CESA Working Paper

No. 20 | 2026

Did reunification affect CO2 emissions in West Germany?

Panagiotis Orfanidis[a] and Hendrik Sonnabend[a]

a FernUniversität in Hagen

FernUniversität in Hagen

Did reunification affect CO_2 emissions in West Germany?

Panagiotis Orfanidis* Hendrik Sonnabend†

This version: March 2026

Abstract

This paper examines the causal impact of German reunification on per-capita CO_2 emissions in West Germany. We construct a "synthetic West Germany" from OECD countries (1971–2003) that closely matches pre-1990 emissions and predictors. We find that after reunification, emissions fall persistently below this synthetic benchmark. Specifically, by 2000, reunification is associated with a reduction of roughly 2.79 metric tons of CO_2 per-capita – about a 21% decline. The divergence emerges gradually over the 1990s rather than as an immediate break in 1990, consistent with gradual structural adjustment. Placebo-in-space/time tests support the interpretation of a genuine effect.

JEL classification: Q54, N34, C23

Keywords: German reunification; Synthetic control method; Political transformation; Climate co-benefits; CO_2 emissions per-capita

*University of Hagen, Department of Economics and Business Administration, Hagen, Germany.

† hendrik.sonnabend@fernuni-hagen.de, University of Hagen, Department of Economics and Business Administration, Hagen, Germany.

1 Introduction

The 1990 German reunification is widely regarded as one of the most consequential political and economic transformations in post-war Europe. The integration of the German Democratic Republic (GDR) into the Federal Republic of Germany (FRG) reshaped institutional frameworks, production structures, and patterns of energy use in both parts of the country. In West Germany, reunification triggered substantial fiscal transfers, shifts in trade and investment, and adjustments in labour and product markets. At the same time, the collapse of heavy industry and outdated production facilities in the former GDR, combined with extensive modernisation of infrastructure and regulation, had the potential to influence Germany's greenhouse gas emissions.

From the perspective of West Germany, the environmental implications of reunification are a priori ambiguous. The fiscal and economic burden of integration may have dampened growth and energy demand, reducing emissions per-capita. Conversely, stronger economic ties with the eastern states, changes in the sectoral composition of output, and the relocation of production could have increased the carbon intensity of economic activity in the West. Moreover, reunification coincided with broader developments such as European market integration and the emergence of international climate policy, complicating simple before-after comparisons.

Despite an extensive literature on the economic and social consequences of reunification, its environmental impact has received comparatively little systematic causal analysis. Existing research has largely focused on macroeconomic aggregates, labour markets, and public finances, while the evolution of CO_2 emissions has mostly been discussed descriptively. To fill this gap, we ask whether German reunification causally reduced per-capita CO_2 emissions in West Germany. Using the synthetic control method (SCM) on OECD data (1971–2003), we build a 'synthetic West Germany' that matches pre-1990 emissions and key predictors. The post-1990 divergence between actual and synthetic emissions is interpreted as the causal effect of reunification. Focusing on this environmental outcome adds an ecological dimension to the literature and allows for a quantification of both the magnitude and the time profile of reunification-related emission changes.

2 Data and Methodology

2.1 Data

The empirical analysis is based on an unbalanced panel of OECD countries covering 1971–2003. West Germany serves as the treated unit, while a set of high-income OECD economies forms the donor pool. The sample starts in 1971 to ensure sufficient pre-treatment observations and extends to 2003 to capture more than a decade of post-reunification adjustment, while maintaining consistent data availability across countries.

The main outcome variable is per-capita CO_2 emissions, measured in metric tons. For Germany, emissions are assembled from official national sources that allow distinguishing between West and East Germany. For all other OECD countries, data are drawn from international statistical agencies and harmonised with the German series to ensure temporal comparability across units. In addition, total greenhouse gas emissions per-capita (measured in CO_2 equivalents) enter the synthetic control procedure as an additional predictor, while CO_2 emissions per-capita remain the main outcome of interest.

To improve the credibility of the synthetic control, several predictors of CO_2 emissions are included in the matching stage. These predictors comprise real GDP per-capita (in 2002 purchasing power parity terms, PPP), the consumer price inflation rate, the share of industry in total output, and the number of passenger cars per 1,000 inhabitants (see the Appendix for data sources and definitions). The first two variables capture overall economic conditions and price dynamics. The latter two are defined as single-year values in 1985 and proxy the structure and intensity of industrial production and transport.

The donor pool consists of OECD economies with sufficiently long and reliable time series on emissions, macroeconomic indicators and structural variables, and which did not experience a comparable political integration shock during the sample period (see the Appendix for details). Excluding such cases reduces the risk of contamination and ensures that the synthetic control provides a credible approximation of West Germany's emission trajectory in the absence of reunification.

