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influence: What explains the passage of  
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## **Domestic dynamics and international influence: What explains the passage of climate change legislation?**

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*April 2014*

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## **Abstract**

This paper analyses national and international factors that drive the adoption of legislation on climate change. Our unique dataset of climate laws identifies 419 pieces of national legislation, policies and strategies addressing climate change mitigation and adaptation in 63 countries. We find that the passage of climate legislation is influenced by both domestic and international factors. Domestically, climate legislation tends to be boosted by high-profile “flagship laws”, on which subsequent legislation is based. Climate legislation is a fairly bi-partisan affair. There is no significant difference in the number of laws passed by left-wing and right-wing governments, except perhaps in Anglo-Saxon countries. However, left-leaning governments are more inclined to pass broad, unifying flagship legislation. In terms of international factors, the propensity to legislate is heavily influenced by the passage of similar laws elsewhere, suggesting a strong role for peer pressure and/or learning effects. The prestige of hosting an international climate summit is also associated with a subsequent boost in legislation. Legislators respond to the expectations of climate leadership that these events bestow on their host. The impact of the Kyoto Protocol is more equivocal, although there is some indication it has increased legislation in countries with formal obligations under the treaty.

**Keywords:** climate change, environmental legislation, international policy diffusion, political economy.

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## **1. Introduction**

Increasing numbers of countries are passing climate change legislation. Practically all major emitters of greenhouse gases have in place laws to control emissions, conserve energy or promote cleaner forms of energy production (Townshend et al 2013b). These laws are not always motivated exclusively by concern about anthropogenic climate change, and they do not add up to a global response that would limit climate change risks to an acceptable level, often understood to mean less than 2°C of average warming. Nevertheless, they constitute a growing aspect of public policy and legislative activity in parliaments around the world. A typical country passes a climate change-related law every 18-20 months (Nachmany et al. 2014).

The objective of this paper is to understand and describe the emergence of climate change legislation. The question is of academic interest in its own right, since climate change is now an important area of public policy, but we also hope to add to the broader literatures on environmental policy diffusion and on the political economy of environmental legislation.

From a practical policy point of view, understanding the drivers behind domestic climate change legislation is important because it might help to unlock effective emission reduction policies. However, we do not assess the quality of legislation, or indeed judge whether more laws are always desirable. Our interest is in the dynamics of how the laws come about.

Specifically, we are interested in the balance between domestic and international factors that might explain climate change legislation. Are climate change laws driven mainly by international commitments such as those under the Kyoto Protocol, or are countries legislating for their own domestic reasons? Are other international factors at work, beyond treaty obligations, such as peer pressure or ambitions for global leadership? In terms of domestic factors, how important is the political orientation of the governing party – is climate action more likely under left-wing or right-wing governments? Is climate policy associated with particular forms of governance?

We try to answer these and other questions econometrically, using a unique new dataset, which we helped assemble over a series of climate legislation surveys (Nachmany et al. 2014; Townshend et al 2011, 2013a, b). A distinct feature of the

surveys is that they were conducted in close cooperation with legislators from the parliaments concerned. They cover legislative action since 1990 in 65 countries plus the European Union as a block. The surveys adopt a fairly broad interpretation of what constitutes climate change legislation, which includes “relevant laws or regulations of comparable status” on energy supply, energy demand, transport and land-use change as well as climate-specific measures like carbon pricing, adaptation, research and new institutions.

There are important caveats in the dataset: It focuses on action by nation states and at the national level, that is, it excludes state, province or city-level activities. There is no analysis of the quality or merit of individual laws (for example, the number of exemptions granted to affected industries), the degree to which a law is implemented or enforced, and the eventual effects it has had. A particular problem for our research question is that when laws are updated – as for example Switzerland did with its CO<sub>2</sub> Act in 2013 – the database only records the latest version, thus omitting earlier activities. Similarly, for the 9 EU member states the database excludes laws that merely implement EU regulations. Only laws that go beyond EU requirements feature.

Nevertheless, the data constitutes one of the richest sources of information about climate change legislation available to date (see Dubash et al. 2013 for a survey of available data sets). The data include almost 500 climate-relevant laws that were on the statute books of the 65 study countries plus the European Union at the end of 2013 – although our study is restricted to 419 laws passed in 63 countries before end-2012 (see section on data below)<sup>1</sup>.

The paper is linked to the extensive literature on the determinants of economic policy reform, which emphasises the crucial role played by political institutions. For example, electoral cycles have been detected in monetary and fiscal policy with incumbent governments more likely to adopt favourable measures (e.g. tax cuts) before an election (Besley and Case 1995; Persson and Tabellini 2003; List and Sturm 2006; also Franzese 2002). Also the form of government and its ideology appear to influence fiscal stabilization, with presidential regimes and right-wing governments

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<sup>1</sup> The EU, Micronesia and the Maldives, as well as laws passed in 2013 are excluded as data are not available for all variables of interest.

more conducive to economic reforms (Alesina et al. 2006; Persson and Tabellini 2003). Moreover the implementation of a policy is easier when the executive faces fewer veto players (Alesina et al. 2006). Our contribution is to determine whether climate policy, like economic policy, is influenced by such political and institutional factors.

The political economy of environmental policy is conceptualised in Oates and Portney (2005), Conglestone (1992) and Hahn (1990). They too highlight the role of political institutions and political interaction between governments and interest groups. Lachapelle and Paterson (2013), Bernauer and Koubi (2009) and Fredriksson et al. (2007) test the theory empirically, but rather than focusing on the formulation of policy they measure directly the impact of political factors, broadly defined, on particular environmental outcomes (greenhouse gas emissions, urban air quality and lead in petrol, respectively).

The global public goods nature of climate change control adds an important international dimension to the problem, which Kroll and Shogren (2008) model as a two-level game at the national and global level. The interaction between domestic policy making and international obligations is further analysed by Murdoch and Sandler (1997), who study compliance with the Montreal Protocol on ozone-depleting substances. There is also a sizeable body of work on forming and enforcing international environmental agreements, using game theory (Barrett 2003, 2007; Hong and Karp 2012) or international relations approaches (e.g. Breitmeier et al. 2011; 2013).

The econometric analysis of policy diffusion has a long tradition, often using event history or hazard models (e.g., Berry and Berry 1990, 1992). Most applications are for US domestic policies, perhaps because there is less heterogeneity between sub-national jurisdictions. The transfer and diffusion of environmental policy outside the US has primarily been studied from a political science angle, with the European Union a frequent case study (e.g., Jordan et al. 2000, Jordan and Lenschow 2000).

