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What determines climate ambition? Analysing NDC enhancement with a mixed-method design

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The 2015 Paris Agreement relies on Nationally Determined Contributions (NDCs) to outline each country's policies and plans for reducing greenhouse gas (GHG) emissions. To strengthen global climate action and achieve the Agreement's temperature goal, it is crucial to enhance the ambition level of NDCs every 5 years. While previous studies have explored the ambition of initial NDCs, limited research has delved into the factors driving the enhancement or lack thereof in NDCs' emission reduction plans. This study employs a mixed-method design to investigate the determinants of NDC enhancement. First, we analyse the updated or revised NDCs of 111 countries using quantitative methods. Second, we conduct qualitative case studies focusing on Brazil and South Africa. Our findings reveal that countries that engaged in stakeholder consultations with civil society, business, and labour groups prior to developing their updated or revised NDCs were more likely to enhance their greenhouse gas reduction targets. These results are further supported by the case studies. South Africa conducted comprehensive consultations and submitted an enhanced GHG target, while Brazil, which did not arrange open consultations, did not improve its target. This study underscores the significance of comprehensive and transparent stakeholder engagement processes, highlighting their potential to drive enhanced NDCs. By involving diverse stakeholders, including civil society, business, and labour groups, countries can foster greater ambition and effectiveness in their climate action, ultimately contributing to the global effort to combat climate change.

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INTRODUCTION

The Paris Agreement follows a procedural approach in which countries have to determine their own contribution to the global effort to tackle climate change through Nationally Determined Contributions (NDCs)¹. The discretion afforded to parties in choosing their own mitigation path, however, has led to substantial variation in commitments². Moreover, an important element of the NDCs is that every five years, countries are required to increase the ambition of their pledges. While we know that not all countries are improving their targets meaningfully³, we know less about the factors that determine the variation in enhancement. Some studies have begun to analyse the ambition level of NDCs, as well as the factors that explain cross-country variation in NDC targets^{4–9}. Nevertheless, with a few exceptions, comparisons of updated and revised NDCs (submitted in 2019–2021) with initial submissions are still rare^{10–13}. Furthermore, there is a dearth of studies that aim at exploring the drivers and barriers that affect the enhancement of consecutive NDCs. It is, therefore, timely to gain insights into how these revised and updated NDCs compare to the first round of NDCs, and what factors underpin NDC enhancement. Our study addresses this gap by exploring the role of political, economic, and structural factors in the development of successive NDCs. Hence, we ask: which drivers and barriers have shaped updated or revised NDCs?

Drawing on previous literature on determinants, we analyse the role of *political institutions, the economy, and the structural context* in the enhancement of NDCs^{7,14–16}. We focus on domestic factors due to the freedom afforded by the Paris Agreement to national authorities in choosing their own climate targets. Domestic drivers allow us to focus on the wide variation of domestic institutions, economic circumstances, and structural factors. Moreover, domestic factors can help us to identify specific actions that countries

can and need to take at the national level to strengthen the ambition of their climate pledges.

Following up on prior literature that emphasises the importance of transparent and inclusive NDC development processes¹⁴, this study, among other factors, explores the role of two key political institutions: democracy and stakeholder consultations. Previous studies have shown that consultative processes can legitimise international pledges and assist domestic stakeholders in holding governments accountable when they fail to deliver on commitments. Extensive literature has examined the role of domestic interest groups in climate policy and has shown that climate action depends on whether and how different interest groups, especially civil society, gain access to policymaking processes^{17–20}. We investigate whether allowing for meaningful engagement with civil society organisations (CSOs) on climate action can potentially enhance the ambition of NDCs, while other stakeholders, such as fossil fuel producers, are likely to resist NDC enhancement²¹. The Paris Agreement's "ratchet mechanism" hinges in part on social pressures from domestic CSOs, as it lacks a formal enforcement mechanism^{22–24}.

