Do the Olympic Games Make People in the Host City Happier?

Quantifying the Intangible Impacts of the Olympics Using Subjective Well-Being Data *

Paul Dolan[†] Georgios Kavetsos[‡] Christian Krekel[§]
Dimitris Mavridis[¶] Robert Metcalfe[‖] Claudia Senik[**]
Stefan Szymanski[††] Nicolas R. Ziebarth[‡‡]

Abstract

The Olympic Games are the most watched sports event in the world, and cities are paying substantial amounts to host the event. We show, exploiting the 2012 Olympic Summer Games in London as a quasi-natural experiment, that hosting the Olympics has a positive impact on subjective well-being in the host city during the event. The magnitude of the effect is equivalent to moving from the bottom to the fourth income decile, everything else held constant. But it does not last very long: it is gone within a year, i.e. there is no legacy. We find that the aggregated, estimated willingness-to-pay in order to host the Olympics is only slightly more than half of the projected costs, and only about a tenth of the actual costs. These conclusions are based on a difference-in-differences design and a novel international panel of more than 26,000 individuals who

*We would like to thank Christopher Boyce, Andrew Clark, Stephen Gibbons, Laura Kudrna, Kate Laffan, Katrin Rehdanz, Claudia Senik, Tali Sharot, Alois Stutzer, Ivo Vlaev, and Gert Wagner, as well as seminar participants at the 2017 Annual Conference of the Royal Economic Society, the 2017 Annual Meeting of the European Public Choice Society, and the 2017 Conference of the European Society for Population Economics for valuable comments and suggestions. We also thank Aline Passlack and Falk Voit for excellent research assistance. Support from the Economic and Social Research Council (ESRC: RES 360-25-0036), the German Science Foundation (DFG; "German Science Foundation", WA 547/5-1), the CEPREMAP, the French National Research Agency, through the program Investissements d'Avenir (ANR-10-LABX_93-01), and the Open Research Area in Europe for the Social Sciences (ORA-10-36) is gratefully acknowledged. The research reported in this paper is not the result of a for-pay consulting relationship. The authors do not have a financial interest in the topic of this paper, and there are no conflicts of interest.

[†]London School of Economics and Centre for Economic Performance, LSE
[‡]Queen Mary University of London and Centre for Economic Performance, LSE
[§]Paris School of Economics and Centre for Economic Performance, LSE
[¶]The World Bank
[‖]Boston University
[**]Paris School of Economics and Université Paris-Sorbonne
[††]University of Michigan
[‡‡]Cornell University

were interviewed in London, Paris, and Berlin during the summers of 2011, 2012, and 2013, that is, before, during, and after the event. The results are robust to controlling for a rich set of observables, including macroeconomic and meteorological conditions, selection into the survey and attrition, and the choice of the counterfactual. They also withstand a series of placebo tests. We complement existing evidence which shows that hosting the Olympic Games has a negligible economic impact on the host city by showing their intangible impact.

Keywords: Subjective Well-Being, Life Satisfaction, Happiness, Olympic Games, Quasi-Natural Experiment

JEL: I30, I31, I38, L83, Z20, Z28

1 Introduction

Do mega events, such as the Olympic Games, make people in the host city happier? The original Olympic Games were staged every four years in Olympia in Ancient Greece as a religious and athletic festival from around the 8th century BCE until 393 CE.[1] Centuries later, Baron Pierre de Coubertin created a committee to restart the Olympic Games, and the first modern Olympiad was celebrated in Athens in 1896. The Olympic Games in Rio de Janeiro were the 28^{th} Summer Games in the modern period, and there have been 22 Winter Games. From the outset, the International Olympic Committee (IOC) has invited cities from around the world to act as hosts of the event.

Until the 1960s, the Olympics were relatively modest affairs with limited finance and investment. The television era of watching sport, combined with the capacity to reach a global audience (about 41 million US citizens watched the opening ceremony of the 2012 Olympic Summer Games in London), however, has enhanced the prestige of the event. This has encouraged fierce competition among cities to host the event, and resulted in a significant rise in expenditure on staging the event. The 1956 Olympic Summer Games in Melbourne cost approximately $63 million (in 2016 prices), including construction costs.[2] In contrast, the 2012 Olympic Summer Games in London required government subsidies of $15 billion alone to cover the direct costs; actual costs turned out to be about five times higher than projected

[1]The widely used date for the first Olympic Games is 776 BCE. However, the first known list of champions dates from the fifth century BCE and the method of calculating the date was refined by Aristotle and Eratosthenes about 100 years later. Other ancient writers disputed this date (Nelson, 2007).

[2]The Official Report of the Organizing Committee for the Games of the XVI Olympiad, Melbourne (1956: 35-39) reported a total cost of Australian pounds 4.5 million, including 2.4 million of construction expenditures; see http://library.la84.org/6oic/OfficialReports/1956/OR1956.pdf, retrieved August 17, 2017.

costs (NAO, 2012).[3] The 2020 Olympic Summer Games will be held in Tokyo, and there are already serious concerns about cost overruns.[4] In a historical double award ceremony in July 2017, the 2024 and the 2028 Olympic Summer Games were awarded to Paris and to Los Angeles, respectively. Los Angeles replaced Boston, which was initially the US bidder but dropped out because projected costs were too high.

Given the public interest in the Olympics and the large public subsidies that they now require, a significant academic literature has sought to measure the economic impact of the event. Much of this literature is devoted to rebutting the claim (often made by economic consultancies on behalf of government officials in order to justify public subsidies) that the Olympics generate substantial multiplier effects by stimulating investment and tourism. Most academic studies find little evidence of any tangible long-term economic impact.[5] In a recent review, Baade and Matheson (2016: 202) state that "*the overwhelming conclusion is that in most cases the Olympics are a money-losing proposition for host cities*".

Given these findings, many proponents of the Olympics now suggest that one of its main contributions is the intangible impact on people in the host city. The UK government's assessment of the 2012 Olympic Summer Games in London focused on intangibles such as "inspiring a generation of children and young people", community engagement, and enthusiasm for volunteering (DCMS, 2013). There is also evidence that citizens are willing to pay substantial amounts to host such events (Atkinson et al., 2008). A national opinion poll conducted immediately after London 2012 found that 55% of respondents believed that the

[3]The NAO's post-Games review also cited several additional sources of costs not included in the official budget, including land acquisition, the costs of the legacy program, the costs of government departments and agencies incurred on Games-related tasks, and contributions to turning the Olympic Village into affordable housing (NAO, 2012: 26-27).

[4]See https://www.forbes.com/sites/ljkelly/2017/08/07/the-cost-of-the-tokyo-olympics-is-spiraling-and-other-cities-are-taking-note, retrieved August 17, 2017.

[5]This argument has several dimensions: the general economic principles are addressed by Crompton (1995), Porter (1999), and Siegfried and Zimbalist (2000). Computable General Equilibrium Modelling has identified negligible or even negative impacts in the cases of London 2012 (Blake, 2005) and Sydney 2000 (Giesecke and Madden, 2007). *Ex-post* studies of local employment and wages (Baade and Matheson, 2002; Coates and Humphreys, 1999, 2003) find little evidence of impacts related to sports infrastructure in general, while Jasmand and Maennig (2008) find evidence of income growth effects associated with Munich 1972, but no employment effects. Tourism effects of major sporting events such as the Olympics and the FIFA World Cup have been studied by Fourie and Santana-Gallego (2011), who find evidence of significant increases in tourist arrivals prior to the event, but no long-run impact thereafter. Tiegland (1999) documents the absence of anticipated long-term tourism benefits following the 1994 Olympic Winter Games in Lillehammer. There is some evidence that sports facilities in general and construction associated with the Olympics in particular have a positive effect on property values: on London 2012, see Kavetsos (2012a), and for other examples, see Feng and Humphreys (2012), Ahlfeldt and Maennig (2010), and Ahlfeldt and Kavetsos (2014). Billings and Holladay (2012) find no significant effects of hosting the Olympics on GDP per capita. Rose and Spiegel (2011) find positive effects of hosting the Olympics on exports, but conclude that this effect is not directly attributable to hosting the event; instead, it is attributable to the signal of openness that a country sends when bidding. Preuss (2004) offers an economic history of financing and expenditure on the Olympics since Munich 1972.

public expenditure on the Games had been well worth the investment.[6] Arguably, an important part of the value of public expenditure is the legacy effect, i.e. the long-term benefits of hosting the Olympics.[7]

We study the nature and the extent of this hypothesized "intangible" impact of the Olympics on people in the host city.[8] We also enquire into whether the effects, if any, persist for at least one year after the event. To do so, we use measures of subjective well-being that have been developed and tested by economists and psychologists for about two decades in order to assess how people think and feel about their lives. There is an accumulation of evidence on how to measure subjective well-being, its correlates, and some of its causes.[9] Economists are showing increasing interest in the use of subjective well-being measures, as these might capture a richer array of intangible effects than allowed for by considering stated preferences or preferences revealed through market behaviors alone. Likewise, policy-makers are increasingly interested in subjective well-being measures for policy evaluation. We use our estimates to calculate the aggregated willingness-to-pay in order to host the Olympics, and then contrast it with the projected and actual costs of hosting. This approach has already been applied to valuing various public goods or bads, including, among others, air quality (Luechinger, 2009; Levinson, 2012), noise pollution (van Praag and Baarsma, 2005), and natural disasters (Luechinger and Raschky, 2009). We are thus contributing to a steadily growing stream of

[6] A new Guardian/ICM poll has revealed that 55% of Britons say the Games are "well worth" the investment because they are doing a valuable job in cheering up the country during hard times, outnumbering the 35% who regard them as a "costly distraction from serious economic problems". The headline to the article reads "London 2012's Team GB success sparks feel good factor"; see www.theguardian.com/sport/2012/aug/10/london-2012-team-gb-success-feelgood-factor, retrieved August 17, 2017.

[7] The concept of "legacy" has become increasingly important in the rationalization and celebration of the Olympics, and this was particularly pronounced in the case of London 2012. The Final Report of the IOC Coordination Commission on the Games mentions the word no less than 90 times in its 127-page report. The concept was used in a number of contexts, including leaving a sporting legacy in the UK (increased participation in sport), a legacy for East London (regeneration of a depressed region), volunteering (increased community engagement of the population), growth in tourist arrivals, and increased foreign direct investment (IOC, 2013). The legacy issue is clearly important given the large public subsidy devoted to hosting the event.

[8] We evaluate the impact on people in the host city rather than the general population in the host country, as cities are bidding to host rather than countries.

[9] Earlier research defined this account of welfare as "experienced utility" (see Kahneman et al., 1997). Since then, there has been increasing interest among policy-makers in using measures of subjective well-being to monitor social progress and evaluate policies (e.g., Stiglitz et al., 2009; HM Treasury, 2011; Dolan and Metcalfe, 2012; OECD, 2013; National Research Council, 2013). Economists have been interested in using subjective well-being to measure the intangible costs and benefits of policies and events (see Di Tella et al., 2001; van Praag and Baarsma, 2005; Oswald and Powdthavee, 2008; Cattaneo et al., 2009; Luechinger and Raschky, 2009; Stevenson and Wolfers, 2009; Metcalfe et al., 2011; Ludwig et al., 2012; Bayer and Juessen, 2015; Goebel et al., 2015; Krekel et al., 2016; Krekel and Zerrahn, 2017) and how people's choices link to their subjective well-being (Rayo and Becker, 2007; Ifcher and Zarghamee, 2011; Benjamin et al., 2012, 2014a, 2014b; Feddersen et al., 2016; Adler et al., 2017). In a similar study, Kavetsos and Szymanski (2010) examine cross-sectionally the impact of hosting major sporting events on life satisfaction.

literature.[10]

To study the intangible impact of the Olympics on people in the host city, we designed our own surveys and collected panel data in three European capitals, interviewing more than 26,000 individuals during the summers of 2011, 2012, and 2013, that is, before, during, and after the event, totaling up to 50,000 individual interviews. Our empirical strategy rests on a difference-in-differences design: our treatment city is London, which hosted the event; Paris and Berlin are our two control cities. To identify causal effects, we exploit the choice of the host city as a quasi-natural experiment: in the years and months prior to this choice, Paris was the favorite to win the bid, only to unexpectedly lose to London by a 50 to 54 vote; Berlin can be seen as a clean control city. We experiment both with pooling Paris and Berlin based on their broad similarity to London, and with treating them differently in recognition of Paris as the failed bidder, which could be interpreted as a negative treatment. In addition to exploiting the choice of the host city as a quasi-natural experiment, we randomized in all three cities the day when respondents were surveyed, i.e. before, during, or after the precise period of the Olympics. Trading off the increase in subjective well-being caused by the Olympics against the increase caused by income, we quantify the willingness-to-pay in order to host the Olympics monetarily.

Our main result is that the Olympics increased the subjective well-being of Londoners during the event, relative to Parisians and Berliners. In terms of potential "legacy" effects, we find that the intangible impact of the Olympics is only short-lived: while the effects are especially strong around the opening and closing ceremonies, we see no lasting change in subjective well-being when we go back to our respondents the year after. We find that the aggregated, estimated willingness-to-pay in order to host the Olympics is only slightly more than half of the projected costs, and only about a tenth of the actual costs. The results are robust to controlling for a rich set of observables, including macroeconomic and meteorological conditions, selection into the survey and attrition, and the choice of the counterfactual. They also withstand a series of placebo tests.

These findings are important for three reasons: first, although the Olympics aim at providing amusement, it is not *ex-ante* clear whether they raise subjective well-being in the host city at all, for example, due to congestion or fear of terrorism. In fact, we observe that anxiety during the summer months of 2012 actually increased in some specifications. Second, it is

[10]Using subjective well-being data to value public goods or bads for which no market prices exist has certain advantages: compared to contingent valuation studies, in particular stated preference approaches, it avoids bias resulting from the expression of attitudes or the complexity of valuation, as it does not reveal the relationship of interest or ask respondents to monetarily value a complex public good or bad in a hypothetical situation. This reduces cognitive burden and mitigates the incentive to answer in a strategic or socially desirable way. It also avoids framing and anchoring effects (Kahneman and Sugden, 2005). Compared to hedonic studies, it avoids bias resulting from the misconception that real estate markets are in, or close to, equilibrium.

well established in the academic literature that hosting the Olympics has negligible tangible impacts, for example, on local job creation. Our findings complement these results by focusing on intangible impacts, which – for a complete cost-benefit account of hosting – should be considered. Finally, given the negligible tangible impacts, potential host cities typically make the case for hosting by stressing intangible impacts, typically in the long-run. We show that such legacy effects in terms of subjective well-being do not exist. To our knowledge, so far, there exists no monetary valuation of the willingness-to-pay in order to host the Olympics.

The paper is organized as follows: Section 2 describes the data collection in the three cities during the three years and the survey items, Section 3 the empirical strategy and identification strategy. Section 4 presents the main results. Section 5 examines their robustness with respect to selection into the survey and attrition, the choice of the counterfactual, and extended controls. Here, we also conduct a series of placebo tests using both placebo outcomes and time periods. Section 6 studies the importance of relative sporting success for our results. Section 7 estimates legacy effects, and Section 8 discusses our findings.

