

Appendix for “Climate Policies for All Seasons: Identifying Effective Climate Policy Measures in Times of Policy Growth”

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Supplemental Online material

Abstract

Technical documentation of the article “Climate Policies for All Seasons: Identifying Effective Climate Policy Measures in Times of Policy Growth”, published at *Climate Policy*.

Contents

A	Model Results	3
A.1	Industry	3
A.2	Energy	7
A.3	Buildings	11
A.4	Transport	15
B	Robustness	19
B.1	Transport	19
B.2	Industry	21
B.3	Energy	23
B.4	Buildings	25
C	Potential reductions: sectors	27
C.1	Industry	27
C.2	Energy	28
C.3	Buildings	29
C.4	Buildings, without carbon taxes	30
C.5	Buildings, without ETS	31
D	Comparison	32
E	Assessment of Evidence	34

F	Data sources	35
G	Climate Datasets	36
H	Comparison	37

A Model Results

This section reports the auxiliary parameters of the reference model (Truncated T prior) for each sector.

A.1 Industry

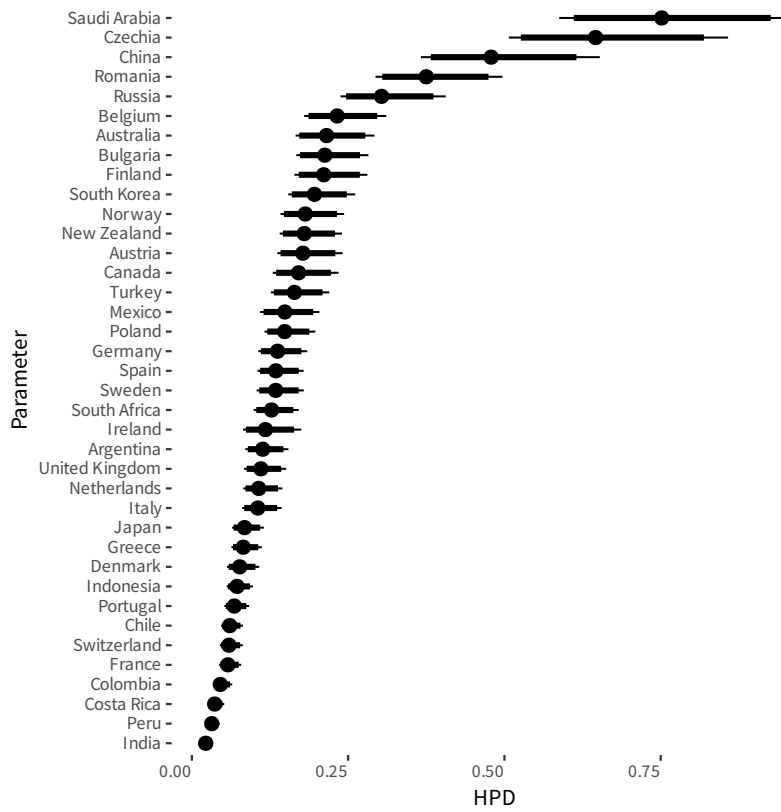


Figure A1: Country-clustered errors (σ_c).

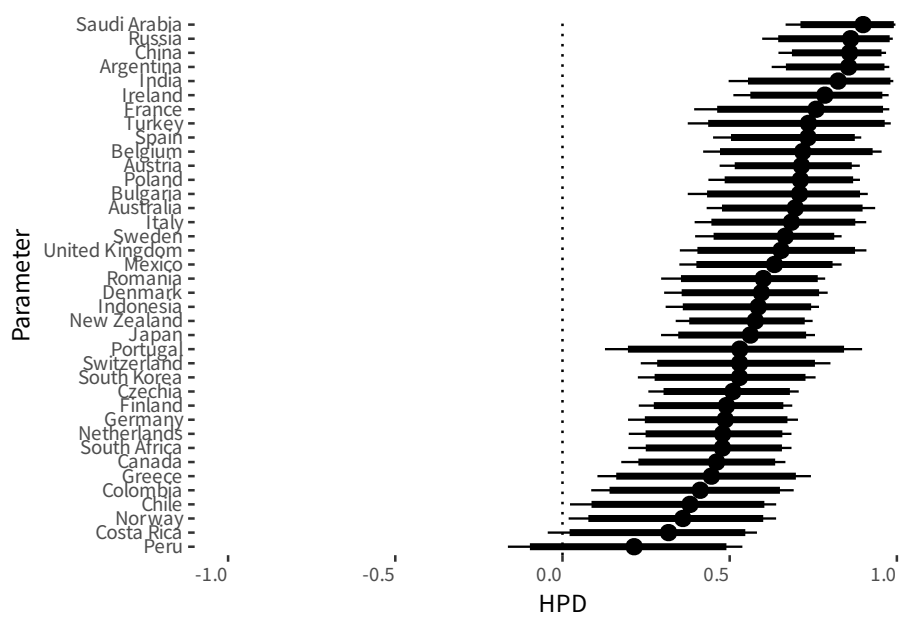


Figure A2: Country-specific Auto-regressive (AR1) parameters (ρ_c).

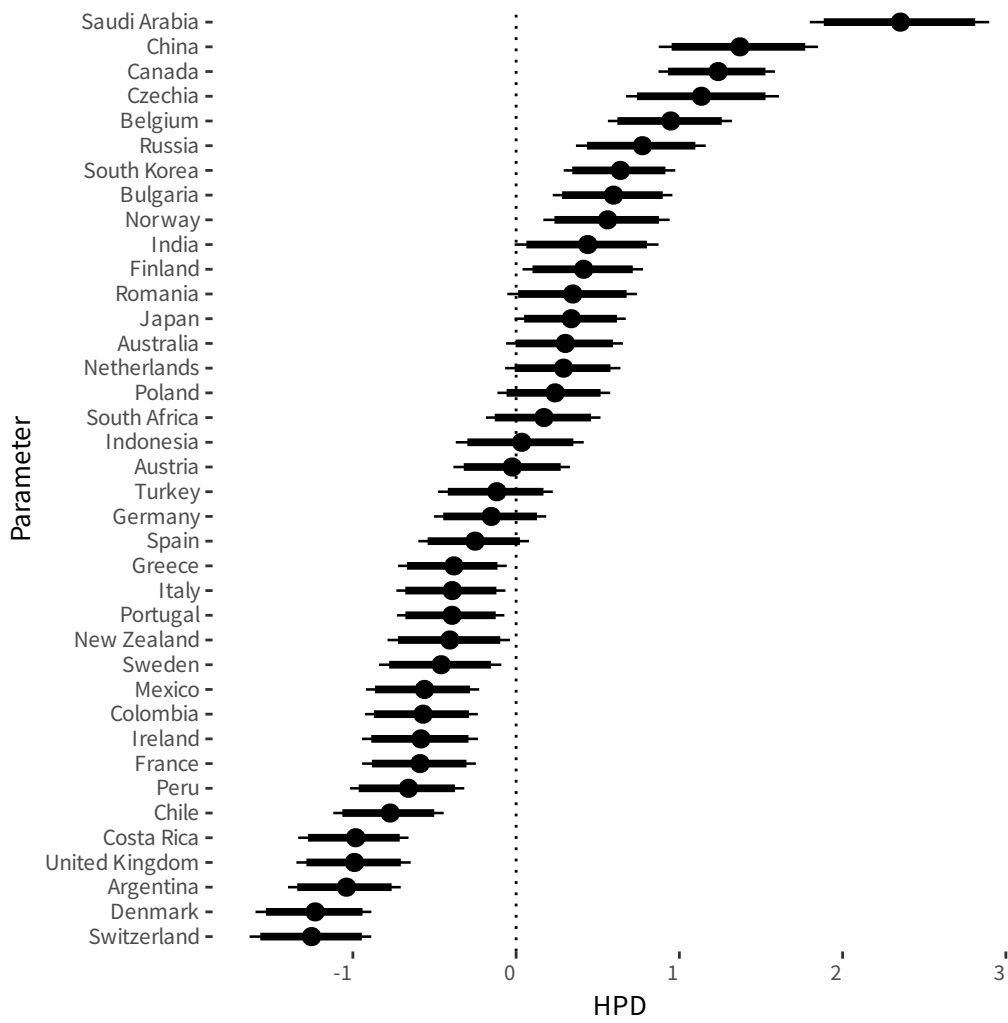


Figure A3: Country-varying intercepts (δ_c).

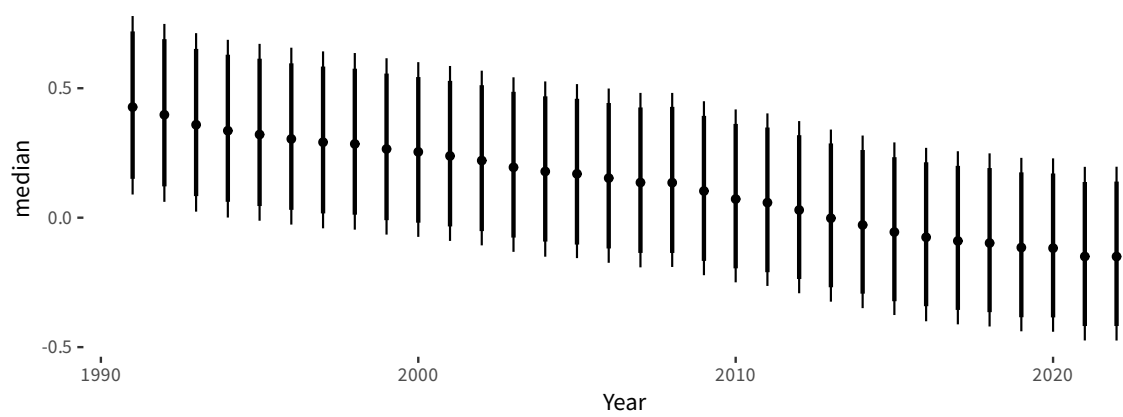


Figure A4: Time-varying intercepts smoothed by a state-space Kalman filter (γ_y).

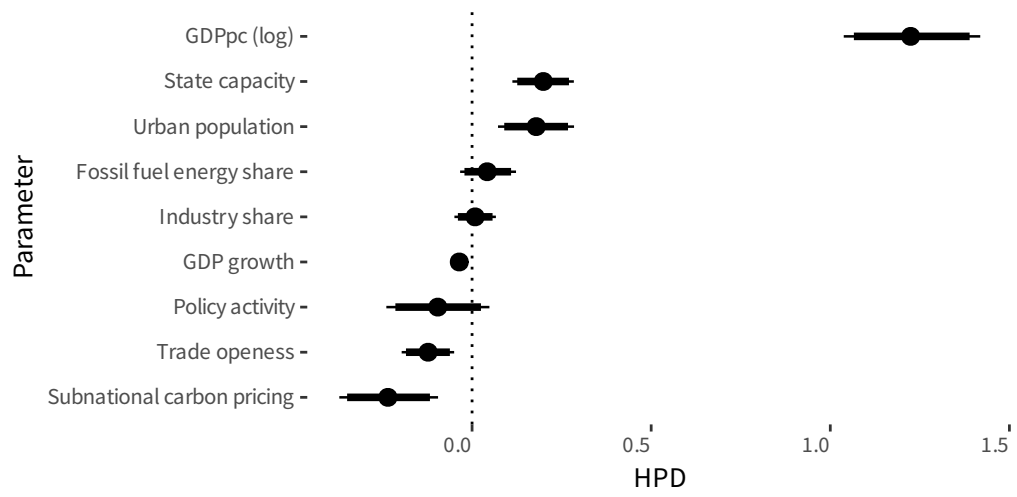


Figure A5: Covariates (β).

A.2 Energy

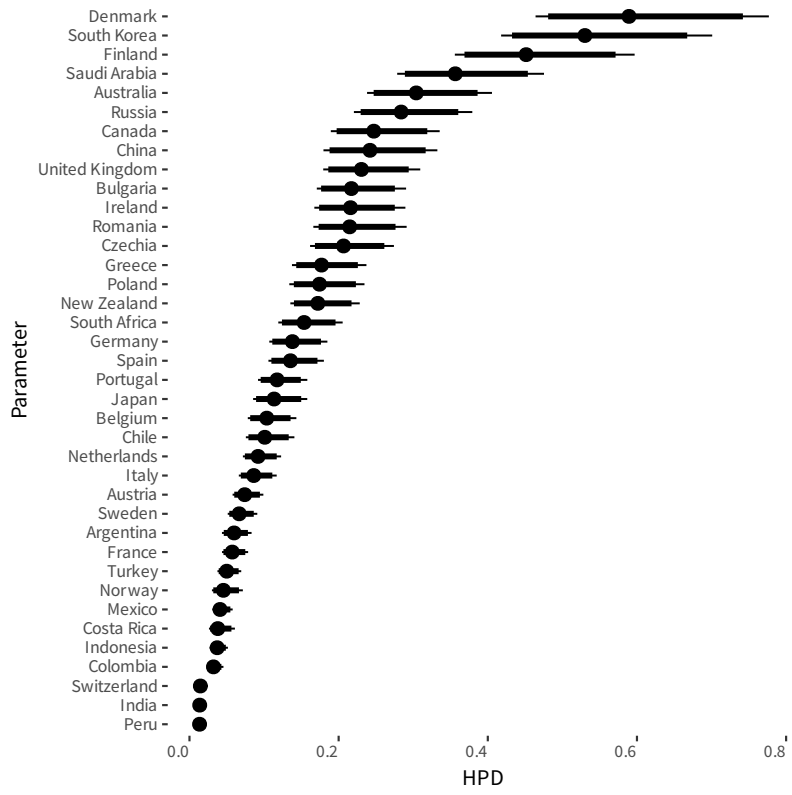


Figure A6: Country-clustered errors (σ_c).