2.2 Synthetic Control Design

The causal effect of German reunification on CO_2 emissions per-capita in West Germany is evaluated using the SCM for comparative case studies (Abadie and Gardeazabal, 2003; Abadie et al., 2010). The basic idea is to approximate the pre-1990 emissions trajectory of West Germany by a convex combination of donor countries, referred to as 'synthetic West Germany'. Donor weights are chosen such that the synthetic unit closely reproduces West Germany's pre-treatment path of CO_2 emissions per-capita as well as the vector of predictor means.

Formally, the pre-treatment period spans 1971–1989, with 1990 treated as the first post-treatment year. Let Y_{1t} denote West Germany's CO_2 emissions per-capita in year t, and let Y_{0t}^W denote the corresponding weighted average of donor-country outcomes. The synthetic control weights are obtained by minimising the root mean squared prediction error (RMSPE) between Y_{1t} and Y_{0t}^W over the pre-treatment period, subject to the constraints that weights are non-negative and sum to one (Abadie, 2021). The resulting synthetic unit provides an estimate of the counterfactual emissions trajectory that West Germany would have followed in the absence of reunification (see the Appendix for more details on the SCM).

The treatment effect of reunification is then given by the difference between actual and synthetic emissions after 1990. Year-specific effects are calculated as $Y_{1t} - Y_{0t}^W$ for all $t \geq 1990$, while longer-run average effects are obtained by aggregating these annual gaps. The main analysis reports the magnitude of the emissions reduction roughly a decade after reunification and interprets it relative to the synthetic benchmark.

Inference follows the standard practice in the synthetic control literature and is based on placebo experiments in time and space (Abadie et al., 2010, 2015; Chen and Yan, 2023). Placebo-in-space exercises reassign the treatment to each donor country in turn, constructing a synthetic counterfactual for each and comparing the resulting gaps to those observed for West Germany. Placebo-in-time exercises shift the intervention date within West Germany to a pre-reunification year and recompute the synthetic control. Together, these procedures provide a benchmark for assessing whether the observed post-1990 divergence between West Germany and its synthetic counterpart is unusually large relative to what could arise from random fluctuations or unrelated shocks.

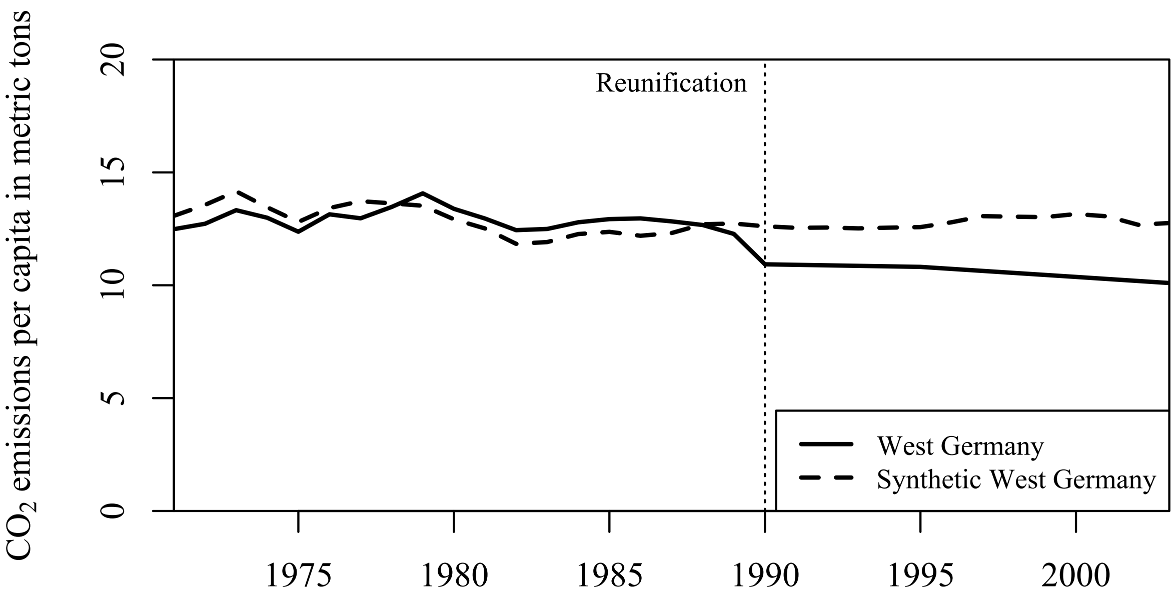
3 Results

Figure 1 shows the evolution of per-capita CO_2 emissions in West Germany and its synthetic counterpart from 1971 to 2003. In the pre-treatment period up to 1989, the synthetic control closely replicates West Germany's emissions trajectory. Both levels and trends align closely, resulting in a very small pre-treatment prediction error. This close fit supports the interpretation of the synthetic control as a credible estimate of the counterfactual emissions path in the absence of reunification.

