

1. Data

1.1 Predictor descriptions and sources

Predictor	Description	Source
New COVID-19 cases (outcome variable)	New confirmed cases of COVID-19 (7-day average) per 1,000,000 people.	Our World in Data ¹
0-week lagged cases	New confirmed cases of COVID-19 (7-day average) per 1,000,000 people at the intervention date	Our World in Data ¹
1-week lagged cases	New confirmed cases of COVID-19 (7-day average) per 1,000,000 people one week before the intervention date	Our World in Data ¹
2-week lagged cases	New confirmed cases of COVID-19 (7-day average) per 1,000,000 people two weeks before the intervention date	Our World in Data ¹
3-week lagged cases	New confirmed cases of COVID-19 (7-day average) per 1,000,000 people three weeks before the intervention date	Our World in Data ¹
4-week lagged cases	New confirmed cases of COVID-19 (7-day average) per 1,000,000 people four weeks before the intervention date	Our World in Data ¹
Stringency index	The Government Response Stringency Index, which is a composite COVID-19 measure as of a given date based on 9 response indicators including school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100 (100 = strictest response).	Our World in Data ¹
Number of tests for COVID-19	The daily number of new tests for COVID-19 per 1,000 people (7-day average).	Our World in Data ¹
COVID-19 vaccination	The total number of people who received two doses at a given date prescribed by the vaccination protocol per 100 people in the total population.	Our World in Data ¹
Gross domestic product (GDP)	GDP per capita at purchasing power parity (constant 2011 international dollars) for the most recent year available.	Our World in Data ¹
Age	The median age of the population for 2020 (UN's population projection).	Our World in Data ¹
Human Development Index	A composite index for 2019 measuring average achievement in three basic dimensions of human development—a long and healthy life, knowledge, and a decent standard of living.	Our World in Data ¹
Life expectancy	Life expectancy at birth in 2019.	Our World in Data ¹

Number of hospital beds	The number of hospital beds per 1,000 people for the most recent year available.	Our World in Data ¹ , Government of the Hong Kong Special Administrative Region ²
Diabetes prevalence	The prevalence of diabetes (% of population aged 20 to 79) in 2017.	Our World in Data ¹
Temperature	The average daily temperature.	ClimatView ³
Precipitation	The amount of daily precipitation.	ClimatView ³
Human mobility (retail and recreation)	These are human mobility data estimated from Google users' location history data, and refer to the percentage change in mobility compared to baseline (median value from January 3 to February 6, 2020, set for each day of the week). The data is categorized into six locations, defined by Google: retail and entertainment (cafes, museums, etc.), groceries and pharmacies, parks (including public and national parks), transit stations, workplaces, and residences.	Google COVID-19 Community Mobility Reports ⁴
Human mobility (groceries and pharmacies)		Google COVID-19 Community Mobility Reports ⁴
Human mobility (transit stations)		Google COVID-19 Community Mobility Reports ⁴
Human mobility (workplaces)		Google COVID-19 Community Mobility Reports ⁴
Human mobility (parks)		Google COVID-19 Community Mobility Reports ⁴
Human mobility (residential)		Google COVID-19 Community Mobility Reports ⁴
Surface area	The country's surface area (sq. km).	World Bank ⁵
Population (0–14)	The population aged 0–14 for 2020 (% of total population).	World Bank ⁶
Population (65–)	The population aged 65 and above for 2020 (% of total population).	World Bank ⁷
Population density	The number of people per sq. km of land area for 2020.	World Bank ⁸
PM2.5	The mean annual exposure to PM2.5 air pollution for 2017 (micrograms per cubic meter).	World Bank ⁹ , and The Hong Kong University of Science and Technology ¹⁰
Infant mortality rate	The infant mortality rate for 2019 (per 1,000 live births).	World Bank ¹¹ , and Macrotrends LLC ¹²
Health expenditure	The health expenditure for 2018 (% of GDP).	World Bank ¹³ , and Macrotrends LLC ¹⁴

