National Policy and Transnational Governance of Climate Change: Substitutes or Compliments? Replication analysis and extensions.

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Introduction

Over the past two decades, countries have battled to reach meaningful multilateral consensus on crucial emission targets at international climate change negotiations (Victor 2011). In last month, the world witnessed the largest ever climate action strikes with over a million people worldwide skipping school and work to call for increased urgency to deal with climate change. The strikes set the tone for the United Nations (UN) General Assembly and climate change summit, which was scheduled just a few days later in New York. The climate summit hoped to foster new and more ambitious commitments towards reducing emissions by 2020. Next year the deadline for countries to toughen up their Nationally Determined Contributions (NDCs) (as agreed through Paris Agreement) for 2020 will indicate whether these civil society pressures are enough to encourage serious state action (Wolfe, Procter, and Kreienkamp 2017). Whether states will proceed in setting ambitious enough targets is questionable. The United States (U.S), Japan, Australia, Saudi Arabia and Brazil chose not to speak at the recent summit, and President Trump looks to leave the Paris Agreement before his term is up (Hook 2019).

The United Nations Framework Convention on Climate Change (UNFCCC) acts as the foundation on which transnational climate governance rests, it provides a system

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through which states and non-state actors formulate strategies and tools for the mitigation of climate change impacts. Transnational climate governance has emerged as an alternative approach to the traditional state-based governance of international negotiations. Cities, non-governmental organizations (NGOs), businesses and other non-state actors have become focal points for scholars in global environmental governance literature (Andonova, Betsill, and Bulkeley 2009; Bäckstrand et al. 2017)

The growing role of sub- and non-state actors in climate initiatives, activism and networking facilitate an alternate governance strategy that challenges the traditional state-led nature of global governance (Hale and Roger 2014). Even so, there is some doubt whether their role is enough to meet the mitigation and adaptation policy needs of countries worldwide. Transnational climate governance seeks to combine the efforts of private and state actors in an attempt to unify their scope and influence, ultimately bringing together multiple networks and industries.

In a recent article by Andonova, Hale, and Roger (2017) they investigate the trend of climate change governance in world politics with the purpose of questioning if "transnational governance depend on, reinforce, replace, or possibly even subvert states and the intergovernmental system?" (p. 253). The article takes a new approach to the idea that transnational governance may serve as an alternative to state-based governance. They examine if a causal relationship between national policies and transnational governance exists and how domestic political institutions might condition this relationship. The authors argue that established national policies incentives sub- and non-state actors to participate in complimentary forms of transnational governance because they can assist transnational actors to meet domestic policy requirements.

Furthermore, *open* domestic institutions are argued to increase the ability of sub- and non-state actors engage transnationally in climate governance actions. The authors attempt to theorize the direct and mediating role of domestic policy and institutions in transnational governance. The intention is to show whether participation in transnational initiatives is highest in countries with strong national climate policies and if open institutions give transnational actors agency to engage in climate governance. The authors build on a dataset by Hale and Roger (2014) which measures the cross-national participation by sub- and non-state actors in transnational climate governance initiatives across a significant number of countries.

In this paper, the objective is to replicate and extend Andonova, Hale, and Roger's analysis. First, this paper will provide context on transnational climate governance. I then re-examine the authors' arguments, methodology and data to check the robustness of their conclusions. Next, I try improve on their models and results. The final section concludes with a discussion of the replication results and implications for future research.

Transnational climate governance debates

Transnational governance is understood as the involvement of state and non-state actors in collective processes and institutions that formulate rules, both formal and informal, to elicit compliance in the pursuit of collective goals. Climate change mitigation is but one example of transnational governance that requires the compliance and agency of regional blocks, states, cities, corporations, NGOs and individuals. Why? The challenge of climate change is one that involves actors from all levels of society. Transnational governance provides states and sub-state actors with a platform to share and discuss solutions, technologies and knowledge on climate issues that can inspire innovation and create change where necessary.

Energy is a fundamental need in our societies, and it reveals itself in almost every aspect of our lives, we depend on it to improve healthcare, standards of living, economic growth and social development. In the developing world, we are witnessing exponential growth in the demand for energy as these economies grow. The challenge is how these countries will shift their energy sources from fossil fuels to renewables in the next decade as they continue to climb up the CO_2 emission rankings. In a study by Taggart et al. (2011) they examine the potential for cooperative renewable energy generation between the Association of Southeast Asian Nation (ASEAN) states and Australia and find considerable potential in producing low-emission energy sources that can meet rising energy demands in the region. Some scholars would argue that transnational relations between these regions on the projects mentioned above are what drives transnational governance, which ultimately subverts state policies (Keohane and Nye 1972). In the study of transnational governance, the role of transnational actors is sometimes seen as leaders rather than just participants. When states do not have the capacity or policies to act on specific issues, transnational governance serves to compensate for these failings.

Andonova, Hale, and Roger suggest that these debates view transnational governance as *substitutes* for domestic policy, where an issue isn't addressed at the state level, actors will turn to transnational governance for engagement and support.