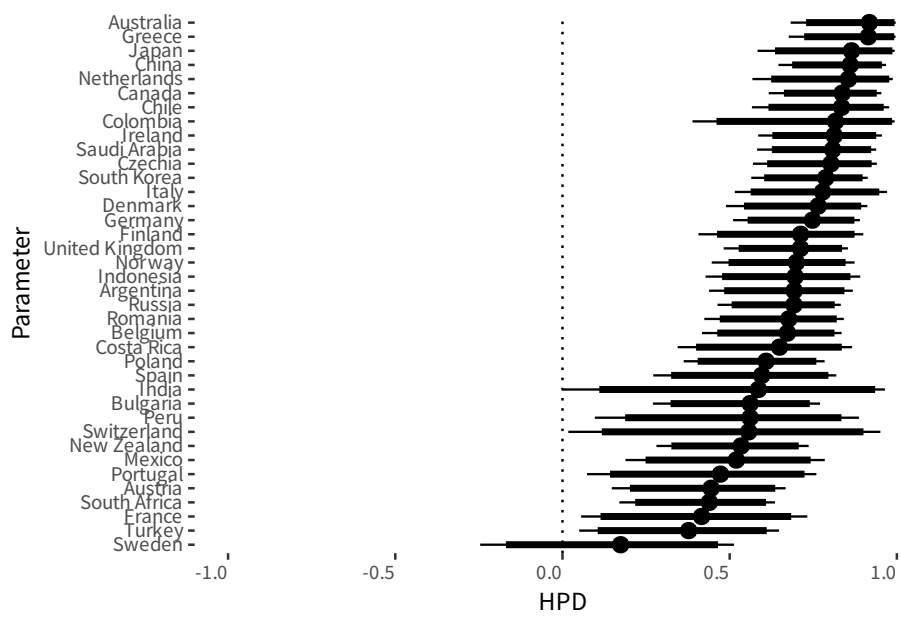


Figure A7: Country-specific Auto-regressive (AR1) parameters (ρ_c).

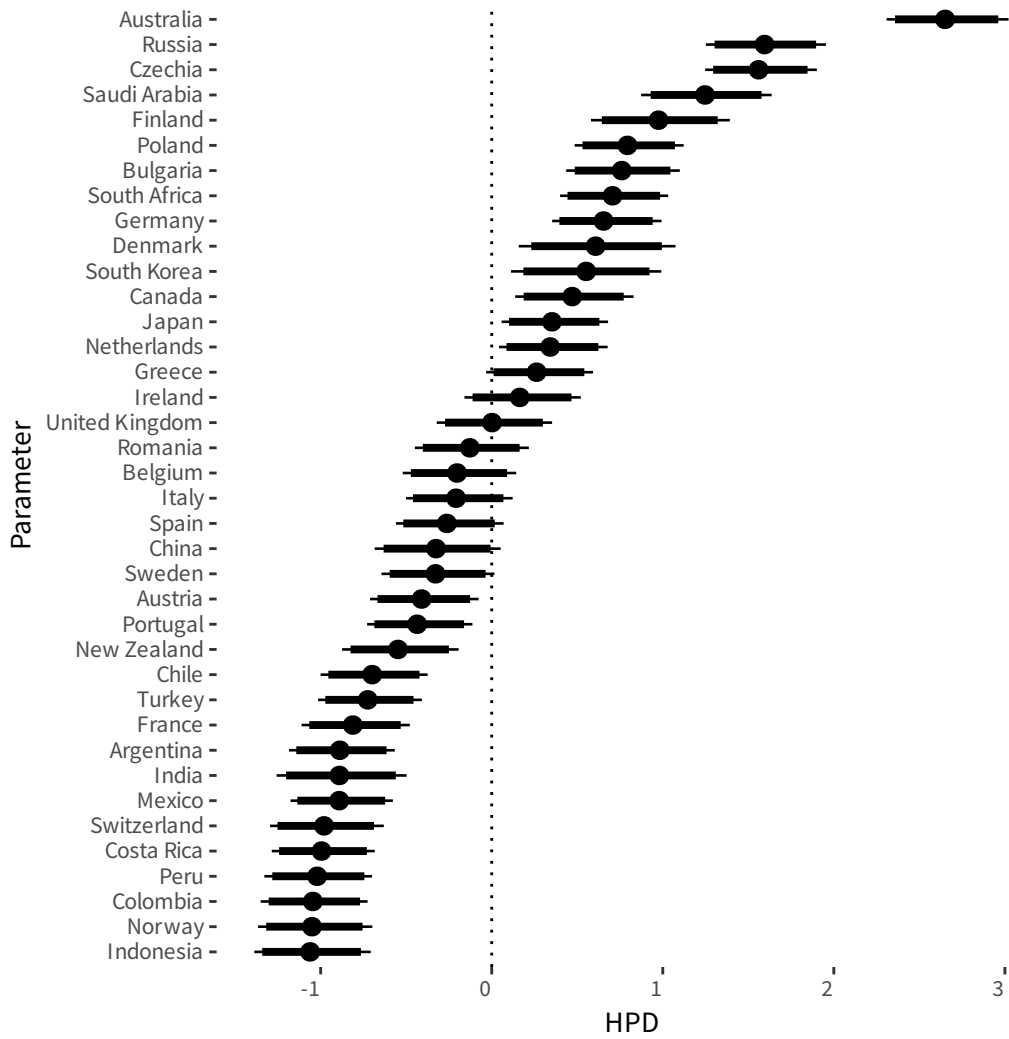


Figure A8: Country-varying intercepts (δ_c).

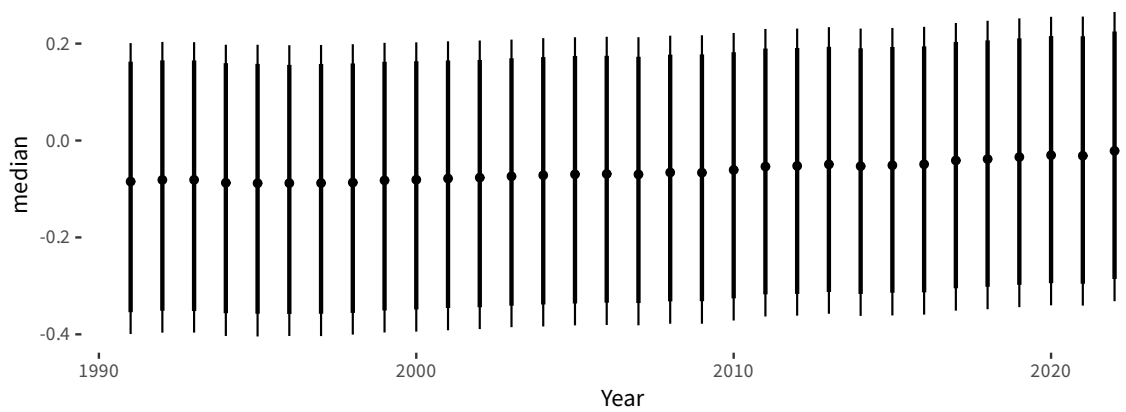


Figure A9: Time-varying intercepts smoothed by a state-space Kalman filter (γ_y).

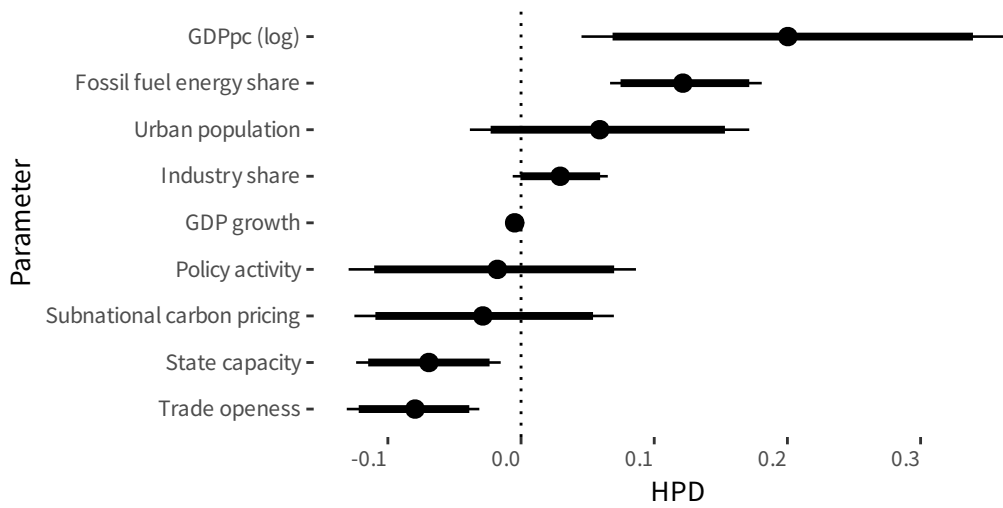


Figure A10: Covariates (β).

A.3 Buildings

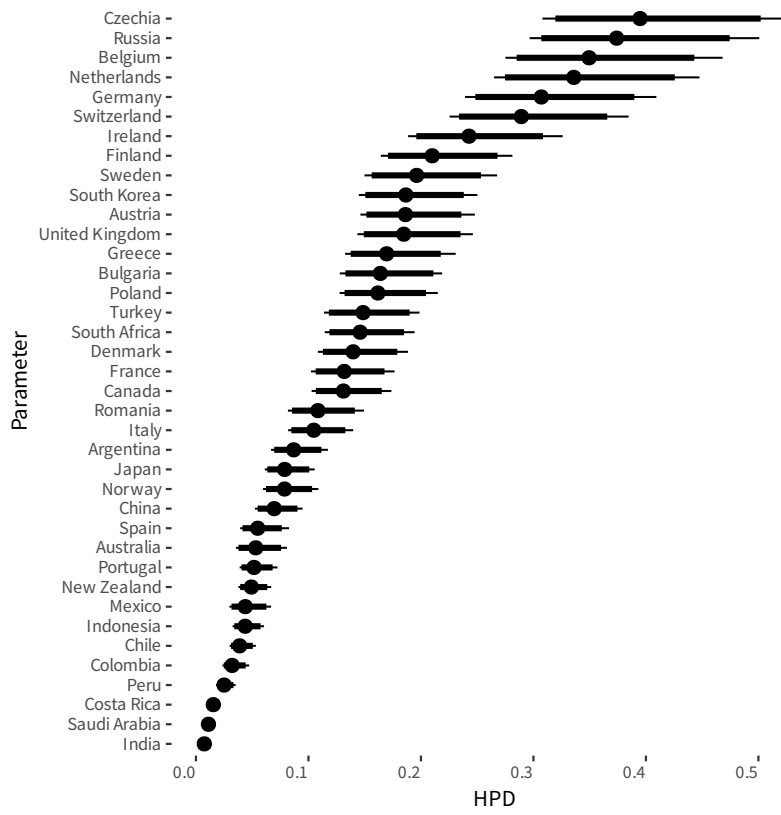


Figure A11: Country-clustered errors (σ_c).

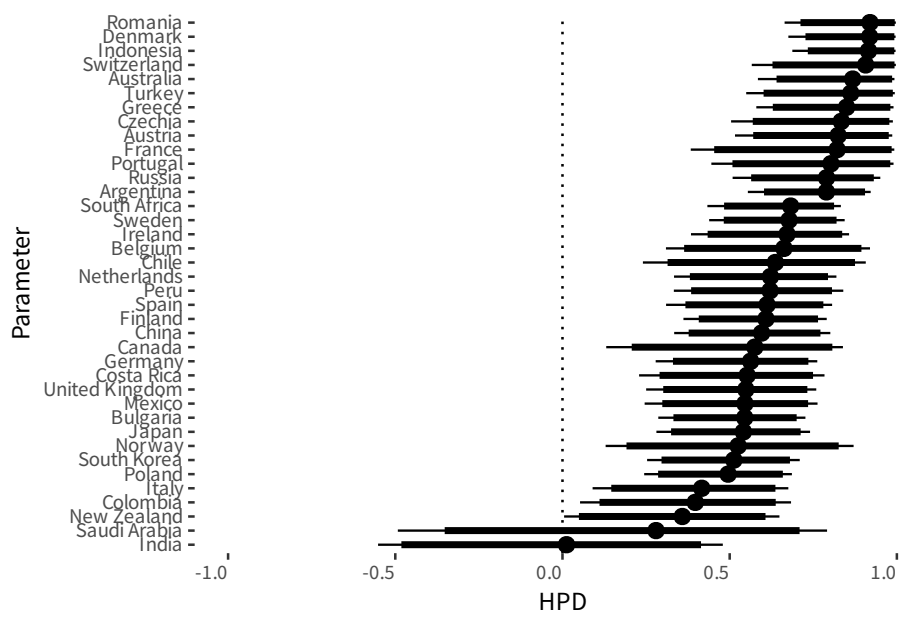


Figure A12: Country-specific Auto-regressive (AR1) parameters (ρ_c).

