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# Clubs, R&D and finance: Incentives for ambitious GHG emission reductions

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INTERGOVERNMENTAL PANEL ON climate change





# Public good provision

Theory of global public good provision/coalition formation provides a clear message: an **effective, global** agreement on climate change control is very unlikely

Even the formation of **climate clubs** is very unlikely unless:

- (i) countries joining the club get benefits that do not accrue to non participants and/or
- (ii) non participants are sanctioned by club members

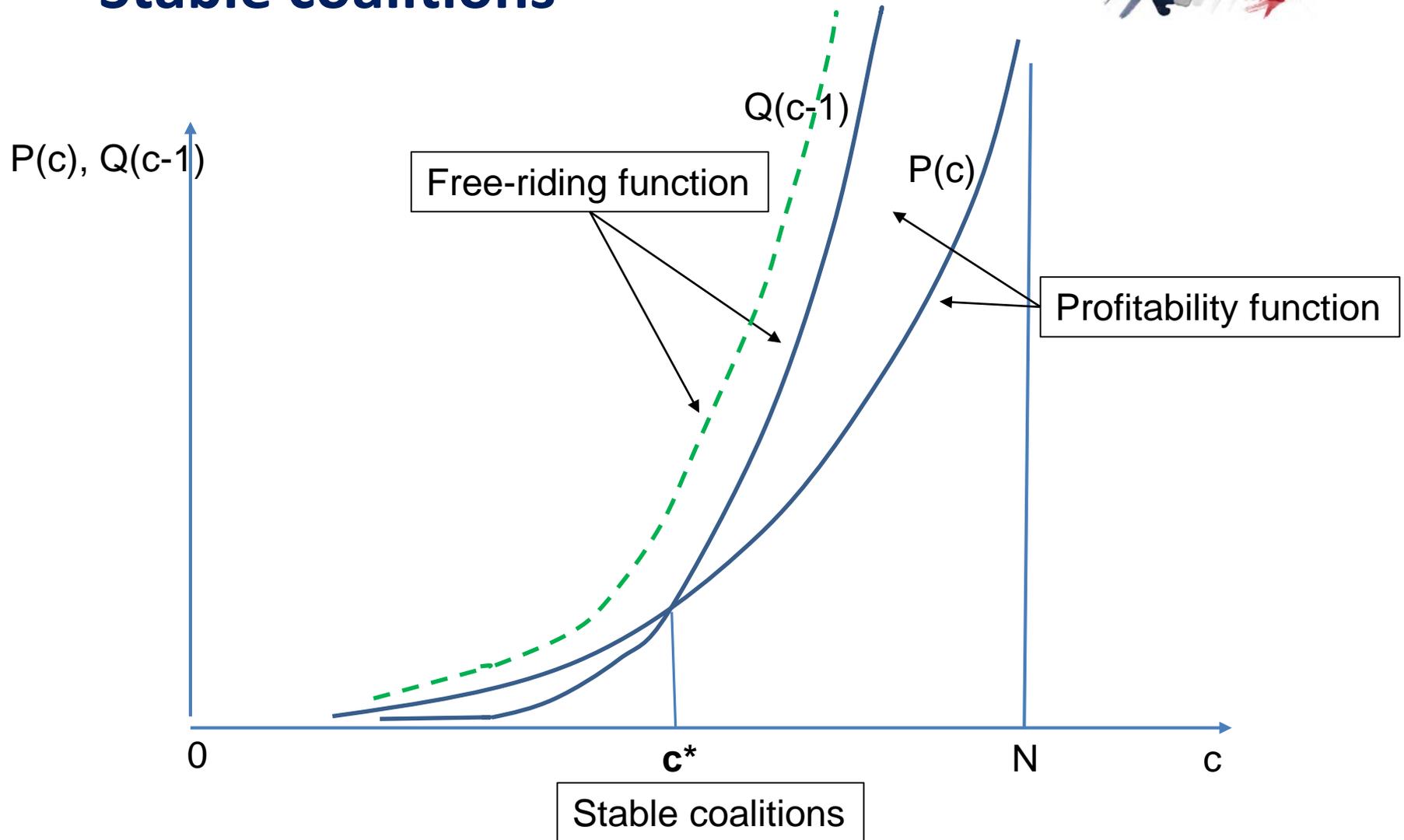
The latter is for example the case of **trade sanctions** often advocated to support the emergence of climate clubs