2 Data

2.1 Sample

We surveyed a panel of more than 26,000 individuals in London, Paris, and Berlin during the summer months of 2011, 2012, and 2013. Paris and Berlin were chosen as comparable cities because (a) they are both capitals, with diversified economies covering industry, finance, education, public administration, transport, and tourism; (b) they are all located in North-West Europe, and belong to the three largest nations in the region; (c) they have all hosted the Olympics before (London in 1908 and 1948, Paris in 1900 and 1924, and Berlin in 1936);[11] (d) they have all expressed interest in hosting the Olympics in recent years;[12]; and (e) they are cities of broadly similar size and wealth (for example, a Eurostat survey in 2006 ranked London, Paris, and Berlin respectively 1^{st}, 2^{nd}, and 10^{th} among European metropolitan areas).

More specifically, our panel covers three periods: (a) 2011 (8^{th} August to 30^{th} September), the year before the Olympics; (b) 2012 (20^{th} July to 2^{nd} October), the year in which the Olympics took place (Olympics: 27^{th} July to 12^{th} August; Paralympics: 29^{th} August to 9^{th} September); and (c) 2013 (23^{rd} July to 12^{th} September), the year after the Olympics, capturing legacy

[11] Berlin won the bid to host the 1916 Olympics but these were canceled due to World War One. London won the bid to host the 1944 Olympics but these were canceled due to World War Two.

[12] Berlin bid for the 2000 Olympics and lost to Sydney. Paris bid for the 2008 Olympics and lost to Beijing (and, of course, for the 2012 Olympics, which London won).

effects or adaptation processes. Note that our sampling period in 2012 does not coincide with any other major events in the three countries at that time.

We employed a mixed methodology approach using a combination of online surveys and telephone interviews. In all cities, each respondent was interviewed using the same mode in all three waves – either online or over the phone. The online sample made use of the Ipsos Interactive Services Panel (IIS), without imposing any quota in the first wave. It was released on a rolling weekly basis in order to sustain a good level of response over the duration of a wave. The phone sample was generated via random digit dialing. Loose quotas (+/- 30%) on age, gender, and work status were set according to the population profile. Despite those quotas being fairly broad, it should be noted that the sample is not representative of the populations of the cities as a whole. In London, the quotas were set according to the London broadband population, while in Paris and Berlin they were set according to the general population. Given the challenges associated with developing and retaining participants within our own three-year panel, participants were incentivized to take part in all three waves by being automatically included in a random prize draw. Separate prize draws of a monetary sum of £/€500, £/€1,000 and £/€1,500 were offered in each of the three cities and waves, respectively.

2.2 Subjective Well-Being Questions

The survey, specifically designed for this study, contains three different types of measures of subjective well-being: (1) evaluation (i.e. life satisfaction); (2) experiences (both happiness and anxiety the day before the interview); and (3) eudemonia (i.e. sense of purpose in life). To date, the subjective well-being literature has focused on high-level evaluative measures such as life satisfaction (Dolan et al., 2008), mainly due to data availability in large-scale surveys. Experience measures such as happiness and anxiety are close to the measure of experienced utility discussed by Kahneman et al. (1997) and Bentham's utilitarianism. Evaluation is closer to decision-utility, and is not the same as experienced utility for many reasons (Kahneman and Deaton, 2010; Dolan and Metcalfe, 2012). Some philosophers, dating back to Aristotle, argue that eudemonia (e.g. worthwhile activities) is the most important element of happiness. If we are to confidently show whether or not the Olympics have an effect on subjective well-being, we need to tap into subjective well-being in these various ways.

Following Dolan and Metcalfe (2012), whose recommendations are incorporated by the Office for National Statistics to measure subjective well-being in the UK, and also in the spirit of Stiglitz et al. (2009), OECD (2013), and the National Research Council (2013), we included

the following four subjective well-being questions into our surveys:[13]

(a) *Evaluative*: Overall, how satisfied are you with your life nowadays?

(b) *Experience*: Overall, how happy did you feel yesterday?

(c) *Experience*: Overall, how anxious did you feel yesterday?

(d) *Eudemonic*: Overall, how worthwhile are the things that you do in your life?

Responses are measured on 11-point Likert scales, with zero denoting "not at all" and ten denoting "completely/very much".[14] By employing these evaluative, experience, and eudemonic subjective well-being measures, we remain consistent with the official measures recommended by the Office for National Statistics in the UK – the so-called *ONS-4* – for evaluating the impacts of policies with respect to subjective well-being.

There is reason to believe that the impact of the Olympics, due to their amusement factor, is more likely to be measurable on experience rather than evaluative or eudemonic measures of subjective well-being. Given that most individuals may be informed about Olympics-related events through news reporting the evening before the day of the interview, we use lagged experience measures to reduce measurement error arising from the retrospective nature of these items. Note that, at this point, we are agnostic about whether the Olympics may have long-run impacts in terms of experience measures. To the extent that the Olympics affect behaviour, which can lead to habit formation, there may well be legacy effects for these measures. So far, however, descriptive evidence suggests that the Olympics did not affect behaviour, at least when it comes to sports-related activities: according to a survey conducted by YouGov on behalf of Pro Bono Economics, only 7% of 2,000 respondents said that they had been inspired to take up sport by the Olympics.[15]

[13]The joint use of these four measures of subjective well-being for the purpose of impact evaluation is novel, although some of them, in particular life satisfaction, have been used for this purpose before. In fact, large-scale, nationally representative panels like the German Socio-Economic Panel (SOEP) (Wagner et al., 2007, 2008) have started asking respondents about their life satisfaction as early as 1984.

[14]Experimental evidence has shown that zero-to-ten scales of subjective well-being measures are more reliable than shorter ones (Kroh, 2006).

[15]See https://www.theguardian.com/sport/2017/feb/24/uk-sport-olympics-participation-numbers-fall, retrieved August 17, 2017.

3 Empirical Strategy

3.1 Models

To estimate the effect of the Olympics on subjective well-being, we employ a difference-in-differences design. More specifically, we use three different models: the first model looks at the year 2012 only and compares the periods before, during, and after the Olympics in London with those in Paris and Berlin. It is specified in Equation (1):

$$\begin{aligned} SWB_i = \beta_0 + \beta_1 London \times OlympicsPeriod + \beta_2 London \times PostOlympicsPeriod + \\ + \beta_3 London + \beta_4 OlympicsPeriod + \beta_5 PostOlympicsPeriod + X_i'\gamma + \phi_d + \epsilon_i \end{aligned} \tag{1}$$

where SWB_i is the subjective well-being of individual i; *London* is a time-invariant dummy variable that equals one if the individual was interviewed in London, and zero otherwise; and *OlympicsPeriod* and *PostOlympicsPeriod* are dummy variables that equal one if the individual was interviewed during and after the exact period of the Olympics (within the year 2012), respectively, and zero otherwise. The base category is the 2012 pre-Olympics period in Paris and Berlin. We observe 1,272 observations (9%) during the pre-Olympics (July 20 to 26, 2012), 6,049 (41%) during the Olympics (July 27 to August 12, 2012), and 7,179 (50%) during the post-Olympics period (August 13 to October 2, 2012).

The second model makes use of the panel structure of the data and uses both years 2011 and 2012. Netting out time-invariant unobserved heterogeneity, this model compares individual-level *changes* between 2011 and 2012 of respondents in London with those in Paris and Berlin. Here, we estimate two specifications, depicted in Equations (2a) and (2b).

Equation (2a) takes the entire sampling period in 2012 as the treatment period, both before (anticipation), during, and after (adaptation) the Olympics. If our identifying assumptions are fulfilled, $London \times 2012$ can be interpreted as the average treatment effect on the treated, or put differently, the average causal effect of the Olympics on the subjective well-being of people in the host city.

$$SWB_{it} = \beta_0 + \beta_1 London \times 2012 + \beta_2 2012 + X_{it}'\gamma + \phi_m + \phi_d + \mu_i + \epsilon_{it} \tag{2}$$

where SWB_{it} is again the subjective well-being of individual i in year t; *London* is a time-

invariant dummy variable that equals one if the individual was interviewed in London, and zero otherwise; and 2012 is a dummy variable that equals one if the individual was interviewed in the year 2012, and zero otherwise.

Equation (2b) uses the panel structure in the same way as Equation (2a), but follows Equation (1) in dividing the year 2012 into three time periods (before, during, and after the Olympics), each of them interacted with the *London* dummy variable. The time periods are defined in the same way as in Equation (1), and thus yield the same number of observations.

$$\begin{aligned} SWB_{it} = \beta_0 + \beta_1 London \times PreOlympicsPeriod_{2012} + \beta_2 London \times OlympicsPeriod_{2012} + \\ + \beta_3 London \times PostOlympicsPeriod_{2012} + \beta_4 PreOlympicsPeriod + \\ + \beta_5 OlympicsPeriod + \beta_6 PostOlympicsPeriod + X'_{it}\gamma + \phi_m + \phi_d + \epsilon_{it} \end{aligned} \tag{3}$$

Note that these specifications pool both Paris and Berlin into a single control group, given our discussion on the broad similarities of the cities and our primary interest in estimating the effect of the Olympics on the subjective well-being of people in host cities. In our robustness section, we relax this assumption by (a) excluding Paris and considering Berlin as the only control group (as Paris had an inherent interest in hosting the Olympics), and (b) considering Paris itself as a separate treatment group.

In all models, we control for a rich set of time-varying observables, X, including demographics (age, gender, marital status), human capital characteristics (education level), and economic conditions (employment status, log annual gross household income, home ownership). To proxy changing economic circumstances in the three cities over time (note that we are only looking at a very short time horizon of up to three years), we control for each country's change in quarterly real GDP since the first quarter of 2008, that is, just before the onset of the recent economic crisis. This also accounts for potentially idiosyncratic impacts of the crisis on the three countries. In our robustness section, we go one step further and include additional economic and meteorological controls to further account for divergent economic developments between cities and meteorological conditions in cities, respectively.

By including individual fixed effects, μ_i, we routinely net out individual unobserved heterogeneity. Moreover, we control for both calendar-month and day-of-week fixed effects, ϕ_m and ϕ_d, as reports of subjective well-being might differ systematically between different months of the year and different days of the week (Taylor, 2006; Kavetsos et al., 2014).[16] Finally,

[16]Note that in Equation (1), we can only control for day-of-week fixed effects, as calendar-month fixed effects are almost perfectly collinear with the period during and after the Olympics.

we control for mode of interview (online or phone).[17] Outcomes are standardized with mean zero and standard deviation one.[18] Robust standard errors are clustered at the interview date level.

3.2 Identifying Assumptions

Regardless of model, our empirical strategy rests on a difference-in-differences design in which we compare the subjective well-being of Londoners with that of Parisians and Berliners over time. To estimate causal effects, we have to make three identifying assumptions.

The first identifying assumption is *ignorability*, which requires the allocation of individuals into treatment and control group to be independent of the outcome. In our context, ignorability would be violated if London was systematically different from Paris, and this difference was correlated with the outcome. For example, London could have had a higher level of subjective well-being in the first place, and this higher level of subjective well-being could have made London more likely to bid for the Olympics. We exploit the choice of the host city as a quasi-natural experiment: in the years and months prior to this choice, Paris was the favorite to win the bid, only to unexpectedly lose to London by a 50 to 54 vote. We take this tight election outcome as a quasi-random allocation into treatment and control group, and argue that ignorability is likely to be fulfilled. Berlin can be seen as a clean control city. Related, the second identifying assumption is *stable unit treatment*, which requires the allocation of one individual into treatment and control group to be independent of the outcome of another. In our context, stable unit treatment is also likely to be fulfilled: the Olympics are a homogeneous event that affect all residents within the host city, so that there should be no within-sample selection and spillovers.

The third, and most important, identifying assumption, is that – controlling for time-varying observables, X, calendar-month and day-of-week fixed effects, ϕ_m and ϕ_d, and individual fixed effects, μ_i – in the absence of treatment, the subjective well-being of Londoners would have followed the same time trend as that of Parisians and Berliners. As this counterfactual is not observable, the *common trend assumption* is not formally testable. We can, however, provide suggestive evidence for the plausibility of this assumption by plotting the development of subjective well-being in treatment and control group prior to treatment.

Figure 1 shows the development of average subjective well-being by calendar week in all three

[17] In some waves/cities we randomized the framing and ordering of the happiness, anxiety, and worthwhileness measures. We routinely control for such variations in the respective regressions.

[18] Note that we standardize outcomes unconditionally. Standardizing conditionally on city, however, leads to very similar results.

cities in the pre-Olympics year 2011.[19] Importantly, given the design of our survey, this development is shown in the same summer months in 2011 as the ones in which the Olympics take place in 2012. We observe common trend behavior for all of our outcomes. Note that differences in levels between cities are of minor importance: we are interested in relative comparisons between cities, and systematic differences in levels are netted out by including city fixed effects.

Table A5 in Appendix A lists potentially confounding events in the UK, France, and Germany in 2012, during the summer months of July, August, and September, that is, during the relevant observation period: as can be seen, there are little confounding events. Some sports success in the UK (notably the Tour de France victory of Bradley Wiggins) fall just into the beginning of our observation period, but, arguably, can hardly be the explanation of our identified effects when using our specification that exploits the exact cut-off dates of the Olympic Games, which started about a week later. There were no major terrorist incidents or natural disasters during the observation period, and no local or general elections either.

4 Baseline Results

4.1 Graphical Evidence

In total, our sample contains 49,528 survey responses (16,922 in London; 19,246 in Paris; and 13,360 in Berlin). Table 8 in Appendix A offers descriptive statistics of outcomes and covariates by city and wave. As with all panels, attrition reduces the number of observations over the three waves. In the first wave, in 2011, 25,958 unique respondents were interviewed in the three cities. A little bit more than half of those respondents, 14,500 or 56%, also participated in the second wave, in 2012. In the third wave, in 2013, slightly more than one third, 9,070 or 35% are left. Appendix B discusses attrition rates.

We start by plotting the subjective well-being measures for 2012: Figure 2 shows the fitted daily means of our four subjective well-being measures over the period of the Olympics in 2012.[20] In all graphs, the first vertical line depicts the day of the opening ceremony (July

[19] In this lowess iterative smoothing, controls include age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, and a dummy variable for survey mode. Robust standard errors are clustered at the interview date level.

[20] This figure is based on a linear regression of the subjective well-being measures on the controls, including age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, and a dummy variable for survey mode. Robust standard errors clustered at the interview date level. Figure 2 plots the local polynomial estimation of the predicted values for each subjective well-being measure.

27, 2012), whereas the second vertical line depicts the day of the closing ceremony (August 12, 2012). For both life satisfaction and happiness, there seems to be a clear rise during the Olympics period in all cities. The impact is most pronounced for London. There also appears to be decline in anxiety and a rise in self-reported sense of purpose, although there is no clear difference between London and the other cities.

The effects appear to be strongly associated with the opening and closing ceremonies. All measures of subjective well-being improve in the run up to the opening ceremony and fall off rapidly after the closing ceremony. The opening and closing ceremonies are both the two most watched and the two most expensive events in terms of ticket prices.[21] The apparent return to "normality" after the Olympics is already suggestive of small or missing legacy effects.

