

# Are Political Leaders with Professional Background in Business Bad for Climate Mitigation?

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## Abstract

Do political leaders affect the climate mitigation of the nation they govern, and if yes, to which leader characteristics voters who care about climate should pay attention to when they vote? There is abundant literature on how ideology of political parties in power affects climate policy outcomes, but there is nothing similar for individual characteristics of government leaders. This is the first study of its kind, building on a dataset of government leaders of OECD countries for the period 1992-2017, we find that leaders' professional background is the trait that has the strongest effect. Higher emissions and lower renewable energy deployment are more likely during the tenure of former businesspersons or economists. Teachers and doctors instead are associated with lower emissions and with higher rates of renewable energy deployment. Our results suggest that voters and pressure groups should care about candidates' professional background, in addition to their party's ideology.

**Keywords:** carbon emissions, political leaders, renewable energy, businessperson

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## Conflicts of interest/Competing interests

There is no conflict of interest involved in this research.

## Availability of data and material (data transparency)

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Data available from the authors upon request.

**Code availability (software application or custom code)**

Code available from the authors upon request.

**Authors' contributions**

LDS conceived the project, designed the research and tests, and ran the econometric analysis. GK led the writing of the article. Both authors collaborated in the collection of the data and the analysis and interpretation of results.

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## 68 **Introduction**

69 There is abundant literature linking the ideology of the political parties of the elected leaders  
70 in office and carbon emissions and climate policy (King and Borchardt, 1994; Jahn, 1998;  
71 Scruggs, 1999; McCright and Dunlap RE, 2003; Neumayer, 2003; Garmann, 2014; Dietz et al.,  
72 2015). However, studies linking individual characteristics of elected leaders and climate policy  
73 outcomes are inexistent. This is a gap in the literature that claims for attention. On the one  
74 hand, there is a growing literature finding important effects of leaders' individual  
75 characteristics on a wide variety of economic policy outcomes (Jones and Olken, 2005;  
76 Congleton and Zhang, 2009; Dreher et al., 2009; Besley et al., 2011; Hayo and Neumeier, 2014).  
77 On the other hand, some studies report a personalization process of modern politics (Caprara  
78 and Zimbardo, 2004; Caprara, 2007; Garzia, 2011), what implies that individual characteristics  
79 of candidates is becoming more important for voters (Winter, 1987; Bittner, 2011; Vecchione et  
80 al., 2011; King, 2002; Cutler, 2003; Aarts et al., 2013; Campbell and Cowley, 2013; Costa and  
81 Ferreira da Silva, 2015; Ferreira da Silva and Costa, 2018; Sevi, 2020).

82 The election of Donald Trump in 2016 raised concerns about the prospects for climate  
83 mitigation in the U.S., the world's second highest emitting economy, responsible for almost  
84 15% of global emissions (and in relation his defeat and election of Joe Biden, raises hopes of  
85 renewed climate actions). Some analysts argue, however, that there is little that even a strident  
86 opponent of climate action like ex-President Trump could do to reverse trends towards  
87 decarbonization, since emissions are driven by technological and macroeconomic  
88 developments, and not climate policies (Nordhaus et al., 2017). On the other hand, we know  
89 that peoples' attitudes towards climate change and mitigation are shaped by their political  
90 affiliation and the approval (or not) of leaders with positive or negative stances towards  
91 climate mitigation (Shao and Hao, 2019).

92 This circumstance raises the question of whether political leaders matter for climate  
93 policy and climate policy outcomes, and if yes, how? What interests us here in particular is

94 whether there are characteristics of individual politicians that make a difference when it comes  
95 down to climate mitigation, over and above say the effect of their party's politics or their  
96 ideology. In other words: are there leader features that predict which politicians will be good  
97 for the climate and which ones bad? This study finds that leaders' prior profession does make  
98 a difference when it comes to climate outcomes and that leaders with backgrounds in business  
99 and economics do notably worse on climate mitigation.

100         The interest about the reasons and consequences of businesspersons in politics stems  
101 from the fact that during this century the amount of businesspersons running for and being  
102 elected in office at different levels of public administration (from local to national level) has  
103 increased dramatically around the world. More specifically, according to our data, between  
104 1992 and 2017, 19 businesspersons have been elected to be in the presidential office of the  
105 OECD countries, with most of them being elected after mid-2000s. Gehlbach et al. 2010, show  
106 that businesspersons are more likely to run for office in countries with weak electoral  
107 institutions, therefore, we can expect the share of businesspersons running for office to be  
108 much higher in developing and middle-income countries. The literature analysing the reasons  
109 and consequences of businesspersons in politics is taking-off, but still there is a gap since most  
110 of the studies focus on how and why businesspersons take office, but little is known yet about  
111 the consequences. At this regard, Szakonyi (2020) is an exception. Our results contribute to fill  
112 this gap and bring some light to the debate about the consequences of businesspersons  
113 running for and serving in political office (Diermeier et al., 2005; Gehlbach et al., 2010;  
114 Braendle, 2016; Szakonyi, 2020), by analysing the impact of businesspersons on climate change  
115 mitigation policies.

116         Past research on the determinants of carbon emissions has focussed on assessing and  
117 comparing the economic, technological, and policy factors that may affect emissions (Sharma,  
118 2011; Menyah and Wolde-Rufael, 2010; Casey and Galor, 2017) - in comparison, we know next  
119 to nothing about the possible effects of political leaders and the ways their background,

120 training and characteristics influence climate mitigation (or not). Despite the richness of the  
121 environmental literature, the impact of a leader's background on environmental policy and  
122 outcomes has not received attention yet. There are studies that show left-wing parties in  
123 government are associated with lower carbon emissions (Dietz et al., 2015; Garmann, 2014),  
124 and that political parties with more pro-environmental positions are likely to adopt more  
125 environmental policies when in government (Knill et al, 2010). There are no equivalent studies  
126 though on the effects of leaders of government, and any impact they might have on top of  
127 those that relate to their political party's agenda or their and their parties' ideology.

