Revisiting the Olympic Effect

Rishav Bista*

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Abstract

Utilizing the log-linear gravity model, Rose and Spiegel (2011b) find statistically robust, permanent and large effects of hosting mega-events (e.g. Olympics, World Cup) on international exports. Surprisingly, they find that the unsuccessful bidders (henceforth *candidates*) to host the Olympics experience a similar impact on 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). The results indicate that hosts (*and not candidates*) experience a permanent increase in exports at the intensive margin. Furthermore, both hosts and candidates experience a permanent *decrease* in exports at the extensive margin. In addition, implementing alternate specifications such as a Tobit specification with zero trade flows and a Poisson Pseudo-Maximum Likelihood (PPML) estimation, I fail to find a robust positive effect of hosting a mega-event on total aggregate exports. Thus, 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 and the aggregate Olympic effect on total exports is not robust.

Keywords: Olympic effect, Gravity model, Signaling effect, Poisson regression, Extensive and Intensive margin, Sample selection, Quantile Regression

JEL Classification : F13, F15

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*Department of Economics, University of Kentucky, Lexington, KY 40506-0034, rishavbist@uky.edu. I thank Dr. Josh Ederington for his invaluable advice and encouragement throughout the course of this paper. I thank Dr. Liu for providing me with his dataset. I thank Dr. Silva for his constant help with the PPML and the quantile regression estimation. All the errors, omissions and opinions in the paper remain my own.

1 Introduction

According to Rose and 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 and 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, Shleifer, and Vishny (1989)). Rose and 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 paper 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

[1] The rationale for estimation for unsuccessful candidates, according to Rose and 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.

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 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 and Kohler (2006), Helpman, Melitz, and Rubinstein (2008), Besedes and Prusa (2010)). Furthermore, it is found to be more important for the survival of trading relationships, especially for developing countries (Besedes and Prusa (2010), Amurgo-Pacheco and 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 paper 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 and 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 and 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

[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.

heteroskedasticity, the parameters of log-linearized models estimated by OLS lead to biased estimates of the true elasticities (see Liu (2009), Silva and Tenreyro (2006), and Felbermayr and Kohler (2010)).

Utilizing the PPML estimation technique with positive trade flows, this paper finds that the impact of hosting or bidding for mega-events in Rose and 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 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 50^{th} 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 and Spiegel (2011b) end with a cautious note: their argument does not explain why countries appear to vigorously compete to win the bids. This paper 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 and 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 The Olympic Effect on Aggregate Exports - Positive Trade Flows

Utilizing the log-linear gravity model, Rose and 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.

2.1 Empirical Specification: Log-Linear Gravity Model

Rose and 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 and Zimbalist (2000) and Coates and Humphreys (2003), Rose and 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 and Wilkerson (2001), Carlino and Coulson (2004), and Maennig and du Plessis (2007)).

[4] According to Rose and 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.

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

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

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 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 and Spiegel (2011b) specification. ϵ represents the omitted influences, assumed to be well behaved.

To ensure that the results are robust, this paper also implements 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

[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 and 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 Appendix Table II for the complete list of Summer Olympic/World Cup hosts and candidates.

of year fixed effects and country/dyadic-specific fixed effects, according to Rose and 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 and 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 Data

The bilateral export (aggregate trade) data are retrieved from Rose's website. This paper 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 Appendix Table III. 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 Appendix Table I.A for the complete description of data sources.

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.A. Rose and 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]

[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 and 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.

[8]In their working paper version, Rose and 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

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 and 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 1.B 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 and Spiegel (2011b) results. Table 1.C 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 and 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 and 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.

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 paper builds on the Rose and

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.

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 and 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 and 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 and Kohler (2006) 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 and 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 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 and Maloney (2003)). Feenstra and 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 and 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.

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 and Pisu (2008), Bernard, Jensen, and Redding (2007), Flam and Nordstrm (2006), and Dutt, Mihov, and Van Zandt (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 :

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

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

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

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

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

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 paper acknowledges that there might be some limitations to the count method of constructing the two margins. According to Baldwin and 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.

3.2 Data

The disaggregated export data at the product level based on the 4 digit SITC Revision 2 classification are 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 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.

3.3 Empirical Results

Table 2 tabulates results for the impact of hosting (and candidacy of) mega-events utilizing disaggregated exports data. Table 2.A reports the results for the extensive and intensive

[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 and 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 and 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 and 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 I.B for further description of the dataset.

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 and 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 2.B 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 2.C. 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

[13] Rose and 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.

with both estimation strategies. Similar to the hosts, the coefficient on the extensive margin is negative although statistically insignificant, for the candidates.

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.

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.

4.1 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 and Spiegel (2011b)) only considers $E(T|Z, T > 0)$. The equation 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:

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

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]

4.2 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 and Kohler (2006)). 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

[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.

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 paper 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 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.

4.3 Empirical Results : Random Effects Tobit Regression

Table 3.A 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.A) 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 3.B 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 1.B) indicated that, on average, the hosts experienced a permanent increase in exports. Table 3.C 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

[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.

[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)).