To analyse the enhancement of NDC ambition, we employ a mixed-method approach that combines quantitative and qualitative methods, which has shown to be especially useful for providing generalisable results²⁵. First, we use logistic regression analysis on NDC enhancement. We employ a dichotomous dependent variable from the Climate Watch data platform that accounts for proposed reductions of total greenhouse gas (GHG) emissions by 2030 in updated or revised NDCs that were submitted between March 2016 and December 2021^{10,26}. If parties reduced their overall GHG emissions through their updated or revised NDCs, then they were coded as "enhanced", otherwise "not enhanced" (see Supplementary Table 2). This

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dependent variable affords us a comparable measure to investigate the change in commitments rather than static climate ambition^{2,27}. Our sample comprises parties that submitted their updated and revised NDCs. The EU is analysed as a single unit since it submitted a single, EU-wide NDC covering all its Member States. We also include two case studies, Brazil and South Africa, to illustrate the findings of the quantitative analysis, which are based on qualitative document analysis and 11 interviews (see Appendices B and H). The main aim of the case studies is to shed further light on the specific mechanisms of the NDC development process.

RESULTS

Figure 1 shows the results of the quantitative models for all political, economic, and structural factors included. Separate models are presented in Supplementary Table 1. First, we investigate the role of *political institutions*. Electoral democracy from the University of Gothenburg's Varieties of Democracy (V-Dem) database has a statistically positive relationship with the enhanced NDC targets at the 0.05 level (Fig. 1 and Table 1), meaning that countries with more democratic political institutions are more likely to enhance their NDCs. In models (2) and (3) of Table 1, we can also see that this relationship is independent of the level of economic development (GDP per capita) and the year in which the updated or revised NDC was submitted. In model (3), the least democratic countries (i.e., Qatar and Saudi Arabia, with an electoral democracy score of ~ 0.08) are $\sim 34\%$ likely to enhance the emission targets in updated or revised NDCs. Countries ranked low on the electoral democracy index (~ 0.5), such as Albania and Kenya, have a $\sim 54\%$ probability of enhancing their NDC mitigation pledges. Lower-ranked democracies (electoral democracy score ~ 0.75), such as South Africa, are 65% likely to improve on their initial NDC emissions, while highly democratic countries (i.e., electoral democracy score ~ 0.9 on the level of New Zealand and the United States) are 71% likely to enhance their pledge. However, partisanship was not statistically significant (We also test corruption in Supplementary Fig. 3).

We construct a new "CSO consultation index" that merges two pre-existing indicators into a single variable, namely: (1) Climate Watch's indicator of whether stakeholder consultations were mentioned in the NDC; and (2) V-Dem's CSO consultation indicator based on an expert survey²⁸ (see Methods for a justification). In Table 2, we analyse the role of civil society consultation and find that countries where CSOs are commonly consulted, were more likely to enhance their NDCs. Countries that rank low on our CSO consultation index, such as North Korea (-1.96) and Nicaragua (-1.85), have a $\sim 27\%$ probability of enhancing their NDC pledges. Meanwhile, medium-ranked countries of our CSO consultation index, such as Paraguay (0.003) and Jordan (-0.1), which mention stakeholder consultations but rank relatively low on V-Dem's CSO consultation indicator, are $\sim 54\%$ likely to enhance their NDC. Countries that score the highest (2.4) on the CSO consultation index, such as the United States and Switzerland, which mention stakeholder consultations as part of their NDC update and rank high on V-Dem's CSO consultation indicator, are 71% likely to enhance their pledge.

The estimates for the economic and structural factors were statistically indistinguishable from zero. This supports the null hypothesis that fossil fuel rents, the receipt of climate finance, the number of people affected by climate hazards, and national income (GDP per capita) do not affect the enhancement of NDCs. While the aforementioned factors do not appear to matter for *change in ambition* (i.e., enhancement of NDCs), they may well influence *static levels* of climate ambition. For instance, although prior research has shown the adverse effect of fossil fuel rents on initial NDC targets, we find a negative but not statistically significant role for NDC enhancement⁷. Hence, fossil fuel rents do not seem to restrict NDC enhancement—at least not for the first round of updates and revisions. This may be the case because countries with substantial fossil fuel rents already exhibit overall lower baseline commitment to climate action—*ceteris paribus*—in their initial NDCs. GDP *per capita*, taken on its own, exerts a positive but statistically insignificant effect on NDC enhancement.