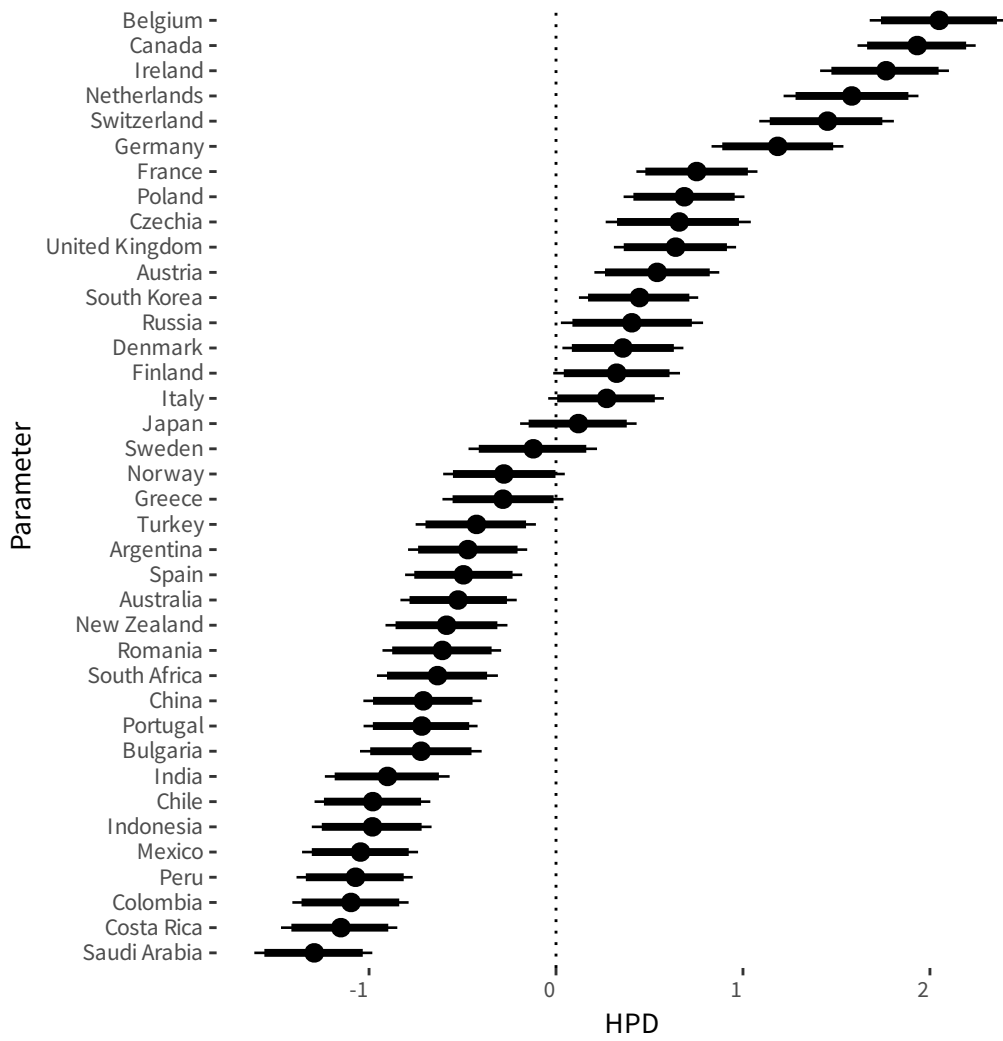


Figure A13: Country-varying intercepts (δ_c).

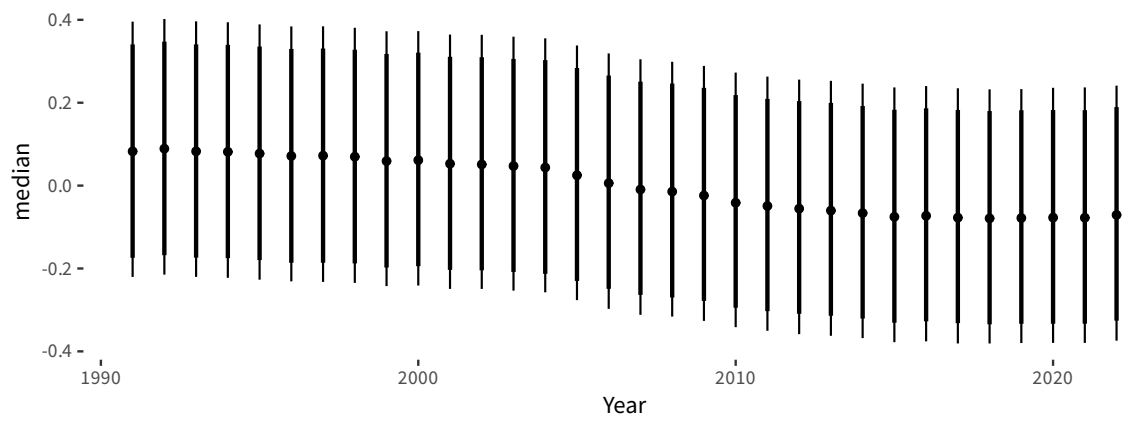


Figure A14: Time-varying intercepts smoothed by a state-space Kalman filter (γ_y).

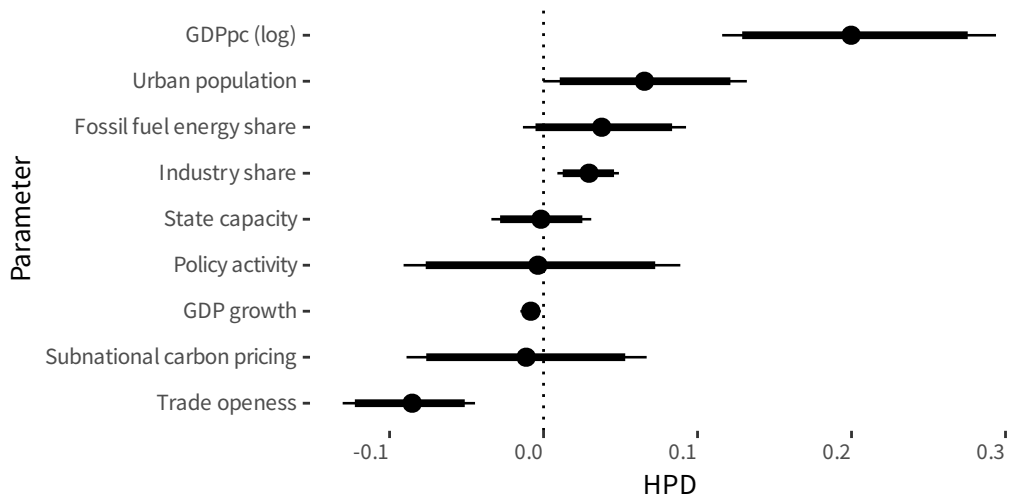


Figure A15: Covariates (β).

A.4 Transport

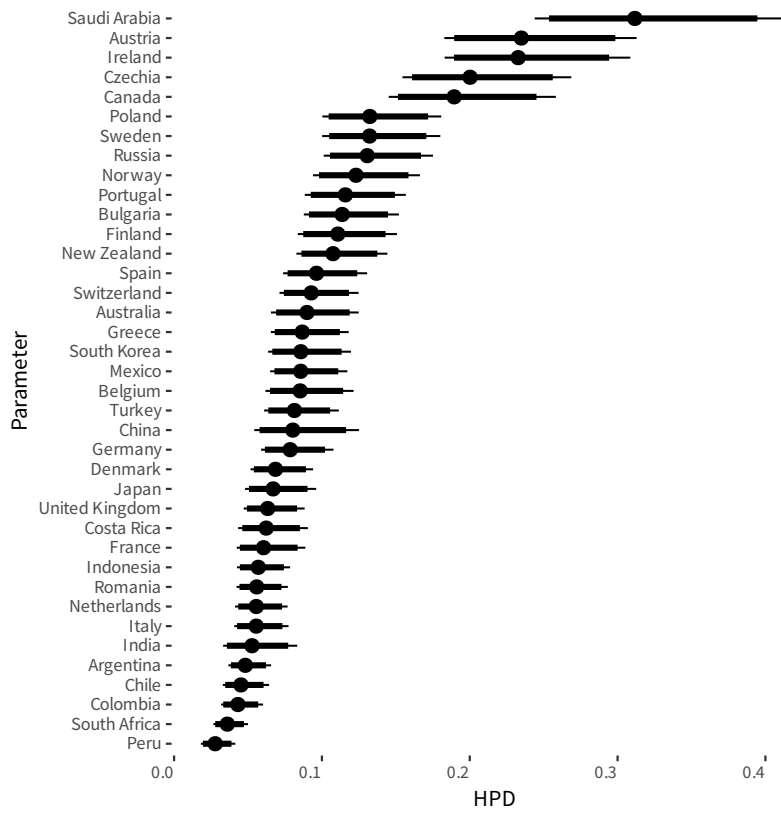


Figure A16: Country-clustered errors (σ_c).

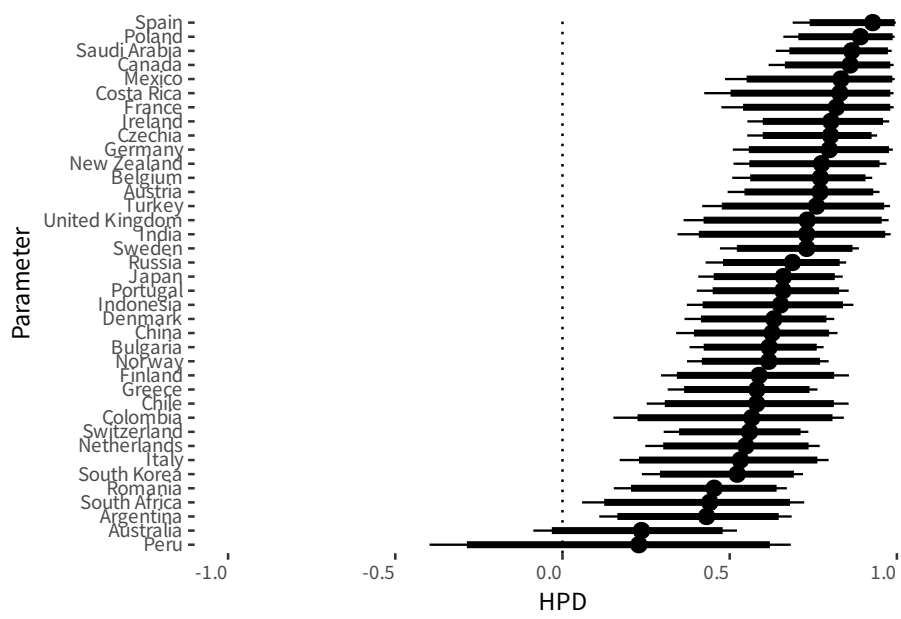


Figure A17: Country-specific Auto-regressive (AR1) parameters (ρ_c).

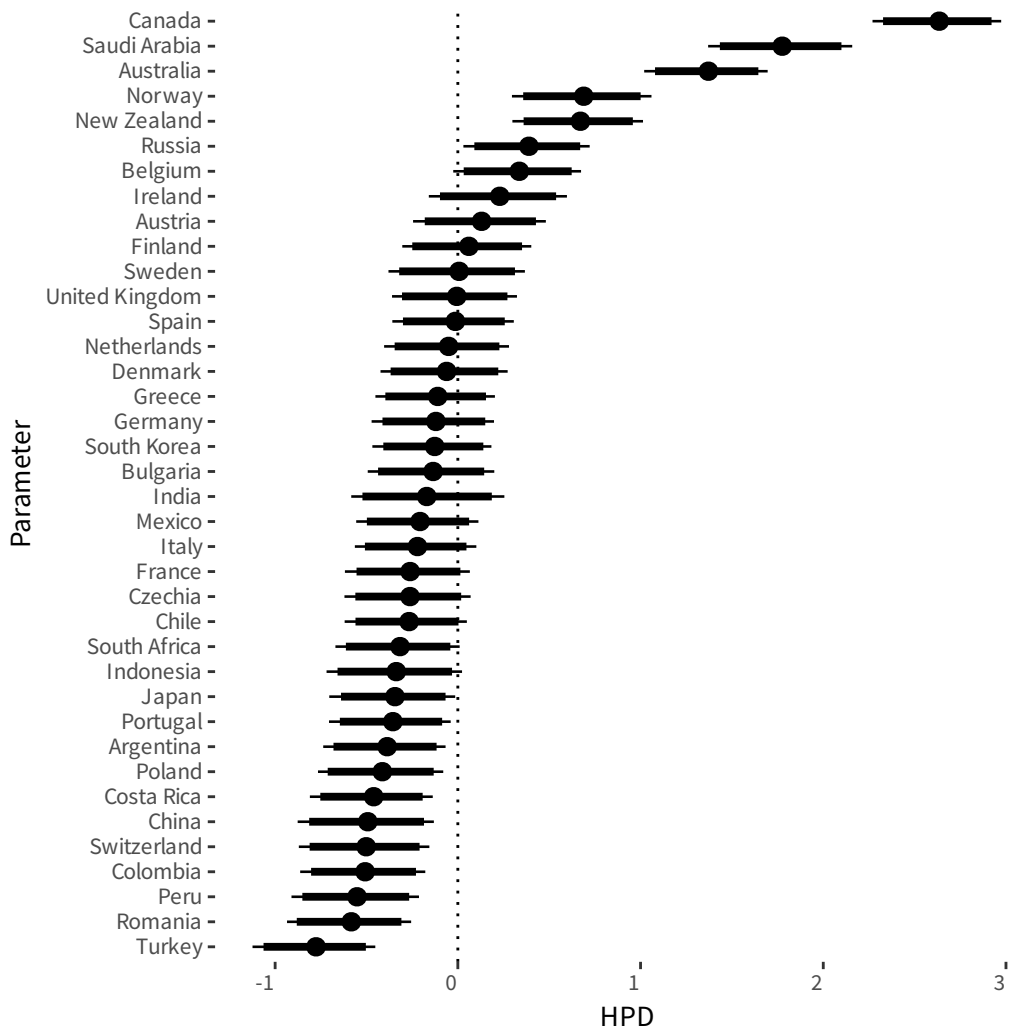


Figure A18: Country-varying intercepts (δ_c).

