

Growing Apart: China and India at the Kigali Amendment to the Montreal Protocol

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Abstract

Developing countries are growing apart on environmental issues. International environmental negotiations are no longer characterized merely by the North–South conflict. Rising powers have come to divide the Global South and redefine the Common-But-Differentiated Responsibilities principle. This article explains the divergence of China and India at the Kigali Amendment to the Montreal Protocol, one of the first global environmental agreements to differentiate obligations *between* developing countries. China and India, the world’s two largest hydrofluorocarbon producers, ended decades of collaboration and split the rest of the developing world behind them. I argue that developmental strategy and political institutions shape the preferences and influences of industrial, governmental, and social stakeholders, thereby explaining their negotiation behavior and outcome. This article explains why China moved faster and further than India on negotiations for hydrofluorocarbon regulation. It has important implications for the two rising powers’ implementation of the Kigali Amendment and for their position formulations on other environmental issues.

In October 2016, 197 countries passed the Kigali Amendment to the Montreal Protocol on Substances That Deplete the Ozone Layer. This amendment, which took eight years to negotiate, is among the first global environmental agreements to reduce greenhouse gas (GHG) emissions (in this case, hydrofluorocarbons, or HFCs). However, China and India—two of the biggest developing countries, which, combined, emit 40 percent of GHGs and 80 percent of HFCs—broke ranks, as China adopted an earlier phasedown schedule than India. Other developing countries took sides, with most countries following China’s schedule and nine following India’s, making the Kigali Amendment the first environmental agreement that differentiates obligations between self-selected groups of developing countries.

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Why did they part ways? Since the inception of the Montreal Protocol, China and India had always coordinated positions to bargain against industrialized countries—until 2016. How do we account for China's position changes, which seemed to raise its domestic compliance costs? What made India insist on a three-year delay, which would cost its HFC sector the first-mover advantage in the global market? Moreover, what does their divergence tell us about developing countries in global environmental negotiations? With their growing market and political clout, China's and India's positions assumed at Kigali could influence other countries' positions and negotiation outcomes at other multilateral environmental agreements (MEAs).

The Kigali Amendment offers a compelling opportunity to study how rising powers form positions on international environmental issues. Existing literature explains countries' environmental foreign policy from structural, institutional, ideational, and personal approaches, but limited research has studied developing countries and, even less so, their divergence. Despite holding different, sometimes opposite positions, developing countries had largely held together to not set up a precedent of differentiating treatments without sufficient justification. In this sense, the Kigali Amendment could undermine the unity of the Global South in MEAs. Still, no academic or policy research so far has attempted to explain why China and India chose to part ways then and there.

This article combines political economic and institutional perspectives to understand the domestic determinants of China's and India's positions on HFC regulation under the Montreal Protocol. Focusing on the interactions of national government, industry, and civil society, I argue that state position formulation is shaped by developmental strategy and political institutions. Developmental strategy influences the preference of industrial stakeholders, the main compliers of regulation. An export-led sector should be more open to international regulation than one focusing on the domestic market. Political institutions shape the roles of civil society and government. Democracy allows diverse stakeholders to assert influence over governmental positions, whereas in an authoritarian system, civil society's participation is more limited, while government has more discretion in assuming positions beyond domestic groups' preferred range.

The empirical analysis draws from fieldwork at the Montreal Protocol negotiations. I observed negotiation sessions, interviewed negotiation participants, and collected materials from other sources. These materials link stakeholder actions in domestic and international arenas to piece together how the two rising powers' developmental strategies drove their preferences apart and how political institutions kept their positions away. I find that China's HFC sector is export oriented and increasingly focused on the industrialized market, which incentivized China to adapt early, voluntarily, and on a larger scale, with governmental encouragement. China's political system centralizes knowledge generation in a homogeneous group of stakeholders, who, albeit holding similar positions, have limited influence over the government's position. India's HFC sector is domestically oriented, its industry less incentivized to adapt to

foreign markets. Its democratic system, however, engages stakeholders of diverse interests, who influenced the Indian government to take a middle ground acceptable to all.

This article contributes to the global environmental politics literature by identifying the domestic determinants of a developing country's environmental foreign policy. Based on one of the first "official" separations within the Global South, this article shows how developmental strategy and political institutions explain developing countries' position formulations on certain international environmental issues. Moreover, this article shows that rising powers are growing apart. With differing self-positioning in the world, as well as differing domestic economic and political structures, their discord is likely to continue, as we can observe at global climate negotiations.

Developmental Strategy and Political Institutions in Position Formulation

Since the dawn of global environmental cooperation, developing countries have moved from the periphery to the center of global environmental negotiations. The post-Cold War multilateralism, economic globalization, and growing experience in international negotiations have made them more willing to bargain, and capable of doing so, on international stages. While developing countries' commonalities in history, political, and economic capacity remain important in understanding their behavior at environmental negotiations (Guha and Martinez-Alier 1997; Johnson and Urpelainen 2020; Kasa et al. 2008), these commonalities are overshadowed by diverging interests and negotiation capabilities. The North-South dynamics are no longer sufficient to explain developing countries' behavior on environmental issues, some of which are seeing significant intra-South cleavages that rival North-South conflicts.

Scholars now recognize the heterogeneity within the Global South and the possibility for differentiated treatments (Allan and Dauvergne 2013; Hurrell and Sengupta 2012; Pauwelyn 2013). However, few have studied why developing countries are united on certain issues and divided on others. On individual countries' environmental foreign policy, existing literature takes structural, institutional, ideational, and personal accounts (Recchia 2002). The structural approach focuses on a country's natural vulnerability, abatement costs, military interests, and features of the MEAs (Grundig 2006; Sprinz and Vaahtoranta 1994). The institutional approach emphasizes domestic groups and interactions (DeSombre 2000; Hopgood 1998; Raustiala 1997). The ideational approach examines how ideas and science empower the epistemic community in environmental negotiations (Haas 1992; Parson 2003). Still, far more research has been done on industrialized than on developing countries, much less in a comparative sense.

