POLICY FORUM

CLIMATE POLICY

The case for a supply-side climate treaty

The Paris Agreement can be strengthened by a treaty limiting global fossil fuel supply

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During decades of international climate policy negotiations, aiming to limit demand for fossil fuels, the stock of carbon dioxide in the atmosphere has increased considerably, and even the flow of emissions to the atmosphere continues to grow (*1*). To reach the Paris Agreement's goal of keeping global warming well below 2°C, substantial parts of the world's fossil fuels simply cannot be combusted and must be left in the ground (*1*, *2*). Recent work thus suggests redirecting climate policies toward fossil fuel producers directly (*3*–*5*) by capping the flows of extraction and restricting the stocks of resources available for exploration. We synthesize key economic mechanisms that support this approach, arguing that an international treaty among fossil fuel–producing countries could (i) enhance the impact of the Paris Agreement in the presence of free riders; (ii) stimulate investment in low-carbon technology research and development (R&D); (iii) provide insurance against a failed Paris Agreement; and (iv) make carbon policies more acceptable to fossil fuel producers, thus increasing their support. None of these effects depend on universal producer participation. Moreover, such a treaty need not be costly and could in fact help reduce the costs of the required transition to a low-carbon economy.

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To restrict carbon emissions caused by fossil fuel combustion, one must regulate fossil fuel demand or supply, or both. Supply-side policies regulate exploration and extraction of fossil fuels, whereas demand-side policies regulate the combustion of fossil fuels. In the Paris Agreement—a demand-side treaty—each country regulates combustion of fossil fuels by restricting emissions within its own borders. If all fossil fuel production (carbon extracted) or consumption (carbon combusted) were covered, regulating either supply or demand could suffice (*6*).

Thus, if the Paris Agreement had universal participation, all parties' nationally determined contributions (NDCs) to reduce emissions were binding, and total contributions were sufficient to reach the agreement's goals, no supply-side measures would be needed. Reduced carbon demand would then lower fuel prices, making exploration and extraction of fossil fuels sufficiently unprofitable to keep enough resources in the ground. However, countries withdraw from the Paris Agreement, NDCs are not binding, and it seems unlikely that total contributions will be ramped up sufficiently fast to keep temperature rise well below 2°C (*1*, *7*).

ENHANCING IMPACT WITH FREE RIDERS

Climate change is a social dilemma, making sufficient cooperation difficult. Curbing climate change would benefit all countries, but individual countries' incentives are weak (*8*): The costs of mitigation are borne by each country, whereas the resulting environmental benefits are shared by everyone. Effective climate policies require that countries contribute considerably more than they would by individually following narrow self-interest.

A supply-side treaty does not remove this fundamental social dilemma. However, if a coalition of countries is willing to make substantial contributions, the cost-efficient approach is to apply both supply- and demand-side measures because this reduces countervailing responses—carbon leakage—outside the coalition (*6*). Markets for coal and, in particular, oil are international, and the prices for these fuels affect local natural gas prices through substitution. If only some countries restrict their fossil fuel demand, global fossil fuel prices decrease, encouraging free-riding countries to increase consumption. Similarly, if only some countries restrict their fossil fuel supply, global fuel prices increase, stimulating production elsewhere. But by restricting their own fossil fuel supply as well as their demand, a coalition of the willing can eliminate global price changes that result from their climate policies (fig. S1). This eliminates carbon leakage through international fossil fuel markets (*9*).

The cost-efficient mix of supply-side and demand-side policies within a coalition depends on how supply and demand for fossil fuels among free riders respond to changes in fossil fuel prices (*6*, *10*) [an empirical survey is available in (*11*)]. Only in the unrealistic case in which fossil fuel demand outside the coalition does not respond to price changes would a cost-efficient policy involve demand-side measures only. Otherwise, supply-side measures should be included to induce higher fossil fuel prices and lower consumption among free riders.

