Stockholm School of Economics
Department of Economics
BE551 Degree Project in Economics
Spring 2023

What Is the Impact of World Expositions on the Trade Volume in Exports?

Albin Nilsson (Student ID. № 25179) and Leonard Xander (Student ID. № 25043)

Abstract. Using the Structural Gravity model, this thesis analyzes the impact of post-war world expositions and specialized expositions on the trade volume in exports. The study runs LSDV regressions on three types of panel data for 183 countries between 1950 to 2017, with a total of 792,720 observations. The results show that hosting any exposition has a larger effect on trade than outdated models would suggest, with positive export increases for the host nation depending on the timeframe. The estimates are highly significant and robust, though endogeneity issues likely persist. These findings suggest that policymakers should prioritize hosting world expositions over other mega-events if they are seeking to boost the trade volume in exports.

Keywords: Trade, Exports, Mega-events, World Expositions

JEL: F19, L83

Supervisor: Andreea Enache
Date submitted: May 15, 2023
Date examined: May 25, 2023
Discussants: Loke Sjödin and Peiyu Wang
Examiner: Johanna Wallenius

We would like to express our deepest appreciation to Andreea Enache and Guilherme Tonsig Garcia Teijeiroor for their invaluable guidance, helpful comments, and constructive criticism. Any and all remaining imperfections are solely our responsibility.

Contents

1 Introduction

"World exhibitions have often been a platform for technological wonders such as the first live television broadcast in New York or architectural feats such as the Eiffel tower in Paris.

For Dubai, which on Friday welcomes visitors to the delayed Expo 2020, the biggest wonder will be the fact it is taking place at all, almost 18 months after the coronavirus pandemic wreaked havoc on the world economy.

[...]

The United Arab Emirates is betting that its estimated $7bn investment in the Expo - and a site estimated to be twice as big as Monaco which will have displays from more than 190 countries — will result in 25m visits and further impetus to an economy already bouncing back from the pandemic."

- Kerr, S. (2021, October 1). Robot orchestra and opera greats: Dubai bets on economic boost from 'world's greatest show'. Financial Times

Mega-events such as World Expositions, Olympic Games, and World Cups are often considered significant catalysts for economic growth, as they bring together various countries, industries, and people, fostering international cooperation and exchange. However, the extent to which these events impact international trade still needs to be fully understood, particularly in the context of the world expositions. This thesis aims to add to the lacunae of the literature exploring the relationship between mega-events and trade by analyzing the effects that world expositions have on the exports and imports of a host country and the factors that influence this relationship. We add to state of the art by conducting a large-scale comparative analysis using an up-to-date and novel data set on world expositions for the last 67 years[1] using the most theoretically grounded models employed in the applied trade literature.

World expositions (also called world's fairs) have been instrumental in exhibiting the progress

[1]Annual data spanning across 1950 to 2017

of human civilization and the latest advances in technology, industry, and culture – and they have a rich history dating back to the mid-19th century as more than 100 world fairs have been held in more than 20 countries across the world (Findling 2023). Some noteworthy examples are The Great Exhibition of 1851 in London, also known as the Crystal Palace Exhibition, which showcased over 100,000 objects worldwide and attracted six million visitors, including Queen Victoria. The Paris Exposition Universelle of 1889 saw the construction of the Eiffel Tower, a 300-meter-tall structure symbolizing French ingenuity and engineering prowess. The Chicago World's Columbian Exposition of 1893 celebrated the 400th anniversary of Christopher Columbus's arrival in the New World. It showcased America's latest innovations in science and technology, including a prototype of a helicopter and the first electric dishwasher. The 1900 Paris Exposition Universelle was the largest ever held, attracting over 50 million visitors and showcasing the first-ever diesel engine, the escalator, and the cinema. The Expo '70 in Osaka, Japan, featured the world's first commercial bullet train and popularized the concept of themed pavilions, which became a staple of future world expositions. To this day, governments coordinate and facilitate these significant public events, which involve the participation of countries and international organizations and are unparalleled in their capacity to attract millions of visitors, generate novel dynamics, and initiate transformation in the cities where they are held (Bureau International des Expositions 2023).

It is clear how world expositions have not only reflected the zeitgeist but have also had a lasting impact on the culture through their legacies. Despite being essentially non-commercial events, these expositions have been closely linked with international relations and trade (Chapell and Corona 2023). For instance, the rationale behind organizing the inaugural Crystal Palace Exhibition was to exhibit Britain to a worldwide audience through Parliament's adoption of free trade, which was anticipated to increase overseas sales of British goods. Likewise, The Philadelphia Centennial Exhibition of 1876 stood out for its demonstration of the early Industrial Revolution's products in America, and foreign visitors were impressed by the industrial and commercial advancements showcased – establishing America's image in the eyes of the outside world as 'a nation of inventors and mechanics instead of a nation of farmers'. As a result, the United States experienced an increase in exports, a decrease in imports, and a growth in the trade balance (Free Library of Philadelphia 2001). The Centennial was followed by a golden age of world fairs from 1880 until World War I.

After the war, the cultural significance of world's fairs declined, there were fewer of them being held, and most of these fairs were unsuccessful either commercially or artistically: As transportation and communication networks improved, fairs had diminishing appeal to individuals who could now access movies or radio programs about foreign lands, or even travel relatively easily to visit them firsthand. Despite this, there have been noteworthy expositions in recent times too – like The Century 21 Exposition of 1962 in Seattle having emphasized the space race and showcased U.S. – Soviet rivalry during the Cold War, or the World Expo '70 in Osaka focusing on its host country's remarkable recovery just 25 years after the end of World War II (Findling 2023).

1.1 Purpose

This study explores post-war (after World War II) expositions to see if there still exists a rationale for hosting grandiose fairs in an international trade setting. The world expositions that enter our data set can be found in Table 1. A world map of these expositions is shown in Figure 1.

Moreover, in the interim to these world's fairs, countries can host smaller expos, officially known as 'International Recognized Exhibitions', hereafter referred to as specialized expositions or expos. According to Bureau International des Expositions (2023) (BIE; the organization governing and regulating world's fairs) these are 'global events designed to respond to a precise challenge facing humanity'. The specialized expos that enter our data set can be seen in Table 2.

1.2 Understanding the Economic Impacts of Mega-Events

As mega-events in general are subject to the considerable public interest in their economic effect on the region or nation, much academic effort has been put into developing models and methods to identify this impact, which is 'based on assessments of value produced as well as the value of the resources used for the production'. But the concept of 'value' in the realm of economics is multifaceted. In the 19th century, economic theory was intertwined with the philosophy of utilitarianism, whose goal was to maximize the overall welfare of society. Therefore, 'value' extended beyond financial aspects and included quality of life and general welfare. However, contemporary economists have adopted a narrower interpretation of 'value', focusing solely on financial value and market-based prices. This restricted definition neglects economic impacts that are not subject to market exchange, such as social well-being, air pollution, excitement, and traffic congestion (Andersson, Armbrecht, and Lundberg 2008).

Numerous studies have been conducted on the local subsidization of sporting events, with many predicting substantial economic benefits. For instance, Humphreys and Plummer (1995) estimated the short-term economic impact of hosting the 1996 Olympic Games in Atlanta to be $5.1 billion. However, more rigorous studies have cast doubt on the net economic benefits of hosting mega-events, as seen in Owen (2005). The costs associated with holding such events appear to be considerable, and the enduring benefits largely stem from infrastructure investments that the host city could make independently of the games. Additionally, a significant portion of the local spending on the event is a substitute for other leisure activities or consumption goods, rather than genuine additional spending. Nonetheless, proponents of hosting such events argue that they generate a non-pecuniary feel-good benefit for local citizens, who are filled with civic pride following the event, even if they do not attend [see for example Rappaport and Wilkerson (2001), Carlino and Coulson (2004), or Maennig and Plessis (2007)]. However, the existence of this intangible spillover is uncertain, as is its magnitude. Most professionals in the field consider it unlikely that these benefits justify the significant public expenditures associated with hosting such events (Coates 2007). We avoid the puzzle of spillovers and other externalities that may arise in seeking to accurately measure the total economic impact of hosting a mega-event and instead look at one indirect effect of hosting a world exposition in that of exports.

Trade is influenced by numerous factors. Francois and Machin (2006) find that enhancements in transportation services and infrastructure have the potential to enhance export outcomes. According to Limao and Anthony J. Venables (2001), infrastructure plays a crucial role in determining transport costs. Their analysis indicates that inadequate infrastructure is responsible for 40 percent of predicted transport costs for coastal nations and up to 60 percent for landlocked countries. Matheson (2012) explains how mega-events are associated with large infrastructure investments. There is thus a link between hosting mega-events and international trade partly through the infrastructure improvements they bring.

Another effect of hosting mega-events is that of signaling. The literature explores the use of international signals to convey future policies to foreign investors. Bartolini and Drazen (1997) model proposes that governments with limited information about future fiscal positions signal their expectations through current policies on capital account openness. Countries in good fiscal condition can signal their prospects in ways that cannot be imitated by countries that expect to face future fiscal difficulties. The signal used in this model is a 'burning money' type, which is informative because it is only attractive to countries that really intend to pursue liberalization.

Krugman (1998) and Mukand (2006) argue that some countries pursue perverse policies to boost investor confidence. Policymakers may feel the need to pursue policies that confirm foreign investors' beliefs about good policy, even if those policies are not optimal for domestic economic fundamentals. Using mega-events as a signal has advantages, such as limiting the cost within the country. The hosting costs are primarily borne by the beneficiaries of the signaled policy change, reducing losses for those not favored by the policy. A world exposition is a rare, highly visible mega-event with a long lead time that lends itself to signals of liberalization.