We also analyse the individual effect of the submission year (2019–2021) of the updated NDC on enhancement (Fig. 1). The

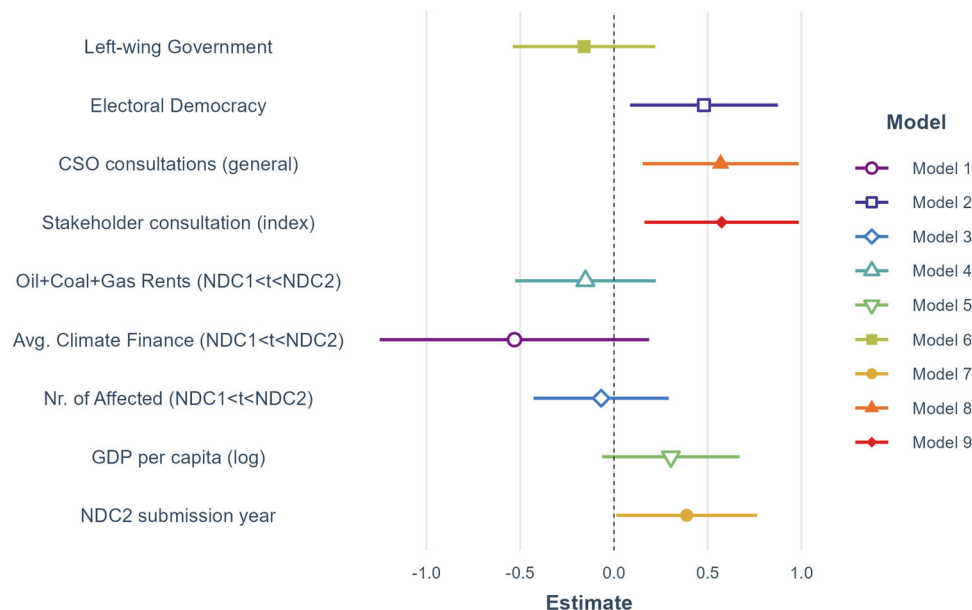


Fig. 1 Results of the quantitative analysis. The dependent variable is the dichotomous enhancement of the updated NDC (reduced total GHG emission estimate by 2030). Fossil fuel rents (oil+coal+gas), receipt of climate finance, and the number of people affected by climate hazards are taken as an average value between the submission of the first and the updated/revised NDC for each country. All other variables are measured from the year of the submission of the updated NDC (NDC2). Point estimates are coefficients from individual bivariate logistic regression models and are presented in terms of logged odds (the logarithm of the ratio of probabilities). Horizontal lines are uncorrected 95% confidence intervals.

result is positive and statistically significant, meaning that the later the NDC update was submitted, the more likely parties were to enhance their NDCs. This result may be due to increased awareness of climate change due to the climate movement or better access to scientific knowledge, such as improved global and national 2030 emission trajectories. The positive role of improving scientific knowledge has also been shown in the case of the Montreal Protocol²⁹. In addition, this finding supports the performance of the Paris Agreement's "ratchet mechanism"³⁰. This lends credibility to the general expectation that governments are inspired by the positive examples of prior NDCs and tend to continually improve their targets.

Case studies

We complement the large-*n* study with illustrative case studies, which expand on the mechanisms behind *political institutions, the economy, and structural context*³¹. When conducting qualitative country case studies, it is crucial to be mindful of the danger of selection bias and strive for a representative sample of cases. We strategically choose two cases that display variation in explanatory variables, such as government ideology, types of democratic institutions and public consultation, receipt of climate finance, fossil fuel production, and climate hazards (see Methods)³². This is to ensure we can make more confident inferences about the range of variation in the overall sample, as opposed to random selection, which is prone to bias with small sample sizes. Both countries are important substantively as major economies or significant emitters of GHGs and members of the BRICS (Brazil, Russia, India, China, South Africa) group, with similar levels of economic development.