Climate policies restrict transactions between producers and consumers of fossil fuels; for example, consumers combusting oil under an emission quota system must obtain quotas. This inserts a wedge between the prices at which producers would sell and consumers would buy, while the two prices remain equal in countries that free ride. Complementing the Paris Agreement with a treaty that limits fossil fuel supply raises fossil fuel prices outside the coalition and helps keep global consumer prices high even among free riders. Combusting fuels becomes less attractive, and a main obstacle for effectuating demand-side efforts will diminish.

STIMULATING LOW CARBON R&D

Development of low-carbon technologies is encouraged if investors expect high consumer prices of fossil fuels. This again enhances the political feasibility of introducing emission-reducing policies, making expectations about effective climate policies self-fulfilling: If regulations of emissions remain weak, future fossil fuel consumer

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prices will be more likely to remain low. Expectations of low future consumer prices provide less incentive for investors to invest in R&D in low-carbon alternative technology. Less innovative technology makes it more costly to reduce emissions and prevents future climate action.

Conversely, a supply-side treaty induces expectations of higher future fossil fuel prices. Such expectations encourage more investment in low-carbon R&D, leading to low future emission-reduction costs and facilitating future climate action, even in free-riding countries (*12*). A supply-side treaty can help prevent cycles of pessimism by supporting fossil fuel price expectations.

INSURANCE AGAINST FAILED DEMAND-SIDE POLICIES

Complementing the Paris Agreement with a supply-side treaty need not be very costly (*6*, *13*). First, if fossil fuel production is reduced through cost-efficient policy instruments, the resources with the highest social costs of extraction will remain in the ground, limiting the profits forgone by not extracting these resources. Cost-efficient quantitative supply restrictions, such as a system of freely allocated and tradable extraction permits, render marginally profitable extraction projects unprofitable while leaving extraction of low-cost resources profitable.

Second, the costs of participating in a supply-side treaty depend crucially on whether demand-side policies will turn out to be effective or not—and again, expectations are essential (*13*). Consider the following scenarios. Agents that invest in fossil fuel exploration and carbon-intensive technologies generally expect that future demand-side policies will be (i) effective, and as expected, these policies turn out to be effective; (ii) effective, but contrary to expectations, they turn out to be ineffective; (iii) ineffective, but contrary to expectations, they turn out to be effective; or (iv) ineffective, and as expected, they turn out to be ineffective.

In scenarios (i) and (ii), the supply-side treaty is superfluous for restricting investments in fossil fuel exploration and high-carbon technologies because such investments are already held back by expectations of effective future demand-side policies. Therefore, the costs of introducing the supply-side treaty are negligible if based on cost-efficient quantitative supply restrictions; although some reservoirs of fossil fuels will not be open for exploration, they would not have been developed even without the supply-side treaty.

However, in cases (i) and (ii), there might be a race to extract reserves expected to become stranded in the future; this is the "Green Paradox" (*10*, *14*). Supply-side policies can suppress such incentives by capping production, reaping global climate benefits at the expense of forgoing producer profits. Moreover, in scenario (ii), emissions can be reduced by the supply-side policies also in the long run when, contrary to expectations, demand-side policies eventually fail.

In scenario (iii), the supply-side treaty is not needed to avoid serious climate change. However, misguided expectations lead to excessive and eventually unprofitable investments in fossil fuel exploration and carbon-intensive technologies. A supply-side treaty prevents these wasteful investments, reducing social costs compared with the case with unrestricted supply.

In scenario (iv), private investors continue investing in fossil fuel exploration and high-carbon technologies, investments that turn out to be profitable if supply is not restricted. A supply-side treaty can be costly in terms of forgone profits for affected firms and individual countries compared with the case with unrestricted supply. Nevertheless, this is precisely the scenario in which a supply-side treaty is mostly needed: When demand regulation fails, the supply-side policies ensure emission reductions both by reducing investment in high-carbon technologies and by directly capping production.

Hence, if the Paris Agreement yields effective climate policies, then the supply-side treaty will not be very costly and might prevent misguided investments. Otherwise, the supply-side treaty insures against unacceptable climate change—in which case, the treaty can cause real loss of profits for affected fossil fuel producers but also generate considerable global climate benefits (*13*).