In Figure 3, we show graphical evidence based on the mean difference in subjective well-being for each individual observed in both 2011 and 2012. The change in subjective well-being responses is then averaged by calendar dates in 2012 and plotted.[22] This is equivalent to the model in Equation (2a). Figure 3 suggests that the subjective well-being effects of the Olympics are restricted to life satisfaction and happiness, and limited to residents in the host city. Once again, we observe large opening and closing ceremony effects among Londoners. Here, we do not observe significant impacts on anxiety or sense of purpose.[23] While Figure 2 provides suggestive evidence that subjective well-being increased in all three cities during the Olympics, this effect disappears in Figure 3 where we focus on individual-level changes.

4.2 Regression Results

Table 1 shows the regression estimates for Equation (1). This model focuses on the year 2012 and differentiates the periods before, during, and after the Olympics. London is the treatment city and responses of Londoners are contrasted with those in Paris and Berlin over time. This is the regression equivalent of Figure 2. We report two separate sets of results – with and without controls – for all four measures of subjective well-being in order to ascertain the relative importance of controlling for observables. In a quasi-natural experiment, the difference between controlling and not controlling for observables should be minor.[24]

The first two columns show that, compared to the pre-Olympics period, life satisfaction in-

[21] See www.theguardian.com/media/2012/aug/13/top-olympics-tv-events-ceremonies and http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/15_10_10_athletics.pdf, retrieved August 17, 2017.

[22] The mean differences between 2012 and 2011 are calculated as follows: first, the predicted values are obtained for each day and city in each year following the same linear regression as in Figure 2. Second, the mean difference is calculated as the value of the 2012 predicted daily value minus the value of the 2011 predicted daily value.

[23] Figure C1 and Figure C2 in Appendix C plots each city separately. The same broad picture appears.

[24] Table 8 in Appendix A includes the full set of controls.

creases during the Olympics period in London relative to Paris and Berlin, regardless of whether or not we control for covariates. The effect size is 0.117 standard deviations without controls and 0.088 standard deviations with controls. We do not find any statistically significant effect for the post-Olympics period, suggesting that there are no immediate legacy effects of the Olympics as far as life satisfaction is concerned. The evidence for happiness in Columns (3) and (4) is, however, not statistically significant. The measure for anxiety in Columns (5) and (6) increases during the Olympics period, and the effect seems to be considerable: 0.118 standard deviations in both Columns (5) and (6). One could speculate that fear of terror attacks may play a role here. Finally, the results for worthwhileness in the last two columns are small and insignificant. Note, however, that there is a stable and considerable reduction in worthwhileness in the post-Olympics period in London relative to the other cities. This coincides with the fall in life satisfaction after the end of the Olympics, following the strong increase, and could be interpreted as a "hangover" after this big sports and social event.

Next, we estimate Equation (2a) which compares individual-level changes between 2011 and 2012 for respondents in London with those in Paris and Berlin. The results are shown in Table 2.[25] A central finding emerges: in line with Figure 3, two of the four subjective well-being measures show a statistically significant and positive effect for London in 2012. The results are almost identical whether or not we include controls, which reinforces the notion of a quasi-natural experiment. Overall, Table 2 supports the hypothesis that the Olympics generated a rise in subjective well-being for Londoners in 2012 in terms of the evaluative component (life satisfaction, Columns (1) and (2)) by around 0.07 standard deviations, and an even larger increase in terms of the positive experiential component (happiness, Column (3) and (4)) by around 0.084 standard deviations. In contrast to the finding in Table 1, when netting out individual-level unobserved heterogeneity, any evidence of a significant anxiety effect disappears. Columns (7) and (8) suggest a significant reduction in worthwhileness in London. This is possibly connected to a post-Olympics "hangover" that we already observed in Table 1.

We now estimate Equation (2b) which, as with Equation (2), compares individual-level changes between 2011 and 2012 for respondents in London with those in Paris and Berlin. However, this time, we use the exact cut-off dates for the Olympics in 2012 in order to identify any specific effects related to the exact period during which the event were staged (i.e. from the opening to the closing ceremony).

The results are presented in Table 3: it shows that life satisfaction increased significantly in London, and specifically during the period of the Olympics (about 0.09 standard deviations); a significant, yet much reduced, effect is also found in London's post-Olympics period (about 0.03 standard deviations). Happiness increased in London in all three time periods within the

[25] Table 8 in Appendix A includes the full set of controls.

2012 wave (0.135 and 0.11 standard deviations in the pre-Olympics and Olympics periods, respectively), with again a significant, yet much reduced, effect in the post-Olympics period (0.05 standard deviations). Anxiety decreased in London in the time leading up to the Olympics, and increased when these were over. For our measure of sense of purpose in life, the estimates show a decrease occurring in London in the post-Olympics period.[26]

In a nutshell, our regression results suggests two punchlines: first, there was a general increase in subjective well-being for Londoners in 2012 relative to Parisians and Berliners, which may have been associated with the experience of hosting the Olympics and which encompassed both the pre- and post-Olympics periods. Second, the Games had a positive impact on subjective well-being among Londoners that was specific to the period during which the Olympics were staged. In other words, there was a general subjective well-being effect in London that can be associated with hosting the event, and there is evidence that this effect was most intense during the staging of the event. The fact that the results do not differ much between models that control for observables and those that do not reinforces the notion of a quasi-natural experiment. Although we do not find that the impact of the Olympics differed much by socio-demographics like age or gender, there is some evidence that wealthier households profited relatively more in terms of subjective well-being.[27] We now test for the robustness of our estimates. For the robustness checks that follow, we resort to Equation (2a), i.e. the model that takes the entire year 2012 as the relevant treatment period, which is our preferred specification.

5 Robustness Checks

5.1 Selection into Follow-Up Survey

One possible concern with our results is that the identified effects of the Olympics might be driven by selection into surveys or attrition. Note that no question in either wave explicitly asked about the Olympics. Hence, there is no *ex-ante* reason to believe that respondents in London were primed, selected, or selected themselves into the panel based on a favorable disposition to hosting the event. However, if more positively (or negatively) disposed individuals were more likely to respond in the second wave of the panel, there would be potential for bias.

We check this issue in three ways: first, we estimate Equation (2a) for a balanced panel. Second, we weigh respondents by the inverse probability of participating in the follow-up

[26] Table 8 in Appendix A includes the full set of controls.
[27] The results are available upon request.

survey.[28] Third, we adopt a propensity-score matching approach: here, we match respondents in the three cities one-to-one based on their likelihood to participate in the follow-up survey, which we predict using our standard set of covariates.[29] Then, we re-estimate our difference-in-differences model using only the matched respondents. Using such "statistical clones" is the most restrictive matching procedure. The results are presented in Table 4. Considering the number of observations, there is clearly some overlap between the three approaches.

The results based on the balanced panel (Table 4, Panel A) are similar, both in terms of significance and size, to those of the unbalanced panel (Table 2). This is also the case for the inverse probability weighting (Table 4, Panel B). Similarly, for the propensity-score matching approach (Table 4, Panel C), the contemporaneous effects of the Olympics in London in 2012 remain significantly positive on both life satisfaction and happiness. The sizes of the coefficients, however, are somewhat attenuated. The specifications in Columns (5) and (6) show a significant increase in anxiety in London in 2012, which is the only difference to our preferred specification and the specification using the balanced panel. The fact that we do not find consistent results for anxiety across all specifications, however, suggests that all anxiety interpretations should be treated with caution.

5.2 Choice of Counterfactual

As mentioned, Paris bid to host the 2012 Olympic Summer Games and was favorite to be selected, only to unexpectedly lose to London. Parisians might therefore not be considered an appropriate control group. In fact, it is possible that the positive life satisfaction and happiness effects identified previously are "contaminated" by a reduction in subjective well-being in Paris. We thus re-estimate Equation (2a) by (a) excluding Paris and using only Berlin as control, and (b) including $Paris \times 2012$ as an additional treatment to $London \times 2012$.

Table 5, Panel A, presents the results comparing London to Berlin, excluding Paris. We consistently find significant increases in life satisfaction and happiness in London in 2012, no significant effects for anxiety, and significant reductions in worthwhileness. However, as shown above, the latter finding is very likely due to a post-Olympics reduction in worthwhileness in London. Overall, these results confirm our preferred specification. Notably, for both life satisfaction and happiness, the size of the effect is somewhat reduced compared to the baseline estimates in Tables 1 and 2: when excluding Paris from the control group, the estimates of life satisfaction nearly halve.

[28] To create inverse probability weights, we first predict the likelihood to participate in the follow-up survey based on our standard set of covariates, and then weigh all regressions by the inverse of this likelihood (Kalton and Flore-Cervantes, 2003).

[29] See Table 8 in Appendix B for the balancing properties of observables after the propensity-score matching.

Table 5, Panel B, presents the results adding Paris as a separate treatment variable, $Paris \times 2012$. The $London \times 2012$ estimates are very robust and the usual interpretations hold up. Those of $Paris \times 2012$, however, suggest evidence for a significant reduction in life satisfaction and happiness in Paris in 2012. No significant effects of $Paris \times 2012$ are estimated for the measures of anxiety and worthwhileness. Overall, these results suggest that the London Olympics effect is robust to the choice of control group.

5.3 Extended Economic and Meteorological Controls

Recall that our regressions control for the quarterly real GDP change since the first quarter of 2008. To further control for potentially divergent economic developments between the three cities, we obtain data on daily stock market index closing values, and include them as additional controls into our preferred specification, the model in Equation (2a). For the UK, we take the FTSE100, for France the CAC40, and for Germany the DAX30, all obtained from Yahoo Finance (http://finance.yahoo.com).

Moreover, given that we have daily data, we also control for weather-related factors which have been shown to have an instantaneous effect on subjective well-being and could thus explain differences in responses between cities (Feddersen et al., 2016). We obtain data on daily precipitation (in inches) and daily maximum temperature (in Fahrenheit) from the National Centers for Environmental Information of the National Oceanic and Atmospheric Administration (www.ncdc.noaa.gov). We gather measurements from different weather stations in and around the three cities, and average them to obtain a daily representative measure for each city.

Table 6 replicates Table 2 including these additional controls. As can be seen, the results remain robust: the coefficients for life satisfaction and happiness have the expected sign, and are very similar in terms of size and significance to the ones in our preferred specification. The same is true for worthwhileness.

5.4 Placebo Tests

Next, we conduct a series of placebo or confirmation tests. In Table 7, Columns (1) to (4), we employ *placebo outcomes*, whereas in Columns (5) to (7), we employ *placebo time periods*. Column (1) replicates Equation (2a) by using a linear probability model with a binary indicator as outcome: it is equal to one if the respondent has thought about her finances the day before the interview. Columns (2) and (3) use our standard indicators of feelings of

happiness and anxiousness the respondent reports to have had when these thoughts occurred, respectively, as outcomes. We would not expect the Olympics to affect these outcomes, and in fact, we do not find any significant effects for them. This is also *prima facie* evidence that our effects are not driven by divergent economic developments between the three cities: if this were the case, we would expect to find significant effects for these outcomes.

In considering outcomes plausibly connected to the Olympics, we use a measure of national pride which has previously been related to major sporting events (Kavetsos, 2012b). We find a strong, significant, and positive effect on this measure (Column 4), which offers supportive evidence that the effects we are measuring in our preferred specification are indeed Olympics-related.

Columns (5) and (6) replicate Equation (1) – originally focussing on the year 2012 only – by using placebo time periods. We use the exact cut-off dates of the Olympics in 2012 to define treatment periods in 2011 (Column 5) and 2013 (Column 6), respectively. Both specifications point towards the fact that there is no "Olympics effect" in the summers of 2011 and 2013. For sake of brevity, we only show results based on the life satisfaction measure; however, similar conclusions also hold for happiness.

Column (7) replicates Equation (2a) – originally focussing on the years 2011 and 12 – by using the years 2011 and 2013: we do not find a significant effect, which is again supportive evidence that we are indeed measuring the impact of the Olympics in our preferred specification. Finally, the results in Column (7) are once more evidence against the fact that our baseline results are driven by divergent economic developments; if this were the case, significant differences between 2012 and 2011 would likely be present as well when considering differences between 2011 and 2013. At the same time, these results already point towards the lack of long-run legacy effects.

6 Sporting Success

An outstanding question is the degree to which the London treatment variable captures the impact of national athletes' performance or an impact of the Olympics *per se*. Team Great Britain exceeded expectations in 2012 (even after having done exceptionally well in Beijing in 2008) and was ranked 3^{rd} in the medal table with a total of 65 medals (of which 29 were gold). Its official target was to be placed 4^{th} with 48 medals.[30] It had ranked 4^{th} (47 medals) in the 2008 Beijing Olympics and 9^{th} (30 medals) in the 2004 Athens Olympics. France's and

[30] See www.telegraph.co.uk/sport/olympics/9374912/Team-GB-medal-target-for-London-2012-Olympics-is-fourth-place-with-48-medals-across-12-sports.html, retrieved August 17, 2017.

Germany's performance was rather stable: France ranked 7^{th} in 2012 (34 medals; 11 gold), having ranked 10^{th} in 2008 (41 medals) and 7^{th} in 2004 (33 medals). Germany ranked 6^{th} in 2012 (44 medals; 11 gold), having ranked 5^{th} in 2008 (41 medals) and 6^{th} in 2004 (48 medals).

To address the impact of medals won on subjective well-being, we run our preferred specification, Equation (2a), and additionally interact the main effect with the daily number of medals won by respondents' nation on the day before the interview; i.e. medals won by France for Parisians, by Germany for Berliners, and by Great Britain for Londoners. In other words, we are estimating whether the positive treatment effect for London is amplified by the relative performance of British Athletes on the day before the interview.

Table 8 presents the results: Panel A considers all lagged medals irrespective of rank (i.e. gold, silver, and bronze), whereas Panel B considers lagged gold medals only, as these carry more weight in the medal table and attract considerable media attention. Our estimates for the *London* × 2012 treatment effect are robust to the inclusion of either measure of performance, showing a significant increase in both life satisfaction and happiness in London in 2012. These results continue to hold if we consider lagged (gold) medals accumulated up to the day before an interview took place.[31] This finding confirms previous research which shows, in a large sample of cross-national surveys, a significant hosting effect of major sporting events on life satisfaction regardless of actual sporting success (Kavetsos and Szymanski, 2010). Likewise, for the Olympics, sporting success does not appear to matter for subjective well-being.

7 Legacy

The concept of "legacy" has become increasingly important in the rationalization and celebration of the Olympics. For our subjective well-being measures, however, graphical evidence in Figures 2 and 3 already suggests a limited legacy effect for London 2012. To test this more formally, we exploit the third wave of our panel into our estimations in order to assess whether there is any statistical evidence in favor of a legacy effect.

Table 9 presents the results of a preferred specification, Equation (2a), extended by including a *London* × 2013 treatment along with a year fixed effect for 2013.

The *London* × 2012 coefficients are in line with the findings in Table 2. They show positive and significant effects on life satisfaction and happiness, no significant effect on anxiety, and a negative effect on worthwhileness. The *London* × 2013 coefficients imply no persistent Olympics effect in London in 2013 for life satisfaction and happiness, once all the controls

[31] The results are available upon request.

are included in Columns (2) and (4). However, our model suggests there may have been a decrease in anxiety in London in 2013 as well as a decrease in worthwhileness. Overall, however, and in line with the findings in Figures 2 and 3, there seems to be little statistical evidence for a significant legacy effect of the Olympics on subjective well-being.