After 1990, the two series begin to diverge. While emissions in synthetic West Germany tend to continue along their pre-treatment trajectory, actual West German emissions decline more strongly. The gap between the two paths widens gradually throughout the 1990s and stabilises at a lower level thereafter. This pattern suggests that reunification is associated with a persistent downward shift in per-capita CO_2 emissions relative to the synthetic benchmark.

The magnitude of the effect becomes clear when considering the level difference around one decade after reunification. By the year 2000, West German emissions per-capita are about 2.79 metric tons lower than those of synthetic West Germany, corresponding to a reduction of roughly 21 percent relative to the counterfactual path. Given the size of the

Figure 1: CO_2 emissions per-capita: West Germany vs. synthetic control, 1971–2003.



Notes: The solid line shows CO_2 emissions per-capita in West Germany. The dashed line shows emissions for the synthetic control unit, constructed as a weighted average of OECD donor countries. The vertical line marks 1990, the year of German reunification. Emissions are measured in metric tons of CO_2 per-capita.

West German population, this implies substantial cumulative emission savings over the 1990s. The estimated effect is therefore not only statistically meaningful but also economically and environmentally sizeable.

The temporal pattern of the treatment effect is consistent with a gradual adjustment process. There is no evidence of an immediate, discrete break in 1990. Instead, the emissions gap opens slowly over several years as structural changes in production, energy use, and regulation take effect. This trajectory aligns with the interpretation of reunification as a deep economic and institutional transformation with delayed but persistent consequences for the carbon intensity of economic activity.

Our findings are robust to several modifications of the empirical design. Alternative predictor sets, leave-one-out routines, and moderate variations in the pre-treatment window all yield synthetic controls with similarly good pre-1990 fit and comparable post-treatment emission gaps. Additional robustness checks with placebos in time and space support our conclusion that the divergence between West Germany and its synthetic counterpart reflects a genuine effect of reunification rather than a modelling artefact or random fluctuation (see the Appendix for details).

4 Discussion

Our results show that German reunification was followed by a sizeable and persistent reduction in per-capita CO_2 emissions in West Germany relative to a synthetic control constructed from other OECD countries. Around a decade after reunification, emissions in West Germany are substantially lower than in the synthetic benchmark, implying cumulative emission savings of economically and environmentally meaningful magnitude. This adds an environmental dimension to the established narrative of reunification as a major political, economic and social turning point in post-war Germany. It also suggests that deep political and economic integration can generate substantial climate co-benefits – even in the absence of an explicit climate policy focus at the time.

Importantly, the pattern is not a mechanical GDP-driven artefact: despite a post-reunification growth slowdown, West German GDP per-capita continues to rise throughout the 1990s (see Abadie et al., 2015), whereas per-capita CO_2 emissions decline (the synthetic path remains broadly flat), implying that structural and regulatory changes beyond output contraction must be at work to account for the observed divergence.

Several mechanisms likely contributed to the gradual decline in emissions per-capita. The macroeconomic slowdown and industrial restructuring associated with reunification reduced energy-intensive activity and shifted the composition of output towards less carbon-intensive sectors. Simultaneously, modernisation of the energy system and the replacement of older, emission-intensive technologies and fuels lowered the carbon content of energy supply. These developments interacted with rising environmental awareness and the tightening of environmental regulation in Germany and Europe, reinforcing incentives to reduce emissions. Demographic factors, such as changes in population growth and household structure, might also have played a role, although they are unlikely to explain the full magnitude of the estimated effect.

References

Abadie, A. (2021). Using synthetic controls: Feasibility, data requirements, and methodological aspects. *Journal of Economic Literature*, 59(2):391–425.

Abadie, A., Diamond, A., and Hainmueller, J. (2010). Synthetic control methods for comparative case studies: Estimating the effect of california's tobacco control program. *Journal of the American Statistical Association*, 105(490):493–505.

Abadie, A., Diamond, A., and Hainmueller, J. (2015). Comparative politics and the synthetic control method. *American Journal of Political Science*, 59(2):495–510.

Abadie, A. and Gardeazabal, J. (2003). The economic costs of conflict: A case study of the basque country. *American Economic Review*, 93(1):113–132.

Chen, Q. and Yan, G. (2023). A mixed placebo test for synthetic control method. *Economics Letters*, 224:111004.

Appendix
"Did reunification lower CO_2 emissions in West Germany?"

Panagiotis Orfanidis* Hendrik Sonnabend†

1 Data sources

This section provides additional details on the data used in the main analysis. The outcome variable is CO_2 emissions per capita, measured in metric tons of CO_2 per capita. For Germany, series for GDP, inflation rate, share of industry, CO_2 and total greenhouse gas (GHG) emissions are obtained from the Federal Statistical Office (Destatis) for the pre-treatment period and official national sources compiled via the Statistical Offices of the Federation and the Laender (Statistikportal) that allow a West/East distinction for emissions for the post-treatment period. For the remaining OECD countries, CO_2 emissions are taken from the International Energy Agency (Report of 2024), and macroeconomic indicators from the World Bank DataBank. The number of passenger cars per 1,000 inhabitants is taken from Dargay et al. (2007). All series are harmonised to ensure consistency of units and coverage over time.

