaggregated data) with a non-linear Poisson model, the decomposition of T_{ijt} (total exports) can be expressed as follows:

$$(T_{ijt}) = (N_{ijt}) * \left(\frac{T_{ijt}}{N_{ijt}}\right) \tag{16}$$

where T_{ijt}, the real aggregate bilateral exports, is decomposed into (N_{ijt} and $\frac{T_{ijt}}{N_{ijt}}$). N_{ijt} is the extensive margin, and $\frac{T_{ijt}}{N_{ijt}}$ is the intensive margin of exports. The estimation equation for the extensive margin of exports or the number of products exported with country-pair fixed effect is given as :

$$N_{ijt} = exp(\beta_0 + \beta_1 Host_{i,t} + \sum \alpha_1 a_{ij} + \sum \alpha_2 Year_t + \gamma Z_{ijt}) + \epsilon_{ijt} \tag{17}$$

[21] Refer to equations (1) and (2) for elaborate discussion on the variables. Z_{ijt} represents all other gravity control variables.

and the estimation equation for the intensive margin or the average volume of exports per product is given as :

$$(\frac{T_{ijt}}{N_{ijt}}) = exp(\beta_0 + \beta_1 Host_{it} + \sum \alpha_1 a_{ij} + \sum \alpha_2 Year_t + \gamma Z_{ijt}) + \epsilon_{ijt} \tag{18}$$

I further estimate the role of the extensive and intensive margin by employing exporter and importer fixed effect Poisson estimation. It also employs the Poisson model to account for the presence of zero trade flows.[22] Accounting for zero trade flows is not only a more appropriate specification, it also allows for a natural way to examine whether new trading relationships were generated by the Olympic effect. In other words, with zero trade flows we can account for country pairs that did not trade initially, but started to trade after a country hosted a mega-event.

2.6.2 Empirical Results : The Poisson Model with Aggregate Exports

The results from the Poisson regressions for aggregate positive trade flows are reported in table 13 .[23] The coefficient on Summer Olympic host is negative but statistically insignificant with importer and exporter fixed effects and negative and statistically significant with country-pair fixed effects. In other words, countries actually experience a decrease in total aggregate exports from hosting the Olympic games. This is in stark contrast to the result obtained from table 1 (log-linear model) where the hosts experienced a permanent increase of exports on average by 24%.

With the aggregate trade data, the result reinforces the claim by Silva & Tenreyro (2006) that if the variance of ϵ_{ijt} depends on the regressors such as GDP, the conditional expectation of $ln(\epsilon_{ijt})$ will also depend on GDP leading to biased estimates of the true elasticity if estimated by OLS. Silva & Tenreyro (2006) mention that the bias tends to be positive for the coefficients on variables (e.g. GDP) that relate to larger volumes of trade and, presumably, to larger variance. Since the host countries (or bidders) have larger GDPs on average compared to non-hosts (or non-bidders), if the variance of the error term increases with GDP, then the error term exhibits higher variance also for the host dummy.[24] Hence, the higher order moments of the error term would be related to the host dummy, leading to biased and exaggerated OLS estimates. The results remain robust to accounting for the presence of zero trade flows (full sample) as illustrated by the panel on table 13 . This suggests that, in this case, heteroskedasticity rather than sample selection is responsible for the disparity between the PPML results and that of OLS with positive trade flows. I tested for the presence of heteroskedasticity in the data with the modified Wald test for group-wise heteroskedasticity for the residuals in the fixed-effect regression model. The null hy-

[22] The dataset utilized are the same as before. Refer to Sections 2.2, 3.2 and 4.2 for further illustration on aggregate data, disaggregate data and with zero trade flows respectively.

[23] Observations are dropped if there is only one observation per group for the country pair fixed effect estimation; hence this estimation tends to have fewer observations than the one with importer and exporter fixed effects.

[24] In my data, the average log(GDP) for all countries is 10.10, while the average log(GDP) of hosts and bidders are 13.43 and 13.08 respectively.

pothesis of homoscedasticity is rejected by the data.[25] Hence, the Olympic effect is not robust to specification and sample selection issues.

Table 14 reports the results with the inclusion of the World Cup hosts. Unlike the Olympic hosts, the coefficient on World Cup hosts is positive and statistically significant, and the result is robust with both fixed effects. Taken literally, hosting of the World Cup permanently increases exports by around 7%($e^{0.07}-1$). The magnitude of permanent increase in exports for the Olympics and the World Cup host was 9% and 40%, respectively, for the log-linear model (table 2) with country-pair fixed effects. This result further reinforces the argument that the coefficient with the log-linear model was highly exaggerated. The panel on table 14 also reports the result with the full sample. The result does not change significantly compared to the Poisson regression with positive trade flows, further reinforcing the notion that heteroskedasticity rather than sample selection is responsible for the disparity between the results for PPML and that of OLS.

Table 15 compares the trade patterns of Olympics hosts with candidates. The effect of hosting the Olympics on total aggregate exports is statistically insignificant, compared to a permanent increase of 16% with the log-linear model (table 3 with country pair fixed effects).[26] However the effect on candidates is negative and statistically significant. Results indicate that the candidates experience a permanent decrease in exports on average by 7%, compared to a permanent increase of 38% with the log-linear model. The general result for the Poisson regression extends to the specification with the full sample. The general implication is that the traditional log-linear model produces biased estimates, which in our case means that the role of the Olympic effect (hosts and candidates) has been exaggerated. A plausible argument as to why hosting (or bidding) could have negative impact on exports would be that there is significant costs (e.g. investment in infrastructure) to hosting and bidding for the Olympic games.[27] These substantial costs have to be financed by the government, potentially through taxation. This increase in taxation could constrain the financial sector of the economy. Furthermore, hosting of mega-events entails significant diversion of attention and resources for the government (e.g. building of idiosyncratic sporting facilities) from other investments (e.g. other infrastructure investments, or policies conducive to trade).

2.6.3 Empirical Results : The Poisson Model with the Extensive and the Intensive Margin of Exports

Turning to table 6, the paper reports the results for the role of extensive and intensive margins of trade with country pair fixed effects. Table 16 indicates that the impact

[25] I conducted the test for the residuals from table 2 . I obtained a test statistic of 2.9e+36 and a p-value of 0. Hence, there was overwhelming evidence indicating heteroskedasticity in my data.

[26] The coefficients on Olympic hosts are negative but statistically insignificant for both of the estimation strategies.

[27] According to Rose & Spiegel (2011b), the candidate cities that could be potential hosts are nominated by IOC after a phase of about ten months on the basis of questionnaire and technical assessments. The relevant criteria for assessment include: government support, public opinion, general infrastructure, security, venues, accommodation and transport.

of hosting Summer Olympic games on total exports is negative and statistically significant. However, results for the extensive and the intensive margin of trade reveals a different story. The results indicate that total trade masks significant heterogeneity in terms of the impact of hosting the Summer games. Olympic hosts do experience a permanently higher impact on exports at the intensive margin of about 75%. The magnitude for the Poisson specification is almost thrice compared to the log-linear model (21%). In other words, there is substantial deepening of existing trade relationships at the product level for Olympic hosts. However, hosts experience a permanent decrease in the extensive margin of exports by 10% compared to a decrease of 14% with the log-linear model (table 4). Based on the results, hosting the Olympics does not enhance trade in products not previously traded by a country pair and is robust to both of the specifications. With the full sample (table 16 , right panel), the results indicate that the Olympic hosts experience a permanent increase of exports at the intensive margin by 58% (compared to 75% with the positive trade flows). However, the positive and significant impact of the Olympics on the intensive margin is robust to both positive trade flows and full sample. Similarly, the results remain robust for the extensive margin even after accounting for zero trade flows further reinforcing the notion that the Olympic effect does not contribute to the extensive margin. On average, the hosts experience a permanent decrease in the number of products exported (extensive margin) by 11%.

Table17 reports the results with the inclusion of the World Cup hosts. The World Cup hosts experience a permanent increase in total exports by 7%. The results indicate that there exists heterogeneity among the type of mega-events and its impact on total exports. The results further indicate that both the Olympic and World Cup hosts experience permanently higher exports through the intensive margin of trade at the expense of the extensive margin. The Olympics and World Cup hosts have exports at the intensive margin that are permanently higher by 60% and 28% respectively. For the extensive margin, the Olympic and the World Cup hosts have exports that are permanently lower by 9% and 5% respectively. The results remain robust to the full sample, further reinforcing the notion that the extensive margin did not contribute to the permanent increase in exports.

Table 18 compares whether the hosts experience trade patterns that are any different from the candidates. The coefficients on both the hosts and candidates for total exports are negative and statistically significant. The Poisson regression indicates a permanent decrease in total exports for hosts and candidates by 10% and 11% respectively. In contrast to the log-linear model (table 6), the Poisson results indicate that only hosts of the Summer Olympic Games experience a positive impact on exports at the intensive margin. At the intensive margin, the hosts experience a permanent increase in exports by 77% (25% for log-linear model) and the candidates experience a permanent decrease in exports by 23% (7% increase for log-linear model). Both the hosts and candidates experience a permanent decrease of exports at the extensive margin. These results for Poisson regression with positive trade flows extends to the full sample. These results are in contrast to the one obtained by Rose & Spiegel (2011b), suggesting that there might be an additional effect in conjunction to the signaling effect that leads to permanent increase in exports for the hosts, or

perhaps the signal sent by the candidates are not strong enough to be perceived by their bilateral trade partners.

Table 7 reports the results with the exporter and importer fixed effects and are similar to those in table 6. The key difference is that the Olympic effect on total aggregate exports is not significant (table 19) with positive trade flows and with the inclusion of candidates (table 21).[28]

Rose & Spiegel (2011a) claim that while hosting the games is sufficient to boost trade, it is not necessary. However, the argument that both hosts and candidates alike send signals of liberalization and thereby experience a permanent increase in exports is not supported by the results obtained in this study. Similarly, the result is also in contrast to the argument put forth by Preuss (2004), where hosting the mega-event supposedly improves international relations as well as raises international awareness of their market, promoting trade ties.

2.7 Sensitivity Analysis - Fixed Effects Quantile Regression

In this section, I analyze the gravity model with the fixed-effect quantile regression to examine whether the Olympic effect has a heterogeneous impact on different levels of export volumes. Instead of concentrating at the conditional mean of the sample distribution, quantile regression provides the estimates at different quantiles of the conditional distribution. In terms of this paper, quantile regression allows me to analyze how hosting the Olympic Games affects exports that vary in amount across country pairs. If the Olympic effect is relevant only country-pairs that already have high volume of exports, it would lead to an overestimation of the trade-creating effect for country-pairs that have exports at the lower quantile (or volumes) of the distribution. On the other hand, if the Olympic effect is equally relevant even for country-pairs with low volume of exports, this intensifies its importance.

Following Koenker & Bassett (1978) and Koenker & Hallock (2001), instead of solving for the conditional expectation function as in the OLS estimation, [29] the

[28] I also ran the specification with the inclusion of the remoteness variable for a country pair. This variable serves as a proxy for multilateral resistance according to Anderson & van Wincoop (2003). Essentially, Anderson & van Wincoop (2003) argue that trade flows between countries are not only determined by factors such as economic mass and distance, but also by the ratio of 'bilateral' to 'multilateral' trade resistance (MTR). According to the specification in Liu (2009), remoteness of a country is defined as the distance to the rest of the world weighted by all other countries' GDP in a given year. The remoteness variable for a given country pair is the product of the two countries' remoteness. It is defined as:

$$Remote_{ijt} = \left(\frac{\sum_{m \neq i} Distance_{mi} GDP_{mt}}{\sum_{m \neq i} GDP_{mt}} \right) \left(\frac{\sum_{m \neq j} Distance_{mj} GDP_{mt}}{\sum_{m \neq j} GDP_{mt}} \right) \tag{19}$$

Adam & Cobham (2007) mention that the failure to control for MTR can cause upward bias to the estimated effect of control variables on trade. However, there was not any substantial difference in the results with the inclusion of the remoteness variable. Hence, these results are not reported in the paper.

[29] The least squares regression estimates the sum of the squared residuals, which gives much weight to outliers.

minimization problem of the conditional quantile function is solved by finding the regression line that equates the number of positive and negative residuals. Following similar specification to Eaton (2009) in a panel format, I estimate the following linear model for the τth conditional quantile, Q, of bilateral exports T,

$$Q_{T_{ijt}}(\tau|Z_{ijt},\alpha_i) = Z'_{ijt}\beta\tau + \sum \alpha_1 Exp + \sum \alpha_2 Year_t \ , \ i = 1, ...N \ \& \ t = 1, ...T \quad (20)$$

where T_{ijt} is the real bilateral exports at time t and $Q(\tau|)$ is the conditional quantile function for quantile $\tau(0 < \tau < 1)$.[30] The explanatory variables are the vector Z_{ijt}, $\alpha_1 Exp$ and $\alpha_2 Year_t$ are exporter and time fixed effects respectively. The quantile regression model specifies the coefficient β as potentially varying per quantile, hence a function of τ. The parameters β are estimated by

$$argmin_{\beta,\alpha} \sum_{k=1}^{K} \sum_{t=1}^{T} \sum_{i=1}^{N} w_k \rho_{\tau k}(T_{ijt} - Z'_{ijt}\beta(\tau k) - \sum \alpha_1 Exp - \sum \alpha_2 Year_t) \quad (21)$$

where w_k refers to weights attached to each quantile.

I use the simultaneous quantile regression with the panel bootstrap procedure with 20 repetitions to obtain an estimate of the entire variance-covariance of the estimators.[31] The OLS estimates that are obtained based on the conditional expectation of the sample distribution are susceptible to heteroskedasticity issues. However, if the estimates are based on the conditional median of T_{ijt} (or other conditional quantile), the estimates of the elasticities of interest can be obtained with the log-linear model using the appropriate quantile regression estimator (Koenker & Bassett (1978); Koenker & Hallock (2001)). Hence, the dependent variable is now measured in logarithms.[32]

The results for the simultaneous fixed effect quantile regression are reported in table 8. I take four conditional quantiles into account ($\tau = 25^{th}$ (Q25), 50th (Q50 -the median),75th (Q75), 90th (Q90)). Table 22 reports the results for the total exports for Olympic hosts. The results remain robust to the one obtained with the PPML estimation. The Olympic effect on total exports does not differ between the individual percentiles. In other words, the Summer Olympic hosts do not experience a permanent increase in total exports at either quantiles or level of exports. Table 23 reports the results for the extensive margin of exports. The results indicate that the Olympic hosts experience a permanent decrease in the extensive margin only for the 50th percentile or above.

Table 24 reports the results for the intensive margin of exports. The Olympics effect on the intensive margin exhibits a monotonic behavior. In other words, the

[30] Eaton (2009) mentions that the conditional quantile function is defined as $Q_T(\tau|Z) = inf\{T : F_{T|Z}(y) \geq \tau\}$ where $F_{T|Z}$ is the conditional distribution of T given Z, and τ is conventionally used to designate the quantiles over the interval (0, 1).

[31] The results reported in this paper are essentially unchanged even with 100 bootstrap replications.

[32] Silva & Tenreyro (2006) mentions that the conditional median might be problematic when T_{ijt} has a large mass of zero observations. In this case the conditional median of T_{ijt} will be a discontinuous function of the regressors, which is generally not compatible with the standard economic theory.

Olympic effect on the intensive margin are relatively constant for all percentiles. The test of equal coefficients for the 25th percentile and the 90th percentile cannot be rejected at any level of significance. These results further confirm that the Olympic hosts experience a permanent increase in exports only at the intensive margin. More importantly, they experience increased exports at the intensive margin for higher as well as lower level of exports.

2.8 Conclusion

This study contributes to the existing literature in various important ways. Utilizing a Poisson model specification at the aggregate trade level, the results indicate that the traditional log-linear model exaggerated the impact of hosting/bidding for mega-events on exports. Summer Olympic hosts and candidates do not experience a permanent increase in exports, while that of World Cup hosts is marginally positive and significant. This result is robust to accounting for zero trade flows (full sample). The results indicate that the Olympic effect is not robust to empirical specification and sample selection issues. The traditional log-linear gravity model is not capable of handling issues of heteroskedastic residuals leading to biased estimates of the true elasticities.

However, utilizing disaggregate trade level data with the Poisson model indicates that total exports mask the heterogeneous impact of mega-events. The results indicate that hosting the mega-events matters. The Summer Olympic and World Cup hosts experience a permanent increase in exports solely at the intensive margin of trade. The Poisson regression further indicates that both hosts experience a permanent decrease in the extensive margin of exports. In other words, hosting of mega-events boosts trade volume of existing trade relationships at the expense of potential new products or number of products traded. However the candidates do not experience any increase in exports at both margins, casting doubt on the signaling effect. Furthermore, the results from the fixed effects quantile regression indicate that Summer Olympic hosts experience an increase in the intensive margin for all percentiles of exports distribution.

Recent literature indicates the importance of the intensive margin of trade for long-run export growth. Besedes & Prusa (2010) indicate that the survival of trading relationships is important for long-run export growth, and that the majority of growth in exports occurs at the intensive margin. Moreover, they imply that there is much less export persistence in developing countries, implying a critical part of improved export growth for developing countries may be focusing on existing relationships. Perhaps an avenue to maintain long-run export growth, especially for developing economies, could be hosting a mega-event. However, this export growth comes at the expense of the extensive margin of exports. Additional studies find that the majority of the growth in trade since 1970 occurred between countries that have had an existing trade relationship, implying the intensive margin is the most important component of export growth (e.g. Helpman *et al.* (2008), Felbermayr & Kohler (2006a)). Amurgo-Pacheco & Pierola (2008) also find that export growth is primarily determined along the intensive margin, especially for developed economies.

The economic benefit of hosting mega-events is realized through a permanent increase in exports at the intensive margin, which is shown to be important for long-run export growth and persistence through time. Rose & Spiegel (2011b) end with a cautious note: their model does not necessarily explain why countries submit repeated or multiple bids for mega-events, or why open economies bid for mega-events. This paper provides some answer to the puzzle: the hosting of the event matters, as countries experience a large increase in exports at the intensive margin. In contrast, the candidates do not experience an increase in exports at either margin, suggesting that bidding itself is not a sufficient condition for a positive impact on exports.

2.9 Tables

Table 1: Olympic Effect on Aggregate Exports: Log-Linear Regression, Positive Trade Flows - Olympics Hosts

Summer Olympics Host	0.24*** (0.04)	0.19*** (0.04)
Log distance	-1.23*** (0.02)	—
Log Exporter population	-0.28*** (0.06)	0.13*** (0.07)
Log Importer population	0.50*** (0.06)	0.90*** (0.06)
Log Exporter real GDP p/c	1.50*** (0.04)	1.47*** (0.04)
Log Importer real GDP p/c	0.95*** (0.03)	1.06*** (0.04)
Currency union	0.64*** (0.08)	0.55*** (0.07)
Common language	0.32*** (0.05)	—
RTA	0.57*** (0.03)	0.38*** (0.04)
Common border	0.36*** (0.08)	—
Islands	1.87*** (0.49)	—
Log product area	0.74*** (0.05)	—
Common colonizer	0.47*** (0.04)	—
Current colony	1.21*** (0.16)	0.43*** (0.12)
Ever colony	1.30*** (0.09)	—
Year effects	Yes	Yes
Exporter fixed effects	Yes	
Importer fixed effects	Yes	
Dyadic fixed effects		Yes
R^2	0.68	0.87
N	93,910	93,910

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable is the logarithm of real export from country i to j. Robust standard errors clustered by country pairs are in parenthesis.

Table 2: Olympic Effect on Aggregate Exports: Log-Linear Regression, Positive Trade Flows - Olympics and World Cup Hosts

Summer Olympics Host	0.10***	0.09***
	(0.04)	(0.04)
World Cup Host	0.44***	0.34***
	(0.04)	(0.04)
Year effects	Yes	Yes
Exporter fixed effects	Yes	
Importer fixed effects	Yes	
Dyadic fixed effects		Yes
R^2	0.68	0.87
N	93,910	93,910
Olympic=WC effect? (p-value)	0.00***	0.00***

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable is the logarithm of real export from country i to j. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in Table 1 are also included but not reported.

Table 3: Olympic Effect on Aggregate Exports: Log-Linear Regression, Positive Trade Flows - Olympics Host and Candidates

Summer Olympics Host	0.17***	0.15***
	(0.04)	(0.04)
Candidates	0.40***	0.32***
	(0.03)	(0.04)
Year effects	Yes	Yes
Exporter fixed effects	Yes	
Importer fixed effects	Yes	
Dyadic fixed effects		Yes
R^2	0.68	0.87
N	93,910	93,910
Host=Candidate ? (p-value)	0.00***	0.00***

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable is the logarithm of real export from country i to j. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in Table 1 are also included but not reported.

Table 4: Extensive and Intensive Margin : Log-Linear Gravity Regression, Positive Trade Flows - Olympics Host

	Total Exports	Extensive Margin	Intensive Margin	Total Exports	Extensive Margin	Intensive Margin
Olympics Host	0.11**	-0.13***	0.24***	0.07	-0.15***	0.22***
	(0.05)	(0.03)	(0.03)	(0.05)	(0.03)	(0.04)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes
R^2	0.69	0.78	0.50	0.88	0.92	0.74
N	72,240	72,240	72,240	72,240	72,240	72,240

Table 5: Extensive and Intensive Margin : Log-Linear Gravity Regression, Positive Trade Flows - Olympics and World Cup Host

	Total Exports	Extensive Margin	Intensive Margin	Total Exports	Extensive Margin	Intensive Margin
Olympics Host	0.04	-0.09***	0.14***	0.02	-0.11***	0.13***
	(0.05)	(0.03)	(0.04)	(0.05)	(0.03)	(0.04)
WC Host	0.17***	-0.10***	0.27***	0.15***	-0.11***	0.26***
	(0.05)	(0.03)	(0.03)	(0.05)	(0.03)	(0.04)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes
R^2	0.69	0.78	0.50	0.88	0.92	0.77
N	72,240	72,240	72,240	72,240	72,240	72,240
Olymp.=WC? (p-value)	0.10*	0.82	0.02**	0.12	0.99	0.05*

Notes: 193 countries for every five year from 1965-2000. Dependent variable is the logarithm of real export from country i to j. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 1 are also included but not reported.