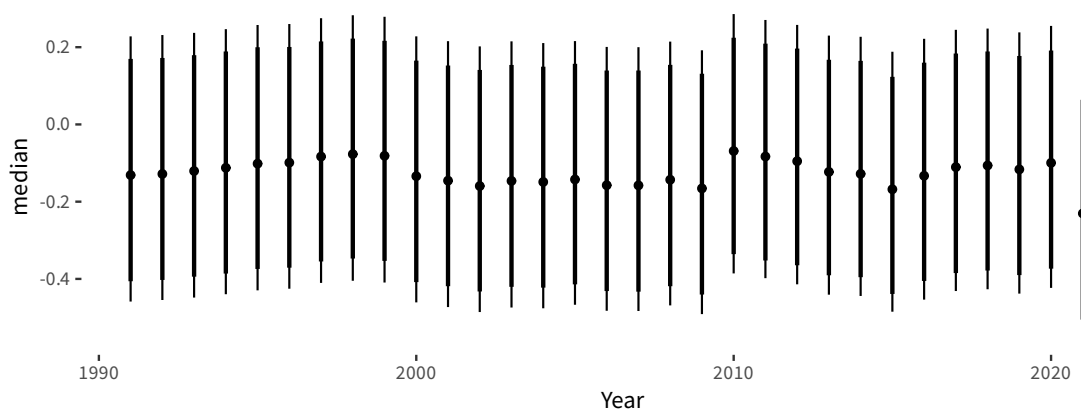


Figure A19: Time-varying intercepts smoothed by a state-space Kalman filter (γ_y).

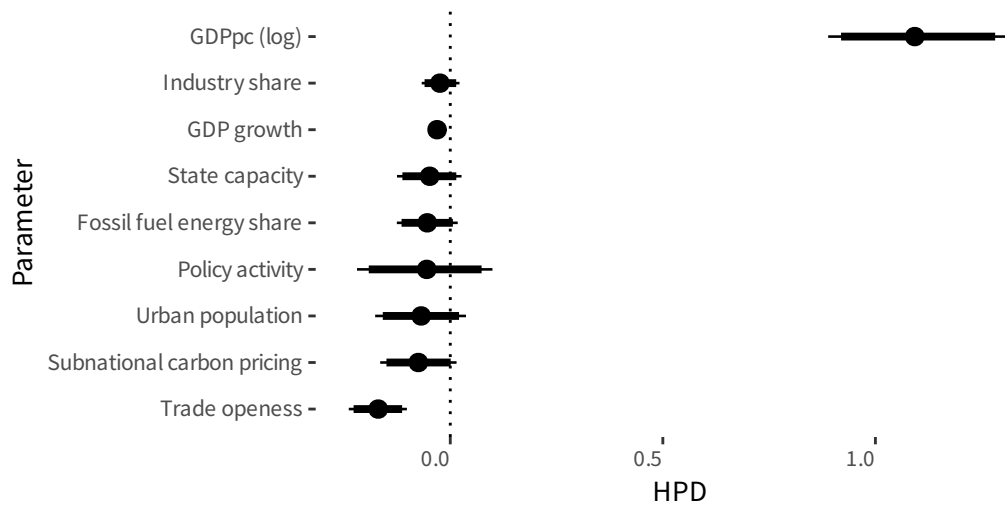


Figure A20: Covariates (β).

B Robustness

B.1 Transport

This section reports the comparison of the reference model (Truncated T prior for Transport) with different model specifications.

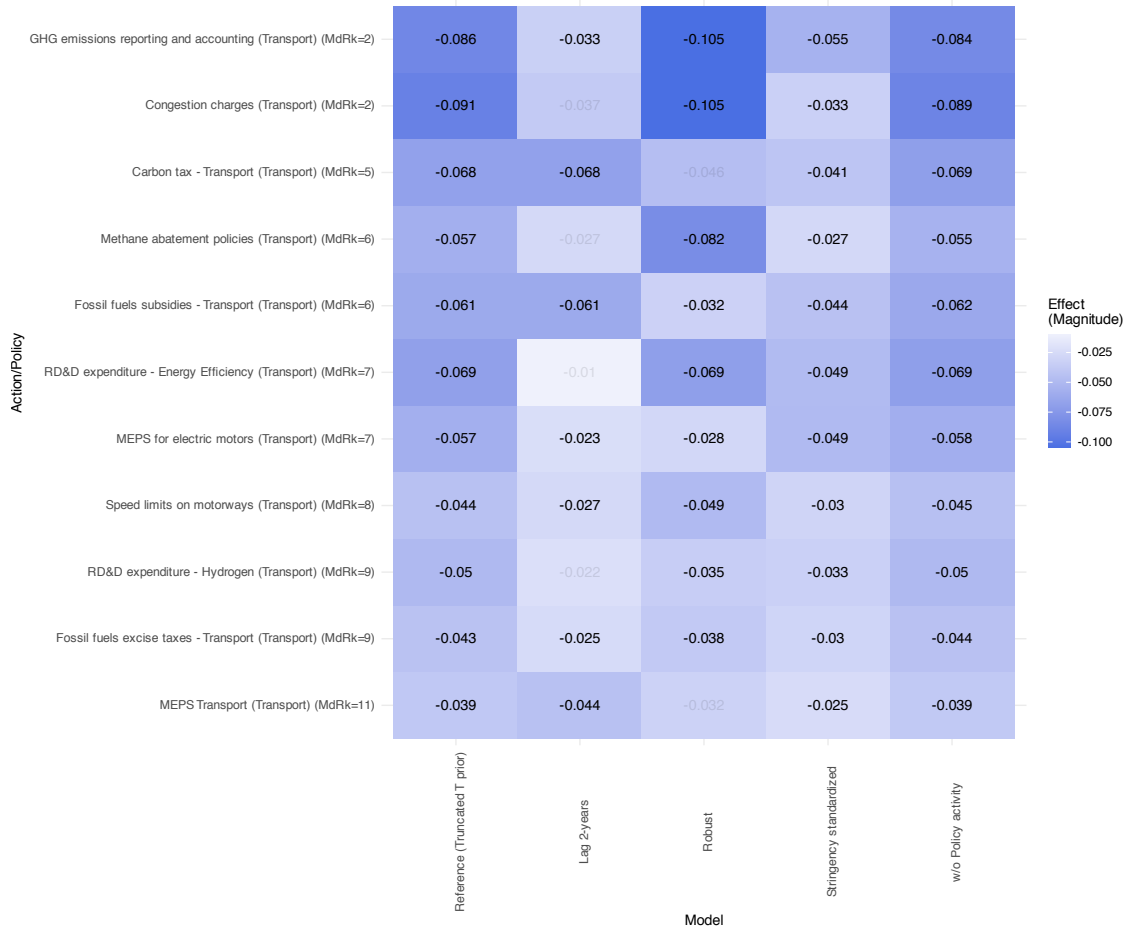


Figure A21: Robustness tests. Transport.

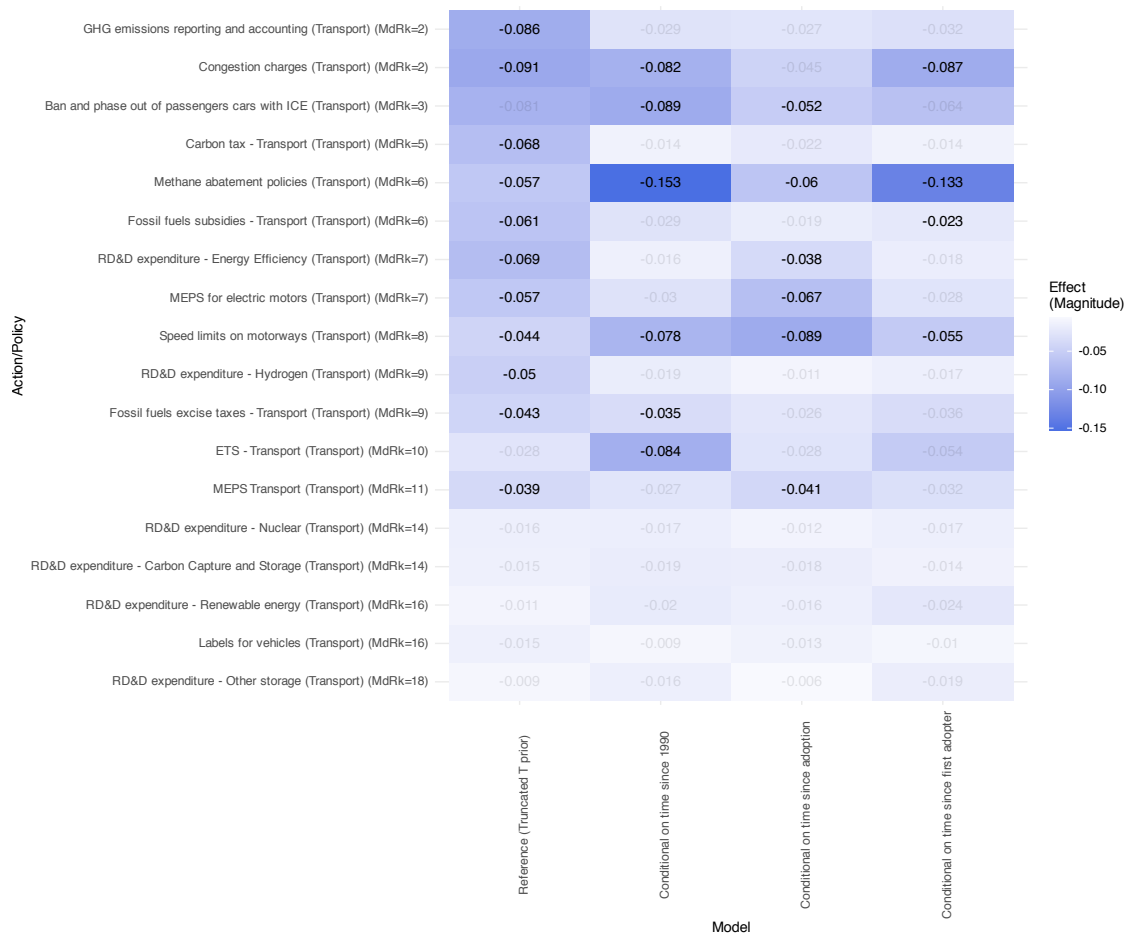


Figure A22: Robustness tests with time models. Transport.

B.2 Industry

This section reports the comparison of the reference model (Truncated T prior for Industry) with different model specifications.

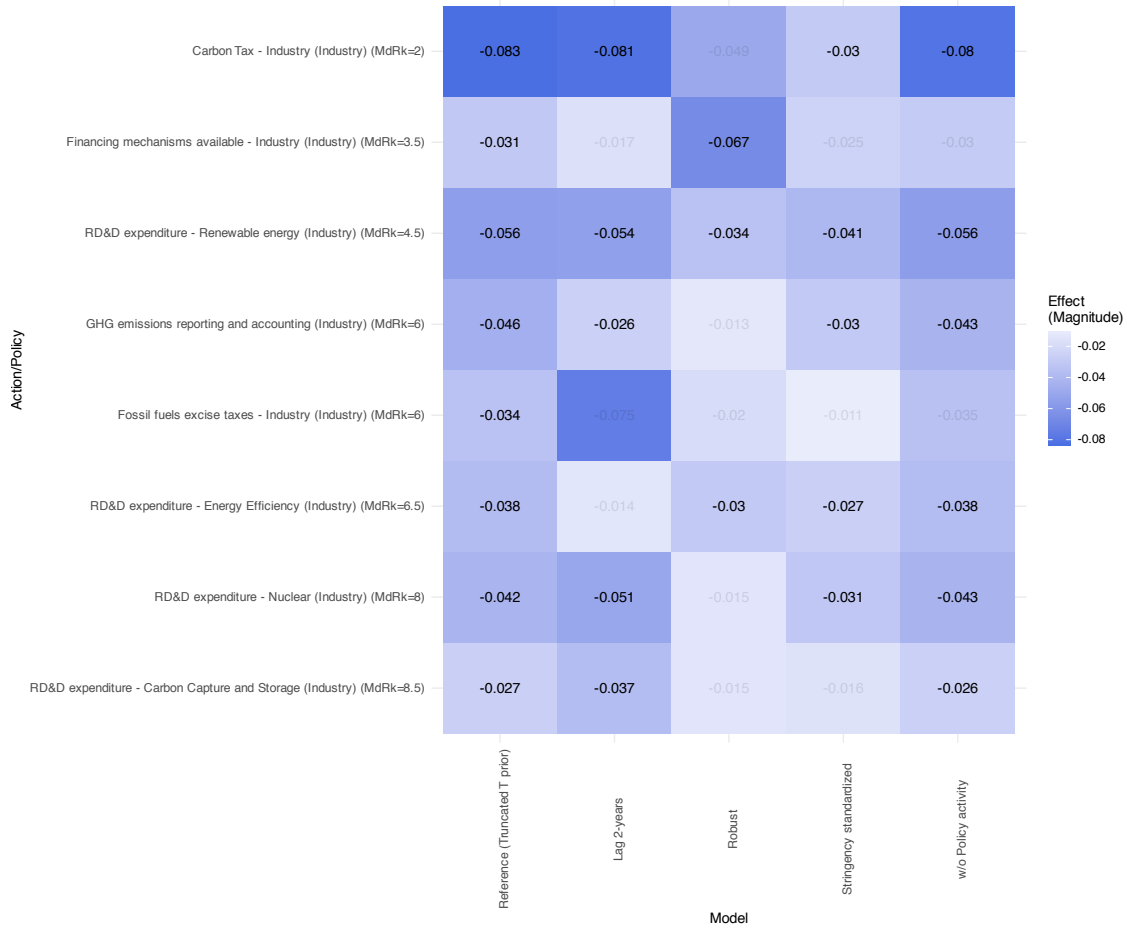


Figure A23: Robustness tests. Industry.