As in our analysis, the main focus of these papers tends to be on policy adoption, rather than the post-adoption dynamics of laws. “Policy” is sometimes unpacked into its constituent parts (e.g., objectives and instruments) to explore whether diffusion

differs between these elements. The pertinent literature identifies a broad set of driving forces, which includes international factors (such as knowledge transfer and pressure to conform), domestic drivers (such as domestic actors, institutions, interests and capacities), as well as the characteristics of the policy at hand (Busch et al. 2005; Kern et al. 2001). Ovodenko and Keohane (2012) and Bernstein and Cashore (2012) highlight the institutional conditions and pathways under which policy transfer may occur. Jordan and Huitema (2014) broaden the analysis to study policy innovation, as well as its subsequent diffusion.

Our paper builds on this body of work by providing new panel-data evidence on the domestic and international factors that explain the adoption of climate change legislation. The paper is structured as follows. Section 2 offers a brief qualitative description of climate change legislation and trends, drawing on Nachmany et al. (2014; see also Dubash et al. 2013). Section 3 describes the empirical strategy and data we use to analyse these trends. Section 4 discusses results, and conclusions are drawn in section 5.

## **2. The emergence of climate legislation**

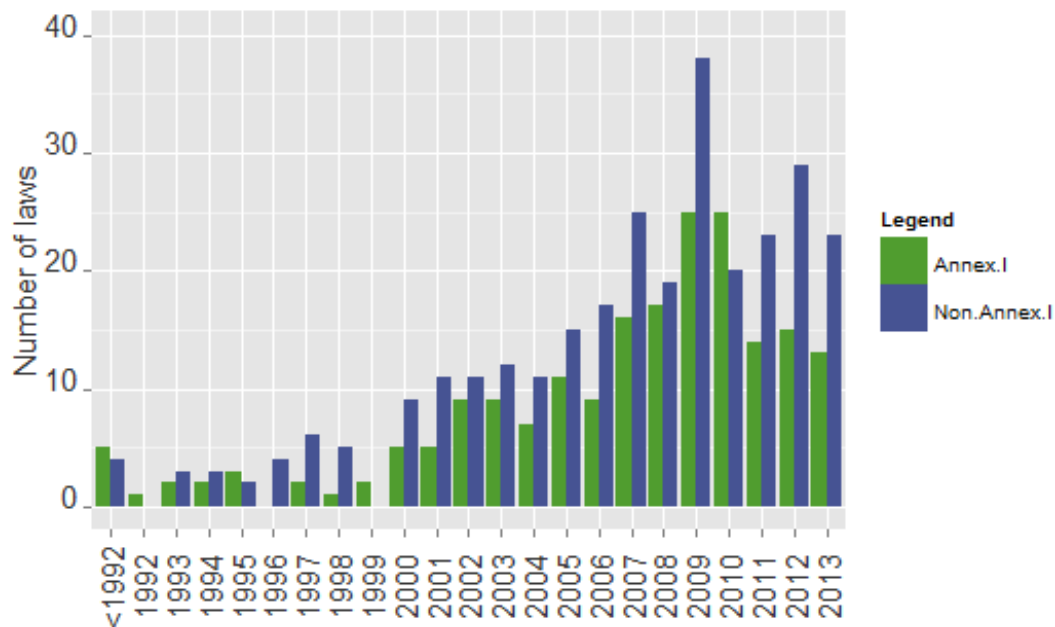
Although scientific knowledge about the greenhouse effect dates back well over 100 years, climate change became an issue of wider policy concern only in the 1990s, after the Intergovernmental Panel on Climate Change had issued its first assessment report and countries started to negotiate what would become the UN Framework Convention on Climate Change. Few countries followed up their (soft) commitments under the 1992 UNFCCC with domestic legislation. The first substantive law that explicitly concerns climate change is Japan's *Law Concerning the Promotion of the Measures to Cope with Global Warming* of 1998, although there were many earlier efforts to protect forests and conserve energy, which were motivated by domestic policy concerns but are also relevant to climate change.

Figure 1 shows the emergence of climate change laws in 65 countries and the EU. There is a steady increase starting in the late 1990s, with a spike around 2009 and 2010. The heavy legislative action around that time may be explained by growing pressure from governments, civil society and international organisations at the time of the Copenhagen climate summit in December 2009. The summit failed to secure a



new international agreement, but many countries made significant national pledges under the Copenhagen Accord and often underpinned their Copenhagen commitments with domestic legislation.

**Figure 1.** Climate change legislation over time



*Note: Annex I and non-Annex I as defined in the UN Framework Convention on Climate Change.  
Source: Nachmany et al.(2014)*

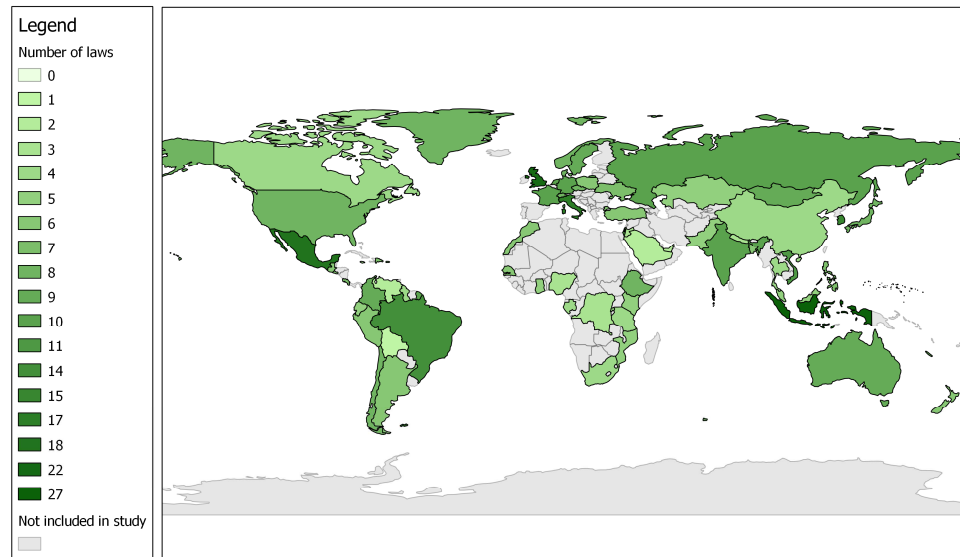
Townshend et al. (2013b) speculate that the fall in activity since 2009/10 may be due to a relaxation in international pressure, the difficult macroeconomic situation in developed countries and the fact that most Annex 1 countries had by then introduced fairly comprehensive climate change legislation. Legislation in Annex-1 countries post-Copenhagen has aimed primarily at the implementation of earlier commitments.

The legislative momentum has therefore shifted to Non-Annex 1 countries, where new laws are still being added to a relatively small stock. Nachmany et al. observe that in the period 2004-08 a non-Annex 1 country would typically pass a climate change law every 31 months. In the period 2009-13 this accelerated to a law every 20 months, similar to the Annex 1 average over the past decade of one climate law every 18 months.

