

THE OLYMPIC EFFECT*

Andrew K. Rose and Mark M. Spiegel

Why should countries offer to host costly 'mega-events' such as the Olympic Games? We show that hosting a mega-event increases exports. This effect is statistically robust, permanent and large; trade is over 20% higher for host countries. Interestingly, unsuccessful bids to host the Olympics have a similar impact on exports. We conclude that the Olympic effect on trade is attributable to the signal a country sends when bidding to host the games, rather than the act of actually holding a mega-event. We develop an appropriate formal model and derive conditions under liberalising countries will signal through a mega-event bid.

When the Olympic flame is lit, China will be hoping for a 17-day festival of sport and international friendship. It sees the games as marking not just its re-emergence as a global economic force but also as a country that the rest of the world treats with admiration and respect.

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1. Motivation

Economists are usually sceptical of arguments about the public provision of infrastructure for sporting events, and rightly so. Agents that endorse the construction of new sports stadia or the staging of mega-events usually do so out of naivety or self-interest. In practice, these events usually end up imposing large costs on their hosts that are not nearly compensated by either the revenues earned during the event or the legacy of large stadia or obscure facilities (velodromes, aquatic centres and so forth) that are left behind. The opening ceremonies of the 2008 Beijing Olympic games are commonly thought to have cost at least \$100 million, when over 100 million Chinese lived on <\$1 per day.

Despite the fact that most economists doubt the wisdom of such policy, there is little question that countries commit substantial resources to become candidates to host mega-events, and much more should they be 'fortunate' enough to actually host the event. While there is usually a vocal minority of opponents, the desire to host the Olympic games is widely held by both the masses and political elites.

* Corresponding author: Andrew K. Rose, Haas School of Business, University of California, Berkeley, CA 94720-1900, USA. Email: arose@haas.berkeley.edu.

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This article examines the possibility that both sides of the argument may be right. In particular, we show that there is a large economic benefit associated with mega-events (justifying the public's enthusiasm), despite the fact that much of the requisite new infrastructure is a net cost (explaining the scepticism of economists). Succinctly, when a country wishes to enter the world stage, it can signal this to both domestic and international constituencies by offering to host a mega-event. We model this narrowly by focusing on trade liberalisation, but believe that the point may be more general.

It is commonly argued that hosting the Olympics will promote a nation's exports. For instance, the International Olympic Committee (IOC) believes that potential visitors will be drawn to Olympic venues after being exposed to them through the games. Preuss (2004) discusses how the Seoul Games in 1988 were intended to improve international relations between South Korea and the Soviet Bloc countries 'as well as raise international awareness of Korean manufactured products' so as to promote Korean exports. We are dubious of the practical relevance of this argument, and thus begin by examining it empirically, using a number of different models of trade. Surprisingly, we find strong evidence of a large persistent effect of the Olympics on both exports and overall trade. Our results seem robust to a battery of sensitivity exercises including tetradic and matching/treatment estimation; we show that countries which have hosted the games seem to have exports over 20% higher, *ceteris paribus*. Other mega-events such as the World Cup also have large positive effects on trade. Somewhat surprisingly (at least to us), countries that host a mega-event seem to realise an economic benefit in the form of greater openness. If openness enhances growth (e.g. Lucas, 2009), the welfare consequences of mega-events may be positive and large.

Our explanation seems to accord well with the facts, at least superficially. In July 2001, Beijing was awarded the right to host the Games of the XXIX Olympiad. Just two months later, China successfully concluded negotiations with the World Trade Organisation, thus formalising its commitment to trade liberalisation. Nor is this a once-off coincidence. Rome was awarded the 1960 games in 1955, the same year Italy started to move towards currency convertibility, joined the UN, and, most importantly, began the Messina negotiations that lead two years later to the Treaty of Rome and the creation of the European Economic Community. The Tokyo games of 1964 coincided with Japanese entry into the IMF and the OECD. Barcelona was awarded the 1992 games in 1986, the same year Spain joined the EEC; the decision to award Korea the 1988 games coincided with Korea's political liberalisation. The correlation extends beyond the Olympics; the 1986 World Cup was held in Mexico coincident with its trade liberalisation and entry into the GATT.

While our observed effect is large, robust and plausible, it may be argued that it is attributable to unobservable differences between those countries that host the games and those that don't, rather than a 'hosting effect.' To address this possibility, we compare trade patterns for countries that host the games to those that bid unsuccessfully for the games. In using this alternative group as a control, our methodology follows a large recent literature, such as Greenstone *et al.* (2008). In our case, the operational assumption is that successful and unsuccessful candidates are similar in terms of proclivity towards trade and liberalisation, differing only by the experience of actually hosting the Olympic games.

Using this identification strategy, we find that countries that were unsuccessful candidates for the games also experience a positive export effect, one similar in size to that experienced by actual Olympic hosts. These findings cast doubt on the idea that a plausible motivation for hosting a mega-event is any change in a country's fundamentals induced by holding the games (such as construction activity or the resulting infrastructure). Instead, our evidence is consistent with the conclusion that *all* countries that bid for the games experience an increase in outward orientation, not just hosts. This too seems to accord with anecdotal information; there are a number of examples of unsuccessful Olympic candidates who liberalised. For instance, South Africa began a dramatic trade liberalisation in the mid 1990s while it mounted (and lost) its bid to host the 2004 Olympics (the choice of Athens was announced in September 1997).

This raises two puzzles. Why should bidding for the Olympics be associated with increased openness? And if hosting the games brings no tangible benefits relative to a control group of unsuccessful candidates, why would any country ever bid to hold an expensive mega-event?

We offer an answer to these puzzles below. We explore the possibility that bidding to host an international mega-event such as the Olympics is part of a costly strategy that signals trade liberalisation and results in increased openness. We develop a theoretical political-economy model consistent with this conjecture. In the model, we obtain a separating equilibrium where bidding to host a mega-event provides a positive signal about future policy intentions. However, consistent with our empirical findings, hosting the games in and of itself has no impact on a nation's fundamentals or trade.

Our model also suggests an answer to the question 'Why a mega-event?' as the choice of a signal of liberalisation intentions. We find that countries will be more likely to use the Olympic signal, the greater is the incidence of the expected cost of sending the signal on the group that expects to benefit from future liberalisation. Major sporting events like the Olympics are traditionally financed by the relevant city (usually the capital) in conjunction with the central government of the host country. Policy makers from these groups are likely to benefit from liberalisation. As such, bidding for the Olympics may serve well as a signal because it aligns the costs and benefits of the signal. To our knowledge, this is the first model where the distributional implications of sending the signal influence the desirability of the signal chosen. Olympic bids are also good signals of liberalisation because they are highly visible, infrequent and have long lead times. Still, our model does not explain all aspects of the data. For instance, our theory provides no clear-cut reason why open countries should bid at all to host a mega-event, let alone why countries bid seriously or repeatedly. Accordingly, we close on a cautious note.

2. Literature Review

2.1. *Mega-events*

A number of studies support local subsidisation of sporting events; they often predict large economic benefits. This work is typically commissioned and is not intended for the academic audience, but it is still influential. For example Humphreys and Plummer

(1995) estimate the short-term economic impact to Atlanta from hosting the 1996 games to be \$5.1 billion.

More rigorous studies are sceptical of the net economic benefits of hosting mega-events; see e.g. Owen (2005). The costs of holding such events seem considerable. Furthermore, any enduring benefits derive mostly from infrastructure investments that the host city could choose to make independently of the games. Much of the spending on the event by local citizens is a substitute from a different leisure activity or consumption good, rather than true additional spending. Moreover, the projects associated with the games typically seem to be white elephants, such as poorly used sporting facilities associated with idiosyncratic Olympic sports, or hotels and transportation infrastructure built to accommodate a one-time peak demand of just three weeks.

Some have argued that hosting sporting events yields a non-pecuniary ‘feel good’ benefit to local citizens who are filled with civic pride following a mega-event, even if they do not attend. However, the very existence of this intangible spillover is uncertain, let alone its magnitude. It seems safe to say that a majority of the profession considers it unlikely that these benefits justify the large public expenditures involved in hosting such events (e.g. Coates, 2007).

2.2. *International Signalling*

The use of international signals to indicate future policy to prospective foreign investors has been discussed in the literature. Bartolini and Drazen (1997) develop a model where governments with asymmetric information about future fiscal positions signal their expectations through current policies on capital account openness. Open capital accounts are more costly for countries in poor fiscal condition, so those countries that expect to be in good fiscal condition in the future can signal their prospects in ways that cannot be profitably mimicked by countries that expect to face future fiscal difficulties.

The signal we consider below is of a ‘burning money’ type, not informative in its own sense, but informative due to the fact that sending the signal is only attractive to the set of countries that sincerely intend to pursue liberalisation. In this sense, it is similar to the costs of delay in a war of attrition model, such as that of the delayed fiscal stabilisation in Alesina and Drazen (1991). Other studies go even farther, e.g. Krugman (1998) and Mukand (2006), who argue that countries sometimes pursue policies that are actually perverse, in an effort to increase investor confidence. Their argument is that in a globalised environment, policy makers may feel the need to pursue policies that would confirm foreign investors’ beliefs about what constitutes good policy. These beliefs may be biased due to herding effects (e.g. Banerjee, 1992) or alternatively because investors may draw incorrect inferences about their impact. As a result, perverse policies may have such an advantage in terms of their impact on agents’ expectations, that pursuing them may be superior to following the path that would yield the best outcome in terms of domestic economic fundamentals.