One caveat of this analysis is that, despite our efforts and incentives to retain participants in the panel, attrition rates are quite high in the third wave. Moreover, we cannot control for country-year shocks, as there is no variation over time in our macroeconomic controls. Yet, the same conclusion is reached if we explicitly account for attrition, by repeating the estimations using a balanced sample, inverse probability weights, or propensity-score matching, as performed in Table 4:[32] we do not find statistical evidence for a significant legacy effect in terms of subjective well-being.

8 Discussion

Every time there is the prospect of hosting a future Olympics, potential bidders ask themselves "is it worth it?" And once the Olympics are over, every host city asks itself "was it really worth it?" We do not rely on imagination or memory to answer these questions, but rather on whether reports of subjective well-being change in response to hosting the event. We employ a novel and newly constructed international panel that measures the different components of subjective well-being, eliciting reports from more than 26,000 individuals in London, Paris, and Berlin during the summer months of 2011, 2012, and 2013. We exploit a quasi-natural experiment to identify the causal effects of the 2012 Olympic Summer Games in London on people's subjective well-being in the host city.

We find that the 2012 Olympic Summer Games in London increased the life satisfaction and happiness of Londoners in the short-run (i.e. during the Olympics period), particularly around the opening and closing ceremonies. Clearly, our identified effects are only average effects: it may well be that, for some population sub-groups, hosting the event did actually decrease subjective well-being, for example, due to congestion. On average, however, our findings point towards positive impacts of hosting, and we find little evidence for heterogeneity: impacts seem independent of age or gender, but tend to be higher among wealthier households.[33] One of the key lessons of our study is that impacts are only short-run: we are not able to detect legacy effects of hosting in terms of subjective well-being. There were no consistent changes (either positive or negative) in anxiety or worthwhileness during the Olympics period for Londoners relative to Parisians and Berliners either. Our findings are remarkably

[32] The results are available upon request.
[33] The results are available upon request.

stable: they are robust to controlling for a rich set of observables, including macroeconomic and meteorological conditions, selection into the survey and attrition, and the choice of the counterfactual. They also withstand a series of placebo tests, including placebo outcomes and time periods.

In terms of size, the increase in life satisfaction – ranging between eight and ten percent of a standard deviation – is quite large compared to standard estimates in the subjective well-being literature: according to our preferred specification, Equation (2a), the impact is equivalent to moving from the bottom to the fourth income decile, everything else held constant. It appears even larger when considering its prevalence, that is, when considering that the event affects a large amount of people in the host city (although only for relatively short time). Using our estimates, we can now calculate the aggregated willingness-to-pay in order to host the Olympics, and then contrast it with the projected and actual costs of hosting.

In our preferred specification, Equation (2a), we find that the Olympics increase life satisfaction by about seven percent of a standard deviation, which corresponds to a rise of about 0.13 points. Note that the coefficient of log annual gross household income – obtained from estimating Equation (2a) with life satisfaction non-standardized – is also about 0.13, and that the mean household income in London in 2012 was £42,389: a 1% (£423.89) increase in household income thus raises life satisfaction by 0.13 points. By rule of three, this implies that a household would be willing to pay £423.89 in order to host the Olympics, everything else held constant. The average household size in London in 2012 was 2.47 (Census Information Scheme, 2012), yielding an individual willingness-to-pay of £171.62. This compares well to, for example, the (highest-category) ticket price of £185 for the male football finals at Wembley Stadium during the 2012 Olympic Summer Games (BBC, 2010). As there were about 8.17 million people living in London in 2012 (Census Information Scheme, 2012), we obtain an aggregated, estimated willingness-to-pay in order to host the Olympics of about £1.4 billion, or in other words, about 58% of the projected costs of £2.1 billion and about 12% of the actual costs of £11.9 billion of hosting (NAO, 2012).

Note that this estimated willingness-to-pay is most likely an upper bound, for two reasons: first, household income is measured annually, and we already know that the impact of the Olympics on life satisfaction lasted less than a year. Assuming, as a lower bound scenario, that the impact is limited to the two months of our observation period in the summer of 2012, we would obtain an individual willingness-to-pay of only £85.81 and an aggregated, estimated willingness-to-pay of only £701.07 million, which is only about 29% of the projected and 6% of the actual costs. Second, evidence suggests that quantifications using subjective well-being data may overestimate the monetary effect of a public good or bad, as it hinges on the correct estimation of the marginal utility of income, which has been shown to have a tendency to be upward biased (Luechinger, 2009). The central message, nevertheless, remains: the costs of

hosting, projected or – to a much larger extent – actual, are well below its subjective well-being benefits in pecuniary terms, regardless of which side one takes in the bounding exercise above.

Another way to look at whether hosting the Olympics was really worth it is through the lens of cost-effectiveness: we already saw that the Olympics increase life satisfaction by about 0.13 points per individual. The actual costs were about £11.9 billion in total, yielding – with about 8.17 million people living in London in 2012 – £1,457 per individual. In other words, the Olympics have a well-being per pound ratio of $0.13/1,457 = 0.00009$. What shall we compare this ratio to? Unfortunately, we still know too little about "how much well-being" particular policies and programs can buy per pound invested (partly because costs of interventions are often not reported), so that direct comparisons with alternative interventions are difficult to make. Clark et al. (2017), in line with HM Treasury and its Green Book on how to appraise proposals before committing funds to policies, therefore suggest to compare this ratio to a fixed threshold of $1/2,500$. This threshold is derived from guidelines on national health service expenditure in Britain: for all possible treatments, these guidelines evaluate the gain in Quality-Adjusted Life-Years (QALYs), measured on a zero-to-one scale; treatment is approved if the cost per QALY is below 25,000, or put differently, if it is below a QALY per pound ratio of $1/25,000 = 0.00004$.[34] For life satisfaction, which is measured on a zero-to-ten scale, the critical value thus becomes $25,000/10$. Since 0.00009 is less than $1/2,500 = 0.0004$, hosting the Olympics clearly fails this *ex-post* cost-effectiveness test as well.

Our study suffers from a number of limitations: our sample is not strictly representative of the populations in London, Paris, and Berlin. We can control for observable differences between the achieved sample and the wider population, but there may be unobservables we are missing, and which would challenge any claims about generalizability. Moreover, the sample is clearly of those proximate to the Olympics, and policy-makers might be interested in the impact of hosting on the broader UK, French, and German populations. Extrapolating our findings to the country-level, therefore, requires caution.

Many cities spend substantial resources attracting and then hosting the Olympics, but the evidence to date suggests that they do not have a significant economic benefit to the host city. This paper presents the first causal evidence of a positive – yet short-lived – subjective well-being impact of the Olympics on local residents during the event. For a complete accounting of the costs and benefits of hosting, policy-makers should take both tangible and intangible impacts into account. To answer our initial question – "was it really worth it?" – for London, we probably have to say "no".

[34] These guidelines are produced by the National Institute for Health and Care Excellence (NICE), which suggests critical values between £20,000 and £30,000. We take £25,000 as the midpoint.

References

Adler, M. D., P. Dolan, and G. Kavetsos, "Would you choose to be happy? Tradeoffs between happiness and the other dimensions of life in a large population survey," *Journal of Economic Behavior & Organization*, 139, 60-73, 2017.

Ahlfeldt, G. M., and G. Kavetsos, "Form or function? The impact of new sports stadia on property prices in London," *Journal of the Royal Statistical Society: Series A*, 177(1), 169-190, 2014.

Ahlfeldt, G., and W. Maennig, "Impact of sports arenas on land values: Evidence from Berlin," *Annals of Regional Science*, 44(2), 205-227, 2010.

Atkinson, G., S. Mourato, S. Szymanski, and E. Ozdemiroglu, "Are we willing to pay enough to 'back the bid'? Valuing the intangible impacts of London's bid to host the 2012 summer Olympic Games," *Urban Studies*, 45(2), 419-444, 2008.

Baade, R., and V. Matheson, "Bidding for the Olympics: Fool's gold?," in Barros, C., M. Ibrahim, and S. Szymanski (eds.), *Transatlantic Sport*, 127-151. Edward Elgar, London, 2002.

Baade, R., and V. Matheson, "Going for the Gold: The economics of the Olympics," *Journal of Economic Perspectives*, 30(2), 201-218, 2016.

Bayer, C., and F. Juessen, "Happiness and the persistence of income shocks," *American Economic Journal: Macroeconomics*, 7(4), 160-187, 2015.

BBC, "*Olympic Games ticket prices*," Downloaded at http://news.bbc.co.uk/1/shared/bsp/hi/pdfs/15_10_10_athletics.pdf, Retrieved August 17, 2017. 2010.

Benjamin, D. J., O. Heffetz, M. S. Kimball, and A. Rees-Jones, "Can marginal rates of substitution be inferred from happiness data? Evidence from residency choices," *American Economic Review*, 104(11), 3498-3528, 2014a.

Benjamin, D. J., O. Heffetz, M. S. Kimball, and N. Szembrot, "Beyond happiness and satisfaction: Toward well-being indices based on stated preference," *American Economic Review*, 104(9), 2698-2735, 2014b.

Benjamin, D. J., O. Heffetz, M. S. Kimball, and A. Rees-Jones, "What do you think would make you happier? What do you think you would choose?," *American Economic Review*,

102(5), 2083-2110, 2012.

Billings, S. B., and J. S. Holladay, "Should cities go for the gold? The longterm impacts of hosting the Olympics," *Economic Inquiry*, 50(3), 754-772, 2012.

Blake, A., "*The economic impact of the London 2012 Olympics*," Christel DeHaan Tourism and Travel Research Institute, Nottingham University Business School, 2005.

Cattaneo, M. D., S. Galliani, P. J. Gertler, S. Martinez, and R. Titiunik, "Housing, health, and happiness," *American Economic Journal: Economic Policy*, 1(1), 75-105, 2009.

Census Information Scheme, "*2011 Census Snapshot: Households and Families*," Greater London Authority Intelligence Unit, London, 2012.

Clark, A. E., S. Flche, R. Layard, N. Powdthavee, and G. Ward, *The Origins of Happiness: The Science of Well-Being over the Life Course*, Princeton University Press, Cambridge, MA, 2017.

Coates, D., and B. Humphreys, "The growth effects of sport franchises, stadia, and arenas," *Journal of Policy Analysis and Management*, 18(4), 601-624, 1999.

Coates, D., and B. Humphreys, "The effect of professional sports on earnings and employment in the services and retail sectors in US cities," *Regional Science and Urban Economics*, 33(2), 175-198, 2003.

Crompton, J., "Economic impact analysis of sports facilities and events: Eleven sources of misapplication," *Journal of Sport Management*, 9(1), 14-35, 1995.

DCMS, "*Post-Games Evaluation: Meta-Evaluation of the Impacts and Legacy of the London 2012 Olympic Games and Paralympic Games Summary Report*", Report 5, 2013.

Di Tella, R., R. MacCulloch, and A. Oswald, "Preferences over inflation and unemployment: Evidence from surveys of happiness," *American Economic Review*, 91(1), 335-341, 2001.

Dolan, P., and R. Metcalfe, "Measuring subjective wellbeing: Recommendations on measures for use by national governments," *Journal of Social Policy*, 41(2), 409-427, 2012.

Dolan, P., T. Peasgood, and M. White, "Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being," *Journal of Economic Psychology*, 29(1), 94-122, 2008.

Feddersen, J., R. Metcalfe, and M. Wooden, "Subjective wellbeing: Why weather matters," *Journal of the Royal Statistical Society: Series A*, 179(1), 203-228, 2016.

Feng, X., and B. R. Humphreys, "The impact of professional sports facilities on housing values: Evidence from census block group data," *City, Culture and Society*, 3(3), 189-200, 2012.

Fourie, J., and M. Santana-Gallego, "The impact of mega-sport events on tourist arrivals," *Tourism Management*, 32(6), 1364-1370, 2011.

Giesecke, J., and J. R. Madden, "*The Sydney Olympics, seven years on: An ex-post dynamic CGE assessment*," Monash University, Centre of Policy Studies and the Impact Project, 2007.

Goebel, J., C. Krekel, T. Tiefenbach, and N. R. Ziebarth, "How natural disasters can affect environmental concerns, risk aversion, and even politics: Evidence from Fukushima and three European countries," *Journal of Population Economics*, 28(4), 1137-1180, 2015.

HM Treasury, "*The Green Book: Appraisal and Evaluation in Central Government*", HM Treasury, London, 2011.

Ifcher, J., H. Zarghamee, "Happiness and time preference: The effect of positive affect in a random-assignment experiment," *American Economic Review*, 101(7), 3109-3129, 2011.

Imbens, G. W., and J. M. Wooldridge, "Recent developments in the econometrics of program evaluation," *Journal of Economic Literature*, 47(1), 5-86, 2009.

IOC, "*Final Report of the IOC Coordination Commission Games of the Olympiad, London, 2012*," Downloaded at http://www.olympic.org/Documents/Games_London_2012/Final%20Cocom%20Report%20London%202012%20EN.pdf, Retrieved August 17, 2017. 2013.

Jasmand, S., and W. Maennig, "Regional income and employment effects of the 1972 Munich Summer Olympic Games," *Regional Studies*, 42(7), 991-1002, 2008.

Kahneman, D., and R. Sugden, "Experienced Utility as a Standard of Policy Evaluation," *Environmental & Resource Economics*, 32(1), 161-181, 2005.

Kahneman, D., and A. Deaton, "High income improves evaluation of life but not emotional well-being," *Proceedings of the National Academy of Sciences*, 107(38), 16489-16493, 2010.

Kahneman, D., P. Wakker, and R. Sarin, "Back to Bentham? Explorations of experienced

utility," *Quarterly Journal of Economics*, 112(2), 375-406, 1997.

Kalton, G., and I. Flores-Cervantes, "Weighting methods," *Journal of Official Statistics*, 19(2), 81-97, 2003.

Kavetsos, G., "The impact of the London Olympics announcement on property prices," *Urban Studies*, 49(7), 1453-1470, 2012a.

Kavetsos, G., "National pride: War minus the shooting," *Social Indicators Research*, 106(1), 173-185, 2012b.

Kavetsos, G., and S. Szymanski, "National well-being and international sports events," *Journal of Economic Psychology*, 31(2), 158-171, 2010.

Kavetsos, G., M. Dimitriadou, and P. Dolan, "Measuring happiness: Context matters," *Applied Economics Letters*, 21(5), 308-311 2014.

Krekel, C., and A. Zerrahn, "Does the presence of wind turbines have negative externalities for people in their surroundings? Evidence from well-being data," *Journal of Environmental Economics and Management*, 82, 221-238, 2017.

Krekel, C., J. Kolbe, and H. Wuestemann, "The greener, the happier? The effect of urban land use on residential well-being," *Ecological Economics*, 121, 117-127, 2016.

Kroh, M., "An experimental evaluation of popular well-being measures," *DIW Discussion Paper*, 546. German Institute for Economic Research, Berlin, 2006.