The result of this sustained legislative action is a stock of almost 500 climate change laws (Figure 2 and Appendix). Annex 1 countries still have a larger number of laws, particularly in Europe. The UK has 22 climate laws on the statute books, Italy 17 and

Germany 12. Prolific legislators outside Annex 1 include Indonesia with 27 laws and South Korea with 15. Nepal, Nigeria, Saudi Arabia and Venezuela are among the 10 countries with three laws or fewer.

**Figure 2.** Climate change legislation at the end of 2013



Source: Nachmany et al.(2014)

The laws differ in their nature and level of ambition. Some are executive orders, others were passed by parliament. Some contain binding statutory commitments, others are mostly aspirational. But in most countries there is what Townshend et al (2013a, b) call a “flagship” law – a wide-ranging piece of legislation that fundamentally defines a country’s approach to climate change, often setting emissions targets or unifying earlier policies under one umbrella. Examples include the 2008 *Climate Change Act* in the UK or Mexico’s *General Law on Climate Change* of 2012. Nachmany et al. (2014) identify flagship laws in 62 of the 66 jurisdiction they study, including in the EU.

Climate change laws also vary in their scope. The data set includes legislation on clean energy production, energy efficiency, carbon pricing, transport, agriculture, forestry, clean R&D and a host of activities that affect vulnerability to climate risks. Most laws deal with more than one of these issues. For example, renewable energy, energy efficiency and carbon pricing may all be addressed in the same law.

However, there is a clear focus on energy. Almost half of the laws in the data base deal with energy supply issues (such as renewable energy), and nearly 40% are

concerned at least in part with energy demand (mostly energy efficiency). Adaptation to climate risk is covered in about 20% of the laws, many of them passed by highly vulnerable countries such as Bangladesh, Jamaica, Kenya, Micronesia, Mozambique, Nepal and Philippines. Similarly, provisions to reduce emissions from deforestation and forest degradation (REDD), which are included in about 25% of laws, dominate legislation in countries with large forests, such as Brazil, Indonesia, Mexico, the Democratic Republic of Congo and Vietnam.

### **3. An empirical strategy to study climate legislation**

Econometric techniques can help to shed further light on the dynamics of climate change legislation described qualitatively above. Our particular interest is in the interplay between domestic and international factors that have driven the adoption of climate change legislation since 1990.

#### ***3.1 Hypotheses***

We therefore examine a set of domestic and international factors, which may be associated with more climate legislation. In terms of domestic factors we test the following hypotheses:

- a) **The level of democracy:** democratic systems, where political accountability is higher and governments are inclined to take voters preferences into account, should pass more climate legislation if there is public concern over the environment and less if there are strong fossil fuel interests.
- b) **Electoral cycles:** the implementation of potentially controversial measures (such as carbon taxes) is not expected close to a general election. Only favourable policy measures (such as renewable energy subsidies) may be observed before elections so the incumbent government can gain an electoral advantage in the polls (Franzese 2002).
- c) **Strength of the executive and form of government:** the stronger and more unified the executive, the easier governments will find it to pass climate laws. Presidential regimes, characterized by strong executives, may therefore be expected to pass more climate laws.

- d) **Existence of a comprehensive climate policy:** countries that have passed broad, unifying legislation (or “flagship laws”) can be expected to pass further laws afterwards aimed at implementation. “Flagship” laws indicate a general direction and prescribe further policy interventions to achieve the goals defined.
- e) **Partisanship:** climate scepticism is often associated with right-of-centre political attitudes, at least in Anglo-Saxon countries (McCright and Dunlap 2011a, b; Painter and Ashe 2012). At the same time left-of-centre governments might be more inclined to pass environmental legislation (Neumayer 2003). So we should observe a different trend in climate policy legislation depending on the political orientation of the parties in power.
- f) **Business cycle:** Concern for the environment may have less political traction during difficult economic times, unless green investment is seen as an effective counter-cyclical policy (as argued by Zenghelis 2013). Therefore the business cycle may be expected to influence the path of climate legislation.

The international factors influencing climate legislation we test include:

- g) **Hosting summits:** Countries hosting high-profile international meetings, such as the annual Conference of the Parties (COP) to the UNFCCC, are thrust into a position of international leadership that may motivate, or overcome resistance to, subsequent climate legislation. We might therefore see more climate legislation in the aftermath of hosting a COP.
- h) **Peer group effects:** the climate action a country undertakes is likely to increase with the number of laws already passed by other countries. This is due to a combination of learning/knowledge spill-overs (the more a policy is adopted the more is known about its merits) and peer pressure (countries with close cultural or trade links are likely to influence each other also on climate policy). Since we are not able to disentangle these two effects, we will generally speak of external peer group effects. They are measured by the number of laws already adopted by all other countries in the sample, although it is reasonable to assume the effect is stronger between countries with strong cultural or economic ties.

- i) **Comitment effect:** climate legislation is likely to be affected by the pledges a country has made internationally. For this reason we expect a boost in the passage of climate laws after the Kyoto Protocol was signed, at least among Annex 1 Parties which have formal obligations under the Protocol.

### 3.2 Estimation strategy

To test these hypotheses we estimate different versions of the following equation:

$$y_{it} = \alpha + \beta \mathbf{D}_{it} + \gamma \mathbf{I}_{it} + \delta \text{GDP}_{it} + \theta_i + \nu_t + \varepsilon_{it} \quad (1)$$

In the main specification  $y_{it}$  represents the total number of climate laws adopted in country  $i$  at year  $t$  (All\_laws). The vector  $\mathbf{D}_{it}$  indicates the domestic factors influencing adoption while vector  $\mathbf{I}_{it}$  includes the international factors. The log of real GDP per capita controls for the level of economic development. We also include a full set of country and year fixed effects ( $\theta_i$  and  $\nu_t$ ) and a random error term  $\varepsilon_{it}$ .

In a first instance we estimate equation (1) using a negative binomial fixed effects model where the log of the expected count is a function of the predictor variables. This model is suitable since we are dealing with a count dependent variable characterized by over-dispersion (i.e. the mean is lower than the variance) and events (e.g. law adoptions) that a country can experience more than once. These features prevent the use of hazard models, which have been employed to study policy diffusion elsewhere (see Berry and Berry 1990, 1992). However, as a robustness check we also estimate the model using logit fixed effects, which measures the probability of passing at least one law in a particular country and year.

Equation (1) is estimated using as the dependent variable initially the total number of climate laws and then the number of specific types of legislation, including laws dealing with energy supply, energy demand, new climate institutions, adaptation, transportation, low-carbon research and development and REDD. (Recall that many laws address more than one issue and therefore feature in several of the narrower specifications).

We then repeat the estimation for a number of restricted samples, such as highly democratic countries or left-leaning governments only. This helps to identify trends in

a subset of the sample, which might otherwise be overlooked. To maintain a sufficient number of non-zero observations, the restricted sample estimations are carried out only for the total number of climate laws.