One question that naturally arises in these types of models is why one form of signal might be preferred to another. We argue that one attribute of using the Olympics as a signal is the incidence of the cost of sending the signal within the country. In particular, it is likely that the cost of hosting the Olympics is primarily borne by the benefactors of

the signalled policy change, limiting the losses to those not favoured by the policy. Mega-events like the Olympics are also infrequent, highly visible and have long lead times, attributes that lend themselves to signals of liberalisation.

3. The Olympic Effect on Trade

If the direct economic benefits seem theoretically dubious, and any indirect effects highly uncertain, the willingness of local and federal governments to heavily subsidise sporting activities is a mystery. We now try to tackle this issue empirically. In particular, we take seriously the argument that hosting a mega-event provides visibility to a host country and thus may stimulate global demand for its exports.

3.1. Specification and Data

We start our investigation by using the well-known and widely employed ‘gravity’ model of international trade (later below, we corroborate our results using a variety of different approaches. This models bilateral trade flows between a pair of countries as a function of the distance between the two countries and their economic ‘masses’. We augment this empirical specification by adding a host of other factors that might also affect their trade intensity. We employ the following specification:

$$\begin{aligned} \ln(X_{ijt}) = & \beta_0 + \beta_1 \ln(D_{ij}) + \beta_2 \ln(\text{Pop}_{it}) + \beta_3 \ln(\text{Pop}_{jt}) + \beta_4 \ln(\text{GDPpc}_{it}) + \beta_5 \ln(\text{GDPpc}_{jt}) \\ & + \beta_6 \text{CU}_{ijt} + \beta_7 \text{Lang}_{ij} + \beta_8 \text{RTA}_{ijt} + \beta_9 \text{Border}_{ij} + \beta_{10} \text{Islands}_{ij} + \beta_{11} \text{Area}_{ij} \\ & + \beta_{12} \text{ComCol}_{ij} + \beta_{13} \text{Colony}_{ijt} + \beta_{14} \text{EverCol}_{ij} + \beta_{15} \text{SameCtry}_{ijt} \\ & + \gamma \text{Summer}_{it} + \varepsilon_{ijt}, \end{aligned} \quad (1)$$

where i denotes the exporting country, j denotes the importer, t denotes time, $\ln(\cdot)$ denotes the natural logarithm operator and the variables are defined as: X_{ijt} denotes real FOB exports from i to j , measured in millions of dollars; D 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; CU is a binary ‘dummy’ variable which is unity if i and j use the same currency at time t and zero otherwise; 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 t ; Border is a binary variable which is unity if i and j share a land border; Island 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 colonised by the same country; Colony is a binary variable which is unity if i colonises j at time t (or *vice versa*); EverCol is a binary variable which is unity if i ever colonised j (or *vice versa*); SameCtry is a binary variable which is unity if i is part of the same country at time t (or *vice versa*); β is a vector of nuisance coefficients; Summer is a binary variable which is unity if i hosted a post-war Summer games at or before time t , and zero otherwise; ε_{ijt} represents the omitted other influences on bilateral exports, assumed to be well behaved.

This data set includes annual observations between 1950 and 2006 (though with many missing observations) for some 196 territories and localities (we refer to these as ‘countries’ below). The sources of our bilateral data set, along with a complete list of the countries themselves are tabulated in the longer version of this article.¹

We estimate this equation with OLS, using a robust covariance estimator (clustered by country-pair dyads) to handle heteroskedasticity. Throughout, we add year-specific fixed effects so as to take account of any time-specific common trends or effects. We also perturb this specification in two important ways. First, we add a comprehensive set of dyadic-specific fixed effects (i.e. a mutually exclusive and jointly exhaustive set of $\{\beta_{ij}\}$ intercepts) to absorb any time-invariant characteristics that are common to a pair of countries. Second, we add comprehensive sets of exporter and importer fixed effects (i.e. sets of $\{\beta_i\}$ and $\{\beta_j\}$) to take account of any time-invariant country-specific factors.² We also show below that our key results are insensitive to the use of other estimation strategies.

The coefficient of interest to us is γ . This represents the permanent export effect – the ‘Olympic Effect’ – associated with having hosted the post-war Summer Olympic games, holding other export determinants constant through the gravity model (we try hard not to interpret these coefficients as causal). The hosts of post-war Olympic games are tabulated in Table A1.³

3.2. *Benchmark Results*

The results of estimating our default specification are presented in Table 1. The default estimates are tabulated in the three columns towards the left, where results are presented for three different sets of fixed effects (none, dyadic and exporter/importer).

Before we discuss the coefficient of greatest interest to us, we briefly discuss the other determinants of trade flows. The gravity model seems to work well. It delivers precisely estimated coefficients that are sensible and similar to those estimated by others. For instance, β_1 is consistently estimated to be economically and statistically significant; exports between a pair of countries fall with distance (as previous researchers have found). Similarly, the size and significance of β_3 and β_5 indicates that larger and richer countries both tend to import more. Exports are larger when countries share a money, language, trade agreement, land border or colonial heritage. Furthermore, the equations fit the (largely cross-sectional) data set well, explaining well over half of the variation in exports. While these results are not of direct interest to us, they do reassure us that our estimates are grounded in a statistical conditioning model that delivers sensible and significant results.

Once the standard trade determinants are accounted for by the gravity model, is there any room left for a permanent export effect of hosting the Summer Olympics? Somewhat

¹ Available at: <http://faculty.haas.berkeley.edu/arose/OlympR2long.pdf>.

² We include both time- and country/dyad-specific fixed effects, so this is a difference-in-differences estimator.

³ We have also estimated both separate and combined Winter and Summer Olympic effects; earlier versions of the article contain the results. While the Winter effect is generally economically and statistically inconsequential, the combined Winter and Summer effect is quite similar to the effect associated with only the Summer games.

Table 1
Permanent Effect of Olympics on Log Exports in Gravity Model

Summer Olympics host (γ)	0.33** (0.04)	0.24** (0.03)	0.30** (0.04)	0.19** (0.04)	0.16** (0.04)	0.34** (0.03)	0.35** (0.04)
Log distance (β_1)	-1.12** (0.02)	n/a	-1.33** (0.02)	-1.26** (0.02)	-1.31** (0.02)	-1.14** (0.02)	-1.32** (0.02)
Log exp population (β_2)	1.07** (0.01)	0.19** (0.06)	-0.25** (0.06)	0.80** (0.02)	0.78** (0.02)	1.08** (0.01)	-0.41** (0.06)
Log imp population (β_3)	0.88** (0.01)	0.80** (0.05)	0.45** (0.05)	0.91** (0.01)	0.28** (0.05)	0.79** (0.02)	0.78** (0.02)
Log exp real GDP p/c (β_4)	1.55** (0.01)	1.24** (0.03)	1.25** (0.04)	1.16** (0.02)	1.20** (0.02)	1.60** (0.01)	1.27** (0.03)
Log imp real GDP p/c (β_5)	1.18** (0.01)	0.87** (0.03)	0.84** (0.03)	1.22** (0.01)	0.85** (0.03)	0.94** (0.02)	0.95** (0.02)
Currency union (β_6)	1.03** (0.10)	0.56** (0.09)	0.67** (0.10)	0.82** (0.10)	0.62** (0.09)	0.80** (0.10)	0.60** (0.09)
Common language (β_7)	0.45** (0.04)	n/a	0.34** (0.03)	0.44** (0.03)	0.35** (0.03)	0.39** (0.03)	0.33** (0.03)
RTA (β_8)	0.27** (0.03)	0.29** (0.02)	0.43** (0.03)	0.33** (0.03)	0.46** (0.03)	0.42** (0.03)	0.47** (0.03)
Common border (β_9)	0.68** (0.08)	n/a	0.46** (0.08)	0.45** (0.08)	0.46** (0.08)	0.70** (0.08)	0.44** (0.08)
# Islands (β_{10})	0.17** (0.03)	n/a	-3.86** (0.32)	0.39** (0.03)	0.55** (0.08)	0.04 (0.04)	0.68** (0.08)
Log product area (β_{11})	-0.07** (0.01)	n/a	0.57** (0.03)	-0.06** (0.01)	0.02 (0.02)	-0.07** (0.01)	-0.02 (0.02)
Common coloniser (β_{12})	0.58** (0.06)	n/a	0.75** (0.05)	0.58** (0.05)	0.77** (0.05)	0.74** (0.05)	0.74** (0.05)
Currently colony (β_{13})	0.61** (0.24)	0.38** (0.19)	0.95** (0.25)	0.75** (0.22)	0.94** (0.22)	0.81** (0.24)	1.02** (0.24)
Ever colony (β_{14})	1.45** (0.10)	n/a	1.42** (0.09)	1.49** (0.09)	1.40** (0.09)	1.31** (0.09)	1.43** (0.09)
Common country (β_{15})	0.09 (0.71)	n/a	-0.95* (0.41)	-0.41 (0.38)	-0.93** (0.35)	-0.35 (0.62)	-0.99* (0.42)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dyadic fixed effects		Yes					
Exporter fixed effects			Yes				Yes
Importer fixed effects			Yes		Yes		
Exporter \times time fixed effects				Yes	Yes		
Importer \times time fixed effects						Yes	Yes
R ²	0.61	0.85	0.69	0.66	0.69	0.64	0.69
RMSE	2.18	1.40	1.94	2.04	1.94	2.09	1.94

Notes. 449,220 bilateral annual observations covering 196 countries, 1950–2006. Robust standard errors (clustered by dyads) in parentheses. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s).

surprisingly (at least initially to us), the answer is unambiguously positive. Consider the column on the extreme left-hand side of Table 1; the estimate of γ is positive and statistically distinguishable from zero at all reasonable significance levels. Furthermore, the ‘Olympic Effect’ is economically large; the point estimate of 0.33, taken literally, implies that countries that have hosted the summer games have exports that are permanently higher by some ($\exp(0.33) - 1 = 39\%$! This is big, broadly comparable in our estimates to, e.g. the effects of a shared regional trade agreement. Reassuringly, including either dyadic or country-specific fixed effects does not change the key result very much.

