

Is corporatism clean or dirty? Examining the effects of corporatism on climate policy

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Abstract

TBD. Use Gillardi's abstract template.

Theoretically, I will defend two sets of claims. First, I argue that corporatism is, *ceteris paribus*, conducive to stringent climate policy when pro-climate public opinion is high, while the reverse holds in countries, where carbon-intensive manufacturing accounts for a large share of overall GDP or value added. Second, corporatism, I submit, has a tendency to impose a relatively greater share of costs on consumers than producers, especially when the economy is highly open. Yet, high electoral competitiveness, especially when driven by green parties, counteracts this tendency.

*Word count: XXX (excluding bibliography and appendix)

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1 Introduction

- Start with climate policy being a long-term Olsonian setting. One or two additional sentences. Most of the literature has focused on the welfare economics and political economy of instrument choice to meet this problem. More recently, however, interest has shifted to the role of political and economic institutions (Finnegan, 2022; Meckling and Nahm, 2022; Meckling et al., 2022; Meckling and Karplus, 2023; Srivastav and Rafaty, 2023; Zwar et al., 2023). Among these institutions is corporatism. In doing so, the lit has revived an older debate.
- Define corporatism and concertation.
- Two developments motivate this broader interest: The reduced-form correlation (figure here, probably better to start with qualitative stuff) and qualitative case studies. Then, point out increasing interest by corporatist actors in climate policy, DGB's comment on KSG and climate framework legislation more generally (Zwar et al., 2023; Flachsland et al., 2024) and BDI's role; Sweden as well (Karlsson, 2021; Matti et al., 2021; Nasiritousi and Grimm, 2022)
- Briefly outline two perspectives and conflicting findings. Point to gaps.
- Then outline your theoretical argument and empirical contributions.

Refer to Table A1.

The remainder of this paper is structured as follows. In Section 2, I will survey the relevant literature. Doing so will pave the way for setting out my theoretical contribution in Section 3. Section 4 is devoted to testing my theoretical hypotheses empirically. In Section 5, I summarise this paper's overall contribution and reflect on potentially promising avenues for future research.

2 Situating the argument in the literature: Mixed empirical results and two contrasting theoretical perspectives

There is a considerable body of work on the link between corporatism and climate policy. The early contributions to the literature were almost entirely empirical, focused on estimat-

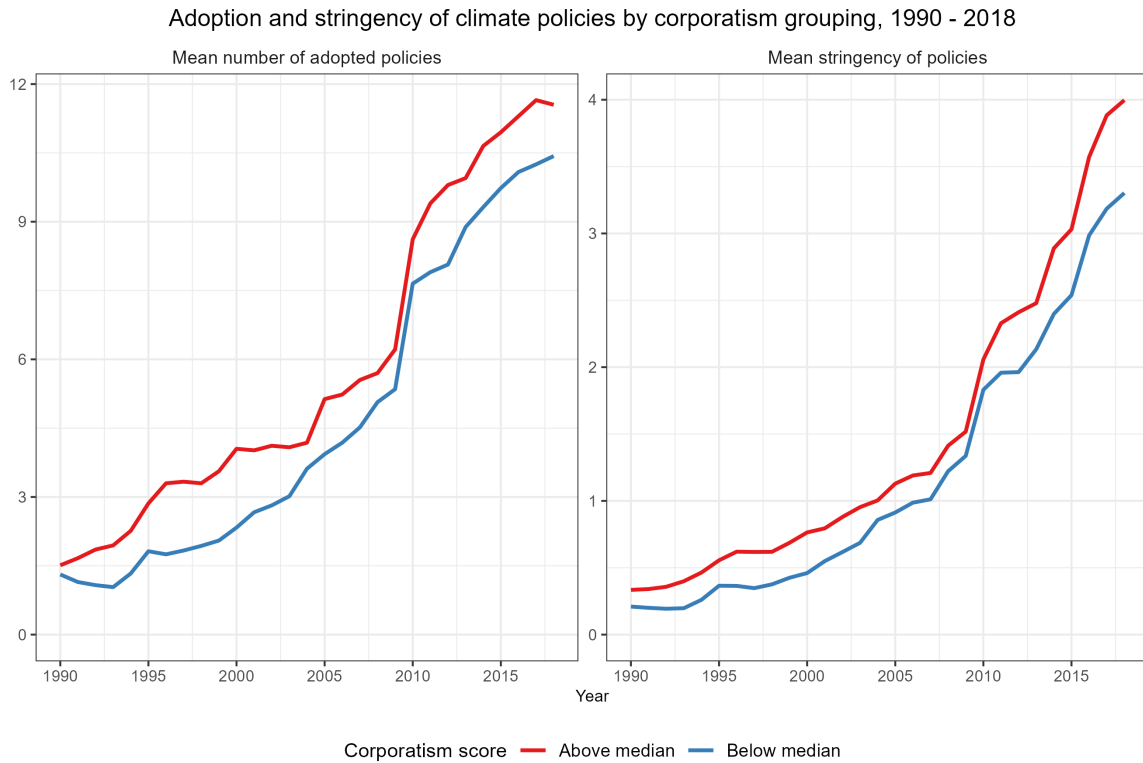


Figure 1: Adoption and stringency of policies by corporatism grouping, 1990 – 2018

Notes: The Figure is based on the OECD's CAPMF (OECD, 2023; Nachtigall et al., 2024) data, with the time-varying corporatism measure taken from Jahn (2016a). The theoretical range for the stringency variable is 0-10. The latter is averaged over all countries, sectors, and instrument types. The median is computed for each year and across countries.

ing the reduced-form¹ relationship between corporatism and carbon emissions (Scruggs, 1999, 2001, 2003; Jahn, 1998, 2016b). While these cross-country regressions yielded mostly, albeit not unambiguously, positive results, two factors cast doubt on the causal nature of this positive correlation – the likely presence of unobserved confounders and the under-theorised link between corporatism and emissions, or, more broadly, the stringency of climate policy.