Unemployment rate	The unemployment rate for 2020 (% of total labor force) (ILO estimate).	World Bank ¹⁵
International migrant stock	The international migrant stock for 2015 (% of population), which represents the total number of international migrants present in a given country at a particular point in time (% of population).	World Bank ¹⁶
Household size	The average household size for 2019 (number of members).	United Nations ¹⁷
Electoral democracy index	The aggregated index (scaled between 0 and 1) of five democratic traits: freedom of association, free and fair elections, freedom of expression, elected officials, and suffrage.	Varieties of Democracy (V-Dem) data set, version 10 ¹⁸
Asia flag	Whether the country belongs to the Asian region defined in Our World in Data: Hong Kong, Indonesia, Israel, Malaysia, South Korea, Thailand, Turkey, Vietnam	Our World in Data ¹

1.2 Summary statistics of predictors during the study period (June 25 – August 13, 2021) in Japan and the countries in the donor pool

Predictor	Japan		Control countries	
	Mean (Standard deviation)	Median [Min, Max]	Mean (Standard deviation)	Median [Min, Max]
New COVID-19 cases	43.62 (37.51)	25.42 [11.66, 123.32]	107.74 (118.61)	61.93 [0.11, 699.68]
Stringency index	51.18 (1.23)	50.46 [50.46, 53.24]	53.77 (15.68)	50.93 [22.22, 92.59]
Number of tests for COVID-19	0.52 (0.11)	0.47 [0.39, 0.73]	3.94 (6.48)	2.47 [0.11, 49.17]
COVID-19 vaccination	23.17 (7.18)	23.06 [11.46, 36.83]	30.79 (19.60)	32.80 [0.15, 78.32]
Gross domestic product (GDP)	39002.22	39002.22	30338.88 (15640.25)	29502.76 [6171.88, 67335.29]
Age	48.20	48.20	37.78 (6.34)	39.65 [22.90, 47.90]
Human Development Index	0.92	0.92	0.86 (0.08)	0.88 [0.66, 0.96]
Life expectancy	84.63	84.63	78.80 (3.70)	78.80 [71.72, 84.86]
Number of hospital beds	13.05	13.05	4.03 (2.44)	3.09 [0.60, 12.27]
Diabetes prevalence	5.72	5.72	7.15 (2.66)	6.81 [3.28, 16.74]
Temperature	25.62 (1.79)	25.49 [22.61, 28.60]	20.82 (6.15)	20.80 [4.56, 33.40]
Precipitation	10.99 (8.63)	8.71 [1.24, 41.53]	2.95 (4.96)	1.35 [0.00, 68.00]
Human mobility (retail and recreation)	-6.42 (6.50)	-8.12 [-13.85, 18.33]	1.63 (19.98)	1.55 [-60.94, 93.88]
Human mobility (groceries and pharmacies)	7.18 (3.51)	7.23 [1.06, 16.60]	21.92 (21.01)	19.44 [-87.09, 188.38]

Human mobility (transit stations)	-19.37 (4.88)	-18.66 [-31.08, -9.38]	-7.09 (32.80)	-6.97 [-74.88, 215.88]
Human mobility (workplaces)	-12.90 (13.83)	-8.12 [-58.35, -4.62]	-16.99 (16.43)	-17.27 [-78.80, 24.90]
Human mobility (parks)	0.24 (13.03)	-0.65 [-19.04, 48.52]	51.36 (79.82)	45.40 [-67.10, 437.75]
Human mobility (residential)	5.78 (3.89)	4.62 [1.67, 19.77]	3.14 (6.61)	3.20 [-14.32, 33.82]
Surface area	377974.00	377974.00	1630627.43 (3545524.20)	262040.00 [320.00, 17098250.00]
Population (0-14)	12.45	12.45	19.41 (5.06)	18.02 [12.54, 33.34]
Population (65-)	28.40	28.40	14.99 (5.27)	16.29 [5.04, 23.30]
Population density	345.23	345.23	328.08 (1093.46)	101.40 [3.34, 7125.52]
PM2.5	11.70	11.70	16.09 (7.55)	14.40 [5.96, 44.31]
Infant mortality rate	1.80	1.80	6.97 (5.68)	4.45 [1.26, 23.50]
Health expenditure	10.95	10.95	7.91 (2.63)	7.68 [2.87, 16.89]
Unemployment rate	2.97	2.97	6.95 (3.30)	6.12 [1.02, 16.85]
International migrant stock	1.61	1.61	10.17 (9.02)	8.99 [0.08, 38.95]
Household size	2.33	2.33	2.98 (0.73)	2.71 [2.10, 4.81]
Electoral democracy index	0.73	0.73	0.61 (0.23)	0.72 [0.10, 0.86]