Table 6: Extensive and Intensive Margin : Log-Linear Gravity Regression, Positive Trade Flows - Olympics Host and Candidates

	Total Exports	Extensive Margin	Intensive Margin	Total Exports	Extensive Margin	Intensive Margin
Olympics Host	0.09** (0.05)	-0.13*** (0.03)	0.23*** (0.03)	0.07 (0.05)	-0.15*** (0.03)	0.22*** (0.04)
Candidates	0.12*** (0.04)	-0.01 (0.03)	0.13*** (0.03)	0.04 (0.04)	-0.03 (0.03)	0.07** (0.06)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes
R^2	0.69	0.78	0.50	0.88	0.92	0.77
N	72,240	72,240	72,240	72,240	72,240	72,240
Host=Cand.? (p-value)	0.67	0.00***	0.02**	0.62	0.00***	0.00***

Table 7: Olympics Effect on Aggregate Exports : Random Effect Tobit Regression, Full Sample - Olympics Hosts

Summer Olympics Host	-0.90*** (0.08)
Log distance	-2.99*** (0.04)
Log Exporter population	2.69*** (0.02)
Log Importer population	2.11*** (0.02)
Log Exporter real GDP p/c	3.05*** (0.03)
Log Importer real GDP p/c	2.35*** (0.03)
Currency union	3.60*** (0.16)
Common language	1.46*** (0.12)
RTA	-0.14** (0.06)
Common border	0.33 (0.22)
Islands	0.65*** (0.07)
Log product area	-0.36*** (0.02)
Common colonizer	1.49*** (0.10)
Current colony	-1.14*** (0.26)
Ever colony	3.53*** (0.29)
Year effects	Yes
Country pair Random effects	Yes
Rho	0.50
N	203,431

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable for the Tobit regression is log (T+1), where T is the real export from country i to j. Robust standard errors are clustered by country pairs are in parenthesis.

Table 8: Olympics Effect on Aggregate Exports : Random Effect Tobit Regression, Full Sample - Olympics and World Cup hosts

Summer Olympics Host	-0.70***
	(0.09)
World Cup Host	-0.70***
	(0.08)
Year effects	Yes
Country pair Random effects	Yes
Rho	0.50
N	203,431
Olympic=WC effect? (p-value)	0.98

Table 9: Olympics Effect on Aggregate Exports : Random Effect Tobit Regression, Full Sample - Olympics Hosts and Candidates

Summer Olympics Host	-0.79***
	(0.08)
Candidates	-0.49***
	(0.07)
Year effects	Yes
Country pair Random effects	Yes
Rho	0.50
N	203,431
Olympic=WC effect? (p-value)	0.02**

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable for the Tobit regression is log (T+1), where T is the real export from country i to j. Robust standard errors are clustered by country pairs are in parenthesis.

Table 10: Extensive and Intensive Margin : Random Effect Tobit Regression, Full Sample - Olympics Host

	Total Export	Ext. Margin	Int. Margin
Olympics Host	0.21** (0.03)	-0.02 (0.02)	0.01 (0.02)
Year effects	Yes	Yes	Yes
Country pair Random effect	Yes	Yes	Yes
Rho	0.64	0.70	0.51
N	144,982	144,982	144,982

Table 11: Extensive and Intensive Margin : Random Effect Tobit Regression, Full Sample - Olympics and World Cup Host

	Total Exports	Extensive Margin	Intensive Margin
Olympics Host	0.15*** (0.03)	-0.02 (0.02)	-0.01 (0.02)
WC Host	0.19*** (0.03)	-0.01 (0.02)	0.04** (0.02)
Year effects	Yes	Yes	Yes
Country pair Random effect	Yes	Yes	Yes
Rho	0.64	0.70	0.51
N	144,982	144,982	144,982
Olympics=WC effect? (p-value)	0.50	0.68	0.09*

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1965-2000. Dependent variable for the Tobit regression is log (T+1), where T is the real export from country i to j. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 1 are also included but not reported.

Table 12: Extensive and Intensive Margin : Random Effect Tobit Regression, Full Sample - Olympics Host and Candidates

	Total Exports	Extensive Margin	Intensive Margin
Olympics Host	0.20*** (0.03)	-0.03 (0.02)	0.03 (0.02)
Candidates	0.08*** (0.03)	0.06** (0.02)	-0.11*** (0.02)
Year effects	Yes	Yes	Yes
Country pair Random effect	Yes	Yes	Yes
Rho	0.64	0.70	0.51
N	144,982	144,982	144,982
Host=Candidates ? (p-value)	0.02**	0.01**	0.00***

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1965-2000. Dependent variable for the Tobit regression is log (T+1), where T is the real export from country i to j. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in Table 1.A are also included but not reported.

Table 13: Olympic Effect on Aggregate Export : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics Hosts

	Positive	Full Sample	Positive	Full Sample
Summer Olympics Host	-0.01	-0.06	-0.07*	-0.10**
	(0.04)	(0.04)	(0.04)	(0.04)
Log distance	-0.78***	-0.79***	—	—
	(0.04)	(0.04)		
Log Exporter population	0.17	0.65***	0.12	0.49***
	(0.13)	(0.10)	(0.13)	(0.10)
Log Importer population	0.13	0.38***	0.23**	0.43***
	(0.09)	(0.08)	(0.09)	(0.08)
Log Exporter real GDP p/c	1.27***	1.27***	1.26***	1.29***
	(0.07)	(0.07)	(0.07)	(0.07)
Log Importer real GDP p/c	1.00***	1.03***	1.03***	1.06***
	(0.04)	(0.05)	(0.04)	(0.05)
Currency union	0.40***	0.46***	0.64***	0.74***
	(0.12)	(0.12)	(0.18)	(0.20)
Common language	0.41***	0.42***	—	—
	(0.10)	(0.11)		
RTA	0.47***	0.44***	0.43***	0.42***
	(0.05)	(0.05)	(0.07)	(0.07)
Common border	0.27***	0.26***	—	—
	(0.07)	(0.07)		
Islands	0.43	-0.54	—	—
	(0.33)	(0.34)		
Log product area	—	10.89	—	—
		(6.68)		
Common colonizer	0.06	0.08	—	—
	(0.11)	(0.11)		
Current colony	1.21***	1.22***	0.68***	0.51***
	(0.24)	(0.23)	(0.18)	(0.18)
Ever colony	0.23*	0.24*	—	—
	(0.14)	(0.14)		
Year effects	Yes	Yes	Yes	Yes
Exporter fixed effects	Yes	Yes		
Importer fixed effects	Yes	Yes		
Country pair fixed effects			Yes	Yes
N	93,910	203,431	88,305	162,447

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable -real export, is measured in levels. Positive trade flows only contains real exports greater than 0. Full sample contains real exports including zeros in levels. Robust standard errors clustered by country pairs are in parenthesis.

Table 14: Olympic Effect on Aggregate Export : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics and World Cup Hosts

	Positive	Full Sample	Positive	Full Sample
Summer Olympics Host	-0.05	-0.10**	-0.11**	-0.13**
	(0.04)	(0.04)	(0.04)	(0.04)
World Cup Host	0.08***	0.10***	0.07***	0.09**
	(0.03)	(0.03)	(0.02)	(0.03)
Year effects	Yes	Yes	Yes	Yes
Exporter fixed effects	Yes	Yes		
Importer fixed effects	Yes	Yes		
Country pair fixed effects			Yes	Yes
N	93,910	203,431	88,305	162,447
Olympic=World Cup effect? (p-value)	0.00***	0.00***	0.00***	0.00***

Table 15: Olympic Effect on Aggregate Export : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics Hosts and Candidates

	Positive	Full Sample	Positive	Full Sample
Summer Olympics Host	-0.02	-0.06	-0.07*	-0.10**
	(0.04)	(0.04)	(0.04)	(0.04)
Candidates	-0.06*	-0.06*	-0.06**	-0.07**
	(0.03)	(0.03)	(0.03)	(0.03)
Year effects	Yes	Yes	Yes	Yes
Exporter fixed effects	Yes	Yes		
Importer fixed effects	Yes	Yes		
Country pair fixed effects			Yes	Yes
N	93,910	203,431	88,305	162,447
Host=Candidates? (p-value)	0.30	0.77	0.46	0.55

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable -real export, is measured in levels. Positive trade flows contains real exports greater than 0. Full sample contains real exports including zeros in levels. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in Table 1 are also included but not reported.

Table 16: Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics Host

		Positive		Full Sample		
	Total	Ext.	Int.	Total	Ext.	Int.
Olympics Host	-0.10**	-0.11***	0.56***	-0.11***	-0.12***	0.46***
	(0.04)	(0.02)	(0.11)	(0.04)	(0.02)	(0.10)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
N	67,156	67,156	67,156	101,541	101,541	101,541

Table 17: Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics and World Cup Host

		Positive		Full Sample		
	Total	Ext.	Int.	Total	Ext.	Int.
Olymp. Host	-0.13***	-0.09***	0.47***	-0.14***	-0.10***	0.37***
	(0.04)	(0.01)	(0.11)	(0.04)	(0.02)	(0.10)
WC Host	0.07**	-0.05***	0.25***	0.07**	-0.06***	0.24***
	(0.02)	(0.01)	(0.09)	(0.02)	(0.01)	(0.08)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Count. pair FE	Yes	Yes	Yes	Yes	Yes	Yes
N	67,156	67,156	67,156	101,541	101,541	101,541
Olym.=WC? (p-value)	0.00***	0.01**	0.18	0.00***	0.10*	0.39

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable -real export, is measured in levels. Positive trade flows contains real exports greater than 0. Full sample contains real exports including zeros in levels. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in Table 1 are also included but not reported.

Table 18: Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics Host and Candidates

		Positive		Full Sample		
	Total	Ext.	Int.	Total	Ext.	Int.
Olympics Host	-0.10*** (0.04)	-0.11*** (0.02)	0.57*** (0.11)	-0.11*** (0.04)	-0.12*** (0.02)	0.47*** (0.10)
Candidates	-0.12*** (0.04)	-0.05*** (0.01)	- 0.21** (0.09)	-0.12*** (0.03)	-0.06*** (0.01)	-0.26*** (0.09)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
N	67,156	67,156	67,156	101,541	101,541	101,541
Host=Can.? (p-value)	0.69	0.00**	0.00***	0.89	0.00***	0.00***

Table 19: Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics Host

		Positive		Full Sample		
	Total	Ext.	Int.	Total	Ext.	Int.
Olympics Host	-0.06	-0.10***	0.65***	-0.07*	-0.13***	0.49***
	(0.04)	(0.02)	(0.12)	(0.04)	(0.02)	(0.10)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exp & Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
N	72,240	72,240	72,240	140,601	140,601	140,601

Table 20: Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics and World Cup Host

		Positive		Full Sample		
	Total	Ext.	Int.	Total	Ext.	Int.
Olympics Host	-0.09**	-0.08***	0.56***	-0.10***	-0.09***	0.42***
	(0.04)	(0.02)	(0.11)	(0.04)	(0.02)	(0.10)
WC Host	0.07***	-0.04***	0.23***	0.07**	-0.08***	0.19***
	(0.03)	(0.01)	(0.09)	(0.03)	(0.01)	(0.10)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exp & Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
N	72,240	72,240	72,240	140,601	140,601	140,601
Olym.=WC ? (p-value)	0.00***	0.02**	0.04**	0.00***	0.48	0.13

Table 21: Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample) - Olympics Host and Candidates

		Positive		Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics Host	-0.06	-0.10***	0.66***	-0.08*	-0.13***	0.50***
	(0.04)	(0.04)	(0.12)	(0.04)	(0.02)	(0.10)
Candidates	-0.13***	-0.04***	- 0.20**	-0.11***	-0.07***	-0.27***
	(0.04)	(0.01)	(0.08)	(0.04)	(0.01)	(0.09)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exp & Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
N	72,240	72,240	72,240	140,601	140,601	140,601
Host=Cand.? (p-value)	0.29	0.00**	0.00***	0.52	0.02**	0.00***

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1950-2000. Dependent variable -real export, is measured in levels. Positive trade flows contains real exports greater than 0. Full sample contains real exports including zeros in levels. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in Table 1 are also included but not reported.

Table 22: Fixed Effect Quantile Regression for Olympics Hosts: Positive Trade Flows - Total Exports

	Q25	Q50	Q75	Q90
Olympics Host	0.06 (0.09)	0.05 (0.04)	-0.01 (0.04)	0.01 (0.06)
Year effects	Yes	Yes	Yes	Yes
Exporter Fixed Effects	Yes	Yes	Yes	Yes
$PseudoR^2$	0.43	0.46	0.47	0.48
N	72,240	72,240	72,240	72,240
(q25)=(q90) ? (p-value)	0.63			

Table 23: Fixed Effect Quantile Regression for Olympics Hosts: Positive Trade Flows - Extensive Margin

	Q25	Q50	Q75	Q90
Olympics Host	-0.01 (0.05)	-0.13*** (0.04)	-0.15*** (0.02)	-0.15*** (0.02)
Year effects	Yes	Yes	Yes	Yes
Exporter Fixed Effects	Yes	Yes	Yes	Yes
$PseudoR^2$	0.49	0.54	0.54	0.50
N	72,240	72,240	72,240	72,240
(q25) =(q90)? (p-value)	0.00***			

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1965-2000. Dependent variable is measured in logs. *t-statistics* are computed using bootstrap standard errors with 20 replications. The results are the same with 100 replications. All the other control variables in Table 1 are also included but not reported.

Table 24: Fixed Effect Quantile Regression for Olympics Hosts: Positive Trade Flows - Intensive Margin

	Q25	Q50	Q75	Q90
Olympics Host	0.16***	0.14***	0.16***	0.24***
	(0.04)	(0.02)	(0.03)	(0.04)
Year effects	Yes	Yes	Yes	Yes
Exporter Fixed Effects	Yes	Yes	Yes	Yes
$PseudoR^2$	0.32	0.33	0.32	0.31
N	72,240	72,240	72,240	72,240
(q25) =(q90) ?	0.12			
(p-value)				

Notes: *** p<0.01, ** p<0.05, * p<0.1. 193 countries for every five year from 1965-2000. Dependent variable is measured in logs. *t-statistics* are computed using bootstrap standard errors with 20 replications. The results are the same with 100 replications. All the other control variables in Table 1 are also included but not reported.

2.10 Appendix

Table 25: Data Sources - Aggregate trade data

- All the common gravity variables are obtained from the dataset provided by Liu .
- FOB exports (for aggregate trade data) retrieved from Rose's website are measured in US $, taken from IFS Direction of Trade CD-ROM, deflated by US CPI for All Urban Consumers (CPI-U), all items, 1982-84=100.
- According to Liu (2009), the GDP and population data are from several standard sources including the PWT6.1, PWT 5.6, WDI2003, Maddison Historical Statistics, International Financial Statistics (IFS) and the United Nations Yearbooks (UNSYB).
- Country-specific data (retrieved from Liu dataset) such as area, island-nation status, contiguity, language, colonizer, and independence are taken from 2003 CIA World Factbook website by Liu.
- Currency-union data taken from Glick-Rose (2002).
- Regional trade agreements taken from WTO website : $http://www.wto.org/english/tratop_e/region_e/eif_e.xls$
- World Cup hosting, participants and years of membership in FIFA are retrieved from : http://www.fifa.com/worldcup/archive/index.html
- Information on Olympic Hosts (along with candidates) are retrieved from Rose's website.

Disaggregate trade data

- Exports at product level are obtained from the World Integrated Trade Solution (WITS) database.
- Within the database, the export data is retrieved from the United Nations Statistics Division (UNSD) COMTRADE (Commodity Trade) database.
- Export data is available at the four-digit SITC- Revision 2 classification.
- All the other variables are obtained from Liu's dataset (described in detail in Appendix25).

Table 26: Hosts and Candidate Cities for Post-war Summer Olympic Games

Year	Host	Candidates
1948	London, UK	Baltimore, Lausanne, Los Angeles, Minneapolis Philadelphia
1952	Helsinki, Finland	Amsterdam, Chicago, Detroit, Los Angeles Minneapolis, Philadelphia
1956	Melbourne, Australia	Buenos Aires, Chicago, Detroit, Los Angeles Mexico city, San Francisco
1960	Rome, Italy	Brussels, Budapest, Detroit, Lausanne Mexico City, Tokyo
1964	Tokyo, Japan	Brussels, Detroit, Vienna
1968	Mexico city, Mexico	Buenos Aires, Detroit, Lyon
1972	Munich, Germany	Detroit, Madrid, Montreal
1976	Montreal, Canada	Los Angeles, Moscow
1980	Moscow, USSR	Los Angeles
1984	Los Angeles, USA	None
1988	Seoul, Korea	Nagoya
1992	Barcelona, Spain	Amsterdam, Belgrade, Manchester, Melbourne Toronto
1996	Atlanta, USA	Athens, Belgrade, Manchester, Melbourne Toronto
2000	Sydney, Australia	Beijing, Berlin, Istanbul, Manchester
2004	Athens, Greece	Buenos Aires, Cape Town, Rome, Stockholm

Data available at : $http://www.olympic.org/uk/games/past/index_uk.asp?OLGT = 1\&OLGY = 1992$

Table 27: Hosts and Candidate Cities for Post-war World Cup Games

Year	Host	Candidates
1950	Brazil	
1954	Switzerland	
1958	Sweden	
1962	Chile	Argentina, Germany
1966	England	Germany, Spain
1970	Mexico	Argentina
1974	Germany	Spain
1978	Argentina	Mexico
1982	Spain	Germany
1986	Mexico	Canada, US
1990	Italy	England, Greece, Russia
1994	US	Brazil, Morocco
1998	France	Morocco, Switzerland
2002	Japan/South Korea	Mexico
2006	Germany	Brazil, England, Morocco
		South Africa

Note: Hosts for years 1950, 1954 and 1958 were the only bidders.

Table 28: Country List

Afghanistan	Cote D'Ivoire	India	Netherlands	St. Pierre & Miq.(b)
Albania	Croatia	Indonesia	Netherlands Antilles	St. Vincent & Gren.
Algeria	Cuba	Iran	New Caledonia	Sudan
Angola	Cyprus	Iraq	New Zealand	Suriname
Antigua & Barbuda	Czech Rep	Ireland	Nicaragua	Sweden
Argentina	Czechoslovakia (b)	Israel	Niger	Switzerland
Armenia	Denmark	Italy	Nigeria	Syria
Aruba	Djibouti	Jamaica	Norway	Tajikistan
Australia	Dominica	Japan	Oman	Tanzania
Austria	Dominica Rep.	Jordan	Pakistan	Thailand
Azerbaijan	Ecuador	Kazakhstan	Panama	Togo
Bahamas	Egypt	Kenya	Papua N. Guinea	Tonga
Bahrain	El Salvador	Korea, Rep.	Paraguay	Trinidad & Tobago
Bangladesh	Eq. Guinea	Kuwait	Peru	Tunisia
Barbados	Estonia	Kyrgyzstan	Philippines	Turkey
Belarus	Ethiopia	Laos	Poland	Turkmenistan
Belgium	Faeroe Islands	Latvia	Portugal	Tuvalu
Belize	Fiji	Lebanon	Puerto Rico (a)	U.A.E.
Benin	Finland	Liberia	Qatar	U.K.
Bermuda	French Guiana (b)	Libya	Reunion (b)	U.S.A.
Bolivia	France	Lithuania	Romania	Uganda
Bosnia& Herzegovina	French Polynesia (b)	Luxembourg	Russia	Ukraine
Brazil	Gabon	Macau	Rwanda	Uruguay
Brunei	Gambia	Macedonia	Samoa (a)	Uzbekistan
Bulgaria	Georgia	Madagascar	Sao Tome & Principe	Vanuatu
Burkina Faso	Germany	Malawi	Saudi Arabia	Venezuela
Burundi	Ghana	Malaysia	Senegal	Vietnam
Cambodia	Greece	Maldives	Serbia	Yemen Arab Rep.
Cameroon	Greenland	Mali	Seychelles	Yemen P.D. Rep.
Canada	Grenada	Malta	Sierra Leone	Yemen, Rep. of
Cape Verde	Guadalupe (b)	Martinique (b)	Singapore	Yugoslavia
C.A.R.	Guatemala	Mauritania	Slovakia	Zambia
Chad	Guinea	Mauritius	Slovenia	Zimbabwe
Chile	Guinea-Bissau	Mexico	Solomon Is.	
China	Guyana	Moldova	Somalia	
Colombia	Haiti	Mongolia	South Africa	
Comoros	Honduras	Morocco	Spain	
Congo, Dem. Rep.	Hong Kong	Mozambique	Sri Lanka	
Congo, Rep. of	Hungary	Myanmar	St. Kitts & Nevis	
Costa Rica	Iceland	Nepal	St. Lucia	

Note: (a) means aggregate date; (b) means bilateral data for Rose & Spiegel (2011b) aggregate data.

3 Reconciling the WTO Effect: An Inquiry into the Extensive and Intensive Margin of Imports

3.1 Introduction

The World Trade Organization (WTO), and its predecessor the General Agreement on Tariffs and Trade (GATT), have in effect served as the constitution of the post-war international trading system (Staiger (2006)). Since 1947, membership in the GATT/WTO has grown from 23 countries to its present size of 153 countries, and average ad-valorem tariffs on industrial goods have been reduced from over 40% to below 4% through eight rounds of multilateral negotiation (the Doha Round is currently ongoing). Although the theory indicates that a reduction in trade barriers should increase trade flows, the empirical literature on the impact of the WTO membership has been rather ambiguous. In his seminal paper, Rose (2004) uses a standard gravity model of trade and reveals little evidence of the GATT/WTO promoting trade. Rose & Spiegel (2011a) findings further suggests that WTO members did not systematically follow more liberal trade policies than non-members.

Subsequent studies based on Rose (2004) findings have produced disparate results. Subramanian & Wei (2007) examine heterogeneity of trade flows for WTO members across countries (based on their level of development) and sectors. They mention that since developing members were not as actively engaged in reciprocal liberalization, trade liberalization should occur on products of export interest to industrial countries but not that of developing countries. Hence, they postulate that imports between industrial members should be large, while imports between industrial and developing members should be small or even non-existent. They find that the industrial countries that participated more actively than developing countries in reciprocal trade negotiations witnessed a large increase in trade. Tomz *et al.* (2007) distinguish formal members from non-member participants (NMPs), and find that NMPs are at least as liberalized as the formal members. Taking these NMPs into account, they find that bilateral trade is 70% higher if both trading partners are formal GATT/WTO members or NMPs. Eicher & Henn (2011) mention that conventional literature on WTO fails to account for three sources of omitted variable bias: multilateral resistance, unobserved bilateral heterogeneity and individual regional trade agreement (RTA) effects. They unify Rose (2004), Subramanian & Wei (2007), and Tomz *et al.* (2007) specifications in one comprehensive approach that minimizes omitted variable bias, and conclude that WTO effects on trade flows are not statistically significant. This seems to a severe blow to the recent literature suggesting significance of WTO in promoting bilateral trade.