More recent work has tried to address these theoretical and empirical shortcomings. Before summarising this work, however, two caveats are in order. First, despite (marked) differences in the theoretical approaches and empirical findings of works in that newer literature, they all exhibit one commonality – they focus on the stringency of climate policies, rather than emissions, as their dependent variable of interest. Stringency refers, roughly

¹See Haile (2018) for an extended discussion of this term in the econometric literature. Here, I use it to indicate that these works do not explore the mechanisms through which corporatism affects emissions.

speaking, to the level of ambition of some climate policy (Nachtigall et al., 2024). For instance, a carbon tax of £20 per tonne CO₂ is less stringent than a tax rate of £100 per tonne. Whether and to what extent more stringent policies result in emissions reductions is a conceptually and empirically distinct question, which the literature therefore ignores.

Second, the more recent literature (implicitly) assumes governments' interests *for*² climate policy to be given exogenously. Given some exogenous pressure to ramp up the stringency of climate policy, this body of scholarship seeks to theorise how corporatist structures – institutionalised fora where labour, business, and the government bargain with one another – moderate that pressure, whether they hinder or help governments with (temporarily) pro-climate objectives. While not discussed explicitly in the literature, at least two rationales underlie this assumption. On the one hand, governments are bound by³ international obligations, notably climate treaties, such as the 2015 Paris Agreement, and/or affected by decisions taken at the inter- or even supra-national levels, particularly the EU one. The *European Effort Sharing Regulation*⁴ (ESR) was, for example, a major reason why the German government introduced an emissions trading scheme for the transport and heating sectors in 2019, as, inter alia, Fesenfeld et al. (2024) argue.⁵ On the other hand, exogenous shocks, including the steep increases in energy prices that some European countries experienced following Russia's invasion of Ukraine, can put pressure on governments to enact climate or climate-relevant policies, such as subsidising households' energy consumption to cushion the effect of rising energy prices (Fetzer et al., 2024).

Bearing these two caveats in mind, let me turn to the two dominant approaches – most prominently articulated by Finnegan (2022) and Mildemberger (2020) respectively – in the more recent literature on the link between corporatism and climate policy. Theoretically, Finnegan-type approaches draw on two literatures: the comparative political economy literature on corporatism (Olson, 1982; Landesmann and Vartiainen, 1992; Landesmann, 1992;

²Conversely, the assumption is that those whose material interests are threatened by decarbonisation oppose it, at least initially, i.e. need to be compensated in some way.

³It is, of course, true that these are merely *de jure* obligations that can be violated in practice if governments find it (politically) expedient to do so. After all, this is why climate agreements must be self-enforcing: they only work when parties have incentives to abide by them, even in the absence of third parties that can enforce compliance (Barrett, 1994, 2007; Harstad, 2012, 2016; Kornek and Edenhofer, 2020; Battaglini and Harstad, 2020). Note that the work by Genovese (2019, 2021) examines how variation in sectoral and economic characteristics moderates governments' incentives to heed their international obligations.

⁴The ESR, adopted in 2018, stipulates emission reduction targets for all EU member states in sectors not covered by the EU emissions trading system (domestic transport (excluding aviation), buildings, agriculture, small industry, and waste). Crucially, non-compliance entails hefty financial sanctions.

⁵Specifically, the German government realised that without additional measures it would violate its obligations under the ESR and have to pay considerable fines, which it wanted to avoid.

Hicks and Kenworthy, 1998; Iversen, 1999; Iversen et al., 2000; Swank, 2002; Wallerstein, 2008; Seidl, 2023) and that on long-term⁶ policymaking (Jacobs, 2011, 2016; Jacobs and Matthews, 2012, 2017; Lindvall, 2010, 2017; Andersson and Lindvall, 2018; Jacques, 2022; Birch, 2023; Sheffer et al., 2024; Hale, 2024).

Accordingly, these authors argue that corporatism is conducive to more stringent climate policy because it allows politicians to credibly promise to compensate the losers of the structural transformation associated with decarbonisation (Finnegan, 2022). This follows from corporatism providing labour and capital with institutionalised access to policymaking (see Section 1) and the folk-theorem logic of repeated games.⁷ That is, concertation in corporatist systems means that capital, labour, and the government interact repeatedly with one another in formally institutionalised settings. Adversely affected segments of the economy, notably workers and businesses in carbon-intensive industries, can then credibly threaten to punish governments for reneging on their promise to compensate them by (effectively) vetoing any government's proposals in the 'next round'. This logic is powerfully illustrated by free allocations or allowances in emissions trading systems, which effectively exempt some emitters from that form of carbon pricing. If governments rescinded these exemptions after promising them to certain producers, those with access to corporatist concertation fora could then 'punish' the government by blocking future increases of the carbon price.⁸ If, as is the case with EU governments because of the ESR, the failure to let carbon prices rise increases the risk of failing to meet emissions reduction targets and thus hefty financial sanctions, this kind of punishment is particularly credible. In sum, because corporatist structures increase the credibility of compensation, the argument goes (Finnegan, 2022), they enable governments to impose short-term costs in pursuit of the long-term gains generated by climate policy.⁹

⁶I summarise these arguments [here](#) and [here](#).