Andrew K Rose and Spiegel (2011) investigate the impact of hosting an Olympic game, another type of mega-event, through modeling trade flows with the Gravity Model of trade. They utilize data on bilateral trade flows from 1950 to 2006 and draw the conclusion that hosting an Olympic game increases a country's exports, *ceteris paribus*. As often is the problem with analyzing the impact of policy on exports, they consider the possibility of reverse causality, and they manage to show that there is none by revealing that a country's openness does *not* affect the likelihood of it hosting an Olympic game. However, they use, according to Head and Mayer (2014), an outdated specification of the Gravity Model, with redundant variables and not as theoretically grounded as the newer specifications of the model, as reviewed by Head and Mayer (2014).[2]

1.3 The Economic Impacts of World Expositions

Previous literature on world expositions is sparse. Holmes and Shamsuddin (1996) look at the short and long-term effects of Expo 86 on U.S. demand for British Columbia tourism, with the argument that tourism creates a chance for residents and tourists to engage in free trade in the markets for goods and services related to tourism. Diez and Kramer (2011) studies the regional economic impact of the Expo 2000 in Hanover, taking into consideration variables such as environmental destruction

[2]The technical differences will be developed in Section 2

and segmentation of the population. Many other studies look at branding effects or the climate impact of hosting world's fairs [see for example Zeng and Li (2014), N. Chen (2012), or Xue, X. Chen, and Yu (2012)].

To focus on the impacts of world expositions on trade, we take the approach of employing the methods suggested by Head and Mayer (2014).

Our approach to looking at the economic impacts of world expositions is novel in a multitude of ways.

1. It is based in the context of international trade, specifically looking at exports.
2. It spans across multiple world expositions held after World War II, rather than focusing on one in particular
3. It utilizes the latest findings of the gravity model to specify a model as theoretically grounded as possible

1.4 Research Questions

This leaves us with the main research questions that our study aims to answer:

- What is the impact of world expositions on the trade volume in exports?
- How do world expositions compare with other mega-events?

2 Methodology

Since we have limited the scope of this paper to estimate the impact of world expositions on bilateral trade, we will use the Gravity Model to estimate the impact of hosting a world exposition. We will in the following give a brief account of the underlying intuition behind the gravity model of trade. This intuitive gravity model has the problem that it does not reflect basic economic realities and as such needs further adjustment. We give an account for the economic foundations underlying the gravity model, and land in a specification of the gravity model called the 'Structural Gravity Model', first developed by Anderson and Wincoop (2003). This version of the gravity model includes multilateral trade resistance terms, which makes it take certain economic realities into account, and as such makes it firmly grounded in economic theory. As for the final specification of our model, we follow the guidelines developed by Shepherd (2013) and Head and Mayer (2014).

In order to compare our estimates of the effect on exports of hosting an exposition with the literature on mega-events, we choose to reconstruct the model used by Andrew K Rose and Spiegel (2011). Since that paper was written there have been developments in the field of research around the gravity model, and as such it is not as grounded in economic theory as our Structural Gravity model. Nevertheless, we choose to use the results coming from that estimation since Andrew K Rose and Spiegel (2011) is the only benchmark we have.

Then we will explain how we create our data set which we use to estimate the Structural Gravity model, where we borrow from a plethora of sources. We explain what alterations to said data we need to do in order to estimate our model, and what alterations to the Andrew K Rose and Spiegel (2011) data set we need to do in order to estimate their model successfully.

2.1 The Gravity Model of Trade

Leamer and Levinsohn (1995) have argued that the gravity model has produced 'some of the clearest and most robust findings in empirical economics'. Intuitively, it is a rather simple equation, stating that trade flows between countries i and j is a product of the countries' respective sizes divided by the distance between i and j:

$$Trade_{ij} = \frac{EconomicSize_i \times EconomicSize_j}{Distance_{ij}}$$

In other words, trade increases as either the economic size of the respective countries increases, or the distance between the countries decreases. The term 'gravity' is derived from the resemblance between the nonlinear form shown and Newton's law of gravity. The exports are directly proportional to the economic 'mass' of both the exporting and importing countries while being inversely proportional to the distance between them (not the square of the distance, as in physics). To put it differently, the gravity model posits that bigger countries tend to have greater trade interactions, while countries that are geographically distant are likely to engage in less trade due to higher transportation expenses.

Traditionally, trade flows between countries have been estimated through free on board (FOB) exports, which is the value of exports flowing from country i to country j as measured at the customs of the exporting country. Distance between countries i and j is typically measured as the distance between their respective capital cities, which albeit not a perfect estimator when investigating trade flows between smaller entities, is good enough when looking at country-level regressions. Commonly, GDP is used as a proxy for economic size such that in practice the equation looks as follows:

$$Exports_{ij} = \frac{GDP_i \times GDP_j}{DistanceCapitals_{ij}}$$

2.1.1 Economic Foundations of the Gravity Model

The intuitive model of the gravity equation is not without limitations. For instance, suppose we assume that trade costs decrease equally for all routes, including domestic trade (which refers to goods traded within a country, or $Exports_{i,i}$), as in the case of a reduction in the price of oil that reduces transport costs everywhere. According to the simple model, this scenario would lead to proportional increases in trade for all bilateral routes, including domestic trade. However, this contradicts the observation that despite the change in trade costs, relative prices remain unchanged. If relative prices do not change, we would expect consumption patterns to remain constant given a fixed level of total production (GDP). This represents an instance where the predictions of the basic gravity model diverge from conventional economic theory (Shepherd 2013).

This is solved by the Anderson and Wincoop (2003) model, hereafter referred to as the 'Structural Gravity' model. As laid out by Head and Mayer (2014), this model is essentially a demand function based on the constant elasticity of substitution structure chosen for consumer preferences. Consumers have a preference for variety, which means that their utility increases from consuming more of a given product variety or from consuming a wider range of varieties without consuming more of any one.

On the production side, the model assumes that each firm produces a single unique product variety under increasing returns to scale, and in equilibrium, the difference between price and the marginal cost covers the fixed cost of market entry. The model assumes that a producer in one country can sell goods in any country with transport costs for international trade. This makes it possible to derive an equilibrium in which firms both produce for the local market and engage in international trade, and in which consumers consume accordingly.

To produce a gravity-like model from these foundations, some macroeconomic accounting identities are imposed. The sum of all production must be equal to GDP in a single-sector economy where there is no input-output relationship. This makes it possible to derive the Structural Gravity model by performing the aggregation in an appropriate way, where the total value of a country's exports becomes the dependent variable in the gravity model:

$$\ln X_{ijt} = \ln Y_{it} + \ln Y_{jt} + \ln Y + (1-\sigma)\left[\ln \tau_{ijt} - \ln \Pi_{it} - \ln P_{jt}\right] \qquad \text{(Structural Gravity)}$$

where X_{ijt} represents the exports indexed over countries at time t, and Y_{it} represents the total value of production for country i at time t.

The elasticity of substitution is measured by the variable σ. This variable takes into account bilateral elasticity to assess their overall effect on the trade flows between the two countries.

Trade costs are included as:

$$\ln \tau_{ijt} = b_1 \ln distance_{ij} + b_2 border_{ij} + b_3 comlang_{ij} + b_4 colony_{ij} + b_5 comcol_{ij} + b_6 custrict_{ijt} + b_7 RTA_{ijt} \qquad \text{(Trade Costs)}$$

where $distance_{ij}$ is the geographical distance between countries i and j, $border_{ij}$ is a dummy variable equal to unity for countries that share a common land border, $comlang_{ij}$ is a dummy variable equal to unity for country pairs that share a common official language, $colony_{ij}$ is a dummy variable equal to unity if countries i and j were once in a colonial relationship, $comcol_{ij}$ is a dummy variable equal to unity for country pairs that were colonized by the same power, $custrict_{ijt}$ is a dummy variable equal to unity for country pairs that are in a common currency union at time t, and RTA_{ijt} a dummy variable equal to unity for country pairs that are in a common regional trade agreement at time t. This formulation is typical of the gravity model literature, in which each of these factors has been found to be a significant determinant of bilateral trade (Shepherd 2013).

Lastly, Π_{it} and P_{jt} are called 'multilateral resistance' terms, which are defined as:

$$\Pi_{it} = \sum_{j=1}^{C} \left(\frac{\tau_{ijt}}{P_{jt}}\right)^{1-\sigma} \frac{Y_{jt}}{Y_t} \text{ and } P_{jt} = \sum_{i=1}^{C} \left(\frac{\tau_{ijt}}{\Pi_{it}}\right)^{1-\sigma} \frac{Y_{it}}{Y_t} \qquad \text{(Multilateral Resistance Terms)}$$

The first concept is known as 'outward multilateral resistance,' which considers the impact of trade costs on exports from country i to all possible export markets, including country j at time t. This term accounts for the fact that the export volume from country i to country j depends not only on the trade costs between those two countries but also on the trade costs across all other export markets. The value of Π_{it} represents the range of opportunities available to consumers in destination i or, alternatively, the level of competition in that market.

The second concept is called 'inward multilateral resistance,' which considers the impact of trade costs on imports into country i from all possible suppliers, including country j at time t. This term accounts for the fact that the import volume from country j to country i depends not only on the trade costs between those two countries but also on the trade costs across all other supplier countries. The term P_{jt} is a known index in economic geography used to measure market potential or access [see Redding and Anthony J Venables (2004), or Hanson (2005)].

Together, these two concepts capture the overall dependence of trade flows on trade costs and resolve the issues identified in the opening of this section with the intuitive gravity model.

2.2 Specification and Estimation

We begin by specifying the structural gravity model to examine the effect of world expositions on exports. After that, we construct an identical model to the now-outdated Andrew K Rose and Spiegel (2011) specification for comparison purposes between their findings of other mega-events (Olympic Games, World Championships) to world expositions.

2.2.1 Structural Gravity

Equation Structural Gravity has significant implications for our estimation technique since it includes variables, the multilateral resistance terms, which are unobserved, and difficult to estimate. We, therefore, need an estimation technique that accurately takes the outward and inward multilateral resistance into account.