However, effective and non self-punishing (credible) trade sanctions are very unlikely as well

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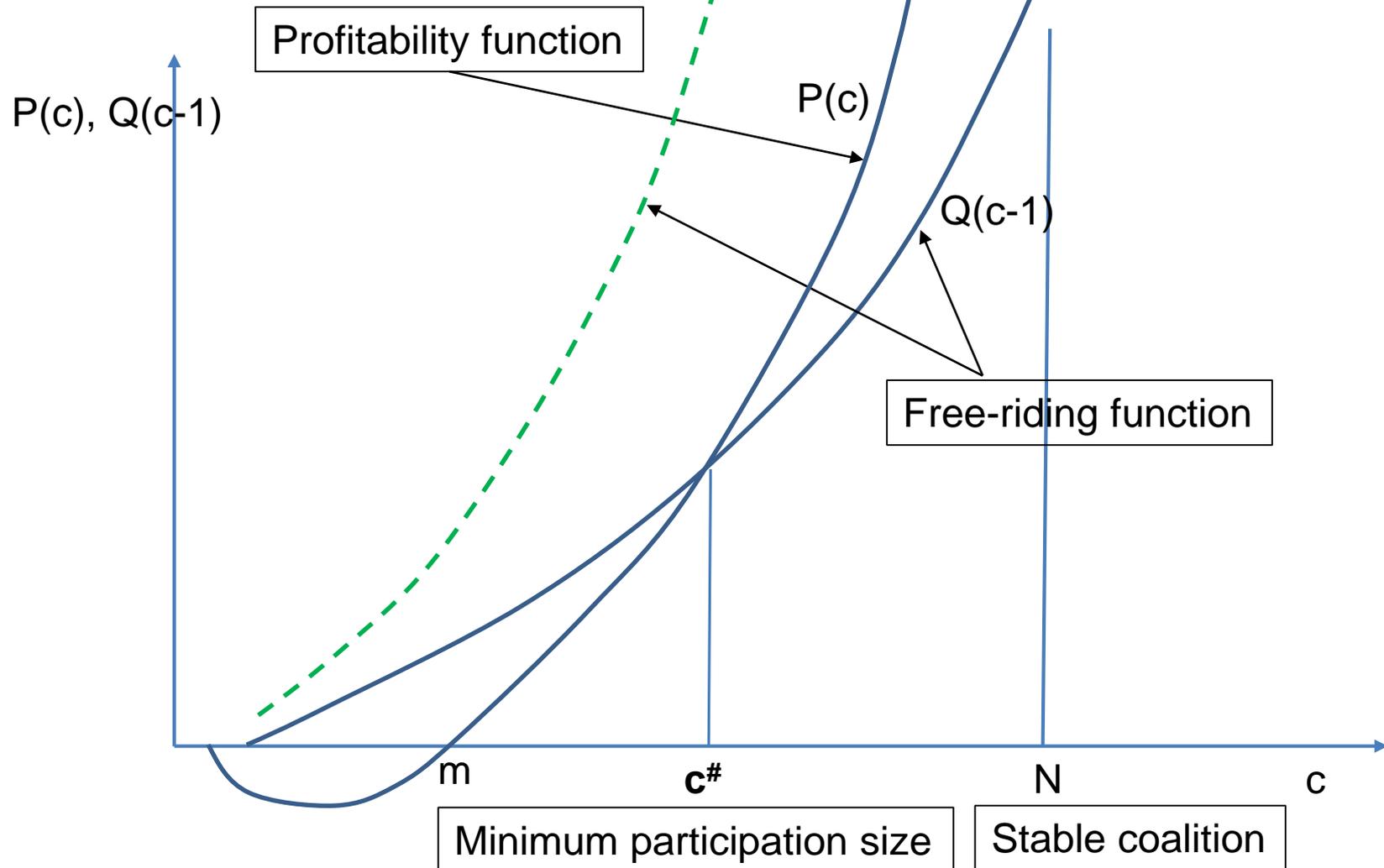