⁷The 'folk theorems' of repeated games show that, with sufficiently low discount rates, any feasible outcome can be supported as a subgame-perfect equilibrium (Tadelis, 2013, 211).

⁸As Sato et al. (2022, 3) write: "Today, all emissions trading systems covering industry offer some form of exemption or "compensation" in the form of free allocation, which to varying degrees enable emitters to carry on with limited adjustment." See also Belausteguigoitia et al. (2022) on the Mexican emissions trading system.

⁹Finnegan (2022) adds two twists to this rather conventional corporatism-related argument. First, applying the logic set out by Rogowski and Kayser (2002) and Chang et al. (2010), he argues that, relative to their majoritarian counterparts, proportional electoral (PR) systems – on account of their lower vote-seat elasticity – make it easier for governments to impose costs on consumers. Second, Finnegan (2022) follows the varieties-of-capitalism logic (Hall and Soskice, 2001, sec. 1.2.6) by maintaining that corporatism and PR systems are institutional complements in the case of climate policy. This is because both institutions facilitate the imposition of (concentrated) short-term costs, with corporatism allowing governments to credibly compensate adversely affected producers and PR systems enabling them to 'ignore' some of the adversely affected consumers or

Empirically, the literature provides some qualitative and quantitative evidence for the stringency-enhancing effect of corporatism. On the quantitative side, [Finnegan \(2022\)](#), for instance, improves on the early ‘reduced-form’ studies by employing more fine-grained and longer-term data as well as more demanding fixed-effects models. As a result, we have somewhat more robust evidence for a positive reduced-form link between corporatism and climate policy. That said, the case for causal identification remains relatively weak and none of the large-N analyses extend beyond 2009 ([Finnegan, 2022](#)).¹⁰ By contrast, the qualitative (comparative) case studies ([Gronow et al., 2019](#); [Kronsell et al., 2019](#)) seek to shed light on the causal mechanisms through which corporatism boosts the stringency of climate policy and thus rectify the lack of attention to mechanisms in ‘reduced-form’ quantitative work. These studies highlight the importance of repeated and institutionalised interactions between the government and potential losers of climate policy – in the form of trade unions and peak business or employers associations – for introducing and sustaining ambitious climate policy.

As part of this renewed interest in the corporatism-climate-policy nexus, however, a competing perspective has emerged, which sees corporatism as impeding stringent climate policy. [Mildenberger \(2020\)](#), the best-known proponent of this view, argues that concertation gives both ‘dirty’ capital and labour – workers and businesses in carbon-intensive sectors – guaranteed access to policymaking (‘double representation’), which, in turn, allows them to either block the adoption of climate policy or reduce its stringency. On this account, then, corporatist structures enable carbon-intensive producers to pursue their interests more effectively (than they could in pluralist interest group systems) by virtue of granting these actors a great deal of veto power. Unlike proponents of the corporatism-as-credible-compensation view, however, [Mildenberger \(2020\)](#) does not offer any large-N empirical evidence for his hypothesis, instead relying on a series of qualitative case studies.

The preceding shows that at least two gaps remain in the literature: one theoretical and the other empirical. Theoretically, there is a need for a more nuanced framework, in particular one that can integrate both the compensation and double-representation logics. Achieving this objective requires us to (i) relax the assumption that governments’ prefer-

voters. I mention this because I will return to the distribution of costs between consumers and producers in Section 3. Unlike [Finnegan \(2022\)](#), I argue that corporatism, not just electoral systems, affects this distribution in the case of climate policy.

¹⁰The reason is that data on shadow carbon prices, compiled by [Althammer and Hille \(2016\)](#) and used by [Finnegan \(2022\)](#) as a proxy for the stringency of climate policy, is only available for the period from 1995 to 2009.

ences for climate policy are exogenous to the political system and (ii) more carefully theorise how corporatist actors' interests are aggregated into overall policies. Doing so is necessary for specifying when the anti-climate preferences of carbon-intensive producers are likely to prevail (and what that means) and when the reverse will be more likely to materialise. That is, blocking policies is not the only option for carbon-intensive producers to respond to governments' climate ambitions (nor necessarily their best response), as Mildenberger-type arguments (implicitly) assume. Instead, they might be able to extract concessions from the government that ultimately shift the costs of climate policy to consumers.