However, total aggregate trade could mask significant heterogeneity in terms of the impact of the WTO membership. This paper utilizes disaggregated product level trade data to examine whether the WTO creates new trade relationships (the extensive margin) or increases trade in existing relationships (the intensive margin). The extensive margin is measured as the number of products imported by a country pair for a given year and the intensive margin is defined as the average volume of imports in existing products between a country pair for a given year.

Past studies such as Liu (2009) and Felbermayr & Kohler (2010b) have examined the role of the WTO membership at the country-level extensive and intensive margin of imports with aggregate trade data. They mention that past studies have ignored the fact that many country pairs exhibit zero trade flows by restricting the sample to only positive trade flows. Hence, they take into account the issue of sample selection bias in the traditional gravity model. Trade with only positive trade flows is viewed as the country-level intensive margin (trade between partners that already trade with one another) of imports. Hence, the difference in trade with zero trade flows (full sample) and positive trade flows is defined as the country-level extensive margin. Furthermore, they implement the Poisson regression as advocated by Silva & Tenreyro (2006) to address the issue of heteroskedasticity prevalent in the log-linear gravity model. Liu (2009) finds a stronger role for WTO in creating new relationships (country-level extensive margin) compared to increase in trade among existing partners (country-level intensive margin). In contrast, Felbermayr & Kohler (2010b) find that the WTO increased imports only at the country-level intensive margin.[33]

With aggregate trade data, the extensive margin of trade could only be captured by accounting for zero trade flows in the data. For example, assume that the U.S. never exported to Italy until 1985, and starts exporting from 1986 onwards. This generally constitutes an increase in the country-level extensive margin of trade (or increase in trading partners). However, with aggregate data information on trade margins might be missing due to the failure to account for the number of products traded at the disaggregate level. For example, an increase in the extensive margin could also be realized, if US exported 24 different products to Italy compared to 10 products the previous year. Hence, a key feature of the product-level extensive and intensive margin implemented in this study is that it allows to account for the extensive margin of imports even with positive trade flows.

In a recent working paper, Dutt *et al.* (2011) examine the role of the WTO at the extensive and the intensive margin of exports with product level data. They implement a dummy for country pair where both are members of the WTO. They find that WTO membership increases the extensive margin of exports, while it has a negligible or even a negative impact on the intensive margin. They implement the traditional log-linear model for positive trade flows and Helpman *et al.* (2008) selection model to deal with the zero trade flows, both of which are subjected to heteroskedasticity issues due to the log-linearization of the dependent variable. They do not implement the multilateral resistance controls in their Helpman *et al.* (2008) specification and resort to one average RTA control, both leading to omitted variable bias issues.[34] Furthermore, Dutt *et al.* (2011) adopt the *mutually-inclusive* coding for the WTO membership. Eicher & Henn (2011) mention that the diversity of results in the empirical WTO literature seems to suggest that econometric specifications or data-coding conventions crucially influence the magnitude of WTO trade effects. There are sev-

[33]Their study differs from Liu (2009) in two ways - they implement dummies for multilateral resistance controls and they average the data over formative GATT periods while Liu (2009) uses yearly observations and implements Dalgin *et al.* (2006) specification of the remoteness term.

[34]Eicher & Henn (2011) mention that the key reason for the insignificant WTO effect in their specification is due to accounting for multilateral resistance controls.

eral key differences between Dutt *et al.* (2011) study and mine. I take into account the multilateral resistance controls and the individual RTA effects to minimize omitted variable bias in the specification.[35] This paper also employs *mutually-exclusive* coding of WTO membership to isolate its impact from other effects (e.g. RTA and Generalized System of Preferences (GSP)).[36] Eicher & Henn (2011) mention that mutually inclusive coding might have exaggerated the WTO effect when increase in trade flows is attributed to both the RTA and WTO memberships as opposed to just the RTA. Furthermore they mention that with mutually inclusive coding, the WTO dummy could exhibit collinearity with the importer-year dummy that controls for multilateral resistance.

In this chapter, with similar WTO dummy as Dutt *et al.* (2011), I find positive impact of WTO membership on total trade and extensive margin with the log-linear model. However, with the PPML estimation for both positive and zero trade flows, the effect is significant but more importantly, negative.

I further examine the heterogeneity of trade flows for WTO members across countries based on their level of development. Past literature, with the exception of Subramanian & Wei (2007) fail to account for this heterogeneity. Subramanian & Wei (2007) mention that the theory suggests the impact of a countrys' membership in the WTO depends on what the country does with it and whom it negotiates with. The results indicate that any positive benefit of the WTO membership is realized entirely through the extensive margin while the impact on the intensive margin is insignificant or even negative. However, the positive impact of the extensive margin is heterogeneous and is contingent upon the importer-exporter relationships. In other words, the industrial WTO members experience increase in imports at the extensive margin only from the developing WTO members and vice-versa. The result is robust to accounting for multilateral trade resistance terms, individual RTAs and zero-trade flows. In contrast to Subramanian & Wei (2007), the developing countries also benefit from the WTO membership. However, the benefit is realized entirely from the extensive margin of imports, and only from the industrial WTO members.

Finally, this study takes into account the role of product heterogeneity based on Rauch (1999) classification. Rauch (1999) classified product categories into three groups: homogeneous, reference priced, and differentiated products. Differentiated goods are subjected to heterogeneity in manufactures (Rauch & Casella (2003)); higher networking effect (Rauch (1999)); lower price elasticities (Erkel-Rousse & Mirza (2002)) and smaller border effects (Evans (2003)). The results are similar across both homogeneous and differentiated goods. In other words, for both goods, the increase in imports is from the extensive margin and is contingent upon importer-exporter relationships. The results are at odds with the theoretical predictions of Chaney (2008) model. Given a reduction in the variable costs, Chaney (2008) predicts that homogeneous (differentiated) goods should witness a larger increase in the intensive (extensive) margin. However, my results indicate that the increase in im-

[35] I do not take into account the country-pair fixed effects in the PPML specification. Refer to the Appendix-B for an extensive argument in regards to the exclusion of country-pair fixed effect.

[36] With the exception of Subramanian & Wei (2007) and Eicher & Henn (2011) past studies have employed *mutually-inclusive* coding that is subjected to various issues.

ports is entirely on the extensive margin for both homogeneous and differentiated goods.

The results are more in line with the theoretical predictions of several studies (e.g. Mansfield & Reinhardt (2008), Francois & Martin (2004), Handley (2011) and Sala *et al.* (2010)) that attribute the benefit of the WTO membership to tariff binds which reduces market uncertainty rather than tariff reduction itself. Sala *et al.* (2010) and Handley (2011) mention that even though the reduction of bound rates may in practice command no reduction of the applied rates, it can reduce or eliminate uncertainty leading to increased entry of firms in the export market. The tariff bindings above applied rates are unable to generate market access via the intensive margin of trade. Sala *et al.* (2010) further predict that bound tariffs are more effective with higher risk destination markets (e.g. developing countries) where a large binding overhang can command substantial market access for these countries.

The results indicate that past studies might have underestimated the role of the WTO by failing to account for the product level extensive and the intensive margin of imports. Furthermore, the importer-exporter relationship is relevant to reap any benefit from the membership. The fact that the entire benefit is realized from the extensive margin perhaps provides empirical support to the "new-new trade theory," that advocates for the indirect benefits of WTO achieved through reduction of market uncertainty via tariff binds.

The remainder of the paper is organized as follows: Section 2 discusses the extensive and the intensive margin of imports along with several estimation issues in the empirical literature. It then specifies the traditional log-linear gravity model and discusses the issues associated with it. It then proposes the PPML estimation for both positive and zero-trade flows. Finally, it talks about the data and reports the results. Section 3 examines the impact of heterogeneity of the WTO membership across countries based on their level of development. Section 4 examines the role of product heterogeneity on the WTO membership. Section 5 summarizes the main findings of the paper.

3.2 Extensive and Intensive Margin of Imports : Role of the WTO membership

Felbermayr & Kohler (2010b) mention that the WTO as a multilateral system is commonly regarded as fostering a transparent and predictable world trading environment that features open markets. According to Subramanian & Wei (2007), the GATT/WTO system, by design, focuses on mutually-agreed reductions of trade barriers (the reciprocity principle) and non-discriminatory treatment between countries (the most-favored nation (MFN) principle). As non-member countries do not participate in reciprocal liberalizations, the member countries do not have legal obligations to extend the benefits of tariff concessions to non-members. Hence, the trade literature has primarily attributed the potential benefit of the WTO membership towards the reduction in tariffs.

In recent years, the theoretical models of trade have ushered into the "new trade theory" that incorporates firm-level productivity differences in trade pattern. Recent studies such as Helpman *et al.* (2008) have advocated for the decomposition of trade

volume into two margins: the extensive and the intensive margin. Various studies such as Melitz (2003) and Chaney (2008) have analyzed the impact of trade liberalization on these two margins. Theoretical prediction of Melitz (2003) and Chaney (2008) indicates that decline in variable trade costs (e.g. reduction in tariffs) increases the extensive as well as the intensive margin. Chaney (2008) further stipulates that a reduction in fixed cost affects only the extensive margin. This paper builds upon the literature by inquiring whether the WTO membership creates new trading relationships (the extensive margin) or increases trade in existing relationships (the intensive margin) at the product level.

Recent theoretical literature in trade attributes the indirect benefits of the WTO membership via tariff binds to reducing market uncertainty in addition to the reduction of tariffs (e.g. Mansfield & Reinhardt (2008), Francois & Martin (2004), Handley (2011) and Sala *et al.* (2010)). When countries join the WTO or when they negotiate tariff levels with each other during trade rounds, they make agreements on bound tariff rates, rather than actually applied rates (Bchir *et al.* (2006)). Members have the flexibility to increase or decrease their tariffs (on a non-discriminatory basis) as long as they don't raise them above their bound levels.[37] Mansfield & Reinhardt (2008) mention that the binds on tariff significantly reduces trade volatility making trade policy and trade flows more predictable. Handley (2011) shows that tariff binds reduce uncertainty by censoring the range of observable tariffs, while Francois & Martin (2004) mention that more important to market access might be the reduction of variance of the tariffs rather than the mean of the tariff itself.[38] Tariff binds is shown to have reduced the risk exporter face that has substantial effects on trade and country's welfare (e.g. Francois (2001), Francois & Martin (2004) and Sala *et al.* (2010)).

Several studies have investigated the importance of tariff binds in reducing uncertainty and its impact on the extensive and the intensive margin. Handley (2011) and Sala *et al.* (2010) argue that tariff binds that reduces uncertainty can increase entry in the export market even when applied protection is unchanged. Sala *et al.* (2010) mention that a one-sided reduction in the volatility of trade policy may in effect appear like a reduction in expected future tariffs. They stipulate that if the current applied tariffs stay unaltered, such risk reductions have no direct effect on the current prices that exporters charge. Thus, from the importers' perspective, the demand for and sales volume of a given product or the intensive margin of trade remain unaffected. In other words the tariff bindings above applied rates are unable to generate market access via the intensive margin of trade. They further stipulate that the effect of bound tariffs on market access must be sought at the extensive margin

[37] The gap between the bound and applied MFN rates is called the "binding overhang". This gap tends to be small on average in industrial countries and often fairly large in developing countries.

[38] They further mention that while tariff bind allow tariff rates to vary below the level of the bind, they reduce both the average applied tariff and the variability of the applied rate of protection. Furthermore, early in the liberalization process, when tariff bindings may be high relative to the underlying mean of the distribution of protection, the gains from subjecting protection to multilateral disciplines may be due to more reductions in variability than to reductions in the mean level of protection.

of trade or it must stem from the export market entry decision of firms.[39] Therefore, even if current rates remain unchanged, negotiations in terms of bound rates affects the extensive margin of trade, but not the intensive margin. Hence, the empirical investigation in this study could be viewed as a test to whether the WTO facilitates trade, if at all, either through tariff reduction or tariff binds.

3.2.1 Empirical Model and Estimations Issues

Initially, the paper employs the traditional log-linear gravity model of trade to examine the role of the WTO membership at the extensive and intensive margin of imports. Subramanian & Wei (2007) mention that all the theories that underlie a gravity-like specification yield predictions on unidirectional trade rather than total trade, and assert that trade effects of WTO relates to imports.[40] Hence, I focus on total imports rather than total trade. For total aggregate imports, I have the specification of the following form :

$$\begin{aligned} lnT_{ijt} &= \beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ &+ \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOI_{ijt} + \beta_5 WTOD_{ijt} + \epsilon_{ijt} \end{aligned} \tag{22}$$

where i denotes the importer, j denotes the exporter and t denotes time. T_{ijt} represents real bilateral imports for a country pair. This section analyzes importer-exporter relationships based on the WTO membership. $WTOI_{ijt}$ is a dummy variable, which is equal to 1, if importers are industrial WTO members and the exporters are also WTO members. $WTOD_{ijt}$ is a dummy variable, which is equal to 1, if importers are developing WTO members and the exporters are also WTO members. I employ the same definition of industrialized and developing countries as Subramanian & Wei (2007). In their study, Subramanian & Wei (2007) utilize these dummies and find that industrial WTO members witnessed a large increase in trade, while for developing WTO members it was not significant. They mention that under the GATT regime, industrial WTO members actively took part in reciprocal liberalization while the developing members were largely exempted from these obligations.

$Year_t$ is year-specific fixed effects implemented to take into account any time-specific common trends or effects (e.g. business cycles, oil price shocks). Imp_{kt} are the list of time-varying importer dummies that take a value of one if $k = i$ and zero otherwise for a given time t. Exp_{lt} are the list of time-varying exporter dummies that take a value of one if $l = j$ and zero otherwise for a given time t. These dummies are included to account for the multilateral resistance controls as suggested by Anderson & van Wincoop (2003). They stipulate that a consistent and efficient

[39] Furthermore, they stipulate that the profitability of such a strategy depends on the expected protection rate and therefore on plausible future tariff reversions. The tariff-binds acts as a ceiling to the risk of such an occurrence by effectively limiting the future possible increment of a tariff and, where the overhang is small, it makes the likeness of the tariff increase more negligible.

[40] They mention that when a country$j$ grants GSP preferences or j liberalizes its imports under the WTO, there is reason to expect $j's$ imports from k to increase but there is no theoretical reason why $j's$ exports to k should also increase by the same proportion

estimate of a theoretical gravity equation is achieved by considering the multilateral and the bilateral trade resistance, hence the omission of these dummies leads to misspecification of the model and biases the estimates of the trade costs towards zero.[41]

The row vector Z_{ijt} represents a list of common gravity control variables (or proxies) for transportation costs and geographical or cultural proximities that are not absorbed by the fixed effects. It includes the natural log of the bilateral distance (D_{ij}), various bilateral pair dummies for country pairs such as using same the currency at time t (CU_{ijt}), sharing a common language ($ComLang_{ij}$), sharing a common land border ($ComBorder_{ij}$), colonized by the same country ($ComCol_{ij}$), country i colonized j at time t or vice versa (Col_{ijt}) and if country i ever colonized j or vice versa ($EverCol_{ij}$). Some country-year specific covariates are absorbed into the time-varying importer and exporter fixed effects (Eicher & Henn (2011) and Subramanian & Wei (2007)).[42]

RTA_{ijt} is a dummy variable that takes on a value of 1 if i and j belong to regional trade agreement in year t. GSP_{ijt} is a dummy variable that takes on a value of 1 if the importing industrial country grants preferences under the generalized scheme of preferences to the exporting country j at time t.[43] According to Subramanian & Wei (2007), RTA represents the culmination of trade integration, whereas the WTO represents some intermediate way station.[44] Similarly, this study relies on the fact that the $RTAs$, GSP and the WTO involves different degrees of liberalization. Hence, I define them *mutually exclusively* in order to isolate the impact of each variable from the other. The coding is "hierarchical", for e.g., if the country pairs are the members of WTO, GSP and the RTA, only RTA dummy takes the value of one. When a country pair belongs to the WTO and in a GSP relationship, only GSP takes a value of 1. Hence, with *mutually exclusive* coding, the coefficient on the WTO membership could be interpreted as a "pure WTO effect". Eicher & Henn (2011) mention that with *mutually inclusive* coding, the WTO dummy might exhibit collinearity with the importer-year dummy that controls for multilateral resistance.[45] In the *mutually inclusive* coding convention, all the dummies for RTA, GSP and WTO can be assigned the value of "1" if the conditions are met.

Following Eicher & Henn (2011), the aggregate RTA vector, RTA_{ijt}, is replaced with dummies that allow each RTA to account for its own individual effect on bi-

[41] Anderson & van Wincoop (2003) mention that the specification requires both importer and exporter fixed effects as trade between any two countries depends on the multilateral resistance of both importers and exporters. Some studies have used time-invariant importer and exporter fixed effects, however Baldwin & Taglioni (2006) argue that these time-invariant fixed effects are not sufficient as the omitted trade costs are time variant.

[42] Due to the inclusion of the time-varying importer and exporter fixed effects, country-specific covariates such as GDP, GDP per capita, population and land area are absorbed.

[43] Refer to the Appendix table 46 for the list of industrial and developing countries.

[44] For example, if a country pair belongs to both WTO and RTA, they would not be expected to trade more with each other than if they are simply members of the RTA but not the members of the WTO.

[45] By construction this collinearity is avoided in mutually exclusive coding since WTO importers are not considered WTO members when the WTO importer is in a RTA or GSP relationship with the exporter (Eicher & Henn (2011).

lateral imports. Eicher & Henn (2011) argue that omitted variable bias ensues when specifications include only one average RTA control. They mention that the individual RTA trade effects matter, since preferential tariff reductions differ vastly across RTAs. They assert that when these individual trade effects are omitted from the empirical approach, the WTO coefficient may be biased upward if it assumes part of a positive, but omitted RTA effect. This analysis employs the set of $RTAs$ as suggested by Eicher *et al.* (2010).[46] Including additional $RTAs$ into the regression also implies that it also diminishes the number of WTO relationships and correct for any upward bias in WTO effect. BTA_{ijt} is a dummy variable that takes on a value of 1 if i and j belong to bilateral trade agreement in year t.[47]

This paper further examines whether the results extend to product level extensive and intensive margin of imports. This chapter utilizes disaggregated data at the four-digit Standard International Trade Classification (SITC) Revision 2 product level to construct the measure of the extensive and the intensive margins of imports. The methodology applied in this analysis to construct the two margins of imports is referred to as the count method. This methodology has been applied in previous studies such as that of Nitsch & Pisu (2008), Bernard *et al.* (2007), Flam & Nordstrm (2006), and Dutt *et al.* (2011). Accounting for the role of product level extensive and intensive margin of imports, in the traditional log-linear form, the decomposition of T_{ijt} (total imports) can be expressed as follows:

$$ln(T_{ijt}) = ln(N_{ijt}) + ln(\frac{T_{ijt}}{N_{ijt}}) \tag{23}$$

where T_{ijt}, the real aggregate bilateral imports (sum of total imports for all products for a given year) between a country pair is decomposed into two different dependent variables (N_{ijt} and $\frac{T_{ijt}}{N_{ijt}}$). N_{ijt} (the extensive margin) is the number of products imported per year per country pair and $\frac{T_{ijt}}{N_{ijt}}$ (the intensive margin) is the average volume of imports per product per year. The estimation equation for the extensive margin of imports or the number of products imported is given as:

$$\begin{aligned} lnN_{ijt} &= \beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ &+ \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOI_{ijt} + \beta_5 WTOD_{ijt} + \epsilon_{ijt} \end{aligned} \tag{24}$$

and the estimation equation for the intensive margin (or the average volume of imports per product) is given as :

$$\begin{aligned} ln(\frac{T_{ijt}}{N_{ijt}}) &= \beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ &+ \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOI_{ijt} + \beta_5 WTOD_{ijt} + \epsilon_{ijt} \end{aligned} \tag{25}$$

There are alternative means of constructing the extensive and the intensive margin

[46]Refer to the Appendix table46 for the complete list of individual $RTAs$ along with the date of their inception.

[47]Refer to the Appendix table47 for further illustration on the bilateral trade agreements.

of trade with product level data which is not explored in this paper.[48]

3.2.2 Poisson Specification

The log-linear specification of the gravity model of trade (as shown in equation (22)) is obtained by taking logarithms of the gravity equation, where the parameters are estimated by OLS. Recent empirical trade literature has indicated that the log-linear gravity model leads to inconsistent estimates in the presence of heteroskedastic residuals. As mentioned by Silva & Tenreyro (2006), the expected value of the log of a random variable is not equal to the log of its expected value ($i.e. E(lnT) \neq lnE(T)$), but also depends on the higher-order moments of its distribution. Hence, whenever the variance of the error term in equation (22) depends on the regressors (e.g. GDP, distance), the conditional expectation of $ln(\epsilon_{ij})$ will also depend on the regressors, violating the condition for consistency of OLS. Hence, under heteroskedasticity, the parameters of log-linearized models estimated by OLS lead to biased estimates of the true elasticities (Liu (2009), Silva & Tenreyro (2006), and Felbermayr & Kohler (2010b)).

Various literatures have proposed the Poisson regression as an alternative solution, such as Flowerdew & Aitkin (1982) and Silva & Tenreyro (2006). They suggest the gravity equation be estimated in the multiplicative form, without taking logarithm of T_{ij} and allowing for heteroskedasticity. The common assumption of the PPML estimation method is that the conditional variance is proportional to the conditional mean, i.e. $E(T_{ij}|Z) \propto V(T_{ij}|Z)$, although the Poisson model is consistent even when the variance function is misspecified. Silva & Tenreyro (2006) mention that even if $E(T_{ij}|Z) \propto V(T_{ij}|Z)$ does not hold, the PPML estimator is likely to be more efficient than other estimators (i.e. Non-linear square estimators) when heteroskedasticity increases with the conditional mean. All that is needed for this estimator to be consistent is the correct specification of the conditional mean. Therefore, the data do not have to be Poisson at all, and the dependent variable need not be an integer for the estimator to be consistent. This is the well-known PML result first noted by Gourieroux *et al.* (1984).