Levinson, A., "Valuing public goods using happiness data: The case of air quality," *Journal of Public Economics*, 96(9-10), 869-880, 2012.

Ludwig, J., G. J. Duncan, L. A. Gennetian, L. F. Katz, R. C. Kessler, J. R. Kling, and L. Sanbonmatsu, "Neighborhood effects on the long-term well-being of low-income adults," *Science*, 337(6101), 1505-1510, 2012.

Luechinger, S., "Valuing Air Quality Using the Life Satisfaction Approach," *Economic Journal*, 119(536), 482-515, 2009.

Luechinger, S., and P. Raschky, "Valuing flood disasters using the life satisfaction approach," *Journal of Public Economics*, 93(3), 620-633, 2009.

Metcalfe, R., N. Powdthavee, and P. Dolan, "Destruction and distress: Using a quasi-experiment to show the effects of the September 11 attacks on mental well-being in the United Kingdom," *Economic Journal*, 121(550), 81-103, 2011.

NAO, "*The London 2012 Olympic Games and Paralympic Games: Post-Games review*," HC794, 2012.

National Research Council, "*Subjective Well-Being: Measuring Happiness, Suffering, and Other Dimensions of Experience*," The National Academies Press, Washington D.C., 2013.

Nelson, M., "The First Olympic Games," Downloaded at http://scholar.uwindsor.ca/llcpub/20, Retrieved on August 17, 2017, 2012.

OECD, "*OECD Guidelines on Measuring Subjective Well-Being*," OECD Publishing, Paris, 2013.

Oswald, A. J., and N. Powdthavee, "Does happiness adept? A longitudinal study of disability with implications for economists and judges," *Journal of Public Economics*, 92(5), 1061-1077, 2008.

Porter, P., "Mega-sports events as municipal investments: A critique of impact analysis," in Zimbalist, A. (ed.), *The Economics of Sport 2*, 370-383. Edward Elgar, London, 1999.

Preuss, H., "Economics of the Olympic Games: Hosting the Games 1972-2000," in Rosner, S. R., and K. L. Shropshire, (eds.), *The Business of Sports*, 415-418. Jones and Bartlett, Sudbury, 2004.

Rayo, L., and G. Becker, "Evolutionary efficiency and happiness," *Journal of Political Economy*, 115(2), 302-337, 2007.

Rose, A. K., and M. M. Spiegel, "The Olympic Effect," *Economic Journal*, 121(553), 652-677, 2011.

Siegfried, J., and A. Zimbalist, "The economics of sports facilities and their communities," *Journal of Economic Perspectives*, 14(3), 95-114, 2000.

Stevenson, B., and J. Wolfers, "The paradox of declining female happiness," *American Economic Journal: Economic Policy*, 1(2), 190-225, 2009.

Stiglitz, J. E., A. Sen, and J. P. Fitoussi, "Report by the Commission on the Measurement

of Economic Performance and Social Progress," OECD Publishing, Paris, 2009.

Taylor, M. P., "Tell me why I don't like Mondays: Investigating day of the week effects on job satisfaction and psychological well-being," *Journal of the Royal Statistical Society: Series A*, 169(1), 127-142, 2006.

Teigland, J., "Mega-events and impacts on tourism; the predictions and realities of the Lillehammer Olympics," *Impact Assessment and Project Appraisal*, 17(4), 305-317, 1999.

van Praag, B., and B. E. Baarsma, "Using happiness surveys to value intangibles: The case of airport noise," *Economic Journal*, 115(500), 224-246, 2005.

Wagner, G. G., J. R. Frick, and J. Schupp, "The German Socio-Economic Panel Study (SOEP) – Scope, Evolution, and Enhancements," *Schmollers Jahrbuch*, 127(1), 139-169, 2007.

Wagner, G. G., J. Goebel, P. Krause, R. Pischner, and I. Sieber, "Das Sozio-Oekonomische Panel (SOEP): Multidisziplinaeres Haushaltspanel und Kohortenstudie fuer Deutschland – Eine Einfuehrung (fuer neue Datennutzer) mit einem Ausblick (fuer erfahrene Anwender)", *AStA Wirtschafts- und Sozialstatistisches Archiv*, 2(4), 301-328, 2008.

Figures

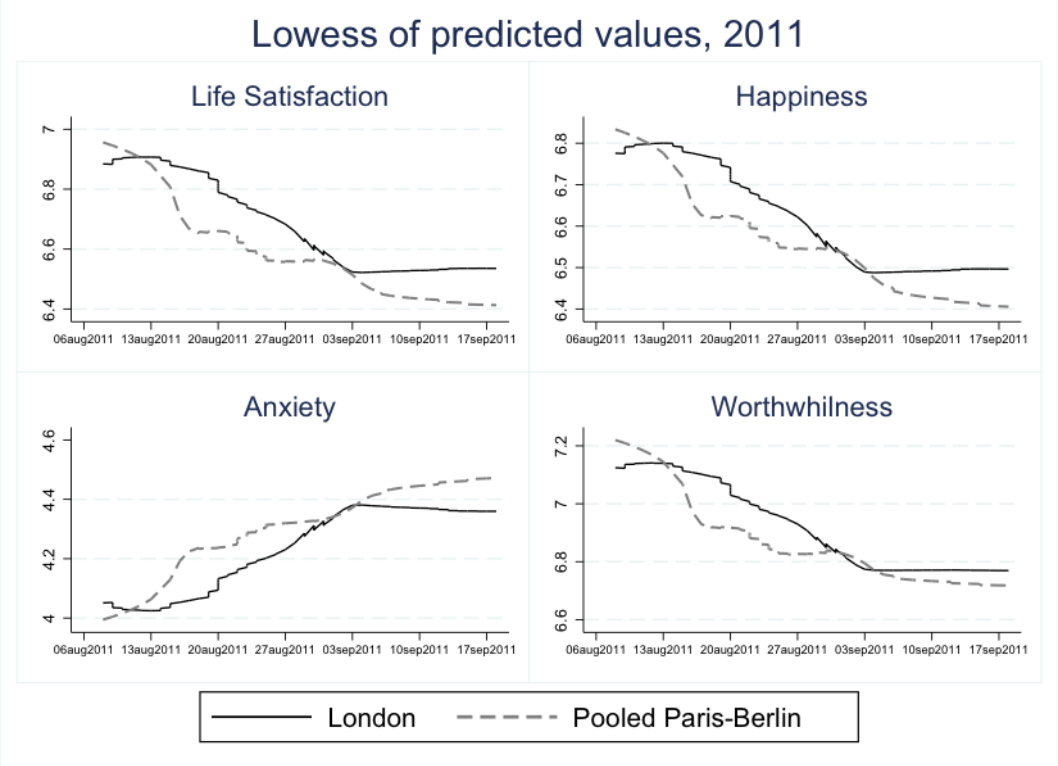

Figure 1: Subjective Well-Being in 2011 in London Relative to Paris-Berlin

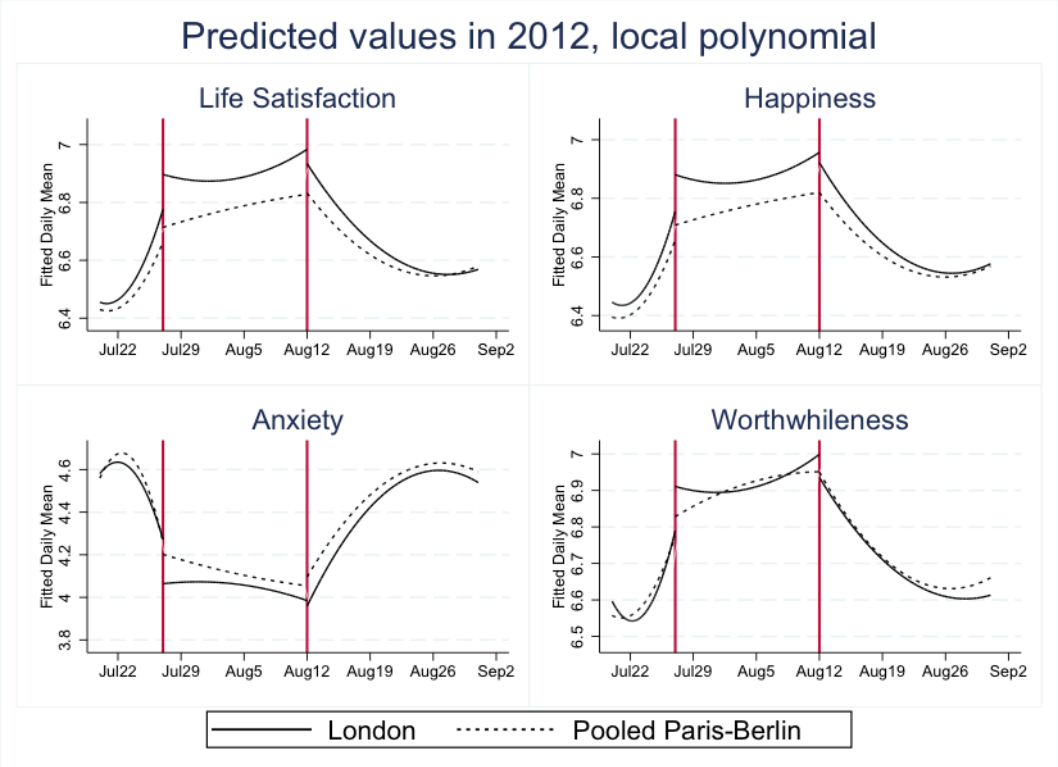

Figure 2: Subjective Well-Being in 2012 in London Relative to Paris-Berlin

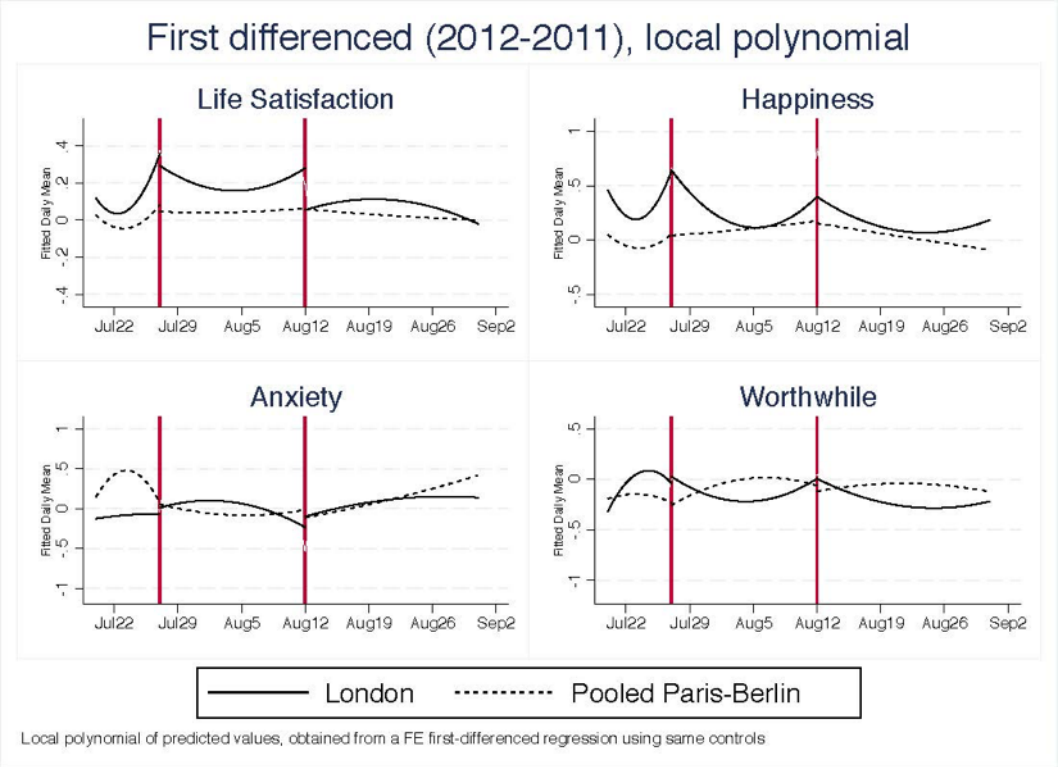

Figure 3: Changes in Subjective Well-Being Between 2012 and 2011 in London Relative to Paris-Berlin

Tables

Table 1: Impact of Olympics on Subjective Well-Being (2012)

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
London×OlympicsPeriod	0.117**	0.088**	0.079	0.053	0.118**	0.118**	0.025	0.028
	(0.048)	(0.042)	(0.043)	(0.042)	(0.048)	(0.049)	(0.046)	(0.043)
London×PostOlympicsPeriod	0.03	0.053	-0.026	0.001	0.099	0.084	-0.085**	-0.081**
	(0.046)	(0.039)	(0.042)	(0.04)	(0.051)	(0.05)	(0.038)	(0.037)
London	-0.07	0.138**	-0.023	0.002	-0.134***	-0.265***	-0.028	0.521***
	(0.038)	(0.056)	(0.027)	(0.049)	(0.036)	(0.057)	(0.024)	(0.044)
OlympicsPeriod	0.17***	0.148***	0.031	0.023	-0.274***	-0.257***	0.193***	0.166***
	(0.032)	(0.032)	(0.028)	(0.024)	(0.037)	(0.033)	(0.032)	(0.026)
PostOlympicsPeriod	0.063**	0.014	0.057**	0.004	-0.068**	-0.059	0.114***	0.098***
	(0.03)	(0.033)	(0.026)	(0.024)	(0.032)	(0.034)	(0.026)	(0.029)
Constant	-0.088***	-0.009	-0.125***	-0.035	0.186***	0.126**	-0.138***	0.055
	(0.026)	(0.039)	(0.024)	(0.025)	(0.02)	(0.053)	(0.023)	(0.038)
N	14,500	14,500	14,500	14,500	14,500	14,500	14,500	14,500
R^2	0.006	0.10	0.026	0.09	0.011	0.036	0.007	0.067
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (1), without and with controls. Regressions with controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and day-of-week effects. Robust standard errors clustered at the date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table 2: Impact of Olympics on Subjective Well-Being (Panel: 2011, 2012)

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
London×2012	0.059***	0.07***	0.086***	0.084***	0.009	0.024	-0.051***	-0.044***
	(0.01)	(0.011)	(0.014)	(0.015)	(0.017)	(0.019)	(0.015)	(0.016)
2012	0.013**	0.005	0.083***	0.043	0.045***	0.022	-0.052***	-0.054***
	(0.006)	(0.013)	(0.017)	(0.022)	(0.009)	(0.015)	(0.008)	(0.013)
Constant	-0.026***	-0.098	-0.129***	-1.228***	-0.014**	0.484	0.015***	-0.409
	(0.003)	(0.30)	(0.021)	(0.448)	(0.005)	(0.428)	(0.003)	(0.336)
N	40,458	40,458	40,458	40,458	40,458	40,458	40,458	40,458
R^2	0.002	0.012	0.008	0.017	0.002	0.007	0.004	0.007
N of People	26,030	26,030	26,030	26,030	26,030	26,030	26,030	26,030
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (2a), without and with controls. Regressions with controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table 3: Impact of Olympics on Subjective Well-Being (Panel: 2011, 2012) – Exact Cut-Off Dates