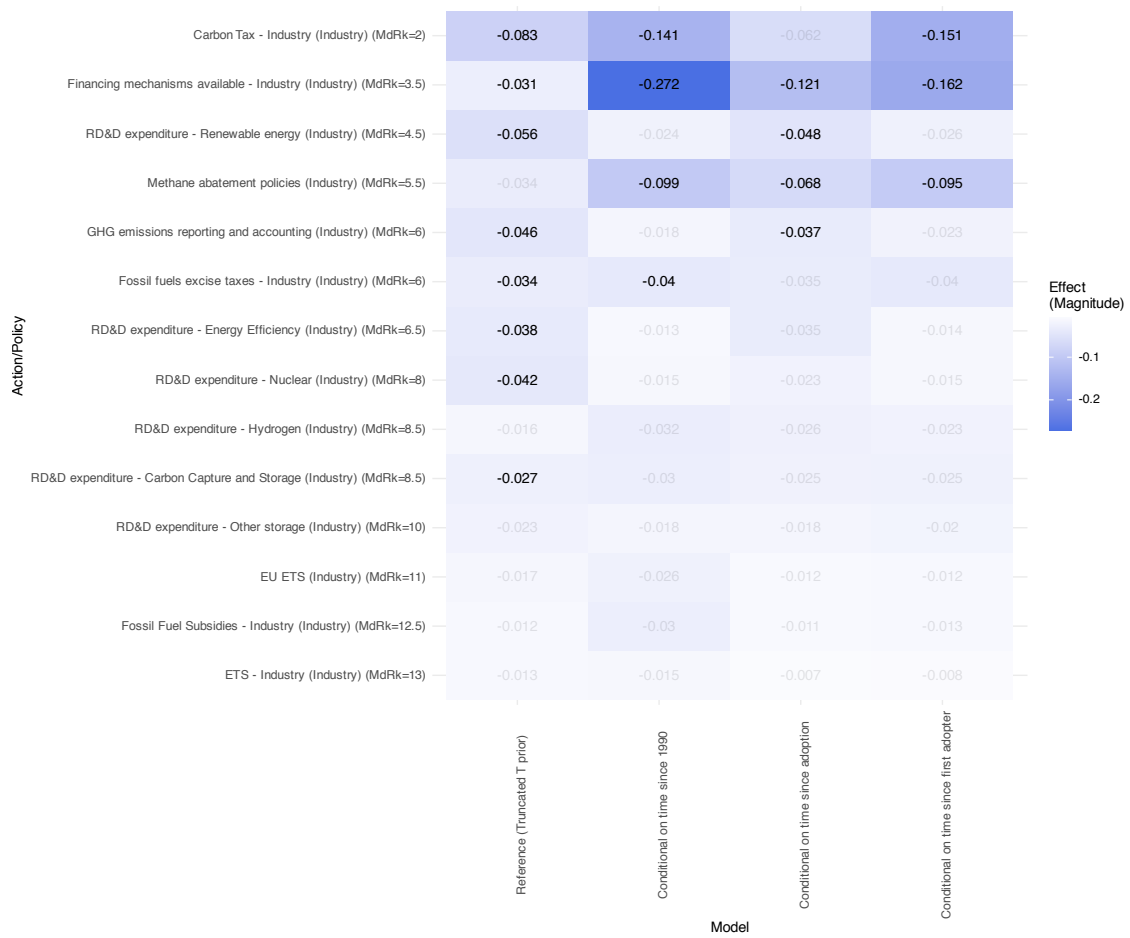


Figure A24: Robustness tests with time models. Industry.

B.3 Energy

This section reports the comparison of the reference model (Truncated T prior for Energy) with different model specifications.

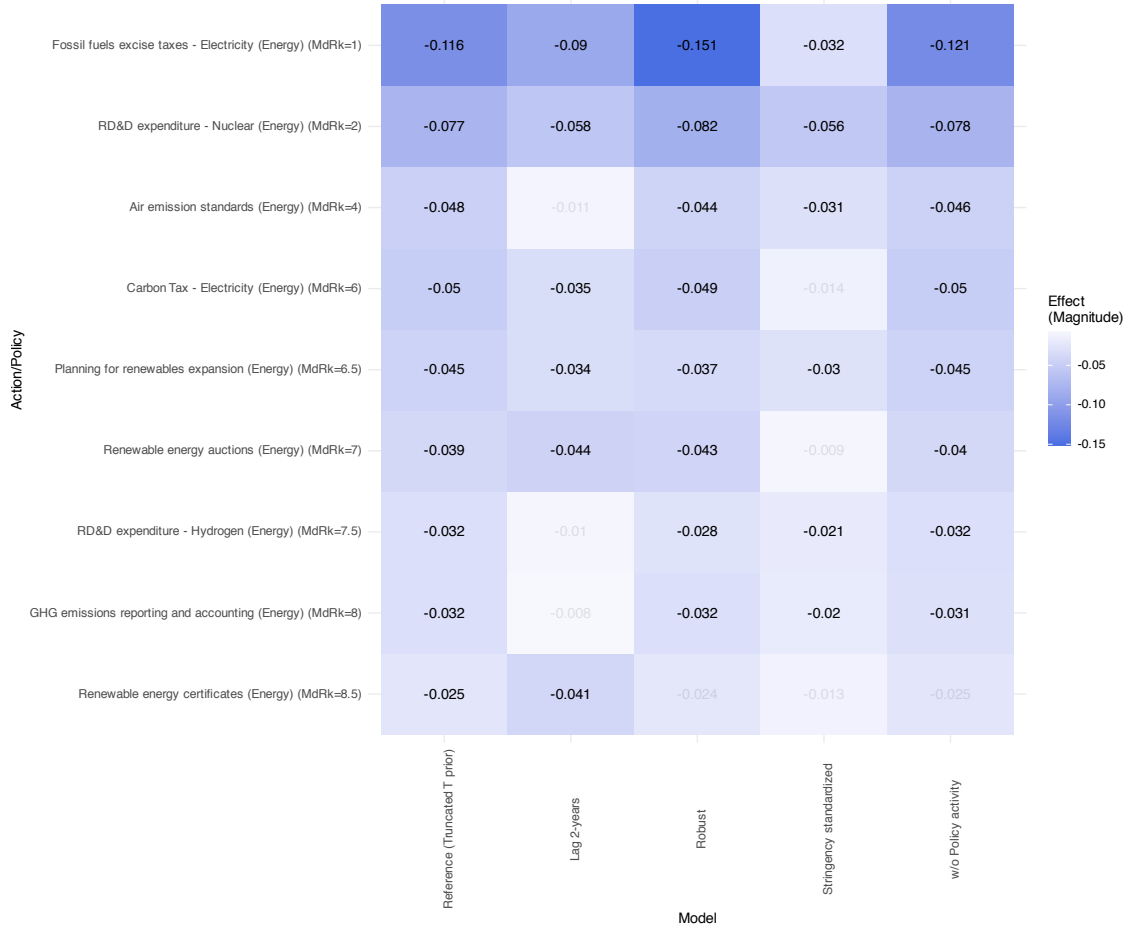


Figure A25: Robustness tests. Energy

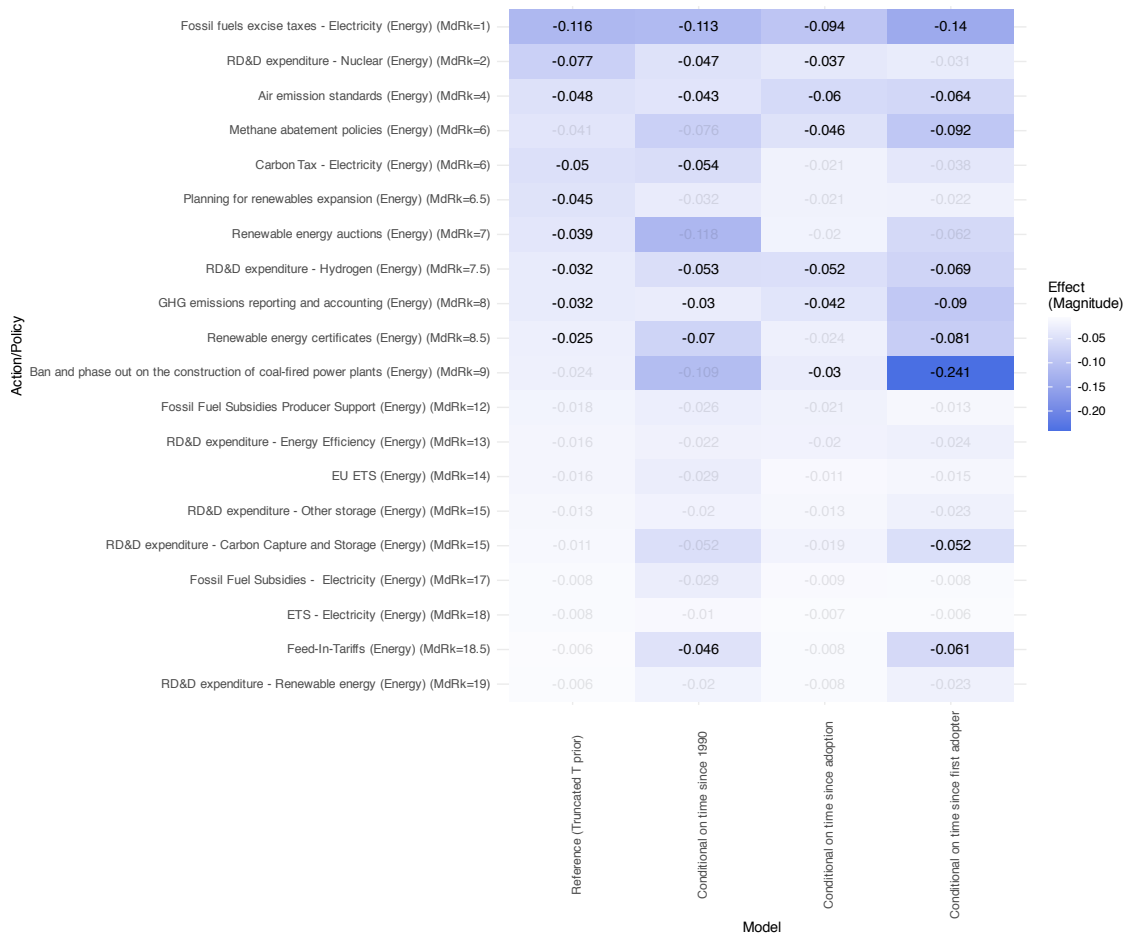


Figure A26: Robustness tests with time models. Energy

B.4 Buildings

This section reports the comparison of the reference model (Truncated T prior for Buildings) with different model specifications.

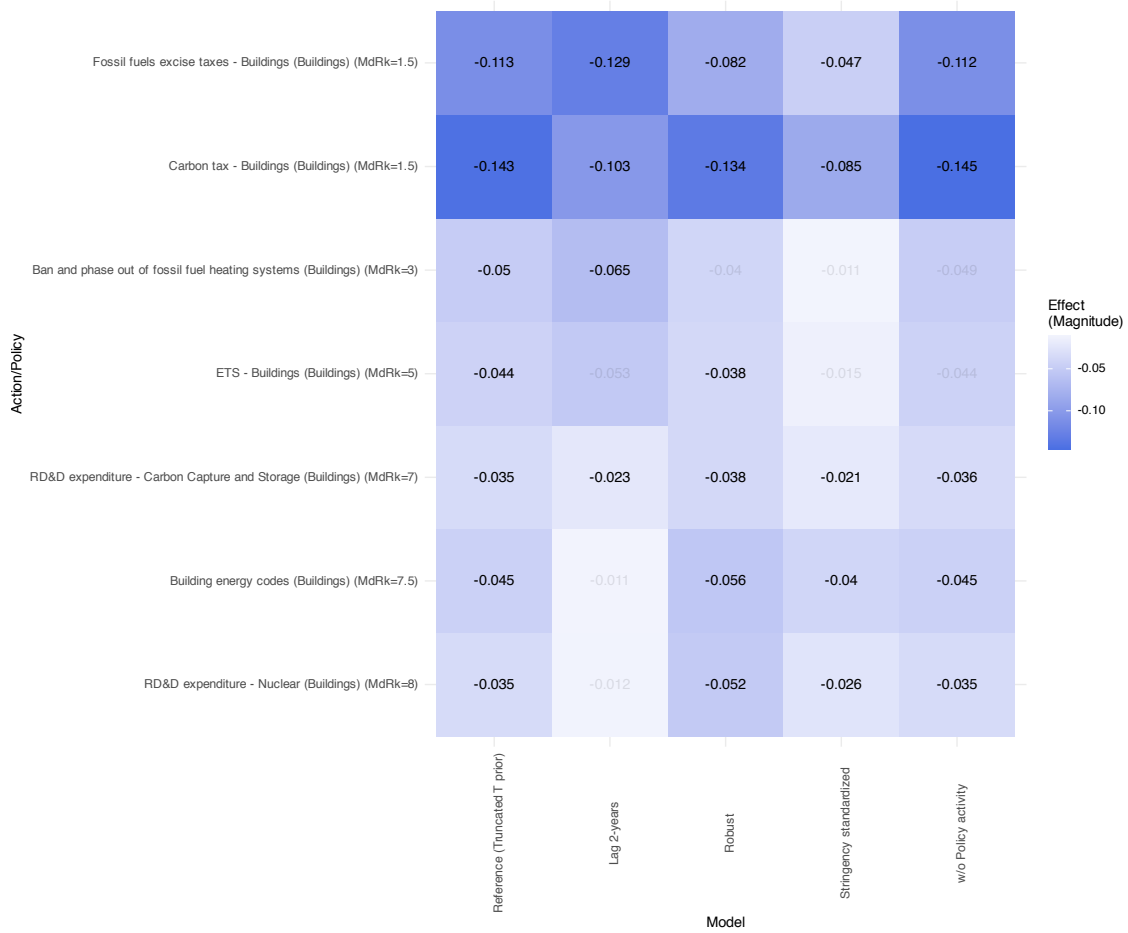


Figure A27: Robustness tests. Buildings.