Brazil

Brazil submitted the first NDC update during the Jair Bolsonaro government in December 2020. The updated NDC reaffirms the target of the initial pledge—to unconditionally decrease GHG emissions by 43% in 2030 (Table 2). The target was significantly less ambitious in the updated NDC since the 2005 baseline GHG emission level was raised *ex-post* to allow for higher emissions³³. The updated NDC also "considers achieving carbon neutrality in 2060" and may even consider "a more ambitious long-term objective in the future, having as a time horizon, for instance, the year 2050". However, very little information is provided about the measures to achieve it. The development of both the first and the updated NDC was entrusted to the Ministry of Environment, while the Ministry of Mines and Energy, Foreign Affairs, and the Office of the Chief of Staff of the Presidency were involved as well (interviewees #4 and #6).

The role of political institutions and the ideology of the President have been crucial for Brazil's climate action. Climate change has been a thorny political topic in previous years³⁴. Bolsonaro promised during his election campaign to withdraw Brazil from the 2015 Paris Agreement and open up the Amazon to increased deforestation³⁵. While the government did not pull out from the Paris Agreement, the hostility of his administration to further climate action has been clear as it abolished the Secretariat for Climate Change and Forests, the agency responsible for action on climate change (interviewee #5).

According to interviewees, the 2021 updated NDC was developed behind closed doors without the explicit involvement of the scientific community and civil society (interviewees #1 and #5). The updated NDC was developed in an opaque manner, as the government restricted and underfunded the Brazilian Forum on Climate Change for stakeholder involvement. While the stakeholder consultations of the Brazilian Forum on Climate Change played a key role in informing the initial NDC, members of the Forum were not consulted for the updated NDC³⁶. Overall, the decline in transparency in the NDC development process is

consistent with general democratic backsliding during Bolsonaro's tenure³⁷. Hence, due to Bolsonaro's absence of political determination to tackle climate change, combined with the exclusion of civil society and academia, the updated NDC did not enhance the GHG emission target of the first NDC. A lack of transparency and engagement with stakeholders allowed the government to submit a non-enhanced NDC with not even inconsequentially stronger GHG emission targets than the first NDC. Interviewee #1, who was involved in the first NDC development process that consulted CSOs, noted that stakeholder consultations could tilt the conversation to greater ambition due to greater national ownership.

Economic and structural factors did not appear to play a major role in the lack of enhancement of Brazil's NDC update. With regard to fossil fuel dependence, although Brazil has oil reserves, it generates electricity mainly from hydropower (66%), natural gas, and wind³⁸. According to interviewees, the most contentious mitigation issue during the NDC development process pertained to agriculture and deforestation (interviewees #2 and #4), given that land use, land-use change, and forestry and agriculture are two of the biggest sources of CO₂ emissions in Brazil (66% in 2020)³⁹. The *bancada ruralista*—a cross-party political caucus of federal deputies and senators who promote the interests of agribusinesses in congress—gained influence under Bolsonaro's administration (interviewee #3). Also, Brazil is highly vulnerable to the effects of climate change, such as wildfires, temperature changes, and sea-level rise^{40,41}. Nevertheless, although our Brazilian interviewees commented on the impacts of recent extreme weather events, they did not think the threat of climate change had played a role in the development of the NDCs.

Based on the document analysis and expert interviews, we find that one of the key changes was the obstruction of meaningful stakeholder consultation in the development process of the updated NDC compared to the initial NDC. The lack of stakeholder engagement was politically driven by the ideological change in government and represents a strategic decision since Bolsonaro's administration was aware that more transparent engagement processes could have led to more public scrutiny and potential pressure from both local and international CSOs. Non-enhancement did not appear to be significantly affected by other economic and structural factors.

South Africa

South Africa submitted its updated NDC in September 2021, during the Presidency of Cyril Ramaphosa. The updated South African NDC set a more ambitious GHG target than the initial NDC by the Jacob Zuma administration in November 2016 (interviewees #7 and #8). The upper end of the target range for the year 2030 was reduced by 32%, and the lower range by 12% compared to the initial NDC (398–614 MtCO₂eq by 2030) (Table 2). The development of both the initial and updated NDC was led by the Department of Forestry, Fisheries and the Environment, along with the Department of Mineral Resources and Energy and the Department of International Relations and Cooperation (DIRCO). The process involved technical analysis, consultation within government, broader stakeholders, provincial public stakeholder workshops, and finalisation in government and cabinet^{42,43}.