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
London×PreOlympicsPeriod$_{2012}$	0.038	0.049	0.142***	0.135***	-0.161***	-0.146***	0.049	0.062
	(0.033)	(0.035)	(0.044)	(0.046)	(0.048)	(0.048)	(0.041)	(0.04)
London×OlympicsPeriod$_{2012}$	0.093***	0.105***	0.107***	0.111***	0.019	0.029	-0.027	-0.019
	(0.016)	(0.017)	(0.024)	(0.023)	(0.027)	(0.028)	(0.021)	(0.021)
London×PostOlympicsPeriod$_{2012}$	0.033**	0.046***	0.059***	0.053***	0.029	0.042**	-0.088***	-0.08***
	(0.013)	(0.014)	(0.017)	(0.018)	(0.019)	(0.02)	(0.02)	(0.021)
PreOlympicsPeriod$_{2012}$	-0.006	-0.003	0.057**	0.018	0.14***	0.089**	-0.112***	-0.076***
	(0.018)	(0.032)	(0.027)	(0.039)	(0.024)	(0.037)	(0.016)	(0.023)
OlympicsPeriod$_{2012}$	0.024**	0.017	0.082***	0.039	-0.009	-0.035**	-0.048***	-0.043**
	(0.01)	(0.017)	(0.018)	(0.022)	(0.012)	(0.018)	(0.012)	(0.017)
PostOlympicsPeriod$_{2012}$	0.007	-0.002	0.065***	0.036	0.071***	0.054***	-0.049***	-0.059***
	(0.008)	(0.013)	(0.02)	(0.024)	(0.012)	(0.017)	(0.011)	(0.014)
Constant	-0.026***	-0.149	-0.114***	-1.284***	-0.014***	0.651	0.015***	-0.481
	(0.003)	(0.294)	(0.022)	(0.447)	(0.005)	(0.435)	(0.003)	(0.325)
N	40,458	40,458	40,458	40,458	40,458	40,458	40,458	40,458
R^2	0.003	0.013	0.008	0.017	0.004	0.009	0.005	0.008
N of People	26,030	26,030	26,030	26,030	26,030	26,030	26,030	26,030
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (3), without and with controls. Regressions with controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table 4: Robustness for Selection Into Surveys and Attrition (Panel: 2011, 2012)

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Balanced Panel							
London×2012	0.059***	0.07***	0.086***	0.084***	0.009	0.024	-0.051***	-0.044***
	(0.01)	(0.011)	(0.014)	(0.015)	(0.017)	(0.019)	(0.015)	(0.016)
2012	0.013**	0.005	0.083***	0.043	0.045***	0.022	-0.052***	-0.054***
	(0.006)	(0.013)	(0.017)	(0.022)	(0.009)	(0.015)	(0.008)	(0.013)
Constant	-0.016***	-0.076	-0.119***	-1.253***	-0.022***	0.476	0.013***	-0.414
	(0.004)	(0.308)	(0.021)	(0.463)	(0.008)	(0.439)	(0.005)	(0.346)
N	29,248	29,248	29,248	29,248	29,248	29,248	29,248	29,248
R^2	0.002	0.012	0.008	0.017	0.002	0.007	0.004	0.007
N of People	14,820	14,820	14,820	14,820	14,820	14,820	14,820	14,820
Controls	No	Yes	No	Yes	No	Yes	No	Yes
	Panel B: Inverse Probability Weights							
London×2012	0.062***	0.072***	0.07***	0.079***	0.009	0.022	-0.047***	-0.041**
	(0.01)	(0.011)	(0.014)	(0.015)	(0.018)	(0.018)	(0.016)	(0.016)
2012	0.011	-0.001	0.082***	-0.034	0.038***	0.03**	-0.04***	-0.049***
	(0.007)	(0.013)	(0.015)	(0.023)	(0.011)	(0.015)	(0.009)	(0.013)
Constant	-0.036***	-0.167	-0.042	-1.601***	-0.066***	0.594	-0.046***	-0.28
	(0.013)	(0.316)	(0.026)	(0.493)	(0.023)	(0.441)	(0.013)	(0.377)
N	28,956	28,956	28,956	28,956	28,956	28,956	28,956	28,956
R^2	0.003	0.011	0.013	0.017	0.004	0.007	0.005	0.007
N of People	14,528	14,528	14,528	14,528	14,528	14,528	14,528	14,528
Controls	No	Yes	No	Yes	No	Yes	No	Yes
	Panel C: Propensity-Score Matching							
London×2012	0.034**	0.051***	0.062***	0.06***	0.046**	0.063***	-0.056***	-0.038***
	(0.013)	(0.014)	(0.015)	(0.014)	(0.03)	(0.023)	(0.018)	(0.019)
2012	0.02***	-0.019	0.085***	0.014	0.02	0.009	-0.054***	-0.091***
	(0.008)	(0.015)	(0.02)	(0.028)	(0.011)	(0.018)	(0.01)	(0.019)
Constant	-0.003	-0.298	-0.20***	-1.694	-0.025***	0.595	0.034***	-1.064
	(0.003)	(0.451)	(0.026)	(0.684)	(0.007)	(0.629)	(0.004)	(0.587)
N	40,458	40,458	40,458	40,458	40,458	40,458	40,458	40,458
R^2	0.002	0.012	0.008	0.017	0.002	0.007	0.004	0.007
N of People	26,030	26,030	26,030	26,030	26,030	26,030	26,030	26,030
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Regressions are based on Equation (2a). Panel A uses a balanced sample; Panel B weights responses with the inverse probability of participating in wave two of the panel (i.e. 2012); Panel C matches respondents in the three cities one-to-one based on their likelihood to participate in wave two of the panel (i.e. 2012), and estimates Equation (2a) for those respondents. Regressions with controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table 5: Robustness for Choice of Control Group (Panel: 2011, 2012)

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: London Treatment							
London×2012	0.033**	0.041***	0.048***	0.071***	0.003	0.015	-0.062***	-0.058***
	(0.013)	(0.015)	(0.018)	(0.02)	(0.018)	(0.019)	(0.019)	(0.019)
2012	0.039***	0.052***	0.122***	0.095***	0.05***	0.033	-0.048***	-0.037**
	(0.01)	(0.017)	(0.025)	(0.025)	(0.015)	(0.021)	(0.011)	(0.017)
Constant	-0.043***	0.169	-0.132***	-1.066	-0.031***	0.322	0.082***	0.076
	(0.003)	(0.40)	(0.032)	(0.583)	(0.007)	(0.535)	(0.004)	(0.427)
N	24,884	24,884	24,884	24,884	24,884	24,884	24,884	24,884
R^2	0.004	0.013	0.011	0.022	0.002	0.011	0.006	0.011
N of People	16,379	16,379	16,379	16,379	16,379	16,379	16,379	16,379
Controls	No	Yes	No	Yes	No	Yes	No	Yes
	Panel B: London and Paris Treatment							
London×2012	0.033**	0.044***	0.048***	0.06***	0.003	0.007	-0.061***	-0.055***
	(0.013)	(0.015)	(0.018)	(0.019)	(0.018)	(0.019)	(0.019)	(0.019)
Paris×2012	-0.043***	-0.033**	-0.062***	-0.031	-0.01	-0.022	-0.018	-0.015
	(0.014)	(0.016)	(0.016)	(0.019)	(0.017)	(0.02)	(0.013)	(0.016)
2012	0.039***	0.039**	0.117***	0.074***	0.05***	0.044**	-0.042***	-0.039***
	(0.01)	(0.015)	(0.021)	(0.024)	(0.015)	(0.019)	(0.01)	(0.015)
Constant	-0.026***	-0.149	-0.088***	-1.274***	-0.014**	0.451	0.015***	-0.432
	(0.003)	(0.297)	(0.021)	(0.447)	(0.005)	(0.422)	(0.003)	(0.335)
N	40,458	40,458	40,458	40,458	40,458	40,458	40,458	40,458
R^2	0.003	0.012	0.008	0.017	0.002	0.007	0.004	0.007
N of People	26,030	26,030	26,030	26,030	26,030	26,030	26,030	26,030
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Regressions based on Equation (2a). Panel A excludes Paris entirely; Panel B includes Paris as an additional treatment, as in case of London. Regressions with controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and day-of-week and calendar-month fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table 6: Impact of Olympics on Subjective Well-Being (Panel: 2011, 2012) – Extended Controls

	Life Satisfaction	Happiness	Anxiety	Worthwhile
London×2012	0.073***	0.087***	0.023	-0.048***
	(0.011)	(0.015)	(0.018)	(0.016)
2012	0.002	0.039	0.049**	-0.06***
	(0.017)	(0.024)	(0.022)	(0.018)
Constant	-0.20	-1.376***	1.021***	-0.469
	(0.378)	(0.508)	(0.458)	(0.405)
N	40,458	40,458	40,458	40,458
R^2	0.012	0.017	0.007	0.008
N of People	26,030	26,030	26,030	26,030
Controls	Yes	Yes	Yes	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (2a) with controls, including: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. They also include the daily stock market index closing value in each country, as well as the daily amount of rain and the daily maximum temperature in each city. Robust standard errors clustered at the interview date level reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$

Table 7: Placebo and Confirmation Tests

	Thoughts about Finances	When Thinking about Finances: Happy	When Thinking about Finances: Anxious	National Pride	Life Satisfaction		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
London×2012	0.022	0.027	-0.046	0.177***			
	(0.02)	(0.022)	(0.026)	(0.017)			
2012	-0.07**	0.064	-0.06	0.008			
	(0.034)	(0.035)	(0.043)	(0.019)			
London×OlympicsPeriod					0.056	0.071	
					(0.05)	(0.06)	
London×PostOlympicsPeriod						0.034	
						(0.061)	
London					-0.135***	-0.147***	
					(0.025)	(0.055)	
OlympicsPeriods					0.145***	0.024	
					(0.034)	(0.038)	
PostOlympicsPeriods						-0.029	
						(0.042)	
London×2013							-0.041
							(0.024)
2013							-0.02
							(0.018)
Constant	-0.899	0.303	-1.405	-1.906***	-1.515***	-1.968***	-0.34
	(0.752)	(0.828)	(1.041)	(0.539)	(0.121)	(0.226)	(0.192)
N	37,400	28,453	28,468	30,778	25,958	9,070	35,028
R^2	0.008	0.016	0.013	0.024	25,958	9,070	0.018
N of People	25,988	21,145	21,158	24,062	0.107	0.116	26,006
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Estimates in Columns (1)-(4) based on Equation (2a), in Columns (5)-(6) on Equation (1), and in Column (7) on Equation (2a). Column (1) estimates a linear probability model using a binary indicator equal to one if the respondent has thought about her finances the day before the interview, and zero otherwise, as outcome; Columns (2) and (3) then use feelings of happiness and anxiousness on a zero-to-ten scale, respectively, which the respondent reports to have had when thinking about her finances, as outcomes. Column (4) uses national pride on a zero-to-ten scale as outcome. Columns (5) and (6) replicate Equation (1) in 2011 and 2013, respectively. Column (7) replicates Equation (2a) by using the years 2011 and 2013 instead of 2011 and 2012. Note that the difference between Column (5) and (6) arises due to the fact that the observation period in 2011 starts later compared to 2013. Controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table 8: The Impact of Medals on Subjective Well-Being

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Lagged Daily Medals							
London×2012×Medals	-0.006	-0.005	-0.004	-0.003	0.012***	0.011***	-0.014***	-0.013***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Medals	0.003	0.002	-0.005	-0.005	-0.002	-0.002	0.009***	0.008***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
London×2012	0.074***	0.083***	0.103***	0.101***	-0.027	-0.009	-0.019	-0.014
	(0.012)	(0.013)	(0.018)	(0.018)	(0.021)	(0.022)	(0.018)	(0.019)
2012	0.007	0.002	0.092***	0.049**	0.049***	0.024	-0.068***	-0.064***
	(0.008)	(0.014)	(0.019)	(0.023)	(0.011)	(0.016)	(0.009)	(0.014)
Constant	-0.026***	-0.097	-0.093***	-1.228***	-0.014***	0.484	0.015***	-0.406
	(0.003)	(0.298)	(0.021)	(0.449)	(0.005)	(0.43)	(0.003)	(0.334)
N	40,458	40,458	40,458	40,458	40,458	40,458	40,458	40,458
R^2	0.002	0.013	0.008	0.017	0.002	0.007	0.005	0.008
N of People	26,030	26,030	26,030	26,030	26,030	26,030	26,030	26,030
Controls	No	Yes	No	Yes	No	Yes	No	Yes
	Panel B: Lagged Daily Gold Medals							
London×2012×Gold	-0.009	-0.008	-0.021	-0.021	0.032**	0.031**	-0.04***	-0.038***
	(0.01)	(0.01)	(0.012)	(0.012)	(0.013)	(0.012)	(0.01)	(0.009)
Gold	0.008	0.007	0.001	0.003	-0.018	-0.017	0.028***	0.025***
	(0.009)	(0.009)	(0.01)	(0.01)	(0.011)	(0.01)	(0.008)	(0.008)
London×2012	0.064***	0.075***	0.109***	0.106***	-0.016	0.001	-0.024	-0.018
	(0.011)	(0.012)	(0.016)	(0.017)	(0.02)	(0.021)	(0.017)	(0.018)
2012	0.01	0.002	0.083***	0.043	0.052***	0.028	-0.065***	-0.063***
	(0.007)	(0.013)	(0.019)	(0.023)	(0.01)	(0.015)	(0.008)	(0.014)
Constant	-0.026***	-0.098	-0.13***	-1.169**	-0.014**	0.482	0.015***	-0.407
	(0.003)	(0.299)	(0.022)	(0.45)	(0.005)	(0.43)	(0.003)	(0.334)
N	40,458	40,458	40,458	40,458	40,458	40,458	40,458	40,458
R^2	0.002	0.012	0.008	0.017	0.002	0.007	0.005	0.008
N of People	26,030	26,030	26,030	26,030	26,030	26,030	26,030	26,030
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Regressions based on Equation (2a), with heterogeneous effects with respect to medals as triple interactions; two-way interactions are included but suppressed. Panel A considers lagged daily medals, Panel B lagged daily gold medals only. Controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$

Table 9: Legacy (Panel: 2011, 2012, 2013)

	Life Satisfaction		Happiness		Anxiety		Worthwhile	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
London×2012	0.057***	0.067***	0.084***	0.077***	0.006	0.019	-0.05***	-0.044***
	(0.01)	(0.011)	(0.015)	(0.014)	(0.018)	(0.02)	(0.016)	(0.016)
London×2013	0.036***	-0.01	0.062***	0.005	-0.075***	-0.098***	-0.035**	-0.065**
	(0.012)	(0.022)	(0.019)	(0.027)	(0.024)	(0.032)	(0.018)	(0.026)
2012	0.013**	-0.01	0.084***	0.069***	0.046***	0.018	-0.052***	-0.056***
	(0.006)	(0.01)	(0.021)	(0.019)	(0.011)	(0.013)	(0.009)	(0.012)
2013	0.036***	-0.003	0.056***	0.026	0.084***	0.054***	-0.066***	-0.074***
	(0.009)	(0.015)	(0.021)	(0.022)	(0.013)	(0.02)	(0.012)	(0.019)
Constant	-0.021***	-0.32	-0.128***	-0.02	-0.02***	0.128	0.065***	0.191
	(0.003)	(0.17)	(0.024)	(0.184)	(0.007)	(0.171)	(0.011)	(0.164)
N	49,528	49,528	49,528	49,528	49,528	49,528	49,528	49,528
R^2	0.002	0.011	0.007	0.014	0.002	0.006	0.003	0.005
N of People	26,036	26,036	26,036	26,036	26,036	26,036	26,036	26,036
Controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Regressions based on Equation (2a), with London×2013 included as additional treatment along with 2013 year fixed effect. Regressions with controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Appendix A: Descriptive Statistics