As suggested by Shepherd (2013), we estimate the model with exporter and importer time fixed effects. Time subscripts are now added because we use longitudinal data. Thus, the model which we estimate is as follows:

$$
\begin{aligned}
&\ln X_{ijt} = C + F_{it} + F_{jt} + (1-\sigma)\ln \tau_{ijt} + \gamma_1 expo1_{it} + \gamma_2 worldexpo1_{it} + \gamma_3 specexpo1_{it} + \mathcal{E}_{ijt} \\
&C = -\ln Y \\
&F_{it} = \ln Y_{it} - \ln \Pi_{it} \\
&\mathrm{F}_{jt} = \ln Y_{jt} - \ln P_{jt} \\
&\ln \tau_{ijt} = b_1 \ln distance_{ij} + b_2 border_{ij} + b_3 comlang_{ij} + b_4 colony_{ij} + b_5 comcol_{ij} + b_6 custrict_{ijt} + b_7 RTA_{ijt}
\end{aligned}
\tag{Structural Gravity Estimation}
$$

where the exporting country is denoted by i, the importing country by j, time by t, and the natural logarithm operator by $\ln(\cdot)$. The variables are defined as follows:

- X_{ijt} are real FOB exports from country i to country j, measured in millions of dollars.
- C is our regression constant. In theory, this should converge to World GDP.
- F_{it} are our exporter time fixed effects, i.e. dummy variables which equal one every time for example Germany in 1956 appears in the data set. F_{jt} is our importer time fixed effects, and works the same, only being for the importing country instead. These will take any characteristics which are constant for a certain country at a given time t. For the exporting country, this would be the GDP Y_{it}, as well as the outward multilateral resistance from country i towards all other countries at time t, Π_{it}. For the importing country, this would be the GDP Y_{jt}, and the inward multilateral resistance P_{jt}.
- τ_{ijt} is trade costs at time t, composed of:
  - $distance_{ij}$: The distance between countries i and j.
  - $border_{ij}$: A binary variable which is equal to 1 if countries i and j share a land border.
  - $comlang_{ij}$: A binary variable which is equal to 1 if countries i and j have a common language.

- $colony_{ij}$: A binary variable which is equal to 1 if country i colonizes country j at time t (or vice versa).
- $comcol_{ij}$: A binary variable which is equal to 1 if countries i and j were both colonized by the same country.
- $custrict_{ijt}$: A binary variable which is equal to 1 if countries i and j are in a common currency union at time t.
- RTA_{ijt}: A binary variable which is equal to 1 if countries i and j have a regional trade agreement at time t.

- $expo1_{it}$ / $worldexpo1_{it}$/ $specexpo1_{it}$: Binary variables which are equal to 1 if country i hosted a post-war Expo (any expo) / World Expo/ Specialized Expo at or after time t, and 0 otherwise.
- $\mathcal{E}_{ijt}$: The omitted other influences on bilateral exports. It is a lognormal distributed error term.

2.2.2 Rose and Spiegel Benchmark

The specification of Andrew K Rose and Spiegel (2011) using world expositions looks as follows:

$$\begin{aligned}\ln X_{ijt} = {} & b_0 + b_1 \ln D_{ij} + b_2 \ln Pop_{it} + b_3 \ln Pop_{jt} + b_4 \ln GDPpc_{it} + b_5 \ln GDPpc_{jt} \\ & + b_6 Cont_{ijt} + b_7 CU_{ijt} + b_8 Lang_{ij} + b_9 RTA_{ijt} + b_{10} Border_{ij} \\ & + b_{11} Islands_{ij} + b_{12} Area_{ij} + b_{13} ComCol_{ij} + b_{14} Colony_{ijt} + b_{15} EverCol_{ijt} \\ & + b_{16} SameCtry_{ijt} + \gamma_1 expo1_{it} + \gamma_2 worldexpo1_{it} + \gamma_3 specexpo1_{it} + \mathcal{E}_{ijt}\end{aligned} \tag{1}$$

where the variables are defined as:

- X_{ijt} denotes real FOB exports from i to j, measured in millions of dollars.
- D_{ij} is the distance between i and j.
- Pop is population.
- $GDPpc$ is annual real GDP per capita.
- $Cont$ is a binary variable which is unity if i and j share a land border and zero otherwise.

- CU is a binary "dummy" variable which is unity if i and j use the same currency at time t.
- $Lang$ is a binary variable which is unity if i and j have a common language.
- RTA is a binary variable which is unity if i and j have a regional trade agreement at time t.
- $Border$ is a binary variable which is unity if i and j share a land border.
- $Islands$ is the number of island countries in the pair (0/1/2).
- $Area$ is the log of the product of the areas of the countries.
- $ComCol$ is a binary variable which is unity if i and j were both colonized by the same country.
- $Colony$ is a binary variable which is unity if i colonizes j at time t (or vice versa).
- $EverCol$ is a binary variable which is unity if i ever colonized j (or vice versa).
- $SameCtry$ is a binary variable which is unity if i is part of the same country as j at time t (or vice versa).
- $expo1_{it}$ / $worldexpo1_{it}$/ $specexpo1_{it}$: Binary variables which are equal to 1 if country i hosted a post-war Expo (any expo) / World Expo/ Specialized Expo at or after time t, and 0 otherwise.
- $\mathcal{E}_{ijt}$: The omitted other influences on bilateral exports. It is a lognormal distributed error term.

2.2.3 Differences

There is a striking difference between Structural Gravity and the model estimated by Andrew K Rose and Spiegel (2011) in the amount of variables that are included in the estimation. The Rose and Spiegel model includes GDP/capita for both of the countries ($GDPpc_i, GDPpc_j$), population for both of the countries (pop_i, pop_j), number of countries in the pair that are island countries ($Islands$), the log of the product of the areas of the countries ($Area$), whether or not country i ever colonized country j ($EverCol$) and if country i and country j are part of the same country at time t ($SameCtry$).

According to Shepherd (2013), the country-specific variables need to be excluded since they are already estimated by the exporter and importer fixed effects. Thus, the impact of the GDP/capita of country i at time t would already be estimated by F_{it}.

Head and Mayer (2014) recommend a more cautious selection of controls to act as proxies for trade costs τ_{ijt}, and the recent literature around the gravity model is leaning in that direction, too. Andrew K. Rose, one of the authors of the Olympic Effect (Andrew K Rose and Spiegel 2011), follows the methodology established by Head and Mayer (2014) in his most recent paper, where he has a much leaner estimation of τ_{ijt}, identical to our estimation of Structural Gravity (Andrew K. Rose 2019).

Furthermore, there lies a difference in the clustering of the standard errors. Both Head and Mayer (2014) and Shepherd (2013) recommend clustering by country pairs since errors are more likely to be correlated on that level. Thus, a variable that lies close at hand is the distance between the countries, which will be different for each country-pair, but identical for i to j trade flows and j to i flows.

Andrew K Rose and Spiegel (2011) however cluster their standard errors on their variable *pairid*, which is an integer variable which uniquely identifies each i to j trade flow. The pairid for i to j exports is thus not the same as the one representing j to i, so when clustering, the entity becomes instead the one-way trade relationship instead of the bilateral one, and theory suggest the bilateral one to be more accurate (Head and Mayer 2014).

2.2.4 Estimation Technique

We use the Least Squares Dummy Variable (LSDV) Method for estimating our fixed effects. Since the Structural Gravity model calls for fixed effects for the exporting country, the importing country as well as for time, the final model which we estimate is as follows:

$$
\ln(X_{ijt}) = b_0 + b_1 \ln distance_{ij} + b_2 border_{ij} + b_3 comlang_{ij} + b_4 colony_{ij} +
$$
$$
b_5 comcol_{ij} + b_6 custrict_{ijt} + b_7 RTA_{ijt} + \gamma_1 expo1_{it} + \gamma_2 worldexpo1_{it} + \gamma_3 specexpo1_{it}
$$
$$
+ \sum_{i=1}^{N-1} \alpha_i D_i + \sum_{j=1}^{M-1} \alpha_j D_j + \sum_{t=1}^{T-1} \alpha_t D_t + \mathcal{E}_{ijt}
$$

where $\sum_{i=1}^{N-1} \alpha_i D_i$ are $N-1$ dummy variables for our exporting countries, where N is the total amount of exporting countries entering our data set[3]. D_i is a dummy variable that equals 1 every time country i enters the data set as the exporting country, and zero otherwise. α_i is the estimated fixed effect of country i, i.e. the unobserved characteristics of country i that remain constant over time. Likewise, α_j is the estimated fixed effect for the importing country j, which there are M of in total. Finally, α_t is the time fixed effects, where D_t is a dummy variable which equals 1 every time year t enters the data set. Together these three fixed effects estimate the F_{it} and F_{jt} variables of the Structural Gravity model, as suggested by Head and Mayer (2014).

As mentioned above, the trade cost term τ_{ijt} is estimated by the five variables *distance*, *contiguity*, *comlang*, *colony* and *comcol*. Lastly, we use heteroskedasticity-robust standard errors, and cluster them on the distance between the countries, as suggested by Shepherd (2013).

2.2.5 Entity and Time Fixed Effects Implications

Fixed effects for the exporter and the importer in each pair control for any country-specific time-independent (omitted) characteristics for each country. This means we keep the within-country variation over time and take out the variation between countries that do not change over time. Time fixed effects control for variables that are constant across countries but evolve over time. Omitting them would result in omitted variable bias in our variables of interest as long as these factors determine exports and are correlated with our variables of interest. We use time fixed effects for all regressions that include variations of country-fixed effects. A regression model that includes both entity and time fixed effects helps to address the issue of omitted variables bias that may

[3]There are $N-1$ dummy variables for the exporting country because including all N categories would result in the dummy variable trap. This is because the constant term in the model already captures the effect of the omitted category.

arise from unobserved factors that remain constant over time or across states. We should add that because we reduce variation in the explanatory variables we obtain less precision in the estimates, but as our data set contains a very large number of observations on the most up-to-date versions we consider this concern mitigated. The same line of reasoning can be applied when bringing up the issue of increases in the sensitivity of measurement errors as a result of reducing variation.

2.3 Unbiasedness of our Model

In the following, we will argue for the unbiasedness of the estimates that result from our models through the four least squares assumptions for causal inference in the multiple regression model presented by Stock, Watson, et al. (2003): (1) The conditional distribution of the error terms has a mean of 0, i.e. that the values $X_{1i}, X_{2i}, \ldots, X_{ki}$ are randomly, or as if randomly assigned, (2) that the variables are independently and identically distributed, (3) That large outliers are unlikely, and (4) that there is no perfect multicollinearity. Furthermore, we have to assume strict exogeneity, i.e. that the idiosyncratic error terms are not only uncorrelated with the other independent variables in the given period but also with all independent variables in any given period.

Random distribution of variables: After adding our fixed effects, we believe that we have an independent variable that is uncorrelated with the idiosyncratic error term, i.e. that all omitted variables are constant over entities but vary across time (Time Fixed Effects), or that they are constant across time but vary across entities (Exporter/Importer Fixed effects).

Variables are independently and identically distributed: Since we are dealing with panel data, observations of for example exports, GDP/capita, and population for a certain country in a certain year will correspond closely with observations of the same country but for a year before. This, too, is handled by our fixed effects.