As emphasized by Wooldridge (2002), the dependent variable for PPML estimation does not have to be count data, and the fixed effect Poisson estimator works whenever the conditional mean assumption holds. Hence, I implement the fixed effect Poisson model in this paper.[49] The most commonly used conditional mean specification in the Poisson model is $E(T_{ijt}|Z_{ijt})= exp(Z_{ijt}\beta)$, for which the coefficients can be explained as an elasticity if the dependent variable (T_{ijt}) is in level and covariates

[48] An alternative measure of the margins at the product level is used by Hummels & Klenow (2005). Dutt *et al.* (2011) mention that the count method and the Hummels & Klenow (2005) method of extensive and intensive margins are comparable with each other. In their study they find the correlation of the extensive margin between the count and the Hummels & Klenow (2005) method to be around 0.86, and the correlation between the intensive margins to be around 0.88.

[49] The random effect Poisson model needs additional maintained assumptions for efficiency against the fixed effect Poisson model. The Hausman specification test, however, rejects the random effect model in favor of the fixed effect model.

(Z_{ijt}) are in logarithms.[50] I have the specification of the following form for the total imports :

$$\begin{aligned} T_{ijt} = \quad & exp \quad (\beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ & + \quad \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOI_{ijt} + \beta_5 WTOD_{ijt}) + \epsilon_{ijt} \end{aligned} \tag{26}$$

where i denotes the importer, j denotes the exporter and t denotes time. T_{ijt} represents real bilateral imports for a country pair, measured in levels. Accounting for the role of product level extensive and intensive margin of imports with a non-linear Poisson model, the decomposition of T_{ijt} (total imports) can be expressed as follows:

$$(T_{ijt}) = (N_{ijt}) * \left(\frac{T_{ijt}}{N_{ijt}} \right) \tag{27}$$

where T_{ijt}, the real aggregate bilateral imports between a country pair is decomposed into two different dependent variables (N_{ijt} and $\frac{T_{ijt}}{N_{ijt}}$) . N_{ijt} is the extensive margin and $\frac{T_{ijt}}{N_{ijt}}$ is the intensive margin of imports.

The estimation equation for the extensive margin of imports or the number of products imported is given as:

$$\begin{aligned} N_{ijt} = \quad & exp \quad (\beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ & + \quad \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOI_{ijt} + \beta_5 WTOD_{ijt}) + \epsilon_{ijt} \end{aligned} \tag{28}$$

and the estimation equation for the intensive margin (or the average volume of imports per product) is given as :

$$\begin{aligned} (\frac{T_{ijt}}{N_{ijt}}) = \quad & exp \quad (\beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ & + \quad \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOI_{ijt} + \beta_5 WTOD_{ijt}) + \epsilon_{ijt} \end{aligned} \tag{29}$$

3.2.3 Non-linear Gravity Model : Selection Bias Issues

I further take into account the presence of zero trade flows prevalent in trade data. Past studies such as that of Eicher & Henn (2011) analyze the role of the WTO

[50] Using nonparametric tests, Henderson & Millimet (2008) confirm that the concerns over estimation in levels versus logs, posed in Silva & Tenreyro (2006), are well-founded. There are various alternatives to estimate the gravity equation multiplicatively, such as nonlinear least squares (NLS) and the Gamma Quasi-Maximum Likelihood estimator (GQMLE). According to Liu (2009), NLS provides more weight to large predicted trade observations in its first order condition. By contrast, GQMLE assumes that the conditional variance is proportional to the square of conditional mean and hence gives less weight to large predicted trade flows. According to Silva & Tenreyro (2006), there seems to be a substantial trade-off between the quantity of data and their variances since larger trade flows and GDP usually have smaller measurement errors with larger variances. The first order conditions of the Poisson model give the same weight to all observations. They suggest (based on a simulation study) that the Poisson model performs remarkably better than the other models under heteroskedasticity.

membership with only positive trade flows. By restricting the sample to only positive trade flows, their analysis has ignored the possibility that the WTO membership may be important for whether or not two countries trade with each other. Liu (2009) mentions that if the GATT/WTO provides any incentive for countries to start new trading relationships, then bilateral trade is less likely to be zero if both trading partners are the GATT/WTO members. According to Liu (2009) and Helpman *et al.* (2008), the presence of zero trade flows in trade data is not random as it is conditioned upon various factors such as distance and trade costs. Heckman (1979) mentions that if the sample selection is based on the value of the dependent variable, then the parameters of the model will always be biased if estimated with OLS. Hence, the log-linear gravity model estimated by the OLS with only positive trade flows, has endogenous sample selection issues. Furthermore, Felbermayr & Kohler (2010b) mention that estimating a gravity equation on non-zero observations alone suffers from an omitted variable bias.

A traditional means of dealing with the presence of zero trade flows in empirical trade literature has been the random effect Tobit model. Tobit model might be even more inconsistent than the OLS in the presence of heteroskedastic and non-normal residuals (Liu (2009), Felbermayr & Kohler (2010b)). Helpman *et al.* (2008) estimate a Heckman-type selection model to account for the prevalence of zero trade flows in trade data. This empirical methodology adopts the log-linear specification in the regression which is susceptible to providing biased estimates due to the presence of heteroskedasticity in trade data (Liu (2009), Felbermayr & Kohler (2010b), and Silva & Tenreyro (2006)). Furthermore, according to Felbermayr & Kohler (2010b), even though the Heckman-type procedures can deal with presence of zero trade flows, it is however not robust to the misspecification of the error term.[51] Hence I utilize the PPML estimation to deal with the non-linearity of the model that involves zero trade relationships.

3.2.4 Data

This chapter utilizes a panel data set that consists of observations for every 5 years beginning in 1965 and ending in 2005 for 175 countries. The data source is described in more detail in Appendix table 45. The countries are listed in Appendix table 46. The disaggregated product level export data is based on the 4-digit Standard International Trade Classification (SITC), Revision 2. The system makes it easier for compiling and also promoting the comparability of international trade statistics. There are 1,249 tradable product categories under this classification. The data is retrieved from the World Integrated Trade Solution (WITS) database. Within WITS, the dataset is retrieved from the United Nations Statistics Division (UNSD) Comtrade database. This dataset is used in the analysis for the extensive and the intensive margins of

[51] Liu (2009) mentions that in Helpman *et al.* (2008) model, for identification purposes, the common religion variable is assumed to affect the probability of having positive trade flows (selection equation), but not the trade volumes. He mentions that the validity of this exclusion condition is often hard to justify and the difficulty to find good instruments might be a concern of their proposed two-stage procedure.

trade. The level of disaggregation affects the extensive margin between countries as there are data available at finer level of classification. However, there are measurement errors associated with finer level of disaggregation and furthermore the choice of the 4-digit classification was made to ensure that the data coverage is the longest possible (e.g. 1962 onwards). [52] The data for the gravity variables are retrieved from the Liu dataset which was used in Liu (2009) study.[53] The data for individual RTA agreement is retrieved from Eicher *et al.* (2010).

Past empirical studies that account for zero trade flows typically assume that the country pairs not covered in the dataset have zero bilateral trade (e.g. Felbermayr & Kohler (2006b)). However, according to Liu (2009), on average for any given year, one third of countries have missing data. Hence, it is likely that more missing positive trade flows are incorrectly assigned as zeros. This consequence of incorrectly assigning zero values to missing trade data, according to Liu (2009), has non-trivial consequences and leads to biased estimates. He further mentions that if this error is positively correlated with the WTO membership, it will cause an overestimation of the role of the WTO membership at the extensive margin.

To minimize such errors while accounting for zero trade flows in the dataset, this study matches the zeros trade flows with Liu (2009) trade dataset.[54] The trade data from UN Comtrade does not report zero trade flows but those categories are omitted from the trade data altogether.

3.2.5 Empirical Results

Table 29 analyzes importer-exporter relationships based on WTO membership for total imports. The estimation includes dummies $WTOI_{ijt}$ and $WTOD_{ijt}$ where importers are industrial and developing country WTO members respectively, and the exporters are also WTO members. The table reports results for the log-linear model, poisson estimation and poisson with zero-trade flows (full sample) respectively. The result indicates that there exists a considerable heterogeneity across RTAs in terms of its impact on imports. Hence, in line with Eicher & Henn (2011), these individual RTAs minimizes the omitted variable bias that could render the WTO coefficient to be biased upwards. The log-linear model is similar to Eicher & Henn (2011) specification that includes the multilateral resistance controls, individual *RTAs* and the country-pair fixed effects to minimize the omitted variable bias. With the log-linear model, the result indicates that the industrial WTO members experience increase in total imports from exporters who are also WTO members by about 22% (22 % = $(e^{0.20} - 1)$. On the other hand, the developing WTO members do not experience any increase in imports from exporter who are also WTO members. However, once we

[52] The data set for UN Comtrade begins from 1962 onwards.

[53] Dr. Xuepeng Liu provided me with his dataset. This dataset is not publicly available.

[54] Liu (2009) mentions that zero observations in his dataset are systematically recorded accounting for more than 50 % of the dataset. Liu (2009) retrieves trade data from various sources to minimize the error associated with incorrectly assigning zero values for missing data. He uses trade data retrieved from the World Export Data (WED); the World Trade Flows (WTF) dataset and the original IFS Direction of Trade Statistics (DOT) dataset.

resort to the PPML estimation, the result indicates that both the members experience decrease in total imports by about 14% (-14% = ($e^{-0.15} - 1$). Hence, under heteroskedasticity, the parameters of log-linearized models estimated by OLS lead to biased estimates of the true elasticities (Liu (2009), Silva & Tenreyro (2006), and Felbermayr & Kohler (2010b)). Furthermore, the result is robust to accounting for the sample selection issues with the inclusion of zero-trade flows.

Table 30 reports the results for the extensive margins of imports. With the log-linear model, the result indicates that the industrial WTO members experience increase in the extensive margin of imports by about 11% while the developing WTO members do not experience any increase in the extensive margin. However, once again with the PPML estimation, both the members experience decrease in the extensive margin of imports. The result is further robust to the full sample (with zero-trade flows).

Table 31 reports the results for the intensive margin of imports. With the log-linear model, the result indicates that the industrial WTO members experience increase in the intensive margin of imports by about 11% while the coefficient on the intensive margin is insignificant for the developing WTO members. With the PPML estimation for positive trade flows and full sample, the coefficient on both the members are positive, but statistically insignificant.

Dutt *et al.* (2011) utilizes a *both-in* dummy (that takes a value of 1, if both the country-pairs are the members of the WTO) to examine the role of the WTO at the extensive and the intensive margin of exports with product level data. The dummies that I have implemented in the specification are somewhat similar to theirs, except, I disaggregate WTO importer members into industrial and developing countries. They find that the WTO membership has positive impact on the extensive margin and insignificant or even negative impact at the intensive margin of exports. Owing to several key differences between their specification and mine, the results indicate that with the PPML estimation, the positive impact on the extensive margin actually turns out to be negative.

Appendix table 41 reports the results with just the industrial and developing WTO members dummy. $WTOInd_{ijt}$ and $WTODing_{ijt}$ are dummies for importers that are industrial and developing WTO members. Eicher & Henn (2011) also estimate a log-linear gravity model with these dummies, while Felbermayr & Kohler (2010b) estimate these dummies with the Poisson specification and account for zero-trade flows.[55] The result with the log-linear model, obtained in this paper are similar to that of Eicher & Henn (2011), whereby both members do not experience any benefit from the WTO membership. With the PPML estimation, my result is a stronger indictment of the lack of effectiveness of the WTO membership as compared to Eicher & Henn (2011) results. The results also extend to the two margin of imports. Felbermayr & Kohler (2010b) find that the WTO increased imports only

[55] Subramanian & Wei (2007) also utilize the log-linear model with these dummies and find that industrial WTO members witnessed a large increase in trade, while for developing WTO members it was negative and significant. They mention that under the GATT regime, industrial WTO members actively took part in reciprocal liberalization while the developing members were largely exempted from these obligations.

at the country-level intensive margin, and more importantly developing countries benefit more than industrial countries. However, my results perhaps suggest that their *mutually inclusive* coding convention along with a single RTA dummy (for an average RTA control) might have exaggerated the WTO effect.

Table 1 provides a rather bleak outlook for the role of WTO in facilitating imports. However, I argue that past studies might have underestimated the role of the WTO membership by excluding the heterogeneity of trade flows for the WTO members across their level of development.

3.3 Extensive and Intensive Margin of Imports : Heterogeneity in the WTO membership

3.3.1 Empirical Model

In this section I examine the heterogeneity of trade flows across WTO members at the extensive and intensive margin of imports based their level of development. Subramanian & Wei (2007) mention that since developing members were not as actively engaged in reciprocal liberalization, trade liberalization should occur on products of export interest to industrial countries but not that of developing countries. Hence, they postulate that imports between industrial members should be large, while imports between industrial and developing members should be small or even non-existent.

Even though tariff reductions might have been heterogeneous across sectors (hence towards exporters), industrial importers had bound majority of their tariff lines (up to 87% of tariff lines). Hence, in line with the theoretical predictions of Sala *et al.* (2010), tariff binds can reduce uncertainty and can increase entry of firms in the export market (or exports from developing to industrial members) even when applied tariff reduction is minimal or unchanged. Hence, theoretically industrial WTO members should see increase in the imports at the extensive margin from developing members with little or no increase in the intensive margin. This prediction was substantiated by Handley & Limo (2010) in their case study of Portugal's accession to EC, where they find considerable entry of firms even in industries where applied tariffs didn't change much. They attribute the increase in entry towards reduced market uncertainty faced by Portuguese exporters. Furthermore, they mention that effects of uncertainty are more important for small and developing economies where trade is central to both consumers and firms. I examine this possibility utilizing the product level data to account for the two margins of imports. For total aggregate imports, with the log-linear specification, I have the specification of the following form :

$$\begin{aligned} lnT_{ijt} &= \beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ &+ \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOII_{ijt} + \beta_5 WTOID_{ijt} \\ &+ \beta_6 WTODI_{ijt} + \beta_7 WTODD_{ijt} + \epsilon_{ijt} \end{aligned} \tag{30}$$

Hence, $WTOII_{ijt}$ and $WTOID_{ijt}$ are dummies for importers that are industrial WTO members while the exporters are industrial and developing WTO members respectively.

Furthermore I utilize two additional dummies , $WTODI_{ijt}$ and $WTODD_{ijt}$, for importers that are developing WTO members while the exporters are industrial and developing WTO members respectively. Past studies have not analyzed this relationship. Even though the developing members have had high tariff barriers, they have tariff binds on 58% of the tariff lines in the industrial sector. According to Subramanian & Wei (2007), the conclusion of the Uruguay Round has partially remedied the developing country exemption. In particular, developing countries that wanted to join the WTO after 1994 have been required to engage in serious trade liberalization, with up to 94% binds in tariff lines of the industrial sector. Sala *et al.* (2010) mention that bound tariffs are more effective with higher risk destinations markets (e.g. developing countries), where even a large binding overhang may still command substantial market access. They further predict that reductions in bound tariffs can generate effective market access even when the bound rates remain above current and long term applied rates. Hence, theoretically the developing members should see increase in the imports at least on the extensive margin.

I test whether this prediction translates into empirics in this paper. With the product level data, I have the estimation equation of the following form:

$$\begin{aligned} lnY_{ijt} &= \beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ &+ \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOII_{ijt} + \beta_5 WTOID_{ijt} \\ &+ \beta_6 WTODI_{ijt} + \beta_7 WTODD_{ijt} + \epsilon_{ijt} \end{aligned} \tag{31}$$

where Y_{ijt} is the dependent variable of interest is categorized into T_{ijt} (real aggregate bilateral imports), N_{ijt} (the extensive margin) and $\frac{T_{ijt}}{N_{ijt}}$ (the intensive margin).

Similarly, for the Poisson Model with the product level data, I have the estimation equation of the following form:

$$\begin{aligned} Y_{ijt} = \; & exp \; (\beta_0 + \sum \alpha_{kt} Imp_{kt} + \sum \theta_{lt} Exp_{lt} + \sum \phi Year_t + \gamma Z_{ijt} + \beta_1 RTA_{ijt} \\ &+ \beta_2 GSP_{ijt} + \beta_3 BTA_{ijt} + \beta_4 WTOII_{ijt} + \beta_5 WTOID_{ijt} \\ &+ \beta_6 WTODI_{ijt} + \beta_7 WTODD_{ijt}) + \epsilon_{ijt} \end{aligned} \tag{32}$$

where Y_{ijt} is categorized into T_{ijt} (real aggregate bilateral imports), N_{ijt} (the extensive margin) and $\frac{T_{ijt}}{N_{ijt}}$ (the intensive margin).

3.3.2 Empirical Results

The results for the log-linear model, PPML estimation with positive trade flows and full sample are reported in Table 2. Table 32 reports the results for the total imports. With the log-linear model, the results indicate that industrial WTO members experience increase in total imports only from developing WTO members by about 26%. The result is robust to the PPML estimation with both positive trade flows and full sample. The results obtained in this paper is in stark contrast to Subramanian & Wei (2007), where they find that industrial WTO members witnessed a large increase in imports from industrial exporters. On the contrary, the industrial WTO members

experience decrease in total imports from industrial WTO members by about 25% (PPML estimation with positive trade flows) and 27% (PPML estimation with full sample). The coefficients on total imports for developing members are negative but statistically insignificant with the PPML estimation (both positive trade flows and full sample).

Table 33 reports the results for the extensive margin of imports. The results indicate that the industrial members experience increase in imports at the extensive margin only from the developing WTO members. The results are robust to all three specifications. In other words, the industrial WTO members import on average 27% (PPML estimation with positive trade flows) and 32% (full sample) more number of products from developing WTO members. The coefficients on the extensive margin between two industrial WTO members are either insignificant or negative and significant. Similarly, the developing members experience increase at the extensive margin of imports, and furthermore, only from the industrial exporter members by about 22% (PPML estimation with positive trade flows) and 28% (full sample). However, the coefficients on the extensive margin between two developing WTO members are statistically insignificant.

Table 34 reports the results for the intensive margin of imports. With the PPML estimation, the results indicate that neither WTO members experience any positive impact at the intensive margin of imports. The developing WTO members actually experience a decrease in the intensive margin from industrial WTO members. Hence, even though the extensive margin of imports increases, the intensive margin declines, resulting in an insignificant WTO effect on total imports.

Various studies (e.g. Rose (2004), Eicher & Henn (2011)), have indicated the lack of effectiveness of the WTO membership, especially for developing members (e.g. Subramanian & Wei (2007)). The results indicate that total trade masks significant heterogeneity in terms of the impact of the WTO membership and the failure to account for the intensive and extensive margin at product level has underestimated the benefits of WTO membership. Furthermore, with the exception of Subramanian & Wei (2007), past might have understated the benefit of WTO membership by failing to account for importer-exporter relationship of WTO membership based on country's level of development. The increases in imports for industrial members from developing members are realized exclusively from the extensive margin and the result is robust to accounting for zero-trade flows. Furthermore, any positive benefits of the WTO membership for developing nations are realized entirely through the extensive margin of imports from the industrial exporter members. In other words, the WTO membership for developing nations enhances imports of products that were not previously traded. The WTO membership however, doesn't lead to deepening of existing trade relationships at the product level (it might even decrease the volume of exports).

The results are more in line with the alternate literature that attributes the role of the WTO membership to tariff binds that reduces market uncertainty, leading to increased entry of firms in the export market (e.g.Handley (2011) and Sala *et al.* (2010)).

3.4 Extensive and Intensive Margin of Imports : WTO Membership and Product level Heterogeneity

Chaney (2008) provides theoretical illustration on the impact of changes in trade barriers to the two margins based on the elasticity of substitution among goods. He mentions that changes in variable costs (e.g. trade barriers) have a larger effect on the extensive margin for goods with lower elasticity of substitution (differentiated goods), while homogeneous goods should experience higher increase in the intensive margin of imports. Examining the role of WTO membership with product heterogeneity could be viewed as an empirical examination of Chaney (2008) theoretical proposition.

Spearot (2010) mentions that despite the massive amount of heterogeneity in varieties within narrowly defined products, the rules of the GATT/WTO, seems to be designed for a more homogeneous environment. The WTO mandates that these products (homogeneous or differentiated) are treated equally in setting tariffs, and when liberalizing tariffs.[56] Hence, given the homogeneous nature of tariff reduction in a heterogeneous product environment, examining the role of product heterogeneity could be viewed as an empirical test as to whether the benefit of the WTO membership is realized entirely through the reduction of tariffs. If that is the case, one would expect higher increase in imports for homogeneous products compared to the differentiated products as the latter has a lower elasticity of substitution (e.g. Bastos & Silva (2010) and Fink *et al.* (2005)) or lower price elasticities (e.g. Erkel-Rousse & Mirza (2002)).

Based on Rauch (1999) classification, I take into account the role of product heterogeneity in terms of the WTO membership on the extensive and intensive margin of imports. Rauch (1999) classified product categories into three groups: homogeneous, reference priced, and differentiated products. According to Rauch (1999), homogeneous goods are those traded on organized exchanges, reference price goods are those not traded on organized exchanges but nevertheless possess reference prices, and all other commodities owing to their intrinsic features are labeled as differentiated. Rauch (1999) argues that search costs tend to be higher for differentiated products and asserts that the networking effect (or search process) conditioned strongly by proximity and pre-existing ties are more prominent for these goods. Rauch & Casella (2003) shows that differentiated goods have larger the impact of international ties between wholesalers on bilateral trade, while Marcouiller (2000) mentions that the value of differentiated goods is more relationship-specific. Using Rauch & Casella (2003) search cost model, Besedes & Prusa (2006) show that transactions in differentiated goods tend to start involving smaller values than that of homogeneous goods and trade relationships tend to be longer for differentiated products. Furthermore, differentiated goods are subjected to heterogeneity in manufactures (Rauch & Casella (2003)); lower price elasticities (Erkel-Rousse & Mirza (2002)) ; smaller border effects (Evans (2003)); greater tariff evasion (Javorcik & Narciso (2007)) and higher communication costs (Fink *et al.* (2005)).

[56] He further mentions that this applies within any product, across all export sources without preferential status, and does not discriminate by quality or other characteristics.