The four columns at the right of the table provide further sensitivity analysis, adding combinations of country-specific fixed effects interacted with linear time trends. This

allows, e.g. each exporter (importer) to have its own trend growth rate of exports (imports), aside from any other global time or other effects. The smallest estimate of γ appears when we include exporter-specific time trends and importer-specific intercepts, but even in this case, previous hosts of the Summer games have exports some ($\exp(0.16) - 1$) 17% larger.

Succinctly, countries that have hosted the Summer Olympic games in the past seem to have exports that are both economically and statistically significant higher, holding other things constant; an effect of 20% seems a reasonable lower bound. Understanding this apparently implausible result more deeply takes up the remainder of the article.

4. Sensitivity Analysis

4.1. *Robustness of Permanent Effect*

Are the (surprisingly) strong linkages between exports and Olympic hosts fragile? Or instead, do small perturbations to the exact sample or choice of conditioning model have a strong effect on the results? No. We provide a battery of robustness checks in Table 2, which is intended to reassure the sceptical reader that our results are essentially insensitive to minor changes in the exact econometric methodology used to estimate γ . Each of the rows in the table corresponds to a different sensitivity check, while the three columns correspond to the default three sets of fixed effects including to the left in Table 1. We only report estimates for the coefficient of interest γ ; other controls are included in the regressions as appropriate but not reported.

The first experiment of Table 2 shows the results when exports from i to j are replaced by imports into i from j . The coefficients remain statistically large and positive. Indeed, the point estimates are, if anything, somewhat larger than those associated with exports. This indicates that the Olympics are associated with an increase in the openness of an Olympic host. The games do not seem to act as simple export promotion, but are instead associated with an increase in two-way trade between the host and the rest of the world.

Next, we change the empirical model by stripping down the gravity model by including only bilateral distance, importer population and importer income as controls. However, our key finding of strong positive γ coefficients persists. The same is true when we add regional dummy variables, taken from the regional groupings from the World Bank (so that they include only developing countries). In particular, we include dummy variables for: East Asia and the Pacific; Europe and Central Asia; Latin American and the Caribbean; the Middle East and North Africa; South Asia; and Sub-Saharan Africa. We then successively delete observations for developing countries from: Latin America or the Caribbean; Africa; Asia; or the Middle East. However, our results do not seem to be sensitively on observations from a particular region of the world.

We check further for sample robustness by selectively dropping different sets of observations. We first drop all observations for importers that are classified as 'industrial' by the IMF. We then consider only middle-income exporters (using the 2008 World Bank definition of a country with real annual GNI per capita between \$976 and

Table 2
Sensitivity Analysis of Permanent Olympics Export Effect

Fixed effects	Years	Years, dyads	Years, exporters, importers
Substitute imports for exports	0.62** (0.04)	0.50** (0.04)	0.65** (0.05)
Stripped down gravity model	0.30** (0.04)	0.22** (0.04)	0.27** (0.04)
Add regional dummies	0.21** (0.04)	0.24** (0.03)	0.30** (0.04)
Drop Latin American, Caribbean importers	0.28** (0.04)	0.22** (0.04)	0.29** (0.04)
Drop African importers	0.37** (0.04)	0.26** (0.04)	0.34** (0.04)
Drop Asian importers	0.35** (0.04)	0.26** (0.04)	0.33** (0.04)
Drop Middle Eastern importers	0.33** (0.04)	0.24** (0.04)	0.30** (0.04)
Drop industrial importers	0.31** (0.04)	0.25** (0.04)	0.27** (0.04)
Only middle income exporters	-0.39** (0.13)	0.88** (0.14)	0.86** (0.14)
Only middle income importers	0.33** (0.05)	0.28** (0.05)	0.27** (0.06)
Drop small (<1 million) exporters	0.28** (0.04)	0.18** (0.03)	0.22** (0.04)
Drop poor (<\$1,000 real GDP p/c) exporters	0.21** (0.04)	0.18** (0.03)	0.24** (0.04)
Drop small (<1 million) importers	0.36** (0.04)	0.25** (0.04)	0.31** (0.04)
Drop poor (<\$1,000 real GDP p/c) importers	0.34** (0.04)	0.25** (0.04)	0.33** (0.04)
Drop all small/poor countries	0.16** (0.04)	0.12** (0.04)	0.17** (0.04)
More balanced sample	0.15** (0.05)	0.16** (0.05)	0.21** (0.05)
Drop late (>2000) data	0.36** (0.04)	0.23** (0.04)	0.27** (0.04)
Drop early (<1960) data	0.32** (0.04)	0.17** (0.04)	0.24** (0.04)
Weight by log product real GDP	0.25** (0.03)	0.17** (0.03)	0.23** (0.04)
Drop > 2.5 σ outliers	0.27** (0.03)	0.18** (0.03)	0.25** (0.04)
Exporter <i>or</i> importer host	0.47** (0.03)	0.33** (0.03)	0.36** (0.04)
Exporter <i>and</i> importer host	0.47** (0.03)	0.34** (0.03)	0.41** (0.03)
Glick–Taylor (1870–1997) data set	0.56** (0.03)	0.34** (0.04)	0.37** (0.04)

Notes. Coefficient on permanent Olympic hosting effect. Standard data set includes up to 449,220 bilateral annual observations covering 196 countries, 1950–2006. Robust standard errors (clustered by dyads) in parentheses. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s). Regressand is log real bilateral exports. Controls included but not recorded: log distance; log exporter population; log importer population; log exporter real GDP p/c; log importer real GDP p/c; currency union dummy; common language dummy; RTA dummy; common land border dummy; # Islands; log product area; common coloniser dummy; current colony dummy; ever colony dummy; and common country dummy.

\$11,905), and then only middle-income importers. We then drop small exporters (defining a small country as one with fewer than a million people), poor exporters (those with real GDP per capita of <\$1,000 per annum), small and then poor importers, and the intersection of these four sets. Finally, we create a more balanced sample by restricting ourselves to the 47 countries with relatively complete bilateral data. None of these robustness checks shakes the confidence we have in our basic results; we once find a negative and significant effect of hosting, but only in the absence of fixed effects. We then check the sensitivity of our results with respect to time. We separately drop late (post-2000) and early (pre-1960) observations; again this does not destroy our findings.

We finish up this analysis with five further experiments. First, we weight our regressions by the log of the product of the country-pair real GDP. Second, we drop outlier observations, defined as those where the residual is far (more than 2.5 standard deviations) away from zero. We then redefine our key Olympics regressor in two ways. First, we construct a variable which is 0 if neither i nor j has hosted the Olympics at or before time t , 1 if *either* i or j has hosted (at or before t) and 2 if *both* i and j have hosted. The last variable delivers insignificant results for hosting the summer games when fixed effects are included; otherwise, our results are insensitive. Finally, we use the Glick–Taylor historical data set, which includes bilateral trade (but not export) data stretching back to 1870. Using this long data set allows us to incorporate observations for countries that have hosted the games at any point during the modern Olympiad era, not just from the shorter post-war period. However, our findings remain resilient; countries seem to have permanently higher trade flows after having hosted the games.

We conclude that our results do not seem to result from some small subset of the data set, and are robust to reasonable changes in the sample and exact specification of our empirical model. Countries that have hosted the Summer Olympic games seem to have higher trade than others.

4.2. *Endogeneity*

A question arises immediately: Can the choice of venue for the Olympic games be treated as plausibly exogenous? Perhaps only countries that are open to trade are chosen to host the games? We attempt to address this point more directly below with a matching methodology that compares Olympic hosts (as ‘treatments’) to other countries (controls), and we also pursue an event study of relevance. Still, we now make several points.

First, the endogeneity critique (along with much of our analysis) is primarily cross-sectional, while the empirical finding of relevance to us is found in the time-series behaviour of trade.

Second, our analysis shows that countries become more open after the Olympics. However, *cities* (not countries) bid to host the games. Indeed, four American cities vied for the 1948 Olympics (which went to London), five American cities applied in 1952 (again without success) and six in 1956 (also unsuccessfully).⁴

⁴ Still, support from the national authorities is now a prerequisite for a serious application.

