The Paris Agreement

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What is the Paris Agreement (PA)?

- The PA consists of two main elements:
- It sets an overall target for long-term global temperature increase (maximum 2 degrees C; aspirational target 1.5 degrees C)
- Each country selects targets for annual GHG emissions by 2030.
- Many countries (LICs) have set two targets:
- Unconditional targets, where each country specifies what the country can do “on its own”, to reduce its GHG emissions
- Conditional targets, which specify, for each country, the reduction in GHG emissions that the country expects to achieve, with help from outside (other countries).

Targets under the PA

- All targets are non-binding, and can be changed.
- As shown below, great variation in targets across countries.
- The paths for and the costs of achieving the targets are unclear, especially for many developing countries.
- The countries' targets set so far, taken together, are not sufficiently ambitious to implement the overall temperature target.
- A presumption is however that targets will be tightened gradually over time.
- Only LICs set conditional targets. HICs, and some LICs, set only unconditional targets.

NDC unconditional and conditional targets of some low-income countries under the Paris Agreement

Country	NDC unconditional contribution by 2030 relative to BAU	NDC conditional contribution	Types of required support
Argentina	15%	30%	Financial support
Colombia	20%	30%	Financial support
Mexico	25%	40%	Policies; technological support
Peru	20%	30%	Financial support
Kazakhstan	15%	25%	Technology transfer; finance
Bangladesh	5%	15%	Financial support; technology transfer
Sri Lanka	4%	16%	Financial support
Thailand	20%	25%	Financial support; technological transfer
Vietnam	8%	15%	Financial support
Algeria	7%	22%	Financial support; technological transfer
Morocco	13%	32%	Access to technology; financial support
Nigeria	20%	45%	Not specified

Some very important LICs have only set unconditional targets (these countries do not expect outside support to implement their LDCs):

- China
- Russia (is this an LIC?)
- All the other Eastern Bloc countries
- Brazil
- South Africa

What types of conditionality?
Consider Peru's statement in its NDC:

"The Peruvian State considers that a 20% reduction (unconditional, relative to BAU emissions) will be implemented through domestic investment and expenses, from public and private resources. An additional 10% reduction is subject to the availability of international financing and the existence of favorable conditions."

Conditionality statements in countries' NDCs: Argentina

Argentina's unconditional target: 15% below BAU emissions. "Argentina could increase its (unconditional) reduction goal to 30% below BAU emissions under the following conditions: a) adequate and predictable international financing; b) support for transfer, innovation and technology development; c) support for capacity building."

Conditionality statements in countries' NDCs: Mexico

"Mexico's 25% unconditional reduction commitment could increase up to 40% in a conditional manner, subject to a global agreement addressing important topics including international carbon price, carbon border adjustments, technical cooperation, access to low-cost financial resources and technology transfer, all at a scale commensurate to the challenge of global climate change."

What are “Business-as-usual” emissions?

- Countries’ “Business as usual” (BAU) emissions paths to 2030 have been defined by the countries themselves.
- There may be incentives to set a higher BAU emissions path than what is realistic. With a high BAU trajectory, the country can point to a high stated “ambition” by targeting a large emissions reduction relative to its stated BAU level.
- We find some countries having unrealistically high BAU levels.

Table 1: Relative increases in GHG emissions and energy-related carbon emissions, 2000-2012, and projected relative increases in total GHG emissions 2012-2030 given business-as usual (BAU) emissions, for 28 countries submitting NDCs under the Paris Agreement

Country	Relative increase in GHG emissions, 2000-2012, %	Relative increase in energy-related carbon emissions, 2000-2012, %	Projected relative increases in GHG emissions under BAU, 2012-2030, %
Angola	62.6	183	59.7
Argentina	14.7	31.2	49.9
Bangladesh	33.8	107	303
Cambodia	4.3	50	100
Central Afr Republic	-3.2	6.7	90.2
Colombia	9.3	22.1	67.5
DRC	2.0	50	118
Cote d'Ivoire	89.5	50	13.3
Ethiopia	42.6	56.3	178
Ghana	5.4	129	25.4
Guatemala	8.3	18.2	38.5
Indonesia	44.3	47.4	45.5
Jordan	42.1	46.7	11.0
Kenya	55.6	28.6	104
Mexico	23.4	20.6	97.6
Morocco	69.8	71.9	140
Nigeria	13.1	24.8	100
Pakistan	39.5	38.6	369
Peru	50.0	69.0	87.4
Sri Lanka	15.4	28.6	300
Thailand	46.9	64.5	47.6
Trinidad & Tobago	66.7	65.2	158
Turkey	37.2	66.7	201
Turkmenistan	66.2	66.1	25.9
Uganda	32.4	N.A.	63.3
Vietnam	156	186	216
Yemen	50	61.5	46.7
Zimbabwe	-7.4	-23.5	318

Sources: World Resources Institute; UNFCCC.