The predictor set used in the synthetic control comprises two types of variables. First, standard predictors, such as CO_2 and total greenhouse gas (GHG) emissions per capita, GDP per capita (PPP, 2002 USD), and the consumer price inflation rate, enter as pre-treatment averages over 1971–1989. Second, we include two special predictors measured in

*University of Hagen, Department of Economics and Business Administration, Hagen, Germany.

† hendrik.sonnabend@fernuni-hagen.de, University of Hagen, Department of Economics and Business Administration, Hagen, Germany.

a single pre-treatment year, 1985: the industry share in value added and passenger cars per 1,000 inhabitants. Choosing 1985 – close to, but clearly before, reunification – improves the match of the late-1980s emissions path and better reproduces West Germany's pre-reunification economic structure. The donor pool consists of high-income OECD economies with sufficiently long and reliable series on emissions and key macroeconomic indicators. Table 1 lists the treated unit and all donor countries and reports average pre-treatment values of CO_2 emissions per capita and selected predictors.

Table 1: Treated unit and donor countries – pre-treatment characteristics in 1985

Country	CO_2	GHG	Industry Share	Inflation Rate	Cars ‰	GDP
West Germany	12.93	17.02	39.39	2.07	253	23557
Australia	13.94	25.50	35.07	6.73	447	22340
Austria	6.96	10.54	30.94	3.19	257	21414
Belgium	10.25	14.11	34.21	4.87	272	20615
Denmark	11.94	15.61	22.73	4.68	264	28772
France	6.21	9.83	25.39	5.83	339	20445
Greece	5.43	8.47	30.46	19.31	95	12326
Italy	6.04	8.21	34.90	9.21	231	18801
Japan	7.16	9.38	39.59	2.03	150	24781
Netherlands	9.55	14.39	29.21	2.26	205	23523
New Zealand	5.78	13.18	33.69	15.42	445	19620
Norway	6.36	21.14	35.70	5.71	259	29913
Portugal	2.37	4.26	32.82	19.46	239	9124
Spain	4.45	6.80	36.21	8.81	126	12750
Switzerland	6.39	8.67	32.01	3.44	283	59377
UK	9.61	13.26	39.76	6.07	301	20597
USA	18.93	24.72	30.86	3.55	611	27776

Notes: CO_2 and GHG denote CO_2 and total greenhouse gas emissions per capita in metric tons of CO_2-equivalent. 'Industry Share' is the share of industry in gross value added in percent. 'Inflation Rate' is the annual consumer price inflation in percent. 'Cars ‰' is the number of passenger cars per 1,000 inhabitants. 'GDP' is the real GDP per capita in 2002 PPP-adjusted US dollars.

Table 2 reports pre-treatment averages of the predictors for West Germany, the OECD donor sample, and the synthetic West Germany. The synthetic unit closely reproduces West Germany's average CO_2 and greenhouse gas emissions per capita, while larger deviations remain for GDP per capita and passenger cars per 1,000 inhabitants. This pattern is consistent with the SCM design in which the predictor-weighting matrix V is tuned to minimise the pre-1990 RMSPE of the outcome, effectively prioritising balance on emissions-related characteristics; weaker balance on auxiliary predictors is common and does not undermine identification, provided the pre-treatment path is well matched. Table 3 shows the corresponding donor weights for synthetic West Germany.

Table 2: Average Values of the Predictors, 1971–1989

Predictor	West Germany	OECD Sample	Synthetic West Germany
CO_2 pc	12.9	8.4	12.9
GHG pc	17.1	13.3	17.0
Industry Share	41.5	34.7	34.5
Inflation Rate	3.9	9.3	5.5
Cars ‰	250	240.7	406
GDP (PPP, 2002 USD)	21333	21226	34935

Notes: CO_2 pc and GHG pc denote average CO_2 and total greenhouse gas emissions per capita in metric tons of CO_2-equivalent over the pre-treatment period 1971–1989. 'Industry Share' is the average share of industry in gross value added in percent. 'Inflation Rate' is the average annual consumer price inflation in percent. 'Cars ‰' is the average number of passenger cars per 1,000 inhabitants. 'GDP' (PPP, 2002 USD) is the real GDP per capita in constant purchasing-power-parity adjusted 2002 US dollars. The 'OECD sample' column reports unweighted averages across donor countries, while the 'Synthetic West Germany' column reports the corresponding weighted averages using the synthetic control weights.