Empirically, it is important not only to conduct large-N tests of the predictions yielded by such a framework, but also to do so using more granular (i.e. disaggregated by sector and instrument type) data covering the past 15 years or so. After all, this was the period when most climate policies were adopted, as Figure A1 bears out. Figure A2 reinforces that point. It also shows that cross-sectoral climate policies, notably the adoption of greenhouse gas (GHG) emission reduction targets (column three in Figure A3), only became widespread after 2009 and are thus excluded from previous analyses. Finally, Figure A4 brings home that there exists considerable variation in the number and stringency of climate policies between sectors and instrument types (market-based vs. non-market-based ones). To reduce the likelihood of the positive corporatism-climate-policy correlation being spurious, i.e. being driven by sectoral or instrument-specific characteristics, disaggregated data are crucial because they allow us to net out time-invariant (un)observed confounders at the sectoral and/or instrument-type level.

3 Theoretical framework

In this section, I take the first step towards filling these gaps by, first, dwelling on the conceptualisation of my independent and dependent variables, respectively, (Section 3.1) and then outlining my theoretical framework (Section 3.2).

3.1 Preliminaries: Defining the dependent and independent variables

My key independent variable, corporatism, is, as [Siaroff \(1999\)](#) and [Jahn \(2016a\)](#) point out, a complex concept. Given that, it is crucial to specify what aspects of corporatism constitute the theoretical quantity of interest – which, incidentally, the literature surveyed above fails to do. I will, as hinted at in the previous sections, mainly focus on the (tripartite) concer-

tation dimension of corporatism, as opposed to other important dimensions, such as the coverage of wage bargaining agreements. By concertation, I mean, following [Munk Christiansen \(2020, 161\)](#), (formal) structures that institutionalise the integration of representatives of labour (e.g. trade unions) and capital (e.g. peak business associations) in the formulation and, potentially, implementation of the government's (economic) policy. While some conceptual fuzziness remains,¹¹ this definition of concertation is sufficient to bring out its central characteristic – the granting of institutionalised access to government policymaking to organised labour and capital. A case in point is, as [Nasiritousi and Grimm \(2022\)](#) and [Zwar et al. \(2023, p. 28 and footnote 28\)](#) note, the *Fossil Free Sweden* initiative – a government-led forum, where trade unions and business associations come together to develop transition plans for the different sectors of the economy.

The reason for zeroing in on concertation is twofold. First, concertation is a feature shared by all corporatist systems, which maximises the scope of my theoretical claims, at least within the group of corporatist countries. Second, concertation captures the structure and frequency of interactions between representatives of capital and labour, on the one hand, and governments, on the other. It is with these patterns of interactions that the two contrasting perspectives in the literature are concerned.

As for my dependent variables, I am interested in two distinct climate policy outcomes. On the one hand, I will analyse the overall (relative) stringency of climate policy (see Section 2), which [Nachtigall et al. \(2024\)](#) define as the ambition of a given policy, relative to the ambition level of the same type of policy in all other countries in the same year. Relying on overall stringency importantly implies that I theoretically ignore instrument choice¹² (standards vs. subsidies vs. taxes) and focus on the ambitiousness of the entire policy mix. This is mainly because the corporatism-climate literature focuses on overall stringency. While extending the theoretical framework below to account for instrument choice might be an interesting avenue for further research, it is beyond the scope of this paper. On the other hand, I will examine the distribution of the costs of climate policy between consumers and producers. These are conceptually distinct because similarly stringent or ambitious climate

¹¹If the objective was to develop easily replicable coding rules – rules implying a high probability that different coders classify the same institutional structures as corporatist ([Clark et al., 2017, 166](#)) – one would have to specify more carefully which policy domains fall within the remit of corporatist policymaking.

¹²On the political economy of instrument choice in climate policy, see: [Keohane et al., 1998](#); [Aidt and Dutta, 2004](#); [Goulder and Parry, 2008](#); [MacKenzie and Ohndorf, 2012](#); [Pahle et al., 2018](#); [Levi et al., 2020](#); [Dolphin et al., 2020](#); [Edenhofer et al., 2021](#); [Metcalf, 2021, 2023](#); [Linsenmeier et al., 2022](#); [Stavins, 2022](#); [Steinebach, 2022](#); [Edmondson et al., 2022](#); [Blanchard et al., 2023](#); [van den Bergh and Botzen, 2024](#).

policies can entail a very different distribution of costs and benefits.

3.2 Hypotheses

With these conceptual preliminaries in place, let me now turn to my theoretical hypotheses. To explain these, it is helpful to consider Figure 2, which offers an overview of my argument. The top and bottom rows, respectively, explicate the two theoretical perspectives – Finnegan- and Mildenberger-type arguments – I discussed in Section 2. As Figure 2 shows, the main or (non-interactive)¹³ effect of corporatism on climate policy stringency depends on the relative strength of the credible-compensation effect (à la Finnegan), relative to the double-representation effect à la Mildenberger.

As stated above, one of my objectives is to integrate the perspectives of both the Finnegan- and Mildenberger-type arguments. To that end, I argue that the effects of corporatism on the stringency of climate policy depend on the degree to which the population or electorate is in favour of climate policy (H1), and the share of value added accounted for by the country’s carbon-intensive manufacturing sector (H2).