Third, the IOC provides details both on how it awards the games and why a city should be interested. There is a long list of technical criteria which are evaluated by an IOC committee; few of these criteria are closely associated with trade. Informally, there is also geographic balancing, and the IOC seems to award perseverance (a number of cities have applied repeatedly). We also note in passing that there is considerable randomness inherent in the process.

Fourth, our data does allow us to consider the issue of reverse causality directly. In particular, we can statistically examine whether more open countries are more likely to bid for, or obtain hosting rights to the Olympics. We conduct probit tests to that effect in Table A2. In addition to including openness, we control for country size and per capita income. We find that openness enters insignificantly throughout, suggesting that reverse causality is not an issue.

Why does the IOC think that cities should be interested in hosting the Olympics? They state:

Apart from the sporting events, the main reason for applying for candidacy lies in the possibilities for economic development and tourism inherent in such an event. For this reason, and also given the high infrastructure costs, only rich countries have the means to make a good return on such a large investment.⁵

Two main reasons seem to motivate most applicant cities, namely international recognition and increased opportunities for invigorated urban and regional development. Indeed, the host city hopes to take advantage of the event to maximise its facilities due to the considerable income generated by the Games, and to give itself an enhanced image to attract future visitors, consumers and potential investors. . . Organising the Olympic Games is a fantastic advertising opportunity for the host city. . . Moreover, organising the Olympic Games is an opportunity for the host city and country to show the world their ability to undertake and organise successfully such an important event. This promotional aspect is often motivated by the politicians of the host country, thereby explaining the heavy involvement of national governments in the organisation and financing of Olympic Games.

4.3. *Other International 'Mega-events'*

While the Olympics are highly visible, they are not the only mega-event. Do other events deliver similar results? One obvious alternative to consider is the World Cup, the only serious competitor with the Olympics for title of most important international sporting event.

Like the Olympics, the FIFA World Cup is held every four years. It began in 1930 in much the small-scale way as did the modern Olympics game, with 13 (mostly Latin American) countries participating in a tournament held in Uruguay. The 1934 and 1938 tournaments were also relatively small and regional, being held in Europe with

⁵ P1 of *Candidate Cities and Venues for the Winter Olympics* available at: http://multimedia.olympic.org/pdf/en/_report/_666.pdf.

Table 3
The Permanent Effects of Other Mega-events on Log Exports

Fixed effects	Years	Years, dyads	Years, exporters, importers
<i>(a) Effects of Hosting Olympics and World Cup</i>			
Olympic effect	0.30** (0.04)	0.19** (0.03)	0.22** (0.04)
World Cup effect	0.31** (0.03)	0.18** (0.03)	0.27** (0.03)
Olympic = World Cup effect? (p-value)	0.80	0.95	0.39
<i>(b) Effects of Hosting Olympics and World's Fair/Expo</i>			
Olympic effect	0.26** (0.04)	0.21** (0.03)	0.26** (0.04)
World's fair/expo effect	0.19** (0.04)	0.07** (0.03)	0.09** (0.03)
Olympic = World's fair/expo effect? (p-value)	0.24	0.00**	0.00**

Notes. Coefficient on permanent effect of having hosted a mega-event. Standard data set includes up to 449,220 bilateral annual observations covering 196 countries, 1950–2006. Robust standard errors (clustered by dyads) in parentheses. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s). Regressand is log real bilateral exports. Controls included but not recorded: log distance; log exporter population; log importer population; log exporter real GDP p/c; log importer real GDP p/c; currency union dummy; common language dummy; RTA dummy; common land border dummy; # Islands; log product area; common coloniser dummy; current colony dummy; ever colony dummy; and common country dummy.

limited participation by the Latins. The event only really took off in 1950 (the 1942 and 1946 events were cancelled for World War II). This was due in part to a convention of alternating the event between the Americas and Europe.⁶ We construct dummy variables for countries that have hosted the World Cup post-war in a manner analogous to those for the Olympic games, and add them to our specification. We report our results in Table 3*a*.

The results of Table 3*a* are intriguing. The effect of hosting the Olympic games remains positive and statistically significant for all three specifications; the coefficients continue to average around 0.2. The effects of hosting the FIFA World Cup are similar in sign, size and statistical precision. Indeed, we can never reject the hypothesis of equal trade effects of hosting the Olympics and the World Cup.

What about international events that do not involve sports? After all, international expositions and world's fairs have an older pedigree than the modern Olympics, stretching back at least to the 1851 Great Exhibition in London's Crystal Palace. The decline of international communication and transportation costs has largely made world's fairs obsolete, and they have declined in importance and number throughout the post-war period (Expo 67 in Montreal is widely considered to be the most successful expo ever held). Still, Table 3*b* adds comparably constructed binary variables for (20) post-war expos and world's fairs to our default specification. In all specifications, the trade effect of hosting a world's fair or expo is positive and statistically significant, though it is smaller than the Olympic effect on trade.

⁶ We note in passing that there has been relatively little competition to host the World Cup, so that we are unable to plausibly compare hosts and unsuccessful candidates, as we do below for the Olympics.

There seem to be a number of ways in which a country can enhance its trade by hosting an international mega-event. The trade-expanding effects of hosting an event like the Olympics seem to be large, and they are broadly comparable to those associated with hosting the FIFA World Cup. Holding an expo or world's fair also seems to have much the same effect. Given our initial doubts concerning the benefits of hosting a mega-event, we now dive into the issue more deeply.

5. Unsuccessful Candidates

It is difficult for us to believe that hosting the Olympics actually has such a large effect on trade, let alone one that enhances trade permanently. Yet our sensitivity analysis shows that our results are sturdy.

We now take a sceptical look at our results from a different angle. To estimate the effects of the Olympics on trade in the previous section, our statistical model compared hosts with non-hosts. This seems a reasonable strategy, since not all countries have hosted the games (so there is cross-sectional variation), and the countries that host the Olympics do so at different points of time (so there is time-series variation). However, it may be that our regression results are implicitly comparing apples with oranges; countries are not randomly chosen to host the Olympics. One way to get at this issue is to compare the trade patterns of host countries with those that bid unsuccessfully for the games. We refer to the latter as unsuccessful 'candidate' countries; candidates are tabulated in Table A1. Our implicit assumption in comparing the trade effects of Olympic hosting and candidacy is that failed candidacies form a valid quasi-experimental counterfactual control group for Olympic hosts (after the inclusion of other conditioning variables).

In Table 4a, we report results when we add a set of binary variables for countries that were unsuccessful candidates to host the Olympics. These have been constructed in the same way as our host dummy variables. For instance, London was awarded the 1948 summer games, so the summer host variable is unity for all British (export) observations from 1948 through the end of the sample. Since Lausanne was an unsuccessful candidate for the 1948 games, all Swiss observations from 1948 also take the value of unity for the comparable summer candidate variable. We tabulate separate export estimates for: being an unsuccessful Olympic candidate; and actually hosting the games. Intriguingly, all the effects – that is, both the host and the candidate coefficients – are significantly positive and economically large. They are also similar in size; as the tests at the bottom of the panel show, the hypothesis that host and candidate effects are equal cannot be rejected at the 1% confidence level (though it can be at the 5% level for two of the three cases, once because of a larger hosting effect and once because of a smaller hosting effect). Table 4b uses narrows the set of unsuccessful being compared to hosts; only the runner-up to the actual host chosen is used. The results remain quite consistent with the idea that the hosting effect on trade is similar in size to that of being an otherwise similar but unsuccessful candidate for the Summer Olympics. Nothing below really hinges on the magnitude of hosting being exactly equal to that of launching an unsuccessful Olympic bid, but we adopt this assumption below for simplicity, and because it seems consistent with the gross facts.

Table 4

(a) *The Permanent Effects of Olympic Hosting and Candidacy on Log Exports.* (b) *Effect of Hosting and Being Runner-up on Log Exports*