Table 3: Donor weights for synthetic West Germany, 1971–1989

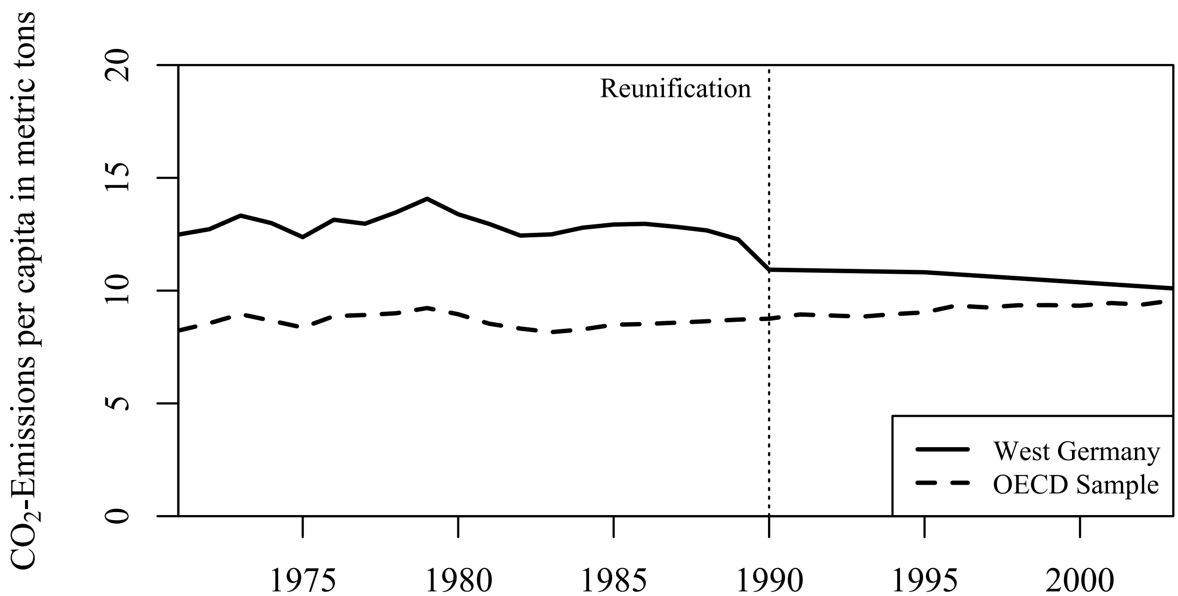
Country	Weight
United States	0.464
Switzerland	0.340
Japan	0.190
Belgium	0.002
Australia	0.001
Austria	0.001
Netherlands	0.001
Norway	0.001

Notes: Countries with weights below 0.001 are omitted.

Following Table 2, Figure 1 plots CO_2 emissions per capita in West Germany and the unweighted average across the OECD donor countries over 1971–2003, with a vertical line marking the reunification year (1990). Prior to 1990, West Germany's per-capita emissions are consistently above the donor-pool average (roughly 13–15 vs. 8–10 metric tons of CO_2

per capita). After 1990, West German emissions decline more steeply than the donor-pool average, suggesting an emerging post-reunification divergence. The figure serves as a descriptive benchmark that motivates the counterfactual analysis; unlike the synthetic control documented in Table 2, the donor-pool mean does not match pre-treatment characteristics or pre-trends.

Figure 1: CO_2 emissions per capita in West Germany and the OECD sample, 1971–2003.



Notes: The solid black line shows CO_2 emissions per capita in West Germany (in metric tons). The grey line shows the unweighted average of CO_2 emissions per capita across the OECD donor countries. The dotted vertical line marks the year 1990 when German reunification took place.

2 Details on the synthetic control method

This section provides additional methodological details on the synthetic control approach used in our study (Abadie et al., 2010; Abadie, 2021). Let Y_{1t} denote CO_2 emissions per capita in West Germany at time t, and let Y_{jt} denote emissions in donor country $j = 2, \ldots, J + 1$.

The synthetic control is a weighted average of donor outcomes,

$$Y_{0t}^{W} = \sum_{j=2}^{J+1} w_j Y_{jt},$$

with non-negative weights w_j that sum to one, chosen to closely match Y_{1t} in the pre-treatment period.

Let X_1 denote the vector of pre-treatment predictor averages for West Germany and X_0 the corresponding matrix for the donors. The weights $W = (w_2, \dots, w_{J+1})'$ solve

$$\min_{W} (X_1 - X_0 W)' V (X_1 - X_0 W) \quad \text{subject to} \quad w_j \geq 0, \ \sum_{j=2}^{J+1} w_j = 1,$$

where V is a positive definite matrix chosen to minimise the pre-treatment root mean squared prediction error (RMSPE) of CO_2 emissions in the pre-treatment period (Abadie et al., 2010). This two-step procedure yields a synthetic control that reproduces both predictor means and the pre-treatment emissions trajectory.