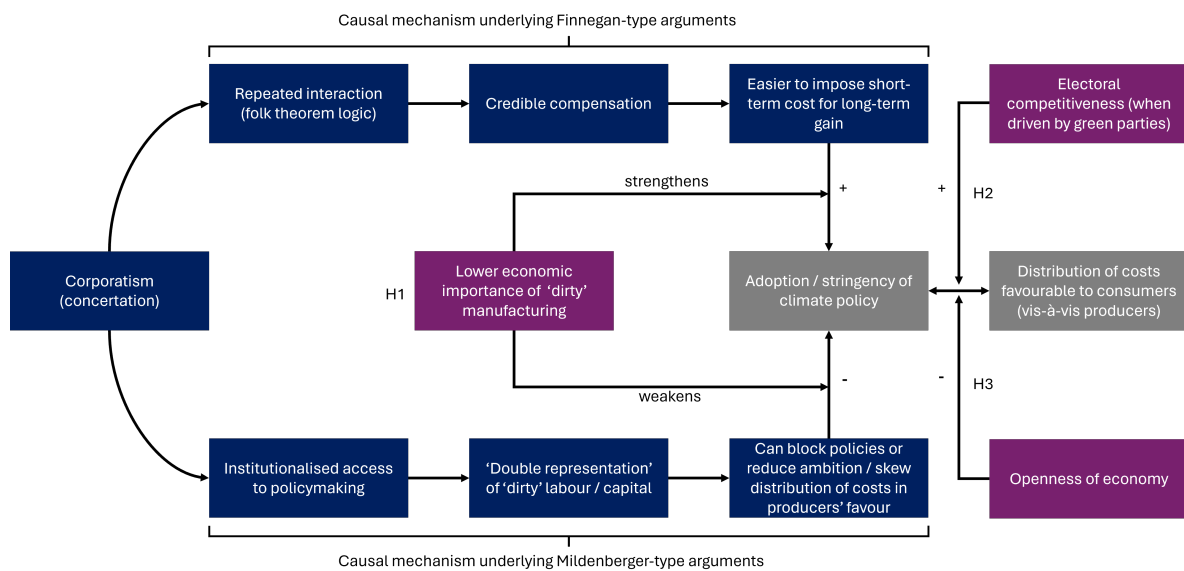


Figure 2: Overview of the theoretical framework

Notes: Purple boxes represent moderating variables, whilst grey boxes refer to my dependent variables of interest. The other boxes are merely coloured for emphasis. Finally, note that indirect effects are not visualised here for simplicity's sake.

The logic of H1 is that, as the share of the electorate that favours (more) stringent climate

¹³In a regression set-up, this would be the coefficient on the corporatism measure without any interaction terms.

policy grows, the strength of corporatism's credible-compensation effect (à la Finnegan) grows, relative to the double-representation effect à la Mildenberger and vice versa (see Figure 2). This is because growing pro-climate public opinion gives the government stronger incentives to counter the resistance of dirty capital and labour by offering compensation for the costs generated by climate policy, rather than shying away from more climate action altogether. Indeed, this is what I would expect if pro-climate opinion is weak. With strong pro-climate public opinion, however, failing to ramp up the stringency of climate policy comes with the risk of losing popularity or even votes.

While H1 is about specifying one scope condition for Finnegan's argument to work, namely sufficiently strong pro-climate public opinion, H2 builds on Mildenberger's logic. H2 states that corporatism's effect on climate policy stringency declines as the economic importance of carbon-intensive manufacturing increases. This is because the strength of the double-representation effect grows, relative to the compensation one, as the carbon-intensive industry accounts for a greater share of GDP or value added, all else equal.

My third and fourth hypotheses concern the distribution of the costs of climate policy between consumers and producers, not policy stringency per se. Following work in international political economy (Rogowski and Kayser, 2002; Chang et al., 2010), I argue that increased electoral competitiveness reduces the willingness of politicians to impose costs on consumers because doing so would harm their electoral prospects (H3). As a result, they will use their clout in corporatist structures to reduce the burden climate policies place on consumers, thus resulting in a distribution of costs more favourable to consumers.

H4 has a Katzensteinian flavour. In more open economies, competitiveness is an important political consideration (Katzenstein, 1985). Unilateral climate policies tend to hurt competitiveness, and this is bad for both capital and labour in carbon-intensive industries. This does not mean that they will necessarily try to prevent stringent climate policy. But it means that they will use corporatist structures to lobby governments to let consumers bear the brunt of the costs of decarbonisation. Greater openness, therefore, should, *ceteris paribus*, result in a distribution of costs more favourable to producers.

| Variable | Operationalisation | Data source |
|---|---|--|
| Dependent variables | | |
| Climate policy stringency | Ambition level, relative to all other countries in a given year | Stringency variable, OECD CAPMF (Nachtigall et al., 2024) |
| Distribution of costs between consumers and producers | Shadow carbon prices for consumers and producers | Finnegan (2022) , Althammer and Hille (2016) |
| | Stringency weighted by upstreamness of sector | Shapiro (2021) , OECD CAPMF |
| Independent variables | | |
| Corporatism | Concertation | Jahn's time-varying index (Jahn, 2016a,b), ICTWSS |
| Pro-climate public opinion | % of the population concerned about the environment | Global Gallup data |
| Carbon-intensive manufacturing sector | % of GDP | CPDS, WDI |
| | % of value added | World Development Indicators, CPDS |
| Electoral competitiveness | Probability of losing/losing office Close elections | Kayser and Lindstädt (2015) |
| Openness of the economy | Total trade as % of GDP | Fetzer and Yotzo (2023) CPDS, WDI |