128 In this piece of research, we empirically test whether leaders' profession, while  
129 controlling for other leaders' characteristics, may have an effect on climate mitigation policy  
130 and outcomes. And more specifically, the question is whether businesspersons have an impact  
131 on climate policy and outcomes, and how. We create a dataset of political leaders' ruling the  
132 countries that signed the Kyoto protocol, and examine within-country variations across these  
133 leaders' profession and characteristics: gender, family situation, age and years in politics. We  
134 do this for a number of countries over the years, while accounting and controlling for  
135 contextual differences between leaders, such as years in office, party ideology and whether  
136 they govern in coalition or in minority (a proxy for their effective power).

137 Previous datasets in the literature cover long periods of time, but they start before  
138 climate policies were introduced, and finish too early for our purposes (early 2000s). We  
139 constructed accordingly a new dataset of political leaders and their characteristics for the  
140 period 1992-2017 (1992 being the year the United Nations Framework Convention on Climate  
141 Change was held) using publicly available data that we retrieved through a web-based search  
142 of encyclopaedias. In line with others before us who studied the effects of political factors on  
143 environmental performance, we focus on OECD countries to compare similar regimes, with  
144 comparable socio-economic, political and environmental policy conditions but sufficient  
145 variation in leader characteristics.

146           We test associations between the above variations and climate policy and outcomes,  
147 measured by the proxies of renewable energy deployment (in terms of installed capacity) and  
148 carbon emissions. One is an indicator of effort, and the other of outcomes. We do not expect  
149 that the two will move necessarily in the same direction. Until recently, the deployment of  
150 renewable energy had not demonstrably displaced fossil fuels (York, 2012); and other policies,  
151 such as regulation or taxation might have a stronger effect on emissions than the development  
152 or not of renewable energy.

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### 154 **Businesspersons in office and Policy Outcomes**

155 In recent years, there is a growing literature that shows how traits of governing politicians link  
156 to policy outcomes, establishing that political leaders' identities have a discernible impact on  
157 government performance. This line of research is based on the proposition that factors related  
158 to individuals' status (such as occupation, income, or education) and life experiences (related  
159 to gender, age, training/profession) may explain differences in policy preferences and  
160 behaviour; and that the quality of leaders is key to their government's performance. One  
161 central hypothesis here is that governing leaders, at least to some degree, may pursue their  
162 own interests. Under this hypothesis, it would not be surprising that, beyond the ideology of  
163 their political parties, political leaders' characteristics might matter when it comes to the  
164 adoption of a wide variety of policies, among them, the ones intended at mitigating climate  
165 change. In the literature, there is a wide variety of studies analysing the impact of the  
166 characteristics of political leader on several policy outcomes. Empirical studies have  
167 established for example that the quality of leaders matters for economic growth (Jones and  
168 Olken, 2005), and more specifically, that more educated leaders increase rates of economic  
169 growth (Congleton and Zhang, 2009; Besley et al., 2011).<sup>1</sup> Constant and Tien (2010) show that  
170 foreign education of leaders matters for Foreign Direct Investments (FDI) inflows in their

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<sup>1</sup> Contrasting findings about the effects of leaders' education are also found Carnes and Lupu (2016).

171 home countries. It is also found that leaders from lower social class backgrounds increase  
172 spending and debt (Hayo and Neumeier, 2014); and that younger politicians behave more  
173 strategically during elections (Alesina et al., 2019).

174 In this setting, one relevant question for voters who do care about climate change is to  
175 identify which of the leaders' characteristics are more relevant as far as climate change  
176 mitigation policies is concerned. We hypothesize that among all the mix of leaders'  
177 characteristics, profession points as probably one of the most important leaders' qualities  
178 potentially affecting policy outcomes regarding the mitigation of climate change. There is a  
179 debate about private sector businesspersons serving in political office (Gehlbach et al., 2010),  
180 especially at the presidential level. It would not be surprising that political leaders who were  
181 in business before being elected, may promote policies with the intention to create a favourable  
182 environment for businesses like theirs (if not their own business). Clear recent examples of this  
183 type of behaviour are Silvio Berlusconi in Italy or Donald Trump in the US. For example,  
184 Dreher et al., (2009) observed that, a presidential level, ex-businesspersons are more likely to  
185 pursue liberalizing reforms that facilitate business activity. However, Beach and Jones (2016),<sup>2</sup>  
186 at a local level, provides contrasting findings. These authors find no evidence that elected  
187 candidates with a business experience had an impact on a wide variety of outcomes (e.g. city  
188 expenditures and revenues). However, the fact that businesspersons do not have an impact  
189 on city outcomes, or the level of administration where they hold office, does not mean that  
190 their businesses cannot benefit from them holding office. For example, Szakonyi (2020) show  
191 that in Russia, firms connected to winning candidates increase their revenue by 60% and profit  
192 margin by 15% by the final year these candidates spend in office.

193 A central feature of climate policy is that a leader needs to take a longer-term view  
194 towards future generations, a predisposition that one would assume is less likely to be found  
195 among leaders with professional backgrounds and social positions that privilege immediate

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<sup>2</sup> These authors use data of California city councils.

196 returns. One plausible expectation is that leaders with professional background in sectors that  
197 are trained to prioritize short-term returns, say businesses, will be less likely to act on the  
198 climate. In addition, experimental evidence, shows that economists, who share common  
199 backgrounds with businesspersons, compared to students enrolled in other university fields,  
200 are more prone to free ride (Marwell and Ames, 1981). Thus, it would be not surprising that a  
201 political leader who is a businessperson or economist, might be less interested in investing in  
202 a “public good” as the climate mitigation, than political leaders with other different  
203 backgrounds.<sup>3</sup> Of course, with this reasoning, we do not pretend to rule that businesspersons  
204 possess intrinsic personality traits that makes them to be innately less sensitive to the climatic  
205 change. Rather, it might also be that they simply are more prone to serve to determinate  
206 businesses environments and networks, who may constitute powerful lobbies.