3.4.1 Empirical Model

Bastos & Silva (2010) suggest that Rauch (1999) categorization is well suited for capturing vertical product differentiation in empirical applications. Broda & Weinstein (2006) also demonstrate that goods traded on organized exchanges are indeed more substitutable than those which are not. They further stipulate that the failure to account for product heterogeneity seems to be the major problem with the empirics of trade that assumes movements in trade costs are unaffected by movements in import demand. The total imports is now disaggregated into imports for homogeneous and differentiated goods categorized at the 4-digit SITC level according to Rauch (1999) classification. I run separate regressions for the two product levels. This paper also analyzes the role of the product heterogeneity and its impact on the extensive and the intensive margin of imports. Hence, for the total aggregate imports, I have the specification of the following form :

$$\begin{aligned} lnT_{ijth} &= \beta_0 + \sum \alpha_{kth} Imp_{kth} + \sum \theta_{lth} Exp_{lth} + \sum \phi Year_t + \gamma Z_{ijth} + \beta_1 RTA_{ijth} \\ &+ \beta_2 GSP_{ijth} + \beta_4 WTOI_{ijth} + \beta_5 WTOD_{ijth} + \epsilon_{ijth} \end{aligned} \tag{33}$$

with h : product group (h = 1 or 2, for differentiated and homogeneous goods)

I implement similar specification for extensive and intensive margin with log-linear model, PPML estimation and PPML estimation with zero trade flows.

3.4.2 Empirical Results

The results from the log-linear model and the PPML estimation with product differentiation for the total, extensive and the intensive margin of imports are reported in table 35-table 37. The estimation includes dummies $WTOI_{ijt}$ and $WTOD_{ijt}$ where importers are industrial and developing country WTO members respectively, and the exporters are also WTO members. Table 35 reports the results for total imports for differentiated and homogeneous goods respectively. With the log-linear model, the result indicates that the industrial WTO members experience increase in total imports from WTO member exporters for both the differentiated and homogeneous goods respectively. On the other hand, the developing WTO members do not experience any increase in imports from WTO exporter members for both product categories. However, once again, when we resort to the PPML estimation, the result indicates that both the members actually experience decrease in total imports for differentiated goods. The result is consistent with the PPML estimation and with the full sample. On the other hand, for homogeneous goods, the coefficient on both the WTO members are statistically insignificant with the PPML estimation.

Table 36 reports the results for the extensive margin of imports. Similar to table 35, although the log-linear model indicates that the industrial WTO members experience increase in total imports from WTO member exporters for both the differentiated and homogeneous goods, the result remains either statistically insignificant or even negative with the PPML estimation. The developing WTO members do not experience any increase in imports from WTO exporter members for both product

categories at the extensive margin. Table 37 reports the results for the intensive margin of imports. Apart from the log-linear model for differentiated goods, the results indicate that both the members do not experience increase in the intensive margin for both of the goods. The result also extends to the PPML estimation with full sample.

Table 38-table 40 analyzes importer-exporter relationship based on WTO membership and country's level of development. Table 38 reports the results for total imports for both of the goods. For differentiated goods with the log-linear model, the results indicate that the industrial WTO members experience increase in total imports from both industrial and developing WTO members. However, with the PPML estimation, the coefficients on total imports between industrial WTO members remain negative and statistically significant. Similar to table 32, with the PPML estimation (full sample), the results indicate that the industrial WTO members experience increase in total imports only from developing WTO members. For developing WTO members the coefficient on total imports are negative (and statistically significant). For homogeneous goods, the results are similar to the one obtained in table 32. The industrial WTO members experience increase in imports only from developing WTO members, and is consistent with the PPML estimation with both positive and full sample.

Table 39 reports the results for the extensive margin of imports. Similar to table 33, with the PPML estimation, the results indicate that industrial WTO members experience increase in the extensive margin only from the developing WTO members. The result is robust to both goods and the full sample. Similarly, the developing WTO members experience increase in the extensive margin only from industrial WTO members. With the PPML estimation, the result extends to both goods and the full sample. The PPML estimation with full sample indicates that the industrial WTO members experience increase in extensive margin of imports from the developing WTO members by about 30% for differentiated goods and by about 34% for homogeneous goods. Similarly, the developing WTO members experience increase in extensive margin of imports from the industrial WTO members by about 28% for differentiated goods and by about 21% for homogeneous goods.

Table 40 reports the result for the intensive margin of imports. The results with the PPML estimation indicate that neither WTO members experience any increase in the intensive margin from either members. The result further extends to the PPML estimation with full sample and is robust to both of the goods.

Even after accounting for product heterogeneity, the empirical examination of the WTO membership on the extensive and intensive margin of imports reveals that the benefits of membership are realized entirely from the extensive margin of imports. The results are further robust to accounting for zero-trade flows. The results further indicate that the benefits of the WTO membership are contingent upon the importer-exporter relationship and country's level of development. The industrial members experience increase in imports only at the extensive margin, and furthermore, only from developing members and vice-versa. The result is robust to both differentiated and homogeneous goods and for zero-trade flows.

The results are at odds with the theoretical prediction of Chaney (2008) as illustrated by the fact that the entire increase in imports is realized through the extensive

margin and is robust to both differentiated and homogeneous goods. More importantly, the impact on the intensive margin is insignificant or even negative. Perhaps these results further provide reinforcement to the argument that the WTO membership is attributed to more than just tariff reduction. Perhaps these results provide support towards the alternate trade literature that stresses the benefits of the WTO membership through tariff binds rather than reduction. The results are in line with the predictions of Handley (2011) and Sala *et al.* (2010) whereby reduction or elimination of uncertainty in the market (achieved through tariff binds) facilitates the entry of firms in the export market (or increases the extensive margin).

3.5 Conclusion

Past studies such as Rose (2004), Rose & Spiegel (2011a) and Eicher & Henn (2011) fail to find a positive impact of the WTO membership on the volume of trade. This study contributes to the existing literature by examining the role of WTO membership on the product level extensive and intensive margin of imports along with product heterogeneity. Furthermore, I take into account the role of importer-exporter relationships based on WTO membership and the country's level of development. This study further accounts for several estimation issues that have plagued the empirical WTO literature. This paper employs *mutually exclusive* coding of WTO membership to isolate the impact of the WTO trade effect and avoid collinearity issues that the *mutually inclusive* coding is susceptible to. This paper utilizes the time varying importer and exporter fixed effect and individual RTA dummies to minimize the problem of omitted variable bias. Finally, I utilize the PPML specification for both positive and zero-trade flows to account for the heteroskedastic and non-normal residuals as well as sample selection issues.

The results indicate that any positive benefit of the WTO membership is realized entirely through the extensive margin while the impact on the intensive margin is insignificant or even negative. Total trade masks significant heterogeneity in terms of the impact of the WTO membership and the failure to account for the intensive and extensive margin at product level has underestimated the benefits of WTO membership. Various studies have indicated the lack of effectiveness of the WTO membership, especially for developing members. The results further indicate that the positive impact on the extensive margin is contingent upon the importer-exporter relationship. In other words, the developing WTO members experience increase in imports at the extensive margin only from the industrial WTO members and vice-versa. The result is robust to accounting for product heterogeneity and sample selection bias (zero-trade flows). Hence, although the WTO membership leads to increase in the varieties of product imported, however, it doesn't lead to the deepening of existing trade relationships at the product level (it might even decrease the volume of exports).

The results are at odds with the theoretical prediction of Chaney (2008) on the reduction in variable costs and its impact on the two margins based on the elasticity of substitution among goods. The results extend to accounting for zero trade flows, suggesting perhaps that the WTO benefits might not have been generated through tariff reduction.

The results are more in line with the theoretical predictions of Handley (2011) and Sala *et al.* (2010), that attributes the role of WTO membership to reducing market uncertainty through tariff binds rather than tariff reduction. They mention that even though the reduction of bound rates may in practice command no reduction of the applied rates, it can reduce or eliminate uncertainty leading to increased entry of firms in the export market. They also mention that the tariff bindings above applied rates are unable to generate market access via the intensive margin of trade. Sala *et al.* (2010) predict that bound tariffs are more effective with higher risk destination markets (e.g. developing countries) where a large binding overhang can command substantial market access for these countries. Handley & Limo (2010) also mention that the effects of uncertainty are more important for small, developing economies where trade is central to both consumers and firms.

Recent studies have illustrated the importance of the extensive margin. Export diversification or a broader export basket reduces the risks of balance of payment crisis and large fluctuations in domestic output after-shocks that can negatively affect the performance of the external sector such as price fluctuations in markets, or output swings in trading partners (Agosin (2007), Lederman & Maloney (2003)). Hummels & Klenow (2005) indicate that exports growth based solely on the intensive margin can have terms of trade effects, which can be reduced by broadening the exporting base of the country. Broda & Weinstein (2006) imply that the extensive margin or increased imports of varieties leads to increase in welfare gains and productivity growth. They estimate the value to U. S. consumers of the expanded import varieties between 1972 and 2001 to be 2.6 percent of GDP.

3.6 Tables

Table 29: The Extensive and the Intensive Margin - Total Imports

	Log-linear (positive)	Poisson (positive)	Poisson (Full sample)
WTOI	0.20***	-0.15*	-0.18**
	(0.05)	(0.08)	(0.08)
WTOD	0.01	-0.15***	- 0.17**
	(0.04)	(0.07)	(0.07)
GSP	-0.02	-0.08	-0.06
	(0.06)	(0.10)	(0.10)
Bilateral FTA	-0.06	0.03	0.03
	(0.06)	(0.09)	(0.09)
ANZCERTA	-0.27	-0.72**	-0.77**
	(0.29)	(0.29)	(0.29)
APEC	-0.23***	0.60***	0.59***
	(0.08)	(0.09)	(0.09)
AP	1.12***	0.30*	0.33*
	(0.22)	(0.19)	(0.19)
AFTA	-0.47**	-0.09	-0.08
	(0.22)	(0.12)	(0.12)
CACM	—	1.33***	1.64***
	—	(0.20)	(0.21)
CARICOM	0.77***	2.08***	2.22***
	(0.21)	(0.25)	(0.25)
EEA	0.42***	-0.02	-0.01
	(0.07)	(0.07)	(0.07)
EFTA	0.23**	0.26**	0.24**
	(0.10)	(0.11)	(0.11)
EU	0.56***	-0.05	0.09
	(0.10)	(0.11)	(0.11)
LAFTA	0.75**	0.01	0.06
	(0.32)	(0.14)	(0.14)
MERCUSOR	0.30	1.38***	1.36***
	(0.21)	(0.17)	(0.17)
NAFTA	0.36**	0.58***	0.57***
	(0.16)	(0.10)	(0.10)
SPARTECA	1.02***	2.14***	2.19***
	(0.27)	(0.28)	(0.28)
USIR	0.52*	1.01***	1.06***
	(0.28)	(0.18)	(0.18)
Log Distance	—	-0.73***	-0.73***
	—	(0.03)	(0.03)
Common Language	—	0.43***	0.44***
	—	(0.08)	(0.08)
Common Border	—	0.25***	0.24***
	—	(0.06)	(0.06)
Currency Union	0.36*	0.21	0.22*
	(0.21)	(0.13)	(0.13)
Common Colonizer	—	-0.01	-0.01
	—	(0.09)	(0.09)
Current Colony	0.46*	1.04***	1.06***
	(0.24)	(0.29)	(0.30)
Ever Colony	—	0.02	0.02
	—	(0.13)	(0.14)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Country-pair fixed effect	Yes		
Pseudo Log-likelihood		-15524.17	-67437.18
N	92,424	92,424	128,091
R^2	0.89	0.93	0.94

Notes: *** p<0.01, ** p<0.05, * p<0.1. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis.

Table 30: The Extensive and the Intensive Margin - Extensive Margin

	Log-linear (positive)	Poisson (positive)	Poisson (Full)
WTOI	0.10*** (0.02)	-0.07** (0.03)	-0.13*** (0.04)
WTOD	-0.01 (0.02)	-0.22*** (0.02)	- 0.23*** (0.02)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Country-pair fixed effect	Yes		
Pseudo Log-likelihood		-1240556.30	-1429325
N	92,424	92,424	128,091
R^2	0.94	0.81	0.81

Table 31: The Extensive and the Intensive Margin - Intensive Margin

	Log-linear (positive)	Poisson (positive)	Poisson (Full)
WTOI	0.10*** (0.05)	0.20 (0.16)	0.03 (0.18)
WTOD	0.02 (0.04)	0.17 (0.15)	0.13 (0.17)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Country-pair fixed effect	Yes		
Pseudo Log-likelihood	-15498.88	-4296.65	-4296.65
N	92,424	92,424	128,091
R^2	0.80	0.73	0.63

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 32: Heterogeneity in the WTO Membership - Total Imports

	Log-linear (positive)	Poisson (positive)	Poisson (Full)
WTOII	-0.03 (0.07)	-0.29*** (0.09)	-0.32*** (0.09)
WTOID	0.23*** (0.06)	0.27** (0.14)	0.30*** (0.14)
WTODI	-0.15** (0.05)	-0.11 (0.08)	-0.07 (0.08)
WTODD	-0.04 (0.05)	-0.09 (0.08)	-0.08 (0.08)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Pseudo Log-likelihood		-15497.49	-67119.48
Country-pair fixed effect	Yes		
N	92,424	92,424	128,091
R^2	0.89	0.94	0.94

Table 33: Heterogeneity in the WTO Membership - Extensive Margin

	Log-linear (positive)	Poisson (positive)	Poisson (Full)
WTOII	0.01 (0.03)	-0.01 (0.04)	-0.07* (0.04)
WTOID	0.12*** (0.02)	0.24*** (0.04)	0.28*** (0.04)
WTODI	0.03 (0.02)	0.20*** (0.03)	0.25*** (0.03)
WTODD	-0.01 (0.02)	0.03 (0.02)	0.01 (0.02)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Country-pair fixed effect	Yes		
Pseudo Log-likelihood		-1232744.90	-1416220.60
N	92,424	92,424	128,091
R^2	0.94	0.81	0.81

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 34: Heterogeneity in the WTO Membership - Intensive Margin

	Log-linear (positive)	Poisson (positive)	Poisson (Full)
WTOII	-0.04 (0.06)	0.16 (0.20)	-0.17 (0.23)
WTOID	0.10* (0.05)	0.03 (0.22)	0.03 (0.22)
WTODI	-0.18*** (0.04)	-0.36** (0.17)	-0.34 (0.22)
WTODD	-0.03 (0.04)	0.09 (0.17)	0.10 (0.19)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Country-pair fixed effect	Yes		
Pseudo Log-likelihood		-4295.25	-4515.66
N	92,424	92,424	128,091
R^2	0.80	0.73	0.63

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 35: The Role of Product Heterogeneity - Total Imports

	Log-linear positive (n)	Poisson positive (n)	Poisson full (n)	Log-linear positive (w)	Poisson positive (w)	Poisson full (w)
WTOI	0.23***	-0.23**	-0.24***	0.14**	0.01	-0.09
	(0.05)	(0.09)	(0.09)	(0.07)	(0.15)	(0.16)
WTOD	-0.09**	-0.36***	-0.38***	-0.06	-0.10	-0.13
	(0.04)	(0.06)	(0.06)	(0.06)	(0.12)	(0.12)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Time varying Imp. and Exp. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair fixed effects	Yes			Yes		
N	82,757	82,757	126,888	65,616	65,616	126,406
R^2	0.91	0.96	0.96	0.84	0.76	0.76

Table 36: The Role of Product Heterogeneity - Extensive Margin

	Log-linear positive (n)	Poisson positive (n)	Poisson full (n)	Log-linear positive (w)	Poisson positive (w)	Poisson full (w)
WTOI	0.10***	-0.06*	-0.14**	0.07***	0.02	-0.16***
	(0.02)	(0.03)	(0.04)	(0.02)	(0.03)	(0.03)
WTOD	-0.03	-0.21***	-0.22***	-0.02	-0.21***	-0.29***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Time varying Imp. and Exp. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair fixed effects	Yes			Yes		
N	82,757	82,757	126,888	65,616	65,616	126,406
R^2	0.93	0.79	0.80	0.91	0.77	0.77

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 37: The Role of Product Heterogeneity - Intensive Margin

	Log-linear positive (n)	Poisson positive (n)	Poisson full (n)	Log-linear positive (w)	Poisson positive (w)	Poisson full (w)
WTOI	0.13***	0.12	-0.03	0.07	-0.04	-0.10
	(0.04)	(0.10)	(0.10)	(0.05)	(0.18)	(0.22)
WTOD	-0.06*	0.15	0.07	0.04	0.18	0.13
	(0.03)	(0.10)	(0.11)	(0.05)	(0.13)	(0.15)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Time varying Imp. and Exp. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair fixed effects	Yes			Yes		
N	82,757	82,757	126,888	65,616	65,616	126,406
R^2	0.83	0.70	0.68	0.79	0.67	0.62

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 38: Heterogeneity in the WTO Membership and the Role of Product Heterogeneity - Total Imports

	Log-linear positive (n)	Poisson positive (n)	Poisson full (n)	Log-linear positive (w)	Poisson positive (w)	Poisson full (w)
WTOII	0.13***	-0.22**	-0.22**	-0.10	-0.37**	-0.56***
	(0.06)	(0.09)	(0.09)	(0.10)	(0.16)	(0.16)
WTOID	0.24***	0.17	0.19*	0.16**	0.46**	0.54***
	(0.06)	(0.11)	(0.11)	(0.11)	(0.19)	(0.20)
WTODI	-0.09*	0.06	0.08	-0.19**	-0.15	-0.12
	(0.05)	(0.07)	(0.07)	(0.07)	(0.15)	(0.15)
WTODD	-0.12*	-0.24***	-0.25***	-0.12*	0.08	0.06
	(0.05)	(0.07)	(0.07)	(0.07)	(0.12)	(0.13)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Time varying Imp. and Exp. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair fixed effects	Yes			Yes		
N	82,757	82,757	126,888	65,616	65,616	126,406
R^2	0.91	0.96	0.96	0.84	0.78	0.77

Table 39: Heterogeneity in the WTO Membership and the Role of Product Heterogeneity - Extensive Margin

	Log-linear positive (n)	Poisson positive (n)	Poisson full (n)	Log-linear positive (w)	Poisson positive (w)	Poisson full (w)
WTOII	0.02	-0.01	-0.07*	0.04	0.02	-0.18***
	(0.03)	(0.04)	(0.08)	(0.03)	(0.04)	(0.04)
WTOID	0.13***	0.22***	0.26***	0.07***	0.21***	0.29***
	(0.04)	(0.04)	(0.04)	(0.02)	(0.03)	(0.04)
WTODI	0.07***	0.19***	0.25***	-0.06***	0.09***	0.19***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
WTODD	-0.01	-0.04	0.02	-0.04**	-0.11***	-0.08***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Time varying Imp. and Exp. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair fixed effects	Yes			Yes		
N	82,757	82,757	126,888	65,616	65,616	126,406
R^2	0.93	0.79	0.80	0.91	0.78	0.78

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 40: Heterogeneity in the WTO Membership and the Role of Product Heterogeneity - Intensive Margin

	Log-linear positive (n)	Poisson positive (n)	Poisson full (n)	Log-linear positive (w)	Poisson positive (w)	Poisson full (w)
WTOII	0.11**	-0.02	-0.15	-0.13	-0.57***	-1.09***
	(0.05)	(0.10)	(0.03)	(0.09)	(0.17)	(0.21)
WTOID	0.10**	-0.17	-0.09	0.09	0.10	0.20
	(0.05)	(0.14)	(0.15)	(0.07)	(0.23)	(0.25)
WTODI	-0.16***	-0.32*	-0.21	-0.13*	- 0.29*	-0.32
	(0.04)	(0.16)	(0.03)	(0.07)	(0.15)	(0.21)
WTODD	-0.11***	-0.06	-0.03	-0.08	0.22	0.23
	(0.04)	(0.17)	(0.20)	(0.06)	(0.14)	(0.17)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Time varying Imp. and Exp. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair fixed effects	Yes			Yes		
N	82,757	82,757	126,888	65,616	65,616	126,406
R^2	0.83	0.70	0.69	0.79	0.67	0.62

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

3.7 Appendix

Table 41: Importer WTO membership - Total Imports

	Log-linear (positive)	Poisson (positive)	Poisson (Full sample)
WTOInd	0.08 (0.09)	-0.33*** (0.04)	-0.35*** (0.08)
WTODing	-0.15** (0.07)	-0.25*** (0.08)	- 0.26*** (0.08)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Pseudo Log-likelihood		-15522.45	-67441.16
N	92,424	92,424	128,091
R^2	0.89	0.94	0.94

Table 42: Importer WTO membership - Extensive Margin

	Log-linear (positive)	Poisson (positive)	Poisson (Full sample)
WTOInd	0.03 (0.04)	-0.01 (0.04)	-0.03 (0.05)
WTODing	-0.10*** (0.04)	-0.03 (0.03)	- 0.01 (0.04)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Pseudo Log-likelihood		-1248666.30	-1438637.20
N	92,424	92,424	128,091
R^2	0.94	0.80	0.80

Table 43: Importer WTO membership - Intensive Margin

	Log-linear (positive)	Poisson (positive)	Poisson (Full sample)
WTOInd	0.06 (0.07)	0.06 (0.26)	0.12 (0.25)
WTODing	-0.06 (0.06)	-0.10 (0.22)	-0.03 (0.21)
Year effects	Yes	Yes	Yes
Time varying importer and exporter fixed effect	Yes	Yes	Yes
Pseudo Log-likelihood		-4298.16	-4516.94
N	92,424	92,424	128,091
R^2	0.80	0.73	0.63

Notes: *** p<0.01, ** p<0.05, * p<0.10. 175 countries for every five year from 1965-2005. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables in table 29 are also included but not reported.

Table 44: Country-pair fixed effects in the empirical specification

Eicher & Henn (2011) mention that a potential omitted variable involves unobserved bilateral heterogeneity. Baldwin & Taglioni (2006) argue that there exists associated bias for coefficients of interest when two countries exhibit unobserved affinities for bilateral trade before joining a trade agreement. Hence, the omission of country-pair fixed effects then renders WTO and RTA estimates biased upwards if the included controls do not account for all bilateral heterogeneity, for instance because some is unobserved (Eicher & Henn (2011)).