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An offshore gas platform operated by Statoil ASA is situated in the Oseberg North Sea oil field 140 kms from Bergen, Norway.

GETTING SUPPORT FROM PRODUCERS

Demand- and supply-side policies distribute costs and benefits differently. Policies restricting fossil fuel demand reduce market prices at which such fuels are traded, so that fossil fuel producers are paid less for their output. Policies that restrict supply, on the other hand, increase market prices.

The atmosphere's limited capacity to absorb greenhouse gases entails that rights to emit are valuable. Emission taxes on consumers and extraction taxes on producers transfer the value of such rights to governments. By contrast, freely allocated emission permits transfer this value to consumers of fossil fuels, and freely allocated extraction permits allocate this value to fossil fuel producers.

The threat of climate change reduces the social value of fossil fuel deposits; the primary scarcity becomes the atmosphere's capacity to absorb greenhouse gases, not the availability of productive reservoirs. With demand-side policies, this loss of asset value of fossil fuel reservoirs is borne by producers. With supply-side policies using freely allocated extraction permits, producers lose stocks left permanently in the ground but are compensated by being able to sell resources still extracted at higher prices (*15*).

Thus, resource exporters might prefer supply-side policies. An international coalition that limits fossil fuel supply would bear similarities to the Organization of the Petroleum Exporting Countries (OPEC)—by acting as a large producer exercising its market power to keep prices high—even though the coalition's objective of leaving large parts of its fossil fuels in the ground is not shared by OPEC and goes beyond their narrow interests as producers.

Resistance from resource exporters might partly explain why decades of negotiations have not produced a sufficiently stringent international climate agreement. Bringing fossil fuel producers on the team through a supply-side treaty might be preferred even by poor resource-importing nations that would otherwise be severely affected by climate change, if the relevant counterfactual is ineffective demand-side policies that lead to uncontrolled climate change.

MORATORIA, ENFORCEMENT, DEBATE

There are strong reasons to believe that a supply-side treaty would strengthen the credibility of plans for a future low-carbon society and thereby make such a society more likely to happen. How can such a treaty come about?

As a first step, rich, well-organized fossil fuel–producing countries with ambitions for effective climate change policies could announce moratoria on fossil fuel exploration in areas under their jurisdiction. For example, countries that control the Arctic could stop exploration in this sensitive region (*13*). As a second step, these countries could invite all fossil fuel producers to prepare supply-side NDCs, in the form of moratoria for exploration and extraction of some of their resources, combined with a cap for maximum yearly future extraction from their remaining reservoirs (*5*). Such supply-side NDCs would expose the gap between planned fossil fuel production and the level consistent with climate goals. They could also convey needs for compensation toward countries with large but not very valuable deposits of coal (*10*, *12*).

Like demand-side measures, supply-side policies will also face resistance, such as from fossil fuel–importing countries and corporations that rely heavily on such fuels. Nevertheless, the fact that demand- and supply-side policies distribute costs and benefits differently indicates that global carbon policies may be facilitated if both approaches are applied in tandem.

In spite of challenges in establishing a supply-side treaty and relating it to the Paris Agreement (*5*), a treaty that limits fossil fuel supply might be relatively easier to enforce because there are considerably fewer major producers than consumers of fossil fuels, and it is feasible to monitor extraction—in particular, from reservoirs pledged to remain undepleted (*4*, *10*).

Previous studies have discussed institutional and political aspects of a possible supply-side treaty (*4*, *5*, *10*). Many questions remain, such as those concerning practical designs of agreements and policy instruments, political feasibility, and distributional aspects, as well as surveillance and enforcement. For example, how can supply-side initiatives induce public support and avoid resistance from affected industry in countries that take a lead, and how can this lead be translated into sustained and escalating international cooperation over time (*4*)? Also, how can financial and other support be used to facilitate a fossil-fuel phase-down, particularly for coal (*5*, *10*, *12*)? To address these important questions, a broad debate, involving scholars and policy-makers of different backgrounds, is crucial. ■

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