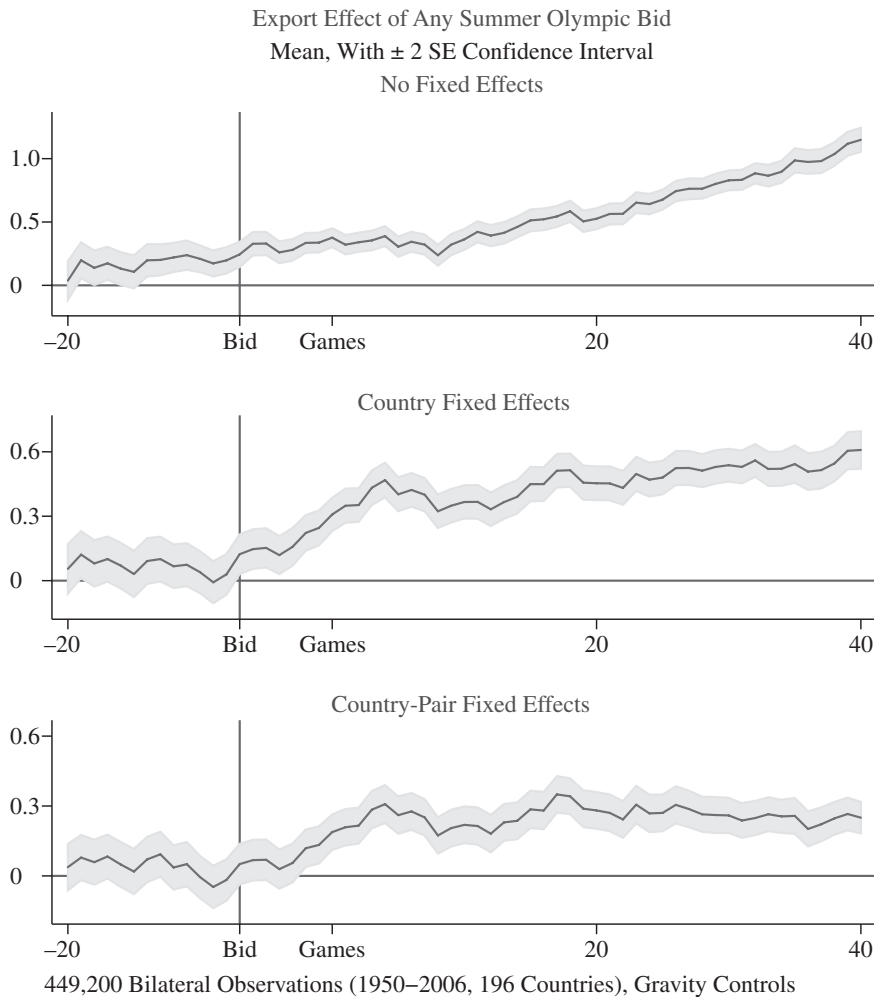
Fixed effects	Years	Years, dyads	Years, exporters, importers
(a)			
Olympic hosting effect	0.30** (0.04)	0.20** (0.03)	0.24** (0.04)
Olympic candidacy effect	0.20** (0.03)	0.25** (0.03)	0.34** (0.03)
Hosting = candidacy effect? (p-value)	0.02*	0.26	0.04*
(b)			
Olympic hosting effect	0.33** (0.04)	0.23** (0.03)	0.29** (0.04)
Runner-up effect	0.09* (0.04)	0.22** (0.04)	0.31** (0.04)
Hosting = runner-up effect? (p-value)	0.00**	0.75	0.68

Notes. Coefficient on permanent effect of having hosted/been a candidate/been the leading runner-up for the Summer Olympics. Standard data set includes up to 449,220 bilateral annual observations covering 196 countries, 1950–2006. Robust standard errors (clustered by dyads) in parentheses. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s). Regressand is log real bilateral exports. Controls included but not recorded: log distance; log exporter population; log importer population; log exporter real GDP p/c; log importer real GDP p/c; currency union dummy; common language dummy; RTA dummy; common land border dummy; # Islands; log product area; common coloniser dummy; current colony dummy; ever colony dummy; and common country dummy.

5.1. *Timing of the Olympic Effect and Exports*

The statistical analysis of Table 4 indicates that bidding to host the Olympics seems to have an export effect comparable in magnitude to that of hosting the games. We explore this result further in Figure 1, which portrays the export effects of bidding for the Summer Olympics, either successfully or unsuccessfully, in an event study. Instead of using a *single* dummy variable to show the post-Olympic *hosting* effect on trade (as in Tables 1–4), we use an unrestricted distributed lag model, so that the lagged impact of *bidding* for the games is allowed to vary depending on the number of years before or since the bid. As bids to host the games are typically submitted seven years before the actual games, we mark the submission of bids with a vertical line, and consider observations up to twenty years before and forty years after the actual games. We control for other trade effects through the gravity model (employed above), portray results for three different sets of fixed effects, and show the coefficients in the distributed lag model along with a \pm two standard error confidence interval.

Exports seem insignificantly different for bidders and non-bidders up until the time the time of the Olympic bid. But after the bid – and before the actual games – exports seem to rise significantly. Exports for Olympic bidders remain significantly higher for decades after the games; the exact size depends on the specification of the fixed effects. This effect does not stem simply from hosting; Figure 2 is an analogue to Figure 1, but examines only unsuccessful bids for the games. The similarity between the two figures is

Fig. 1. *The Olympic Effect on Exports*

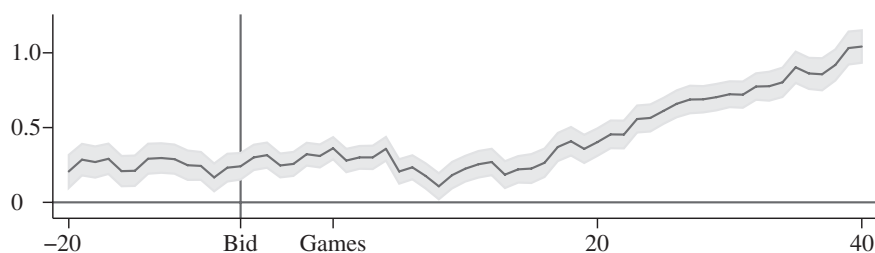
12

striking; in both cases, the export effect starts around the time of the bid, rises before the actual games and appears to be a highly persistent effect.⁷

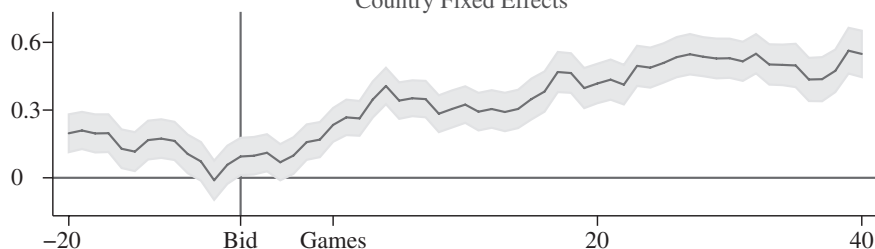
This is an intriguing result, one which we find reasonably consistently throughout our investigation. It implies that the (sizeable) effect on trade seems to come not from actually hosting the games but from being a country that bids for them. More generally, signalling that the country is capable and willing to host the Olympics through a highly visible international bid for a mega-event seems to be associated with a sizeable trade-expanding effect. Indeed, the effect of sending this signal seems broadly comparable in size to actually hosting the games. This is consistent with our

⁷ Analogues to Figures 1 and 2 for imports are similar and available in an extended version of the article. Also, the analogue event study for the natural logarithm of real GDP per capita (taken from the PWT 6.3 with PPP-adjustments, controlling for fixed time- and country-specific effects) is available in the extended version. It shows a slight, imprecisely estimated increase in real GDP per capita after a bid to host the summer games.

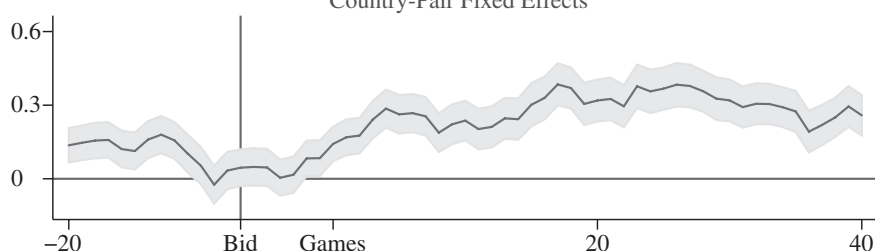
Failed Summer Olympic Bids and Exports
 Mean, With ± 2 SE Confidence Interval
 No Fixed Effects



Country Fixed Effects



Country-Pair Fixed Effects



449,200 Bilateral Observations (1950–2006, 196 Countries), Gravity Controls

Fig. 2. *Unsuccessful Olympic Bids and Exports*

view that any direct trade effect of hosting the games is small. Moreover, it suggests that the observed effects of hosting a mega-event do not seem to stem from a ‘big push’ type of process (e.g. Murphy *et al.*, 1989). We dismiss as implausible the idea that economic fundamentals (e.g. transport infrastructure) relevant for trade have been improved by both hosts and unsuccessful candidates alike during the run-up to a serious Olympic bid.⁸

6. Further Robustness Checks

In this section, we move beyond the conventional gravity model and briefly subject our results to three further sensitivity tests. Given our interest in estimating and comparing

⁸ The fundamentals of relevance for trade seem essentially unrelated to the characteristics of a good Olympic bid.

the trade effects of both hosting and bidding for a mega-event like the Olympics, we have three particular concerns: econometric issues associated with the gravity model; econometric issues associated with selection bias and endogeneity; the presence of our finding in multilateral data.⁹

6.1. *Tetradic Estimates*

We begin by dealing with the problem that gravity models like ours may be misspecified because of ‘monadic’ problems. These refer to omitted factors that are specific to a single country but may vary over time, such as those associated with ‘multilateral resistance’ to trade, e.g. Anderson and Van Wincoop (2003). To deal with the problem, we adopt the ‘method of tetrads’ advocated by Head *et al.* (2010). With this method, consistent estimators of the coefficients of interest can be attained in the presence of multilateral resistance by comparing export observations to exports for a pair of base countries for the same year (the technique is ‘tetradic’ since one compares trade flows for four countries). This method avoids the large number of coefficient estimates that would be required to estimate the monadic effects using a more conventional fixed effects method, but does not either infeasible computational demands or non-linear estimation; Head *et al.* (2010) provide more details.