Felbermayr & Kohler (2010b) argue true endogeneity seems a less severe problem with WTO membership compared to RTAs. An upward bias would arise, for instance, if there is some unobserved dyad-specific variable which is positively correlated with both WTO membership and bilateral trade. According to Felbermayr & Kohler (2010b), this type of concern seems far less convincing for the WTO which is a multilateral, not a regional trading arrangement. They further argue that jointly entering a multilateral agreement like the GATT/WTO is a very unlikely response to being natural bilateral trading partners. In a similar vein, the notion that certain countries are more natural trading partners than others for the whole world (instead of bilaterally) seems far-fetched. Hence, they do not include country-pair fixed effects in their estimation.

Furthermore, Eicher & Henn (2011) themselves suggest that the heterogeneity of RTAs and the multilateral resistance as most important factor that drove their results. Country-pair fixed effects seemed to be more relevant for the RTA as opposed to the WTO membership.

Furthermore, in STATA, one can implement Poisson estimation by running a fixed effect Poisson estimator. Like any other non-linear estimations, the inclusion of time varying importer and exporter dummies makes the convergence of the likelihood function extremely difficult. Silva & Tenreyro (2006) developed a PPML code in STATA to account for this problem. Essentially the program drops the perfectly collinear explanatory variables in the OLS regression, which in turn facilitates the convergence of the likelihood estimation. However, this program doesn't allow for fixed effects estimation, hence one need to include country pair dummies to account for country pair fixed effects. With the presence of computationally cumbersome time-varying exporter and importer fixed effects the inclusion of country pair dummies exceeds the matrix size in STATA. Hence, due to the limitations of STATA, country pair fixed effect is not feasible to be estimated with Poisson specification that includes the time varying dummies.

Table 45: Data

- Imports data at product level are obtained from the World Integrated Trade Solution (WITS) database deflated by US CPI for All Urban Consumers (CPI-U), all items, 1982-84=100. Within the database, the import data is retrieved from the United Nations Statistics Division (UNSD) COMTRADE (Commodity Trade) database.
- Import data is available at the four-digit SITC- Revision 2 classification.
- All the common gravity variables are obtained from the dataset provided by Liu .
- Country-specific data (retrieved from Liu dataset) such as common border, language, colonizer, and independence are taken from 2003 CIA World Factbook website by Liu.
- The great circle distances are constructed from latitudes and longitudes of country pairs by Liu.
- Currency-union data taken from Glick-Rose (2002).
- GSP data are retrieved from the UN publication : Operation and Effects of the Generalized System of Preferences by Liu. I extend the GSP information for 2005 from the WITS database.
- Individual Regional trade agreements are retrieved from Eicher *et al.* (2010).
- GATT/WTO formal memberships are retrieved from Subramanian & Wei (2007) and the WTO website:
  $http://www.wto.org/english/tratop_e/region_e/eif_e.xls$
- For bilateral FTAs until 2000, this paper uses the ones listed in Subramanian & Wei (2007). For additional bilateral FTAs I use the WTOs website on regional agreements :
  $http://www.wto.org/english/tratop_e/region_e/eif_e.xls$
  by selecting all agreements notified to the WTO whose date of entry into force fell between 2001 and 2005.

Table 46: Country List

Albania (2000)	Ghana (1957)	Panama (1997)
Algeria	Greece (1950)*	Papua N. Gui. (1994)
Angola (1994)	Grenada (1994)	Paraguay (1994)
Antigua and Barbuda (1987)	Guatemala (1991)	Peru (1951)
Argentina (1967)	Guinea (1994)	Philippines (1979)
Armenia(2003)	Guinea-Bissau (1994)	Poland (1967)
Australia (1948)*	Guyana (1966)	Portugal (1962)*
Austria (1951)*	Haiti (1950)	Qatar (1994)
Azerbaijan	Honduras (1994)	Romania (1971)
Bahamas	Hong Kong (1986)	Russia
Bahrain (1993)	Hungary (1973)	Rwanda (1966)
Bangladesh (1972)	Iceland (1968)*	Samoa
Barbados (1967)	India (1948)	Sao Tome & Prin.
Belarus	Indonesia (1950)	Saudi Arabia (2005)
Belgium (1948)*	Iran	Senegal (1963)
Belize (1983)	Iraq	Seychelles
Benin (1963)	Ireland (1967)*	Sierra Leone (1961)
Bermuda	Israel (1962)	Singapore (1973)
Bhutan	Italy (1950)*	Slovak Rep. (1993)
Bolivia (1990)	Jamaica (1963)	Slovenia (1994)
Botswana (1987)	Japan (1955)*	Solomon Isl. (1994)
Brazil (1948)	Jordan(2000)	Somalia
Bulgaria (1996)	Kazakhstan	South Africa (1948)
Burkina Faso (1963)	Kenya (1964)	Spain (1963)*
Burma(Myanmar) (1948)	Kiribati	Sri Lanka (1948)
Burundi (1965)	Korea, South (R)(1967)	St. Kitts & Nevis (1994)
Cambodia(2004)	Kuwait (1963)	St. Lucia (1993)
Cameroon (1963)	Kyrgyz Republic (1998)	St. Vincent & Gren.(1993)
Canada (1948)*	Lao People's Dem. Rep.	Sudan
Cape Verde	Latvia (1999)	Suriname (1978)
Central African Rep. (1963)	Lebanon	Swaziland (1993)
Chad (1963)	Lesotho (1988)	Sweden (1950)*
Chile (1949)	Liberia	Switzerland (1966)*
China(2001)	Libya	Syria
Colombia (1981)	Lithuania(2001)	Tajikistan
Comoros	Luxembourg (1948)*	Tanzania (1961)
Congo, Dem. Rep. of (Zaire) (1971)	Macedonia	Thailand (1982)
Congo, Rep. (1963)	Madagascar (1963)	Togo (1964)
Costa Rica (1990)	Malawi (1964)	Tonga(2007)
Cote D'Ivoire (Ivory Coast) (1963)	Malaysia (1957)	Trinidad & Tob. (1962)
Croatia(2000)	Maldives (1983)	Tunisia (1990)
Cyprus (1963)	Mali (1993)	Turkey (1951)
Czech Republic (1993)	Malta (1964)	Turkmenistan
Denmark (1950)*	Mauritania (1963)	Uganda (1962)
Djibouti (1994)	Mauritius (1970)	Ukraine (2008)
Dominica (1993)	Mexico (1986)	U.A.E. (1994)
Dominican Rep. (1950)	Moldova (2001)	United Kingdom (1948)*
Ecuador (1996)	Mongolia (1997)	United States (1948)*
Egypt (1970)	Morocco (1987)	Uruguay (1953)

Years of accession in GATT/WTO are in parentheses.* denotes Industrial countries based on Subramanian and Wei (2007).

Table 47: List of Regional Trade Arrangements (RTA)

Abbreviation	Start	Member countries
ANZCERTA	1983	Australia, New Zealand
APEC	1989	Australia, Brunei, Canada, China (1991), Chile (1994), Taiwan (1991), Hong Kong (1991), Indonesia, Japan,South Korea, Malaysia, Mexico (1993), New Zealand,Papua New Guinea (1993), Peru (1998), Philippines,Singapore, Thailand, United States, Vietnam (1998).
AP	1969	Bolivia, Colombia, Ecuador, Peru, Venezuela (1973), Former: Chile (1969-76)
AFTA	1967	Brunei (1984), Cambodia (1998), Indonesia, Laos (1997) Malaysia, Myanmar (1997), the Philippines, Singapore,Thailand Vietnam (1995)
CACM	1960	Costa Rica (1963), El Salvador, Guatemala, Honduras,Nicaragua.
CARICOM	1968	Antigua and Barbuda, Bahamas (1983), Barbados Belize (1995), Dominica (1974), Guyana (1995), Grenada (1974) Jamaica, Montserrat (1974), St. Kitts and Nevis, St. Lucia(1974) St. Vincent & Grenadines, Suriname (1995),Trinidad & Tobago.
EEA	1994	Austria, Belgium, Denmark, Finland, France, Germany Greece, Luxembourg, Iceland, Italy, Ireland, Liechtenstein Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom
EFTA	1960	Iceland, Liechtenstein (1991), Norway (1986) Switzerland; Former: Denmark (1960-72), United Kingdom (1960-72) Portugal (1960-85), Austria (1960-94), Sweden (1960-94) Finland (1986-94)
EU	1958	Austria (1995), Belgium, Denmark (1973), Finland (1995) France, Germany, Greece (1981), Luxembourg Ireland(1973), Italy, Netherlands, Portugal (1986) Spain (1986),Sweden (1995), United Kingdom (1973)
LAIA/LAFTA	1960	Argentina, Bolivia (1967), Brazil, Chile Colombia (1961) Ecuador (1961), Mexico Paraguay, Peru, Uruguay,Venezuela (1966)
MERCOSUR	1991	Argentina, Brazil, Paraguay, Uruguay
NAFTA	1988	Canada, United States, Mexico (1994).
SPARTECA	1981	Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia Nauru, Niue, Palau, Papua-New Guinea, Salomon Islands Samoa, Tonga, Tuvalu, Vanuatu, Australia, New Zealand.

4 Fiscal Episodes and the Extensive and Intensive Margin of Exports

4.1 Introduction

Alesina & Ardagna (2010) examine the impact of large changes in fiscal policy stance, such as large increase (stimuli) or reduction (consolidation) of budget deficits of all OECD countries on both the economy and the dynamics of the debt. They find that fiscal consolidation or stabilization of debt is associated with the avoidance of economic downturns or even economic expansions (rather than recessions). Utilizing a sample of advanced economies over the last 30 years, IMF (2010) finds that fiscal consolidation typically has a contractionary effect on output in the short-term. IMF (2010) uses simple statistical techniques (previously implemented by Cerra & Saxena (2008) and Romer & Romer (1990)) to investigate the short-term effects of consolidation on international exports and growth, among others. They find that fiscal consolidation reduces GDP and raises unemployment.

This paper pertains to examining the impact of fiscal episodes on international exports and furthermore provides evidence on the mechanism by which such fiscal episodes stimulate exports. IMF (2010) find that interest rates fall in response to fiscal consolidation episode supporting consumption and investment. Similarly, they find that currency depreciation (due to fiscal consolidation) spurs net exports. Hence, these two factors provide a cushioning role on the contractionary impact of fiscal episodes on output. Utilizing the standard gravity model of trade, this study analyzes the impact of fiscal stimuli and fiscal consolidation (collectively known as fiscal episodes) on total exports for 20 advanced economies from 1970-2010. Furthermore, I utilize disaggregated product-level trade data to analyze whether fiscal episodes leads to new trading relationships (the extensive margin) or an increase in trade in existing relationships (the intensive margin). The extensive margin is measured as the number of products exported by country i to country j at time t. The intensive margin is defined as the average volume of trade in existing product-country trade relationships or average exports per product from country i to country j at time t.

Exchange rate depreciation due to fiscal consolidation could be viewed as a reduction of the price of exports. Hence, from the importers' perspective the demand for and sales volume of a given product or the intensive margin of trade would increase. If the positive impact of fiscal consolidation on exports is primarily due to the exchange rate channel (as indicated by IMF (2010)) then we should see an increase in the intensive margin of exports. This paper argues for an additional channel (facilitated due to fiscal consolidation) - the interest rate channel, which also impacts exports. I argue that a decrease in interest rates leads to a decrease in fixed cost of exports (e.g. cost of borrowing and capital expenditures). Griffoli (2006) mentions that interest rates affect production and, more importantly, the number of firms active in the export market because of fixed costs. This study argues that changes in interest rate due to fiscal episodes would also affect exports primarily via the extensive margin. IMF (2010) fails to elaborate on the connection between interest rates and international exports, which is one of the focal points of this paper.

Finally, this paper analyzes whether the impact on exports from episodes is con-

tingent upon the fiscal stance from the importers. IMF (2010) argues that if countries simultaneously implement fiscal consolidation, then the impact on exports will diminish since all countries cannot increase net exports at the same time. The argument is based on the notion that both countries would experience currency depreciation; hence there would be no relative decrease in the price of exports. However, this study argues that the exporters still could experience increase in exports via the extensive margin based on the interest rate channel irrespective of the importers' fiscal stance.

This analysis examines the total effect or the cumulative effect (e.g. adding the effect on exports from time t till time $t+3$) of fiscal episodes on total, extensive and intensive margins of exports.[57] The results from the log-linear estimation reveal that exporters that implement fiscal consolidation experience increases in total exports. The paper also examines the marginal effect (impact of fiscal episode one, two or three year after the initial year of episode) of fiscal episodes on exports. Results indicate that there is a delayed positive effect of fiscal consolidation on total exports.[58] The results are in line with the findings of IMF (2010) that exports expand in response to fiscal consolidation, providing a key cushioning role on the impact of fiscal consolidation on output. Furthermore, fiscal stimuli leads to decreases in total exports.

Results indicate that fiscal consolidation leads to an increase in exports solely through the extensive margin of exports. In other words, fiscal consolidation leads to an increase in new relationships at the product level. However, this paper finds that the effect on the intensive margin is negative and statistically significant, implying that fiscal consolidation leads to a decrease in existing trading relationships at the product level. Hence, the results perhaps suggest that the positive effect on exports is realized via the interest rate channel whereby decrease in interest rates leas to increases in the extensive margin of exports. Additionally, fiscal stimuli has a negative impact on total, extensive and intensive margins of exports.

When both countries implement fiscal consolidation simultaneously, the results indicate that exporters do not experience any increase in total exports. However, the exporters experience increases in the extensive margin at the expense of the intensive margin of exports. Similarly, the results extend to the scenario when exporters implement fiscal consolidation and importers implement fiscal stimuli. Hence, irrespective of the importers' fiscal stance, exporters who experience fiscal consolidation experience increases in the extensive margin of exports. However, countries that implement fiscal stimuli do not experience increases in total, extensive or the intensive margins of exports irrespective of the importers' fiscal stance (in fact their exports decrease and is statistically significant).

The remainder of the paper is organized as follows: Section 2 discusses the impact of fiscal episodes on total exports via the exchange rate and the interest rate channel. It also discusses its impact on the extensive and the intensive margin of exports.

[57] Alesina & Ardagna (2010) and IMF (2010) mention that there is a delayed effect of fiscal episodes on the economy. For example, according to IMF (2010), in response to fiscal consolidation interest rate fall by about 20 basis points after two years while GDP falls by about 0.5%.

[58] The impact of fiscal episode at the year of the episode is insignificant. However, there is significant positive impact after one year following the episode. Three years after the episode, the effect diminishes.

Section 3 presents the empirical specification (log-linear gravity model of trade) and discusses the data along with the definition of fiscal consolidation and stimuli. Finally, it presents the results for the marginal and cumulative effect of fiscal episodes on total, extensive and the intensive margin of exports. Section 4 examines the impact of fiscal episodes contingent upon the fiscal stance by the importers. Section 5 examines the impact of fiscal episodes based on IMF (2010) definition on total exports and the extensive and intensive margin. Section 6 summarizes the main findings of the paper.

4.2 Fiscal Episodes and International Trade

4.2.1 The Impact of Fiscal Episodes on Total Exports: The Exchange Rate and the Interest Rate Channel

According to IMF (2010), budget deficits and government debt soared during the Great Recession. In 2009, the budget deficit averaged about nine percent of GDP in advanced economies, compared to only one percent of GDP in 2007. Furthermore, by the end of 2010, government debt is expected to reach about 100 percent of GDP - its highest level in 50 years. Similarly, Alesina & Ardagna (2010) mention that, as a result of the fiscal response to the financial crisis of 2007-2009, the US will experience the largest increases in deficits and debt accumulation. The key question for governments as Alesina & Ardagna (2010) put it, would be how to stop the growth of the insurmountable debt and return to normal public finances. The governments of the advanced economies have already undertaken or planned substantial spending cuts and tax increases. IMF (2010) states that although there might be widespread agreement that reducing debt has important long-term benefits, the central question to economists is whether fiscal consolidation will hurt economic growth in the short-term.

Alesina & Ardagna (2010) find that fiscal consolidation based upon spending cuts and no tax increases are more likely to reduce deficits and debt over GDP ratios than those based upon tax increases. IMF (2010) also examines the impact of fiscal consolidation in 15 advanced economies over the past 30 years. In contrast to Alesina & Ardagna (2010), they find that fiscal consolidation typically has a contractionary effect on output. According to IMF (2010), a fiscal consolidation equal to 1% of GDP typically reduces GDP by about 0.5% within two years and raises the unemployment rate by about 0.3%. Furthermore, they find that the domestic demand (primarily consumption and investment) also falls. Even though there are disparate findings as to whether fiscal episodes (notably consolidation) are truly expansionary, the focus of this paper is the impact of these episodes on international exports.

IMF (2010) mentions that in response to a fiscal consolidation, the exchange rate depreciates and this real depreciation is almost fully explained by nominal exchange rate depreciation or currency devaluation boosting net exports. They find that for each 1% of GDP of fiscal consolidation, the value of currency usually falls by about 1.1%, and the contribution of net exports to GDP rises by about 0.5%. Hence they mention that net exports expand in response to fiscal consolidation, providing a key cushioning role on the impact of fiscal consolidation on output. The increase in net

exports reflects both an increase in real exports in response to the real exchange rate depreciation and a decline in real imports, which also reflects the fall in income.

Similarly, IMF (2010) finds that reductions in interest rates also usually support output during episodes of fiscal consolidation. They find that for each 1% of GDP of fiscal consolidation, interest rates usually fall by about 20 basis points after two years. IMF (2010) stipulate that a fall in interest rates is likely to support consumption and investment. However, they fail to elaborate on the connection between interest rates and international exports, which is one of the focal points of this paper. Utilizing the standard gravity model of trade, we analyze the impact of fiscal stimuli and fiscal consolidation on exports for 20 countries from 1970-2010.

According to Alesina & Ardagna (2010), if agents believe that the fiscal tightening generates a change in regime that "eliminates the need for larger, maybe much more disruptive adjustments in the future," it would have expansionary impact on the economy. If agents believe that the stabilization is credible and avoids a default on government debt, they can ask for a lower premium on government bonds. Private demand components sensitive to the real interest rate can increase if the reduction in the interest rate paid on government bonds leads to a reduction in the real interest rate charged to consumers and firms. The decrease in interest rate can also lead to the appreciation of stocks and bonds, increasing agents' financial wealth, and triggering a consumption/investment boom. Similarly, IMF (2010) mentions that the rate of inflation usually does not change much following fiscal consolidation, the fall in real interest rates is similar. At the same time, the long-term nominal interest rate on government bonds falls broadly in line with short-term rates. Furthermore, they mention that the response of long-term rates suggests that fiscal consolidation may reduce risk premiums.

4.2.2 Fiscal Episodes and the Extensive and Intensive Margin of Exports

This study examines the impact of these fiscal episodes on the extensive and the intensive margin of exports. The recent theoretical models of trade have emphasized firm-level productivity differences in trade structure. For ex. Helpman *et al.* (2008) incorporate firm-level heterogeneity and advocate for the decomposition of trade volume into the extensive and intensive margins. In addition to analyzing the impact of fiscal episodes utilizing the standard gravity model of trade, this paper builds on IMF (2010) by inquiring whether these fiscal episodes lead to new trading relationships (the extensive margin) or an increase in trade in existing relationships (the intensive margin) at the product level. Various studies have analyzed the impact of trade policies such as trade liberalization on these two margins, notably Melitz (2003) and Chaney (2008). These studies indicate that a decline in variable trade costs (e.g. reduction in tariffs, exchange rate depreciation) increases the extensive as well as the intensive margin. These studies have placed substantial emphasis on fixed trade costs. Furthermore, Chaney (2008) shows that a reduction in fixed costs (e.g. information costs) affects only the extensive margin.

Exchange rate depreciation for exporters could be viewed as a reduction of the price of exports or the reduction of prices that the exporters charge. Hence, from

the importers' perspective the demand for and sales volume of a given product would increase.

This study argues that a decrease in interest rates could be viewed as a decrease in fixed costs (e.g. cost of borrowing and capital expenditures). Hence, in line with Chaney (2008), this paper argues that changes in interest rates due to fiscal episodes would also affect exports primarily via the extensive margin. Griffoli (2006) mentions that interest rates affect production and, more importantly, the number of firms active in the export market because of fixed costs. In sum, the cost of capital (used to finance the fixed cost) affects trade through the extensive margin. He mentions that as interest rates diminish, fixed costs decline, more firms are able to enter the market, and all firms increase capital investment, two forces that boost total exports. Hence the argument is that a fixed cost of entry is dependent on interest rates. Firms borrow funds at the ongoing real interest rate to set up or expand an export business, or that exporting requires investment in capital whose rental cost depends on the real interest rate. Griffoli (2006) mentions that the requirements to enter or expand operations in the export market are dependent on capital expenditures. Hence, logistics, production, product adaptations or just maintaining an office abroad are all capital intensive activities for which the relevant cost is the interest rate. Costs of entry are much more tangible and immediate to firm managers and thus are more likely to be sensitive to changes in interest rates.

Various studies have indicated the importance of both margins. Export diversification, or a broader export basket, reduces the risks of balance of payments crises and large fluctuations in domestic output after-shocks that can negatively affect the performance of the external sector, such as price fluctuations in international markets or output swings in trading partners (Agosin (2007), Lederman & Maloney (2003)). Feenstra & Kee (2008) suggest that increases in sectoral export variety boost country productivity as the new exporting basket can improve the use and allocative efficiency of the economy. Hummels & Klenow (2005) indicate that export growth, based solely on the intensive margin, can have terms-of-trade effects, especially for large economies which can be reduced by broadening the exporting base of the country.

Besedes & Prusa (2010) argue that the survival of trading relationships is important for long-run export growth, and that the majority of growth in exports occurs at the intensive margin. Felbermayr & Kohler (2006a) postulate that the intensive margin historically explains the majority of export growth, leaving room for the extensive margin to increase in importance for future export growth. Amurgo-Pacheco & Pierola (2008) also find that export growth is primarily determined along the intensive margin, especially for developed economies.