The estimated treatment effect at time t is

$$\hat{\alpha}_t = Y_{1t} - Y_{0t}^{W}, \quad t \geq 1990.$$

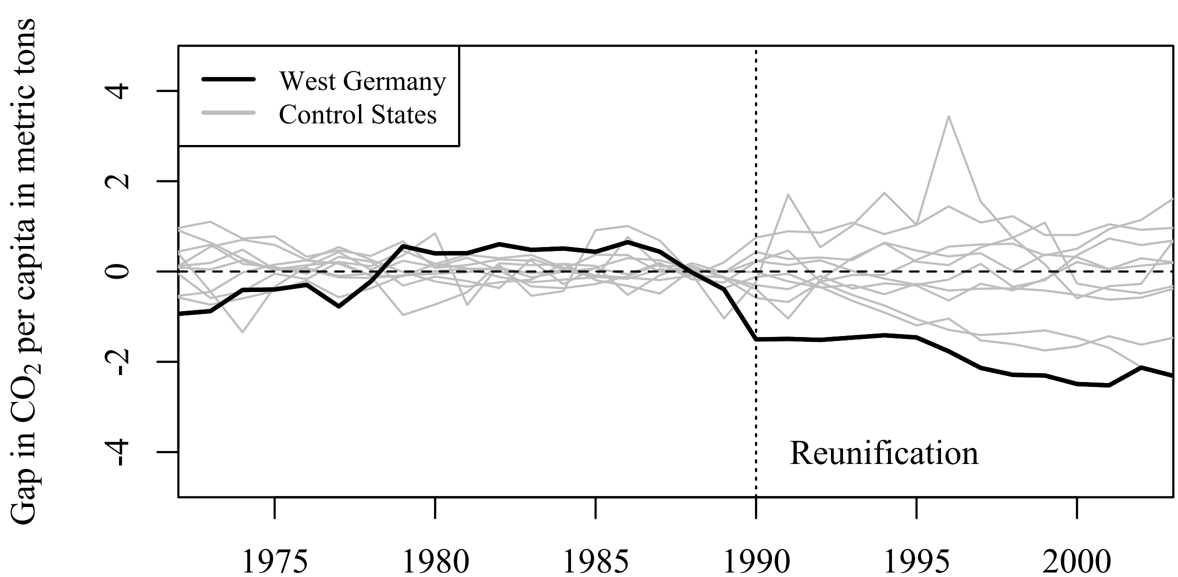
Average effects over longer horizons are obtained by aggregating $\hat{\alpha}_t$ over subsets of the post-treatment period (e.g. 1995–2003). A close pre-treatment fit between Y_{1t} and Y_{0t}^{W} is a central requirement for credible causal inference in synthetic control applications (Abadie, 2021).

3 Robustness tests

This section presents the detailed design and results of the robustness tests referenced in the main text. Specifically, we assess whether the post-1990 divergence for West Germany is unusually large relative to the donor pool (placebo-in-space), specific to the true intervention year rather than a generic time pattern (placebo-in-time), and robust to the exclusion of potentially influential donor countries (leave-one-out).

For the placebo-in-space exercise, we re-estimate the synthetic control for each donor country in turn, treating it as if it had experienced a reunification shock in 1990. For each placebo unit, a corresponding synthetic control is constructed from the remaining donors (excluding the placebo unit itself), and the post-treatment gaps between actual and synthetic emissions are computed. Figure 2 plots the trajectories of these post-treatment gaps for West Germany and all placebo units. The West German gap stands out as one of the largest and most persistent negative deviations, supporting the interpretation of a genuine reunification effect on CO_2 emissions per capita rather than a modelling artefact.

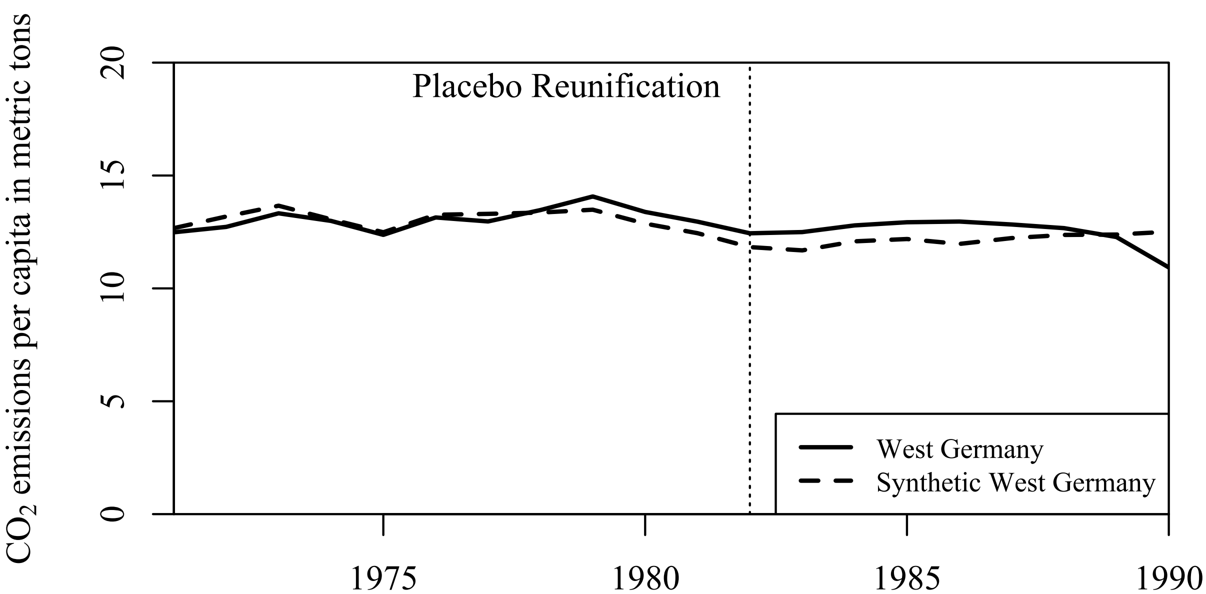
Figure 2: Placebo-in-space absolute gaps in CO_2 emissions per capita, 1975–2000.