Large outliers are unlikely: Observations that are far outside the usual range of the data can easily make the regression results misleading, and thus need to be unlikely for our regression to reliable. Mathematically speaking, all of our variables need to have nonzero and finite fourth moments, i.e. $0 < E(X_i^4) < \infty$. Typically, the fourth moment is assumed to be finite when it comes to observational data that has a practical upper limit, such as GDP, which can never be larger than the whole world GDP (since then all economic activity would transpire in the same country). Furthermore, how large a country's exports are will always be physically bounded by its resources, labor force, and size. Thus, it is to be expected that outliers are rare. That we, indeed, have no outliers in our data set is further illustrated in our summary statistics table, Table 3.

Multicollinearity: We assume there to be no perfect multicollinearity between our variables.

2.3.1 Endogeneity

We must pay special attention to the problem of endogeneity when estimating the Structural Gravity model, especially when including policy variables, like the decision to host world expositions. This is because policies are often determined, to some extent, by a country's level of integration in international markets. For instance, more open economies have the incentive to implement more liberal policies, creating a circular causal chain between policies and trade, also known as reverse causality. From an econometric perspective, the endogeneity of an explanatory variable violates the first assumption for causal inference with Multiple Linear Regressions by introducing a correlation between that variable and the error term. If left uncorrected, endogeneity can lead to significant bias in the estimated parameters. We develop and discuss this issue further under 3.1.4.

2.4 Data

To examine the causal impact of world expositions on exports, three types of panel data for 183 countries are collected. First, data on the main outcome variable (exports) from the International Monetary Fund (IMF). Second, data on macro variables for international trade from Penn World Table (PWT). Third, country-specific controls are scraped from the CIA factbook (CIA). Table 4 shows the sources for each variable.

We use the 'Direction of Trade Statistics' (DOTS) from IMF which contains the value of merchandise exports (reported on a free on board or FOB basis) and imports (reported on cost, insurance, and freight or CIF basis) disaggregated (bilateral) according to a country's main trading partners, on an annual basis from the year 1950 to 2017. It should be noted that some data is supplemented by estimates derived from reports or partner countries whenever such data is unavailable or non-current – but we argue using the most recent iteration of DOTS mitigates this measurement error to some extent (as explained in Section 2.2.5).

We processed the IMF data in the following way. First, we converted all approximately 7,000,000 observations into the correct format; transposing years from columns to rows (converting the data into long format). Next, we dropped all rows whose attribute is 'Status' (not 'Value') as they are superfluous for our purposes. As we had one column which specified the value in USD, and another column that said what this value was (either imports from the first country to the second country or exports from the first country to the second country), we made the data wider to obtain two columns for trade volumes for every year and unique import-export pair – one containing the exports and the other containing the imports. Next, we renamed the columns to prepare it for statistical analysis. Finally, we created unique pair identification codes for each import-export pair by concatenating the respective countries' country codes (IMF 3-digit numeric codes), to create unique integer keys for each pair.

Other important data points, such as data regarding contiguity (whether or not two countries share a land border), the distance between the countries, whether or not they share a common language, whether or not they are in a trade agreement at the time t and more is taken from Andrew K Rose and Spiegel (2011) paper. We separate between time-invariant variables (distance between the two countries; if they share a land border; if they share a common language; if they ever have been in a common colonial relationship) and time-variant variables (if they are in a common currency union at time t, if they are in a regional trade agreement at time t, and if they currently are in a colonial relationship). The time-invariant data we match on all our pairs without any problem. The time-variant data can only match successfully up until 2006 when the data set from Rose & Spiegel ends. To supplement this, we take data from one of Rose's most recent papers (Andrew K. Rose 2019), where he has similar data stretching ranging from 2000 to 2017. For a more in-depth description of our data set and all the sources, please see Table 4. Lastly, we joined the annual US-CPI urban consumer data from 1950 to 2023. Since we only have data on regional trade agreements or currency unions from 1950 to 2017, we decide to drop all observations which are outside of that time frame.

We get the data on all expositions from the homepage of the Bureau International des Expositions. The world expositions that enter our data set can be found in Table 1, and the specialized expositions can be found in Table 2.

2.4.1 Variables entering the Structural Gravity Model

Further preparation needs to be done before we can estimate the Structural Gravity model as specified by Anderson and Wincoop (2003) and Shepherd (2013). We deflate the exports by US-CPI (where 1982-84 = 100) and take the natural logarithm to get our dependent variable *lexp*.

We code two columns into our data set which are 1 for each year where the exporting country hosted either (1) a world exposition or (2) a specialized exposition, respectively. After sorting the data descendingly by year, and grouping by exporting country and year, we code two more columns to equal 1 if the cumulative sum of the groups is equal to or bigger than one. We are left with our two variables, *worldexpo1* and *specexpo1*, who equal 1 for the year and all years following the exporting country hosting either a world exposition or specialized exposition, respectively. Letting them enter our model will thus lead to us estimating a *permanent* effect of hosting an exposition. Furthermore, we code a third column, *expo1* to be 1 if either *worldexpo1* or *specexpo1* is 1, in other words, if the exporting country has hosted any type of exposition.

We take the natural logarithm of the distance between country i and country j to get *ldist*. The other variables which will enter the Structural Gravity Model, *custrict, comlang, rta, border, comcol* and *colony* remain unchanged. The complete list of variables can be found at Table 5

2.4.2 Rose & Spiegel data set

For our benchmark with the Olympic Effect estimated by Rose & Spiegel, we download the STATA data set from Andrew K. Rose's homepage, which includes observations from 1950 to 2006. In order to estimate their model, we have to do some further alterations to the data.

Also here, we deflate the exports by US-CPI and thereafter take the natural logarithm to get the variable *lexp*. Similar to our data set for estimating the Structural Gravity Model, we code the variables *expo1*, *worldexpo1* and *specexpo1* to be variables representing the permanent effect of hosting a world exposition.

Also here, we take the natural logarithm of the distance to get *ldist*, but since Andrew K Rose and Spiegel (2011) do not correctly assess that the country-specific data is included by the fixed effects, we have to add the following variables to our data set. We take the natural logarithm of the population data to get *lpop1* and *lpop2*, the population data for the exporting country and the importing country, respectively. We divide the GDP data by the population data and take its natural logarithm to get two new variables, *lrgdppc1* and *lrgdppc2*, the GDP per capita of the exporting country and the importing country, respectively. We take the logarithm of the product of the two countries land areas to get the new variable *lareap*.

The other variables which will enter the model as specified by Andrew K Rose and Spiegel (2011), *custrict, comlang, rta, islands, border, comcol, colony, evercol* and *comctry* remain unchanged. The entire list can be found in Table 6

3 Main Findings and Discussion

We will in the following show our results from estimating the Structural Gravity Model, which shows that hosting a world exposition is significantly connected to a permanent increase in exports. We conduct some robustness checks and see that the effect is still significant. Furthermore, we will see that reverse causality might not be a large problem, and that the increase in exports does not mainly stem from better trade relations with the countries participating in the exposition. We perform a benchmark test running the same model as Andrew K Rose and Spiegel (2011) with the same data, and see that hosting a world exposition leads to a permanent increase of exports which is larger than the effect Rose and Spiegel estimated for hosting the Olympic Games. At last we discuss some possible drivers for this increase in exports, and discuss possible sources for the difference between our estimates and the estimates of Andrew K Rose and Spiegel (2011).

3.1 Results

Table 7 presents the main results of our analysis, which estimates the effect of hosting a World Expo or a Specialized Expo on a country's exports through the use of the Structural Gravity Model. We have in all regressions included exporter, importer, and time fixed effects through the LSDV-method.

Before we delve into the coefficients of greatest interest, let us briefly discuss the other determinants of trade flows that we accounted for using the gravity model. Our analysis confirms that the gravity model works well, and we obtain precisely estimated coefficients that are sensible and similar to those estimated by other researchers. Specifically, we find that exports between a pair of countries fall with distance, larger and richer countries tend to import more, and exports are larger when countries share a common language, trade agreement, land border, or colonial heritage. Moreover, our equations fit the data set well, explaining over half of the variation in exports. These results reassure us that our estimates are grounded in a statistical conditioning model that delivers sensible and significant results.

Head and Mayer (2014) conducted a meta-analysis where they compared the coefficients of the most used variables in 159 papers on the gravity equation, published in *Journal of International Economics* and *Review of Economic Statistics*. They gathered over 2500 estimates and reported the mean, median, and standard deviation of each variable. We have compared the results obtained when estimating our structural model with their results which can be found in Table 8, and see that our results all fall within one standard deviation of the means reported by Head and Mayer (2014) in their meta-analysis[4].

After accounting for the standard trade determinants using the gravity model, we examine whether there is room for a permanent export effect of hosting an exposition. We find that there is indeed a significant positive permanent effect on trade when hosting an exposition. We estimate the effect World expositions have on trade in three different ways. Firstly, we estimate the overall impact of hosting an exposition. Secondly, we perform two further estimations, one estimating the effect of hosting a 'World exposition,' and one estimating the effect of hosting a 'Specialized exposition,' the difference being that the latter type is focused around a certain innovation or industry, while the former generally invites the presentation of any innovation.

When estimating with the more theoretically grounded and state-of-the-art Structural Gravity model (Table 7), we find the following. Hosting any exposition has a large effect on trade, with exports permanently increasing by 78% (!) $[exp(0.579) - 1]$ (Column 2). Hosting a world exposition doubles a country's exports $[exp(0.695) = 2.00]$, whilst hosting a specialized expo now increases a country's exports by 9.5%, permanently. This regression explains 67.2 percent of the variation in the data and takes 792,720 observations from 1950 to 2017 into account.

[4] Head and Mayer (2014) have only reported the average effect of a colonial link between the countries. Since we have two variables that estimate that effect, we have taken the average of the two when compared to the meta-analysis. The *colony* variable alone is within one and a half standard deviations from the mean reported in the meta-analysis, while *comcol* is within one standard deviation. The mean of the two falls also within one standard deviation of the reported mean in the meta-analysis.