On the other hand, scholars argue that transnational governance is driven by domestic political conditions and contexts (Roger, Hale, and Andonova 2017). The uptake of transnational governance argued to be shaped by the various political contexts within states influences the type of engagement that occurs in transnational governance. Scholars assert that transnational initiatives are orchestrated by states and intergovernmental organisations to increase influence and leverage over challenges like climate change (Hale and Roger 2014). Sending and Neumann (2006) show that transnational governance is transforming the practice of state sovereignty as states translate their domestic institutions into institutions of a transnational form. The ever more pluralist dimension of transnational networks and intergovernmental arrangements are shaping novel regulatory institutions globally (De Búrca, Keohane, and Sabel 2014). Here, states and transnational modes of governance work together to *compliment* one another rather than substitute. What's important to note is that much of the rules, standards and decisions adopted by transnational climate initiatives are legally not binding, thus states must still act in their own capacity on domestic policies and regulations to achieve the aims of these initiatives (Hey 2006). In the case of the Paris Agreement, combined national climate commitments still fall short of the 1.5 degree targets. Without strong state-based policies, these transnational initiatives can only go so far as setting goals but rely on states to take action in their own political and economic contexts (Chan et al. 2019). The Andonova, Hale, and Roger advance the debate by "investigating *how* and *when* different modes of governance complement or substitute each other" (p. 256).

Technology, communication and transportation have all become essential factors in the changing nature of transnational relations between states (Roger and Dauvergne 2016). Globalisation has shaped the need for transnational actors to present suitable strategies for states to better navigate the costs and benefits of economic and diplomatic cooperation. A complex interdependence between states and non-states actors has gradually emerged and is now a popular research field in International Relations. The role of domestic societal pressures is one type of diffusion mechanism that incentives non-state or sub-state actors to participate and eventually adopts rules or network on an

issue beyond their state's borders (Andonova, Hale, and Roger 2017). In the case of transnational climate governance, a society's environmental values are a fundamental influence on participation in transnational governance. The drive of consumers and voters to project their values on an issue like environmental protection influences the engagement of government and civil society (Betsill and Bulkeley 2004). The participation of sub-state and non-state actors in transnational initiatives helps to provide citizens with reliable information about their state's commitments and what changes in consumption they can make to assist broader commitments. Municipal networks and urban governance has played a vital role in promoting more environmentally conscious development strategies for cities and other urban residents. Andonova, Hale, and Roger argue that there is a greater demand for participation when citizens have a collective commitment to the environment, in sociological and economic literature evidence suggest that wealthier societies tend to have stronger environmental values (Inglehart 1995; Gelissen 2007).

Civil society is a crucial component of an equitable and democratic society (Bernauer, Böhmelt, and Koubi 2013). Civil society groups are considered to operate outside state structures with the use of voluntary social relationships to create engagement or action on specific domestic or global issues. Environmental non-governmental organisations are today a prominent feature in global environmental governance and play a dominant role in policy-making and deliberation. For these types of organisations to effectively engage in public debates and mobilisation within states and globally, they require a political system which has a high degree of civil liberty and openness. If countries are tolerant of non-state actors within their domestic spheres, they are likely to tolerate transnational initiatives even when they do not necessarily align with their present internal policies. Domestic constraints will, in contrast, make it difficult for sub- and non-state actors to put forward policy preferences and mobilise over issues that are at odds with their government. Transnational networks are argued to have leverage for these types of situations, possibly providing international pressure to spur domestic policy change (Keck and Sikkink 2014). However, transnational governance often seeks to create action in parallel to, or without, the state.

Political decentralisation gives citizens as well as their elected representatives more say or influence over domestic policy-formulation and decision-making. Andonova, Hale, and Roger argue that the degree of institutional decentralisation of a state affects the

opportunities for sub- and non-state actors to engage in transnational deliberation on an issue. For example, in order for cities or regional governments to participate in transnational climate governance, they require the authority to do so by their existing political system. Leadership from cities and regions in cross-border schemes usually appear more prominently in relatively decentralised systems of administration. The state of California in the United States is an example of a sub-state actor with the authority to develop and implement policy on climate change without federal permission. The Global Warming Solutions Act (2006) was a landmark legislation for cutting emissions and committing the state towards a clean energy future (Environmental Defense Fund 2019). Limited agency of sub- or non-state actors could limit their ability to pursue alternative policy other than what is encouraged by the central government. In Andonova, Hale, and Roger's article, their analysis emphasises the relationship between openness and decentralisation of political institutions on participation in transnational climate governance. The next section will re-examine their analysis.

Replication of Andonova, Hale, and Roger (2017)

Do political institutions and state policies influence the likelihood of participation in transnational governance? This question forms part of the authors' primary research question from which they develop the basis of their empirical analysis. First, they claim that the openness of a political system helps create incentives for participation in transnational climate governance. The ability for sub- and non-state players to act and communicate freely in their society allows for open engagement between the public and government, which encourages policy deliberation. Second, where states have established proactive climate change policies, participation in transnational governance is expected to increase. Lastly, the authors seek to examine whether state policies have an effect where political institutions are relatively closed-off and constrain social agency.