### ***3.1 Data***

Our analysis is the first to use the extended 2014 version of the Globe Climate Legislation Study (Nachmany et al. 2014). Compared with the 2013 edition (Townshend et al. 2013a) the coverage has doubled from 32 countries to 65 countries (plus, in each case, the EU), which together are responsible for almost 90% of global greenhouse gas emissions. Our analysis had to exclude two countries (Micronesia and Maldives), laws at EU level and those passed in 2013 because of gaps in control variables. But over the 23 year study horizon (1990-2012) we still have a panel of  $23 \times 63 = 1449$  country-year observations. About 80% of these are zero entries, that is years without legislative activity. At least one law was passed in 296 country-years for a total of 419 laws.

The data were assembled through a careful multi-stage process that involved quality control from in-country experts. Initial research began with a desk search of national government websites, ministerial websites and non-governmental review documents. Subsequently, country specialists (e.g., from local universities, think tanks or the UK embassy) were approached for peer review and to seek data on additional laws. This helped to reduce problems of linguistic bias and close data gaps in countries with limited on-line presence and data sharing capacity. Since respondents were only required to identify, rather than assess, laws there should be few problems with reference group bias. As a final quality check an official review was requested from nominated members of parliament and/or ministerial employees. Official reviews were received for 56 of the 65 countries.

The Globe data are complemented by political and economic variables from different sources. The political variables come from the database of political institutions (DPI) of the World Bank, compiled by Beck et al. (2001), and updated in 2012. To capture the form of government we define the variable “pres”, a dummy equal to 1 if the president is elected directly and zero if either the assembly or parliament elects the president. The orientation of the executive is measured by “left”, an indicator variable

taking value 1 if the party of the executive is left-of-centre and zero if the executive belongs to a right-wing or centrist party. The dummies “ele” and “bef\_ele” measure the electoral cycles; the first dummy is equal to 1 in the year when the executive is elected while “bef\_ele” is equal to 1 in the year before the elections.

The level of democracy is measured using the polity2 index from the Polity IV dataset. This index assigns to each country a yearly score ranging from -10 to +10, with higher values associated with better democracies. Also the measure of institutional constraints on the executive, “unified” comes from the Polity IV dataset. As in Alesina et al. (2006) this dummy takes value 1 if the party of the executive has an absolute majority in the legislative. Economic variables on GDP were accessed from the IMF's statistics database. The business cycle is measured by the cyclical component of GDP, using the Hodrick-Prescott filter (see Doda 2014).

Finally we consider two years of lagged effect after hosting a Conference of the Parties, the number of climate laws adopted by all other countries up to this point and four years of lagged effect after the Kyoto Protocol. Table 1 summarises the full list of variables with some descriptive statistics.

#### **4. Empirical evidence**

We now turn to the empirical estimation of equation (1). The main set of results makes use of the full sample of around 1,400 country-year observations. Subsequently we split the sample into different categories to explore legislative dynamics for particular country groupings, such as those included in Annex 1 of the UNFCCC.

**Table 1. Descriptive Statistics**

Variable	mean	sd	min	max	Observations.
All_laws (count)	0.2891	0.6647	0	6	1,449
All_laws (binary)	0.2042	0.4033	0	1	1,449
Host	0.0379	0.1911	0	1	1,449
Flag	0.1732	0.3785	0	1	1,449
Kyoto	0,1739	0,3791	0	1	1,449
Bus_Cycle	~0	0,1194	-.7338	.4351	1,447
Left	0.3409	0.4741	0	1	1,449
Democracy	5.0241	5.9256	-10	10	1,447
Ele	0.2104	0.4077	0	1	1,449
Bef_ele	0.2106	0.4079	0	1	1,449
Pres	0.5465	0.4979	0	1	1,449
Unified	0.4320	0.4955	0	1	1,449
logGDP	8.4003	2.3854	4.4630	23.2697	1,447

***Variable Definitions***

host:	dummy=1 for each country hosting a meeting, in the year of the meeting and in the two years
flag:	after.
peer	dummy=1 for each country passing a flagship legislation in the year of the pass and in the
left:	following years.
Kyoto:	number of laws (for each specific type) passed in all other countries till time t-1 (peer group
Bus_Cycle	effects)
democracy:	dummy=1 for left wing governments
ele:	dummy=1 for the four years after Kyoto (1998-2001)
bef_ele:	cyclical component of the Hodrick-Prescott filtered log of real GDP
unified:	Polity2 variable taking values -8 to 10 (increasing in the level of democracy)
pres:	dummy=1 in the year of elections
logGDP:	dummy=1 in the year before the elections
	dummy=1 when the party of the executive controls the majority of the legislative branch
	dummy=1 for presidential systems
	log of real gdp per capita

***4.1 Evidence from the full sample***

Table 2 reports the main set of results using the full sample. The first column shows the results for the total number of laws while in the columns (2)-(8) we repeat the analysis for specific types of climate laws, such as those concerning energy supply. For clarity we comment mainly on the sign and the significance of the coefficients, although the negative binomial regression coefficients have a numerical meaning. They measure the change in the difference in the logs of expected counts of the



dependent variable when the predictor variable changes by one unit, given the other predictor variables in the model are held constant.

**Table 2.** Negative Binomial Fixed Effects (years: 1990-2012). Dependent variable: Number of laws passed

VARIABLES	(1) All_laws	(2) Energy_Supply	(3) Energy_Demand	(4) Institutions	(5) Adaptation	(6) Transportation	(7) R&D	(8) REDD
Peer	0.159*** (0.061)	0.578*** (0.136)	0.518*** (0.182)	0.582*** (0.126)	2.804*** (0.550)	1.680*** (0.282)	1.463*** (0.343)	1.148** (0.483)
Host	0.680*** (0.237)	0.301 (0.236)	0.841** (0.420)	0.433 (0.324)	1.270 (1.087)	1.533** (0.595)	1.238* (0.689)	1.803*** (0.550)
Kyoto	-5.601* (3.250)	-7.301*** (2.416)	8.433*** (2.988)	-3.656 (4.050)	0.054 (3.239)	-12.393*** (3.351)	-12.598*** (2.918)	-2.469 (7.624)
Flag	1.331*** (0.226)	1.523*** (0.231)	1.402*** (0.295)	1.853*** (0.225)	3.404*** (0.599)	2.511*** (0.479)	2.341*** (0.380)	2.115*** (0.462)
Bus_Cycle	-0.471 (0.620)	-1.720** (0.857)	-2.008* (1.117)	-1.052 (0.888)	-0.957 (2.261)	-1.987 (2.451)	-1.577 (1.281)	-4.926 (3.140)
Left	0.137 (0.172)	0.400* (0.232)	0.463 (0.342)	0.310 (0.272)	-0.523 (0.887)	0.972 (0.739)	0.960** (0.414)	-0.098 (0.341)
Democracy	0.062 (0.040)	0.279* (0.152)	0.249** (0.108)	0.029 (0.053)	-0.011 (0.056)	0.465 (0.359)	0.034 (0.089)	0.154** (0.075)
Ele	-0.011 (0.133)	0.011 (0.170)	-0.071 (0.246)	0.004 (0.153)	-0.438 (0.303)	-0.750* (0.408)	-0.328 (0.251)	0.098 (0.223)
Bef_ele	-0.159 (0.120)	0.051 (0.162)	-0.151 (0.177)	-0.356** (0.163)	-0.432 (0.352)	-0.335 (0.306)	-0.153 (0.328)	-0.281 (0.292)
Unified	0.477** (0.222)	0.772 (0.519)	0.695 (0.477)	0.649* (0.358)	-0.528 (0.752)	1.526* (0.855)	1.063* (0.610)	-0.447 (0.601)
Pres	0.765* (0.454)	0.765 (0.489)	0.583 (0.806)	0.315 (0.595)	-1.450 (0.893)	1.944 (1.299)	0.289 (0.769)	0.450 (0.968)
logGDP	0.252 (0.406)	0.050 (0.152)	-0.840 (0.826)	0.595 (0.583)	1.364 (1.521)	-1.167 (1.639)	0.010 (0.074)	4.776*** (1.607)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Obs.	1,383	1,383	1,383	1,383	1,383	1,383	1,383	1,383