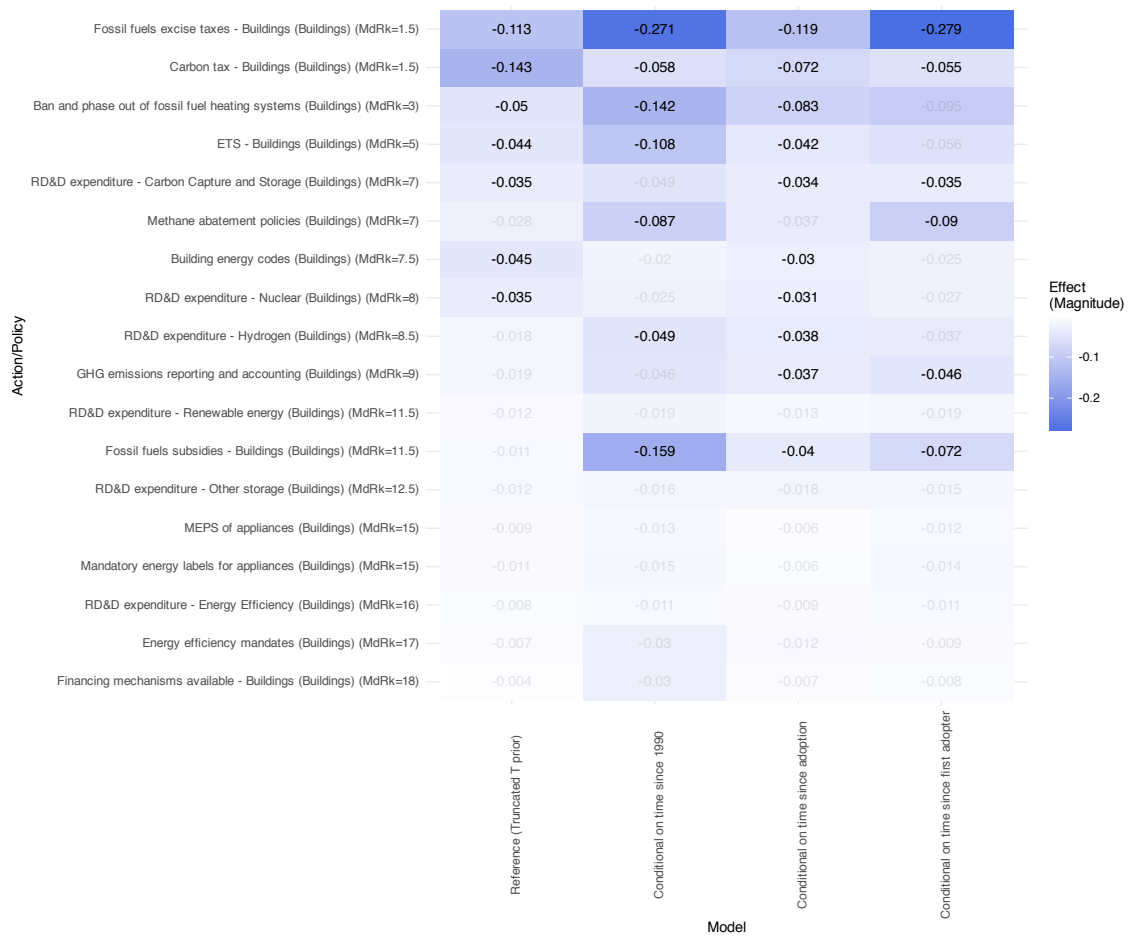


Figure A28: Robustness tests with time models. Buildings.

C Potential reductions: sectors

The article only shows the details of the potential reductions in one sector. This section presents the figures for the remaining sectors. Also, in the case of the Buildings sector, there is an extra pair of cases where carbon taxes or ETS are not together.

C.1 Industry

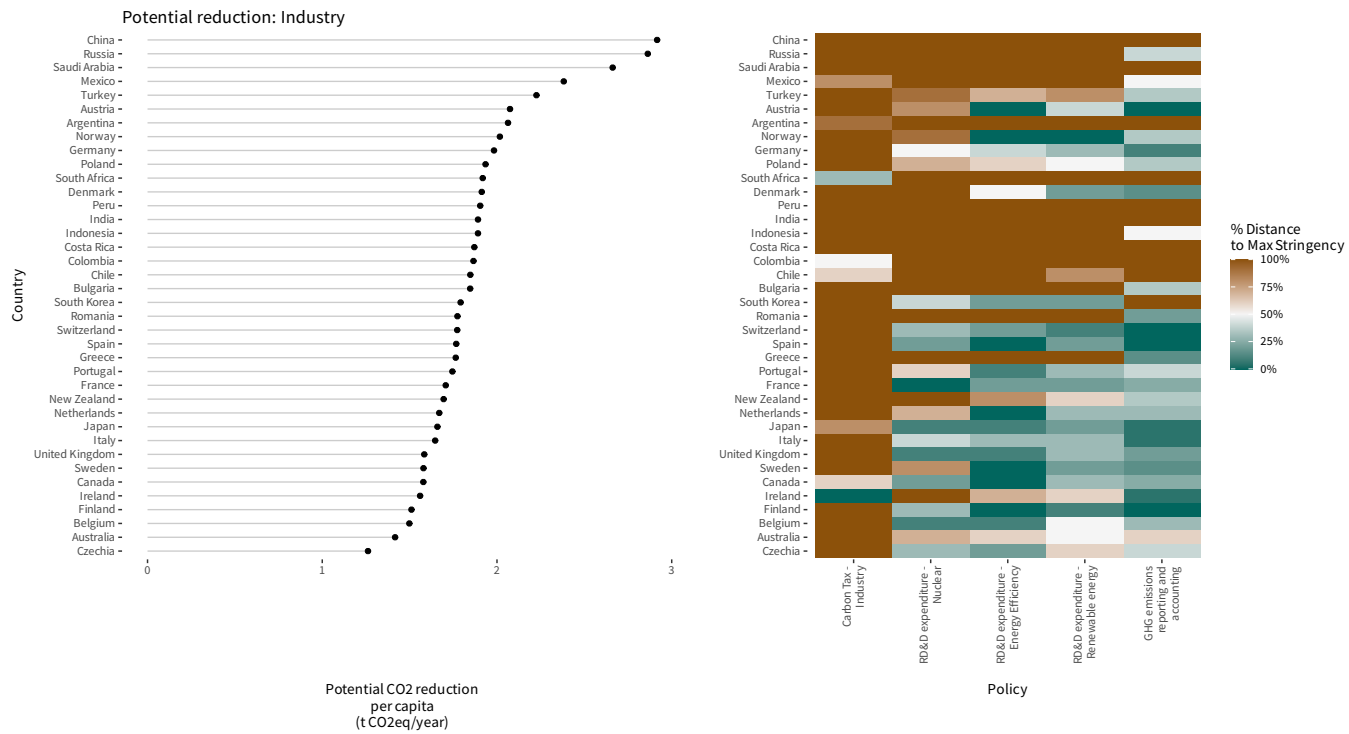


Figure A29: Potential reduction actions in Industry.

C.2 Energy

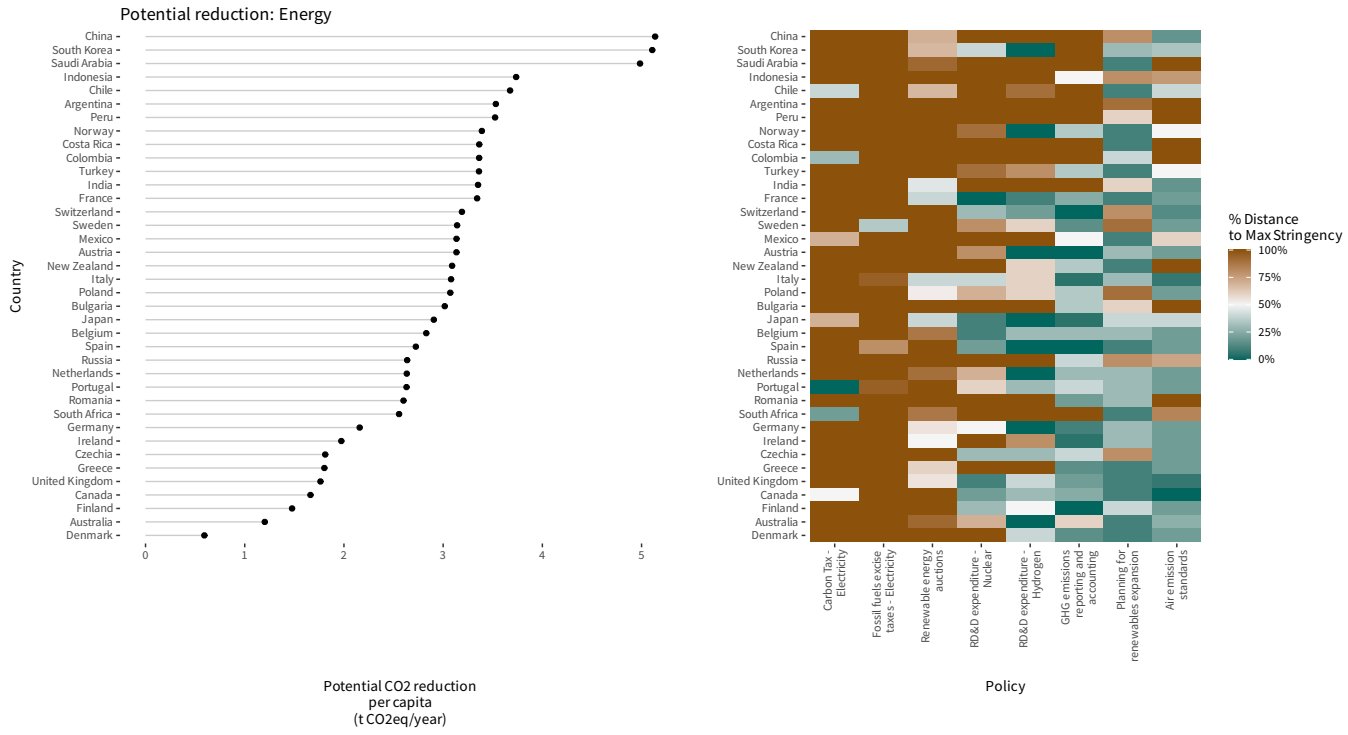


Figure A30: Potential reduction actions in Energy.