* CAPMF = Climate Actions and Policies Measurement Framework, CPDS = Comparative Political Dataset, ICTWSS = Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, WDI = World Development Indicators

Table 1: Summary of variables and their operationalisation

4 Empirical analysis

4.1 Data

For climate policy: [Nachtigall et al. \(2024\)](#), [Finnegan \(2022\)](#), [Furceri et al. \(2023\)](#), and, importantly, [Lieberman and Ross \(2024\)](#)

[Kayser and Lindstädt \(2015\)](#); [Cox et al. \(2020\)](#)

4.2 Estimation and results

4.2.1 Extending Finnegan's results

4.2.2 Testing the theory on more fine-grained data

4.2.3 Robustness

4.3 Limitations

5 Conclusion

- Re-state RQ and objectives
- Emphasise contributions and argument.
- Limitations
- Directions for future research (perhaps point to [Shapiro \(2021\)](#) here and discuss that this might be an interesting outcome variable; maybe include sth in appendix).
- Return to broader relevance.

Appendix

Additional tables

| Variable | Corporatism score | | | | Diff in means | p.value |
|--------------------------------------|-------------------|----------|--------------|---------|---------------|---------|
| | Above median | | Below median | | | |
| | Mean | Std.Dev. | Mean | Std.Dev | | |
| Number of adopted policies | 5.9 | 3.7 | 4.7 | 3.7 | -1.2 | <0.001 |
| Stringency | 1.5 | 1.2 | 1.2 | 1.1 | -0.3 | <0.001 |
| Manufacturing value added (% of GDP) | 15.5 | 4.5 | 16.4 | 5.0 | 0.9 | 0.003 |
| Industry value added (% of GDP) | 25.1 | 5.1 | 27.1 | 5.7 | 2.0 | <0.001 |
| CO2 emissions per capita | 8.9 | 4.1 | 8.1 | 4.1 | -0.8 | <0.001 |
| Fossil share electricity | 51.7 | 31.0 | 64.3 | 24.7 | 12.7 | <0.001 |
| Fossil share energy | 75.5 | 20.1 | 84.0 | 11.2 | 8.5 | <0.001 |
| Trade CO2 share | 28.9 | 40.7 | 20.5 | 50.8 | -8.4 | 0.002 |
| Openness of economy | 96.6 | 60.4 | 98.9 | 60.1 | 2.3 | 0.572 |
| Gallagher's disproportionality index | 5.1 | 4.6 | 8.0 | 4.7 | 3.0 | <0.001 |

Table A1: Balance table for Figure 1

Notes: The Table and Figure 1 are based on the following sample of countries: The sample of countries is: Bulgaria, Estonia, Poland, Chile, Sweden, Norway, Croatia, Japan, Mexico, Türkiye, Slovak Republic, Greece, Latvia, France, Czech Republic, Luxembourg, Korea, Netherlands, Canada, Slovenia, Finland, Switzerland, South Africa, Argentina, Australia, Germany, Belgium, Austria, Israel, Malta, New Zealand, Romania, Spain, Ireland, Italy, Hungary, Denmark, United Kingdom, Lithuania, and Portugal.