4.3 Empirics: Log-linear gravity model

4.3.1 Total Aggregate Exports

IMF (2010) utilizes a simple statistical technique to investigate the short-term growth effects of consolidation and how those effects are influenced by such factors as monetary policy and international trade. They estimate the average impulse response of

output to action-based fiscal consolidation using panel data analysis. The estimated equation makes use of an autoregressive model in growth rates estimated on annual data for 1980-2009 for 15 advanced economies. In this paper we utilize the standard log-linear gravity model of trade to examine the impact of fiscal episodes on international exports. In addition to measuring the impact of fiscal episodes on total exports, we also examine the impact of fiscal episodes on the extensive and the intensive margins of exports. The standard specification of the gravity model estimated by OLS is of the following form:

$$\begin{aligned} lnT_{ijt} &= \beta_0 + \sum_{k=0}^{k=3} \beta_{t+k} EFC_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} EFS_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} IFC_{it+k} \\ &+ \sum_{k=0}^{k=3} \beta_{t+k} IFS_{it+k} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t \\ &+ \gamma Z_{ijt} + \epsilon_{ijt} \end{aligned} \tag{34}$$

where i denotes the exporter, j denotes the importer, and t denotes time. T_{ijt} denotes real exports value of country i to j at time t. EFC_{it+k} is a binary variable which is unity if i implements fiscal consolidation at time t+k, where $k = 0, 1, 2, 3$ and zero otherwise. Similar to Alesina & Ardagna (2010) we advance the impact of fiscal episodes to one, two and three years following the beginning of an episode.[59] According to IMF (2010), including lags of fiscal episodes allows for a delayed impact of fiscal consolidation on exports. Their results indicate that the impact of fiscal consolidation on exchange rates and interest rates usually take around two years from the start of the episode to fully materialize. Hence, these year specific dummies are intended to capture the marginal effect of fiscal episodes on exports or additional effect of fiscal episodes on exports after the year of implementation of episodes. Similarly, EFS_{it+k} is a binary variable which is unity if i implements fiscal stimuli at or before time t, and zero otherwise. Furthermore, IFC_{it+k} and EFS_{it+k} are binary variables which are unity if j implements fiscal consolidation and fiscal stimulus at time t+k, respectively.

Imp_a are the list of importer dummies that take the value of one if a=j, and zero otherwise. Exp_b are the list of exporter dummies that take the value of one if b=i, and zero otherwise. These dummies are comprehensive sets of exporter and importer fixed effects that take into account any time-invariant country-specific factors. $Year_t$ is a year-specific fixed effect implemented to take into account any time-specific common trends or effects (e.g. business cycles, oil price shocks). The row vector Z_{ijt} represents a list of common gravity control variables (or proxies) between the bilateral country pair that are not absorbed by the fixed effects. It includes the natural logs of variables such as the bilateral distance, population, annual real GDP per capita and product of the areas of the countries. It further includes bilateral pair dummies such as country pairs using the same currency at time t, country pairs i and j sharing a

[59] For example, if U.S implements fiscal consolidation in year 1980, we analyze the impact of episodes with four different time frames: 1980, 1981, 1982 and 1983.

common language, country pairs i and j having a regional trade agreement at time t, country pairs sharing a common land border, number of island countries in the country pair, country pairs colonized by the same country, country i colonized j at time t or vice versa and if country i ever colonized j or vice versa. ϵ represents the omitted influences, assumed to be well behaved.

To ensure that the results are robust, I also implement the specification of the following form:

$$\begin{aligned} lnT_{ijt} &= \beta_0 + \sum_{k=0}^{k=3} \beta_{t+k} EFC_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} EFS_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} IFC_{it+k} \\ &+ \sum_{k=0}^{k=3} \beta_{t+k} IFS_{it+k} + \sum \alpha_1 a_{ij} + \sum \alpha_2 Year_t + \gamma Z_{ijt} + \epsilon_{ijt} \end{aligned} \tag{35}$$

where a_{ij} are a list of country pair dummies that take the value of one if i exports to j, and zero otherwise. These country pair dummies are a comprehensive set of dyadic-specific fixed effects that absorb any time-invariant characteristics common to a country pair. Inclusion of year fixed effects and country/dyadic-specific fixed effects, according to Rose & Spiegel (2011b), can be viewed as a difference-in-differences estimator. Z_{ijt} includes all the other control variables mentioned in equation (34) pertinent to the gravity model of trade.

4.3.2 Extensive and Intensive Margin of Exports

This study further examines the impact of fiscal episodes on the extensive and intensive margins of exports. This paper utilizes disaggregated data at the four-digit Standard International Trade Classification (SITC) Revision 2 product level to construct a measure of the two margins. The methodology applied in this paper to analyze the two margins of exports is commonly referred to as the count method. Previous studies, such as those of Nitsch & Pisu (2008), Bernard *et al.* (2007), Flam & Nordstrm (2006), and Dutt *et al.* (2011), have adopted a similar methodology to decompose total trade into the extensive and the intensive margins. In the traditional log-linear form, the decomposition of total exports can be expressed as follows:

$$ln(T_{ijt}) = ln(N_{ijt}) + ln(\frac{T_{ijt}}{N_{ijt}}) \tag{36}$$

where T_{ijt}, the real aggregate bilateral exports (sum of total exports for all products for a given year) or total exports between a country pair is decomposed into two different dependent variables (N_{ijt} and $\frac{T_{ijt}}{N_{ijt}}$). N_{ijt} (the extensive margin) is the number of products exported per year per country pair and $\frac{T_{ijt}}{N_{ijt}}$ (the intensive margin) is the average volume of exports per product per year. Utilizing the log-linear gravity model

specification, total exports can be expressed by the following estimation equation :

$$\begin{aligned} lnT_{ijt} &= \beta_0 + \sum_{k=0}^{k=3} \beta_{t+k} EFC_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} EFS_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} IFC_{it+k} \\ &+ \sum_{k=0}^{k=3} \beta_{t+k} IFS_{it+k} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t \\ &+ \gamma Z_{ijt} + \epsilon_{ijt} \end{aligned} \tag{37}$$

The estimation equation for the extensive margin of exports is given as :

$$\begin{aligned} lnN_{ijt} &= \beta_0 + \sum_{k=0}^{k=3} \beta_{t+k} EFC_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} EFS_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} IFC_{it+k} \\ &+ \sum_{k=0}^{k=3} \beta_{t+k} IFS_{it+k} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t \\ &+ \gamma Z_{ijt} + \epsilon_{ijt} \end{aligned} \tag{38}$$

and for the intensive margin is given as :

$$\begin{aligned} ln(\frac{T_{ijt}}{N_{ijt}}) &= \beta_0 + \sum_{k=0}^{k=3} \beta_{t+k} EFC_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} EFS_{it+k} + \sum_{k=0}^{k=3} \beta_{t+k} IFC_{it+k} \\ &+ \sum_{k=0}^{k=3} \beta_{t+k} IFS_{it+k} + \sum \alpha_1 Imp_a + \sum \alpha_2 Exp_b + \sum \alpha_3 Year_t \\ &+ \gamma Z_{ijt} + \epsilon_{ijt} \end{aligned} \tag{39}$$

This study further estimates the role of the extensive and the intensive margins with a comprehensive set of dyadic-specific fixed effects similar to equation (35).[60]

There are alternative means of constructing the extensive and the intensive margin of trade, which are not explored in this paper.[61] This study acknowledges that there might be some limitations to the count method of constructing the two margins. According to Baldwin & Nino (2006), each of the product categories encompass a range of individual goods, so one cannot hope to pick up the full extensive margin.

[60] Variable Z includes all the pertinent control variables for the gravity model of trade.

[61] An alternative measure of the margins at the product level is used by Hummels & Klenow (2005). They define the extensive margin as a weighted count of the categories in which a country exports relative to the categories exported by the rest of the world. The intensive margin is defined as the nominal exports from a country relative to the nominal exports from the rest of the world in the categories that the country also exports. Hence, the extensive margin can be viewed as a measure of diversification and the intensive margin as a measure of trade volume. Dutt *et al.* (2011) mention that the count method and the Hummels & Klenow (2005) method of extensive and intensive margins are comparable with each other. They find the correlation of the extensive margin between the count and the Hummels & Klenow (2005) method to be around 0.86, and the correlation between the intensive margins to be around 0.88.

Hence, this measure cannot ascertain the full link between the fiscal episodes and the number of varieties as some changes in the intensive margin may capture changes in the extensive margin.

4.3.3 Data

The disaggregated product level export data is based on the 4-digit Standard International Trade Classification (SITC), Revision 2. There are 1,249 tradable product categories under this classification. The data is retrieved from the World Integrated Trade Solution (WITS) database. Within WITS, the dataset is retrieved from the United Nations Statistics Division (UNSD) Comtrade database. This dataset is used in the analysis for the extensive and the intensive margins of trade. The level of disaggregation affects the extensive margin between countries as there are data available at finer level of classification. However, there are measurement errors associated with finer level of disaggregation and furthermore the choice of the 4-digit classification was made to ensure that the data coverage is the longest possible (e.g. 1962 onwards). GDP per capita and population data are retrieved from WDI (2012). The rest of the data for gravity variables are retrieved from Rose's website. Refer to appendix table 59 for further description of the data set. The paper utilizes a panel of 20 OECD countries for the time period from 1970-2010. The rationale for focusing on advanced economies according to IMF (2010) is due to the fact that fiscal policy adjustment needs are particularly large, on average, for the group of advanced economies. Appendix table 60 and table 61 lists all the countries in the sample and their respective years of fiscal episodes.

4.3.4 Definitions of Fiscal Episodes

This paper adopts the definition of fiscal episodes proposed by Alesina & Ardagna (2010). They focus on the size of the fiscal packages (i.e. the magnitude of the change of the government deficit) and the composition (i.e. the percentage change of the main government budget items relative to the total change). They utilize cyclically adjusted values of the fiscal variables to account for variations of the fiscal variables induced by business cycle fluctuations. They implement the method proposed by Blanchard (1990) that corrects various components of the government budget for year-to-year changes in the unemployment rate.[62]

Alesina & Ardagna (2010) define a period of fiscal adjustment (stimulus) for a year where the cyclically adjusted primary balance improves (deteriorates) by at least 1.5 % of GDP. They argue that these definitions of episodes are based on a rather demanding criterion that rules out small but prolonged consolidation or stimuli. Hence, these are very sharp and large episodes that clearly indicate a change in the fiscal stance.

[62] Alesina & Ardagna (2010) further mention that the cyclically adjusted value of the change in a fiscal variable is the difference between a measure of the fiscal variable in period t computed as if the unemployment rate were equal to the one in $t-1$ and the actual value of the fiscal variable in year $t-1$. To calculate the measure of the fiscal variable in period t as if the unemployment rate were equal to the one in $t-1$, they follow the procedure in Alesina & Perotti (1995).

Furthermore, these large fiscal changes allow one to isolate changes in fiscal policy which are policy induced as opposed to cyclical fluctuations of the deficits.[63] They use the primary deficit, which is the difference between current and capital spending, excluding interest rate expenses paid on government debt, and total tax revenue as opposed to the total deficit, to avoid that episodes selected result from the effect that changes in interest rates have on total government expenditures.[64]

4.3.5 Empirical Results - Cumulative Effect

The results from the log-linear gravity model utilizing product level export data are shown in table 1. In this section we examine the total effect (summation of all the marginal effects) of fiscal episodes on total, extensive and intensive margins of exports. In other words, we test the hypothesis whether the total effect or the cumulative effect of episodes on exports starting from time t to time $t+3$ is statistically different from zero. Table 1 tabulates the results where we add all the coefficients (or marginal effects) of each episode (at different time periods) together and test the null hypothesis that the coefficients jointly equal 0.[65] Table 48 tabulates the total effect of fiscal episodes for exporters. The results indicate that the total effect of fiscal consolidation for exporters (from time t to $t+3$) is positive and statistically significant. In other words, countries that implement fiscal consolidation experience an increase in their total exports by about 7%. The result is robust to the inclusion of country pair fixed effects. These results are in line with IMF (2010) that exports expand in response to fiscal consolidation, providing a key cushioning role on the impact of fiscal consolidation on output.

Table 48 also reports the results for the cumulative impact of fiscal stimuli on total exports. The results indicate that the total effect of fiscal stimuli for exporters (from time t to $t+3$) is negative and statistically significant. In other words, countries that implement fiscal stimuli experience a decrease in their total exports by about 21%.[66] Based on the intuition advanced by IMF (2010), one could argue that fiscal stimuli (in contrast to fiscal consolidation) would lead to exchange rate appreciation, making their exports more expensive from the importers' perspective. Hence, this would lead to a decrease in total exports. Similarly, an increase in output would also lead to an increase in interest rates, making borrowing more expensive and ultimately reducing investment.

Table 48 also reports the results for the cumulative impact of fiscal episodes on the extensive and intensive margin of exports. As mentioned before, if the impact of fiscal consolidation on exports is purely via the exchange rate channel, then one

[63] This definition misses fiscal adjustments and stimuli which are small in each year but prolonged for several years.

[64] Using these criteria, according to Alesina & Ardagna (2010) they focus as much as possible on episodes that do not result from the automatic response of fiscal variables to economic growth or monetary policy induced changes on interest rates, but they should reflect discretionary policy choices of fiscal authorities.

[65] The nlcom command in STATA tests the null that the addition of coefficients jointly equals 0. It provides us with the coefficient estimate and the standard error respectively.

[66] The results are robust to the inclusion of country-pair fixed effects.

would see an increase in the intensive margin. However, if the effect is via the interest rate channel (decrease in fixed cost), then one would see an increase primarily in the extensive margin of exports. The coefficient of the total or cumulative effect on the extensive margin of exports for countries experiencing fiscal consolidation is also positive, statistically significant, and robust to both exporter and importer or country-pair fixed effects. Hence, countries implementing fiscal episodes experience an increase of 16% on the extensive margin. However, the coefficients on the intensive margin of exports are negative and statistically significant. Hence, the results suggest that the positive impact of fiscal consolidation on exports is realized entirely through the extensive margin at the expense of the intensive margin. The results further indicate that the positive effect on exports are realized via the interest rate channel whereby the decrease in interest rates could be viewed as a decrease in fixed costs leading to an increase in the extensive margin of exports. The results for the impact of fiscal stimuli extend to the extensive and intensive margin. In other words, countries that experience fiscal stimuli do not experience any positive impact on exports at either margins (in fact it is negative and statistically significant).

4.3.6 Empirical Results - Marginal Effect

The results in table 2 report the marginal effect of fiscal episodes on exporters. Table 50 includes year fixed effects along with exporter and importer fixed effects. The left column contains the coefficient of fiscal consolidation and stimuli experienced by exporters on total exports. We advance the impact of fiscal episodes to one, two, and three years following the beginning of an episode to allow for a delayed impact of fiscal episodes on total exports. These fiscal episode dummies are intended to capture the marginal effect of fiscal episodes on total exports. In others words, these dummies capture the additional effect of fiscal episodes on total exports one, two and three years after the initial year of implementation. The results indicate that the coefficient on fiscal consolidation at time t is statistically insignificant. However, at time $t+1$, the coefficient on the fiscal consolidation dummy is statistically significant and positive. Hence, countries that have implemented fiscal consolidation at time t have exports that are higher by 4% at time $t+1$, or one year after the date of implementation. Similarly exports increase by 3%, two years after the initial date of fiscal consolidation. However three years after the date of fiscal consolidation the impact on total exports fades away. The preliminary results indicate a potential non-linear impact of fiscal consolidation on exports. The results remain robust to the inclusion of country-pair fixed effects as tabulated in table 51.

Table 50 also reports the results for the impact of fiscal stimuli on total exports. Similar to the previous result, the coefficient on fiscal stimuli at time t is negative and statistically significant. Hence, at time t, countries that have experienced fiscal stimuli have exports that are lower by 8% . The results further indicate that the coefficients are negative and statistically significant throughout the different time periods. The results remain robust to the inclusion of country-pair fixed effects as

tabulated in table 51[67]

Table 50 also reports the results for the extensive and intensive margins of exports for countries implementing fiscal episodes. The coefficient on the extensive margin of exports for countries implementing fiscal consolidation is positive, statistically significant, and robust to both exporter and importer or country-pair fixed effects. At time $t+1$ or 1 year after the date of the episode, countries that have implemented fiscal consolidation have exports that are higher by 5% with importer/exporter fixed effects and country-pair fixed effects. However, the coefficients on the intensive margin of exports are statistically insignificant for earlier years of the episode but as we advance the effect to two and three years after the episode, the results indicate a significant negative effect. Hence, the results suggest that the positive impact of fiscal consolidation on exports is realized entirely through the extensive margin at the expense of the intensive margin. Hence, the results reinforce the argument that perhaps the interest rate channel is more plausible for explaining the positive impact of fiscal episodes on exports, thereby providing some cushioning effect towards the negative impact of fiscal consolidation on GDP. The results for the impact of fiscal stimuli extend to the extensive and intensive margin. In other words, countries that experience fiscal stimuli do not experience any positive impact on exports at either margins (in fact at time $t+2$ and $t+3$ it is negative and statistically significant).

4.4 Fiscal Episodes and Exporter-Importer Relationship

In this section the paper analyses whether or how the impact of fiscal episodes on exports changes when many countries conduct fiscal episodes simultaneously. This is especially relevant since a number of advanced economies set fiscal consolidation in motion. In other words, this section analyzes whether the impact on exports from episodes is contingent upon the fiscal stance from importers.

IMF (2010) argues that the fiscal consolidation in the importers reduces demand for exports from exporters that also experience fiscal consolidation. Assume, for example, that the U.S. implements a fiscal consolidation episode in 1980. If the majority of the countries in the data set also implement similar fiscal consolidation, then perhaps the U.S. might not experience a significant increase in exports as opposed to the alternative. Hence, according to IMF (2010) the exchange rate channel provides a smaller buffer as currencies cannot all depreciate at the same time and net exports cannot increase for all countries simultaneously. This would imply that there could be large output costs associated with fiscal consolidation implemented across all the large economies concurrently. However, IMF (2010) also points out that large changes in interest rates could perhaps provide a cushioning role in this situation.

4.4.1 Empirical Results

Table 3 presents the results for the impact of fiscal episodes contingent upon exporter and importer relationship. Table 52 examines the impact on total, extensive and intensive margins of exports when both exporters and importers implement fiscal

[67] The analysis for importer fiscal episodes will be presented in Section 4.

consolidation simultaneously. Here, we simply add the coefficients of the impact of fiscal consolidation on exporters and importers as tabulated in table 50 (e.g. coefficient on exporter consolidation + coefficient on importer consolidation) and test the null hypothesis that the cumulative effect equals 0. The results indicate that when both exporters and importers experience fiscal consolidation simultaneously, exporters do not experience any increase in total exports. The results remain robust to both estimation strategies. However, once we turn to the extensive margin, the results indicate that exporters that experience fiscal consolidation export higher numbers of products to countries that also experience fiscal consolidation. Hence, the results once again suggest that perhaps the interest rate channel is driving the increase in the extensive margin. The results on the intensive margin once again are negative and statistically significant.

Table 53 tabulates the results for exporters and importers that experience fiscal stimuli simultaneously. The results indicate that exporters experience a decrease in total, extensive and intensive margins of exports. Table54 tabulates the results for exporters that experience fiscal consolidation and importers that experience fiscal stimuli. The results indicate that exporters do not experience any increase in total exports. However, the impact on the extensive margin reveals a different story. Two years after the date of the episode, exporters experience an increase in the extensive margin by 5% when importers implement stimuli simultaneously. Hence, the results indicate that, irrespective of the importers' fiscal stance, exporters who implement fiscal consolidation experience increases in the extensive margin of exports.

Table 55 tabulates the results for exporters that implement fiscal stimuli and importers that implement fiscal consolidation simultaneously. Similar to table 53, when exporters implement fiscal stimuli they do not experience an increase in total, extensive or intensive margins of exports. Hence, irrespective of the importers' fiscal stance, exporters who implement fiscal stimuli do not experience any positive impact on exports; in fact their exports decrease and the result is statistically significant.

4.5 Robustness Check

In contrast to Alesina & Ardagna (2010), IMF (2010) provides alternative method for identifying periods of fiscal consolidation based on policy actions intended to reduce the budget deficit. IMF (2010) argue that the problem with the standard approach is that it ignores the motivation behind fiscal actions. According to them, it omits years during which actions aimed at fiscal consolidation were followed by an adverse shock and an offsetting discretionary stimulus.[68] The standard approach would therefore tend to miss cases of consolidation followed by adverse shocks, because there may be little or no rise in the CAPB despite the consolidation measures.

[68] For example, according to IMF (2010), assume that two countries adopt identical consolidation policies, but then one is hit by an adverse shock and adopts discretionary stimulus, while the other is hit with a favorable shock. Here, the change in the cyclically adjusted primary budgetary balance (CAPB) would show a smaller increase for the first country than for the second country, despite the presence of identical consolidation measures.

IMF (2010) identify cases in which the government implemented tax hikes or spending cuts to reduce the budget deficit. In contrast to Alesina & Ardagna (2010) where they identify periods of consolidation based on successful (cyclically adjusted) budget outcomes, IMF (2010) identifies episodes based on fiscal policy actions motivated by deficit reduction, irrespective of the outcomes. Hence, they claim to have examined accounts and records of what countries actually did.[69]

In this paper, we conduct robustness check based on IMF (2010) definition of fiscal consolidation. The analysis is based on 15 advanced economies from 1980-2009. Appendix table 62 lists the countries in their sample and the respective years of fiscal consolidation according to their definition. The results based on their definition are shown in table 4. The results indicate that the coefficient on fiscal consolidation at time t and $t+1$ is statistically significant and imply that countries that have implemented fiscal consolidation have exports that are higher by 6% and 9% respectively. However two years after the date of fiscal consolidation the impact on total exports fades away. The results remain robust to the inclusion of country-pair fixed effects. Table 56 also reports the results for the extensive and intensive margins of exports for countries implementing fiscal consolidation. The coefficient on the extensive margin of exports is positive and statistically significant at time $t+1$ and $t+2$ and is robust to both exporter and importer or country-pair fixed effects. In contrast to Alesina & Ardagna (2010), however, the coefficients on the intensive margin of exports are statistically significant and positive for the time periods t and $t+1$. Hence, the results suggest that the positive impact of fiscal consolidation on exports is realized via both the extensive and intensive margins.

Table 57 examines the total effect of fiscal consolidation on total, extensive and intensive margins of exports. The results indicate that the total effect of fiscal consolidation for exporters is positive and statistically significant. Hence, countries that implement fiscal consolidation experience an increase in their total exports by about 17%. The coefficient on the cumulative effect on the extensive and intensive margin of exports is also positive, but unlike previous results, are statistically insignificant.

Table 58 presents the results for the impact of fiscal consolidation contingent upon exporter and importer relationship or when both exporters and importers implement fiscal consolidation simultaneously. The results indicate that when both exporters and importers experience fiscal consolidation simultaneously, exporters do not experience any increase in total exports. The results remain robust to both estimation strategies. The result further indicates that exporters that experience fiscal consolidation export higher numbers of products to countries that also experience fiscal consolidation at time $t+2$. The results on the intensive margin are statistically insignificant.