C.3 Buildings

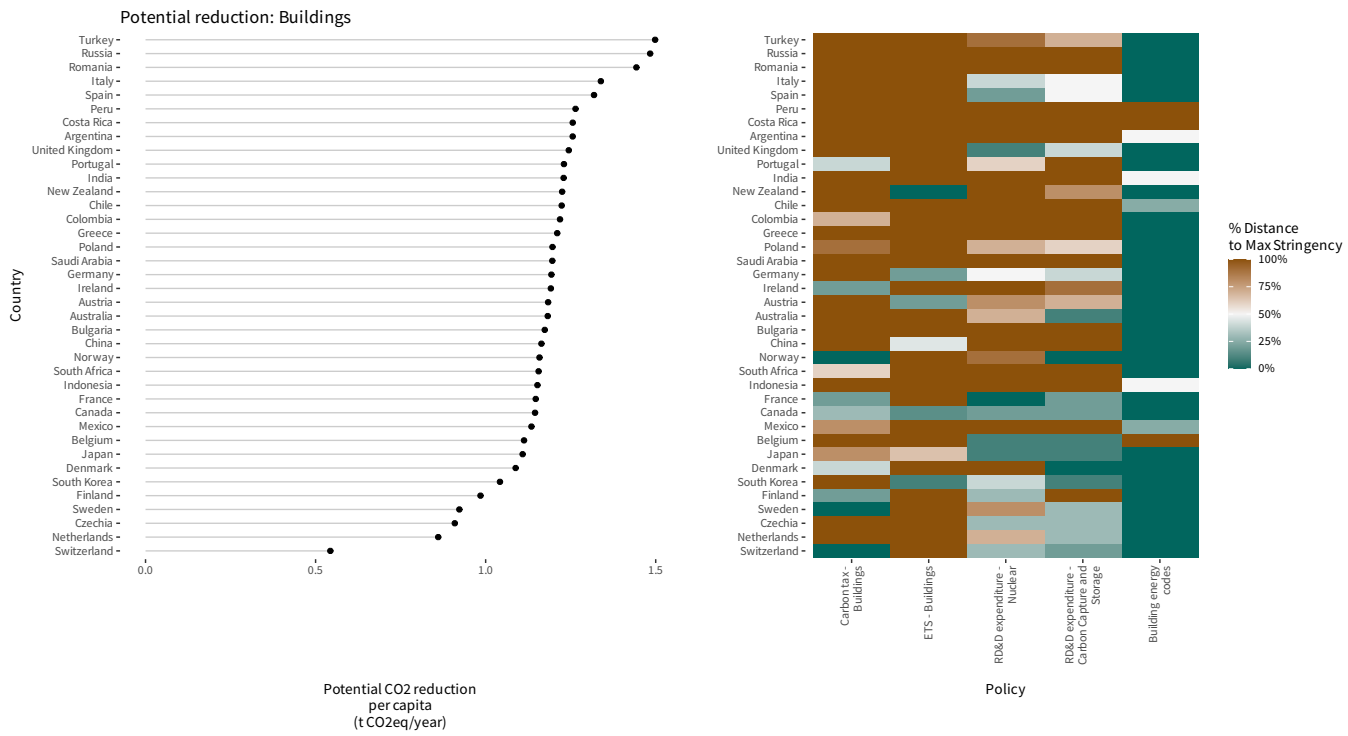


Figure A31: Potential reduction actions in Buildings.

C.4 Buildings, without carbon taxes

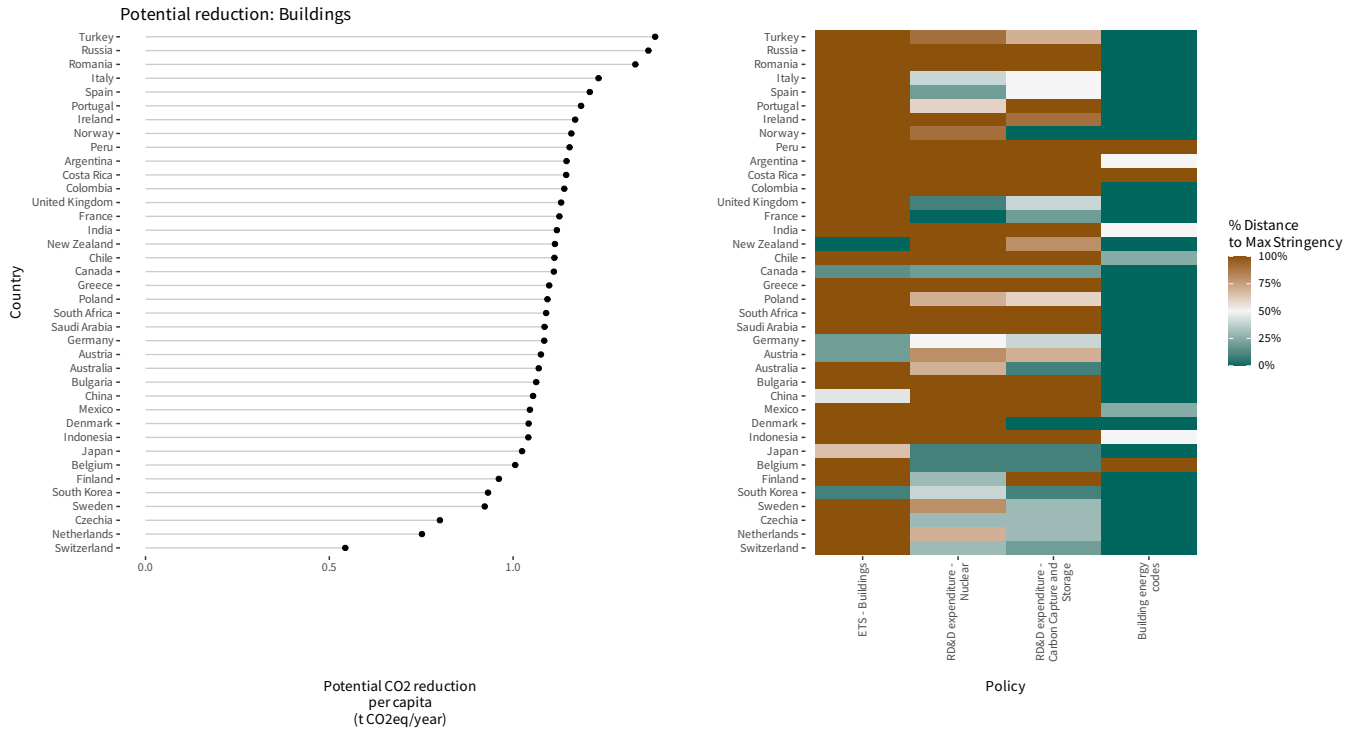


Figure A32: Potential reduction actions in Buildings, excluding carbon taxes.

C.5 Buildings, without ETS

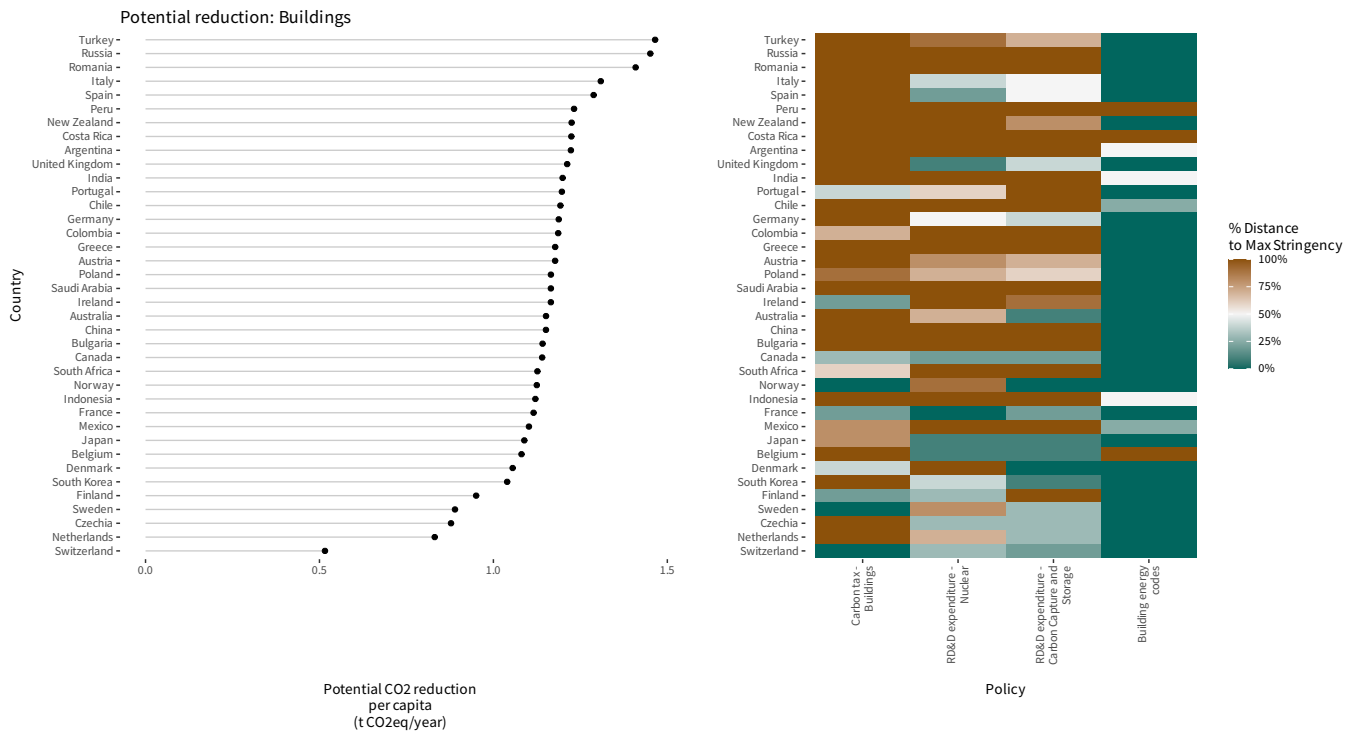


Figure A33: Potential reduction actions in Buildings, excluding ETS.

D Comparison

”ActionPolicy” refers to the original OECD label, which is used in our article. The last two columns exhibit the labels employed by Stechemesser et al. (2024). Stechemesser et al. (2024) also base their work on the OECD dataset but use slightly different names for the labels, as shown in the final columns. Furthermore, in the course of their analysis, they aggregate some policies. The respective labels are presented in the third column.

Table A1: List of effective policies, consistently classified. Policy mix.

Sector	ActionPolicy / Original OECD	Stechmesser et al. (2024)	Stechmesser et al. (2024) / OECD
Buildings	Ban and phase out of fossil fuel heating systems	Ban & phase out	Ban and phase out of fossil-fuel heating systems
Buildings	Ban and phase out of fossil fuel heating systems	Ban & phase out	Ban and phase out of fossil-fuel heating systems
Buildings	Building energy codes	Building code	Building energy codes
Buildings	Building energy codes	Building code	Building energy codes
Buildings	Carbon tax - Buildings	Taxation	Carbon tax - Buildings
Buildings	Carbon tax - Buildings	Taxation	Carbon tax - Buildings
Buildings	ETS - Buildings	Taxation	Emissions trading schemes - Buildings
Buildings	ETS - Buildings	Taxation	Emissions trading schemes - Buildings
Buildings	Fossil fuels excise taxes - Buildings	Taxation	Fossil fuels excise taxes - Buildings
Buildings	Fossil fuels excise taxes - Buildings	Taxation	Fossil fuels excise taxes - Buildings
Electricity	Air emission standards	Air pollution standard	Air pollution standards for coal power plants
Electricity	Carbon Tax - Electricity	Taxation	Carbon tax - Electricity
Electricity	Carbon Tax - Electricity	Taxation	Carbon tax - Electricity
Electricity	Fossil fuels excise taxes - Electricity	Taxation	Fossil fuels excise taxes - Electricity
Electricity	Fossil fuels excise taxes - Electricity	Taxation	Fossil fuels excise taxes - Electricity
Electricity	Planning for renewables expansion	Renewable planning	Planning for renewables expansion
Electricity	Planning for renewables expansion	Renewable planning	Planning for renewables expansion
Electricity	Renewable energy auctions	Renewable subsidy	Auctions for solar PV and wind
Electricity	Renewable energy auctions	Renewable subsidy	Auctions for solar PV and wind
Electricity	Renewable energy certificates	Renewable portfolio standard	RPS with tradeable renewable energy certificates
Electricity	Renewable energy certificates	Renewable portfolio standard	RPS with tradeable renewable energy certificates
Industry	Carbon Tax - Industry	Taxation	Carbon tax - Industry
Industry	Carbon Tax - Industry	Taxation	Carbon tax - Industry
Industry	Financing mechanisms available - Industry	Financing mechanism	Financing mechanism for energy efficiency - Industry
Industry	Financing mechanisms available - Industry	Financing mechanism	Financing mechanism for energy efficiency - Industry
Industry	Fossil fuels excise taxes - Industry	Taxation	Fossil fuels excise taxes - Industry
Industry	Fossil fuels excise taxes - Industry	Taxation	Fossil fuels excise taxes - Industry
Transport	Carbon tax - Transport	Taxation (driving)	Carbon tax - Transport
Transport	Carbon tax - Transport	Taxation (driving)	Carbon tax - Transport
Transport	Congestion charges	Taxation (driving)	Congestion Charges
Transport	Congestion charges	Taxation (driving)	Congestion Charges
Transport	Fossil fuels excise taxes - Transport	Taxation (driving)	Fossil fuels excise taxes - Transport
Transport	Fossil fuels excise taxes - Transport	Taxation (driving)	Fossil fuels excise taxes - Transport
Transport	Fossil fuels subsidies - Transport	Fossil fuel subsidy reform	Fossil fuels subsidies reform - Transport
Transport	MEPS Transport	Performance standard	Minimum energy performance standards - Transport / Fuel economy standards
Transport	MEPS Transport	Performance standard	Minimum energy performance standards - Transport / Fuel economy standards

Table A2: List of ineffective policies, consistently classified. Policy mix.

Sector	ActionPolicy / Original OECD	Stechmesser et al. (2024)	Stechmesser et al. (2024) / OECD
Buildings	Fossil fuels subsidies - Buildings	Fossil fuel subsidy reform	Fossil fuels subsidies reform - Buildings
Buildings	Mandatory energy labels for appliances	Label	Mandatory labels for appliances
Buildings	MEPS of appliances	Performance standard	Minimum energy performance standards of appliances
Electricity	Ban and phase out on the construction of coal-fired power plants	Ban & phase out	Ban on the construction of new and phase out of existing unabated coal plants
Industry	Fossil Fuel Subsidies - Industry	Fossil fuel subsidy reform	Fossil fuels subsidies reform - Industry
Transport	Ban and phase out of passengers cars with ICE	Ban & phase out	Ban and phase out of passengers cars with ICE

Table A3: List of inconsistently classified policies. Policy mix.