Additional figures

Climate policy adoption and stringency, in levels and growth rates, 1990 - 2022

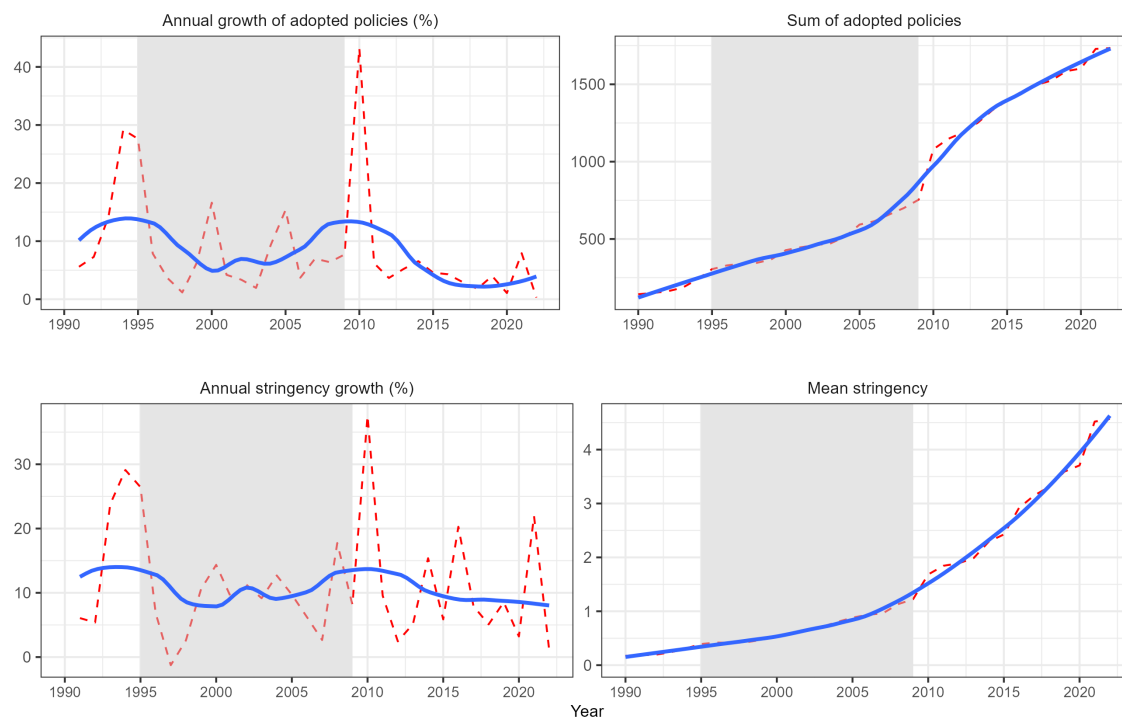


Figure A1: Number of climate policies adopted by country-year

Notes: The Figure is based on the OECD's recently released CAPMF database (OECD, 2023; Nachtigall et al., 2024). The grey shaded area represents the time period of Finnegan's analysis. The red dotted lines capture the actual values, while the blue solid lines represent results from bivariate loess regressions with span 0.5. The theoretical range for the stringency variable is 0-10.

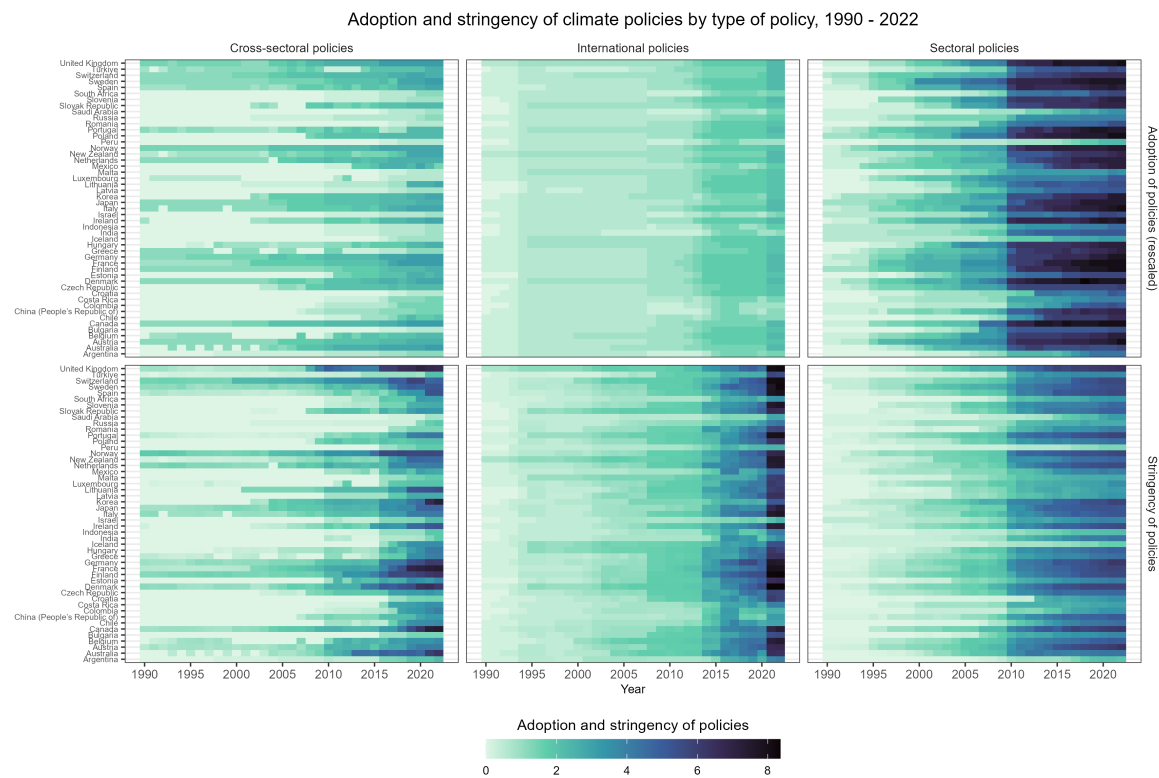


Figure A2: Adoption and stringency of climate policies by type of policy and country, 1990 – 2022

Notes: The Figure is based on the OECD's CAPMF database (OECD, 2023; Nachtigall et al., 2024).