In response to the increasingly sophisticated behavior of developing countries, recent studies have examined the internal dynamics of the Global South and individual countries' environmental foreign policy. Some focus on

coalitions within the Global South (Bhandary 2017; Watts and Depledge 2018), others on individual states, usually taking a geopolitical perspective (Eckersley 2020; Jayaram 2015). In the context of a power shift from Western to non-Western countries, a growing literature compares rising powers' environmental policies (Aamodt and Stensdal 2017; Harrison and Kostka 2014; Shi and van Rooij 2015; Wu 2018). By comparison, fewer studies compare their environmental foreign policies. Among the few, Stokes et al. (2016) analyze the discord between China and India at the Minamata Convention on Mercury from domestic resources, developmental constraints, and technological capacity. Even here, their contrasting negotiation behavior didn't result in differentiated treatments in the treaty. Until the Kigali Amendment, developing countries had been reluctant to differentiate obligations arbitrarily between themselves, except for special treatments based on country categories (e.g., least developed and small-island states).

Existing studies may suggest three potential explanations for China and India's divergence at Kigali, but none of these explanations alone can account for the contrasting behaviors of China and India. A structural argument may be that China's HFC sector is larger in size and more advanced in technology, hence more prepared for transition. However, China's HFC production is as reliant on Western technologies as India's, and both countries face high transition costs and technological uncertainty. If anything, China's greater emissions profile should entail higher abatement costs, hence less cooperation than India (Stokes et al. 2016). An intuitionist may argue that China's authoritarian system may have allowed the government to make aggressive commitments without domestic backlash. This might be true, but why haven't political systems worked earlier? Personal diplomacy plays a crucial role in international environmental negotiations (Benedick 1998), which means bilateral talks and persuasion of the United States and European Union (EU) may have helped in forging agreements with China and India. Still, why did China move faster and further than India? In this article, I argue that China and India's divergence is indeed related to political system and industrial profile, but through decision-making processes that have not been captured by existing studies.

This article analyzes state position formulation at MEAs from political economic and institutional perspectives. Developing countries exhibit diverse growth pathways and political institutions. Compared to industrialized countries, many developing countries view economic growth as the precondition for political and social development, which makes them willing to prioritize growth at any cost (Ohno 2013). Their integration into the global economy complicates certain environmental foreign policy making by differentiating interests of industries with various market orientations, technology endowments, and positions in the supply chains (Falkner 2008; Lake 2009). An export-oriented sector is open to the global market and vulnerable to policy changes in other countries. It can lower environmental standards to attract investments or adopt higher environmental standards to promote industrial

competitiveness (Vogel 1995). As many trade agreements now require tightening environmental standards in exchange for favorable trade treatments (Bechtel and Tosun 2009), exporters have incentives to adapt preemptively by increasing trade before agreements enter into force (Magee 2008) or investing in new products for the new market. Exporters can collaborate with foreign companies to access technology, which requires sticky capital investment and makes exporters more open to international regulation (Kelsey 2021). In addition, government is more likely to support its export sector in maintaining competitiveness (Evans 1995). A domestic-focused sector, on the contrary, is insulated from the international market. As long as domestic policy does not change, the sector is less concerned with international regulation or collaborating with foreign companies, particularly if doing so will cut their profit away. Correspondingly, the government may find no need to intervene.

Developing countries also feature diverse political institutions that are not seen in the Global North. Regarding political institutions and environmental quality, some argue that democracy improves environmental quality through participation and accountability (Policardo 2016). Others find that authoritarianism can be more effective in making unpopular environmental regulations (Beeson 2010; Gilley 2012). While it is uncertain whether democracy improves environmental quality in developing countries (Kim et al. 2018), state capacity and political institutions seem to matter (Harrison and Kostka 2014; Marcoux and Urpelainen 2012). I argue that political institutions shape a country's position formulation through the composition and influence of domestic stakeholders. These actors include companies, industrial associations (IAs), advocacy groups, and research institutions. While companies and governmental agencies are usually involved in decision-making, other stakeholders' participation varies considerably across political systems.

In a democratic developing country, diverse nonstate actors can participate in decision-making. These actors provide important alternative information and implementation resources to industry, which makes government value their positions as well as that of the industry. An authoritarian system is less participatory. Certain nonstate groups can be excluded even though they can provide valuable information for decision-making. These stakeholders have less control over government and are less likely to bargain with the state, whose capacity to intervene in the economy gives it more leeway at international negotiations. Even as domestic bargaining participants hold similar interests, the government's position is not necessarily bound by them.

Figure 1 illustrates how developing countries spread across the two-dimensional framework may formulate positions at multilateral environmental negotiations that require changes in the manufacturing industries. Democracies with export-oriented sectors can be "reformers," whose industries are receptive to international regulation and their governments less likely to stand in their way. Democracies with domestic-oriented industries, on the contrary, can be "reluctant compliers," who oppose regulation but are open to changes given

		Developmental Strategy	
		Domestic (market) oriented	Export oriented
Political Institutions	Democracy	"Reluctant compliers" (e.g. India)	"Reformers" (e.g. Malaysia, Mexico, Thailand)
	Authoritarianism	"Resisters" (e.g. Saudi Arabia)	"Unpredictable speedsters" (e.g. China)

Figure 1
 Illustrative Categorization of Developing Countries

proper stakeholder input and windows of opportunity. Authoritarian export-oriented countries, as "unpredictable speedsters," can take more progressive stands than domestic stakeholders. Authoritarian domestic-oriented countries are "resisters," because neither industry nor government is incentivized to accept international regulation.

Case Information and Data

The Vienna Convention for the Protection of the Ozone Layer was established in 1985 to protect the stratospheric ozone layer. The Montreal Protocol on Substances That Deplete the Ozone Layer (1987) implements the Vienna Convention by identifying and controlling ozone-depleting substances. It gives developing countries a ten-year grace period for compliance and the Multi-Lateral Fund (MLF) to finance their transitions. Under the Montreal Protocol and its amendments, chlorofluorocarbons (CFCs), the major ODS, were replaced by hydrochlorofluorocarbons (HCFCs) and then HFCs, which possess negligible ozone-depleting yet high global-warming potential (GWP). In this article, the ODS sector refers to the chemical industry that produces HFCs and the appliance industries that use HFCs in their products, even though HFCs are not ODS. In recent years, developing countries have become the largest producers, traders, and consumers of ODS products.