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 4 A-C). 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 2.A). However, the effect on exports at the extensive and intensive margin turns out to be statistically insignificant. Table 4.B indicates that World Cup hosts experience similar increases in exports, with a minimal increase in exports at the intensive margin. Table 4.C 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 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 and Kohler (2010), 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.

5 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 and Aitkin (1982) and more recently by Silva and 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

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

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

Silva and 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 and 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 and Millimet (2008) confirm that the concerns over estimation in levels versus logs, posed in Silva and 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 and 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, Monfort, and Trognon (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]

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 paper.

5.1 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

[19] Silva and 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 and 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.

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:

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

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 :

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

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

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

This paper further estimates 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.

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

[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.

5.2 Empirical Results : The Poisson Model with Aggregate Exports

The results from the Poisson regressions for aggregate positive trade flows are reported in Table 5.A.[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.A (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 and 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 and 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 5.A. 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 hypothesis of homoscedasticity is rejected by the data.[25] Hence, the Olympic effect is not robust to specification and sample selection issues.

Table 5.B 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

[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.

[25] I conducted the test for the residuals from Table 1.B. 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.

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 1.B) 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 5.B 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 5.C 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 1.C 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).

5.3 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 6.A indicates that the impact of hosting Summer Olympic games on total exports is negative and statistically significant.

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

[27]According to Rose and 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.

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 2.A). 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 6.A, 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%.

Table 6.B 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 6.C 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 2.C), 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 and 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 7.A) with positive trade flows and with the inclusion of candidates (Table 7.C).[28]

Rose and 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 paper. 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.

6 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

[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 and van Wincoop (2003). Essentially, Anderson and 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 and 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.

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 and Bassett (1978) and Koenker and Hallock (2001), instead of solving for the conditional expectation function as in the OLS estimation, [29] the 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 τ^{th} conditional quantile, Q, of bilateral exports T,

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

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 and Bassett (1978); Koenker and Hallock (2001)). Hence, the dependent variable is now measured in logarithms.[32]

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

[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 and Tenreyro (2006) mentions that the conditional median might be problematic when T_{ijt} has a

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), 50^{th} (Q50 -the median),75^{th} (Q75), 90^{th} (Q90)). Table 8.A 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 8.B 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 50^{th} percentile or above.

Table 8.C reports the results for the intensive margin of exports. The Olympics effect on the intensive margin exhibits a monotonic behavior. In other words, the Olympic effect on the intensive margin are relatively constant for all percentiles. The test of equal coefficients for the 25^{th} percentile and the 90^{th} 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.

7 Conclusion

This paper 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

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.

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 and 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 and Kohler (2006)). Amurgo-Pacheco and 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 and 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.

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Olympic Effect on Aggregate Exports: Log-Linear Regression, Positive Trade Flows

Table 1.A: Olympics Hosts

Summer Olympics Host	0.24***	0.19***
	(0.04)	(0.04)
Log distance	-1.23***	—
	(0.02)	
Log Exporter population	-0.28***	0.13***
	(0.06)	(0.07)
Log Importer population	0.50***	0.90***
	(0.06)	(0.06)
Log Exporter real GDP p/c	1.50***	1.47***
	(0.04)	(0.04)
Log Importer real GDP p/c	0.95***	1.06***
	(0.03)	(0.04)
Currency union	0.64***	0.55***
	(0.08)	(0.07)
Common language	0.32***	—
	(0.05)	
RTA	0.57***	0.38***
	(0.03)	(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***	0.43***
	(0.16)	(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 1.B: 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=World Cup 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.A are also included but not reported.

Table 1.C: 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.A are also included but not reported.

Extensive and Intensive Margin : Log-Linear Gravity Regression, Positive Trade Flows

Table 2.A : Olympics Host

	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. 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 2.B : Olympics and World Cup Host

	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. 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*

Table 2.C : Olympics Host and Candidates

	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics Host	0.09**	-0.13***	0.23***	0.07	-0.15***	0.22***
	(0.05)	(0.03)	(0.03)	(0.05)	(0.03)	(0.04)
Candidates	0.12***	-0.01	0.13***	0.04	-0.03	0.07**
	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)	(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=Candidates? (p-value)	0.67	0.00***	0.02**	0.62	0.00***	0.00***

Notes: *** p<0.01, ** p<0.05, * p<0.1. 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.A are also included but not reported.

Olympics Effect on Aggregate Exports : Random Effect Tobit Regression, Full Sample

Table 3.A: 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 3.B: 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

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 3.C: 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.

Extensive and Intensive Margin : Random Effect Tobit Regression, Full Sample

Table 4.A : Olympics Host

	Total Export	Ext. Margin	Int. Margin
Olympics Host	0.21**	-0.02	0.01
	(0.03)	(0.02)	(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 4.B: Olympics and World Cup Host

	Total Export	Ext. Margin	Int. Margin
Olympics Host	0.15***	-0.02	-0.01
	(0.03)	(0.02)	(0.02)
WC Host	0.19***	-0.01	0.04**
	(0.03)	(0.02)	(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*

Table 4.C: Olympics Host and Candidates

	Total Export	Ext. Margin	Int. Margin
Olympics Host	0.20***	-0.03	0.03
	(0.03)	(0.02)	(0.02)
Candidates	0.08***	0.06**	-0.11***
	(0.03)	(0.02)	(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.