207

## 208 **Data**

209 A paid research assistant constructed the leaders’ database under our guidance. The approach  
210 was to start with an internet search of open access encyclopaedias (Wikipedia, Britannica) and  
211 find the leaders in government for each country in our dataset from 1992 to 2017. A "leader"  
212 was defined as the President in Presidential and Semi-presidential systems; and the Prime  
213 Minister in Parliamentary democracies. Once the name of the leader was found, data was  
214 compiled from the encyclopaedias on start and end date of term(s), profession, education,  
215 number of children, age, years in politics, political party and its ideology – where information  
216 was missing, this was pursued through additional web searches. We did not include interim  
217 governments lasting less than six months (at least 183 days). Each year had a separate entry.

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<sup>3</sup> These authors ran an experiment intended at maximising the likelihood of free riding. Participants were asked to invest a number of tokens in a collective fund. The share of tokens invested that maximizes the collective benefit was 100%. On average, participants with very heterogeneous backgrounds contributed around 40-50%. Telling participants that the collective good was going to be something non-divisible doubled contributions to about 80%. Only first-year economics graduate students behave very differently, since, on average, they only contributed 20% to the collective fund and a significant number of individuals in this group tried to free ride completely.



218 For consistency, we include only the twenty-seven countries that were OECD members  
219 at the time of ratification of the Kyoto protocol (before 2000) and excluding that is, six countries  
220 that joined after 2010. (Chile, Estonia, Israel, Slovenia, Latvia, and Lithuania). The countries  
221 included in the analysis are Australia, Austria, Belgium, Canada, Czech Republic, Denmark,  
222 Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Mexico,  
223 Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Turkey, UK,  
224 and US.

225 We determined a leader's profession by looking into his main occupation prior to  
226 becoming a professional politician. We classified as "Politician/State Official" those who went  
227 directly from school/university to becoming politicians or state officials, or who did not have  
228 a clear professional trajectory before becoming politicians (e.g., worked different jobs for a few  
229 years). We grouped professions into eight groups: Businesspersons, law-related, college  
230 lecturers, politician/civil servants, scientists/science-related, other professions (see Table A1  
231 in the Appendix).

232 Our sample includes 156 leaders for a total of 681 leader-year observations (see Table 1). Our  
233 average leader is 55 years old, governed for 4 years, and has been in politics for 30 years (Table  
234 2). Most leaders are lifetime politicians or civil servants (33%), but there is also a good  
235 representation of businesspeople (12%), lawyers (14%), professors (13%) and scientists (15%)  
236 (Table 1). The grand majority of leaders are men (92% - only 13 leaders in our sample are  
237 women GDP and population data were taken from the World Bank Databank. For carbon  
238 emissions, measured in tonnes per year, we used Global Carbon Project (2019) data. For  
239 renewable energy, we created a new consolidated Renewable Capacity dataset, merging data  
240 from the International Energy Agency (IEA), which has data available from 1980 to 1999, with  
241 data from the U.S. Energy Information Administration (EIA), which has complete data from  
242 2000 onwards (before it was only measuring hydroelectric capacity). We indexed both datasets  
243 to the year 2000 to do this.

**Table 1. Frequency analysis of qualitative variables in the model, 1992-2017**

	Overall		Between Country		Between Leader	
	n	%	n	%	n	%
<i>Gender</i>						
Men	632	92.89	27	100.00	143	91.61
Women	49	7.11	9	33.33	13	8.39
<i>Occupation</i>						
Business	77	11.18	15	55.56	19	12.26
Law	110	15.97	16	59.26	23	14.19
College Lecturer	78	11.32	12	44.44	20	12.90
Politician/civil servant	237	34.40	22	81.48	52	33.55
School Teacher/physician	21	3.05	6	22.22	7	4.52
Economist	35	5.08	7	25.93	8	4.52
Scientist/Science related	33	14.08	7	59.26	24	5.16
Other	90	4.93	14	18.52	5	12.90
<i>Children</i>						
No	56	8.13	9	33.33	12	7.74
Yes	625	91.87	27	100.00	144	92.26
<i>Political orientation of the party</i>						
Left-wing	260	37.74	25	92.59	61	39.35
Centre	31	4.50	4	14.81	9	5.81
Right-wing	390	57.76	27	100.00	86	54.84
<i>Ruling with majority</i>						
No	515	75.91	27	100.00	120	76.77
Yes	166	24.09	15	55.56	36	23.23
<i>Ruling in coalition</i>						
No	205	29.75	17	62.96	40	25.81
Yes	476	70.25	25	92.59	116	74.19
# observations	681		27		156	

245 Note: *Between-Country* values indicates how many countries have been ruled by a leader with a specific  
 246 characteristic. For instance, 100% (27) of the countries in our sample have had a man as a ruler at least once, while  
 247 33% (9) of the countries have had a woman as a ruler at least once. *Between-Leader* values indicates the frequency  
 248 distribution of the leader characteristics across countries. For instance, 92.2% (141) of the leaders are men, while  
 249 8.4% (13) of the leaders are women.

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**Table 2. Descriptive statistics of the continuous variables in the model, 1992-2017**

	n	Mean	Std. Dev.	Min	Max
Age	681	55.54	8.50	35	78
Years in Office	681	29.71	10.24	0	61
Years in politics	681	3.96	2.79	1	13
GDP/1,000,000 (2010 US \$)	681	1,430,000	2,670,000	7,920	17,000,000
GDP per capita	681	35,454	17,311	5,632	91,566
Population/1,000	681	40,900	59,400	261	323,000
% Urban population	681	75.90	10.96	49.13	97.961
Installed renewable capacity (million Kw)	681	18.12	27.90	0.072	214.472
CO2 emissions (kt)	681	458,000	1,060,000	2,263	6,130,000

253

## 254 Empirical model

### 255 *Basic model*

256 To estimate the impact of leaders' characteristics on CO<sub>2</sub> emissions and installed renewable  
257 energy capacity, we use a linear model with country fixed-effects, while also controlling on  
258 other demographic and economic country characteristics. We are interested in measuring the  
259 average effect of leader characteristics, with special attention to leader's profession, on CO<sub>2</sub>  
260 emissions and renewable capacity. Our basic specification is:

261

$$262 \ln Y_{it} = \sum_k \beta_k Z_{jit} + \sum_m \lambda_m X_{it} + \delta_t + \mu_i + \varepsilon_{it} \quad (1)$$

263

264 where  $Y_{it}$  is the outcome variable, CO<sub>2</sub> emissions or renewable capacity, for country  $i$  in year  $t$ ,  
265  $Z_{jit}$  are a set of socio-economic characteristics for leader  $j$ , ruling country  $i$  in year  $t$ , and  $X_{it}$  are  
266 country controls.  $\beta_k$  and  $\lambda_m$  are the set of parameters associated to our explanatory variables to  
267 be estimated, and  $\varepsilon_{it}$  is a random error term.  $\delta_t$  are year fixed-effects ( $t$ ), which are estimated  
268 by including year dummies, and  $\mu_i$  are and country ( $i$ ) fixed-effects.

269

270 The matrix  $X_{it}$  contains the following country level variables: logarithm of the GDP and  
271 of the total population, and the percentage of urban population. Controlling for national  
272 income (GDP), our model isolates the effect of leaders on climate policy and outcomes, and  
273 controls for the possible effect of income on both emissions and types of leaders elected (e.g.  
274 higher income countries emitting more and electing specific types of leaders). Reverse  
275 causation is a limited concern for our research question. Undoubtedly, there will be a share of  
276 the electorate that may prioritize the candidates' position towards carbon emissions or his/her  
277 commitment to renewable energy, however, this group of potential voters is not big enough  
at least during our sample period, to be likely to affect the types of leaders elected.<sup>4</sup> There are

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<sup>4</sup> Using the 1996 National Election Study data, Guber (2001) finds that despite environmental issues is associated by surveyed individuals as a strength of the Democratic Party, those issues seldom shape individual vote preferences. According to the Eurobarometer published in 2016, on average, only 6% of the European citizens thought that climate change is one of the most important issues facing Europe.

278 also no obvious attributes that would both affect the electability of say businesspersons  
 279 compared to other professions, and make them less likely to adopt stringent climate policy.  
 280 And to the extent that there are say distinctive psychological dispositions in leaders from  
 281 certain professions, this does not undermine our objectives, which is to document such  
 282 differences and their impacts, rather than identify their potential sources, which we see as a  
 283 question for further research.

284 We address to an extent other sources of unobserved heterogeneity across countries,  
 285 such as economic, cultural or political factors omitted that affect both climate policy/outcomes  
 286 and the pool of candidates or voters' choice between politicians with different characteristics  
 287 with the consideration of the country fixed-effects which eliminate bias from unobserved time-  
 288 invariant factors - such as location, geography or culture - that differ among countries but do  
 289 not change over time. We also include year fixed-effects by including year dummies, which  
 290 control for changes in the outcome variables over time but do not differ across countries (say  
 291 global oil prices, or a global macro-economic shock). The omission of the country fixed-effects  
 292 may jeopardize the strict exogeneity assumption if unobserved time-invariant country-level  
 293 factors captured by  $u_i$  are correlated with the covariates in equation (1). Strict exogeneity is a  
 294 necessary condition in order to obtain consistent/unbiased estimates.

295 The matrix  $Z_{jit}$  is composed by our explanatory variables of interest, i.e. a wide variety  
 296 of leader socio-demographic characteristics: leader's profession, having children, gender, age,  
 297 years in politics, years in office, ideology of the party, type of government (majority, coalition).

298 To estimate equation (1), and get rid of the unobserved heterogeneity across countries,  
 299 we resort to the following equation:

300

$$301 \quad (\ln Y_{it} - \ln \bar{Y}_i) = \sum_k \beta_k (Z_{k,jit} - \bar{Z}_{k,i}) + \sum_m \pi_m (X_{m,it} - \bar{X}_{m,i}) + \delta_t + (\varepsilon_{it} - \bar{\varepsilon}_i) \quad (2)$$

302

303 In equation (2), each variable is demeaned with its time-average in each country. In this  
 304 setting, the identification strategy hinges around the within-country variation of the outcome  
 305 and the explanatory variables around their means.

306

307 *3.2. Total effects of leader characteristics*

308 In order to estimate the total effect of the leader characteristics on our outcome variables, we  
 309 take into account the concept of “bad controls” (Angrist and Pischke, 2009). They define as a  
 310 “bad control” a control variable that is itself an outcome variable, while a good control is a  
 311 variable that has been fixed at the time when the variable of interest is determined. A classic  
 312 example is the discussion of whether occupations should be included or not in wage equations  
 313 if we want to estimate a precise value of the returns to education. Education determines the  
 314 type of occupation achieved, therefore some of the effect of education on wages is indeed  
 315 captured by occupation coefficients. The problem can be analytically formalized in the  
 316 following way. Let’s rewrite equation (2) as follows:

317

$$318 \ln Y_{it}^* = \beta_0 + \beta_1 Z_{1,jit}^* + \beta_2 Z_{2,jit}^* + \beta_3 Z_{3,jit}^* + \pi X_{it}^* + \delta_t + \varepsilon_{it}^* \quad (3)$$

319

320 Where  $Z^*=(Z_1^*, Z_2^*, Z_3^*)$  are three leader characteristics that affect our outcome variables (CO2  
 321 emissions or renewable capacity). Suppose that we are especially interested in measuring the  
 322 impact of  $Z_1^*$  on  $Y^*$ , and that  $Z_1^*$  has an impact on  $Z_3^*$  but not on  $Z_2^*$ , then we can write:

323

$$324 Z_{3,jit}^* = \gamma_0 + \gamma_1 Z_{1,jit}^* + \gamma_2 Z_{2,jit}^* + e_{it}^* \quad (4)$$