1.3 Balance table of Japan and the countries in the donor pool

Predictor	Japan	Counterfactual values in Japan	Control countries*
4-week lagged cases	11.7	11.1	80.7
3-week lagged cases	12.1	11.1	77.9
2-week lagged cases	14.5	13.9	83.1
1-week lagged cases	20.9	21.2	103.3
0-week lagged cases	31.3	31.9	116.4
Stringency index	51.7	65.5	54.0
Number of tests for COVID-19	0.5	3.1	3.8
COVID-19 vaccination	18.7	35.0	27.6
Gross domestic product (GDP) per capita	39002.2	44083.9	30338.9
Age	48.2	46.1	37.8
Human Development Index	0.9	0.9	0.9
Life expectancy	84.6	82.3	78.8
Number of hospital beds	13.1	6.4	4.0
Diabetes prevalence	5.7	7.6	7.1
Temperature	24.8	22.0	20.8
Precipitation	10.3	4.4	3.0
Human mobility (retail and recreation)	-6.9	-0.2	0.0
Human mobility (groceries and pharmacies)	6.1	24.4	21.0
Human mobility (transit stations)	-19.6	-5.3	-8.6
Human mobility (workplaces)	-10.3	-10.2	-16.9
Human mobility (parks)	-1.3	98.2	47.7
Human mobility (residential)	4.9	2.8	3.0
Surface area	377974.0	276711.9	1630627.4
Population (0-14)	12.4	13.6	19.4
Population (65-)	28.4	20.8	15.0

Population density	345.2	1628.5	328.1
PM2.5	11.7	16.8	16.1
Infant mortality rate	1.8	2.9	7.0
Health expenditure	11.0	9.5	7.9
Unemployment rate	3.0	5.4	6.9
International migrant stock	1.6	18.2	10.2
Household size	2.3	2.4	3.0
Electoral democracy index	0.7	0.7	0.6
Asia	1.0	0.3	0.2

* the weighted average of each country with the estimated country-specific weights