In terms of political factors, climate change has not been a major electoral issue in South Africa. Rather, climate policy has been the result of deliberations within African National Congress party leadership, bureaucracy, and key stakeholders (interviewees #7–#9)⁴⁴. However, the development of the updated NDC was more open to stakeholders than the development of the initial NDC (interviewee #11). In February 2021, Ramaphosa established the Presidential Climate Commission (PCC), which brought together 22 commissioners from government, business organisations, civil society, organised labour, and the scientific community

to review the draft of the NDC update^{42,43}. The PCC consultations played a key role in shifting the balance in favour of target enhancement compared to more sceptical government institutions, such as DIRCO and the Department of Trade and Industry (interviewees #7–#9)⁴⁵.

Economic factors played a significant role during stakeholder consultations amid concerns about unemployment and economic decline as South Africa's economy contracted by 6.4% in 2020^{45,46}. Labour organisations and big emitters opposed the closure of coal-fired power plants (interviewee #8). Particularly, mining and metalworkers' unions were unwilling to team up with environmental organisations⁴⁷. The Congress of South African Trade Unions has been reluctantly supportive of the energy transition out of concern over substantial job losses adding to the already high unemployment^{48,49} and supported the emphasis on a just transition, which was fully integrated into the NDC update (interviewees #8 and #10).

Historically, climate action has been impeded by South Africa's high dependence on coal-fired power through the state-owned company Eskom, which is a central political actor along with the oil company Sasol⁵⁰. However, Eskom has been immersed in a crisis due to spiralling prices and unreliability, while the cost of renewable energy has been falling⁵¹. Cheap domestic solar energy has rendered it a competitive alternative to coal and a potential solution to the crisis⁴⁸. Stakeholders part of the PCC agreed about reducing overreliance on fossil fuels but disagreed about the specific measures and targets. All interviewees noted that by the time of the NDC update, the stance of the big emitters had shifted from obstruction to restrained collaboration, which was supported by fundamental changes in the cost of renewable energy technology (interviewees #7 and #9)⁴⁴. Furthermore, the enhanced targets of the NDC were regarded as helpful for attracting more international climate finance (interviewee #10), although it was felt that further international financing was needed to achieve the climate targets, according to a business representative (interviewee #9).

Based on the presented evidence, we find that the main changes that mattered for the enhancement of the updated NDC target were political and institutional. Interviewees note that the PCC consultations played a key role in the enhancement of NDC targets by counterbalancing more conservative government departments. Transparent stakeholder engagement helped to inform the government of feasible climate targets, despite a challenging domestic and international economic landscape. According to the interviews, rampant disruptions in energy production have reduced confidence in the state-owned coal power producer Eskom. These trends were boosted by cost-effective and innovative renewable energy opportunities, such as the global decline in the price of solar energy.

DISCUSSION

The findings from the quantitative analysis suggest that democratic institutions are robust predictors of the enhancement of NDCs. Overall, more than half (53%) of the 111 updated and revised NDCs in our dataset enhanced their 2030 emission estimates. The qualitative part of our study offers some support for the quantitative results. We illustrated the quantitative results through cases of two distinct democratic regimes. The ideological change of the government played a vital role in the Brazilian case due to the Bolsonaro administration's deep scepticism of climate action. In the South African case, several economic and structural changes took place between the submission of the initial NDC by the Zuma administration and the submission of the updated NDC during the Ramaphosa administration. Disruptions caused by state energy producer Eskom and cheaper solar energy increased overall confidence in renewable energy, despite an economic crisis. However, we argue that one of the key factors in the Brazilian and South African cases was the implementation (and non-implementation) of stakeholder consultations. While the Brazilian

government closed off the development of its updated NDC, South Africa maintained a relatively open and democratic process, which led to results consistent with the quantitative part of the study. As a result, South Africa enhanced its GHG emission targets for 2030, while Brazil did not improve its initial NDC pledge. In this study, we have focused on two democratic countries, which are generally more open to stakeholder consultations than non-democratic regimes. Further research could therefore shed light also on the respective roles of political, economic, and structural factors for NDC enhancement in non-democratic regimes.