3.1.1 Rose & Spiegel Benchmark

The Rose Benchmark Table 9 shows a positive permanent effect of hosting an exposition on trade by 26.5% $[exp(0.235) - 1]$, and we find that this positive effect is mainly driven by hosting a world expo, while hosting a specialized expo has an insignificant, but small positive effect (Column 2). This regression explains 69.5 percent of the variation in the data, and takes 449,220 observations from 1950 to 2006 into account. Comparing our estimates with the main estimate from Andrew K Rose and Spiegel (2011), we see that the overall effect from hosting any type of exposition is slightly smaller than the effect from hosting the summer Olympic games (Table 10). The effect of hosting a World Exposition specifically is 28 percentage points higher than the Olympic Effect, whilst the effect of hosting a Specialized Exposition is 31 percentage points smaller.

Comparing the estimates of the other variables entering the model, they are identical to those of Andrew K Rose and Spiegel (2011) when they include exporter and importer fixed effects. Furthermore, the heteroskedasticity-robust standard errors estimated in our model are identical to those of Andrew K Rose and Spiegel (2011), as we chose to cluster on *pairid*, like them. It is noteworthy that the estimation of the impact of *island* and *lareap* is zero, indicative of that they are absorbed by the fixed effects. Most likely our way of computing the LSDV model is better at detecting variables absorbed by the fixed effects than Rose and Spiegel's, as theirs was computed some 14 years ago, with most likely inferior computing power and computing methods.

3.1.2 Robustness Checks

In order to investigate whether the surprisingly strong linkages between hosting any kind of exposition, as well as the strong linkages between hosting a specialized exposition or a world exposition, we will conduct several robustness checks, to see if the effect still persists.

Firstly, we choose to divide up the data into two parts, one for all observations before 1985, and one for all observations after (and including) 1985. We chose 1985 since it is approximately the middle between the beginning and end of our data set, 1950 and 2017. We recalculate the expo1, worldexpo1, and specexpo1 variables for the data set only including the observations after 1985 so that only expositions hosted after 1985 are considered. If we were not to calculate those dummy variables, the effect of expositions hosted before 1985 would also be considered, since our dummies are permanent. The results, as shown in Table 11, show that both after controlling for Exporter/Importer fixed effects, the permanent effect that hosting an exposition has on trade is still positive and significant. We can even see that hosting a specialized exposition before 1985 had a greater effect on a country's exports than after 1985, and hosting a world exposition after 1985 had a greater effect on exports than hosting one before 1985. The main takeaway, however, from this robustness check is that the results of Table 7, the effect which hosting an exposition has on a country's exports, are not driven by specific characteristics of these two time periods, for example, the rapid globalization and economic expansion of the post-war years, nor the effect of decreasing transportation and communication costs typical of the Information Age.

Thirdly, we choose to further manipulate the way our model works. One problem with letting a *expo1*, *worldexpo1* and *specexpo1* be binary variables is that you do not capture the effect of a country hosting several expositions over a period of time. One example would be Italy, who hosted three specialized expos back to back, one in 1953 (EA 53, an agriculture exposition in Rome), another in 1954 (The International Exhibition of Navigation in Naples), another in 1955 (The International Expo of Sport in Turin), and then another specialized exposition in 1961 (Expo61 in Turin), one in 1992 (Expo Colombo '92 in Genoa), and at last a world exposition in 2015 (Expo 2015 in Milan). In our model, the binary variables *specexpo1* and *expo1* would be 1 from 1953 and onward (for almost 95% of our observations), and would lead to us essentially only estimating the effect of hosting the first specialized expo in 1953, without taking the 5 others into account. So instead of estimating a permanent effect with a binary variable, we choose to estimate a cumulative effect with a variable that simply counts the number of expositions the country had hosted at time t. So in Italy's case, the new variable *specexpocum* would be 0 before 1953, turn 1 in 1953, be 2 in 1954, etc. Replacing *expo1*, *worldexpo1* and *specexpo1* with *expocum*, *worldexpocum* and *specexpocum* respectively, we run our regressions again, with otherwise identical specifications. The results, as shown in Table 12, show that the effect is still significant and positive. However, the effect is smaller than for the original results, which is to be expected, since we are now estimating the effect of hosting one exposition, versus estimating the effect of ever having hosted an exposition.[5]

[5] Note the decrease from*worldexpo1* to *worldexpocum*. Since Japan is the only country to have hosted two world expositions, the coefficient *worldexpo1* has to have been driven by Japan experiencing a large increase of exports after their '70 and '85 expositions.

We choose to conduct one last robustness check where instead of letting the *expo1*, *worldexpo1* and *specexpo1* dummy variables equal 1 in all years after hosting an exposition, we only let them be 1 for the following 4 years. In that way, we will see the 'short-run effect' of hosting an exposition. The results, as shown in Table 13, indicate that hosting any type of exposition affects exports insignificantly in the short run. However, when separating world expositions and specialized expositions, we see that the former precedes a significant increase in exports, and the latter precedes a significant decrease in exports, in the short run.

3.1.3 Participating Countries

So, after having established the correlation between exports and hosting a world exposition, we will investigate the origins of these exports. We gathered data on countries having a national pavilion at Expo 58 in Brussels, Belgium, Expo 62 in Seattle, USA, and Expo 70 in Osaka, Japan. After dividing the data up into three stripped-down versions, one which only included the magnitude of trade flows going into Belgium, one for Seattle, and one for Japan, we coded variables that equaled one permanently, after the country had had a national pavilion at that country's exposition site. We find, however, in Table 14 that countries who had participated in an exposition, i.e. who had a national pavilion, did not trade significantly more with the host country than countries who did not.

3.1.4 Endogeneity

Is it reasonable to consider the selection of a world exposition location as exogenous? We are able to directly address the issue of reverse causality in our data. Specifically, we are able to statistically analyze whether countries that are more open are more likely to host a world exposition. We carry out probit tests to examine this issue [see Andrew K Rose and Spiegel (2011)], and Table 15 presents our findings. Along with openness, we also include controls for country size and per capita income. Our results indicate that openness has no significant effect, suggesting that reverse causality is not a concern in this particular setting. It is, however, not strong proof, and therefore we proceed with caution when interpreting our estimates obtained from any regression.

3.2 Analysis

As for why after hosting a world exposition a country's exports increase, there are some possibilities: More trade-liberal countries are more likely to host a world exposition, and as such, countries who host a world exposition have higher exports. This would be the case for reverse causality. Secondly, hosting a world exposition act as a signal for wishing to be more trade-liberal and getting positive exposure to the outside world, but there is nothing inherent with world expositions that would increase exports by that much. Thirdly, World expositions are inherently trade-promoting, under the following drivers: increased awareness and exposure, increased networking opportunities, increased investment opportunities, and a 'legacy effect'.

3.2.1 Drivers

During a world exposition, there is an opportunity for the host country to show off their latest innovations, their biggest companies, and their best products for many actors. The event attracts millions of people around the world. These visitors can learn about the country's history, culture, and the products they offer, and the visitors may leave the exposition site with a more positive image of the country than when they came. This increased awareness and exposure may generate increased interest in the country's products and services, which can translate to increased exports.

One of the primary benefits of an exposition is the increased networking potential. The event brings together business people, government officials, and consumers worldwide, allowing companies from the host country to connect with potential buyers and partners. During the event, the host country can participate in business forums, seminars, and other networking events, which can help create new business relationships. These relationships can help to increase exports by creating new markets for the host country's products and services. The same reasoning goes for increased investment potential.

Finally, hosting a World Fair can have a legacy effect that can continue to benefit a country's exports long after the event has ended. The legacy effect refers to the lasting impact of hosting the event on a country's economy, infrastructure, and international relations. For example, hosting a World Fair can develop new infrastructure, such as new airports, highways, and public transportation systems. These improvements can make it easier for a country to export its products and services.

Hosting a World Fair can also create a positive image of a country in the minds of the global audience, which can increase demand for its products and services.

We saw in Table 14 that the increase in exports which a country experiences after hosting a world exposition probably does not come from increased trade with countries participating in the exposition, i.e. countries having a national pavilion on the exposition grounds. As such, whatever the driver is for the increasing exports, it does not come from participating countries managing to build a better trade-relationship with the host-country, but rather something which affects all countries in the world. However, this result is not robust. Firstly, we only chose to perform the test on three world expositions. Secondly, the specification is dubious: the gravity model is typically not used to estimate one-way trade-flows, which also limits us to only being able to include time fixed effects. As such, the connection between this method and the theory underlying the Structural Gravity Model is uncertain, and the results should not be seriously considered.

The disconnect becomes obvious in the third column, estimating the effect of participating in the Expo '70 in Osaka, Japan on exports to Japan. Here all other variables belonging to the Structural Gravity Model do not enter the model, since they are never 1: there was no country which shared a currency with Japan (*custrict*), no country which also speaks Japanese (*comlang*), no country sharing a land border with Japan (*border*), no country being a colonised by them in the last 50 years, and apparently no country entering a regional trade agreement (*rta*) with them (among the countries participating in the exposition).

3.2.2 Causal Interpretation of the Estimates

The different estimates we obtain come from the Structural Gravity model which is well-grounded theoretically, but they still have a risk of suffering from reverse causality which would bias them upwards and render them meaningless to interpret. One way to decrease this concern is by looking at the effects in the short run. Table 13 shows that the effect of hosting world expositions on the trade volume in exports is lower in the short run, and we conclude that the 'true' causal effect of hosting a world exposition on the volume of exports is likely somewhat lower than this estimate of approximately 30 percent, with the argument that this estimate should be freer from endogeneity concerns than the permanent effect (less room for reverse causality under a shorter time frame).

3.2.3 World Expositions in Relation to other Mega-Events

Andrew K Rose and Spiegel (2011), using their specification, data set, and estimation technique find that Olympic Games seem to suggest a 36 percent increase in exports, ceteris paribus. When we reconstruct their model (but for world expositions) and run it on their data set, we obtain estimates of 64 percent, which is greater than the estimates they found by 28 percentage points(Table 10). They, however, attribute the dramatic increase in the volume of exports following the Olympic Games to signaling. As outlined in Section 1.2, signaling boosts investor confidence which could explain the positive increase in exports. World expositions differ from Olympic Games and World Cups in many ways, and an obvious difference is in the amount of media coverage, where world expositions do not receive as much recognition as the other mega-events. Assuming this is the case, the signaling effect from world expositions would likely be smaller or at its upper bound the same as other mega-events such as the Olympic Games. Therefore, if we compare the Δ between our identical specification to their results (see Table 10), we can attribute at most 36 percent to the signaling, and assume the remaining 27 percentage points to consist of causal effects inherent solely to world expositions. The implication is that something else must explain this surplus in the volume of exports. To understand why, we go to the fundamentals behind what an exposition is. It is about countries showing off their proudest innovations which come from their industry; something fundamentally related to exports as it most often is the case firms trade with each other rather than the country on its own. We try hard not to interpret the absolute magnitudes of the permanent effects of hosting world expositions as causal, but we are more confident in interpreting the difference between hosting a world exposition and the Olympic games as free from endogeneity concerns (assuming both results suffer from similar reverse causality issues). Therefore, even if we have weak proof of reverse causality not being a concern (see Section 3.1.4), we can get a meaningful interpretation of the difference between World Expos and the Olympic Games, finding that world expositions are of greater benefit by looking only at the volume of exports. This is of economic significance to policymakers deciding upon which mega-event to choose should it become a question.