Alesina & Ardagna (2010) argue that IMF (2010) methodology involves many judgment calls. More importantly, according to Alesina & Ardagna (2010), the idea that this procedure would eliminate endogeneity (i.e., fiscal policy responding to the economy and not the other way around) is highly questionable. They further mention that the descriptive IMF and OECD reports usually describe what happens to the

[69] They analyze OECD Economic Surveys, IMF Staff Reports, IMF Recent Economic Developments reports, country budget documents, and additional country-specific sources.

deficit in a particular period, and hence do not go into the details of policy makers intentions, discussions and congressional records. They argue that many other studies have used different methodologies, and have identified cases of expansionary fiscal adjustments, thereby drawing similar conclusions to their study.

4.6 Conclusion

Past studies such as Alesina & Ardagna (2010) and IMF (2010) examine the impact of fiscal episodes on the economy, notably growth. While Alesina & Ardagna (2010) find that fiscal consolidation can be expansionary, IMF (2010) finds that fiscal consolidation typically has a contractionary effect on output and employment in the short-term. Furthermore, IMF (2010) finds that fiscal consolidation leads to a depreciation of the exchange rate and a reduction of the interest rate. They further find that exchange rate depreciation increases net exports and the decline in interest rate stimulates consumption and investment, thus providing a cushioning role on the contractionary impact. This paper argues for additional channel through which fiscal consolidation would impact exports - the interest rate channel.

This study contributes to the existing literature by examining the impact of fiscal episodes on total exports utilizing the standard log-linear gravity model of trade. Furthermore, this paper utilizes disaggregated product-level trade data to analyze whether fiscal episodes lead to new trading relationships or an increase in trade in existing relationships. Furthermore, this paper examines the total or the cumulative effect of fiscal episodes on total exports and the two margins of exports. Finally, this study analyzes whether the impact on exports from episodes is contingent upon the fiscal stance from the importers.

The results indicate that fiscal consolidation increases total exports, however there is a delayed response of exports to fiscal consolidation. The results also indicate that fiscal stimuli lead to a decrease in total exports. The positive impact of fiscal consolidation on exports from the exchange rate channel would potentially be reflected by the increase in the intensive margin of exports, as exchange rate depreciation can be viewed as a reduction in the price of exports. This study argues that a decrease in interest rates due to fiscal consolidation leads to a decrease in fixed cost of exports, hence affecting total exports primarily through the extensive margin of exports.

Utilizing disaggregated product-level data, the results indicate that fiscal consolidation leads to an increase in exports solely through the extensive margin of exports or an increase in new product relationships. However, this paper finds that the effect on the intensive margin is negative and statistically significant, implying that fiscal consolidation leads to a decrease in existing trading relationships. Additionally, fiscal stimuli has a negative impact on total, extensive and intensive margins of exports. Hence, the results obtained are more in line with the interest rate argument whereby the positive effect on exports is realized due to a decrease in interest rates leading to an increase in the extensive margin of exports.

Furthermore, irrespective of the importers' fiscal stance, when exporters implement fiscal consolidation they do not experience any increase in total exports. However, the results indicate that exporters experience an increase in the extensive margin

at the expense of the intensive margin of exports. However, countries that implement fiscal stimuli do not experience increases in total, extensive or intensive margins of exports, irrespective of the importers' fiscal stance.

Various studies have indicated the importance of the extensive margin of exports. Export diversification, or a broader export basket, reduces the risks of balance of payments crises and large fluctuations in domestic output after-shocks that can negatively affect the performance of the external sector, such as price fluctuations in international markets or output swings in trading partners (Agosin (2007), Lederman & Maloney (2003)). Feenstra & Kee (2008) suggest that increases in sectoral export variety boost country productivity as the new exporting basket can improve the use and allocative efficiency of the economy. Hummels & Klenow (2005) indicate that export growth, based solely on the intensive margin, can have terms-of-trade effects, especially for large economies which can be reduced by broadening the exporting base of the country.

4.7 Tables

Table 48: Total effect of Fiscal Episodes - Exporters

	Total	Ext.	Int.	Total	Ext.	Int.
Consolidation	0.07*	0.15***	-0.08**	0.06*	0.15***	-0.09**
	(0.04)	(0.02)	(0.04)	(0.04)	(0.02)	(0.04)
Stimuli	-0.24***	-0.14***	-0.10**	-0.24***	-0.13***	-0.10***
	(0.04)	(0.02)	(0.04)	(0.04)	(0.02)	(0.04)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. 20 countries from 1970-2010. Dependent variables are in logs. All the other control variables are also included but not reported. Robust standard errors clustered by country pairs are in parenthesis.

Table 49: Total effect of Fiscal Episodes - Importers

	Total	Ext.	Int.	Total	Ext.	Int.
Consolidation	-0.07	0.03	-0.10**	-0.07*	0.03	-0.10**
	(0.04)	(0.02)	(0.04)	(0.04)	(0.02)	(0.04)
Stimuli	-0.08	-0.01	-0.07	-0.07	-0.01	-0.06
	(0.05)	(0.02)	(0.05)	(0.05)	(0.02)	(0.05)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Notes: *** p<0.01, ** p<0.05, * p<0.1. 20 countries from 1970-2010. Dependent variables are in logs. All the other control variables are also included but not reported. Robust standard errors clustered by country pairs are in parenthesis.

Table 50: Marginal Effect of Fiscal Episodes - Importer and Exporter Fixed Effect

	Total Exports	Extensive Margin	Intensive Margin
$EFCt$	0.00	0.01**	-0.01
	(0.01)	(0.01)	(0.01)
$EFCt+1$	0.04***	0.05***	-0.01
	(0.01)	(0.01)	(0.01)
$EFCt+2$	0.03***	0.05***	-0.03**
	(0.01)	(0.01)	(0.01)
$EFCt+3$	-0.00***	0.04***	-0.04***
	(0.01)	(0.00)	(0.01)
$EFSt$	-0.08***	-0.05***	-0.03***
	(0.01)	(0.01)	(0.01)
$EFSt+1$	-0.05***	-0.04***	-0.01
	(0.01)	(0.01)	(0.01)
$EFSt+2$	-0.05***	-0.03***	-0.03**
	(0.01)	(0.01)	(0.01)
$EFSt+3$	-0.05***	-0.02***	-0.03***
	(0.01)	(0.01)	(0.01)
$IFCt$	-0.03***	0.00	-0.03***
	(0.01)	(0.01)	(0.01)
$IFCt+1$	-0.01	0.01	-0.02*
	(0.01)	(0.01)	(0.01)
$IFCt+2$	-0.02	0.01	-0.02**
	(0.01)	(0.01)	(0.01)
$IFCt+3$	-0.02	0.01	-0.03**
	(0.01)	(0.01)	(0.01)
$IFSt$	-0.03**	-0.01	-0.02
	(0.01)	(0.01)	(0.01)
$IFSt+1$	-0.02	-0.00	-0.02
	(0.01)	(0.01)	(0.01)
$IFSt+2$	-0.02	-0.00	-0.02
	(0.01)	(0.01)	(0.01)
$IFSt+3$	-0.01	0.00	-0.01
	(0.01)	(0.01)	(0.01)
Year effects	Yes	Yes	Yes
R^2	0.92	0.83	0.88
N	14,441	14,441	14,441

Notes: *** p<0.01, ** p<0.05, * p<0.1. 20 countries from 1970-2010. Dependent variables are in logs. All the other control variables are also included but not reported. Robust standard errors clustered by country pairs are in parenthesis.

Table 51: Marginal Effect of Fiscal Episodes - Country pair Fixed Effect

	Total Exports	Extensive Margin	Intensive Margin
$EFCt$	0.00	0.01*	-0.01
	(0.01)	(0.01)	(0.01)
$EFCt+1$	0.04***	0.05***	-0.01
	(0.01)	(0.01)	(0.01)
$EFCt+2$	0.02**	0.05***	-0.03***
	(0.01)	(0.01)	(0.01)
$EFCt+3$	-0.00***	0.04***	-0.04***
	(0.01)	(0.00)	(0.01)
$EFSt$	-0.08***	-0.05***	-0.03***
	(0.01)	(0.01)	(0.01)
$EFSt+1$	-0.05***	-0.04***	-0.01
	(0.01)	(0.01)	(0.01)
$EFSt+2$	-0.05***	-0.02***	-0.03**
	(0.01)	(0.01)	(0.01)
$EFSt+3$	-0.06***	-0.02***	-0.03***
	(0.01)	(0.01)	(0.01)
$IFCt$	-0.03**	0.00	-0.03***
	(0.01)	(0.01)	(0.01)
$IFCt+1$	-0.01	0.01	-0.02*
	(0.01)	(0.01)	(0.01)
$IFCt+2$	-0.02	0.01	-0.02**
	(0.01)	(0.01)	(0.01)
$IFCt+3$	-0.02	0.01	-0.02**
	(0.01)	(0.01)	(0.01)
$IFSt$	-0.03**	-0.01	-0.02
	(0.01)	(0.01)	(0.01)
$IFSt+1$	-0.02	-0.00	-0.02
	(0.01)	(0.01)	(0.01)
$IFSt+2$	-0.02	-0.00	-0.02
	(0.01)	(0.01)	(0.01)
$IFSt+3$	-0.01	0.00	-0.01
	(0.01)	(0.01)	(0.01)
Year effects	Yes	Yes	Yes
R^2	0.97	0.93	0.94
N	14,441	14,441	14,441

Notes: *** p<0.01, ** p<0.05, * p<0.1. 20 countries from 1970-2010. Robust standard errors clustered by country pairs are in parenthesis. All the other control variables are also included but not reported.

Table 52: Fiscal Stimuli and Consolidation on Exporter-Importer Relationship : EFC-IFC

	Total	Ext.	Int.	Total	Ext.	Int.
Time-t	-0.02	0.02**	-0.04***	-0.03	0.02*	-0.04***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+1	0.03	0.06***	-0.03*	0.03	0.06***	-0.03*
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+2	0.01	0.06***	-0.05***	0.01	0.06***	-0.05***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+3	-0.02	0.04***	-0.06***	-0.02	0.04***	-0.06***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Table 53: Fiscal Stimuli and Consolidation on Exporter-Importer Relationship : EFS-IFS

	Total	Ext.	Int.	Total	Ext.	Int.
Time-t	-0.11***	-0.06***	-0.05***	0.11***	-0.06***	-0.05***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+1	-0.07***	-0.05***	-0.03	-0.07***	-0.04***	-0.03
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+2	-0.07***	-0.03***	-0.05***	-0.07***	-0.03***	-0.05**
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+3	-0.06***	-0.02**	-0.04**	-0.06***	-0.02**	-0.04**
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Table 54: Fiscal Stimuli and Consolidation on Exporter-Importer Relationship : EFC-IFS

	Total	Ext.	Int.	Total	Ext.	Int.
Time-t	-0.03	0.01	-0.03*	-0.03	0.00	-0.03*
	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)
Time-t+1	0.02	0.05***	-0.02	0.02	0.05***	-0.02
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+2	0.01	0.05***	-0.02***	0.01	0.05***	-0.04**
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+3	-0.01	0.04***	-0.05***	-0.01	0.04***	-0.05***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Table 55: Fiscal Stimuli and Consolidation on Exporter-Importer Relationship : EFS-IFC

	Total	Ext.	Int.	Total	Ext.	Int.
Time-t	-0.10***	-0.04***	-0.06***	-0.10***	-0.04***	-0.06***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+1	-0.06***	-0.03***	-0.03*	-0.07***	-0.03***	-0.03**
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+2	-0.07***	-0.02*	-0.05***	-0.07***	-0.02*	-0.05***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Time-t+3	-0.07***	-0.01	-0.06***	-0.07***	-0.01	-0.06***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Table 56: IMF Definition of Fiscal Consolidation - Marginal Effect

	Total	Ext.	Int.	Total	Ext.	Int.
$EFCt$	0.06*	0.01	0.05*	0.06*	0.01	0.05*
	(0.03)	(0.02)	(0.03)	(0.03)	(0.01)	(0.03)
$EFCt+1$	0.09***	0.05**	0.05**	0.10***	0.05**	0.05**
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
$EFCt+2$	0.03	0.03**	0.00	0.04*	0.03**	0.01
	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
$EFCt+3$	-0.02	-0.01	-0.01	-0.01	-0.01	-0.00
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
$IFCt$	0.00	0.00	-0.00	0.01	0.00	0.00
	(0.03)	(0.01)	(0.03)	(0.03)	(0.01)	(0.03)
$IFCt+1$	-0.04	0.00	-0.04*	-0.04	0.00	-0.04*
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
$IFCt+2$	-0.02	-0.00	-0.02	-0.02	-0.00	-0.02
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
$IFCt+3$	-0.03	-0.00	-0.02	-0.02	-0.00	-0.02
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes
R^2	0.92	0.78	0.90	0.97	0.89	0.96
N	5,965	5,965	5,965	5,965	5,965	5,965

Table 57: IMF Definition of Fiscal Consolidation - Total Effect

	Total	Ext.	Int.	Total	Ext.	Int.
EFC	0.16*	0.07	0.09	0.18*	0.07	0.11
	(0.09)	(0.05)	(0.07)	(0.09)	(0.06)	(0.07)
IFC	-0.09	0.00	-0.09	-0.07	0.00	-0.07
	(0.08)	(0.04)	(0.07)	(0.08)	(0.04)	(0.06)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

Table 58: IMF Definition of Fiscal Consolidation : Exporter-Importer Relationship

	Total	Ext.	Int.	Total	Ext.	Int.
Time-t	0.06	0.01	0.05	0.06	0.01	0.05
	(0.04)	(0.02)	(0.04)	(0.04)	(0.02)	(0.04)
Time-t+1	0.06	0.05**	0.01	0.06	0.05*	0.01
	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)
Time-t+2	0.00	0.02	-0.02	0.02	0.02	-0.01
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Time-t+3	-0.05	-0.02	-0.03	-0.04	-0.02	-0.02
	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exporter f.e.	Yes	Yes	Yes			
Importer f.e.	Yes	Yes	Yes			
Dyadic f.e				Yes	Yes	Yes

4.8 Appendix

Table 59: Data Sources

- GDP per capita and population data is retrieved from the WDI website: $http://data.worldbank.org/data$
- All the common gravity variables are obtained from Rose's website .
- Exports at product level are obtained from the World Integrated Trade Solution (WITS) database, deflated by US CPI for All Urban Consumers (CPI-U), all items, 1982-84=100.
- Within the database, the export data is retrieved from the United Nations Statistics Division (UNSD) COMTRADE (Commodity Trade) database.
- Export data is available at the four-digit SITC- Revision 2 classification.

Table 60: List of Countries and Episodes of Fiscal Stimuli

Country	Year
Australia	1990, 1991
Austria	1975, 2004
Belgium	1975, 1981, 2005
Canada	1975, 1982, 1991, 2001
Denmark	1974, 1975, 1980, 1981, 1982
Finland	1978, 1982, 1983, 1987, 1990, 1991, 1992, 2001, 2003
France	1975, 1981, 1992, 1993, 2002
Germany	1995, 2001
Greece	1981, 1985, 1989, 1995, 2001
Ireland	1974, 1975, 1978, 2001, 2007
Italy	1972, 1975, 1981, 2001
Japan	1975, 1993, 1998, 2005, 2007
Netherlands	1975, 1980, 1995, 2001, 2002
New Zealand	1988
Norway	1974, 1976, 1977, 1986, 1987, 1991, 1998, 2002, 2007
Portugal	1978, 1985, 1993, 2005
Spain	1981, 1982, 1993
Sweden	1974, 1977, 1979, 1980, 1991, 1992, 2001, 2002
United Kingdom	1971, 1972, 1973, 1990, 1991, 1992, 2001, 2002, 2003
United States	2002

Source: Alesina & Ardagna (2010)

Table 61: List of Countries and Episodes of Fiscal Consolidation

Country	Year
Australia	1987, 1988
Austria	1984, 1996, 1997, 2005
Belgium	1982, 1984, 1987, 2006
Canada	1981, 1986, 1987, 1995, 1996, 1997
Denmark	1983, 1984, 1985, 1986, 2005
Finland	1973, 1976, 1981, 1984, 1988, 1994, 1996, 1998, 2000
France	1979, 1996
Germany	1996, 2000
Greece	1976, 1986, 1991, 1994, 1996, 2005, 2006
Ireland	1976, 1984, 1987, 1988, 1989, 2000
Italy	1976, 1980, 1982, 1990, 1991, 1992, 1997, 2007
Japan	1984, 1999, 2001, 2006
Netherlands	1972, 1973, 1983, 1988, 1991, 1993, 1996
New Zealand	1987, 1989, 1993, 1994, 2000
Norway	1979, 1980, 1983, 1989, 1996, 2000, 2004, 2005
Portugal	1982, 1983, 1986, 1988, 1992, 1995, 2002, 2006
Spain	1986, 1987, 1994, 1996
Sweden	1981, 1983, 1984, 1986, 1987, 1994, 1996, 1997, 2004
United Kingdom	1997, 1982, 1988, 1996, 1997, 1998, 2000

Source: Alesina & Ardagna (2010)

Table 62: List of Countries and Episodes of Fiscal Consolidation - IMF Definition

Country	Year
Australia	1986, 1987
Belgium	1982, 1983, 1987, 1993
Canada	
Denmark	1983, 1984, 1985, 1986
Finland	1992, 1993, 1994, 1996, 1997, 1998
France	
Germany	1997
Ireland	1982, 1983, 1987, 1988, 2009
Italy	1992, 1993, 1995, 1997
Japan	1997
Portugal	1983, 2002
Spain	
Sweden	1983, 1993, 1995, 1996, 1997
United Kingdom	1981, 1997
United States	1991

Source: IMF (2010)

5 Conclusion

Utilizing disaggregated product level trade data, this dissertation examines the impact of trade liberalization, fiscal consolidation and membership in multilateral organizations on the extensive and intensive margins of trade. This dissertation offers insight on the channel by which such trade policies stimulate trade. The results indicate that past studies limited to total aggregate trade masks the heterogeneous trade creating effect, and hence underestimate the impact of these policy variables. The results also indicate that the traditional empirical model (log-linear gravity model) of trade that has been extensively employed to analyze trade flows leads to biased estimates in the presence of heteroskedastic residuals. Hence, given the nature of trade data where heteroskedasticity is prevalent, the PPML estimation proves to be a more appropriate methodology.

The first chapter of the dissertation shows that the traditional log-linear model as employed by Rose & Spiegel (2011b) exaggerated the impact of hosting/bidding for mega-events on exports. Utilizing a Poisson model specification at the aggregate trade level, the results indicate hosts and candidates do not experience a permanent increase in exports. However, utilizing disaggregate trade level data with the Poisson model indicates that total exports mask the heterogeneous impact of mega-events. The results indicate that hosting the mega-events matters since only the hosts experience a permanent increase in exports solely at the intensive margin of trade. Given the importance of the intensive margin for long-run export growth and less export persistence among developing countries, perhaps an avenue to maintain long-run export growth, especially for developing economies, could be hosting a mega-event. Avenue for further research would be to analyze whether the Olympic effect has heterogenous impact for exporters at lower end of the productivity distribution (i.e. lower per-capita income level), compared to the one at the upper end of the productivity distribution (i.e. higher per-capita income level). Studies indicate that exports for countries at lower end of the productivity distribution have higher elasticity with respect to change in variable trade costs. This could provide more insight in regards to the benefits of hosting mega-events especially for developing economies. Hence, one could separate the dataset into quartiles according to the distribution of the per-capita income variables (i.e. product of GDPs per capita), whereby the quartiles can objectively control for per-capita income differences among countries.

The second chapter finds that total trade masks significant heterogeneity in terms of the impact of the WTO membership and the failure to account for the intensive and extensive margin at product level has underestimated the benefits of WTO membership. Various studies have indicated the lack of effectiveness of the WTO membership, especially for developing members. I find that the benefit of the WTO membership is realized entirely through the extensive margin. The results are in line with the argument put forth by studies such as Handley (2011) and Sala *et al.* (2010), that attributes the role of WTO membership to reducing market uncertainty through tariff binds rather than tariff reduction, thereby leading to increased entry of firms in the export market. Hence, the results indicate that the WTO membership would prove beneficial in reducing the effects of uncertainty especially for higher risk

destination markets and small and developing economies where trade is central to both consumers and firms. Furthermore, export diversification (or increases in the extensive margin) is shown to reduce the risks of balance of payment crisis and large fluctuations in domestic output after-shocks that can negatively affect the performance of the external sector such as price fluctuations in markets, or output swings in trading partners (Agosin (2007), Lederman & Maloney (2003)).

Further research would include investigating the impact of the WTO membership along the distribution of trade flows or level of trade flows. Past literature looks at impact of the WTO membership on average trade flows or at the conditional mean of the sample distribution of trade flows. However, bilateral trade flows at the upper end (or country that already trade at high volume) and lower ends of the trade volume distribution could be unevenly influenced by traditional gravity determinants, especially by trade agreements such as the WTO. Countries that already trade at the higher level of trade distribution perhaps enjoy lower trade costs or established networks. However, countries that trade at the lower end of distribution might be doing so due to higher trade costs or no established trade relationships. Hence, the argument is that trade initiatives such as the WTO membership for countries at the lower end of the distribution could reveal stronger trade effects due to higher elasticity in response to decreasing trade costs or market uncertainty. Hence the WTO membership could prove even more beneficial for developing economies.

The third chapter of this dissertation examines the impact of fiscal episodes on international exports and provides some support for the channel by which these episodes impact exports. The results indicate that fiscal consolidation (stimuli) leads to increase (decrease) in total exports. Furthermore, the results indicate that fiscal consolidation leads to an increase in exports solely through the extensive margin. The results support the argument put forth by the paper that the decrease in interest rate (due to fiscal consolidation) leads to a decrease in fixed costs of exports, hence increasing the extensive margin of exports or the number of products. IMF (2010) mention that in 2009, the budget deficit averaged about nine percent of GDP in advanced economies, compared to only one percent of GDP in 2007. Furthermore, the governments of the advanced economies have already undertaken or planned substantial spending cuts and tax increases. Hence, this chapter suggests that countries that have undertaken fiscal austerity measures can experience an increase in exports at the extensive margin, thus providing a cushioning role on the potentially contractionary impact on growth due to fiscal consolidation.

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