325

326 Replacing equation (4) in equation (3) and rearranging yields:

327

$$328 \ln Y_{it}^* = (\beta_0 + \beta_3 \gamma_0) + (\beta_1 + \beta_3 \gamma_1) Z_{1,jit}^* + (\beta_2 + \beta_3 \gamma_2) Z_{2,jit}^* + \lambda X_{it}^* + \delta_t + (\varepsilon_{it}^* + \beta_3 e_{it}^*) \quad (5)$$

329

$$\ln Y_{it}^* = \lambda_0 + \lambda_1 Z_{1,jit}^* + \lambda_2 Z_{2,jit}^* + \pi X_{it}^* + \delta_t + \nu_{it}$$

329

330 According to equations (3) and (5), some of the effect of  $Z^*_1$  on  $Y^*$  will be an indirect effect  
331 exerted via  $Z^*_3$ . More specifically, the direct effect of  $Z^*_1$  on  $Y^*$  is picked-up by  $\beta_1$ , while the  
332 indirect of  $Z^*_1$  on  $Y^*$  via  $Z^*_3$  is picked up by  $\gamma_1\beta_3$ . In this setting, if we want a straightforward  
333 estimation of the total effect of  $Z^*_1$  on  $Y^*$ , then we should exclude  $Z^*_3$  from the model.

334 According to the citizen-candidate theory, there is a political competition and selection  
335 is a game between citizens competing to reach and hold office (Osborne and Slivinski, 1996).  
336 This means that many of interactions among individual characteristics we can observe in  
337 society can be extrapolated to politicians. For example, empirical evidence shows that women  
338 are less likely to choose or be chosen for certain occupations and or that women having  
339 'successful' working careers are less likely to have children. Therefore, in order to estimate the  
340 total effect of leader's gender on our outcome variables, occupation and children should not  
341 be included as controls. Analogously, it can also be observed a bidirectional relationship  
342 between age and the number of years in politics. On the one hand, years in politics increase  
343 with age; on the other hand, the number of years in politics (experience) determines the age at  
344 which a politician takes office. That is, more experienced politicians are more likely to be  
345 elected. Age also determines the achievement of certain occupations, for example, occupations  
346 as scientist or university professor are achieved at older ages than other less qualified  
347 occupations, or than professional politicians who start in politics at very young ages. Thus,  
348 age is a bad control when we estimate the impact of years in politics, while the latter variable  
349 and occupation are bad controls when we estimate the impact of leader's age on our outcome  
350 variables.

351 All the associations mentioned above are supported by our data. The estimates of the  
352 effect of leader characteristics on our outcome variables (CO2 emissions and renewable  
353 capacity) have into account all these relationships across variables. Therefore, we estimate the  
354 total effect for each leader characteristic omitting those other characteristics used as covariates  
355 that can be also affected by this specific leader characteristic.

## 356 **Empirical results**

### 357 *The impact of leader's profession: Businesspersons and economists are bad for the climate*

358 Tables 3 and 4 present our results. In Table 3, we report the impact of leader's profession on  
359 emissions and renewable energy, while controlling for other leader characteristics (gender,  
360 age, etc), other country-level variables of interest, country fixed-effects and year fixed-effects.  
361 In Table 3, occupations are dummy variables, which are all included simultaneously, except  
362 the base category (businesspersons) - therefore each occupation is compared with  
363 businesspersons. Table 4 instead estimates one model for each occupation, therefore, compares  
364 each profession with all the rest (Columns 1 and 5).

365 The first general conclusion from our results is that leader characteristics matter:  
366 several characteristics of political leaders have statistically significant effects on either or both  
367 carbon emissions and renewable energy deployment. However, profession stands out as the  
368 trait where differences really matter (Tables 3 and 4). And it is businessmen that score worst  
369 (we use the word business 'men' here literally -all leaders with business background in our  
370 sample are men). Years in which businesspersons are governing are associated with 5% more  
371 emissions and 28% less renewable energy capacity (Table 4).

372 When we compare leaders coming from other professions with businesspersons, we  
373 find considerable differences (Table 3). Compared with businesspersons, lawyers and  
374 university professors are associated with 6% less emissions, politicians/civil servants 5%,  
375 scientists 3%, and school teachers/physicians as much as 16% (though we should treat this  
376 last result with caution, as only 7 leaders or 3% of leader years in our sample correspond to  
377 teachers/physicians - Table 1). The only category almost as bad as businesspersons are  
378 economists with 3% more emissions than the rest of the occupations (Table 4), and no  
379 statistically significant difference from businesspersons (Table 3).

380 One might think that the worst performance of businesspersons in climate outcomes is  
381 not surprising. But the businessmen in our sample do not fare any better in terms of renewable

382 energy development, a dynamic economic sector which one would expect entrepreneurs to  
383 support it more. Indeed, all professions do better than businesspersons, with differences  
384 higher than 20%. School teachers/physicians and scientists stand out in terms of renewables:  
385 years in which they preside are associated with 47% and 37%, respectively, more renewable  
386 energy than years when businesspersons govern. The other professions also report quite  
387 sizable differences with respect to businesspersons: lawyers (22%), college professors (19%),  
388 and politicians/civil servants (28%) As with CO2 emissions, economists (and “other  
389 professions”) are the only ones who do not have statistically significant differences from  
390 businesspersons in terms of renewable energy (Table 3). Comparing each profession with all  
391 others (Table 4), we see that teachers/physicians score much better than others in terms of  
392 both carbon emissions (years that they govern associated with 12% less emissions) and  
393 renewable energy deployment (with 24% more capacity the years that they govern, followed  
394 by scientists, 17%).

395         Our results confirm our hypotheses, and are also in line with what we know regarding  
396 other policy outcomes from theory and previous studies. From the content and nature of their  
397 job, focussed on caring and human health, it makes sense that teachers and doctors are more  
398 concerned with curbing carbon emissions and in mobilizing renewable energy. Experimental  
399 studies have shown that economists are more like to free ride in public good provisioning than  
400 people from other backgrounds (Marwell and Ames, 1981). Features also of businesspersons  
401 and economists that in the economics literature are found to be good for growth (Dreher et al,  
402 2009), such as their focus on output or liberalizing reforms, may make businesspersons  
403 potentially bad for the climate. For example, the emphasis of businesspersons or economists  
404 on economic efficiency over broader social goals may make them more oriented to pursue  
405 short-term growth at all costs, and less likely to undertake short-term costs or sacrifices  
406 necessary for reducing carbon emissions. Likewise, liberalization in many cases has also meant  
407 environmental deregulation, which might explain also differences between



408 businesspersons/economists and professions such as lawyers or lawmakers (politicians and  
409 civil servants).