One issue that arises in tetradic gravity specifications is the designation of the base countries. To ensure that our results are robust, we use three different pairs of base countries: the United States and the United Kingdom; Japan and France; Germany and Canada. A second issue is that the error terms in our tetrads are likely to be correlated, as error terms for individual countries appear repeatedly across observations. We therefore use the methodology of Head *et al.* (2010) to correct our standard error estimates. Finally, this estimation technique requires variation across both dyads and time, so that the dummy variable we used for Table 1 is inadmissible; we substitute instead a dummy which is 0 if neither i nor j has bid for the Olympics at or before time t , and 1 if either i or j has.

Our results are reported in Table 5. It can be seen that we continue to obtain positive and statistically significant effects of either hosting or candidacy for the Olympics, regardless of our choice of base countries; our point estimate are, if anything, implausibly large.

6.2. *Matching: A Treatment Methodology*

We next use a treatment methodology, comparing exports for either ‘treated’ hosts or candidate countries to exports for their matched ‘control’ counterparts. Candidate and host countries for the Olympic games are not randomly selected from our sample; instead they choose whether to submit a bid or not. Thus, there is the possibility that

⁹ We focus our attention on the effects of mega-events on *trade* rather than trade *policy* since the latter is difficult to measure. We have experimented with the Wacziarg and Welch (2008) measure of trade liberalisation, and find that it is positively (and often significantly) correlated with past Olympic hosting or candidacy, taking into account factors like country size and income, controlling for time- and country-effects. This result is consistent with our model. Work here awaits better empirical measures and models of trade liberalisation. 10

Table 5
Tetradic Permanent Effects of Olympic Hosting/Candidacy on Log Exports

Base exporter	USA	Japan	Germany
Base importer	UK	France	Canada
Effect of host/candidacy	0.44** (0.04)	0.45** (0.04)	0.76** (0.04)
Observations	534,820	523,406	514,703

Notes. Bilateral data set covers 196 countries, 1950–2006. Robust standard errors in parentheses. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s). Regressors included but not recorded: Currency Union dummy; and Regional Trade Agreement dummy. Year effects included but not recorded.

our results largely reflect selection bias; using a matching technique allows us to handle this problem more effectively. We do two kinds of matching: we match actual Olympic host countries to candidates; and we match the union of hosts and candidates to non-candidates. If host and candidate countries experience similar trade boosts, we expect the first exercise to lead to small differences in exports. If bidding for a mega-event is key, we expect the second exercise to result in large trade effects.

The variables that we use to match country-pair-year observations include the logs of: distance, exporter and importer populations, exporter and importer real GDPs per capita; and dummy variables for sharing a common language or border. Essentially the matching estimator is trying to use these variables to estimate two things: what trade would have been for bidders if they had not actually made a bid; and what trade would have been for non-bidders if they had made a bid. We match observations using a stratification technique; Becker and Ichino (2002) provide more details and references on the methodology.¹⁰

Our results, along with bootstrapped standard error estimates are shown in Table 6. We find that hosts of the Summer Olympics experience a small increase in exports compared with candidates for the games. This effect is statistically significant at a 5% (but not 1%) confidence level. This weak result contrasts with the comparison of hosts and candidates considered together against non-candidate countries. Bidders experience a considerable trade boost compared with non-candidates. These effects are economically large (exports rise by about 20%) and are significant at the 1% confidence level.¹¹

6.3. *Multilateral Data*

As a final robustness check, we examine the effect of hosting or being a candidate for the Olympics on the aggregate export/GDP ratio; we also consider being a World Cup host. We do this by simply regressing multilateral data (so that an observation is for a particular country and year) on the Olympic dummies. To account for other determinants of trade as a fraction of output, we also control for the logs of population, real GDP per capita and include country fixed effects (year effects are added as sensitivity analysis in another column).

¹⁰ This technique will not work if an unobserved characteristic correlated with both bidding and openness remains.

¹¹ For computational reasons, we estimate our matching effects using only exports to developed countries.

Table 6
Using a Matching Methodology for Export Effects

Treatment	Control	Effect
Host	Candidate	0.08* (0.04)
Host or candidate	Non-candidate	0.18** (0.07)

Notes. Average effect of treatment on treated for bilateral exports, stratification estimator. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s). Matching variables: log distance; log exporter population; log importer population; log exporter real GDP p/c; log importer real GDP p/c; common language dummy; and common border dummy. Bootstrapped errors in parentheses. Annual observations on exports to developed countries.

Table 7
Permanent Mega-event Effects on Aggregate Log (Exports/GDP) using Multilateral Data

	Country fixed effects	Country, year fixed effects
Hosting summer Olympics	0.14 (0.07)	0.13* (0.06)
Summer Olympic candidacy	0.19** (0.07)	0.14 (0.08)
Summer Olympic bid (hosting or candidacy)	0.18* (0.08)	0.14 (0.08)
World Cup	0.20** (0.05)	0.18** (0.06)

Notes. Coefficients, with robust standard errors (clustered by countries) in parentheses. Coefficients significant different from 0 at 0.05 (0.01) marked with one (two) asterisk(s). Each cell represents a separate OLS estimation. Controls included but not recorded: log of population; log of real GDP per capita. 6,081 annual observations, 1960–2006 for 182 countries.

Our results are shown in Table 7. We find that countries which have hosted the Olympics have trade approximately 15% ($=\exp(0.14) - 1$) higher, other things being equal. We obtain a similar but slightly large effect for unsuccessful candidacy; this effect (unlike the hosting effect) is significantly above zero at conventional confidence levels. All in all, our aggregate results mirror those above in the sense that we cannot reject the hypothesis that the coefficient estimates on hosting and candidacy are positive and equivalent. Finally, we also obtain similar positive and statistically significant coefficient estimates for having hosted the World Cup in all of our reported regressions.

7. A Signalling Model

7.1. Setup

Our results suggest that the Olympic effect on trade in the data is not associated with hosting the games but rather with bidding for them. In this section, we develop a political-economy signalling model consistent with this result. Our model is of the ‘burning money’ type. We assume that countries that intend to pursue liberal trade policies in the future can signal this intent by engaging in the costly activity of bidding to host the Olympic Games. The payoff for sending this signal is that countries which expect to

liberalise receive increased investment in the export sector (the sector whose prices are raised by liberalisation). Under appropriate parameter conditions, we obtain a separating equilibrium where countries that choose to liberalise also choose to bid for the Olympics; those that prefer to remain closed neither send the signal nor do they liberalise.

We introduce a two sector-specific factors model of a small open economy in which liberalisation increases prices in the export sector and lowers them in the import-competing sector. National governments differ in the degree to which they value gains to the exporting sector, and we assume that they cannot credibly reveal these valuations to potential investors. The government in each country makes a discrete liberalisation and signalling decision based on its expectations concerning the impact of liberalisation on its utility.

Both sectors of the economy produce using a fixed domestic factor, which can be considered sector-specific capital. Putty capital, k , is mobile across sectors and earns an international market rate of return, which is fixed at r^* .¹² Real output levels in the export and import-competing sectors satisfy $y_j(k)$, where $y_j' > 0$ and $y_j'' < 0$, $j = x, m$. For simplicity, we assume that all putty capital is imported by domestic entrepreneurs, who have claims on the fixed factors and earn any residual profits from operations.

As the country is small, it takes world prices as given. However, domestic prices are a function of the government's liberalisation decision. Liberalisation raises prices in the export sector and lowers them in the import-competing sector. Prices while the nation is closed to external markets are denoted p_x^c and p_m^c , while after opening they are p_x^o and p_m^o respectively, where $p_x^o > p_x^c$ and $p_m^o < p_m^c$.

The timing of the model is as follows: first, the government decides whether or not to submit a bid to host the Olympics. Next, the private agents make their investment decisions, based on their expectations of the government's liberalisation decision. Finally, the government makes its liberalisation decision, the winning Olympics host is named and the payoffs are determined.

To ensure sub-game perfection, we solve the model backwards. Subsequent to receiving the government's signal, foreign putty capital is invested in each sector to equate the value of marginal product in that sector to the world interest rate, such that,

$$p_j^l y_j'(k_j^{*l}) = (1 + r^*), \quad (2)$$

where k_j^{*l} ; $j = x, m$ and $l = c, o$ represent the equilibrium amount of putty capital allocated to sector j . As $dk_j^{*c}/dp_j = -y'/p_j y'' > 0$; $j = x, m$ it follows that $k_x^{*c} < k_x^{*o}$ and $k_m^{*c} > k_m^{*o}$.

Given that the government's liberalisation decision confirms investor expectations, the return to the domestic entrepreneurs in each sector, v_j^l , satisfies

$$v_j^l = p_j^l y_j(k_j^*) - (1 + r^*)k_j^*. \quad (3)$$

It is easy to show that the return in the export (import-competing) sector is greater (lower) under liberalisation.¹³

¹² We assume that capital markets are open.

¹³ The induced capital inflows are an example of the benefits that might result from sending a credible signal of approaching liberalisation. The signal may also induce additional investment, or other cooperative behaviour.