Two things make HFCs more difficult to regulate than their predecessors. First, the Montreal Protocol was created to regulate ODS, which HFCs are not. Moreover, the Clean Development Mechanism (CDM) of the UNFCCC already qualified HFC-23¹ incineration as carbon emission reductions (CERs). Second, unlike their predecessors, HFCs have no universal alternatives. Multiple alternatives are under various stages of development with trade-offs in safety,

1. HFC-23 is a by-product of HCFC manufacturing and has GWP of 14,800.

efficiency, and environmental impact. The drop-in alternatives, such as HFOs, require minimal appliance modification but are heavily patented. Natural alternatives, like water, carbon dioxide, ammonia, and propane, are inexpensive but require more appliance adjustment. In other words, HFC phasedown is not a simple bargain for financial support, on which China and India share interest. Decisions on HFC alternatives lay bare economic and political differences between the two countries.

Negotiations on HFC regulation initiated when Micronesia submitted a proposal in 2009. From 2009 to 2013, major developing countries opposed the proposal, arguing that the Montreal Protocol had no jurisdiction over GHGs. Starting June 2013, the United States launched separate bilateral talks with China and India, but only China accepted HFC regulation under the Montreal Protocol, while India did not come on board until Narendra Modi assumed power in 2014 (White House 2013, 2014). Figure 2 marks the major position changes of China and India during the negotiation.

I base the empirical analysis on fieldwork at Montreal Protocol negotiations at the Open-End Working Group (OEWG) and Meeting of Parties (MOP) from 2017 to 2019. Fieldwork data include negotiation observations, interviews, distributed materials, and other data acquired from negotiations and fieldtrips to China. At each negotiation, I observed the weeklong plenary negotiations, contact groups, side events, and receptions, where I interviewed national delegations; technical experts and scientists; intergovernmental and developmental organizations (Die Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), United Nations Industrial Development Organization,

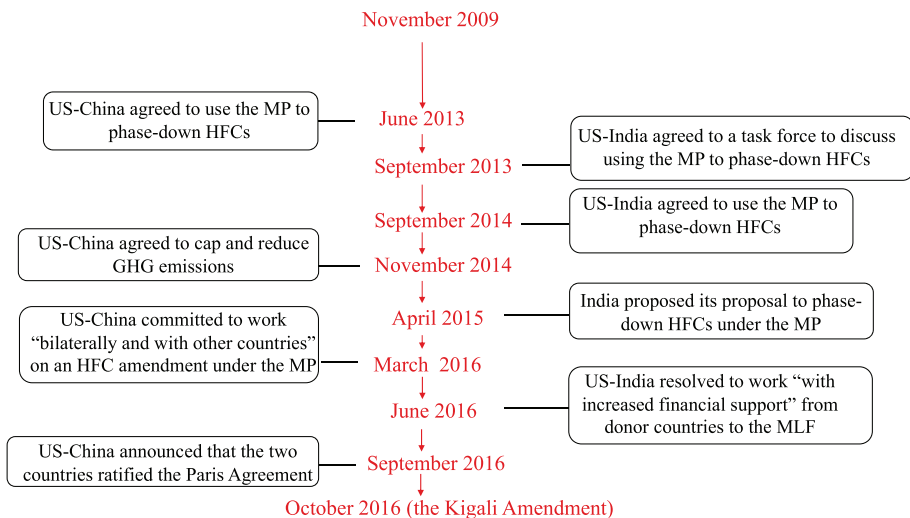


Figure 2

Major Position Shifts of China and India on HFC Phasedown (2009–2016)

the United Nations Development Programme, and the United Nations Environment Programme); Montreal Protocol agencies (MLF and Technology and Economic Assessment Panel); nongovernmental organizations (NGOs) and think tanks; and companies and industrial associations of the ODS sector from China, India, the United States, and the EU, most of which participated for the entire period of HFC negotiations. To gauge domestic stakeholders' influence on governmental positions, I compared delegations' positions with domestic stakeholder preferences in terms of base/freeze years and phasedown schedules. The closer the governmental position was to the preferences of domestic stakeholders, the greater influence these stakeholders had over the governmental position.

Explaining the Kigali Amendment

This section analyzes each dimension separately. For the developmental strategy, I look at the developmental strategy of the ODS sector before examining the industrial response to potential HFC regulation. For the political institutions, I survey the political system and stakeholders involved and then compare their positions.

Developmental Strategy and Industrial Response

On HFC regulation, industrial stakeholders' preferences evolved with ODS market trends and HFC negotiation. China's export-led growth brings about a globally integrated ODS sector with governmental backing. This led to voluntary industrial response with extensive governmental support to navigate the transition from HFCs. India does not prioritize the manufacturing sector. Its ODS sector faced a largely untapped domestic market and a less-interventionist government, which gave it little incentive to accept HFC regulation.

China adopts an export-led industrialization with the secondary sector contributing 40.5 percent of national GDP. Like other East and Southeast Asian countries, China welcomes foreign direct investments and prioritizes manufacturing and export. Each industry is organized by an industrial association that communicates between industry and government. Both ODS production and appliance industries in China are export oriented. China has the largest fluorite reserve in the world, which gives it the advantage in producing ODS. The market is dominated by low value-added products and price competition. The ODS appliance industries use ODS as refrigerants and blowing agents. China is also the world's largest residential air-conditioner and refrigerator exporter. Its cooling appliance manufacturers export both under their brands and for foreign brands under OEM.

Voluntary adaptation from industry started immediately after the first HFC proposal in 2009. Relying on export, but with limited technology independence, the ODS production industry was vulnerable to changes in the export

market. The Global Financial Crisis reduced international demand, and domestic price competition led to a continued slump. Meanwhile, industrialized countries began to turn away from HFCs. The US manufacturers developed HFOs. In 2010, the EU proposed full use restrictions by May 2013 on HFC-23 CERs, which would cut a large chunk of profit of Chinese ODS manufacturers. In 2011, the EU banned the use of HFC-134a in new models of mobile air-conditioning systems. The industry-wide predicament forced Chinese ODS manufacturers to diversify. They may have opposed imminent HFC regulation in China because they had just invested to convert production lines to HFCs. However, they were willing to collaborate with foreign companies, who had patents and distribution channels, to produce profitable low-GWP alternatives. In 2010, Changshu 3F Zhonghao announced a 3,000-ton production line of HFO-1234yf, a low-GWP alternative to HFC-134a, for Dupont. In 2012, Juhua announced its collaboration with Honeywell to produce HFC-152a, a low-GWP alternative to HCFC-22. In October 2012, Sinochem Lantian and Honeywell started a joint venture to produce HFC-245fa to replace HCFC-141b as a foaming agent. The new company would also produce Solstice, a low-GWP foaming agent. In December 2012, Arkema acquired 5 percent share of Changshu 3F. Most major ODS manufacturers in China initiated collaboration with foreign companies before the United States–China bilateral talk in 2013, and three joint ventures started production before the Kigali Amendment.