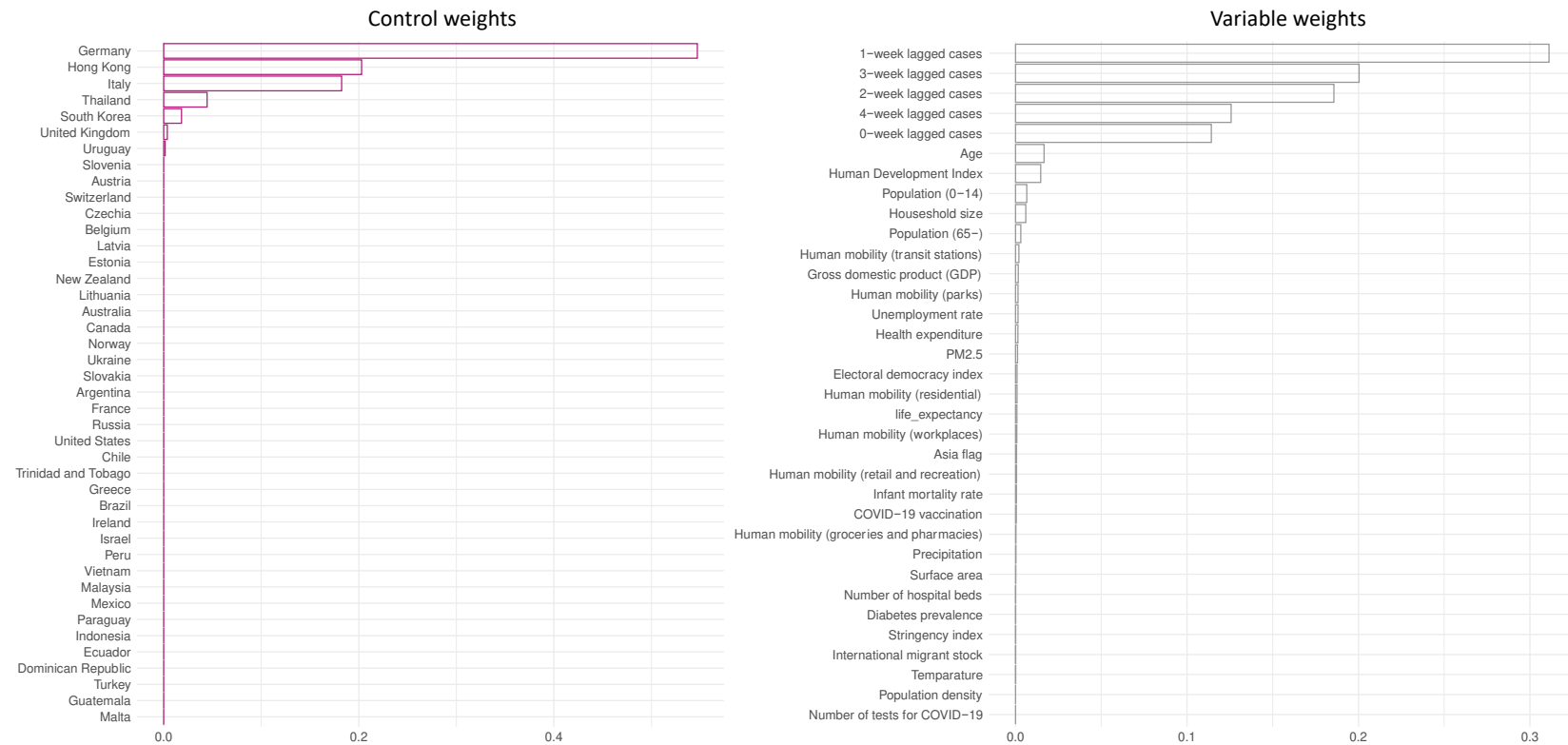
2 Detailed values of the estimated weights in Supplementary figure 1

Unit	Weight	Type
Argentina	0.000000	Control Unit Weights (W)
Australia	0.000000	Control Unit Weights (W)
Austria	0.000000	Control Unit Weights (W)
Belgium	0.000000	Control Unit Weights (W)
Brazil	0.000000	Control Unit Weights (W)
Canada	0.000000	Control Unit Weights (W)
Chile	0.000000	Control Unit Weights (W)
Czechia	0.000000	Control Unit Weights (W)
Dominican Republic	0.000000	Control Unit Weights (W)
Ecuador	0.000000	Control Unit Weights (W)
Estonia	0.000000	Control Unit Weights (W)
France	0.000000	Control Unit Weights (W)
Germany	0.546934	Control Unit Weights (W)
Greece	0.000000	Control Unit Weights (W)
Guatemala	0.000000	Control Unit Weights (W)
Hong Kong	0.202785	Control Unit Weights (W)
Indonesia	0.000000	Control Unit Weights (W)
Ireland	0.000000	Control Unit Weights (W)
Israel	0.000000	Control Unit Weights (W)
Italy	0.182394	Control Unit Weights (W)
Latvia	0.000000	Control Unit Weights (W)
Lithuania	0.000000	Control Unit Weights (W)
Malaysia	0.000000	Control Unit Weights (W)
Malta	0.000000	Control Unit Weights (W)
Mexico	0.000000	Control Unit Weights (W)
New Zealand	0.000000	Control Unit Weights (W)
Norway	0.000000	Control Unit Weights (W)
Paraguay	0.000000	Control Unit Weights (W)
Peru	0.000000	Control Unit Weights (W)
Russia	0.000000	Control Unit Weights (W)
Slovakia	0.000000	Control Unit Weights (W)
Slovenia	0.000000	Control Unit Weights (W)
South Korea	0.018249	Control Unit Weights (W)
Switzerland	0.000000	Control Unit Weights (W)
Thailand	0.044508	Control Unit Weights (W)
Trinidad and Tobago	0.000000	Control Unit Weights (W)
Turkey	0.000000	Control Unit Weights (W)
Ukraine	0.000000	Control Unit Weights (W)
United Kingdom	0.003632	Control Unit Weights (W)
United States	0.000000	Control Unit Weights (W)