Table A1: Descriptive Statistics

	London			Paris			Berlin		
	2011	2012	2013	2011	2012	2013	2011	2012	2013
Life Satisfaction	6.515	6.690	6.756	6.668	6.675	6.724	6.681	6.733	6.846
	(2.00)	(1.951)	(1.951)	(1.794)	(1.748)	(1.753)	(1.993)	(1.977)	(1.939)
Happiness	6.448	6.683	6.791	6.724	6.710	6.803	6.497	6.632	6.771
	(2.15)	(2.07)	(2.10)	(1.873)	(1.812)	(1.812)	(2.236)	(2.166)	(2.165)
Anxiousness	4.252	4.296	4.064	4.324	4.436	4.464	4.197	4.328	4.402
	(2.722)	(2.667)	(2.686)	(2.564)	(2.512)	(2.531)	(2.685)	(2.583)	(2.582)
Worthwhileness	6.865	6.716	6.822	6.699	6.594	6.611	7.226	7.181	7.273
	(2.048)	(2.087)	(2.081)	(1.752)	(1.704)	(1.754)	(1.93)	(1.892)	(1.861)
Age	28.925	32.515	35.124	28.140	30.390	32.240	26.532	29.482	31.876
	(14.929)	(14.379)	(14.259)	(15.20)	(14.981)	(14.984)	(14.688)	(14.613)	(14.452)
Male	0.407	0.413	0.431	0.472	0.476	0.465	0.429	0.436	0.450
	(0.491)	(0.493)	(0.495)	(0.499)	(0.499)	(0.499)	(0.495)	(0.496)	(0.498)
Log Annual Gross Household Income	10.386	10.434	10.446	10.310	10.396	10.398	10.006	10.076	10.163
	(0.786)	(0.755)	(0.748)	(0.694)	(0.661)	(0.643)	(0.83)	(0.832)	(0.812)
Married	0.418	0.451	0.483	0.356	0.371	0.375	0.332	0.367	0.396
	(0.493)	(0.498)	(0.50)	(0.479)	(0.483)	(0.484)	(0.471)	(0.482)	(0.489)
With Partner	0.146	0.135	0.115	0.213	0.202	0.190	0.167	0.169	0.159
	(0.353)	(0.342)	(0.319)	(0.409)	(0.402)	(0.392)	(0.373)	(0.374)	(0.365)
Separated	0.023	0.020	0.014	0.022	0.019	0.020	0.029	0.024	0.023
	(0.15)	(0.141)	(0.119)	(0.146)	(0.135)	(0.139)	(0.167)	(0.152)	(0.149)
Divorced	0.071	0.082	0.084	0.083	0.089	0.098	0.100	0.112	0.115
	(0.256)	(0.274)	(0.277)	(0.276)	(0.285)	(0.297)	(0.299)	(0.316)	(0.3199)
Widowed	0.029	0.035	0.039	0.026	0.030	0.034	0.022	0.027	0.031
	(0.168)	(0.185)	(0.192)	(0.16)	(0.17)	(0.182)	(0.146)	(0.162)	(0.174)
In School	0.053	0.021	0.012	0.084	0.060	0.042	0.126	0.089	0.069
	(0.224)	(0.142)	(0.107)	(0.278)	(0.237)	(0.201)	(0.332)	(0.285)	(0.253)
Professional Degree	0.148	0.141	0.174	0.153	0.033	0.185	0.052	0.319	0.316
	(0.355)	(0.348)	(0.379)	(0.36)	(0.177)	(0.388)	(0.223)	(0.466)	(0.465)
University Degree	0.429	0.442	0.416	0.102	0.522	0.000	0.436	0.400	0.429
	(0.495)	(0.497)	(0.493)	(0.303)	(0.50)	(0.00)	(0.496)	(0.49)	(0.495)
Other Higher	0.200	0.181	0.178	0.515	0.242	0.631	0.234	0.212	0.188
Education Degree	(0.40)	(0.385)	(0.383)	(0.50)	(0.428)	(0.483)	(0.423)	(0.409)	(0.391)
Part-Time Employed	0.120	0.126	0.127	0.071	0.064	0.062	0.128	0.128	0.130
	(0.325)	(0.332)	(0.333)	(0.257)	(0.244)	(0.24)	(0.334)	(0.334)	(0.337)
Self-Employed	0.096	0.092	0.104	0.036	0.030	0.026	0.091	0.083	0.087
	(0.294)	(0.289)	(0.305)	(0.187)	(0.17)	(0.158)	(0.288)	(0.276)	(0.282)
Unemployed:	0.059	0.041	0.036	0.049	0.043	0.042	0.056	0.046	0.047
Looking for Job	(0.235)	(0.199)	(0.187)	(0.216)	(0.202)	(0.201)	(0.229)	(0.21)	(0.212)
Unemployed:	0.085	0.088	0.073	0.038	0.036	0.036	0.044	0.041	0.034
Permanently	(0.278)	(0.284)	(0.259)	(0.191)	(0.187)	(0.187)	(0.206)	(0.198)	(0.181)
Retired	0.134	0.170	0.205	0.172	0.200	0.244	0.123	0.161	0.187
	(0.341)	(0.376)	(0.404)	(0.377)	(0.40)	(0.429)	(0.328)	(0.367)	(0.39)
Lives: Flat Share	0.346	0.301	0.261	0.422	0.389	0.375	0.719	0.702	0.680
	(0.476)	(0.459)	(0.439)	(0.494)	(0.488)	(0.484)	(0.449)	(0.458)	(0.467)
Lives: Relatives	0.077	0.048	0.039	0.058	0.053	0.041	0.034	0.027	0.022
	(0.266)	(0.214)	(0.194)	(0.233)	(0.225)	(0.198)	(0.180)	(0.161)	(0.147)
Lives: Other	0.013	0.012	0.014	0.025	0.002	0.013	0.038	0.034	0.043
	(0.115)	(0.108)	(0.119)	(0.157)	(0.045)	(0.115)	(0.191)	(0.181)	(0.203)
N	9,402	4,663	2,857	9,629	5,945	3,672	6,927	3,892	2,541

Notes: Means (proportions for the case of binary variables). Standard deviations in parentheses.

Table A2: Table 1 with Full Set of Controls

	Life Satisfaction	Happiness	Anxiety	Worthwhileness
London×OlympicsPeriod	0.088**	0.053	0.118**	0.028
	(0.042)	(0.042)	(0.049)	(0.043)
London×PostOlympicsPeriod	0.053	0.001	0.084	-0.081**
	(0.039)	(0.04)	(0.05)	(0.037)
London	0.138**	0.002	-0.265***	0.521***
	(0.056)	(0.05)	(0.057)	(0.044)
OlympicsPeriod	0.148***	0.023	-0.257***	0.166***
	(0.032)	(0.024)	(0.033)	(0.026)
PostOlympicsPeriod	0.014	0.004	-0.059	0.098***
	(0.033)	(0.024)	(0.034)	(0.029)
Age	-0.036***	-0.026***	0.016***	-0.01**
	(0.004)	(0.004)	(0.003)	(0.004)
Age^2	0.001***	0.001***	-0.001***	0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Male	-0.051***	-0.04**	-0.103***	-0.121***
	(0.018)	(0.017)	(0.022)	(0.016)
Log Annual Gross Household Income	0.209***	0.162***	-0.106***	0.098***
	(0.011)	(0.011)	(0.013)	(0.013)
Married	0.26***	0.272***	0.031	0.28***
	(0.024)	(0.026)	(0.028)	(0.024)
With Partner	0.188***	0.246***	-0.009	0.16***
	(0.02)	(0.023)	(0.024)	(0.027)
Separated	-0.052	-0.074	0.047	0.045
	(0.056)	(0.055)	(0.066)	(0.055)
Divorced	0.061	0.08	-0.015	0.115***
	(0.041)	(0.041)	(0.033)	(0.038)
Widowed	0.075	0.124**	-0.038	0.134**
	(0.042)	(0.052)	(0.062)	(0.06)
In School	0.082**	0.059	0.001	0.136***
	(0.04)	(0.04)	(0.045)	(0.045)
Professional Degree	-0.011	-0.045	0.074**	0.042
	(0.03)	(0.032)	(0.033)	(0.031)
University Degree	0.036	-0.024	0.083***	0.08***
	(0.025)	(0.024)	(0.026)	(0.02)
Other Higher Education Degree	0.045	-0.001	0.017	0.099***
	(0.032)	(0.033)	(0.025)	(0.026)
Part-Time Employed	0.005	0.007	-0.026	0.005
	(0.032)	(0.027)	(0.029)	(0.029)
Self-Employed	0.061	0.017	-0.076**	0.163***
	(0.034)	(0.03)	(0.037)	(0.033)
Unemployed: Looking for Job	-0.361***	-0.265***	0.16***	-0.283***
	(0.049)	(0.047)	(0.045)	(0.06)
Unemployed: Permanently	-0.221***	-0.188***	0.113***	-0.284***
	(0.05)	(0.043)	(0.032)	(0.044)
Retired	0.045	0.068	-0.05	-0.027
	(0.04)	(0.04)	(0.036)	(0.033)
Lives: Flat Share	-0.149***	-0.087***	0.064***	-0.029
	(0.019)	(0.018)	(0.023)	(0.024)
Lives: Relatives	-0.249***	-0.171***	0.116**	-0.11***
	(0.038)	(0.039)	(0.047)	(0.04)
Lives: Other	-0.171**	-0.117	0.03	0.044
	(0.028)	(0.025)	(0.038)	(0.026)
Change in Quarterly Real GDP	-0.04	-0.054**	0.156***	-0.016
since 2008Q1	(1.887)	(2.215)	(2.262)	(1.809)
Constant	-0.009	-0.035	0.126**	0.055
	(0.039)	(0.025)	(0.053)	(0.038)
N	14,500	14,500	14,500	14,500
R^2	0.10	0.09	0.036	0.067
Controls	Yes	Yes	Yes	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (1). All regressions also control for survey mode, and include day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$

Table A3: Table 2 with Full Set of Controls

	Life Satisfaction	Happiness	Anxiety	Worthwhileness
London×2012	0.07***	0.084***	0.024	-0.044***
	(0.011)	(0.015)	(0.019)	(0.016)
2012	0.005	0.043	0.022	-0.054***
	(0.013)	(0.022)	(0.015)	(0.013)
Age	-0.03**	0.04	0.003	-0.005
	(0.014)	(0.02)	(0.017)	(0.016)
Age^2	0.001**	-0.001	-0.001	0.001
	(0.0001)	(0.002)	(0.001)	(0.001)
Log Annual Gross Household Income	0.068***	0.037***	-0.051***	0.044***
	(0.012)	(0.014)	(0.014)	(0.012)
Married	0.111***	0.227***	-0.072	-0.026
	(0.039)	(0.037)	(0.042)	(0.047)
With Partner	0.059**	0.131***	-0.041	0.015
	(0.026)	(0.028)	(0.03)	(0.022)
Separated	0.126***	0.193***	0.114**	0.027
	(0.042)	(0.054)	(0.052)	(0.051)
Divorced	0.157***	0.02	0.003	0.022
	(0.05)	(0.062)	(0.053)	(0.045)
Widowed	-0.028	0.021	-0.163	-0.105
	(0.085)	(0.116)	(0.095)	(0.073)
In School	-0.017	-0.021	0.035	0.026
	(0.031)	(0.044)	(0.046)	(0.036)
Professional Degree	0.021	0.025	-0.003	0.012
	(0.019)	(0.019)	(0.021)	(0.019)
University Degree	0.008	-0.015	0.045	0.009
	(0.021)	(0.021)	(0.023)	(0.019)
Other Higher Education Degree	0.005	-0.009	-0.001	0.005
	(0.02)	(0.019)	(0.024)	(0.017)
Part-Time Employed	-0.055**	-0.041	0.028	-0.067**
	(0.023)	(0.025)	(0.027)	(0.028)
Self-Employed	-0.037	-0.067	0.075	-0.072**
	(0.033)	(0.036)	(0.039)	(0.035)
Unemployed: Looking for Job	-0.287***	-0.176***	0.124***	-0.117***
	(0.031)	(0.035)	(0.034)	(0.032)
Unemployed: Permanently	-0.104***	-0.044	0.131***	-0.151***
	(0.033)	(0.042)	(0.049)	(0.033)
Retired	0.002	-0.036	0.095**	0.017
	(0.042)	(0.057)	(0.043)	(0.047)
Lives: Flat Share	0.001	-0.036	-0.035	0.0255
	(0.025)	(0.026)	(0.03)	(0.028)
Lives: Relatives	-0.081**	-0.033	-0.013	0.006
	(0.039)	(0.041)	(0.045)	(0.039)
Lives: Other	0.005	-0.031	0.039	0.046
	(0.037)	(0.035)	(0.043)	(0.035)
Change in Quarterly Real GDP	3.859**	3.517	2.502	1.731
since 2008Q1	(1.887)	(2.215)	(2.262)	(1.809)
Constant	-0.098	-1.228***	0.484	-0.409
	(0.30)	(0.448)	(0.428)	(0.336)
N	40,458	40,458	40,458	40,458
R^2	0.012	0.017	0.007	0.007
N of People	26,030	26,030	26,030	26,030
Controls	Yes	Yes	Yes	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (2a). All regressions also control for survey mode, and include calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$