The Chinese government facilitated the transition shortly after the 2013 United States–China joint statement. Chinese ODS manufacturers lost the financial incentive to incinerate HFC-23 after the EU terminated HFC-23 CER. To compensate for the revenue loss and motivate HFC-23 incineration, the National Development and Reform Council (NDRC) approved regressive subsidies for HFC-23 incineration for HCFC-22 projects that had no CDM funding. To encourage ODS manufacturers to leapfrog to low-GWP alternatives, the Ministry of Environmental Protection created a task force in 2013, with experts from universities and IAs, to draft the *HCFC Alternative Technology Guidebook*. It outlined three principles for selecting the “List of Recommended HCFC Alternatives,” one of which says that “alternatives should not have high-GWP.” The first draft of the list contained twelve alternatives, and all except one were natural alternatives (MEP 2015). A second draft added two HFO alternatives as foaming agents but still left the main HFO alternative for vehicle air conditioners, HFO-1234yf out of the list.

The ODS appliance industries also opposed HFC regulation before 2013, but their voluntary adaptation was even more thorough. The largest ODS appliance industry is refrigeration and air conditioning (RAC). China is the world’s largest RAC exporter (33.5% for air conditioners and 22.8% for refrigerators). Major companies, such as GREE, Midea, and Haier, are all domestic owned. As the RAC ownership plateaued in urban areas by 2008 and in rural areas by 2012, the RAC industry reoriented toward the foreign market, especially the industrialized countries.

Exposure to the global market incentivized the RAC industry to move away from high-GWP HFCs. Seeing the domestic sale stagnation and long-term trend in low-GWP cooling, the Chinese RAC industry began to adapt before the governmental commitment. Less disadvantaged than the ODS production sector in the global market, the RAC industry was more motivated to develop its own HFC alternatives than to collaborate with foreign companies. With governmental encouragement, the industry began “leapfrogging” by converting production lines that use HCFCs directly to those that use low-GWP refrigerants, mostly R-290. During the first HPMP (2011–2015), Chinese RAC manufacturers secured US\$ 36 million from the MLF in 2011, US\$ 9 million in 2012, and US\$ 8.5 million in 2013, most of which was used to covert production lines from HCFCs to R-290. In December 2012, the MEP contracted four appliance manufacturers to phase out 3,300 metric tons of HCFCs for US\$ 18 million. In early 2013, the MEP contracted another four appliance companies to phase out 2,858 metric tons of HCFCs, 59 percent of which would be replaced by HFC-32, a medium-GWP refrigerant. By 2015, China’s manufacturing capacity for R-290 air conditioners reached 4 million to 5 million units.

Unlike China’s, India’s economy is not built on export of manufactured goods. By 2016, India’s manufacturing sector contributed merely 23 percent of national GDP. India’s growth strategy creates a smaller and domestically oriented ODS sector, featuring an ODS production industry dominated by domestic companies and appliance industries, with a strong existence of foreign companies. Companies organize industrial associations to lobby policy makers.

India’s ODS sector also adjusted before the Indian delegation changed position in 2014. However, these adjustments were less coordinated, smaller in scale, and with less governmental intervention. India’s ODS production industry is dominated by five companies: SRF, Navin Fluorine, Gujarat Fluorochemical, Hindustan Fluorocarbons, and Chemplast Sanmar. Only three of them produce ODS, as some widely used ODS are primarily imported from China. India’s ODS manufacturers maintained decent profit margins by limiting competition (Council on Energy, Environment, and Water et al. 2016). Projecting a 10%–12% domestic market growth, SRF, India’s largest HFC producer, scaled up its HFC capacity threefold in 2014. Facing little external pressure, ODS manufacturers took a firm position against HFC regulation and did not adapt until the Indian government changed stance after the second United States–India talk in 2014. Only in March 2016, Navin signed an agreement with Honeywell to produce HFO-1234yf. A month later, SRF announced its plan to pilot HFO-1234yf production with its own technology.

Similar to China’s, India’s ODS appliance industries, especially the RAC industry, opposed HFC regulation for difficulty in finding low-GWP alternatives. Consider, for example, the room air conditioner industry: foreign companies from Japan and South Korea, such as Daikin, Hitachi, LG, and Samsung, compose more than half of the market. These companies responded differently based on their market projections. Some invested in efficiency improvement of

existing high-GWP refrigerants, while others sought medium- or low-GWP alternatives. In as early as 2002, Godrej and Boyce introduced hydrocarbon to replace CFCs. With support from the GIZ under a Germany–India agreement, Godrej and Boyce started a new production line of room air conditioners using R-290 with the highest five-star energy-efficiency ratings (Ghosh 2019; Natural Resources Defense Council [NRDC] et al. 2013). Daikin, one of Japan’s largest fluorocarbon and air conditioning manufacturers, developed the medium-GWP HFC-32 air conditioners in 2010. To promote this technology, Daikin offered free access to its pledged patents, making HFC-32 an affordable alternative to HFC-410a in developing countries. In February 2013, Daikin India announced that its HFC-32 products would be available in India. Panasonic also planned to offer split air conditioners using HFC-32 (NRDC et al. 2013).