Clustered standard errors at the country level in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Overall, the results confirm that both domestic and international factors influence climate policy adoption, although not all the factors identified in our initial hypotheses turn out to be significant. Looking at the evidence from the total number of laws (column 1), having flagship legislation in place is the most powerful domestic factor affecting adoption, increasing significantly the number of laws passed subsequently. A strong, unified executive also increases legislative activity.

In contrast to other areas of public policy (Besley and Case 1995; Persson and Tabellini 2003; List and Sturm 2006), the proximity of elections does not appear to influence the adoption of climate legislation in the full sample. Nor do we find evidence of ideological bias, rejecting the hypothesis that left wing governments tend

to produce more climate legislation. However, further below we will find evidence of both these features in a more restricted set of circumstances.

Among the external factors we find strong evidence of a “peer group effect”, either through learning, peer pressure or diffusion: the stock of laws adopted previously by the other countries in the sample is a strong predictor of adoption. Even more pronounced is the strong positive effect that hosting the UNFCCC Conference of the Parties has on the adoption of climate legislation. In contrast, the post-Kyoto period was characterized by lower legislative activity across the full sample of countries. As we will see below, this is probably because Kyoto imposed commitments only on a small number of countries.

The results for specific types of climate legislation (columns 2-8) are broadly similar. The existence of a flagship law and the strength of the executive are again the dominant domestic factors in explaining climate legislation, while peer group effects and hosting a COP are the most robust international predictors. Interestingly there climate legislation on energy matters (columns 2-3) increases in difficult economic times, suggesting that clean energy investment is part of a countercyclical fiscal policy in many countries. In columns (2) and (7) we also find evidence of partisan bias, suggesting that left-wing governments are more likely to legislate on energy supply and low-carbon R&D than right-wing administrations.

A note of caution is required in interpreting the results in columns (2)-(8): given the smaller number of non-zero observations when considering specific types of law, the evidence becomes less robust than the analysis of all climate laws in column (1).

The same caveat applies even more strongly to the results in Table 3, which concerns the adoption of flagship laws, that is, the broad, unifying pieces of legislation that determine a country’s general approach to climate policy. Taking advantage of the fact that most flagship laws were passed after the year 2000, we therefore restrict the sample to the period 2000-2012. Even so the data set includes only 50 flagship laws in over 800 country-year observations. Since flagship legislation is also a binary variable taking values of 0 or 1, we estimate emergence of flagship legislation through both the negative binomial and a logit fixed effect model.

The results in Table 3 suggest that the adoption of flagship laws is mainly driven by the strength of a unified executive and is more likely under presidential regimes. Interestingly, we find evidence of partisanship: left-leaning governments are significantly more likely to pass these broad, strategic laws. In contrast, flagship legislation does not appear to be affected by international factors.

**Table 3.** Analysis of flagship legislation (years: 2000-2012). Binary Dependent variable (=1 when a flagship legislation is adopted)

VARIABLES MODEL	(1) Flagship Negative Binomial	(2) Flagship Logit
Peer	0.311 (0.219)	0.363 (0.267)
Host	-0.773 (0.737)	-0.908 (0.849)
Left	1.755* (0.959)	2.069* (1.180)
Democracy	0.272 (0.265)	0.293 (0.307)
Ele	-0.396 (0.422)	-0.484 (0.501)
Bef_ele	-0.102 (0.398)	-0.119 (0.495)
Bus_cycle	3.109 (3.096)	3.738 (3.672)
Unified	1.734** (0.801)	1.957** (0.947)
Pres	1.540* (0.915)	1.833* (1.060)
logGDP	-0.804 (1.567)	-1.042 (1.841)
Country FE	YES	YES
Year FE	YES	YES
Obs.	816	538

Clustered standard errors at the country level in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

## 4.2 Evidence from restricted samples

Next we estimate equation (1) for a series of restricted data sets to shed light on the drivers of climate legislation in particular groups of countries. Table 4 contains the results of six such regressions. The sample was split into periods of left-wing and right-wing administration, Annex 1 and non-Annex 1 countries, and countries with more or less advanced democracies (where the latter are defined as having a polity2 score of less than 8). The much smaller number of observations in some of the samples means we report results only for the total number of climate laws.

**Table 4.** Negative Binomial Fixed Effects (years: 1990-2012). Dependent variables: Number of laws passed.

VARIABLES	Political orientation of the executive		Status under the UNFCCC		Quality of democracy	
	(1) Left-wing	(2) Right-wing	(3) Annex 1	(4) Non-Annex 1	(5) High	(6) Low
Peer	0.185*** (0.047)	0.180** (0.082)	0.190*** (0.059)	0.142 (0.093)	0.115*** (0.043)	0.812*** (0.190)
Host	0.124 (0.636)	0.642* (0.349)	0.815* (0.444)	0.590* (0.308)	0.597** (0.251)	0.150 (0.755)
Kyoto	5.032* (2.591)	-7.254* (4.194)	4.673 (3.237)	-5.137 (4.733)	9.540*** (2.219)	-38.369*** (9.637)
Flag	1.358*** (0.330)	1.410*** (0.283)	1.544*** (0.353)	1.030*** (0.288)	1.109*** (0.266)	2.149*** (0.301)
Bus_Cycle	-3.120*** (0.789)	0.600 (0.836)	(a)	(a)	(a)	(a)
Left			0.086 (0.197)	0.172 (0.321)	0.028 (0.160)	1.092 (0.700)
Democracy	0.043 (0.127)	0.008 (0.041)	0.493*** (0.096)	0.060 (0.036)		
Ele	-0.158 (0.210)	0.025 (0.189)	-0.230 (0.207)	0.176 (0.173)	-0.306* (0.159)	0.648*** (0.199)
Bef_ele	-0.371 (0.237)	-0.091 (0.162)	-0.360** (0.165)	-0.040 (0.163)	-0.277* (0.145)	0.237 (0.210)
Unified	0.109 (0.505)	0.358 (0.298)	0.552 (0.372)	0.393 (0.295)	0.431 (0.277)	0.687** (0.282)
Pres	13.030*** (1.379)	1.571*** (0.442)	-1.452 (1.028)	0.759* (0.400)	0.356 (0.650)	0.047 (0.491)
logGDP	0.074 (0.071)	0.331 (0.596)	(a)	(a)	(a)	(a)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Obs.	471	912	418	967	762	645