Data

For the most part, I was able to replicate the results of Andonova, Hale, and Roger's paper in R using their Stata codebook and dataset. The authors' test their argument with a measurement of cross-national participation of sub- and non-state actors in transnational

Table 1: Descriptive Statistics of Dependent Variables

Statistic	N	Mean	St. Dev.	Min	Max
TCG	189	76	282	0	2,555
TCG (adjusted)	189	32	125	0	1,448
TCG high CL	96	132	383	0	2,555
TCG low CL	93	19	66	0	553

climate governance (TCG). This indicator operates as the dependent variable and aims to measure how many instances of participation in 71 initiatives were observed in 2012. Another version of this dependent variable was constructed to exclude two of the largest initiatives, which have a larger than the average number of participants. Furthermore, the authors estimate sub-samples of states using civil liberty (CL) scores to separate the groups into two additional dependent variables. These are split using the mean score of civil liberties in order to test the effect of *open* or *closed* political institutions on participation. See table 1 for descriptive statistics of the dependent variables.

The role of political institutions in TCG participation is explained using the Freedom House civil liberty score and a (binary) federalism variable. Civil liberty was transformed from its original scale to one which the authors' claim would make interpretation easier (1-7 scale to a 0-6 scale), but no record of the transformation was made in their code. The federalism variable is taken from the Forum on Federations dataset and aims to measure the effect of political decentralisation on the agency of sub- and non-state actors. I found majority (169 out of 192) of the sample for this variable to be *non-federal* while only 23 states were counted as *federal*. The authors' were in essence testing the effect of non-federal regimes on participation rather than "decentralised" federal regimes' effect on participation. To capture how ambitious state climate policies are the author's use an Environmental Performance Index Climate Policy (EPI climate) indicator and a count of international environmental agreements ratified (IEAs) by states. The former variable predates the majority of TCG initiatives, thus showing the historical commitments of states before the upsurge of climate negotiations. The latter variable is averaged between the years 2002-2013 but showed signs of extreme outliers upon examination. A natural log of GDP per capita and CO_2 emissions are also included. The former, GDP per capita, is constructed as the annual average from 1990 to 2010 in current terms. The authors' do not include these calculations in their code or give further explanation as to why

they used this version of the variable. The latter, CO_2 emissions, is included to control for underlying country characteristics that may affect variation in the total number of participants in transnational climate initiatives.

Table 2: Descriptive Statistics of Independent Variables

Statistic	N	Mean	St. Dev.	Min	Max
Federalism	192	0.1	0.3	0	1
Civil Liberties (CL)	192	3.5	1.8	0.0	6.0
EPI climate	132	45.1	23.1	1.8	95.7
IEA ratifications	191	51.0	24.5	10.0	144.0
GDP per capita	183	7.9	1.5	5.0	11.0
Trade	181	0.03	0.4	0.0	5.5
ISO 14001	192	0.1	0.5	0.0	5.5
INGOs	149	0.1	0.2	0.0	1.5
Carbon Dioxide	183	9.1	2.6	3.3	15.5

The authors employed a trade variable and an environmental management measure that were noticeably problematic. These two variables are meant to examine whether economic interdependence encourages increased participation in TCG. Trade, meaning how much a country trades with other countries, is weighted by its trading partners' level of participation. Further diagnostics reveal South Africa as an observation measuring significantly larger (5.459) than the mean (0.0319) in the sample. Outliers like this will affect the central tendency of a sample, particularly the mean, which is most sensitive to outliers. I suspect they may have coded this variable incorrectly or transformed it inappropriately. Similarly, the ISO 14001 variable, which measures the number of firms and businesses compliant with the ISO 14001 environmental management standard, has extreme outliers and is summarized incorrectly (55.32 instead of 5.532) in their summary table. Lastly, the authors create a variable called INGOs that measures membership across countries in the International Union for Conservation of Nature (IUCN), in order to test whether membership leads to greater participation. Both INGO and ISO 14001 are extremely right-skewed, with a high number of observations clustered around zero.

For their robustness checks (table 3), the authors employ measures of political rights (Freedom House), regime type (Polity IV), voice and accountability (World Bank Governance Indicators), EPI (a more general measure of environmental peformance), air pollution (PM10 air pollutant), green aid (aid received for *green* projects), foreign direct investment (FDI, from the World Development Indicators). Green aid and FDI were

Table 3: Descriptive Statistics of Independent Variables for Robustness Checks

Statistic	N	Mean	St. Dev.	Min	Max
Voice and Accountability	191	2.4	1.0	0.3	4.1
Political Rights	189	2.4	1.0	0.1	4.4
Regime Type	129	3.3	6.4	−10.0	10.0
EPI	131	50.1	9.3	25.6	76.2
Air pollution	176	59.5	41.4	7.6	222.1
Green aid	173	63.6	145.9	0.0	1,178.5
FDI	130	15.8	51.9	0.02	519.3
GDP	132	24.5	1.8	20.5	29.7

rescaled but there distributions and residuals remained highly right skewed with many outliers. The next section will look at the models employed by the authors and their conclusions thereof.