410 Another possible channel of causality could be social, rather than directly related to  
411 personal or education attributes of leaders. It could plausibly be the case that strong business  
412 networks finance the election of people from their community (or economists), with the  
413 intention to promote a business-friendly agenda that might involve environmental  
414 deregulation. This merits further research. But note that this does not help explain the worse  
415 performance on businesspersons on renewable energy development, or the positive impacts  
416 of other professions, such as teachers or scientists on climate or renewables.

417

#### 418 *The impact of other leader's characteristics*

419 Results regarding the impact of other leader characteristics are also shown in Tables 3 and 4.  
420 In Table 3, we show the results of the models including all leader's characteristics, while Table  
421 4 tests also for the effect of these variables but without controlling for other leader  
422 characteristics – this is to check whether some variables that we included in Table 3 act as 'bad  
423 controls' upon others (see explanation in previous section). For example, if one checks the  
424 effect of gender controlling for profession, as we do in Table 3, then the effect from the  
425 concentration of women leaders in a particular profession (that might be good or bad for  
426 climate policy) is taken away. However, if gender determines the type of profession, some of  
427 the impact of leader's gender on CO2 emissions and renewable energy operates through  
428 occupation. For example, none of the female leaders in our dataset have previous experience  
429 in business, while female leaders tend to concentrate in occupations such as professional  
430 politicians and health care related professions. Table 4 then runs the regressions without any  
431 control to eliminate controls that possibly take away part of the effect of interest. In reality, we  
432 are interested on both types of information – the total, direct and indirect, impact of the leader

433 characteristics by excluding so-called “bad controls” (what is captured by Table 4), as well as  
434 the separate effects of the leader characteristics by controlling all covariates (Table 3).

435 Previous literature shows that female politicians are less corrupt or opportunistic  
436 (Brollo and Troiano, 2016), are more likely to support foreign aid (Hicks et al., 2016), and also  
437 are more prone to invest in infrastructures that are more related to the needs of their own  
438 gender (Chattopadhyay and Duflo, 2004). It is also observed that women prefer higher social  
439 spending than men (Lott and Kenny, 1999; Abrams and Settle, 1999; Aidt and Dallal, 2008,  
440 Svaleryd, 2009). This evidence supports the notion that female leaders should be good for  
441 climate mitigation, however, our results indicate the opposite. This result was somewhat  
442 surprising, but we tested different specifications (including running a test without Angela  
443 Merkel who accounts for 24% of all women leader-years in our sample to see if the  
444 performance of her presidency drives in any way the results), but the positive sign for females  
445 comes out strong and statistically significant (1% level) in all cases.

446 According to our results in Table 3, tenures of female governors are associated with  
447 higher levels of carbon emissions by a considerable 8%, though they have no discernible effect  
448 on renewable energy capacity. However, as we explained above, gender is highly associated  
449 with profession, therefore, it is likely that part of the effect of gender is taken away by  
450 profession. Indeed, results reported in Table 4 are somewhat different. We observe that once  
451 possible bad controls are excluded, the effect of women’s tenures on carbon emissions falls by  
452 3 percentage points, while their effect on renewables becomes positive with a 25% increase of  
453 deployment compared to men, statistically significant at 1%. This can be interpreted as  
454 indicating that a significant effect of women on emissions and renewable capacity operates  
455 through its relationship with other variables that we included in Table 3. We know for example  
456 that there are fewer women in business and more women that are teachers, professionals in  
457 the health sector or civil servants. It is then likely that some of the effect of a leader’s profession  
458 on the outcome operates indirectly through gender. It makes sense then that taking out

459 variation in terms of professions, which is what we do in Table 3, the effect of women on  
460 emissions increases while that in renewables is dampened.

461 Gender does not have to affect policy preferences for innate biological reasons, but  
462 through a range of acculturation processes, including training or profession. Table 4, where  
463 such factors are not controlled for, gives them a better sense of differences between women  
464 and men, as they stand by the time they are leaders. Even so, we see that the negative effect of  
465 women on emissions remains statistically significant and considerable (5% more emissions).  
466 The small number nonetheless of women leaders in our sample means our finding should be  
467 treated with caution, and explored further by testing gender differences in environmental  
468 policies in samples where there are more women leaders, such as for example mayors. Still,  
469 the result is interesting as it is *prima facie* inconsistent with the rest of the literature that finds  
470 women less prone than men to short-term, strategic political-electoral thinking (Brollo and  
471 Troiano, 2016), something that should favour strong action on climate. Experimental studies  
472 too suggest that once in power the choices women make are more socially oriented than those  
473 of men (Gneezy et al., 2003; Song et al., 2004). One possibility is that such pro-social/altruistic  
474 preferences could be dominated by other factors, where women may be less prone to take  
475 action that is good for the climate.

476 One potential explanation for the positive link between female leadership and CO2  
477 emissions could be the so called “Queen Bee-phenomenon”, according to which women  
478 leaders in male-dominated organizations tend to succeed by resembling men and distancing  
479 from preferences associated with women (Derks et al., 2016; Faniko et al., 2017). This would  
480 work the opposite way offsetting possible altruistic preferences for climate policy. A Queen-  
481 bee effect is a plausible hypothesis that could be explored with further qualitative/case-study  
482 analysis, though what is striking in our result is not that just women resemble men in climate  
483 (in)action, but that they actually perform worse, an intensified Queen-bee effect of a sorts.  
484 What requires further study is also why the effect of women on renewable energies would go

485 in the opposite direction to that of carbon emissions. True, as we noted there is no reason why  
486 a leader cannot increase during her mandate both renewable energy deployment and carbon  
487 emissions, given that the scale of renewable energy is still too small to make a difference. Still,  
488 it is not directly clear why would women differ in this to men, assuming that this result is due  
489 to a systematic difference.