Clustered standard errors at the country level in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

(a) We were unable to account for the business cycle and the level of GDP, as the negative binomial model failed to converge when including these variables.

Looking at the political orientation of governments (columns 1 and 2) we find some interesting nuances compared to the main findings in Table 2. The existence of flagship legislation, the stock of adoptions in the previous period and the form of government continues to be strong predictors of adoption for both left and right wing governments. But the motivating effect of hosting a COP appears to apply mostly to right-wing governments. In contrast left-wing governments were more inclined to pass climate legislation in the aftermath of Kyoto, while the opposite happened under right-wing governments. Left leaning governments appear to produce more climate legislation in difficult economic times – suggesting a greater belief in counter-cyclical fiscal policy – while the economic cycle does not influence the legislation activity of right wing administrations. It is worth bearing in mind that results on left-of-centre governments are less robust, given the relatively small sample size.

The small number of observations also affects the strength of results for the Annex-1 panel, while those for non-Annex 1 countries are broadly consistent with the main findings for the combined sample (columns 3 and 4). In line with our expectations, the coefficient of the Kyoto dummy is positive for Annex I countries, which have binding obligations under the Kyoto Protocol, although it is not statistically significant, probably due to the small number of observations. This suggests that the low level of climate legislation following Kyoto that we observed in the full sample is due to the trend experienced in non-Annex I countries, which represent the 70% of our sample. In Annex 1 countries we also find significant evidence of electoral cycles, with countries less likely to pass climate legislation right before an election year.

The last two sub-samples on democracy (columns 5 and 6) are more balanced, with a similar number of observations in each. As before we find supporting evidence for the peer group effect, and the power of flagship legislation. Advanced democracies experienced a boost in legislation activity in the four years following Kyoto, possibly because this is associated with Annex 1 status, while the opposite holds for less democratic regimes. Since 17 out of 19 COP meetings have taken place in advanced democracies it is not surprising to find a positive and significant effect here only in column (5).

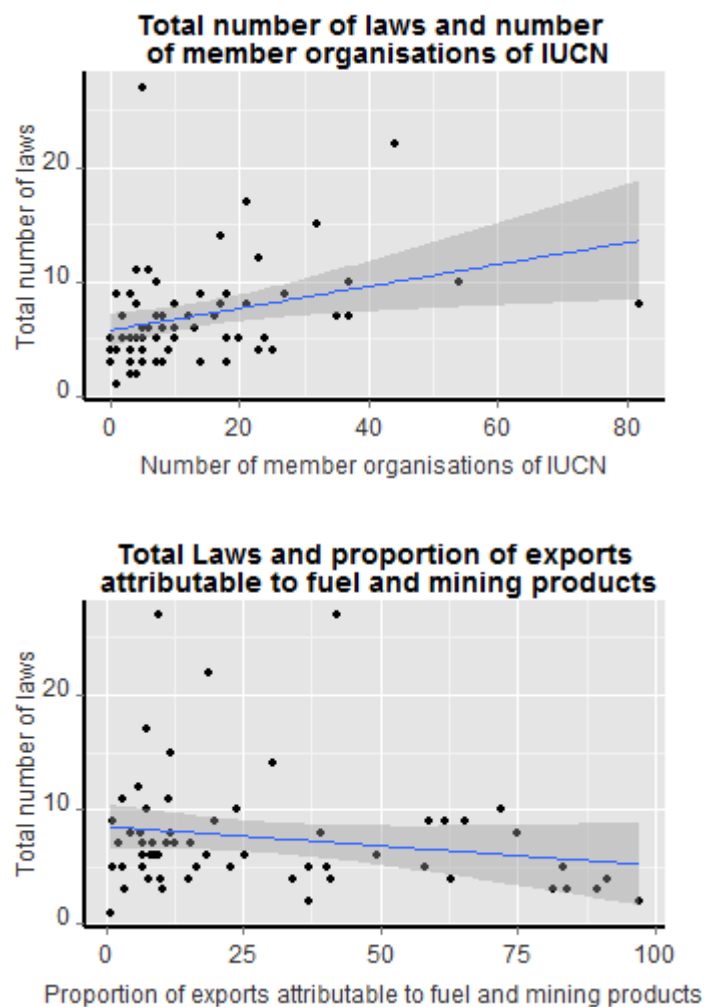
Interestingly, we find stronger evidence on electoral cycles than in the full sample. In particular, advanced democratic regimes tend to pass climate change legislation away from the election year, while the opposite holds in less democratic regimes.

### ***4.3. Robustness checks***

We next undertake some complementary analysis and robustness checks. A few of the hypotheses we posted at the outset could not be tested fully in the regression model, often because they concern features that do not vary over time, such as a country's inclusion in Annex 1 of the UNFCCC. Alongside other time-invariant factors their impact is absorbed in the country fixed effects and as such cannot be identified separately. To get some indication of the importance of these factors we have to study aggregate trends outside the regression model.

One important question that may be explored in this way is the role of interest groups. One would expect the presence of a strong high-carbon (e.g. fossil fuel or energy-intensive industry) lobby to slow down the adoption of climate change laws, while a strong environmental lobby would lead to more laws. To explore this, we plot the number of climate laws in each country against two indicators associated with the strength of high-carbon and environmental lobbies, respectively (Fredriksson et al. 2007): the share of fuel and mining products in a country's exports, and the number of national member organisations in the International Union for the Conservation of Nature (IUCN). Figure 3 shows that the correlation with the number of laws is negative in case of high-carbon lobbies and positive in case of environmental lobbies. This is not conclusive evidence but it corroborates arguments about the importance of lobby groups in climate legislation.