Table A4: Table 3 with Full Set of Controls

	Life Satisfaction	Happiness	Anxiety	Worthwhileness
London×PreOlympicsPeriod$_{2012}$	0.049	0.135***	-0.146***	0.062
	(0.035)	(0.046)	(0.048)	(0.04)
London×OlympicsPeriod$_{2012}$	0.105***	0.111***	0.029	-0.019
	(0.017)	(0.023)	(0.028)	(0.021)
London×PostOlympicsPeriod$_{2012}$	0.046***	0.053***	0.042**	-0.08***
	(0.014)	(0.018)	(0.02)	(0.021)
PreOlympicsPeriod$_{2012}$	-0.003	0.018	0.089**	-0.076***
	(0.032)	(0.039)	(0.037)	(0.023)
OlympicsPeriod$_{2012}$	0.017	0.039	-0.035**	-0.043**
	(0.017)	(0.022)	(0.018)	(0.017)
PostOlympicsPeriod$_{2012}$	-0.002	0.036	0.054***	-0.059***
	(0.013)	(0.024)	(0.017)	(0.014)
Age	-0.056***	0.012	0.025	0.011
	(0.018)	(0.022)	(0.020)	(0.017)
Age^2	0.001***	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Log Annual Gross Household Income	0.074***	0.057***	-0.055***	0.049***
	(0.015)	(0.018)	(0.019)	(0.015)
Married	0.192***	0.345***	-0.061	0.001
	(0.042)	(0.050)	(0.058)	(0.065)
With Partner	0.094***	0.187***	-0.079**	0.027
	(0.031)	(0.036)	(0.037)	(0.029)
Separated	0.163**	0.176**	0.090	0.054
	(0.064)	(0.070)	(0.071)	(0.075)
Divorced	0.126	0.002	0.013	0.023
	(0.075)	(0.081)	(0.071)	(0.058)
Widowed	-0.045	0.069	-0.117	-0.156
	(0.120)	(0.167)	(0.130)	(0.098)
In School	-0.006	0.024	0.032	0.016
	(0.042)	(0.055)	(0.053)	(0.041)
Professional Degree	0.002	0.033	0.001	-0.006
	(0.022)	(0.024)	(0.026)	(0.024)
University Degree	-0.040	-0.027	0.025	-0.021
	(0.025)	(0.026)	(0.029)	(0.021)
Other Higher Education Degree	-0.040	-0.023	0.052	-0.033
	(0.027)	(0.027)	(0.031)	(0.022)
Part-Time Employed	-0.094***	-0.038	0.051	-0.065
	(0.027)	(0.030)	(0.034)	(0.036)
Self-Employed	-0.047	-0.064	0.069	0.011
	(0.043)	(0.041)	(0.049)	(0.047)
Unemployed: Looking for Job	-0.304***	-0.185***	0.123***	-0.114**
	(0.036)	(0.042)	(0.043)	(0.044)
Unemployed: Permanently	-0.059	0.022	0.060	-0.158***
	(0.040)	(0.046)	(0.054)	(0.040)
Retired	-0.012	0.039	0.078	0.098
	(0.046)	(0.046)	(0.049)	(0.052)
Lives: Flat Share	-0.002	-0.023	0.014	0.007
	(0.031)	(0.034)	(0.039)	(0.032)
Lives: Relatives	-0.077	0.014	-0.025	-0.007
	(0.040)	(0.046)	(0.058)	(0.043)
Lives: Other	0.049	-0.018	0.098	0.039
	(0.045)	(0.047)	(0.051)	(0.046)
Change in Quarterly Real GDP	1.621	-1.009	6.768**	-0.168
since 2008Q1	(2.539)	(2.938)	(3.025)	(2.361)
Constant	-0.149	-1.284***	0.651	-0.481
	(0.294)	(0.447)	(0.435)	(0.325)
N	40,458	40,458	40,458	40,458
R^2	0.013	0.017	0.009	0.008
N of People	26,030	26,030	26,030	26,030
Controls	Yes	Yes	Yes	Yes

Notes: Estimates for each measure of subjective well-being based on Equation (2b). All regressions also control for survey mode, and include day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$

Table A5: Potentially Confounding Events in the UK, France, and Germany in 2012

Date	Potentially Confounding Event
UK, 2012, July to September	
6 July	Andy Murray makes it to the final of the 2012 Wimbledon Championships Men's singles, becoming the first Briton to do so in 74 years. He is defeated at the final two days later by Roger Federer.
7 July	Britain's Jonathan Marray and Denmark's Frederik Nielsen win Wimbledon's men's doubles final by three sets to two. Marray becomes the first Briton to win such a match since 1936.
22 July	Bradley Wiggins wins the 2012 Tour de France bicycle race, the first British rider ever to do so.
12 August	Golfer Rory McIlroy wins the 2012 US PGA Championship at Kiawah Island.
10 September	Andy Murray wins the US Open Tennis Championship, the first British man to win a Grand Slam tournament since 1936.
France, 2012, July to September	
16 July 2012	The commission on renewal and ethics in public life is formed by Franois Hollande.
August	France posts zero growth in the second quarter of 2012, as in the previous two.
Germany, 2012, July to September	

Continued on next page

Continued from previous page

Date	Potentially Confounding Event
July 3	Success for German players in the Wimbledon tennis singles: in the Men's section, Florian Mayer and Philipp Kohlschreiber reach the quarter finals; in the Women's section, Sabine Lisicki reaches the quarter finals, and Angelique Kerber reaches the semi finals.
August 9 to 12	Hanse Sail in Rostock
September 15 to 19	gamescom in Cologne
September 18 to 23	photokina in Cologne
September 20 to 27	Frankfurt Motor Show in Frankfurt
September 22 to October 7	Oktoberfest in Munich
Sources:	BBC 2017, Various

Appendix B: Attrition

Accounting for attrition across the three waves is potentially important, as only 35% of wave one respondents were also interviewed in wave three; see Table B1. Attrition was somewhat more pronounced in London, where 31% of the initial sample was interviewed in wave three, compared to 38% and 37% in Paris and Berlin, respectively.

Is attrition selective? To find out, we estimate the effect of remaining in the panel on our four measures of subjective well-being. This is tantamount to asking whether "happier" individuals are more likely to remain in the panel or to drop out, and whether this differs in London relative to Paris or Berlin. Positive findings of this kind would likely bias our results.

As shown in Table B2, some selection bias is actually at play. Individuals who are happier and less anxious are more likely to remain in the panel. There is, however, no evidence of selection bias that differs across the three cities (although life satisfaction is weakly correlated to remaining in the panel in London).

Note that for all of these analyses, we make use of our entire sample, that is, all observations (stayers and drop-outs), not only those included in our main regressions. This is the reason why the sample size in these analyses differs from that in our main regressions.

Table B1: Number of Individuals Interviewed

	Wave 1	Wave 2	Wave 3
	Sample Attrition: Entire Sample		
Only Wave 1	11,165		
Only Waves 1 & 2	5,695	5,695	
Only Waves 1 & 3	139		139
All Waves	9,143	9,143	9,143
Total	26,142	14,838	9,282
% of Initial	100	56.76	35.51
	Sample Attrition: London		
Only Wave 1	4,679		
Only Waves 1 & 2	1,879	1,879	
Only Waves 1 & 3	42		42
All Waves	2,883	2,883	2,883
Total	9,483	4,762	2,925
% of Initial	100	50.22	30.84
	Sample Attrition: Paris		
Only Wave 1	3,541		
Only Waves 1 & 2	2,402	2,402	
Only Waves 1 & 3	62		62
All Waves	3,656	3,656	3,656
Total	9,661	6,058	3,718
% of Initial	100	62.71	38.48
	Sample Attrition: Berlin		
Only Wave 1	2,945		
Only Waves 1 & 2	1,414	1,414	
Only Waves 1 & 3	35		35
All Waves	2,604	2,604	2,604
Total	6,998	4,018	2,639
% of Initial	100	57.42	37.71

Notes: In Wave 1 (2011), interviews were conducted from August 8 to September 30. In Wave 2 (2012), interviews were conducted from July 20 to October 2. In Wave 3 (2013), interviews were conducted from July 23 to September 12.

Table B2: Testing for Differences in Attrition

	Life Satisfaction	Happiness	Anxiety	Worthwhile
Present (in all 3 Waves)	0.031	0.060**	-0.062**	0.030
	(0.026)	(0.027)	(0.025)	(0.025)
London	-0.106***	-0.027	0.031	-0.195***
	(0.021)	(0.021)	(0.020)	(0.020)
Paris	-0.013	0.123***	0.034	-0.263***
	(0.020)	(0.021)	(0.020)	(0.019)
Present×London	0.066	0.018	-0.047	0.032
	(0.035)	(0.036)	(0.034)	(0.034)
Present×Paris	0.012	-0.034	0.040	-0.033
	(0.032)	(0.033)	(0.033)	(0.031)
Constant	-0.007	-0.093***	-0.014	0.176***
	(0.016)	(0.017)	(0.015)	(0.015)
N	26,135	26,115	26,113	26,094
R^2	0.002	0.004	0.002	0.012
Controls	Yes	Yes	Yes	Yes

Notes: "Present" is equal to one if an individual is present in all waves, and zero otherwise. Controls include: age, age^2, gender, marital status, education level, employment status, log annual gross household income, home ownership, change in quarterly real GDP since first quarter of 2008, a dummy for survey mode, and calendar-month and day-of-week fixed effects. Robust standard errors clustered at the interview date level reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$

Table B3: Balancing Properties of Observables after Propensity-Score Matching

	Mean London	Mean Paris & Berlin Pooled	Scale-free Normalizd Difference
Age	31.65	30.492	0.056
Male	0.415	0.46	0.065
Log Annual Gross Household Income	10.448	10.246	0.188
Married	0.446	0.378	0.097
With Partner	0.14	0.185	0.087
Separated	0.019	0.021	0.01
Divorced	0.076	0.10	0.06
Widowed	0.033	0.031	0.008
In School	0.026	0.07	0.146
Professional Degree	0.149	0.142	0.014
University Degree	0.514	0.432	0.116
Other Higher Education Degree	0.142	0.255	0.202
Part-Time Employed	0.117	0.091	0.061
Self-Employed	0.084	0.052	0.091
Unemployed: Looking for Job	0.046	0.043	0.01
Unemployed: Permanently	0.084	0.04	0.129
Retired	0.166	0.191	0.047
Lives: Flat Share	0.308	0.524	0.318
Lives: Relatives	0.053	0.039	0.047
Lives: Other	0.01	0.014	0.026
N	10,438	18,624	–

Notes: The last column shows the normalized difference, calculated as $\Delta x = (\bar{x}_t - \bar{x}_c) \div \sqrt{\sigma_t^2 + \sigma_c^2}$, where $\bar{x}_t$ and $\bar{x}_c$ denote the sample mean of the covariate of the treatment and control group, respectively, and σ^2 denotes the variance. As a rule of thumb, a normalized difference greater than 0.25 indicates a non-balanced covariate, which might lead to sensitive results (Imbens and Wooldridge, 2009).

Appendix C: Additional Figures

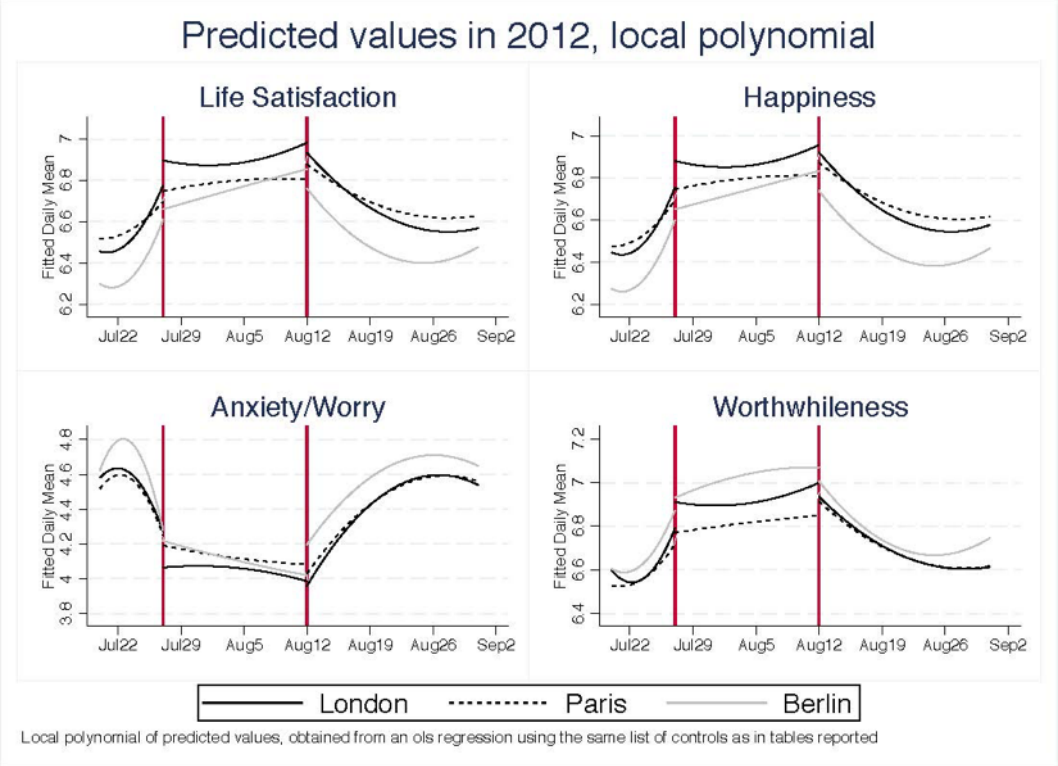

Figure C1: Subjective Well-Being in London, Paris, and Berlin in 2012

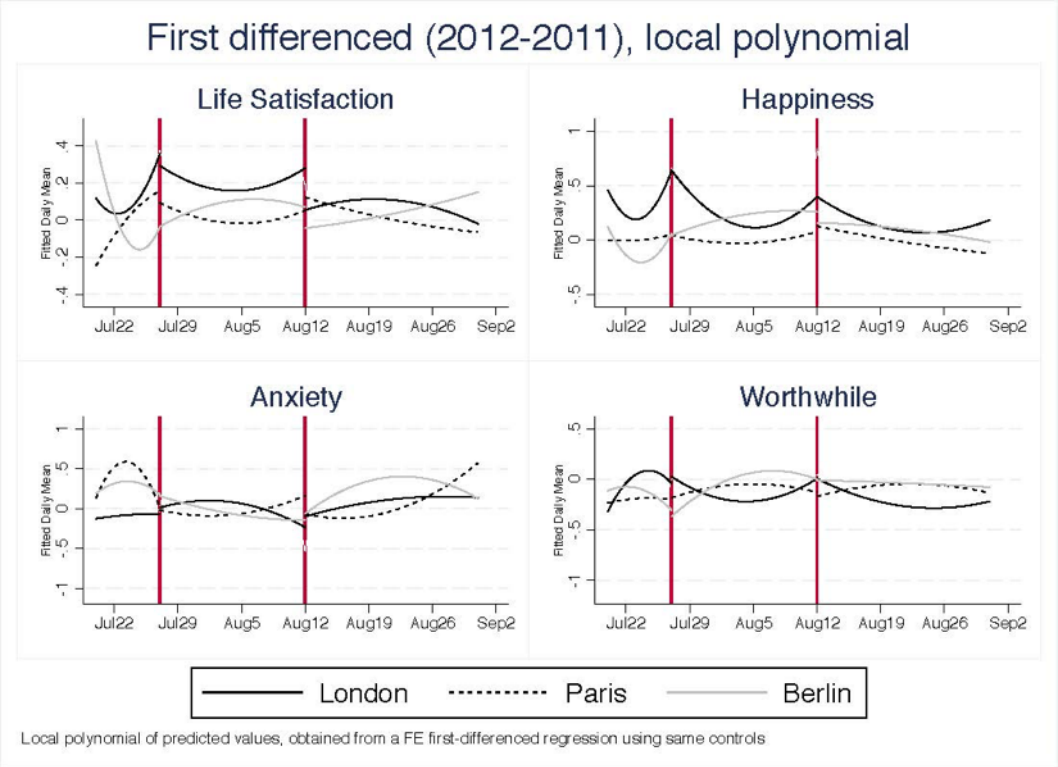

Figure C2: Changes in Subjective Well-Being Between 2012 and 2011 in London, Paris, and Berlin