Sector	ActionPolicy / Original OECD	Stechmesser et al. (2024)	Stechmesser et al. (2024) / OECD
Buildings	Financing mechanisms available - Buildings	Financing mechanism	Financing mechanisms for energy efficiency - Buildings
Buildings	Financing mechanisms available - Buildings	Financing mechanism	Financing mechanisms for energy efficiency - Buildings
Buildings	Fossil fuels subsidies - Buildings	Fossil fuel subsidy reform	Fossil fuels subsidies reform - Buildings
Buildings	Mandatory energy labels for appliances	Label	Mandatory labels for appliances
Buildings	MEPS of appliances	Performance standard	Minimum energy performance standards of appliances
Electricity	Air emission standards	Air pollution standard	Air pollution standards for coal power plants
Electricity	Ban and phase out on the construction of coal-fired power plants	Ban & phase out	Ban on the construction of new and phase out of existing unabated coal plants
Electricity	ETS - Electricity	Taxation	Emissions trading schemes - Electricity
Electricity	ETS - Electricity	Taxation	Emissions trading schemes - Electricity
Electricity	Feed-In-Tariffs	Renewable subsidy	Feed in tariffs for solar PV and wind
Electricity	Feed-In-Tariffs	Renewable subsidy	Feed in tariffs for solar PV and wind
Industry	ETS - Industry	Taxation	Emissions trading schemes - Industry
Industry	ETS - Industry	Taxation	Emissions trading schemes - Industry
Industry	Fossil Fuel Subsidies - Industry	Fossil fuel subsidy reform	Fossil fuels subsidies reform - Industry
Transport	Ban and phase out of passengers cars with ICE	Ban & phase out	Ban and phase out of passengers cars with ICE
Transport	ETS - Transport	Taxation (driving)	Emissions trading scheme - Transport
Transport	ETS - Transport	Taxation (driving)	Emissions trading scheme - Transport
Transport	Fossil fuels subsidies - Transport	Fossil fuel subsidy reform	Fossil fuels subsidies reform - Transport

E Assessment of Evidence

To assess the evidence of a specific policy’s effect on reducing emissions, we make decisions at two different levels: the individual model level and the cross-model comparison of effects. We apply filters to minimize false positives and ensure that we only report evidence of a negative impact on emissions for policies that satisfy strict criteria.

In our cross-model comparison of effects, we determine a policy to be effective if at least two out of the three prior specifications classify it as effective.

At the model level, we define an effect as any policy associated with a reduction in emissions. Some of our models have restricted priors within the negative zone, which means that all of the posterior distribution mass lies in this area. As a result, we cannot use the traditional Bayesian approach of providing a percentage of evidence for a negative effect. Instead, we separate the percentiles of the parameters closer to zero into two ranges: from the 90th to 95th percentiles and from the 95th percentile to zero (the latter being the maximum value in this context). We then calculate the distances between these two ranges. Figure A34 illustrates this, with the distance between the 90th and 95th percentiles shown in red and the distance from the 95th percentile to zero depicted in green. If evidence of a reduction in emissions exists, the posterior distribution should not be “sticking” to zero, indicating that the red distance (90 to 95%) should be smaller than the green distance (95% to zero). Additionally, we introduce a second filter by including a small constant (0.002, based on the magnitude of the average parameters). This constant helps to clearly distinguish between the two percentiles (represented by the red and green lines) and effectively classifies parameters as either effective or ineffective. Together, these two filters form our regular assessment of evidence at the individual model level. For more lenient evaluations, we relax this criterion and do not apply the constant.

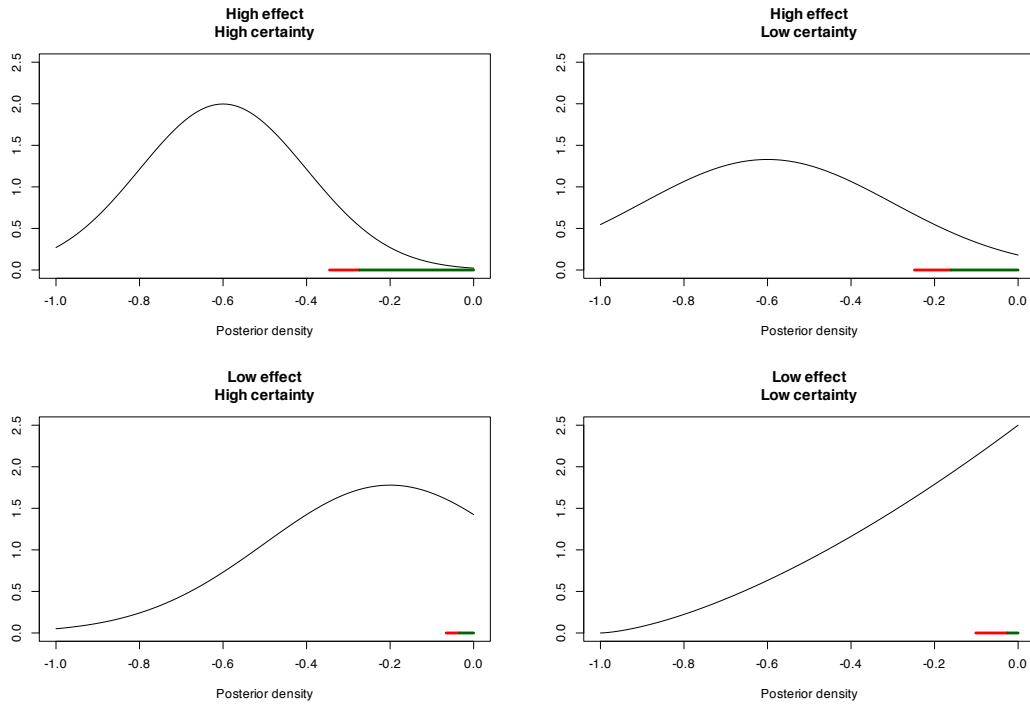


Figure A34: Example of Posterior Distributions with Varying Magnitudes of Effect and Levels of Certainty: The red line illustrates the distance between the 90th and 95th percentiles, while the green area represents the distance from the 95th percentile to zero, where zero indicates an absolute lack of evidence. When the red line is larger than the green line, it indicates that the parameter is not “sticking” to zero, thereby providing evidence of a negative effect—specifically, a reduction in emissions.

F Data sources

Variable	Description	Measurement	Data Source	Time
CO₂ emissions by sector	Sector-specific CO ₂ emissions: buildings, energy, industry, and transport, population-adjusted and logged	Metric tons per million people (log)	EDGAR	2000–2022
Climate policies	Individual climate policies across sectors and instruments	Stringency (integers 0 to 10)	CAPMF	2000–2022
GDP per capita	Economic wealth of a country	USD (constant prices, PPP-adjusted)	World Bank, WDI (NY.GDP.PCAP.KD)	2000–2022
GDP growth	Annual change in national economic output	Percent change (%)	World Bank, WDI (NY.GDP.MKTP.CD)	2000–2022
Fossil fuel energy share	Proportion of total energy consumption derived from fossil fuels	Percent of total energy (%)	World Bank, WDI (EG.USE.COMM.FO.ZS)	2000–2022
Industry share	Contribution of the industrial sector to GDP	Percent of GDP (%)	World Bank, WDI (NV.IND.TOTL.ZS)	2000–2022
Trade openness	Trade volume relative to economic size	Percent of GDP (%)	World Bank, WDI (NE.TRD.GNFS.ZS)	2000–2022
Urban population	Share of population living in urban areas	Percent of population (%)	World Bank, WDI (SP.URB.TOTL.IN.ZS)	2000–2022
State capacity	Government’s ability to effectively implement and enforce policy	Composite index (standardized)	Hanson & Sigman (2021)	2000–2015 (filled to 2022)
Climate policy activity	Total number of climate policies adopted	Count of policies	CAPMF	2000–2022

G Climate Datasets

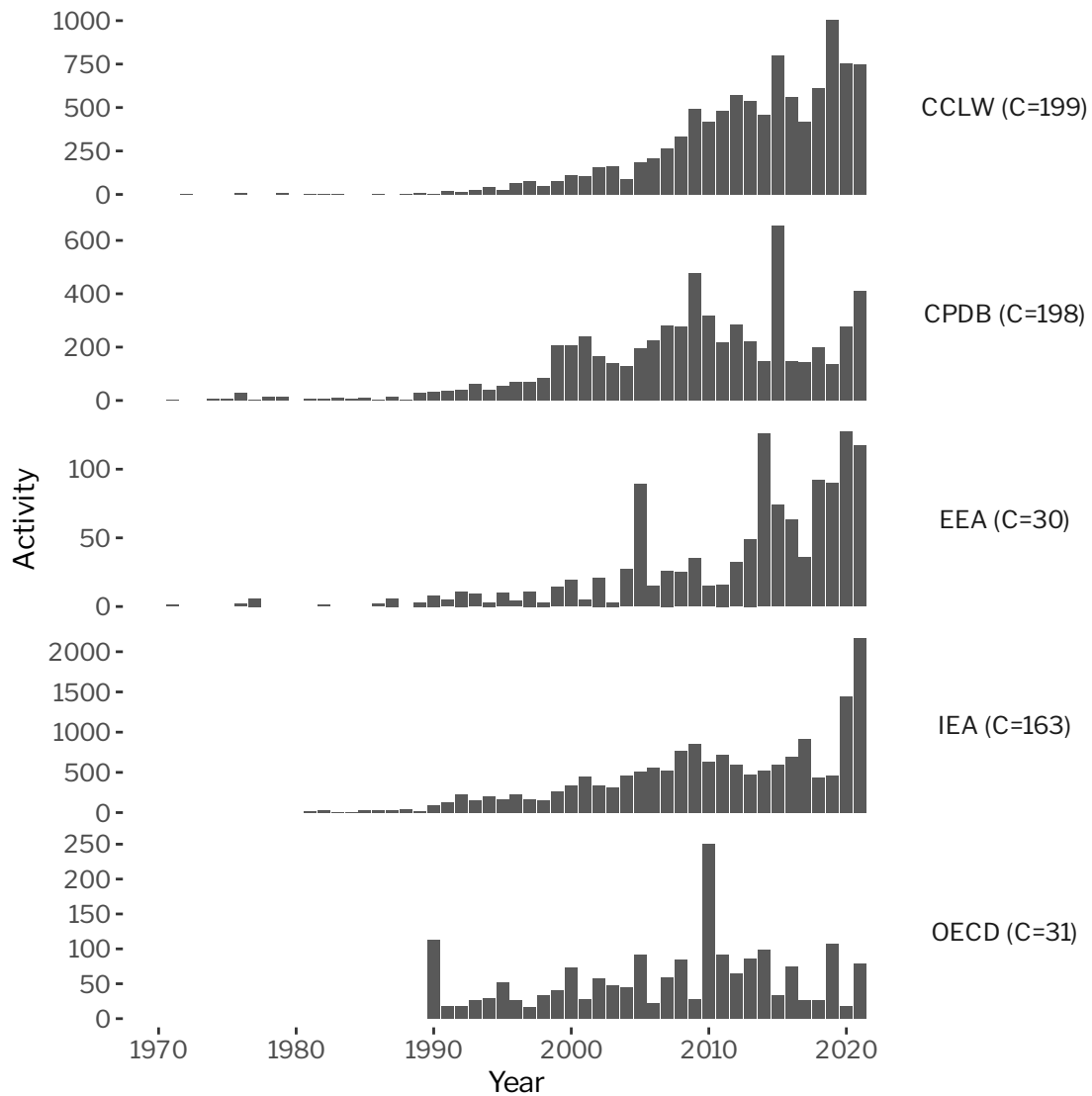


Figure A35: Climate policy growth across different climate datasets^a.

^aThe figure shows the growth of climate policies across different datasets. Each bar represents the new policy activity included in the respective dataset in each year. The number in parenthesis presents the number of countries covered by the respective datasets. The different number of countries and policies in each database implies that the vertical axis is singular for each database. CCLW refers to the Climate Change Laws of the World dataset (Fankhauser, Gennaioli, and Collins, 2016), CDPD denotes the Climate Policy Database (NewClimate Institute, Wageningen University and Research, and PBL Netherlands Environmental Assessment Agency, 2023), EEA represents the European Environment Agency dataset (E. E. Agency, 2024), IEA is the International Energy Agency dataset (I. E. Agency, 2024), and OECD refers to the dataset from the Organisation for Economic Co- operation and Development (Nachtigall et al., 2024).

H Comparison

Sector	Agreement		Disagreement		% Correct
	Effect	No-Effect	Effect	No-Effect	
Transport	0.71	0	0	0.29	0.71
Electricity	0.67	0	0	0.33	0.67
Industry	0.60	0	0	0.40	0.60
Buildings	0.56	0	0	0.44	0.56
TOTAL	0.63	0	0	0.37	0.63

Table A5: Comparison with Stechemesser et al. (2024)^a.

^aThe table compares our findings with those of Stechemesser et al. (2024), using the Truncated T model as the baseline. It highlights where our analysis agrees with theirs and where our conclusions differ.

References

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- Fankhauser, Samuel, Caterina Gennaioli, and Murray Collins. “Do international factors influence the passage of climate change legislation?” In: *Climate Policy* 16.3 (2016), pp. 318–331. DOI: [10.1080/14693062.2014.1000814](https://doi.org/10.1080/14693062.2014.1000814).
- Nachtigall, Daniel et al. “The climate actions and policies measurement framework: a database to monitor and assess countries’ mitigation action”. In: *Environmental and Resource Economics* 87.1 (2024), pp. 191–217. DOI: [10.1007/s10640-023-00821-2](https://doi.org/10.1007/s10640-023-00821-2).
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