4 Conclusion

World expositions were for long regarded as the principal way for countries to show off their latest innovations on the international stage, but fell out of vogue after the two World Wars. The objective of this thesis has been to examine the impact of post-war world expositions and specialized expositions on the trade volume in exports and provide a rationale for why policymakers should consider hosting a world exposition as opposed to other mega-events. The identification strategy used was the Structural Gravity model which is at the forefront of the applied trade literature. Our study fills some voids in this literature as the impact of world expositions on international trade has not yet been reported, although the effects of other mega-events have been. We used three types of panel data for 183 countries between 1950 to 2017 from the International Monetary Fund, Penn World Table, and the CIA Factbook, having 792,720 observations.

We find that hosting any exposition has a larger effect on trade compared to what previous and outdated models would find, with exports permanently increasing by 64 percent. Hosting a world exposition doubles a country's exports whilst hosting a specialized expo increases a country's exports by 9.5 percent permanently. The estimates are strongly significant and robust to a variety of sensitivity tests. These are dramatic changes that suggest the estimates likely suffer from endogeneity issues. We tackle this problem by first comparing world expositions with benchmark results from studies done on the effect of other mega-events on the trade volume in exports, concluding that world expositions increase exports by some 28 percentage points over the likes of the Olympic Games. Secondly, we look at the effect in the short run, which increases exports by some 30 percent, which is more likely closer to a true estimate than the permanent effect. Moreover, this effect does not seem to come from better trade-relations only with the countries participating in the exposition, but instead that trade increases with all countries. Therefore, even if the magnitude is dubious, we find economically significant results for policymakers in choosing what mega-event to host in case they look for benefits in international trade.

Future research on this topic could include finding a valid instrumental variable to solve the endogeneity problem in reverse causality. This would likely render more truthful estimates of the causal effect of world expositions on the trade volume in exports, which could shine a light on if the benefits in the trade balance can offset the costs involved in hosting a world exposition. Another way to contribute to the state of the art would be to set up the intersectoral Structural Gravity model to see if any sectors benefit more from hosting a world exposition.

5 Appendix

Figure 1: Map of post-war World Expositions

Source: Authors' own illustration, locations gathered from Bureau International des Expositions (2023)

Table 1: List of post-war World Expositions

Dates	**Name**	**Country**	**City**	**Theme**	**Visitors (m)**	**Area (ha)**	**Attending Countries**
12/1949 - 06/1950	Exposition internationale du bicentenaire	Haiti	Port-au-Prince	*The festival of Peace*	NaN	24	15
07/1958 - 09/1958	Brussels World's Fair	Belgium	Brussels	*A World View: A New Humanism*	41	200	42
04/1962 - 10/1962	Century 21 Exposition	United States	Seattle	*Man in the Space Age*	9.60	30	24
04/1967 - 10/1967	Expo '67	Canada	Montreal	*Man and His World*	50.30	365	62
03/1970 - 09/1970	Expo '70	Japan	Osaka	*Progress and Harmony for Mankind*	64.2	329.82	75
04/1992 - 10/1992	Expo '92	Spain	Seville	*The Era of Discovery*	41.80	215	108
06/2000 - 10/2000	Expo 2000	Germany	Hanover	*Man, Nature, Technology*	18.1	160	155
03/2005 - 09/2005	Expo 2005	Japan	Aichi	*Nature's Wisdom*	22.04	173	121
05/2010 - 10/2010	Expo 2010	China	Shanghai	*Better City, Better Life*	73.08	523	192
05/2015 - 10/2015	Expo 2015	Italy	Milan	*Feeding the planet, Energy for life*	21.5	110	145
10/2021 - 03/2022	Expo 2020	United Arab Emirates	Dubai	*Connecting Minds, Creating the Future*	24.103	438	192

Source: Wikipedia contributors (2023): `https://en.wikipedia.org/wiki/List_of_world_expositions`.

Table 2: List of post-war Specialized Expos

Dates	**Name**	**Country**	**City**	**Theme**	**Visitors (m)**	**Area (ha)**	**Attending Countries**
07/1949 - 08/1949	Universal Sport Exhibitio	Sweden	Stockholm	*Sport and physical culture*	NaN	NaN	37
09/1949 - 10/1949	The International Exhibition of Rural Habitat	France	Lyon	*Rural Habitat*	NaN	110	NaN
04/1951 - 05/1951	The International Textile Exhibition	France	Lille	*Textile*	1.5	15	22
07/1953 - 10/1953	EA 53	Italy	Rome	*Agriculture*	1.7	12	NaN
09/1953 - 10/1953	Conquest of the Desert	Israel	Jerusalem	*Conquest of the Desert*	NaN	4.6	13
05/1954 - 10/1954	The International Exhibition of Navigation	Italy	Naples	*Navigation*	NaN	100	25
05/1955 - 06/1955	The International Expo of Sport	Italy	Turin	*Sport*	NaN	NaN	11
06/1955 - 08/1955	Helsingborg exhibition 1955	Sweden	Helsingborg	*Modern Man in the Environment*	NaN	NaN	10
05/1956 - 06/1956	Exhibition of citriculture	Israel	Beit Dagan	*Citrus*	NaN	55	NaN
07/1957 - 09/1957	Interbau	Germany	Berlin	*Reconstruction of Hansa District*	1	53	13
05/1961 - 10/1961	Expo 61	Italy	Turin	*Celebration of centennial of Italian unity*	5	50	19
06/1965 - 10/1965	IVA 65	Germany	Munich	*Transport*	3.2	50.2	36
04/1968 - 10/1968	HemisFair '68	United States	San Antonio	*Confluence of Civilizations in the Americas*	6.40	37.64	23
08/1971 - 09/1971	Expo 71	Hungary	Budapest	*The Hunt through the World*	1.9	35	52
05/1974 - 11/1974	Expo '74	United States	Spokane	*Celebrating Tomorrow's Fresh New Environment*	5.6	41	10
07/1975 - 01/1976	Expo '75	Japan	Okinawa	*The Sea We would like to See*	3.48	100	35
06/1981 - 07/1981	Expo 81	Bulgaria	Plovdiv	*Hunting*	NaN	NaN	NaN
05/1982 - 10/1982	1982 World's Fair	United States	Knoxville	*Energy Turns the World*	11	30	16
05/1984 - 11/1984	1984 World's Fair	United States	New Orleans	*The World of Rivers- Fresh Water as a source of life*	7.35	33.99	15
03/1985 - 09/1985	Expo 85 (Tsukuba, Japan)	Japan	Tsukuba	*Dwellings and Surroundings*	20.3	100	48
11/1985 - 11/1985	Expo 85 (Plovdiv, Bulgaria)	Bulgaria	Plovdiv	*Inventions*	1	5.8	73
05/1986 - 10/1986	Expo '86	Canada	Vancouver	*Transportation and Communication*	22.11	70	55
04/1988 - 10/1988	Expo '88	Australia	Brisbane	*Leisure in the Age of Technology*	18.5	40	36
06/1991 - 07/1991	Expo 91	Bulgaria	Plovdiv	*The activity of young people*	NaN	NaN	8
05/1992 - 08/1992	Expo Colombo '92	Italy	Genoa	*Christopher Columbus*	1.7	6	54
08/1993 - 11/1993	Expo '93	South Korea	Daejeon	*The Challenge of a New Road of Development*	14.5	90.1	141
05/1998 - 09/1998	Expo '98	Portugal	Lisbon	*The Oceans*	10.1	50	143
06/2008 - 09/2008	Expo 2008	Spain	Zaragoza	*Water and Sustainable development*	5.65	25	108
05/2012 - 08/2012	Expo 2012	South Korea	Yeosu	*The Living Ocean and Coast*	8.2	25	103
06/2017 - 09/2017	Expo 2017	Kazakhstan	Astana	*Future Energy*	4.1	25	115

Source: Wikipedia contributors (2023): `https://en.wikipedia.org/wiki/List_of_world_expositions`.

Table 3: Summary Statistics

Variable	N	Mean	Standard Deviation	Min	Max	Range
year	1083215	1996.0	18.2	1950.0	2017.0	67.0
Dependent Variable						
lexp	887164	9.95	3.72	-5.60	21.48	27.08
Trade Costs τ						
ldist	1083205	8.15	0.82	3.68	9.42	5.74
custrict	1083215	0.01	0.11	0.00	1.00	1.00
comlang	1083215	0.19	0.39	0.00	1.00	1.00
rta	1017026	0.23	0.42	0.00	1.00	1.00
border	1083215	0.03	0.16	0.00	1.00	1.00
comcol	1083215	0.09	0.28	0.00	1.00	1.00
colony	1083215	0.02	0.13	0.00	1.00	1.00
Exposition Variables						
worldexpo1	1083215	0.03	0.18	0.00	1.00	1.00
specexpo1	1083215	0.07	0.25	0.00	1.00	1.00
expo1	1083215	0.08	0.27	0.00	1.00	1.00
worldexpocum	1083215	0.04	0.20	0.00	2.00	2.00
specexpocum	1083215	0.12	0.54	0.00	5.00	5.00
expocum	1083215	0.16	0.65	0.00	6.00	6.00

Sources: See Table 4.