Drawing on a novel CSO consultation index, we argue that democratic practices, such as open stakeholder consultations, can hold the key to understanding why some governments were more likely to enhance their NDCs. The results are supported by previous studies that point to the positive role of democratic institutions on the enhancement of climate policy, in general, and the participation of a free civil society, elections and civil liberties in particular^{18,21,52,53}. There are at least two policy implications flowing from the present study. First, our results do not mean that countries simply need to become more democratic but rather that the strengthening of open, transparent, and democratic stakeholder engagement with civil society can lead to improved climate pledges. This finding is supported by prior analyses, which emphasise the need for multi-stakeholder engagement that includes domestic civil society actors^{54,55}. Second, institutionalised stakeholder consultation processes with high levels of buy-in tend to be more successful at strengthening climate policy and can create an added impetus¹⁰. Moreover, the inclusive development of NDCs may also lead to more effective implementation⁵⁶.

We concentrated on domestic factors since the Paris Agreement allows national authorities more freedom to decide on their own commitments⁵⁷. Future studies could, shed light on international factors, such as the role of international pressure (including diplomatic pressure exerted by other parties) and the role of international institutions such as the World Bank and the International Monetary Fund. Furthermore, we did not analyse the extent to which the updated NDCs are implemented. It can be expected that successful implementation (and potential over-achievement) of previous NDCs might help raise ambition, but that cannot be tested because implementation has just started, as some countries meeting their NDCs would result in even higher emissions than current trends⁵⁸.

We investigated the role of political, economic, and structural factors and found that target enhancement is not significantly affected by structural or economic factors. This is useful to know as these factors are less malleable by policymaking. However, we found that stakeholder consultations—a highly malleable factor—mattered the most for NDC enhancement. We accounted for the *change* in NDC ambition through the enhancement of 2030 GHG emission estimates in updated and revised NDCs. We did not focus on static levels of ambition in NDCs, even though static ambition levels and changes in ambition may be related to each other. One hypothesis is that countries with low static ambition in their initial NDC would be more likely to enhance their pledges because they have given themselves space to make deeper emissions cuts. An alternative hypothesis might be that countries with low static ambition in their initial NDC would be less likely to enhance their NDCs because the same underlying factors that resulted in low ambition in the first place also result in the country refraining from increasing its ambition. Future research should therefore investigate the variation in commitments during subsequent cycles of NDC enhancement. A key distinction in this regard pertains to the fact that both the initial and the updated/ revised NDCs focus on the year 2030, allowing for a straightforward comparison of emissions under the updated NDC to those under the initial NDC. By contrast, future NDCs will establish targets for years beyond 2030 (e.g. 2035), which complicates the analysis of “enhanced” ambition. Further research could develop

similar metrics to allow for analysing ambition changes across time frames.

METHODS

Regression analysis

The quantitative part of the study employs cross-sectional data to analyse the enhancement of NDC GHG emission estimates among 111 countries. Due to data limitations, we account for 111 countries in our most expansive logistic regression model. The Paris Agreement has 195 parties, which means that we lack information on 73 NDC updates. The large-scale nature of the analysis contributes to the literature with generalisable findings across all updated or revised NDCs. We build on an indicator provided by the Climate Watch platform, managed by the World Resources Institute, which assesses the proposed total reduction of GHG emissions by 2030 in the updated NDC. In the creation of the dimensions of NDC target enhancement, we draw on prior research^{10,59}. We code the NDCs as either 1 for “enhanced GHG emission estimate” or 0 for “no enhancement”. The study employs a dichotomous dependent variable principally due to two reasons. First, the Climate Watch data precluded the construction of a clearly defined dichotomous indicator. Second, the construction of a continuous variable would entail the use of subjective value judgments, which could present methodological challenges. For instance, a continuous variable would require us to consider differences in economic development and responsibility for climate change to determine appropriate cut-off points for the level of enhancement. The dataset includes countries that submitted their first and revised or updated NDC during the period between March 2016 and December 2021. The first NDC was submitted by Papua Guinea on 24 March 2016. The last NDC in our dataset was submitted by Mozambique on 27 December 2021. We define enhancement in the latest updated/revised NDC submissions during the aforementioned period, compared to the first NDC and not in comparison to the intended NDC (INDC). We do not account for countries that did not update their NDC during this timeframe, as we cannot predict what their pledges would have been like otherwise.