Uruguay	0.001498	Control Unit Weights (W)
Vietnam	0.000000	Control Unit Weights (W)
Human mobility (groceries and pharmacies)	0.000258	Variable Weights (V)
Number of tests for COVID-19	0.000020	Variable Weights (V)
Human mobility (parks)	0.001486	Variable Weights (V)
COVID-19 vaccination	0.000426	Variable Weights (V)
Precipitation	0.000244	Variable Weights (V)
Human mobility (residential)	0.000899	Variable Weights (V)
Human mobility (retail and recreation)	0.000564	Variable Weights (V)
Stringency index	0.000080	Variable Weights (V)
Temperature	0.000062	Variable Weights (V)
Human mobility (transit stations)	0.001947	Variable Weights (V)
Human mobility (workplaces)	0.000716	Variable Weights (V)
Asia dummy	0.000612	Variable Weights (V)
0-week lagged cases	0.114212	Variable Weights (V)
Health expenditure	0.001406	Variable Weights (V)
Electoral democracy index	0.000915	Variable Weights (V)
Diabetes prevalence	0.000094	Variable Weights (V)
Gross domestic product (GDP) per capita	0.001646	Variable Weights (V)
Number of hospital beds	0.000115	Variable Weights (V)
Household size	0.006016	Variable Weights (V)
Human development index	0.014728	Variable Weights (V)
Life expectancy	0.000825	Variable Weights (V)
Median age	0.016651	Variable Weights (V)
International migrant stock	0.000065	Variable Weights (V)
Infant mortality rate	0.000539	Variable Weights (V)
PM2.5	0.001206	Variable Weights (V)
Population (0-14)	0.006568	Variable Weights (V)
Population (65-)	0.003053	Variable Weights (V)
Population density	0.000025	Variable Weights (V)
Surface area	0.000144	Variable Weights (V)
Unemployment rate	0.001469	Variable Weights (V)
3-week lagged cases	0.200372	Variable Weights (V)
2-week lagged cases	0.185709	Variable Weights (V)
1-week lagged cases	0.311175	Variable Weights (V)
4-week lagged cases	0.125753	Variable Weights (V)

Supplementary figure 1: Estimated weights by (Left) countries in the donor pool and (Right) predictors.

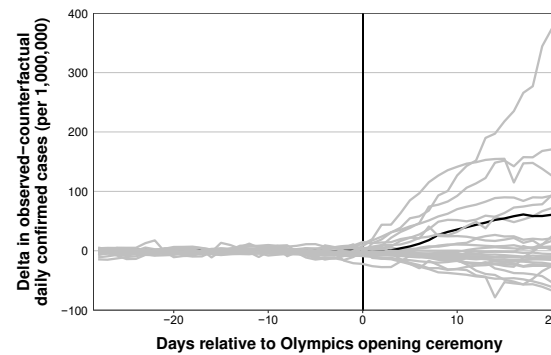
The weights were estimated using the conjugate gradient optimization method to attain the smallest mean squared prediction error (MSPE) during the pre-intervention period.



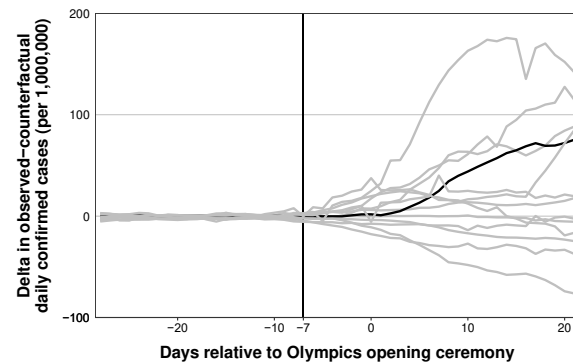
Supplementary figure 2: Placebo synthetic controls by permutating Japan and other countries in the donor pool.

We pruned any placebos that poorly fit the data in the pre-intervention period. If a placebo control has a mean squared prediction error that is 10 times greater than that of Japan, it has been removed from the corresponding figure.