Models

Andonova, Hale, and Roger employ a negative binomial regression model measured by maximum likelihood to generate estimates. Before the selection of this model, the authors note that they did test a Poisson model on the data but experienced issues of overdispersion, inefficient estimates as well as inflated z-scores. A negative binomial regression is used to handle overdispersion for count data and has a log-gamma random effect at unit level instead of a normal distribution. The model does not assume the variance is equal to the mean.

In the authors' results (table 4), they find support for their core argument related to institutional and policy effects on participation. They also find that ambitious climate change policies (EPI climate measure) has a positive effect on participation across all their models. The EPI climate measure has a lot of missing observations (60) which is not discussed or mentioned in the paper. The concern here is if certain outliers skewed the result of this conclusion, making it questionable whether definitive inferences can be made about this relationship. The claim that societal demand and transnational interconnectedness has a positive effect on participation in transnational climate governance is at odds with the authors' results. First, GDP per capita result does not support the argument that the wealth of society translates to increased participation. Second, and not surprisingly, their trade variable did not yield statistically significant results. Thus

the authors conclude that societal wealth and demands, as well as economic interdependence, are not consistent predictors of participation. The sub-sample models 3 and 4 indicate that states with higher civil liberties allow for societal demands to operate and show GDP per capita as well as ISO 14001 to have a more significant and positive effect on participation. However, they find in model 4 that these effects are entirely absent. Model 4 also shows an interesting result for trade which the authors fail to acknowledge in the paper; an extremely low coefficient (-9152.9) and very large standard error (6136.9) that would surely evoke some concern over the variable's accuracy of the measurement or coding. The next section introduces changes to particular variables found problematic and discusses the results of new regressions in the hopes of improving on the authors' results.

Improved data and models

The basis for the authors' choice to use trade and FDI in their analysis is based on the following hypothesis stated in their paper:

> *The more a country depends upon foreign markets that themselves exhibit high levels of participation in transnational governance schemes, the more non-state and sub-state actors in that country participate in transnational climate governance.*

I reconstruct their trade variable [1] using export, import and GDP data (2012) from the world development indicators (World Bank 2019). I did not weight the variable as the authors did due to insufficient justification for such weighting in the paper. I then transformed the ISO 14001 as well as the INGO variables using a square-root transformation for the fact that they are count variables. The new main regressions are reported in table 5.

Overall, the empirical results do provide support for the two hypotheses related to institutional and policy effects. The first model shows evidence that civil liberty has a positive and significant effect on participation in the baseline model (see figure 1). However, in model 2 the effect is less significant. This indicates that the two largest initiatives in the first sample have a big influence on how civil liberty effects participation. Federalism

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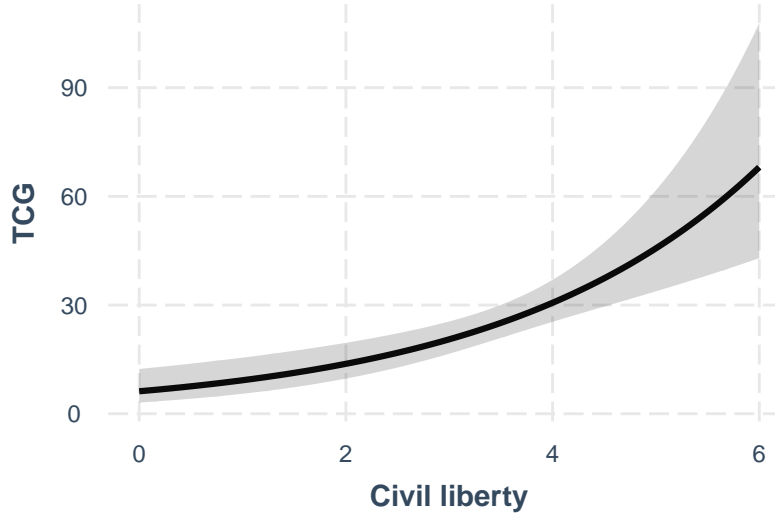1. $log(InternationalTrade = \frac{(Exports+Imports)}{2 \times GDP})$

Figure 1: Effects plot of TCG and civil liberty

remains significant in my results, however the accuracy of this variable is questionable. Both EPI climate and IEA produce reasonable effects on participation in models 1 and 2. The EPI climate result suggests that state climate policy is an essential force in increasing participation. The IEA variable, which measures international environmental agreements ratified (Mitchell 2002–2013), is significant in the first model; however, in the model that adjusts for two large initiatives, it returns insignificant. European countries in the population inevitably skew the result as they have an average IEA much larger than the mean. This variable could be improved by updating its scope and including agreements which have been signed in the last 5 years.