Notes: The solid black line shows the absolute difference between observed CO_2 emissions per capita in West Germany and its synthetic control (in metric tons per capita). The grey lines show the corresponding absolute differences for the donor countries, each compared to its own synthetic control unit. The dotted vertical line marks 1990 (German reunification). The figure benchmarks the post-1990 West German gap against the distribution of donor-placebo gaps.

As an additional check, we shift the treatment date for West Germany to a pre-reunification year and recompute the synthetic control. Figure 3 implements this placebo-in-time test by assigning a placebo intervention in 1982 (coinciding with the peak of the early-1980s oil-crisis period) and re-estimating the synthetic control using 1971–1981 as the pre-treatment window, with effects evaluated over 1982–1990. The absence of a pronounced and persistent divergence after 1982 contrasts with the strong post-1990 gap in the baseline specification, reinforcing that the observed decline relative to the synthetic control is specific to reunification rather than driven by generic time dynamics or model instability.

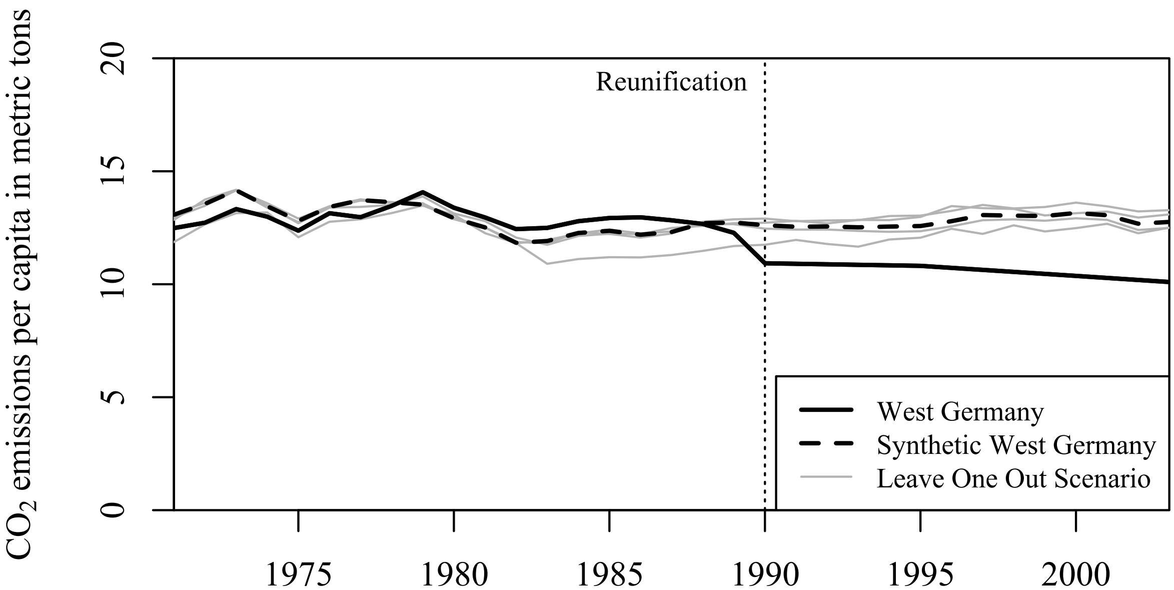
Figure 3: Placebo-in-time test – CO_2 emissions per capita in West Germany and synthetic



Notes: The solid line shows CO_2 emissions per capita in West Germany (metric tons of CO_2 per capita). The dashed line shows emissions for the synthetic control unit, constructed as a weighted average of OECD donor countries. The dotted vertical line marks 1982, a placebo intervention date chosen to coincide with the peak of the early-1980s oil crisis. The absence of a pronounced and persistent gap after 1982 contrasts with the strong post-1990 divergence in the main specification.