Olympic Effect on Aggregate Export : Poisson Regression (Positive Trade Flows and Full Sample)

Table 5.A: Olympics Hosts

	Positive trade flow	Full Sample	Positive trade flow	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
Log Likelihood	-38530716	-42627986	-1.28e+10	-1.49e+10
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 5.B: Olympics and World Cup Hosts

	Positive trade flow	Full Sample	Positive trade flow	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
Log likelihood	-38507036	-42595194	-1.268e+10	-1.492e+10
N	93,910	203,431	88,305	162,447
Olympic=World Cup effect? (p-value)	0.00***	0.00***	0.00***	0.00***

Table 5.C: Olympics Hosts and Candidates

	Positive trade flow	Full Sample	Positive trade flow	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
Log likelihood	-38519813	-42617642	-1.281e+10	-1.493e+10
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.A are also included but not reported.

Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample)

Table 6.A : Olympics Host

	Positive trade flows			Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
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
Log likelihood	-8941124	-411545	-495793	-9622401	-5493697	-648151
N	67,156	67,156	67,156	101,541	101,541	101,541

Table 6.B : Olympics and World Cup Host

	Positive trade flows			Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics 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
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-8926337	-411277	-495388	-9608969	-548004	-647762
N	67,156	67,156	67,156	101,541	101,541	101,541
Olym.=WC effect? (p-value)	0.00***	0.01**	0.18	0.00***	0.10*	0.39

Table 6.C : Olympics Host and Candidates

	Positive trade flows			Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics Host	-0.10***	-0.11***	0.57***	-0.11***	-0.12***	0.47***
	(0.04)	(0.02)	(0.11)	(0.04)	(0.02)	(0.10)
Candidates	-0.12***	-0.05***	- 0.21**	-0.12***	-0.06***	-0.26***
	(0.04)	(0.01)	(0.09)	(0.03)	(0.01)	(0.09)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Country pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-8895895	-4112256	-495498	-9537753	-548032	-647707
N	67,156	67,156	67,156	101,541	101,541	101,541
Host=Candidates? (p-value)	0.69	0.00**	0.00***	0.89	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 -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.A are also included but not reported.

Extensive and Intensive Margin : Poisson Regression (Positive Trade Flows and Full Sample

Table 7.A : Olympics Host

	Positive trade flows			Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics Host	-0.06 (0.04)	-0.10*** (0.02)	0.65*** (0.12)	-0.07* (0.04)	-0.13*** (0.02)	0.49*** (0.10)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exp & Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-27183300	-1349660	-1250121	-57230	-1771787	-1574895
N	72,240	72,240	72,240	140,601	140,601	140,601

Table 7.B : Olympics and World Cup Host

	Positive trade flows			Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics Host	-0.09** (0.04)	-0.08*** (0.02)	0.56*** (0.11)	-0.10*** (0.04)	-0.09*** (0.02)	0.42*** (0.10)
WC Host	0.07*** (0.03)	-0.04*** (0.01)	0.23*** (0.09)	0.07** (0.03)	-0.08*** (0.01)	0.19*** (0.10)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exp & Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-27167941	-1349466	-1249783	-57217	-1771002	-1574661
N	72,240	72,240	72,240	140,601	140,601	140,601
Olym.=WC effect? (p-value)	0.00***	0.02**	0.04**	0.00***	0.48	0.13

Table 7.C : Olympics Host and Candidates

	Positive trade flows			Full Sample		
	Total Export	Ext. Margin	Int. Margin	Total Export	Ext. Margin	Int. Margin
Olympics Host	-0.06 (0.04)	-0.10*** (0.04)	0.66*** (0.12)	-0.08* (0.04)	-0.13*** (0.02)	0.50*** (0.10)
Candidates	-0.13*** (0.04)	-0.04*** (0.01)	- 0.20** (0.08)	-0.11*** (0.04)	-0.07*** (0.01)	-0.27*** (0.09)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Exp & Imp FE	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-27139406	-1349499	-1249833	-57191	-548464	-1574392
N	72,240	72,240	72,240	140,601	140,601	140,601
Host=Candidates? (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.A are also included but not reported.

Fixed Effect Quantile Regression for Olympics Hosts: Positive Trade Flows

Table 8.A : 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
$Pseudo R^2$	0.43	0.46	0.47	0.48
N	72,240	72,240	72,240	72,240
(q25) Olympics Host=(q90) Olympics Host? (p-value)	0.63			

Table 8.B : 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
$Pseudo R^2$	0.49	0.54	0.54	0.50
N	72,240	72,240	72,240	72,240
(q25) Olympics Host=(q90) Olympics Host? (p-value)	0.00***			

Table 8.C : Intensive Margin

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

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.A are also included but not reported.

Appendix

Table I.A : 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.

Table I.B: Data Sources - 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 Appendix I A).

Table II. A: 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 II. B: 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 III : 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 only; (b) means bilateral data only for Rose (2011) aggregate trade data.