Table 4: Data sources

Name	**Source**	**Link**	**Timespan**
lexp	IFS Direction of Trade Statistics	`https://data.world/imf/direction-of-trade-statistics-dots`	1950-2019
expo1	BIE	`https://www.bie-paris.org/site/en/all-world-expos`	1950-2019
worldexpo1	ibid	`https://www.bie-paris.org/site/en/all-world-expos`	1950-2019
specexpo1	ibid	`https://www.bie-paris.org/site/en/all-specialised-expos`	1950-2019
ldist	Andrew K Rose and Spiegel (2011), Andrew K. Rose (2019), who in turn sourced it from CIA Factbook	`https://www.cia.gov/the-world-factbook/`	-
lpop1	Andrew K Rose and Spiegel (2011) who in turn sourced it from PWT 10.01	`https://www.rug.nl/ggdc/productivity/pwt/?lang=en`	1950-2006
lpop2	ibid	ibid	1950-2006
lrgdppc1	ibid	ibid	1950-2006
lrgdppc2	ibid	ibid	1950-2006
custrict	Andrew K Rose and Spiegel (2011), Andrew K. Rose (2019)	`http://faculty.haas.berkeley.edu/arose/`	1950-2017
comlang	Andrew K Rose and Spiegel (2011), Andrew K. Rose (2019)	ibid	1950-2017
rta	Andrew K Rose and Spiegel (2011), Andrew K. Rose (2019)	ibid	1950-2017
border	Andrew K Rose and Spiegel (2011), Andrew K. Rose (2019), who in turn sourced it from CIA Factbook	`https://www.cia.gov/the-world-factbook/`	-
island	Andrew K Rose and Spiegel (2011), who in turn sourced it from CIA Factbook	ibid	-
lareap	ibid	ibid	-
comcol	Andrew K Rose and Spiegel (2011), Andrew K. Rose (2019), who in turn sourced it from CIA Factbook	ibid	1950-2017
colony	ibid	ibid	1950-2017
evercol	Andrew K Rose and Spiegel (2011) who in turn sourced it from CIA Factbook	ibid	1950-2006
comctry	ibid	ibid	1950-2006
cpi	U.S. Bureau of Labor Statistics, CPI for all Urban Consumers, U.S. City Average	`https://data.bls.gov/cgi-bin/surveymost`	1950-2017

Notes: No underlying data, authors' own creation.

Table 5: List of Variables in the Structural Gravity Model

Type of Variable	**Name**	**Description**	**Unit**
Dependent Variable	*lexp*	The natural logarithm of exports flowing from country 1 to country 2. Measured in dollars and is "Free on board" exports, i.e., the value of the exports at the export country's customs frontier. Is deflated by US-CPI, where 1982-84 = 100.	USD
Key Independent Variables	*Expo1*	A binary variable, which is 1 in all the years following country 1 hosting either a) a world exposition or b) a specialized exposition, else it is 0.	Binary
	Worldexpo1	A binary variable, which is 1 in all the years following country 1 hosting a world exposition, else it is 0.	Binary
	Specexpo1	A binary variable, which is 1 in all the years following country 1 hosting a specialized exposition, else it is 0.	Binary
Trade costs τ	*ldist*	The natural logarithm of the distance between country 1 and country 2.	Miles
	custrict	A binary variable, which is 1 if countries 1 and country 2 share a currency at time t, else it is 0.	Binary
	comlang	A binary variable, which is 1 if countries 1 and 2 have a language in common, else it is 0.	Binary
	RTA	A binary variable, which is 1 if countries 1 and 2 share a regional trade agreement at time t, else it is 0.	Binary
	Border	A binary variable, which is 1 if countries 1 and 2 share a land border, else it is 0.	Binary
	ComCol	A binary variable, which is 1 if countries 1 and 2 have had the same colonizer.	Binary
	Colony	A binary variable, which is 1 if country 1 colonizes country 2 at time t	Binary

Sources: See Table 4.

Table 6: List of Variables in Rose and Spiegel's Gravity Model

Type of Variable	**Name**	**Description**	**Unit**
Dependent Variable	*lexp*	The natural logarithm of exports flowing from country 1 to country 2. Measured in dollars and is "Free on board" exports, i.e., the value of the exports at the export country's customs frontier. Is deflated by US-CPI, where 1980-81 = 100.	USD
Key Independent Variables	*expo1*	A binary variable, which is 1 in all the years following country 1 hosting either a) a world exposition or b) a specialized exposition, else it is 0.	Binary
	worldexpo1	A binary variable, which is 1 in all the years following country 1 hosting a world exposition, else it is 0.	Binary
	specexpo1	A binary variable, which is 1 in all the years following country 1 hosting a specialized exposition, else it is 0.	Binary
Gravity Equation	*ldist*	The natural logarithm of the distance between country 1 and country 2 in miles.	Miles
	lpop1	The natural logarithm of the population of country 1.	People
	lpop2	The natural logarithm of the population of country 2.	People
	lrgdppc1	The natural logarithm of country 1's GDP per capita, deflated by US-CPI where 1980-81 = 100.	USD
	lrgdppc2	The natural logarithm of country 2's GDP per capita, deflated by US-CPI where 1980-81 = 100.	USD
Control Variables	*custrict*	A binary variable, which is 1 if countries 1 and country 2 share a currency union at time t, else it is 0.	Binary
	comlang	A binary variable, which is 1 if countries 1 and 2 have a language in common , else it is 0.	Binary
	rta	A binary variable, which is 1 if countries 1 and 2 share a regional trade agreement at time t, else it is 0.	Binary
	border	A binary variable, which is 1 if countries 1 and 2 share a land border, else it is 0.	Binary
	island	The number of island countries in the pair. Can either take on the value 0, 1, or 2. (0 if neither country 1 nor country 2 is an island country, 1 if one of them is and 2 if both are)	Ternary
	lareap	The natural logarithm of the product of the areas of both countries	ha^2
	comcol	A binary variable, which is 1 if countries 1 and 2 have had the same colonizer .	Binary
	colony	A binary variable, which is 1 if country 1 colonizes country 2 at time t (or vice versa)	Binary
	evercol	A binary variable, which is 1 if country 1 ever colonized country 2 at time t (or vice versa)	Binary
	comctry	A binary variable, which is 1 if country 1 and country 2 are part of the same country at time t.	Binary

Source: Andrew K Rose and Spiegel (2011), page 656.

Table 7: Results: Structural Gravity Model

	lexp	
	(1)	(2)
expo1	0.579***	
	(0.044)	
worldexpo1		0.695***
		(0.046)
specexpo1		0.091**
		(0.042)
ldist	−1.453***	−1.453***
	(0.021)	(0.021)
custrict	0.848***	0.838***
	(0.094)	(0.094)
comlang	0.402***	0.400***
	(0.037)	(0.037)
rta	0.299***	0.298***
	(0.029)	(0.029)
border	0.426***	0.426***
	(0.102)	(0.102)
comcol	0.793***	0.794***
	(0.052)	(0.052)
colony	1.497***	1.498***
	(0.128)	(0.128)
Exporter, Importer F.E.	Yes	Yes
Time F.E.	Yes	Yes
Cluster-Robust S.E.	Yes	Yes
Cluster	ldist	ldist
N	792,720	792,720
R^2	0.672	0.672
Adjusted R^2	0.672	0.672

Notes: Fixed effects estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 2017.
Sources: See Table 4

Table 8: Comparing our Results with Head and Mayer (2014) Estimates

Estimates	**Variables**	**Meta-analysis results**		**Our results**	
		Mean	*S.d.*	*Coefficients*	*Within one S.d*
Distance	*ldist*	-1.14	0.41	-1.453	✓
Contiguity	*border*	0.52	0.65	0.426	✓
Common Language	*comlang*	0.33	0.29	0.4	✓
Colonial link	*colony*	0.75	0.49	1.145	✓
RTA/FTA	*rta*	0.36	0.42	0.298	✓
Common currency	*custrict*	0.86	0.39	0.838	✓

Notes: Meta-analysis results gathered from Head and Mayer (2014), Table 4. Our results retrieved from Table 7. Our results of *Colonial link* is the average between *comcol* and *colony*.
Sources: See Table 4

Table 9: Results: Rose & Spiegel estimation

	lexp	
	(1)	(2)
expo1	0.235***	
	(0.037)	
worldexpo1		0.492***
		(0.051)
specexpo1		0.055
		(0.038)
ldist	−1.327***	−1.327***
	(0.018)	(0.018)
lpop1	−0.259***	−0.246***
	(0.059)	(0.059)
lpop2	0.446***	0.442***
	(0.055)	(0.054)
lrgdppc1	1.263***	1.258***
	(0.034)	(0.034)
lrgdppc2	0.841***	0.841***
	(0.030)	(0.030)
custrict	0.668***	0.660***
	(0.095)	(0.096)
comlang	0.346***	0.346***
	(0.034)	(0.034)
rta	0.429***	0.434***
	(0.026)	(0.026)
border	0.460***	0.461***
	(0.082)	(0.082)
island		
	(0.000)	(0.000)
lareap		
	(0.000)	(0.000)
comcol	0.741***	0.742***
	(0.050)	(0.050)
curcol	0.960***	0.954***
	(0.250)	(0.249)
colony	1.428***	1.424***
	(0.090)	(0.090)
comctry	−0.964**	−0.956**
	(0.414)	(0.413)
N	449,220	449,220
R^2	0.695	0.695
Adjusted R^2	0.694	0.694
Time F.E.	Yes	Yes
Exporter/Importer F.E.	Yes	Yes
Cluster-Robust S.E.	Yes	Yes
Cluster	pairid	pairid

Notes: Fixed effects estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 2006.

Sources: See Table 4

Table 10: Comparing our estimates with Rose and Spiegel's

Andrew K Rose and Spiegel (2011)	Estimate	$Exp(x) - 1$	Our variable	Estimate	$Exp(x) - 1$	Δ
Summer Olympics	0.31	0.36	Any exposition	0.235	0.26	-0.1
Summer Olympics	0.31	0.36	World Exposition	0.492	0.64	0.28
Summer Olympics	0.31	0.36	Specialized Exposition	0.055	0.06	-0.3

Notes: Estimates for Summer Olympics from Andrew K Rose and Spiegel (2011). Exposition estimates are retrieved from Table 9.