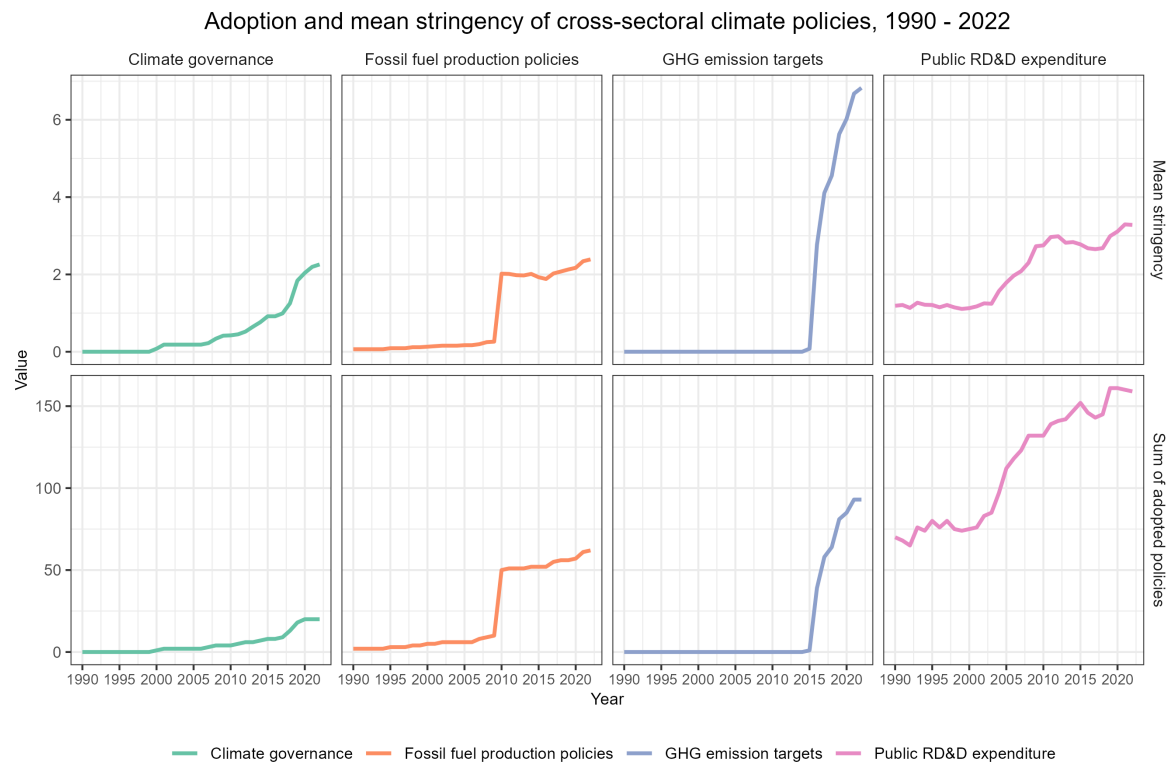


Figure A3: Adoption and mean stringency of cross-sectoral climate policies, 1990 – 2022

Notes: The Figure is based on the OECD's CAPMF database (OECD, 2023; Nachtigall et al., 2024).

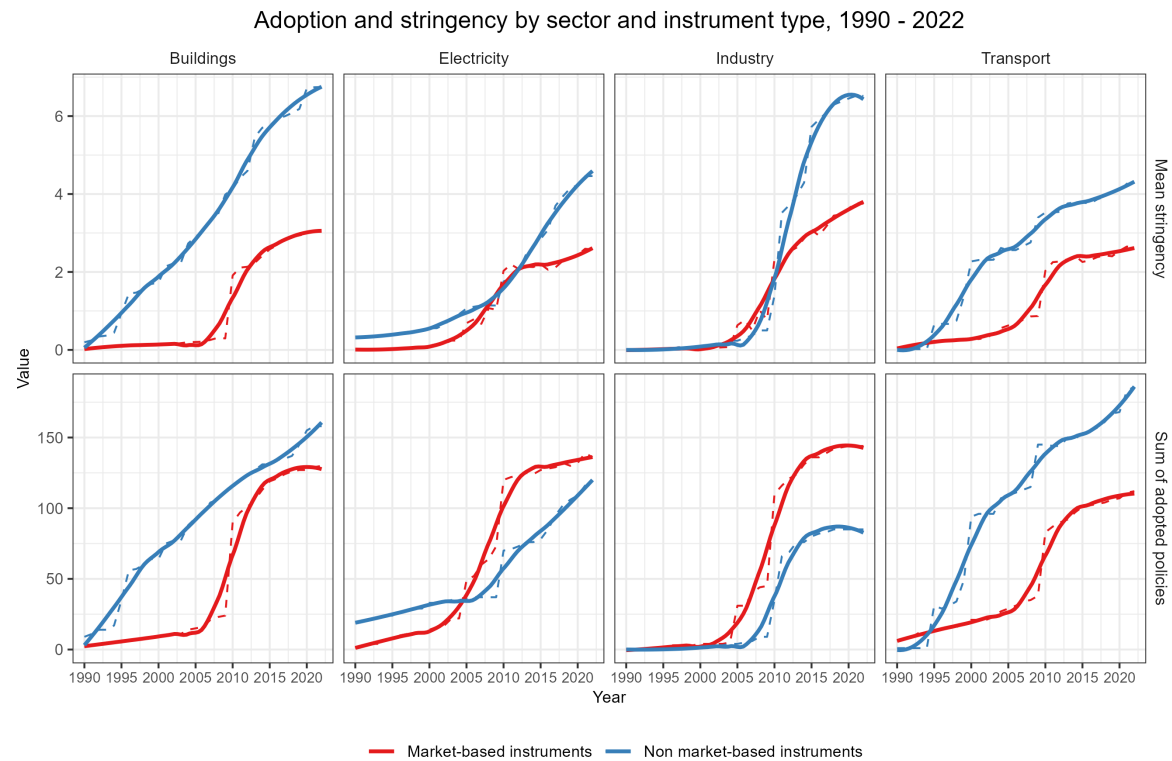


Figure A4: Adoption and stringency of climate policies by sector and instrument type, 1990 – 2022

Notes: The Figure is based on the OECD's CAPMF database (OECD, 2023; Nachtigall et al., 2024). The dotted lines trace out the actual values, whereas the solid ones represent the results from bivariate loess regressions with span 0.5.