490 To the best of our knowledge, there is no much evidence about the impact of age, years  
491 and politics and years in office on policy outcomes, therefore we cannot build any hypotheses  
492 based on previous evidence. However, it seems plausible that in terms of age and experience,  
493 we might expect younger politicians to take a longer-term view and hence favour more  
494 stringent climate action. Older politicians though might care more about their legacy than  
495 short-term political expedience, and they might be more likely to care about the future of their  
496 descendants than younger politicians. In this line, we estimate statistically significant impacts  
497 (at 5% level) for leader's age and years in politics - however, we find this impact to be generally  
498 fairly small.

499 To comment on the impact of age and years in politics, we think that Table 4 is probably  
500 in this case a better guide than Table 3, since the age and years in politics naturally co-vary  
501 and hence controlling for one while testing for the other, takes away some of the relevant  
502 variation of both variables. According to the estimates in Table 4, age associates with reduced  
503 emissions (Column 3), 0.1% less emissions for each extra year of age (that is 1% less emissions  
504 per decade of age difference). However, no discernible effect on renewable energy is observed  
505 (Column 7). As a minimum, we can conclude that our results do not confirm an expectation  
506 that younger politicians would care more about the climate. While in principle a leader's  
507 attitude towards the future could play a role in climate policy preferences (younger politicians  
508 more concerned with longer-term impacts, both from a purely opportunistic perspective since  
509 they might be around for longer, and pay the consequences of their actions, and from a

510 generational perspective caring more about later impacts), our research does not provide  
511 evidence in support of this hypothesis.

512         Years in politics has a statistically significant but small negative effect on CO2  
513 emissions (Column 4), and only after a certain number of years in politics since in this  
514 specification only the quadratic polynomial, but not the linear, has turned out to be statistically  
515 significant. However, the impact of years in politics on the deployment of renewable energy  
516 is much more important. The estimated impact is inverted U-shaped, that is, positive but  
517 decreasing (Column 8).

518         Regarding the variable ‘years in office’, we are reluctant to draw any generalizing  
519 conclusions about seasoned versus ‘fresh’ politicians. How long a politician stays in power,  
520 instead, seems to make a considerable difference, leaders in first term associated with lower  
521 emissions, while leaders who have stayed more than 8 years have significantly higher  
522 emissions compared to those with shorter mandates (Table 3). One may interpret this as  
523 fresher leaders starting with better intentions, an effect which over the years get watered  
524 down.

525         Finally, a generational perspective is not observed in the case of parenthood. Parents,  
526 that one could expect them to care more about the longer-term impacts of climate change, do  
527 not seem to have discernable differences on either carbon emissions or renewable energy from  
528 non-parents (Table 3).

529

530 Table 3. Determinants of Carbon emissions and renewable energy development, 1992-2014, 27 countries

	Log(CO <sub>2</sub> )	Log(renewable)
<u>Business/Entrepreneur (Base category)</u>		
Law	-0.0620*** (0.0149)	0.217*** (0.0664)
College lecturer	-0.0640*** (0.0146)	0.191*** (0.0664)
Politician/civil servant	-0.0512*** (0.0117)	0.279*** (0.0532)
School Teacher/physician	-0.158*** (0.0212)	0.467*** (0.0962)
Economist	-0.0159 (0.0186)	0.0463 (0.0826)
Scientist/Sciences related occupation	-0.0326** (0.0137)	0.370*** (0.0612)
Other occupations	-0.0415** (0.0199)	0.0628 (0.0906)
Year 1-4 after being elected (first mandate)	-0.0563*** (0.0133)	0.00259 (0.0604)
Year 5-8 after being elected 1st time (second mandate)	-0.0367*** (0.0133)	0.000259 (0.0600)
Have children (yes/no)	0.00545 (0.0149)	-0.111 (0.0677)
Female	0.0793*** (0.0154)	0.0815 (0.0702)
Age	-0.0149*** (0.00467)	0.00455* (0.00263)
Age square	0.000123*** (4.19e-05)	
Years in politics	0.00395*** (0.00146)	-0.00499** (0.00200)
Years in politics square	-7.71e-05*** (2.67e-05)	
Left party	0.0191** (0.00776)	-0.0591* (0.0351)
Governing in majority	0.0455*** (0.0111)	-0.168*** (0.0498)
Governing in coalition	0.0159 (0.0119)	-0.143*** (0.0528)
log(GDP)	0.406*** (0.0415)	1.071*** (0.183)
% of urban population	0.0116*** (0.00166)	0.0373*** (0.00753)
log(population)	1.694*** (0.0888)	-3.980*** (0.397)
Constant	-20.58*** (1.449)	36.02*** (6.275)
Observations	681	681
R-squared	0.685	0.730
# Number of countries	27	27

531 Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 4: Estimates of the effect of selected leader characteristics omitting possible "bad controls".

	Log(CO <sub>2</sub> )				Log(Renewable)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Business/Entrepreneur	0.0510*** (0.0112)				-0.276*** (0.0505)			
Law	-0.0164 (0.0102)				-0.00299 (0.0465)			
College lecturer	-0.0265** (0.0118)				-0.0198 (0.0540)			
Politician/civil servant	-0.00698 (0.00790)				0.0938*** (0.0356)			
School Teacher/physician	-0.118*** (0.0190)				0.242*** (0.0883)			
Economist	0.0326** (0.0163)				-0.187** (0.0735)			
Scientist/Sciences related occupation	0.0173 (0.0107)				0.166*** (0.0483)			
Other occupations	0.0292* (0.0170)				-0.174** (0.0779)			
Female		0.0494*** (0.0139)				0.253*** (0.0629)		
Age				-0.00102** (0.000478)			0.00158 (0.00217)	
Years in politics			0.00206 (0.00132)					0.0313** (0.0155)
Years in politics square			-4.76e-05** (2.28e-05)					-0.00123** (0.000550)
<b>Omitted variables</b> <b>"Bad controls"</b>	None	Occupation, children	Occupation, children, age	Occupation, children, years pol.	None	Occupation, children	Occupation, children, years pol.	Occupation, children, age