**Figure 3.** Total legislation per country against environmental or fossil fuel lobbies

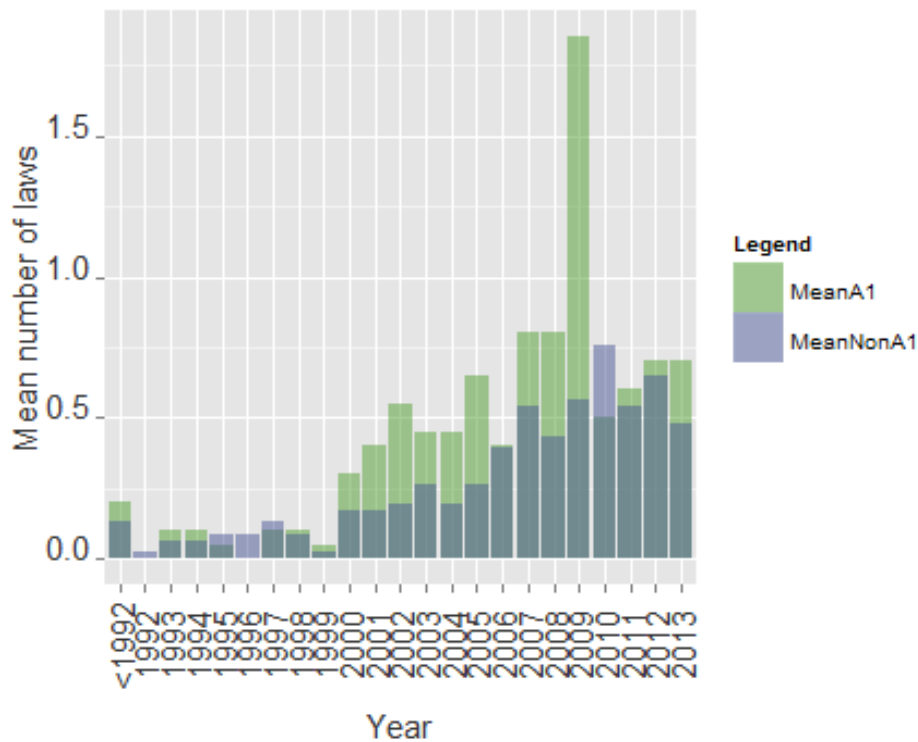


Our regression results found some differences in the attitude of right-wing and left-wing governments, but they are relatively small, given the evidence found elsewhere on strong right-wing climate scepticism particularly in Anglo-Saxon countries (McCright and Dunlap 2011a, b; Painter and Ashe 2012). To explore this further we ran the regression model with a highly restrictive sample of Anglo-Saxon countries only (Australia, Canada, New Zealand, UK and US). Given the small sample the results are not very robust, but they do indicate a statistically significant difference between left-wing and right-wing governments. Consistent with the literature, the latter are much less inclined to pass climate legislation.

Another question that has not been fully resolved concerns the commitment effect of international treaties. We shed some light on the issue by analysing Annex 1 and non-Annex 1 countries separately (see Table 4) and by including a dummy variable on the Kyoto Protocol. The results suggest that Kyoto has had some effect on legislation in Annex 1 countries, but the signal is weak. As further evidence we therefore performed a t-test to compare the average number of laws passed annually in an Annex 1 country and a non-Annex 1 country. This provides stronger results. We find statistically higher legislation activity in Annex I countries between 1998 and 2006, that is, immediately after the protocol was signed in December 1997. Since 2006 the effect has levelled off, perhaps because climate action is increasingly also expected from non-Annex 1 countries. Figure 4 makes this point graphically.

The next set of robustness checks concern our estimation method. First, we explore alternatives to the negative binomial count model. The negative binomial was chosen because it is best suited to the legislation patterns we observe in our data. But as an additional specification we also estimate equation (1) using a binary dependent variable that only capture whether a country passes a climate law in a given year (but not how many laws). We use a logit fixed effects model to analyse this specification. Table 5 displays the results.

**Figure 4.** Annual climate change laws in Annex 1 vs non-Annex 1



As before, the evidence is supporting the peer group effect and again shows that flagship laws increase the likelihood of further legislation. The coefficients on the summit host dummy and the strength of the executive become insignificant, which could imply that such factors are associated more with the extent of adoption rather than just the likelihood of adoption. However the result can also be explained by the fact that logit models are less reliable than the negative binomial model when data display a high degree of over dispersion. For this reason, we treat the logit results as a useful check, but assign more significance to the results from the count model reported before.

Another alternative model specification concerns the use of fixed effects. The main model includes separate country and year fixed effects. One might be concerned that under this structure the “peer” pressure variable could capture no more than a general increasing trend in adoption (or in any unobservable correlated with adoption). To explore this issue we experiment with an alternative to equation (1) which also includes a country-specific linear time trend. The additional variable would account for any unobservable changes over time at the country level. The drawback of this model is that it is less likely to converge for runs that are limited to particular kinds of



laws (e.g. those related to energy, transportation, adaptation, etc. only). However, for the total number of laws it delivers results very similar to the ones obtained from the main specification. In particular the peer pressure effect remains positive and highly significant.

**Table 5.** Logit Fixed Effects (years: 1990-2012). Binary Dependent variables (=1 when one or more laws pass)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All_laws	Energy_Supply	Energy_Demand	Institutions	Adaptation	Transportation	R&D	REDD
Peer	0.115*** (0.026)	0.941*** (0.227)	0.614** (0.304)	0.877*** (0.218)	4.854*** (1.247)	2.722*** (0.696)	2.743*** (0.628)	1.616*** (0.613)
Host	0.678 (0.451)	0.307 (0.573)	0.779 (0.555)	0.610 (0.542)	1.825* (1.098)	2.400** (0.982)	2.425** (1.182)	2.176** (0.854)
Kyoto	-8.869*** (2.916)	-11.942*** (3.728)	81.525** (40.357)	145.599*** (36.117)	279.557*** (73.070)	156.395*** (39.123)	-23.617*** (5.184)	115.503*** (41.593)
Flag	2.401*** (0.387)	3.113*** (0.472)	1.857*** (0.484)	2.899*** (0.469)	6.295*** (1.338)	4.784*** (1.250)	5.031*** (1.103)	3.109*** (0.707)
Bus_Cycle	-0.714 (0.822)	-2.886** (1.454)	-1.968 (1.715)	-1.193 (1.406)	-1.716 (3.494)	-4.632 (3.684)	-2.892 (1.883)	-6.593 (4.384)
Left	0.089 (0.267)	0.510 (0.360)	0.454 (0.430)	0.517 (0.375)	-0.737 (1.342)	1.232 (1.272)	0.951 (0.624)	-0.018 (0.464)
Democracy	0.016 (0.041)	0.370* (0.208)	0.297** (0.145)	-0.001 (0.062)	-0.018 (0.082)	0.690 (0.650)	0.044 (0.120)	0.194* (0.099)
Ele	0.166 (0.228)	0.004 (0.286)	-0.026 (0.352)	-0.032 (0.232)	-0.561 (0.437)	-0.755 (0.664)	-0.542 (0.364)	0.065 (0.281)
Bef_ele	-0.088 (0.181)	0.247 (0.260)	0.095 (0.266)	-0.525** (0.241)	-0.702 (0.475)	-0.292 (0.531)	-0.041 (0.410)	-0.215 (0.381)
Unified	0.418 (0.392)	0.938 (0.757)	0.648 (0.671)	0.595 (0.445)	-1.017 (1.181)	2.109* (1.279)	1.018 (0.935)	-0.577 (0.852)
Pres	0.956 (0.698)	2.050* (1.049)	0.697 (1.126)	0.664 (0.696)	-2.351* (1.387)	2.088 (1.870)	-0.043 (1.283)	1.768 (1.745)
logGDP	0.111 (0.130)	-0.013 (0.128)	-0.852 (1.042)	0.456 (0.831)	1.767 (2.472)	-1.550 (2.476)	0.014 (0.084)	6.140*** (2.318)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Obs.	1,383	1,041	929	1,257	704	542	833	854