The Indian government offered neither financial support for HFC-23 incineration nor policy guidance for HFC transition. It supported industry mainly by facilitating information exchange. Responding to industrial demand, the Ministry of Environment, Forest and Climate Change (MoEFCC) held an Indo-US Workshop on HFCs in February 2011, attended by more than 100 participants from India, the United States, and Europe. Indian IAs stressed that the RAC sector was price sensitive, that HFCs were the only feasible alternatives to HCFCs, and that the industry “cannot afford frequent changeovers as it involves huge capital investment” (RAMA 2011). Participants agreed to launch a Joint Indo-US Technical Task Force to produce a report covering all sectors by August 2011. Similar stakeholder workshops took place in April 2012 and February 2013, in which industrialized countries and think tanks presented technological solutions and exchanged concerns with the Indian ODS sector. The Indian government’s noninterventionist approach continued after 2014. Despite Godrej’s success in producing and selling R-290 units, the Indian government made no policy to promote low-GWP refrigerants. As stated in its HFC proposal, “why cannot alternative chemicals and technologies come in market and compete?” (Ministry of Environment, Forest and Climate Change 2015). Days before the Kigali Amendment was adopted, the Indian government demanded that ODS manufacturers incinerate HFC-23 at their own cost.

Political Institutions and Governmental Position Formulation

Developmental strategy may affect the preference of the industry as the main stakeholders, but the governmental position at international negotiations is also influenced by other stakeholders of various interests and influence. China’s authoritarian system involves public stakeholders in addition to the industry. These stakeholders, once contributing their knowledge, have limited control over the details of HFC regulation. India’s democratic system allows for diverse stakeholders, who advocate for their interests and influence the Indian delegation at Kigali.

China has an authoritarian system with limited division of power. Under the single party’s rule, the national government is free from electoral uncertainty,

judicial review, and budget constraints, leading to greater policy continuity and discretion. China's ODS policy is drafted by the MEP and approved by the State Council. The MEP implements decisions made at the Montreal Protocol and heads the Ozone Protection High-Level Inter-Agency Task Force, consisting of seventeen national agencies.

Four groups are involved in ODS policy making. The first are companies in the ODS sector. Although their inputs are essential, these companies are not directly involved in policy making. Their voices are channeled through a second group, quasi-public industrial associations, which connect industry with government. These IAs, once governmental organizations, are now "social organizations" and fund themselves by offering consulting, publishing, training, and event-organizing services. However, they locate in the same buildings as governmental agencies and engage routinely in governmental policy making. Public research institutions provide research necessary for decision-making. Some universities have long-term R&D partnerships with industrial companies. National labs, the National Science Academy, the Academy of Meteorological Sciences, the Foreign Economic Cooperation Office (MEP), and other governmental organizations also supply information through grant-funded or industry-contracted research. Most IAs, research institutions, and governmental agencies are obligated to assist with policy making. No environmental NGOs are directly involved in ODS policy making.

Nonstate stakeholders restrict participation to domestic consultation. Consultation meetings are organized regularly by the MEP and attended by IAs, scholars, and governmental agencies. These meetings review policy implementation and discuss potential regulations. Governmental ministries and external donors can appropriate grants to research organizations and IAs to conduct research informing ODS policy making. Companies communicate primarily with IAs, though they occasionally meet with governmental agencies or attend international workshops. Only the largest IAs and experts regularly attend Montreal Protocol negotiations, mostly in observational and consulting capacities. Out of 155 side events and publications registered at the Montreal Protocol website (2014–2016), only four concerned China or were held by Chinese organizations, and all of them focused on R-290, China's preferred alternative to HFC-410a (see the later discussion).

China's position change in 2013 was not fully anticipated by domestic stakeholders. HFC regulation became a priority item in Obama's climate diplomacy in his second term. In 2013, the United States initiated bilateral talks with China and India. China agreed to phase down HFCs "through multilateral approaches that include using the expertise and institutions of the Montreal Protocol" (White House 2013). This came as a surprise to domestic stakeholders. Notwithstanding industrial adaptation, China's ODS sector had no consensus on when and how HFC should be regulated, nor were industrial and epistemic communities notified that the government was ready to negotiate HFC regulation. A Chinese scientist deeply involved in the Montreal Protocol

and Chinese ODS policy commented, “We knew it was coming, but we did not know it came so soon and in such radical form” (interview 201801). That said, stakeholders did sense the forthcoming regulation on HFCs. In 2011, China released its first *Five-Year Plan for Controlling for GHG Emissions*, which outlined a major objective to reduce non-CO₂ GHG emissions, including HCFCs and HFCs. This plan empowered the NDRC to control industrial GHG emissions. In early 2013, the NDRC suggested that China’s GHG emissions may peak by 2025, and it planned to introduce a cap mechanism starting the thirteenth Five-Year Period. Months before the United States–China talk, the NDRC began sending strong signals to ODS manufacturers that tighter HFC restrictions were in the pipeline and that continued refusal to discuss HFC phasedown would not be tolerated. China’s ODS sector did not want to phase down HFCs yet, but “China is a responsible world power, economics sometimes has to submit to politics” (interview 201803).

The Chinese delegation surprised domestic stakeholders again during the negotiation for the phasedown schedule. It stated that China did not fixate on any schedules and was open on how to address HFCs. Domestic stakeholders produced five industry-specific reports in addition to academic and technical studies on HFC regulation. I analyze these industry reports on the overall HFC sector as well as specific industries involved in HFC production and residential, automobile, commercial, and industrial air-conditioning/cooling. Except for the overall HFC report, the other four were published after 2013. These reports largely represent the nonstate groups’ preference on HFC regulation.

As Table 1 shows, these reports are not easily comparable but still reveal important information about the dynamics between state and nonstate stakeholders. First, these reports used different scenarios, and three out of five reports did not consider the three phasedown schedule proposals widely discussed at the Montreal Protocol. Second, no IA reports estimated abatement costs or economic benefits of HFC regulation. Instead, they estimated the “environmental benefits” through potential GHG emission reductions. This contrasts with Indian stakeholders, who emphasized high transition costs to avoid costly regulation. Chinese IA reports analyzed compliance challenges without any cost estimation, opposition to specific regulations, or requests for governmental support. The ODS sector knew that cost estimates would not sway governmental decisions. The use of GHG emissions as the main indicator across regulation scenarios implies that China’s ultimate concern with regard to HFC control was climate mitigation. All IA reports assumed that China caps GHG emissions by 2030.