**Note:** All models include all other controls included in table 3;  
 Marginal effects pick-up the total effect of each leader characteristic.  
 The coefficients associated to professions are estimated in separate models, that is, on model for each profession  
 Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## 538 **Discussion and Conclusions**

539 Our research is in line with what the related literature in economics has shown, and confirms  
540 that leader features, as in many economic policy outcomes, have a discernible impact on  
541 environmental policy outcomes as well. As we hypothesize in this paper, and in line with  
542 previous research regarding other policy outcomes, businesspersons, and to a lesser extent,  
543 economists, are definitely bad for climate action. Medical doctors and teachers do better and  
544 like scientists they are good for developing renewable energy. Unlike what one would expect,  
545 women are not better than men regarding CO2 emission, though women tend to promote the  
546 deployment renewable energy much more than men. Age or experience have small effects.  
547 Our results overall indicate that electing leaders with the right characteristics might be a small,  
548 but necessary, step in making progress with climate mitigation. That is, voters who want to  
549 see real action on climate action should give extra consideration to the professional  
550 background of the candidates.

551 In our empirical analysis, we use a country fixed-effects model. This means that the  
552 identification strategy hinges on linking within-country variations in CO2 emission and in the  
553 deployment of renewable energies with within-country variations of political leaders  
554 characteristics ruling the country. This implies that the size effect is taken away, that is,  
555 countries responsible of a higher share of world global emissions do not have a higher  
556 incidence in our results than smaller economies responsible for a smaller share of global  
557 emissions. This circumstance makes the link between our outcome variables and leaders'  
558 characteristics we estimate here more robust. Analogously, despite citizens' concerns  
559 regarding climate change has increased in recent years, we think that during our sample  
560 period (1992-2017) leaders' climate change positions regarding environmental policies during  
561 electoral campaigns do not seem to be yet crucial in deciding whether they are elected or not.



562 Therefore, our results are not likely to be biased due to reverse causality, something that  
563 strengthens the causal relationship we estimate here.

564         Even though our results indicate that the impact of leader's characteristics, especially  
565 his/her profession, is strong and sizeable, our research has certain limitations that should be  
566 taken into consideration. First, there are idiosyncratic effects that may be missed by research  
567 such as ours focussed as it is on systematic patterns. The antipathy of President Trump for  
568 example towards climate mitigation action is probably not reduced to his experience as a  
569 businessperson only. However, this type o personality traits are generally unobservable for  
570 the researcher. Second, the fact that leader characteristics have, other factors equal, an impact  
571 on emissions or renewable energy development does not mean that these impacts are stronger  
572 than other macro-economic, technological, or ideological factors. What it means is that leader  
573 characteristics matter and that electorates concerned with climate change should take them  
574 into consideration when deciding who to vote, alongside the ideologies and explicit  
575 statements and promises of the leaders and their parties.

576         The main contribution of our research is that it addresses for the firs time the gap in  
577 the literature on possible links between political leaders and environmental outcomes, which  
578 to the best of our knowledge is virtually inexistent. We think the above results could be better  
579 treated as hypotheses for further research, which could mobilize case studies on leaders with  
580 interviews, surveys or regression analyses at lower levels of leadership (e.g. regional  
581 governors or mayors). Further research could shed light on whether it is the lack of specialized  
582 knowledge or lack of training on climate issues in business/economic curricula, or the general  
583 profit-first norms cultivated in the business/economics world that drive such differences.  
584 Alternatively, it could be proximity or alliances to industrial or fossil fuel interests developed  
585 in the professional careers of the leaders that make them reluctant to undertake later action on  
586 climate change. Future research should also consider possible 'spill-over' effects leaders in  
587 core countries might have on the emissions of others and which are not the object of our

588 research (think of the effect of a Trump presidency on the emissions of other countries given  
589 the withdrawal of the US from the Paris agreement). A businessperson elected in the US, the  
590 hypothesis is, might have a bigger impact on global emissions, than say a businessperson in  
591 Greece. Second, it would be important to look whether the emergence of a new breed of  
592 authoritarian/populist leaders and parties changes in a significant way the associations we  
593 found here.

594           We cannot talk about ‘policy’ implications of our findings, but there are clear ‘political’  
595 implications. Our research suggest that voters who care about the climate should pay attention  
596 to candidates’ professional backgrounds, in addition to the candidate’s party’s ideology or  
597 specific positions on climate change and policy. Pressure groups also who want to push for  
598 climate mitigation legislation or funding should know that times where for example the  
599 governors are scientists or doctors are times when they can be more ambitious and push for  
600 more action, perhaps even more than what the political affiliations or stated preferences of the  
601 candidates suggest. Reversely, periods where the leaders are businesspersons or economists  
602 are perhaps periods for more oppositional politics, and vigilance and pressure should be  
603 maintained even if such leaders or their parties express pro-climate action preferences.

604

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725 Appendix

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**Table A1.**  
**Leaders profession codification**

	<b>N</b>
<b><u>Businesspersons</u></b>	
Bank Executive	5
Business Manager	44
Entrepreneur	28
<b><u>Law</u></b>	
Barrister	12
Lawyer	92
Legal Consultant	6
<b><u>Lecturer/Professor</u></b>	
<b>86</b>	
<b><u>Politician/Civil servant</u></b>	
Civil servant	37
Diplomat	16
Politician/State Official	183
State Company Official	1
<b><u>Schoolteacher/physician</u></b>	
Medic	6
Schoolteacher	15
<b><u>Economist</u></b>	
Auditor	6
Economist	29
<b><u>Scientist/science related</u></b>	
Engineer	12
Scientist	13
<b><u>Other</u></b>	
Clerk	26
ICT Professional	8
Farmer	6
Journalist	34
Unionist	9
Worker	3
Airline Steward(ess)	4

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