We assume that the reputation cost of being awarded the games and backing out is prohibitive. As such each nation expects to host the games conditional on being awarded them.¹⁴

Let h represent the cost of hosting the Olympics, net of any non-pecuniary benefit of hosting the games, such as national pride. Let π represent the probability that a candidate will be awarded the right to host the games conditional on having sent the signal. The expected cost of sending the signal is therefore equal to πh . The government finances the cost of sending the signal by imposing a lump-sum tax on each sector, where the export sector pays a share γ of the cost of sending the signal, $\gamma\pi h$, and the import-competing sector pays the rest, $(1 - \gamma)\pi h$.¹⁵

The government is assumed to have a utility function that is concave in earnings from each sector. The government's utility function is assumed to satisfy

$$U_g = \sum_j \theta_j u(v_j), \quad (4)$$

where $u' \geq 0$, $u'' \leq 0$ and $j = x, m$.¹⁶ For simplicity, we normalise by setting $\theta_m = 1$, and define $\theta \equiv \theta_x$ as the measure of the degree to which government utility favours the export sector. We assume that there is a continuum of heterogeneous countries $z \in [\underline{z}, \bar{z}]$, where a higher z indicates a higher value of θ^z , the value of θ held by the government of country z . We assume that θ^z is symmetrically distributed on the interval $[\underline{\theta}, \bar{\theta}]$ with mean value 1. For notational simplicity, we drop the z superscripts.

Prior to sending the signal, U_g then satisfies

$$U_g = \theta u(v_x^c) + u(v_m^c). \quad (5)$$

After sending a credible signal and liberalising, government utility, \hat{U}_g , satisfies

$$\hat{U}_g = \theta u(v_x^o - \gamma\pi h) + u[v_m^o - (1 - \gamma)\pi h]. \quad (6)$$

7.2. Equilibrium

An equilibrium is a set of signal and liberalisation decisions by each government that maximises its expected utility, along with a set of investment decisions in the two sectors consistent with maximising the returns to the domestic entrepreneurs, conditional on the signal of the government.

¹⁴ Bidding for the Olympics and not hosting them would be highly embarrassing and would impact a nation's international reputation. These are infrequent, highly visible events with long lead times. We know of only one counter-example; Denver backed out of hosting the winter games in 1976 when voters rejected a bond issue to finance the event. We also rule out signals by countries that have no chance of winning the rights to host the games as π , the probability of winning hosting rights conditional on bidding, is common across countries.

¹⁵ We assume that the probability of winning the bid is independent of national characteristics. This assumption could be relaxed if, for instance, the world 'rewards' a country with a mega-event for undertaking a liberalisation that might be in the interests of the rest of the world, but hurts some domestic constituency.

¹⁶ The welfare function is specified in terms of earnings in each sector for simplicity. This function is assumed to encompass all proceeds in these sectors, including any redistribution of government tariff revenues and the effects of other trade distortions that yield differential valuations of domestic prices under closed and open policies.

In an earlier version of this article (Rose and Spiegel (2009)), we demonstrate that the change in government utility with liberalisation is monotonically increasing in θ . Define θ^* as the value of θ^z which leaves the government indifferent between staying closed and not sending the signal, and sending the signal and liberalising. By equations (5) and (6), θ^* satisfies

$$\theta^* = \frac{u(v_m^c) - u[v_m^o - (1 - \gamma)\pi h]}{u(v_x^o - \gamma\pi h) - u(v_x^c)}. \quad (7)$$

We next derive the conditions necessary to rule out off-equilibrium path outcomes, where the signal sent by the government fails to match its subsequent liberalisation decision. Let $\tilde{v}_j^c \equiv v_j^c(k_j^{*o})$ ($j = e, m$) represent the value of revenues in sector j consistent with the off-equilibrium path strategy of signalling liberalisation and then not liberalising, i.e., with capital consistent with liberalisation but prices consistent with remaining closed. As shown in the longer version of this article, a sufficient (but not necessary) condition to ensure that this strategy is not chosen is

$$v_x^c \geq \tilde{v}_x^c - \gamma\pi h. \quad (8)$$

This restriction requires that the earnings of the export sector without liberalisation are higher when the government does not send the costly signal.

Similarly, let $\tilde{v}_j^o \equiv v_j^o(k_j^{*c})$; $j = x, m$ represent i.e. the value of revenues in sector j consistent with not signalling liberalisation and then liberalising. A sufficient (but not necessary) condition to ensure that this strategy is not chosen is

$$v_x^o - \gamma\pi h \geq \tilde{v}_x^o. \quad (9)$$

This restriction requires that the earnings of the export sector with liberalisation are higher when the government sends the (costly) signal. Combined, these restrictions imply that revenues in the export sector are lower under both off-equilibrium path strategies.

Given these restrictions, we obtain our first proposition:

PROPOSITION 1. *There exists a separating equilibrium where countries with $\theta^z \geq \theta^*$ send the signal and liberalise, and countries with $\theta^z < \theta^*$ neither send the signal nor liberalise.*

Proof. First, consider the set of countries with $\theta^z < \theta^*$. As the gains from liberalising are monotonic in θ and we have ruled out off-equilibrium path strategies, these countries' governments would prefer to not send the signal. Similarly, the countries with governments holding values of θ^z that satisfy $\theta^z \geq \theta^*$ would choose to send the signal and liberalise.

7.3. Incidence of Signalling Cost

It can be seen in equation (6) that the desirability of sending the signal and liberalising is a function of γ , the export sector's share of the cost of sending the signal. As liberalisation benefits the export sector and harms the import-competing sector, it seems plausible that the government's preference for liberalising is increasing in γ , as it mitigates the disadvantages from liberalisation to the import-competing sector.

However, this must be balanced against the government's preference for revenues from the export sector, parameterised by θ . If the government favours the export sector too heavily, the desire for liberalisation could be decreasing in γ .

More formally, differentiating θ^* with respect to γ in equation (7) yields

$$\frac{\partial \theta^*}{\partial \gamma} = \frac{\pi h \{ \theta^* u'(v_x^o - \gamma \pi h) - u'[v_m^o - (1 - \gamma) \pi h] \}}{u(v_x^o - \gamma \pi h) - u(v_x^c)}. \quad (10)$$

The denominator is positive, so the sign of the derivative is equal to the sign of the bracketed term in the numerator. There are three terms here: θ^* ; the marginal utility of the export sector after liberalisation; and the marginal utility of the import sector after liberalisation. The entire term will be negative if and only if

$$\theta^* \leq \frac{u'[v_m^o - (1 - \gamma) \pi h]}{u'(v_x^o - \gamma \pi h)}. \quad (11)$$

Condition (11) requires that θ^* (the relative valuation of export earnings held by the government that is just indifferent between liberalising and not liberalising) is less than or equal to the marginal rate of substitution between post-liberalisation earnings in the import-competing and export sectors. Intuitively, this implies that relative earnings in the import-competing sector are sufficiently low, even after adjusting for the relative weight placed on export earnings (θ^*). For example, in the benchmark case where the government values earnings in each sector equally ($\theta^* = 1$), the condition will be satisfied if earnings net of expected signalling costs subsequent to liberalisation are lower in the export sector than in the import sector.

Given this condition, we obtain our second proposition:

PROPOSITION 2. *Given a separating equilibrium for all countries $z \in [\underline{z}, \bar{z}]$, and satisfaction of condition (11), an increase in γ reduces θ^* , raising the set of countries that choose to send the signal and liberalise, while if (11) is violated, an increase in γ increases θ^* .*

The proof follows directly from equations (10) and (11). The intuition behind Proposition 2 lies in the fact that increases in γ improve the alignment between the costs and benefits from liberalisation.

This may favour the use of bidding for the olympics as a signal of openness intentions. The costs of hosting the Games are traditionally borne by the host city (usually the capital) in conjunction with the central government of the host country. Policy makers from these groups are likely to benefit from liberalisation. In terms of our model, 'mega-events' like the Olympics may be high γ signals.

To summarise: our model suggests that countries choose to bid for a mega-event to signal investors about their future liberalisation intentions. Under certain parameter conditions, governments that wish to liberalise can profit from sending the costly signal of bidding to host the games, while those that do not wish to liberalise do not; a separating equilibrium. Moreover, the conditions imply that the probability-weighted cost of holding the Olympics must be sufficiently large to dissuade governments that do not wish to liberalise from sending a false signal. This motivates the choice of a costly mega-event as a signal of liberalisation intentions.

Furthermore, the model also demonstrates that distributional implications matter; the incidence of the cost of the signal has an impact on its desirability. The signal must be sufficiently costly to the export sector, the sector that would benefit from the policy change, not just costly to the nation. Also, if the government does not favour the export sector too greatly, and liberalisation has sufficient distributional consequences, an increase in share of expected cost of hosting games borne by the export sector increases the marginal government's willingness to bid. That is, the higher is the expected burden of hosting the Olympics on the exportable sector, the more attractive is bidding for a mega-event as a signal of liberalisation.