These stakeholder inputs had limited influence over the final governmental position. The HFC production industry preferred the Indian proposal’s freeze year and the North American proposal’s phasedown schedule (ZRICI 2016). The residential RAC industry report discussed three scenarios, the most practical of which peaks in 2027 (CHEARI 2015). The industrial/commercial cooling

Table 1
Chinese Nonstate Stakeholder Input on HFC Phasedown (2013–2016)

<i>Research Organization and Date</i>	<i>Project Name</i>	<i>Industry</i>	<i>Chemicals</i>	<i>Method</i>	<i>Main Findings</i>
Peking University (Jan. 2013)	Controlling HFCs Impact Assessment—Opportunities and Challenges	automobile and residential air conditioning, HFC-23, and PU foam	HFC-134a, HFC-410a, HFC-245fa, HFC-23	cost–benefit analysis, BAU plus two to eight mitigation scenarios	HC-290 is preferred to replace HFC-410a, and HC should be used to avoid phasein of HFC-245fa. Mitigation scenarios of automobile and HFC-23 scenarios have trade-offs.
CAS (Sep. 2013)	An Investigation of Non-CO ₂ GHG from the Motor Vehicles in China and Its Control Potential Analysis	automobile air conditioning	HFC-134a	emission modeling of N ₂ O, CH ₄ , and HFC-134a of BAU and five mitigation scenarios	The refrigerant-changing scenario has greatest emission reduction potential, followed by the emission standard tightening scenario and refrigerant-recycling scenario.
CRAA (Dec. 2014)	Report on Chinese Industrial and Commercial Cooling Industry’s Use of HFCs	industrial and commercial refrigeration and air conditioning	HFC-134a, HFC-410a	emission potential of low/high-growth models, each with BAU and four mitigation scenarios	In both growth models, scenario C presents the largest reduction potential given current technology, but it will be very costly in the high-growth model.

Table 1
(Continued)

<i>Research Organization and Date</i>	<i>Project Name</i>	<i>Industry</i>	<i>Chemicals</i>	<i>Method</i>	<i>Main Findings</i>
CHEARI (Mar. 2015)	China Residential Refrigerator and Air-Conditioners Life-Cycle Non-CO ₂ GHG Emission Reduction Potential Research	residential refrigeration and air conditioning	HFC-410a, HFC-32	emission potential and measures of the most feasible and the ideal scenarios against BAU	This report quantifies the emission reduction potential by life cycle segments of residential refrigerator and air conditioners, as well as the measures required to reach emission reduction goals.
ZRICI (Jun. 2016)	China Fluorochemical Industry Mitigation Research	HFC production	all major HFCs	analysis of HFC alternatives by country and comparison of North American, EU, and Indian proposals	China should take the baseline year of the Indian proposal and the phasdown schedule of the North American proposal.

industry report used four mitigation scenarios with different adopted rates of medium- and low-GWP alternatives, with scenario C (peak before 2024 and with 10% reductions by 2029) representing China's maximum reduction capacity (CRAA 2014). In other words, three industries that combined produce 71 percent (volume) and 84 percent (USD) HFCs preferred to freeze HFC production during 2027–2029 or at least after 2024. However, at Kigali, China agreed to use 2020–2022 as the baseline, freeze by 2024, and reduce 10 percent by 2029. This position was more progressive than the ODS sector preferred.

India is a parliamentary democracy. Two contending political parties, the Indian National Congress (INC) and the Bharatiya Janata Party (BJP), have taken turns in ruling. The eight-year HFC negotiation was divided into the administrations of Manmohan Singh from the INC (2009–2014) and Narendra Modi from the BJP (2014–2016). The Ozone Cell under the MoEFCC makes and implements ODS regulation. India's democratic system invites diverse stakeholders from public, private, and social sectors for ODS policy making. Indian IAs are headed by the largest companies and represent their members' interests. Balancing industry interests are the civil society groups that favor HFC regulation. These NGOs draw power from expertise rather than the ability to mobilize citizens. They incorporate works from academic, industrial, governmental, and international organizations.

Indian stakeholders participated actively in domestic and international forums. The Ozone Cell holds at least two meetings annually, including stakeholder consultations, workshops, program launches, and roundtables. Participants include the MoEFCC and other governmental agencies, companies, IAs, developmental and UN agencies, and NGOs. At these meetings, stakeholders present on technology and market analyses with policy suggestions. Indian companies, IAs, and NGOs attended MOPs and OEWDs regularly, held side events, and distributed publications. Some NGOs, such as the Centre for Science and Environment (CSE), were awarded the Partnership Award by the Montreal Protocol Secretariat.

Indian stakeholders have strong influence over the delegation. Three months after the United States–China bilateral talk, the United States–India bilateral talks took place, but India agreed only to consider (rather than to accept) HFC regulation under the Montreal Protocol. The joint statement did not stop the Indian delegation from opposing the HFC agenda item at the MOP-25. It contended that “while the United States and India had agreed to establish a task force on HFCs, it would be premature to discuss any action until the task force had been formed and completed its work” (United Nations Environment Programme 2013). India's stalling can be explained from domestic politics. In a democracy with a strong bureaucratic class, the prime minister cannot make deals without a cabinet majority, and the MoEFCC cannot enforce regulation against strong industrial opposition. Toward the end of Manmohan Singh's term, his administration was bogged down in corruption scandals and unable to make substantive policy (interview 201802). The joint statement was

symbolic, as ministries, especially the MoEFCC, wanted to keep a hard line and did not support Singh's decision (Ghosh 2019).

China's position shift was a wake-up call for India. Since 2009, China and India had always coordinated stances. Roughly half of India's interventions were supported by China, but this number dropped to zero at the MOP-25. Although feeling "betrayed," India tried to make sense of China's actions (interview 201902). After all, China produced two-thirds of the world's HFCs. "Reluctance from India risks leaving India on the sidelines as China and the U.S. develop their special relationship" (Shende 2013). What really changed the minds of Indian stakeholders was less international pressure than the suspicion that they would be left behind in terms of market, technology, and financial assistance (interviews 201801 and 201901).

Still, no real change took place until Modi became prime minister in May 2014. Promising to bring India jobs and growth, Modi centralized governmental power and encouraged integration into the global supply chain. Soon, the US Department of Energy reached out to India with an agenda that included cooling as one of the issue areas and hinted that the United States expected to forge synergies on country-level actions between climate change and ozone protection (interview 201902). The issue was incorporated into the fifth United States–India Strategic Dialogue in July 2014, and the United States linked potential investment in the power sector to an agreement on climate change during the negotiation with the Indian Ministry of Power. Secretary of state John Kerry co-chaired the negotiations and met with Modi afterward. Kerry's visit to India was the first cabinet-level exchange between the Obama and Modi administrations, and it aimed to pave the way for Modi's upcoming visit to the United States (PTI 2016). India finally agreed to regulate HFCs under the Montreal Protocol in September 2014 (White House 2014).