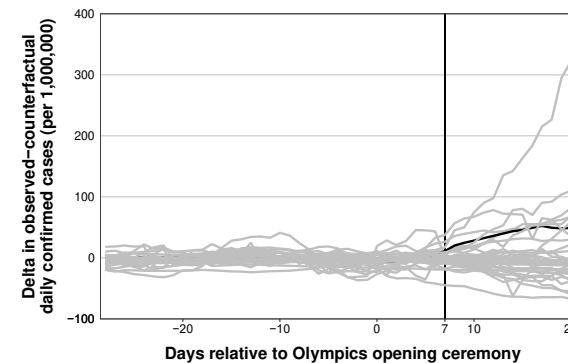
(A): The intervention timing: day of the opening ceremonies



(B): The intervention timing: -7 days before the opening ceremonies



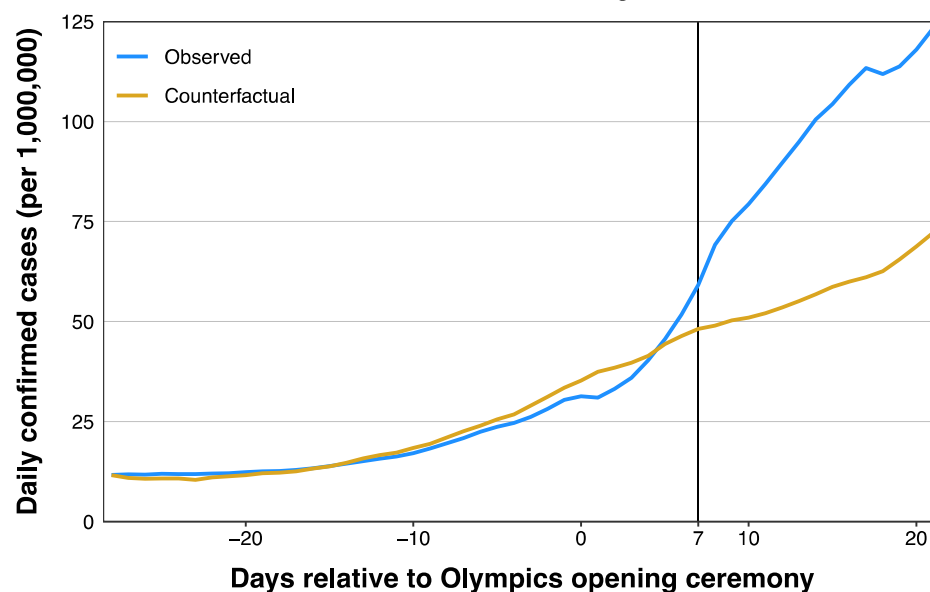
(C): The intervention timing: +7 days after the opening ceremonies



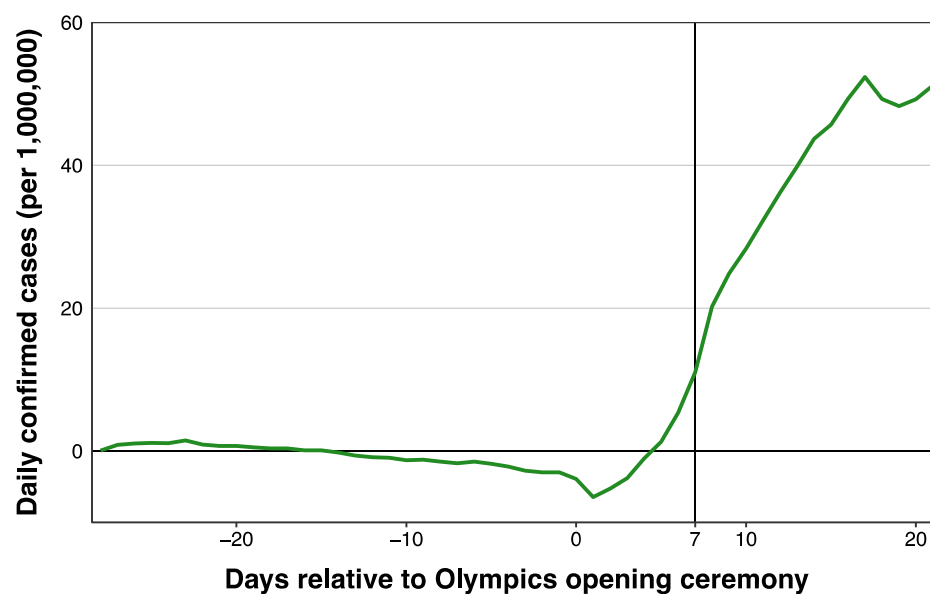
Supplementary figure 3: Observed and counterfactual daily confirmed COVID-19 cases per million people in which counterfactuals were constructed using +7 days after the opening ceremonies as the intervention timing.