The remaining explanatory variables examine the relevance of societal demand and transnational connectedness in supporting participation. In the authors' results, GDP per capita and trade never reach significant results across all their models. Similarly in my results, GDP per capita and trade do not have a significant effect on participation. The standard errors for trade became significantly smaller in my results, suggesting the new measure may be more precise than the authors' version of the variable. Although the variable is not significant in the models employed, business and trade between nations could lead to increased exchanged on environmental issues as well as knowledge dissemination. In a study by Al-Mulali and Ozturk (2015) they find that trade openness, among other development variables, has a long-term negative impact on the environment in Middle East and North Africa. Trade is a crucial piece of the global governance puzzle and could be used to generate strategies and actions to reduce environmental degredation

and increase transnational climate governance participation. The ISO 14001 results also suggests that businesses commitment to environmental standards may encourage greater participation in TCG. However, I find this variable problematic as China and Japan score significantly higher in certification numbers than any other country in the sample. I verified their numbers as true, but do believe they are high leverage points in the variable sample. Finally, the INGO result yields a relatively small significance for instances of participation in model 1, however in the adjusted TCG model it does show significance. This variable has fairly large number of missing values (41), particularly for countries in Africa, Asia and Eastern Europe.

The spilt-sample models 3 and 4 provide additional support for the conditional effects of political institutions on climate policy. Model 3 represents countries with higher than average civil liberty scores, and the results show significance for the majority of the variables except for trade and INGOs. In model 4, my results are very similar to that of the authors' in that low civil liberty restricts the effect of societal mechanisms on participation. However, their conclusion with regards to international linkages is contested by my result. The authors' trade result coefficient of -9152.110 and standard error of 6136.914 are extreme and seem problematic. The results for the new trade variable remain insignificant, however the estimate and standard error are consistent with the rest of the results and are noticeably better. My results yield ISO 14001 as significant in a case of low civil liberties, its effect is modest but suggests that countries with low civil liberty could still be influenced by international economic connections to participate in transnational climate governance. China scores highest in the ISO 14001 variable so I suspect it would have a large influence in the outcome of the variable in this model.

In table 6 the effect of 3 different explanatory variables on TCG is tested and compared against the authors' civil liberty variable. First, I use a the Freedom House aggregated total score for all categories because it extends beyond civil liberty into areas of political rights and electoral democracy (Freedom House 2012). This score is rated on a scale of 0-12, where the lower score translates to a poor score or vice versa across categories. Next, I test voice and accountability from the World Development Indicators and polity, which are both already included in the original dataset. The Freedom House total score (figure 2) and polity yield positive results but their effect is still not as high as civil liberty. The Freedom House score looks to have a more consistent confidence interval than civil
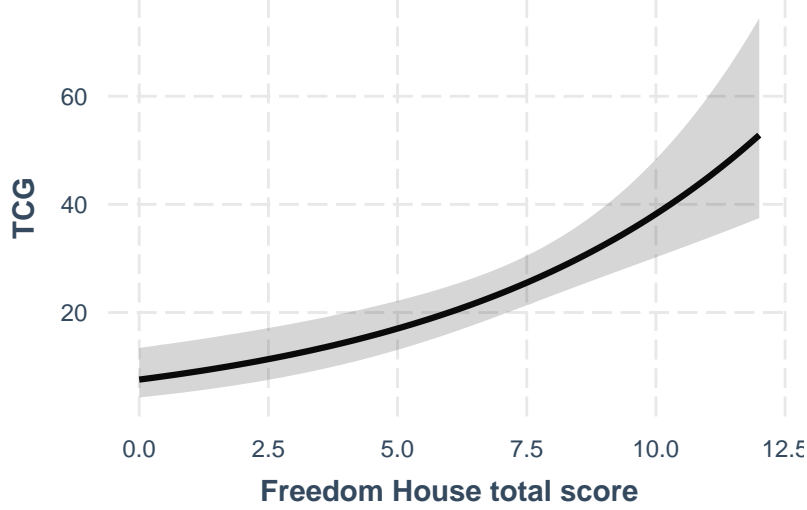
Figure 2: Effects plot of TCG and Freedom House

liberty and a smaller standard error, suggesting it could also be a valuable predictor for TCG participation accross countries. Voice and accountability produces a larger effect on participation however both the standard error of the variable and model are higher than that of civil liberty and the baseline model.

The final regressions act as robustness checks for the authors' results. As mentioned earlier, I found the Green Aid and FDI variables problematic due to their skewed distributions and residuals. The FDI variable (World Bank 2014) is employed as an alternative to economic interdependence, the authors' rescale the variable but do not correct the highly right skewed distribution. The Green Aid measure is used to determine whether the amount of aid a country receives for *green projects* correlates with participation. I use a logarithm transformation on both variables in an attempt to reveal a clearer picture of their distributions. Regression table 7 shows the results for the new robustness checks. Each model reports different specifications of the model 1 as robustness tests. The first two models replace the primary climate policy variable with air pollution PM10 and the broader measure of EPI in order to measure a country's commitment to environmental protection. My first model does not see the air pollution PM10 variable yield any significance, unlike the authors' result. The EPI measure is significant for participation, suggesting that domestic environmental commitments carry more weight than broader international agreements such as PM10. Models 3–5 present alternative measures of domestic institutions to ensure the robustness of their leading indicators. Polity, voice and accountability and political rights all yield positive results and do not change the con-

clusion that domestic institutions matter for participation. FDI and green aid perform slightly better in my improved regression however, they still do not yield much more significance and do not necessarily outperform Trade or ISO 14001.