Table 11: Results: Dividing the Data into pre and post 1985

	lexp			
	Pre 1985	Pre 1985	Post 1985	Post 1985
	(1)	(2)	(3)	(4)
expo1	0.366***		0.432***	
	(0.041)		(0.052)	
worldexpo1		0.261***		0.500***
		(0.042)		(0.061)
specexpo1		0.067		0.202***
		(0.049)		(0.056)
ldist	−1.663***	−1.654***	−1.000***	−1.000***
	(0.022)	(0.021)	(0.023)	(0.023)
custrict	0.546***	0.324***	1.224***	1.221***
	(0.118)	(0.112)	(0.117)	(0.117)
comlang	0.670***	0.483***	0.207***	0.206***
	(0.038)	(0.039)	(0.042)	(0.042)
border	0.618***	0.576***	0.282***	0.280***
	(0.109)	(0.105)	(0.098)	(0.098)
colony	1.277***	1.420***	1.524***	1.525***
	(0.128)	(0.129)	(0.114)	(0.114)
comcol	0.874***	0.874***	0.553***	0.554***
		(0.055)	(0.069)	(0.069)
rta	0.304***	0.255***	0.378***	0.383***
	(0.033)	(0.031)	(0.053)	(0.053)
Exporter, Importer F.E.	Yes	Yes	Yes	Yes
Time F.E.	Yes	Yes	Yes	Yes
Cluster-Robust S.E.	Yes	Yes	Yes	Yes
Cluster	ldist	ldist	ldist	ldist
N	573,374	573,374	219,346	219,346
R^2	0.696	0.698	0.658	0.658
Adjusted R^2	0.696	0.698	0.658	0.658

Notes: Fixed effects estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 1984, and 1985 to 2017, respectively.
Sources: See Table 4

Table 12: Results: Cumulative Exposition Variables

	lexp	
	(1)	(2)
expocum	0.157^{***}	
	(0.016)	
worldexpocum		0.474^{***}
		(0.040)
specexpocum		0.058^{***}
		(0.020)
ldist	-1.453^{***}	-1.453^{***}
	(0.021)	(0.021)
custrict	0.851^{***}	0.846^{***}
	(0.094)	(0.094)
comlang	0.401^{***}	0.400^{***}
	(0.037)	(0.037)
border	0.425^{***}	0.424^{***}
	(0.102)	(0.102)
colony	1.495^{***}	1.497^{***}
	(0.128)	(0.128)
comcol	0.792^{***}	0.792^{***}
	(0.052)	(0.052)
rta	0.301^{***}	0.299^{***}
	(0.029)	(0.029)
Exporter, Importer F.E.	Yes	Yes
Time F.E.	Yes	Yes
Cluster-Robust S.E.	Yes	Yes
Cluster	ldist	ldist
N	792,720	792,720
R^2	0.672	0.672
Adjusted R^2	0.672	0.672

Notes: Fixed effects estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 2017.
Sources: See Table 4

Table 13: Results: Short Run (4 Years) effect of Expositions

	lexp	
	(1)	(2)
expo1	−0.028	
	(0.021)	
worldexpo1		0.259***
		(0.026)
specexpo1		−0.150***
		(0.027)
ldist	−1.393***	−1.393***
	(0.021)	(0.021)
custrict	0.998***	0.997***
	(0.104)	(0.104)
comlang	0.553***	0.553***
	(0.036)	(0.036)
border	0.481***	0.481***
	(0.104)	(0.104)
colony	1.339***	1.339***
	(0.124)	(0.124)
rta	0.705***	0.704***
	(0.031)	(0.031)
N	853,010	853,010
R^2	0.667	0.667
Adjusted R^2	0.667	0.667
Time F.E.	Yes	Yes
Exporter/Importer F.E.	Yes	Yes
Cluster-Robust S.E.	Yes	Yes
Cluster	ldist	ldist

Notes: Fixed effects estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 2017.
Sources: See Table 4

Table 14: Results: Participating Countries

	lexp		
	(1)	(2)	(3)
expo58part1	−0.030		
	(0.421)		
expo62part1		0.201	
		(0.242)	
expo70part1			0.454
			(0.291)
ldist	−0.338*	−1.459***	−1.131***
	(0.190)	(0.294)	(0.236)
custrict	0.683*	0.151	
	(0.392)	(0.554)	
comlang	0.248	0.751***	
	(0.392)	(0.241)	
rta	1.255***	1.227***	
	(0.318)	(0.359)	
border	0.014	−1.176**	
	(0.558)	(0.579)	
comcol			
colony	0.886	0.180	
	(0.577)	(0.841)	
N	3,049	8,259	8,239
R^2	0.668	0.647	0.631
Adjusted R^2	0.665	0.644	0.628
Time F.E.	Yes	Yes	Yes
Other F.E.	No	No	No
Cluster-Robust S.E.	Yes	Yes	Yes
Cluster	ldist	ldist	ldist

Notes: Fixed effects estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 2017.
Sources: See Table 4

Table 15: Determinants of Hosting an Exposition

Treatment (1)	Control (0)	Log(Export/GDP) (openness)	Log(population)	Log(Real GDP/c)
Host	Non-Host	-0.0034 (0.0025)	0.3301 (0.0052)***	0.5077 (0.0096)***

Notes: Probit estimation; year effects included but not recorded. Coefficients with standard errors recorded in parentheses; coefficients significantly different from zero at 0.1/0.05/0.01 level marked with one/two/three asterisk(s). Data ranges from 1950 to 2017.
Sources: See Table 4

References

Anderson, James E. and Eric Van Wincoop (2003). "Gravity with gravitas: A solution to the border puzzle". In: *American economic review* 93.1, pp. 170–192.

Andersson, Tommy D., John Armbrecht, and Erik Lundberg (June 2008). "Impact of Mega-Events on the Economy". In: *Asian business & management* 7.2, pp. 163–179. DOI: `10.1057/abm.2008.4`. URL: `http://dx.doi.org/10.1057/abm.2008.4`.

Bartolini, Leonardo and Allan Drazen (1997). "Capital-Account Liberalization as a Signal". In: *American Economic Review* 87.1, pp. 138–154.

Bureau International des Expositions (2023). *About.* URL: `https://www.bie-paris.org/site/en/about-world-expos`.

Carlino, Gerald and N. Edward Coulson (2004). "Compensating differentials and the social benefits of the NFL". In: *Journal of Urban Economics* 56.1, pp. 25–50.

Chapell, Urso and Cesar Corona (2023). *History.* URL: `https://www.expomuseum.com/history`.

Chen, Ni (2012). "Branding national images: The 2008 Beijing summer olympics, 2010 Shanghai World Expo, and 2010 Guangzhou asian games". In: *Public Relations Review* 38.5, pp. 731–745.

Coates, Dennis (2007). "Stadiums and arenas: Economic development or economic redistribution?" In: *Contemporary economic policy* 25.4, pp. 565–577.

Diez, Javier Revilla and Jens Kramer (2011). "Expo 2000 revisited: The regional economic impact of the world exposition in Hannover". In: *Expo 2000 Revisited: the Regional Economic Impact of the World Exposition in Hannover*. Franco Angeli, pp. 72–86.

Findling, John (2023). *World's fair - Modernism and Cold War rivalries — Britannica.* URL: `https://www.britannica.com/topic/worlds-fair/Modernism-and-Cold-War-rivalries`.

Francois, J. and M. Machin (2006). "Institutional Quality, Infrastructure, and the Propensity to Export". In: *Centro Studi Luca d'Agliano Development Studies Working Paper No.224*.

Free Library of Philadelphia (2001). *Significance of the Centennial Exhibition.* URL: `http://libwww.library.phila.gov/CenCol/exh-signif.htm`.

Hanson, Gordon H (2005). "Market potential, increasing returns and geographic concentration". In: *Journal of international economics* 67.1, pp. 1–24.

Head, Keith and Thierry Mayer (2014). "Gravity equations: Workhorse, toolkit, and cookbook". In: vol. 4. Handbook of international economics. Elsevier, pp. 131–195.

Holmes, Richard A. and Abul FM Shamsuddin (1996). *Short and Long Term Effects of World Exposition 1986 on US Demand for British Columbia Tourism.*

Humphreys, Jeffrey M. and Michael K. Plummer (1995). *The economic impact on the state of Georgia of hosting the 1996 Summer Olympic Games.*

Krugman, Paul (1998). *The confidence game.*

Leamer, Edward E. and James Levinsohn (1995). "International trade theory: the evidence". In: *Handbook of international economics* 3, pp. 1339–1394.

Limao, Nuno and Anthony J. Venables (2001). "Infrastructure, geographical disadvantage, transport costs, and trade". In: *The world bank economic review* 15.3, pp. 451–479.

Maennig, Wolfgang and Stan Du Plessis (2007). "World Cup 2010: South African economic perspectives and policy challenges informed by the experience of Germany 2006". In: *Contemporary Economic Policy* 25.4, pp. 578–590.

Matheson, Victor (2012). *Assessing the infrastructure impact of mega-events in emerging economies.*

Mukand, Sharun W (2006). "Globalization and the 'confidence game'". In: *Journal of International Economics* 70.2, pp. 406–427.

Owen, Jeffrey G. (2005). "Estimating the cost and benefit of hosting Olympic Games: what can Beijing expect from its 2008 Games". In: *The industrial geographer* 3.1, pp. 1–18.

Rappaport, Jordan and Chad Wilkerson (2001). "What are the benefits of hosting a major league sports franchise?" In: *Economic Review-Federal Reserve Bank of Kansas City* 86.1, pp. 55–86.

Redding, Stephen and Anthony J Venables (2004). "Economic geography and international inequality". In: *Journal of international Economics* 62.1, pp. 53–82.

Rose, Andrew K and Mark M Spiegel (2011). "The olympic effect". In: *The Economic Journal* 121.553, pp. 652–677.

Rose, Andrew K. (2019). "Soft power and exports". In: *Review of International Economics* 27.5, pp. 1573–1590.

Shepherd, Ben (2013). *The gravity model of international trade: A user guide.*

Stock, James H, Mark W Watson, et al. (2003). *Introduction to econometrics*. Vol. 104. Addison Wesley Boston.

Wikipedia contributors (2023). *List of world expositions — Wikipedia, The Free Encyclopedia*. `https://en.wikipedia.org/wiki/List_of_world_expositions`. [Online; accessed 1-June-2023].

Xue, Ke, Xi Chen, and Mingyang Yu (2012). "Can the World Expo change a city's image through foreign media reports?" In: *Public Relations Review* 38.5, pp. 746–754.

Zeng, Lin Hui and Guang Ming Li (2014). "World Expo 2010 promotes the reduction in carbon emissions of urban transport". In: *Applied Mechanics and Materials* 522, pp. 1826–1830.