Supplementary figure 3A shows the observed and counterfactual trajectories of daily cases per 1,000,000. Supplementary figure 3B shows the differential between the observed and counterfactual trajectories.

A. Observed and counterfactual trajectories



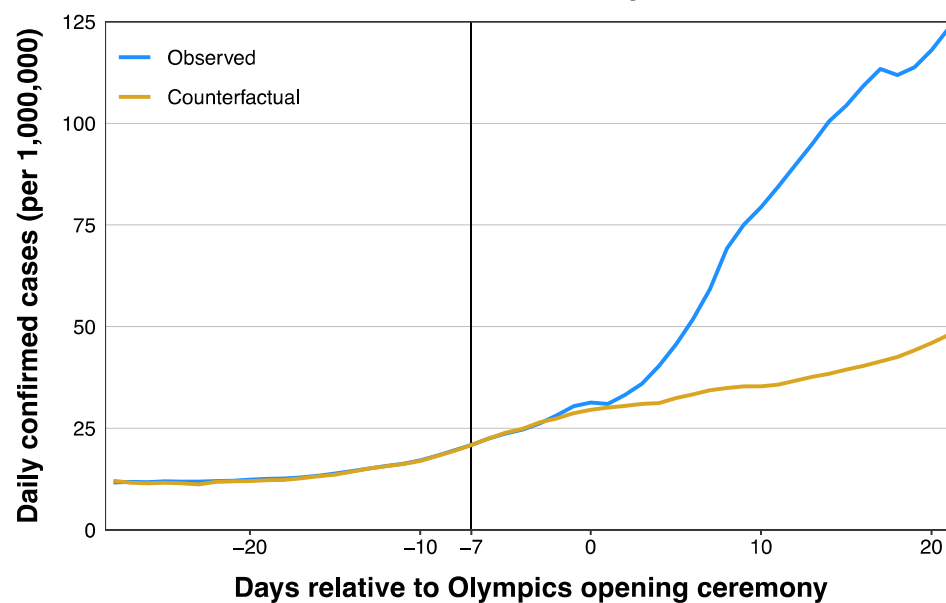
B. Difference between observed and counterfactual



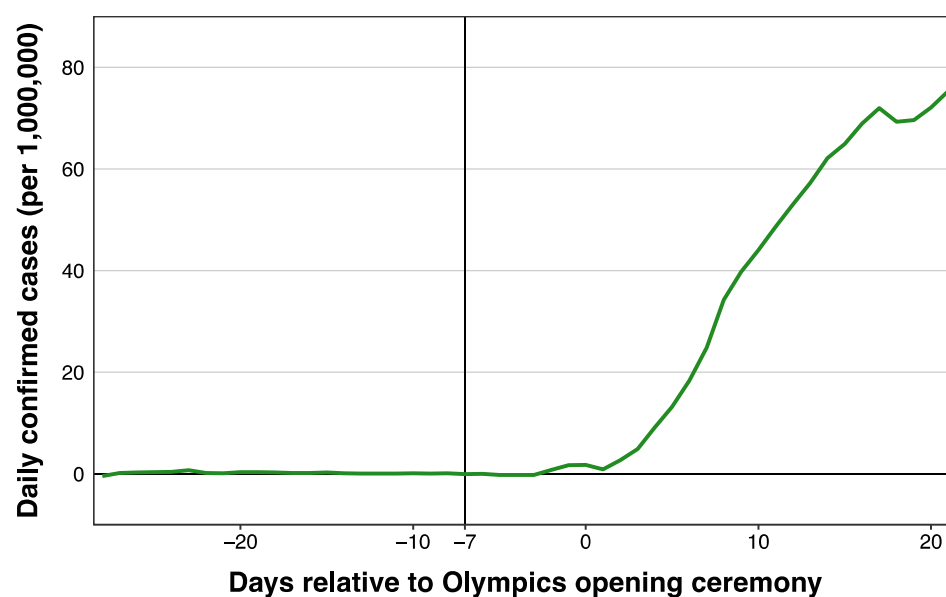
Supplementary figure 4: Observed and counterfactual daily confirmed COVID-19 cases per million people in which counterfactuals were constructed using -7 days before the opening ceremonies as the intervention timing.