Results

The results of the statistical analysis provide evidence to support the importance of particular mechanisms at play between domestic political structures and the agency of sub- and non-state actors in transnational governance. The results suggest that national policies and transnational initiatives reinforce one another. Furthermore, they help provide clarity on the politics of participation that are discussed in existing case-orientated literature. The European cases exaggerated the relevance of open institutions and pro-climate policies in the analysis, cutting a clear North-South divide. Downie (2013) studies the involvement of environmental ministries of E.U. states in UNFCCC. The environmental departments of the United Kingdom (U.K.), Germany and the Netherlands encouraged an immediate and robust move towards climate policy from E.U. nations since the first Conference of Parties (COP) in Berlin. The progressive coalition between environmental
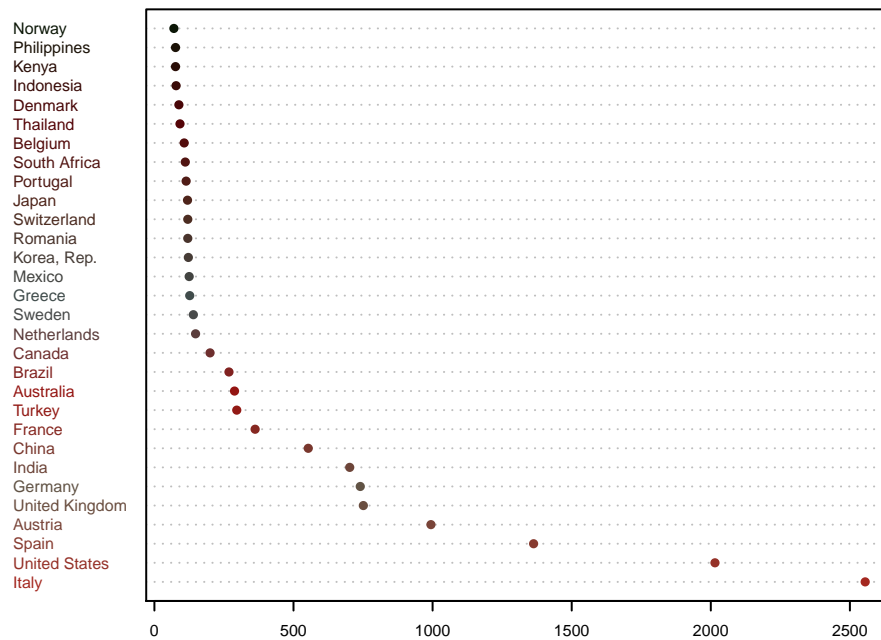

Figure 3: Top 30 instances of participation across countries

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departments across the E.U. region was supported by domestic political incentives due to the strong public support for climate change mitigation. The E.U. negotiating position was ultimately held by the respective environmental departments of the member states (Downie 2013).

U.S. case orientated literature captures another interesting finding around the role of sub-state actors in climate change initiatives and policy-making. There has been little to no policy reaction to international agreements around emission cuts at a federal level since the Kyoto Protocol besides the Bush administration's *Global Climate Change Initiative* of 2002 (Selin and VanDeveer 2007). Despite Congress having consistently opposed greenhouse gas (GHG) controls, there has been a steady increase in U.S. states and municipalities adopting climate change policies and mitigation strategies (Selin and VanDeveer 2007). The Center for Climate and Energy Solutions (previously called the Pew Center on Global Climate change) is a policy hub involved in progressive climate change action programs for over 30 states across the U.S (`https://www.c2es.org/`). Figure 3 maps the top 30 instances of cross-national participation, U.S-based sub- and non-state actors rank second-most in instances of participation (2,015) in transnational climate governance. This is an impressive figure considering the state of federal policy on climate change and suggests there is, in fact, a large coalition of willing sub- and non-state actors engaging with the climate issue.

Less democratic states such as China show a different pattern in participation that can be partially explained by the paper's results. China, a country with restrictive civil rights and institutions, has ambitious state and business policies related to clean energy and carbon markets. This has translated into a relatively high level of participation with selective backing from the central government. The electric motor vehicle market is dominated by China, and its solar industry is steadily growing to help curb the state's dependence on coal (Li et al. 2007). Kenya and South Africa are the only two African states that feature in the top 30 instances of participation. Much of the existing literature regarding Africa and climate change centres around current and future impacts. Despite the continent's minuscule collective contribution to GHG emissions, it remains the region most vulnerable and the least prepared for its effects. A recent Afrobarometer policy paper examines the current awareness and experience of climate change on the continent (Selormey et al. 2019). A key finding of the report was that more than 2-to-1 ordinary

Africans have identified worse climate conditions over the past decade and the main culprit being more severe droughts. 58% of Africans had heard of climate change on the continent, but interestingly South Africa appeared to be among the least aware citizens on the issue. This increasing awareness for climate change by citizens will hopefully encourage more civil and domestic engagement on the problem at the transnational level.