The sample comprises countries that submitted their updated and revised NDCs. We average all our variables across all EU Member States per year. The use of this dependent variable is favourable for three reasons. First, this measure accounts for dynamic enhancement in relation to the original pledge rather than static aggregate climate commitments. This allows us to investigate a change in commitments and not the factors that cause changes in the overall level of climate action. Second, the indicator accounts for total emission reductions by 2030, which represents a more generalisable interpretation of NDC enhancement, because it allows us to compare highly different types of NDC updates. For instance, determining enhancement would be made more difficult by focusing on specific characteristics of NDCs (i.e., the type of emission target or the inclusion of new policies). Countries maintain considerable discretion over the revision of their NDCs, by strengthening and/or adding a GHG target; changing emission baselines and business-as-usual (BAU) scenarios; expanding the scope, target period, and coverage of the prior GHG target; and through the addition of new policies and measures⁵⁹. Some of these additions may be highly stringent, while others are relatively undemanding. For instance, 59 NDC updates included some type of change in their BAU or base year emissions. As an example, Bosnia and Herzegovina used a different base year (2014) as a reference but also provided data using 1990 as a reference to make the comparison with the INDC easier. Moreover, 25 countries in our dataset propose a net-zero target for the years 2030, 2050, or 2060 or for a specific sector. However, it is difficult to compare these targets among themselves and with the rest of the sample.

We find that our measure of GHG emission reduction estimate by 2030 is reasonably rigorous since it requires a quick response and discounts attempts to change baselines (i.e., inflate the updated BAU scenario) in favour of the country putting forward an NDC. Additionally, the 2030 GHG emission reduction estimate allows for more comprehensive comparisons as it encompasses more countries than similar indicators, such as the Climate Target Update Tracker by Climate Action Tracker^{60,61}. However, while rigorous, the indicator does not compare the level of NDC enhancement as it does not measure baseline ambition in the first NDC. What could be considered a lesser enhancement for some countries may be more significant for others due to, for instance, historical emissions and differences in levels of economic development.

To study the differences among countries, we use binary logistic regression to examine the dichotomous dependent variable. We evaluate the explanatory variables part of separate models due to the risk of multicollinearity (see Supplementary Fig. 1). We test the independent variables part of separate models to reduce the danger of inaccurate coefficient estimates and overestimation due to multicollinearity⁶². To minimise the risk of multicollinearity due to a restricted sample, we tested the main models with only three variables: main predictor; GDP *per capita* (log) to control for economic development; and submission year to control for temporal effects. First, to assess *politics*, we account for democracy using the Polyarchy Index from the Varieties of Democracy database²⁸. This index evaluates electoral democracy on a scale between 0.018 and 0.922 for our sample of countries, with higher values representing a higher degree of suffrage, freedom of expression, freedom of association, the fairness of elections, and whether the executive is appointed through popular elections. Using measures from V-Dem excludes smaller states in the full dataset (i.e., Andorra, Monaco, Nauru) and limits our sample to 111 countries and less in some models. We measure government partisanship with an indicator (Leftist Government) from the same database, which captures the extent the ruling government during the submission year of the updated NDC is socialist/communist⁶³. The indicator measures the “extent does the current government promote a specific ideology based on country expert ratings, which is measured on a scale from 0 to 1”²⁸.

To capture the extent stakeholder consultations meaningfully engage with civil society during the development of the updated or revised NDCs, we constructed a new “CSO consultation index”, which merges two indicators: (1) V-Dem’s CSO consultation indicator (v2cscnsult), which is based on the survey question “Are major CSOs routinely consulted by policymakers on policies relevant to their members?” with national experts from 2021; and (2) Climate Watch’s indicator on whether stakeholder consultation was mentioned under the section that describes the “planning processes that the Party undertook to prepare its NDC” (M_PL2)⁶⁴. We combine both indicators since we are interested in detecting meaningful consultations that include CSOs, which compared to other interest groups, would be expected to support more enhanced climate action. For instance, updated NDCs, in many cases, list strictly governmental agencies among consulted stakeholders (i.e., Lebanon, Malawi, Pakistan) or briefly mention that the process was “participatory” (i.e., Albania, Oman, Sri Lanka), omitting further clarification. In many cases, industry leaders are consulted, but civil society appears to be left out of the NDC development process (i.e., Bangladesh, Samoa, Lao PDR). Climate Watch’s stakeholder consultation indicator is re-coded (1 = no mention of stakeholder consultations; 2 = stakeholder consultations were mentioned), while V-Dem’s CSO consultation indicator is re-scaled to between 0 and 6. We employ the following equation:

$$\text{CSO consultation index} = \text{v2cscnsult} \times \text{M_PL2} \quad (1)$$