8. Conclusion

In this article, we model this linkage between mega-events and liberalisation both theoretically and empirically. The motivation for hosting a mega-event like the Olympics seems elusive to economists. Plausibly measured net economic benefits are rarely large and typically negative; claims of non-economic benefits are difficult to verify. Yet in practice countries compete fiercely for the right to host such events. Why? This article identifies one potential explanation; countries that host the games enjoy a substantive permanent increase in trade – the 'Olympic Effect'. Similar increases in openness are observed for countries that host other mega-events, such as the World Cup and, until recently, World's Fairs. For a country pursuing a trade-oriented development strategy, such an outcome would clearly be attractive.

Our empirical results show that the Olympic effect is robust; hosting the games tends to increase a country's openness substantively and permanently. But we not believe that hosting the Olympics has an actual causal effect on trade; while hosting the games is sufficient to boost trade, it is not necessary. In practice, we find that countries that bid for the Olympics unsuccessfully also experience a boost in trade, comparable to that received by actual Olympic hosts. This finding implies that the Olympic Effect on trade does not stem from a change in economic fundamentals, caused by the activity or infrastructure associated with hosting the Olympics. Instead, our empirical findings suggest that bidding for the Olympics is a costly policy signal that is followed by future liberalisation. We explore this conjecture in a political-economy model, where governments choose whether or not to signal future liberalisation by hosting a mega-event like the Olympics. We derive the conditions for a separating equilibrium, where only countries that value liberalisation choose to send the signal and liberalise. Our model also suggests that the size and distributional consequences of this type of signal may influence its desirability.

We close with a number of cautions. First, our model makes no clear statement on the merit of public support for hosting mega-events. Second, there are other motivations for hosting mega-events which we have not modelled; for instance, our theory cannot easily explain the behaviour of countries that submit repeated or multiple bids for large sporting events, why open economies bid for mega-events and why countries seem to spend so much effort on their bids. Finally, other signals of and routes to liberalisation exist, and our analysis does not examine the relative effectiveness of these paths; we leave such issues to future research.

Appendix

Table A1

Hosts and Unsuccessful Candidate Cities for Post-war Summer Olympics Games

	Host	Unsuccessful 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, Minneapolis, Philadelphia, 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, Birmingham, Brisbane, Paris
1996	Atlanta, USA	Athens, Belgrade, Manchester, Melbourne, Toronto
2000	Sydney, Australia	Beijing, Berlin, Istanbul, Manchester
2004	Athens, Greece	Buenos Aires, CapeTown, Rome, Stockholm
2008	Beijing, China	Istanbul, Osaka, Toronto, Paris

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

Table A2

Determinants of Bidding for and Hosting the Summer Olympics

Treatment (1)	Control (0)	Log(export/GDP)	Log(population)	Log(real GDP p/c)
Host	Non-host	-0.43 (0.31)	0.24 (0.13)	0.68** (0.20)
Bidder	Non-bidder	-0.31 (0.20)	0.42** (0.09)	1.01** (0.15)
(host or unsuccessful candidate)				
Host	Unsuccessful candidate	-0.64 (0.63)	-0.23 (0.28)	-0.43 (0.52)

Notes. Probit estimation; year effects included but not recorded. Coefficients with standard errors in parentheses; coefficients significantly different from zero at 0.05 (0.01) level marked with one (two) asterisk(s).

University of California

Federal Reserve Bank of San Francisco

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References

- Alesina, A. and Drazen, A. (1991). 'Why are stabilizations delayed?', *American Economic Review*, vol. 81, pp. 1170–88.
- Anderson, J.E. and Van Wincoop, E. (2003). 'Gravity with gravitas: a solution to the border puzzle', *American Economic Review*, vol. 93(1), pp. 170–92.
- Banerjee, A. (1992). 'A simple model of herd behaviour', *The Quarterly Journal of Economics*, vol. 107(3), pp. 797–817.

- Bartolini, L. and Drazen, A. (1997). 'Capital-account liberalization as a signal', *American Economic Review*, vol. 87(1), pp. 138–54.
- Becker, S.O. and Ichino, A. (2002). 'Estimation of average treatment effects based on propensity scores', *The Stata Journal*, vol. 2(4), pp. 358–77.
- Coates, D. (2007). 'Stadiums and arenas: economic development or economic redistribution?', *Contemporary Economic Policy*, vol. 25(4).
- Head, K., Mayer, T. and Ries, J. (2010). 'The erosion of colonial trade linkages after independence', *Journal of International Economics*, forthcoming.
- Humphreys, J.M. and Plummer, M.K. (1995). 'The Economic Impact of hosting the 1996 Summer Olympics', <http://www.selig.uga.edu/forecast/olympics/OLYMTEXT.HTM>.
- Krugman, P. (1998). 'The confidence game', *The New Republic*.
- Lucas, R.E.J. (2009). 'Trade and the diffusion of the industrial revolution', *American Economic Journal: Macroeconomics*, vol. 1(1), pp. 1–25.
- Mukand, S.W. (2006). 'Globalization and the 'Confidence Game'', *Journal of International Economics*, vol. 70, pp. 406–27.
- Murphy, K.M., Shleifer, A. and Vishny, R.W. (1989). 'Industrialization and the big push', *Journal of Political Economy*, vol. 97(5), pp. 1003–26.
- Owen, J.G. (2005). 'Estimating the cost and benefit of hosting Olympic games', *The Industrial Geographer*, vol. 1(3), pp. 1–18.
- Preuss, H. (2004). *The Economics of Staging the Olympics*, Edward Elgar: Northampton.
- Wacziarg, R. and Welch, K.H. (2008). 'Trade liberalization and growth', *World Bank Economic Review*, vol. 22(2), pp. 187–231.

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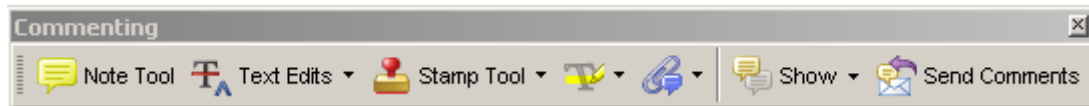
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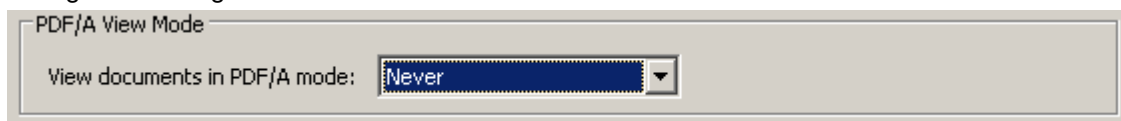
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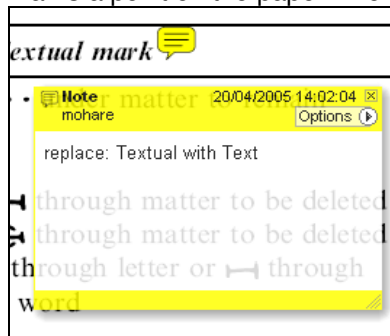
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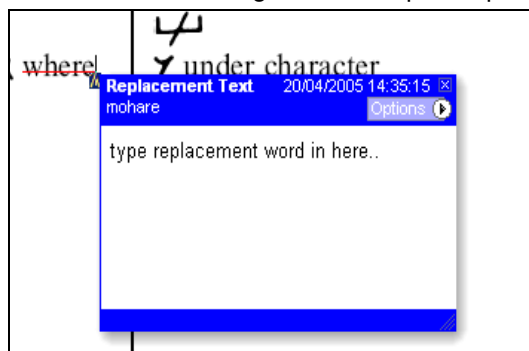


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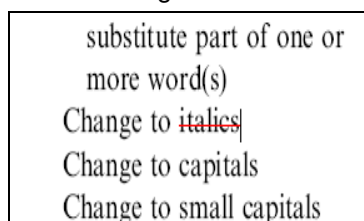


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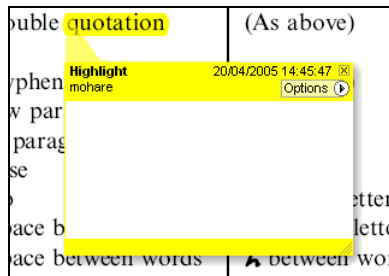


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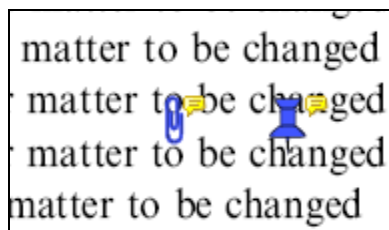


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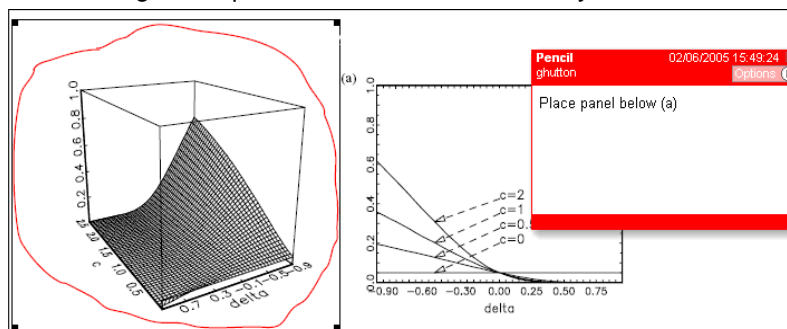


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