Conclusion

In this paper, I replicate the analysis by Andonova, Hale, and Roger (2017) between participation in transnational climate initiatives, political institutions and state policies. My replication was successful, and my results supported the authors' theory that the openness of a political institution increases sub- and non-state participation in transnational climate governance. Similarly, the establishment of proactive climate change policies by states also translated into increased participation. However, early diagnostics using the `car` package in `R` revealed several problems with certain control variables in the dataset. To solve this problem, I reconstruct their trade variable and transform the business compliance variable (ISO 14001) and the IUCN membership variable (INGO) in the hope to improve the results of their original regression models. The improved models showed improved output for the variables mentioned above and model diagnostics showed some improvements. The analysis implies that future studies should focus on the broader effects of transnational climate initiatives on state policies and inter-governmental cooperation. The study of transnational climate governance brings light to the dynamics between transnational networks, domestic policies and international agreements. The traditional political science distinction between domestic and international spheres is challenged by the problem of climate change as it implicates governance and politics on multiple scales that intersect one another. The Paris Agreement places state policies at the centre of the agreement; this demonstrates the point that a synergy between local-level transnational networks, state policies and intergovernmental devices is crucial for the agreement's success. How intergovermental organisations can best support pro-active domestic and transnational commitments needs further analysis.

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Appendix

Table 4: Article Regression Results

		Dependent variable:		
	TCG	TCG (Adjusted)	TCG (High CL)	TCG (Low CL)
	(1)	(2)	(3)	(4)
Civil Liberty	0.471***	0.172**		
	(0.088)	(0.083)		
Federal	0.577**	0.166	1.133***	0.133
	(0.282)	(0.261)	(0.351)	(0.499)
EPI climate	0.029***	0.037***	0.018**	0.042***
	(0.007)	(0.006)	(0.007)	(0.014)
IEAs	0.012**	0.008	0.014**	0.023
	(0.006)	(0.005)	(0.006)	(0.014)
GDP per capita	−0.039	0.012	0.246*	0.166
	(0.110)	(0.105)	(0.130)	(0.200)
Trade	−0.057	0.068	−0.096	−9,152.110
	(0.173)	(0.158)	(0.155)	(6,136.914)
ISO14001	0.455***	0.061	0.732***	0.258
	(0.152)	(0.139)	(0.220)	(0.240)
INGOs	0.003	1.388***	−0.330	1.247
	(0.530)	(0.484)	(0.542)	(1.834)
CO_2 emissions	0.607***	0.685***	0.501***	0.541***
	(0.091)	(0.085)	(0.117)	(0.157)
Constant	−6.624***	−7.568***	−5.627***	−7.260***
	(1.394)	(1.334)	(1.851)	(2.589)
Observations	115	115	61	54
Log Likelihood	−498.152	−423.325	−303.352	−195.741
θ	1.227*** (0.167)	1.494*** (0.229)	1.618*** (0.291)	0.846*** (0.172)
Akaike Inf. Crit.	1,016.305	866.649	624.703	409.483

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5: New Regression Results

	Dependent variable:			
	TCG	TCG (Adjusted)	TCG (High CL)	TCG (Low CL)
	(1)	(2)	(3)	(4)
Civil liberty	0.399***	0.168*		
	(0.092)	(0.088)		
Federal	0.604**	0.234	1.073***	0.079
	(0.287)	(0.273)	(0.364)	(0.488)
EPI climate	0.026***	0.032***	0.022***	0.027*
	(0.007)	(0.007)	(0.008)	(0.015)
IEAs	0.012**	0.006	0.015***	0.025*
	(0.006)	(0.005)	(0.006)	(0.014)
GDP per capita	−0.076	−0.014	0.194	−0.018
	(0.109)	(0.107)	(0.127)	(0.201)
Trade (new)	0.009	−0.016	0.014	−0.010
	(0.020)	(0.019)	(0.023)	(0.037)
ISO 14001 (sqrt)	0.015***	0.006*	0.014***	0.029***
	(0.004)	(0.004)	(0.005)	(0.006)
INGOs (sqrt)	0.008	0.047***	−0.016	0.060*
	(0.016)	(0.015)	(0.019)	(0.031)
CO_2 emissions	0.481***	0.569***	0.512***	0.306*
	(0.109)	(0.105)	(0.150)	(0.178)
Constant	−5.406***	−5.529***	−6.354***	−3.346
	(1.747)	(1.701)	(2.404)	(2.825)
Observations	107	107	55	52
Log Likelihood	−459.813	−398.216	−270.054	−187.696
θ	1.303*** (0.186)	1.493*** (0.233)	1.883*** (0.360)	0.903*** (0.187)
Akaike Inf. Crit.	939.626	816.431	558.109	393.391