Supplementary figure 4A shows the observed and counterfactual trajectories of daily cases per 1,000,000. Supplementary figure 4B shows the differential between the observed and counterfactual trajectories.

A. Observed and counterfactual trajectories



B. Difference between observed and counterfactual



References

1. Our World in Data. COVID-19-data. Oxford: Our World in Data; 2020 [Available from: <https://github.com/owid/covid-19-data/tree/master/public/data> accessed December 17, 2021.
2. Health Bureau of the Government of the Hong Kong Special Administrative Region. Statistics – Health Care Resources. 2021 [Available from: https://www.healthbureau.gov.hk/statistics/en/health_statistics.htm accessed December 17, 2021.
3. Japan Meteorological Agency. Global weather data tool (ClimatView daily values) [Japanese]. Tokyo: Japan Meteorological Agency; [Available from: <https://www.data.jma.go.jp/gmd/cpd/monitor/dailyview/index.php> accessed December 17, 2021.
4. Google. COVID-19 Community Mobility Reports. California: Google; 2020 [Available from: <https://www.google.com/covid19/mobility/> accessed December 17, 2021.
5. World Bank. Surface area (sq. km). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/AG.SRF.TOTL.K2> accessed December 17, 2021.
6. World Bank. Population ages 0-14 (% of total population). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/SP.POP.0014.TO.ZS> accessed December 17, 2021.
7. World Bank. Population ages 65 and above (% of total population). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS> accessed December 17, 2021.
8. World Bank. Population density (people per sq. km of land area). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/EN.POP.DNST> accessed December 17, 2021.
9. World Bank. PM2.5 air pollution, mean annual exposure (micrograms per cubic meter). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/EN.ATM.PM25.MC.M3> accessed December 17, 2021.
10. The Hong Kong University of Science and Technology. Final Report for Chemical Speciation of PM2.5 Filter Samples. The Hong Kong University of Science and Technology; 2018 [Available from: https://www.epd.gov.hk/epd/sites/default/files/epd/english/environmentinhk/air/studyreports/files/final_report_mvtmpms_2017.pdf accessed December 17, 2021.
11. World Bank. Mortality rate, infant (per 1,000 live births). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/SP.DYN.IMRT.IN> accessed December 17, 2021.

12. Macrotrends LLC. Hong Kong Infant Mortality Rate 1950-2022. [Available from: <https://www.macrotrends.net/countries/HKG/hong-kong/infant-mortality-rate> accessed December 17, 2021.
13. World Bank. Current health expenditure (% of GDP). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS> accessed December 17, 2021.
14. Health Bureau of the Government of the Hong Kong Special Administrative Region. Statistics – Domestic Health Accounts. 2021 [Available from: https://www.healthbureau.gov.hk/statistics/en/dha/dha_summary_report.htm accessed December 17, 2022.
15. World Bank. Unemployment, total (% of total labor force) (modeled ILO estimate). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS> accessed December 17, 2021.
16. World Bank. International migrant stock (% of population). Washington, DC.: World Bank; [Available from: <https://data.worldbank.org/indicator/SM.POP.TOTL.ZS> accessed December 17, 2021.
17. United Nations. Household size and composition. New York: United Nations; [Available from: <https://www.un.org/development/desa/pd/data/household-size-and-composition> accessed December 17, 2021.
18. Coppedge Michael, John Gerring, Carl Henrik Knutsen, et al. V-Dem Dataset - Version 10. Gothenburg: V-Dem Institute; [Available from: <https://doi.org/10.23696/vdemds20> accessed December 17, 2021.