India's acceptance of HFC regulation may have been affected by China, but its position on how and when this regulation would happen was based on domestic consultation (Ghosh 2019). The Indian government needed information to determine its bargaining strategy. Independent research organizations, such as the Council on Energy, Environment, and Water (CEEW); CSE; the Institute for Governance and Sustainable Development (IGSD); and the Natural Resources Defense Council (NRDC), provided indispensable analyses that industry did not offer. Their research surveyed different industries and modeled emission scenarios. They highlighted several key concerns for India, including carbon accounting and research of technical, technological, economic, and climate impacts of HFC phasedown (Ghosh 2013).

Domestic stakeholders' positions were incorporated into India's proposal made in April 2015. This proposal assumed high growth in economy, urbanization, and ODS-appliance penetration rates in India. India proposed a late baseline year (2028–2030), freeze year (2031), and completion by 2050. It further requested non–Article 5 countries to fund the "full-conversion cost"

(as opposed to the incremental transition cost) of HFC phasedown. India's proposal, as an opening bargaining gambit, reflected the civil society's position to phase down high-GWP HFC and the industry preference to delay the changeover. Domestic groups received the Indian proposal with different attitudes. Among the ODS sector, the transition was easiest for the foam and hardest for the RAC industry, hence the former pushed for demonstration projects and policy guidance, while the latter insisted on late phasedown and finance. Among the research groups, CEEW and The Energy and Resource Institute (TERI) supported the Indian proposal, but CSE preferred faster phasedown and natural refrigerants (Table 2).

In the eighteen months that followed, domestic stakeholders scaled up activities at all levels. Domestically, two more stakeholder consultation meetings took place before the MOP-28. Major stakeholders met with the MoEFCC to discuss India's bargaining strategies. Industrial stakeholders requested the government to "stick to the proposal of full cost of conversion and the timelines as solutions are not available across for most of the products" (RAMA 2015). On the international stage, research groups were more active. As Table 3 shows, Indian stakeholders had four times as many side events and side-event publications as Chinese stakeholders. Unlike the ODS sector, which highlighted the uncertainty and high cost of HFC phasedown, the research groups persuaded policy makers that HFC phasedown was cost-beneficial for India in the long run. CSE justified its expeditious phasedown schedule with proposals for energy efficiency and leapfrogging to natural refrigerants. NRDC and IGSD illustrated that the market was ready for transition even without significant governmental finance. CEEW, in its last report before the Kigali Amendment, pointed out that HFO-1234yf's cost in the long run would be only three times as much as HFC-134a, as opposed to seven to eight times as claimed by IAs. It also suggested that India claim leadership by the "willingness to bear cost of transition," and if India were to accept an earlier freeze year, it should highlight its "higher contribution across forums, especially (at the) UNFCCC" (Sharma and Chaturvedi 2016).

These research groups' activities outside negotiation rooms aimed to convince the Indian delegation of the promise of HFC regulation and to show other parties the challenges India faced in HFC transition. Immediately prior to the Indian proposal, the NRDC held a side event on HFC phaseout in India, and the IGSD and TERRE Policy Center held a joint side event for HFC phasedown. These groups' lobbying continued until the last moments of negotiation. Eventually, India adopted 2024–2026 as baseline, 2028 as freeze year, and phasedown by 2047. This was middle ground between industry and NGO preferences. It is a big leap forward from India's original proposal, while it held the bottom line of the ODS sector—patents of HFO-1234yf would expire as early as 2025–2029, right before the freeze year. The differentiated obligations of India and China and energy efficiency provisions were also incorporated into the text of the agreement.

Table 2
Major Indian Nonstate Stakeholder Input on HFC Phasedown (2013–2016)

<i>Research Organization and Date</i>	<i>Industry</i>	<i>Publication/Presentation Name</i>	<i>Method</i>	<i>Main Findings/Arguments</i>
CEEW (Jul. 2014)	residential air conditioning	Modeling Long-Term HFC Emissions from India's Residential Air-Conditioning Sector	six different growth and technology scenarios and their emissions	India should transition away from high-GWP refrigerants, because it reduces GHG emission and offers significant energy efficiency benefits.
CSE (Jul. 2015)	whole sector	Judging the Amendment Proposals on Equity and Ambition	analyze North American, island, EU, and Indian proposals based on equity and ambition principles	The Indian proposal needs significant revision to make baseline and phasedown schedules more ambitious. India should push for energy efficiency provision, financial and technology support for HFC phasedown, and HFC destruction.
CEEW (Jul. 2015)	whole sector	India's Amendment Proposal and Long-Term HFC Emissions	estimates the Indian proposal's emission reduction	It supports the Indian proposal, saying it will be successful in deep HFC emission cuts for India, Pakistan, African nations, and so on, but will have limited impact on those of China and other high-income A5 countries. India should not be treated in the same way as China.

RAMA (Jul. 2015)	refrigeration and air conditioning	Full Cost of Conversion	n/a	India should stick to the proposal of full cost of conversion and timelines.
IPIUA (Jul. 2015)	foam	Industry Perspective on Foam Manufacturing Sector Including Micro, Small and Medium Enterprises	n/a	The foam industry can transition to zero/low-GWP alternatives, but it needs demonstration projects as well as incentives and policy guidance.
RAMA (Aug. 2015)	refrigeration and air conditioning	Technology Trends Including Availability and Costs in RAC Sector	market analysis	India should delay the changeover as much as possible. Estimation of cost impact is not possible at this stage.
TERI (Jun. 2016)	whole sector	India's Amendment Proposal for Phase-Down of HFCs: TERI's Views	n/a	It supports the Indian proposal's freeze year of 2031.