The index is centred on a ratio between -2 and $+2$. In essence, the “CSO consultation index” weights stakeholder consultations

prior to the development of the updated or revised NDC by each country's overall institutional capability to take advantage of the input of CSOs. We find that democracies are overall more likely to consult meaningfully with CSOs (see Supplementary Fig. 2).

Second, to examine the role of the *economy*, we use data from the World Bank on Gross Domestic Product (GDP) *per capita* (measured in constant 2015 US dollars) from the year preceding ($t - 1$) the submission of the updated NDC⁴⁶. We take the natural logarithm of GDP per capita due to the diminishing returns at higher levels of economic development. Additionally, we use data on climate finance from the OECD Statistics database on climate-related external development finance flows⁶⁵. The measure accounts for climate change mitigation flows received by developing countries, which are marked "significant" based on the Rio Markers as in previous studies⁶⁶.

Third, to analyse structural factors, we draw upon data on exposure to climate change from the University of Louvain EM-DAT database⁶⁷. We subset the data for climate change-related events, such as storms, floods, landslides, wildfires, and extreme temperature events. We employ data on the number of people affected (controlled by population) by extreme weather events in the period between the initial and updated NDC. We also use data on fossil fuel rents from the World Bank, which is measured as the share of coal, oil and natural gas rents of GDP for the yearly average between the initial and the updated NDC.

Furthermore, we control for the submission year of the revised/updated NDC since governments who submitted their NDCs at different time periods likely had access to more recent and improved scientific information on emission scenarios and potential development pathways.

Qualitative case studies

In the qualitative part of the study, we focus on two country cases: Brazil and South Africa. Our aim is to focus on a diverse set of major country cases with substantive prominence³². These cases were chosen due to their variation in the electoral systems, change in the quality of democratic institutions, economic conditions, fossil fuel production and vulnerability to climate change. They cover different government ideologies, presidential (Brazil) and parliamentary (South Africa) democracies, although they score similarly for 2021 V-Dem (South Africa—0.75, Brazil—0.8). Brazil and South Africa are both members of the G20, BRICS, and head BASIC. We focus on the similarities and differences between the initial and the first updated NDC for the country cases in terms of the drivers and barriers. Our goal is to untangle the potential role of political, economic, and structural factors, or lack thereof, on the enhancement of the 2030 GHG emission estimate in each case.

We used a variety of sources, including official government documents related to the development of NDCs, reports from local analysts and news media, as well as semi-structured interviews with policy experts involved in the development of the NDCs. Due to the sensitive nature of the data and the roles of some of the individuals interviewed, we have kept their names anonymous. We also triangulated the information provided by interviewees with other sources to ensure accuracy. A list of interviewees can be found in Supplementary Table 3.

Our case studies allow us to illustrate the factors that influence the enhancement of NDC emission pledges, and using a combination of documents and interviews, we can understand these factors in the context of the political, economic, and structural conditions of the countries studied. The qualitative approach also provides additional insight into key variables and allows us to identify nuances that may have been overlooked by quantitative analysis. Additionally, it allows us to fill potential gaps and overcome the limitations of cross-country measures, and it also strengthens the external validity of the study.

Reporting summary

Further information on research design is available in the Nature Research Reporting Summary linked to this article.

DATA AVAILABILITY

The quantitative data associated with this study is available on [GitHub](#).

CODE AVAILABILITY

Computer code available upon request.

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AUTHOR CONTRIBUTIONS

L.P. led the writing and analysis. L.P. and H.v.A. designed the research; L.H. and S.O. contributed additional ideas and text. All authors read and approved the final paper.

COMPETING INTERESTS

The authors declare no competing interests.

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