## 5. Conclusions

Parliaments around the world are increasingly legislating on climate change. They act with a view to both reduce greenhouse gas emissions and adapt to the impacts of a changing climate. A key concern is the cleaner production and more efficient use of energy, but climate laws also cover transport, agriculture, forestry and a host of activities, like water use, that are vulnerable to climate risks. Some laws are couched in terms of green growth, energy security, air pollution or other domestic objectives, rather than climate change *per se*, but more and more countries are passing laws that are explicitly aimed at climate change, establishing new policies, processes and institutions (such as independent agencies and oversight bodies) to deal with the problem.

This paper analyses the driving forces behind the adoption of such legislation, using a dataset of 419 climate change laws and policies passed in 63 countries between 1990 and 2012. We are not interested in the detailed workings or the technical content of these laws, although this is clearly an important area of research and policy practice. Our interest is in the political dynamics that led to the passage of the laws.

In particular we seek to establish the extent to which climate legislation is driven by domestic factors - such as the party-political orientation of the government – and the extent to which governments respond to international influences, such as peer pressure, intergovernmental learning, and commitments under international treaties. We find that the adoption of climate legislation is influenced by both domestic and international factors, with some unexpected results.

One such surprise is the bipartisan nature of climate legislation. We find no difference between left-wing and right-wing governments in terms of overall climate legislation. High-profile climate change legislation is in fact often passed with bipartisan support from all parties (Townshend et al. 2011). There are, however, differences in emphasis. Left-leaning administrations are more inclined to pass unifying flagship legislation, intervene in the energy sector or promote low-carbon R&D. They are also more interested in green investment as a counter-cyclical fiscal policy. More fundamental differences only exist in Anglo-Saxon countries, where right-wing governments are significantly less inclined to legislate on climate change. However, due to data constraints that conclusion is not very robust.

Our findings are broadly consistent with the literature on economic policy reform, suggesting that climate change policy follows similar dynamics. For example, the need for a strong executive, which we highlight, was also found by e.g. Alesina et al. (2006) and Persson and Tabellini (2003). There is some evidence that governments avoid passing climate laws too close to an election, as has been observed with other public policies, although this is evident only in countries with a strong democratic tradition. Despite elements of bipartisanship, electoral politics still matters.

In terms of international factors, the propensity to legislate is heavily influenced by the passage of similar laws elsewhere. This effect is very strong for all types of climate legislation, although our analysis does not tell us whether this is through peer

pressure or learning effects. We measure the peer effect by the number of laws passed in all other countries. It is reasonable to assume that it will be stronger between countries with close cultural or economic ties, but the exploration of this hypothesis has to await further analysis.

Hosting a climate summit – which catapults the host into a position of environmental leadership – is associated with additional domestic legislation in subsequent years. It appears that international media presence and pressure to lead by example can change the domestic discourse and push climate change up the political agenda.

The evidence on the commitment effect of international treaties, like the Kyoto Protocol, is less strong. Legislative activity in Annex 1 countries has been significantly higher than in non-Annex 1 countries in the nine years following the Kyoto Protocol, reflecting the differentiated responsibilities assigned by the protocol. But that effect is levelling off, and there is no evidence that the Kyoto Protocol has increased legislative activities across the sample. Perhaps this indicates that climate change laws are often motivated by domestic factors, such as energy security or local environmental concerns.

It is worth recalling that we do not assess the quality of laws or their implementation, and have therefore little to say about the success or failure of different climate policies. Our approach is purely enumerative, based on the number of laws that have been passed, and of course more laws do not necessarily equate to stronger climate policy. Individual laws will differ in their ambition (e.g. their carbon targets), stringency (e.g. the number of exemptions) and scope (e.g. sector coverage). The number of laws also depends on legislative strategy, in terms of what is deemed to require primary legislation and what is left to policies and regulation. Clearly there is a research need for more evaluative assessments to establish the relative merit of different policies and legislative approaches.

Nevertheless, we believe our results are valuable by putting the spotlight on, and beginning to understand the drivers of, an important area of public policy that is likely to grow in relevance in the future. While adding to the broader literature on policy diffusion and the political economy of environmental legislation, the results also provide some practical lessons about future climate policy.

In particular, the results caution against focusing too narrowly on international treaties as the sole solution to the climate problem. Climate change is a global collective action problem that clearly requires international coordination. However, it appears that domestic (perhaps unilateral) action could be as important in creating momentum through peer pressure and learning effect, and that more domestic action might be a possible route to unlock the stalemate in the international negotiations.

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### Appendix: Climate Legislation by Country (as at end-2013)

Country	Laws	Country	Laws	Country	Laws
Argentina	6	Guyana	4	Pakistan	7
Australia	9	India	10	Peru	6
Bangladesh	5	Indonesia	27	Philippines	7
Bolivia	3	Israel	11	Poland	4
Brazil	14	Italy	17	Russia	10
Canada	4	Jamaica	4	Rwanda	5
Chile	9	Japan	8	Saudi Arabia	3
China	5	Jordan	3	Senegal	6
Colombia	9	Kazakhstan	5	South Africa	4
Costa Rica	7	Kenya	5	South Korea	15
Czech Rep	6	Malaysia	5	Sweden	7
DR Congo	3	Maldives	1	Switzerland	8
Denmark	8	Mexico	9	Tanzania	5
Domin. Rep	7	Micronesia	3	Thailand	4
Ecuador	5	Mongolia	9	Turkey	6
El Salvador	6	Morocco	6	UAE	2
Ethiopia	9	Mozambique	5	Ukraine	7
France	10	Nepal	3	UK	22
Gabon	4	Netherlands	7	US	8
Germany	12	N. Zealand	6	Venezuela	2
Ghana	5	Nigeria	3	Vietnam	10
Guatemala	6	Norway	8		