Table 3

Side Events and Publications Concerning China and India at Montreal Protocol Negotiations (2014–2016)

<i>Year</i>	<i>Event</i>	<i>Organization</i>	<i>Country</i>	<i>Side Event or Publication</i>	<i>Title</i>
2014	OEWG-34	CEEW	India	publication	Modelling Long Term HFC Emissions from India's Residential Air-Conditioning Sector
2015	OEWG-35	IGSD, TERRE	India	side event	The Importance of Energy Efficiency in HCFC Phaseout and HFC Phasedown (1300–1500)
2015	OEWG-35	NRDC	India	side event	Business Case for Phasing out HFCs in India (1300–1500)
2015	OEWG-35	IGSD, TERRE	India	side event	Workshop for an HFC Phase Down Amendment (18:00–20:00)
2015	OEWG-36	CSE	India	publication	An equity-Based Framework for an Ambitious phase-down of HFCs Under the Montreal Protocol
2015	OEWG-36	CSE	India	publication	Getting the World off the Chemical Treadmill—A Per Capita Convergence Framework for an Ambitious Phase-Down of HFCs Under the Montreal Protocol
2015	OEWG-36	CSE	India	side event	Judging the HFC Amendment Proposals on the Basis of Fairness and Ambition

2015	OEWG-36	CHEAA	China	side event	China's Endeavour to Use Low-GWP Alternative in Residential Air-Conditioner
2015	OEWG-36	IGSD, TERRE, LBNL	India	side event	The Double Climate Benefits of Energy Efficiency and Low GWP Refrigerants in Air Conditioning
2015	OEWG-36	CHEAA	China	side event	Safety Issue on Using HC-290 Technology in Residential Air-Conditioner and Related Safety Standards
2015	MOP-27	UNDP	India	side event	Indian Experience in Adoption of Low-GWP Technologies in Residential Air-Conditioning Applications
2015	MOP-27	TERRE, ISHRAE, IIAR, Climate Control Middle East Magazine	India	side event	Non-HFC Cold Chain: Food and Energy Security
2015	MOP-27	IGSD	India	publication	Reducing Stress on India's Power Grid
2016	OEWG-38	CSE	India	publication	What Kind of Amendment? Ideas for Framework to Phase Down HFC in an Ambitious and Equitable Manner (CSE)
2016	OEWG-38	CSE	India	side event	Prioritizing Natural Refrigerants During HFC Phase-Down Amendment
2016	OEWG-38	CEEW, IIASA	India	side event	Economy-Wide Cost of Transition for the HFC Phase Down in India

Table 3
(Continued)

<i>Year</i>	<i>Event</i>	<i>Organization</i>	<i>Country</i>	<i>Side Event or Publication</i>	<i>Title</i>
2016	MOP-28	CEEW	India	side event	Implications of Different Baselines and Freeze Years for an Operational Strategy and Sector Wise HFC Phase Down in India
2016	MOP-28	GIZ Proklima	China	publication	Promoting R290 AC in China and Beyond
2016	MOP-28	MEP/FECO	China	publication	Low-GWP Technologies Introduction and Standards Barriers in R&AC Sectors of China
2016	MOP-28	IGSD	India	publication	New Indian Leadership for Super-Efficient Room Air Conditioning Using Lower GWP Refrigerants

Conclusions

The divergence of China and India at Kigali is among the most significant developments in recent global environmental negotiations. This article explains this divergence from national developmental strategy and political institutions, which shape industrial preference and governmental weighing of stakeholder inputs. China's export-oriented ODS sector was receptive to international regulation, and its political system grants Chinese government the power to assume even more aggressive positions at international negotiations. India's domestically focused ODS sector was resistant to international regulation, but the democratic system of India allowed stakeholders of diverse interests to influence the governmental position, which ultimately fell within the domestic bargaining range. China and India exhibit two distinct types of position formulation here, which characterize their negotiation and implementation of the Kigali Amendment. Chinese government guided the leapfrogging to R-290, and the ODS sector has made tremendous investment converting production lines, modifying standards, and promoting to seize the market before making a profit. This strategy is costly, yet potentially rewarding. India lets the market decide the best technology, offering institutional support to lower transition costs by facilitating bulk procurement and buyers' clubs. This liberal approach is cost-efficient, at least in the short term, as it intends to wait and see how China's chosen technology goes.

China and India's divergence sheds light on the common and differentiated interests between developing countries. The Global South's level of unity differs across environmental issues. When liability and vulnerability fall on different countries, as in the case of climate change, internal cleavages widen as the largest GHG emitters face significant trade-offs between domestic interests and those of vulnerable developing states. This is less an issue for ozone depletion. With the MLF, negotiations for CFC and HCFC phaseout went smoothly. The GWP of HFCs increased internal conflicts within the Global South between small island and gulf states, which is why HFC regulation took longer to negotiate than CFC and HCFC regulation. However, China and India remain the main producers of ODS products as well as beneficiaries of MLF funding.

The fact that China and India are free to break paths does not mean that they would at Kigali. This article suggests two factors that made their divergence more likely. First, the ODS sector in China became more integrated into the global supply chain, especially into the industrialized market, between 2009 and 2016. Market shifts drove the positions of Chinese companies closer to HFC regulation. The attributes of HFCs also matter. If transition from HFCs did not involve tremendous uncertainty regarding GWP, safety, and cost, the interests of China and India would have been more aligned and their divergence would have been less likely. Out of technology and climate concerns, the Chinese government steered its industry toward natural refrigerants, whereas the Indian government let the ODS sector decide and finance the transition. If

the two countries had had similar sectoral orientations, their ODS sectors might have held similar views, and it would have been costlier for their governments to break paths. If China had a more democratic system, its position might be more predictable, although not necessarily as progressive.

This article also suggests that the split between China and India is deeply rooted and likely to last. Their divergence at Kigali was no accident and not necessarily undesirable for them. Although Groups 1 and 2 of Article 5 countries did not appear until the last hours of the negotiation, the “differentiated treatments between developing countries” had long been proposed by Indian stakeholders, as they argued that China was too developed to qualify for the preferential treatments at the Montreal Protocol and the UNFCCC. In this sense, the Kigali Amendment marks rising powers reconsidering their interests and responsibilities in global environmental agreements. As their positions increasingly reflect domestic and national interests, China and India are likely to differ on other environmental issues. This might bring about a “new normal” to multilateral environmental negotiations, in which differentiated treatments between developing countries become more common.

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