Quite a few LICs' targets do not depend on BAU

- Some have «hard» targets: Russia, Eastern Bloc countries, Brazil. This is more satisfactory than targets depending on an uncertain BAU.
- «Intensity targets»: The target is formulated as a particular reduction in GHG emissions intensity in GDP, a GDP is on a growing path.
- India is one country with intensity target (35% reduction in emission intensity by 2030).

Model for explaining unconditional and conditional NDC targets

Two groups of countries.

1. “Low-ambition” countries or LICs:

- These countries have not previously had climate policies nor done much to reduce their GHG emissions.
- They also expect outside assistance to implement their conditional NDCs.

2. “High-ambition” countries or HICs:

- They have more established and ambitious climate policies.
- They can provide financial support for climate action in L countries.
- They may sometimes act cooperatively.
- Their own NDCs are unconditional.

Outline of the model

- Countries set their unconditional NDCs non-cooperatively.
- Only L countries set conditional NDCs.
- Conditionality of NDCs can be specified as follows by LICs:

  i) They need financial support from HICs.

  ii) They need support to investments in renewable energy from HICs.

  iii) Climate action of a given LIC is conditional on other countries' implementation of the PA.

The two first are the most commonly specified.

Outline of model for explaining unconditional, and conditional, NDCs

1. For unconditional NDCs, countries maximize a welfare function of utility from carbon emissions, and of costs of emissions. This gives an optimal carbon price, and emissions level.
2. For conditional NDCs, additional mitigation in LICs is in response to financial support provided by HICs. This leads to more mitigation, and a higher carbon price, in LICs.
3. The model also derives the optimal support that HICs are willing to provide to LICs.

Unconditional NDCs

Consider an efficient mitigation policy:

- Each LIC sets a single, uniform, carbon price, v_L, but which likely differs between LICs.
- This carbon price, v_L, includes:

  A) Climate impacts for the LIC itself from own emissions, and

  B) "Co-benefits" for the LIC itself from reducing its GHG emissions (e.g. from reduced local air pollution).

Impact A is likely to be small for almost all countries, while impact B could (in principle) be larger.

NDC conditional on financial support

- Assume that a bloc of HICs makes a fixed payment (a ***support carbon price***), denoted by q_{LC}, for each unit of reduction in emissions in an LIC, below the country's own unconditional target.
- The model derives the HIC country bloc's optimal level of support to the LIC.
- HICs as a group have incentives to support mitigation in LICs, because marginal mitigation costs are (much) lower in LICs than in the HICs.

Conditional NDC policies: a LIC's decisions

- The LIC maximizes a quadratic utility function w.r.t. its carbon emissions.

$$W_{LC} = R_{LC} - \frac{1}{2}\gamma R_{LC}{}^{2} - (p + v_L)R_{LC} + q_{LC}(R_{LU} - R_{LC})$$

Explanation of symbols:

- R_{LU} = GHG emissions under the unconditional NDC
- R_{LC} = GHG emissions under the conditional NDC
- p = fossil fuel price

Conditional NDC policies: a LIC's decisions

- The LIC's optimal emissions level under conditionality, taking the support price q_{LC} to mitigation from the H bloc as given, is:

$$R_{LC} = \frac{1}{\gamma}(1 - p - v_L - q_{LC})$$

- The higher the carbon price v_L, and the higher the carbon support price from HICs to LICs, q_{LC}, the lower the conditional carbon emissions, R_{LC}.
- In particular, setting $q_{LC} > 0$ reduces emissions by q_{LC}/γ.

Key issues for understanding policies of HICs

- **Additionality**: The fraction of the conditional emissions reductions in the LIC, that result from the help from HICs. If this fraction is 100%, there is full additionality.

- **Leakage:** When emissions are reduced from one economic unit (e.g. a firm), emissions may increase in other units, in the same economy and the rest of the world.

Conditional NDC policies : HICs' payments. Case 1

- Consider full additionality and no leakage
- There is full information about mitigation costs.
- The HIC bloc maximizes the following function w.r.t. q_{LC}:

$$V_{HC} = v_H \frac{q_{LC}}{\gamma} - \left(q_{LC} - \lambda \frac{q_{LC}}{2} \right) \frac{q_{LC}}{\gamma}$$

Explaining the notation:

v_H = carbon price in the HIC bloc

q_{LC}/γ = amount of emissions reductions in the LIC, that results from the conditional policy

λ = the share of the specific surplus that is captured by the HIC bloc

$(q_{LC} - \lambda q_{LC}/2)$ = average carbon support price paid by the HIC bloc to the LIC country.

Further explanation

- The specific surplus in each mitigating unit (firm) in the LIC, associated with support payments from the HIC bloc, equals (q_{CL} – c) per unit, where c = unit mitigation cost for that firm.

- In the model, c is uniform across units on [0, q_{LC}]. (This also follows from the quadratic macro emissions benefit function).

- The average specific surplus across all units in the L country that receive support payments from the H bloc, then equals $q_{LC}/2$.