Finally, we assess robustness to donor composition using a leave-one-out (jackknife) procedure. We repeatedly re-estimate the synthetic control while omitting one donor country at a time, yielding a set of alternative synthetic trajectories. Figure 4 shows that these leave-one-out paths closely track the baseline synthetic West Germany constructed from the full donor pool. The similarity across specifications indicates that the main results are not driven by any single donor country (e.g., one receiving a high weight), but reflect a stable pattern generated by the donor pool as a whole.

Figure 4: Leave-one-out synthetic controls for West Germany, 1971–2003.



Notes: The solid black line shows observed CO_2 emissions per capita in West Germany (metric tons of CO_2 per capita). The dashed black line shows emissions for the baseline synthetic West Germany constructed from the full donor pool. The grey lines show alternative synthetic controls obtained by re-estimating the model while leaving one donor country out at a time. The close alignment between the baseline and leave-one-out paths indicates that no single donor country drives the results.

References

Abadie, A. (2021). Using synthetic controls: Feasibility, data requirements, and methodological aspects. *Journal of Economic Literature*, 59(2):391–425.

Abadie, A., Diamond, A., and Hainmueller, J. (2010). Synthetic control methods for comparative case studies: Estimating the effect of california's tobacco control program. *Journal of the American Statistical Association*, 105(490):493–505.

Dargay, J., Gately, D., and Sommer, M. (2007). Vehicle ownership and income growth, worldwide: 1960–2030. *The Energy Journal*, 28(4):143–170.

CESA Working Paper

Series

CESA Working Paper No. 1 | 2023
Andreas Hauptmann, Benjamin Schwanebeck and Hans-Jörg Schmerer
Plant-level adjustments to imports and exports at the extensive margin

CESA Working Paper No. 2 | 2023
Joscha Beckmann, Marco Kerkemeier and Robinson Kruse-Becher
Regime-specific exchange rate predictability

CESA Working Paper No. 3 | 2023
Joscha Beckmann, Timo Heinrich and Jennifer Rogmann
Inflation expectations and cognitive uncertainty

CESA Working Paper No. 4 | 2024
Daniel Monsees and Matthias Westphal
Disruptions in Primary Care: Can Resigning GPs Cause Persistently Negative Health Effects?

CESA Working Paper No. 5 | 2024
Giulio Callegaro, Mario Lackner and Hendrik Sonnabend
The Napoleon complex revisited: New evidence from professional soccer

CESA Working Paper No. 6 | 2024
Mario Lackner and Hendrik Sonnabend
When performance melts away: Heat causes mental errors in high-stakes competitions

CESA Working Paper No. 7 | 2024
Johannes Hollenbach, Hendrik Schmitz and Matthias Westphal
Gene-environment interactions with essential heterogeneity

CESA Working Paper No. 8 | 2024
Kamila Cygan-Rehm and Matthias Westphal
School Starting Age and the Gender Pay Gap over the Life Cycle

CESA Working Paper

Series

CESA Working Paper No. 9 | 2024
Marco Kerkemeier
(Co-)Explosiveness of corporate credit spreads

CESA Working Paper No. 10 | 2024
Christoph Wegener, Robinson Kruse-Becher and Tony Klein
EU ETS Market Expectations and Rational Bubbles

CESA Working Paper No. 11 | 2025
Anna Krumme and Matthias Westphal
Monetary returns to upper secondary schooling, the evolution of unobserved heterogeneity, and implications for employer learning

CESA Working Paper No. 12 | 2025
Robinson Kruse-Becher and Philip Letixerant
Oil price expectations in explosive phases

CESA Working Paper No. 13 | 2025
Sarah Rezaei, Hendrik Sonnabend and Bastian Westbrock
Overconfidence and Goal-Setting

CESA Working Paper No. 14 | 2025
Rainer Baule, Sebastian Schlie and Xiaozhou Zhou
The Term Structure of Intraday Return Autocorrelations

CESA Working Paper No. 15 | 2025
Mario Lackner and Hendrik Sonnabend
Positive Feedback Shapes Gender Gaps in Adolescent Risk-Taking – Causal Evidence from Real-Risk Competitions

FernUniversität in Hagen

CESA Working Paper

Series

CESA Working Paper No. 16 | 2025
Hendrik Sonnabend and Matthias Westphal
Family First: The causal effect of family size on cultural participation

CESA Working Paper No. 17 | 2025
Malte Petersen, Hendrik Sonnabend and Jürgen Weibler
Do Fields of Study Shape Social Preferences? Selection and Curricular Imprinting in Economically Oriented versus Prosocial Programs

CESA Working Paper No. 18 | 2026
Anna Krumme and Matthias Westphal
Is Academic-Track Schooling Worthwhile Without College? Decomposing Monetary Returns to Education

CESA Working Paper No. 19 | 2026
Klaus Andresen, Ursula Müller and Hans-Jörg Schmerer
Energy for Growth: Satellite Synthetic Control Evidence from Indonesia

CESA Working Paper No. 20 | 2026
Hendrik Sonnabend and Matthias Westphal
Did reunification affect CO2 emissions in West Germany?

FernUniversität in Hagen