Note: *p<0.1; **p<0.05; ***p<0.01

Table 6: Alternative Explanatory Variable

	Dependent variable:			
	tcg			
	(1)	(2)	(3)	(4)
Civil liberty	0.399***			
	(0.092)			
Freedom House (total score)		0.162***		
		(0.035)		
Voice and Acc			1.023***	
			(0.170)	
Polity				0.057***
				(0.020)
Federal	0.604**	0.676**	0.586**	0.758***
	(0.287)	(0.285)	(0.275)	(0.282)
EPI climate	0.026***	0.025***	0.026***	0.026***
	(0.007)	(0.007)	(0.007)	(0.007)
IEAs	0.012**	0.012**	0.005	0.017***
	(0.006)	(0.005)	(0.006)	(0.005)
GDP per capita	−0.076	−0.015	−0.193*	0.041
	(0.109)	(0.103)	(0.110)	(0.105)
Trade (new)	0.009	0.012	0.010	0.020
	(0.020)	(0.020)	(0.019)	(0.021)
ISO 14001 (sqrt)	0.015***	0.016***	0.015***	0.015***
	(0.004)	(0.004)	(0.004)	(0.004)
INGO (sqr)t	0.008	0.016	0.008	0.009
	(0.016)	(0.016)	(0.015)	(0.016)
CO_2 emissions	0.481***	0.427***	0.504***	0.399***
	(0.109)	(0.105)	(0.105)	(0.107)
Constant	−5.406***	−5.325***	−5.504***	−5.171***
	(1.747)	(1.741)	(1.689)	(1.765)
Observations	107	107	107	99
Log Likelihood	−459.813	−459.583	−454.199	−440.698
θ	1.303*** (0.186)	1.311*** (0.187)	1.433*** (0.207)	1.358*** (0.195)
Akaike Inf. Crit.	939.626	939.166	928.398	901.396

Note: *p<0.1; **p<0.05; ***p<0.01

Table 7: Robustness checks

		Dependent variable:						
				tcg				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Civil liberty	0.397***	0.358***				0.418***	0.468***	0.389***
	(0.090)	(0.098)				(0.087)	(0.112)	(0.097)
Federal	0.635**	0.759***	0.758***	0.586**	0.539**	0.617**	-0.116	0.610**
	(0.288)	(0.292)	(0.282)	(0.275)	(0.273)	(0.264)	(0.353)	(0.308)
EPI climate			0.026***	0.026***	0.031***	0.013**	0.032***	0.027***
			(0.007)	(0.007)	(0.007)	(0.005)	(0.008)	(0.007)
IEAs	0.016***	0.014**	0.017***	0.005	0.015***	0.009*	0.021**	0.010
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)	(0.009)	(0.007)
GDP per capita	-0.329***	-0.363***	0.041	-0.193*	-0.390***	-0.119	-0.592***	-0.216
	(0.091)	(0.106)	(0.105)	(0.110)	(0.124)	(0.105)	(0.165)	(0.149)
Trade (new)	0.046**	0.014	0.020	0.010	-0.001	-0.004	-0.006	0.022
	(0.019)	(0.021)	(0.021)	(0.019)	(0.019)	(0.019)	(0.025)	(0.021)
ISO 14001 (sqrt)	0.017***	0.019***	0.015***	0.015***	0.012***	0.013***	0.019***	0.022***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)
INGOs (sqrt)	0.020	0.013	0.009	0.008	0.017	-0.006	0.018	0.009
	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)	(0.015)	(0.023)	(0.019)
CO_2 emissions	0.379***	0.351***	0.399***	0.504***	0.540***		0.646***	0.473***
	(0.074)	(0.095)	(0.107)	(0.105)	(0.105)		(0.158)	(0.119)
Pollution	-0.003							
	(0.002)							
EPI		0.028						
		(0.017)						
Polity			0.057***					
			(0.020)					
Voice				1.023***				
				(0.170)				
Political Rights					1.176***			
					(0.197)			
GDP						0.557***		
						(0.101)		
fdi.log							-0.030	
							(0.136)	
greenaid.log								-0.047
								(0.045)
Constant	-3.111***	-2.237	-5.171***	-5.504***	-5.167***	-12.410***	-3.106	-4.250**
	(1.086)	(1.370)	(1.765)	(1.689)	(1.676)	(2.618)	(2.386)	(2.065)
Observations	129	107	99	107	107	102	71	95
Log Likelihood	-514.558	-464.236	-440.698	-454.199	-453.177	-444.317	-265.079	-385.572
θ	1.179*** (0.157)	1.200*** (0.168)	1.358*** (0.195)	1.433*** (0.207)	1.451*** (0.208)	1.521*** (0.221)	1.553*** (0.284)	1.343*** (0.209)
Akaike Inf. Crit.	1,049.116	948.473	901.396	928.398	926.355	908.634	552.159	793.145

Note: *p<0.1; **p<0.05; ***p<0.01