Conditional NDC policies (cont.): Case 1

The optimal carbon support price, q_{LC}, from the HIC bloc to the LIC is found from maximizing the HIC bloc's utility function:

$$q_{LC} = \frac{v_H}{2-\lambda}$$

λ=0 is equivalent to a standard monopsonist solution. This gives $q_{LC}=v_H/2$, and then $q_{LC}<v_H$. This reflects the H bloc's aversion to providing net rents to emitters in the LIC.

λ=1: Perfectly discriminating monopolist, no net rent left in the LIC. This gives $q_{LC} = v_H$, corresponding to a globally efficient solution.

Conditional NDC policies: H countries' payments. Case 2

- This case is less favorable to H country support. Changes from model 1 are:
- There is now asymmetric informational about units' mitigation costs.
- The H bloc cannot perfectly identify those units that need support and those that do not need support.
- Consider also potential leakage.

The objective function of the H bloc can then be written as

$$V_{HC} = v_H \frac{(1-\rho)q_{LC}}{\gamma} - q_{LC} \frac{v_L + q_{LC}}{\gamma}$$

ρ = degree of leakage. The H bloc is now also assumed to pay for mitigation already induced by the L government.

Conditional NDC policies. Cases 1 and 2 compared

- The optimal carbon support price, paid by the HIC bloc to the LIC, is in Case 2:

$$q_{LC} = \frac{(1-\rho)v_H - v_L}{2};$$

- which can be compared to the optimal support price with complete information on mitigation costs (Case 1):

$$q_{LC} = \frac{v_H}{2-\lambda}$$

Case 1 versus Case 2

Three factors make the support from the H bloc to mitigation in L countries less advantageous in Case 2 than in Case 1:

1. Asymmetric information about firms' mitigation costs
2. There is imperfect identification of targets for subsidy
3. With leakage, mitigation is made less efficient as it is counteracted by additional emissions elsewhere

All three factors reduce the carbon support price (which expresses the H bloc's willingness to pay for L country mitigation).

Support to renewables investments

- Observability, and additionality, are both likely to be more favorable for renewables investments than for general mitigation support. In particular, renewables can be managed more directly.
- Renewables may also have a separate development effect on top of its mitigation effect.
- Such factors could make support to renewables investments more favorable, when compared to general mitigation support through a carbon price.

Support to renewables investments (cont.)

- Increases in the deployment of renewable energy may however be difficult to implement in many LICs, as

a) investments are needed which may be difficult to finance for many LICs (even though they get some support from HICs), and
b) technical competence may be needed but is perhaps lacking.

- Mitigation through renewables investments may then require additional instruments than those discussed here.

Policy conditionality in NDCs

- Very few countries specify policy conditionality as basis for their conditional NDCs.
- Types of conditionality for NDC policies specified by LICs:

a) Conditional on high carbon taxes «elsewhere».

b) Conditional on use of border taxes to protect own exposed industries.

Conditional NDCs with policy conditionality (cont.)

- With policy conditionality, there is typically no direct payment from the HIC bloc to the LIC.
- This conditionality thus tends to be more favorable for HICs, and less favorable for LICs, because financial transfers between the blocs are often not involved, or much smaller.
- It could also in principle be part of a more efficient solution (if combined with support from HICs to LICs; considering that HICs have limited budgets for such support).

Summing up: The Paris Agreement is likely to imply a hierarchy of carbon prices:

1. **«High» carbon prices** in high-ambition countries (HICs) related to their own mitigation activity.
2. **«Low» carbon prices** in low-ambition countries (LICs), related to these countries' own climate policy initiatives. These carbon prices could be driven by co-benefits of mitigation for these countries.
3. **«Intermediate» carbon prices** associated with support policies from H countries to L countries.

The carbon prices of categories 2 and 3 can also vary substantially.

This situation may make it difficult to create a common global carbon market, with a unified carbon price, which is a target of many.

Can additional mitigation policies and action be induced in LICs, through HIC support?

- The model discussed has been based on the CDM, which has many inefficiencies.
- These policies may work better under the PA than they did under the Kyoto Protocol, since L countries under the PA for the first time have national emissions targets. This may reduce problems with leakage and lack of additionality.
- Mitigation action could instead be taken by LICs themselves, setting higher domestic carbon taxes, possibly stimulated by financial support from the HIC bloc. This would be more efficient than relying on a CDM-like mechanism.

Global targets under the PA: Can they be reached?

- So far, the (conditional) targets set by all countries are far from sufficient to meet the global mitigation target implied by the overall 2 (1.5) degree target. Still, global emissions will be on an upward trend even if all NDCs are fulfilled, as currently formulated.
- Many L countries are still skeptical toward increasing their own carbon prices.
- Also, most conditional targets depend on financial support which is not yet available: HICs' willingness to pay for mitigation action in LICs is currently low.
- A question is whether targets, and corresponding mitigation action, can be tightened gradually toward 2030, to make up what is missing. This is possible but looks unlikely today.