# Stable coalitions





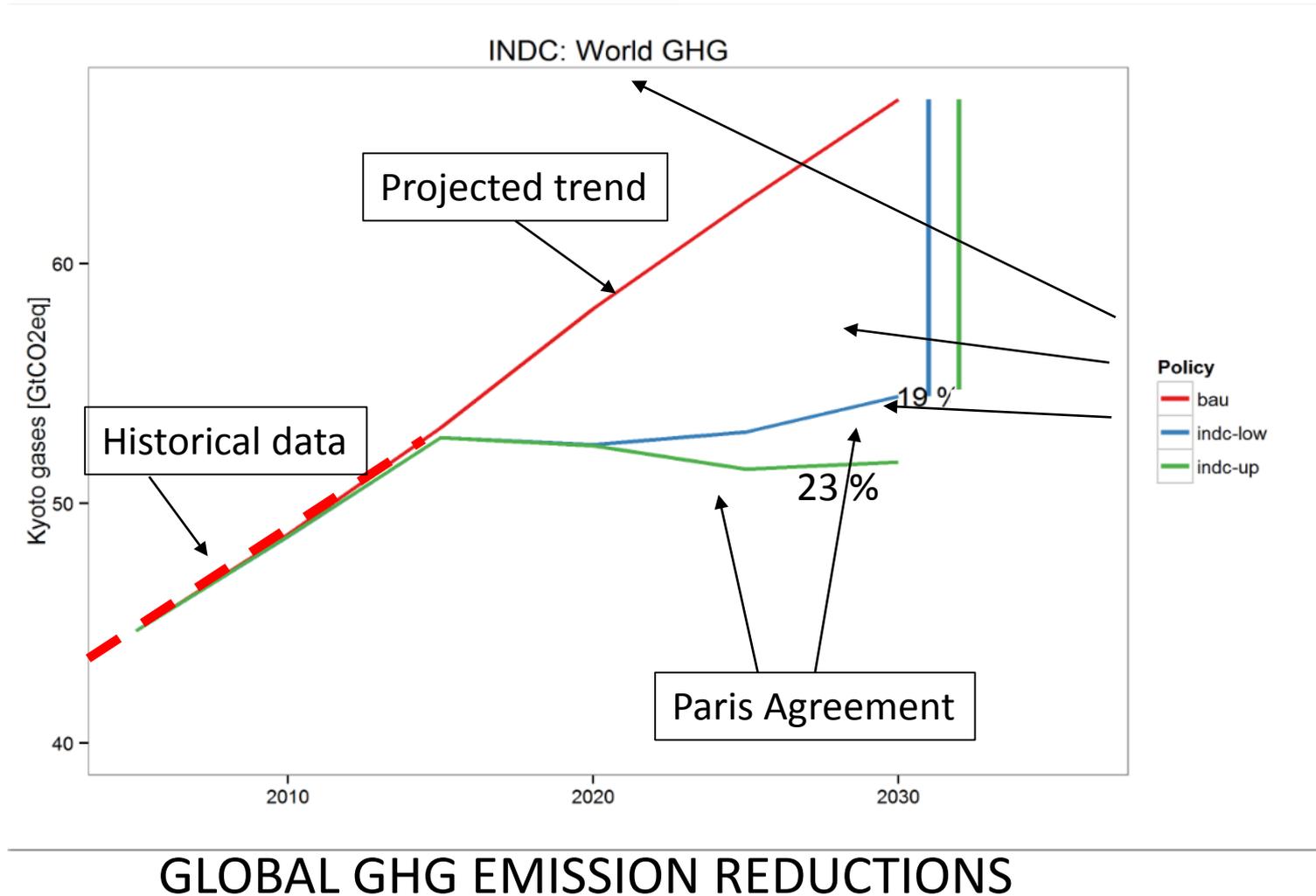
# Minimum participation



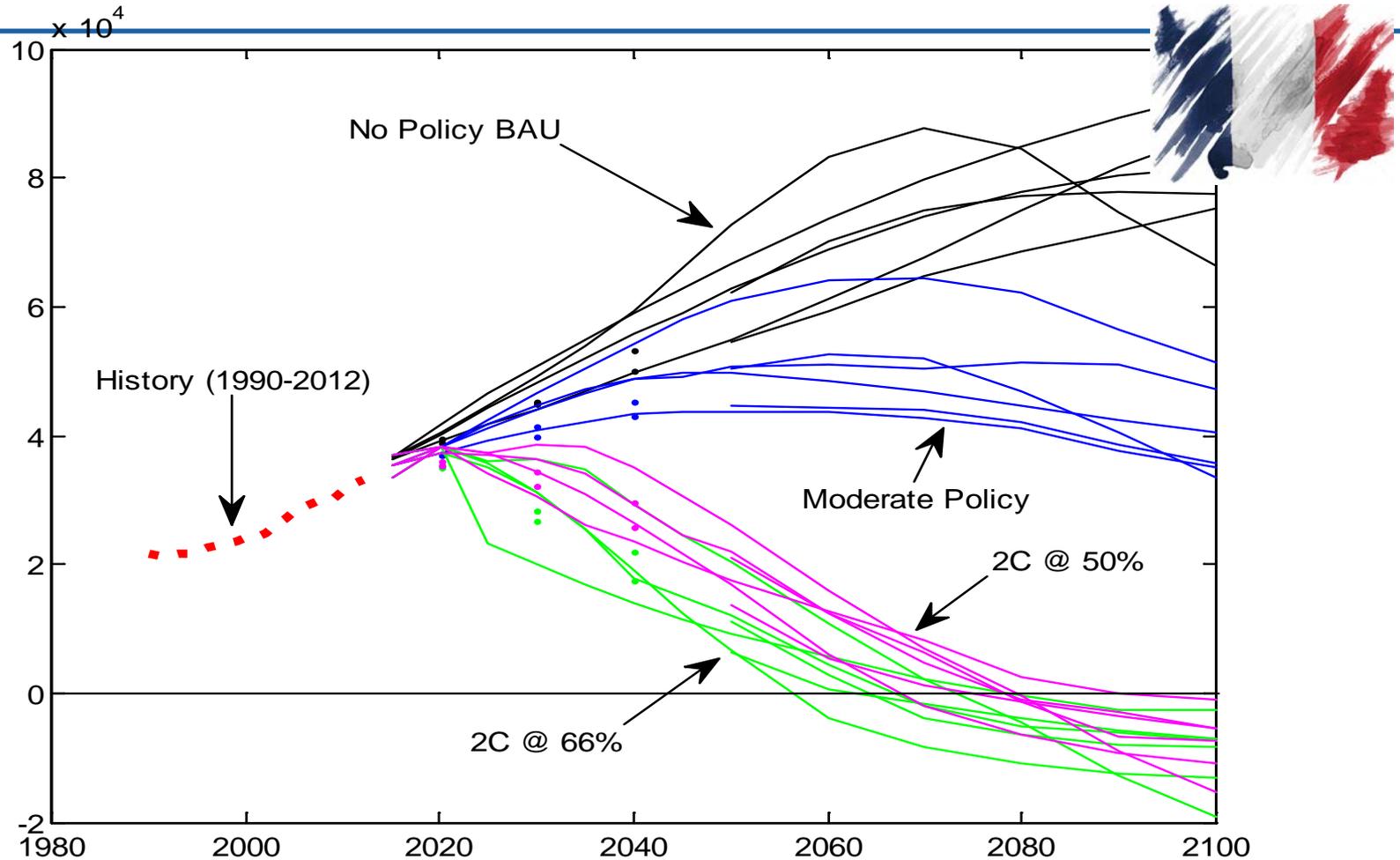


# The Paris Agreement

In this context, the Paris agreement is probably one of the best outcomes one can envisage:



# The Paris Agreement is largely insufficient if the goal is 2°C



- Achieving 2C with sufficient probability would require departing from historical trends in emissions in the next 5-10 years at most (Source: historical data: EIA/IEA; Projections: LIMITS multi model ensemble)

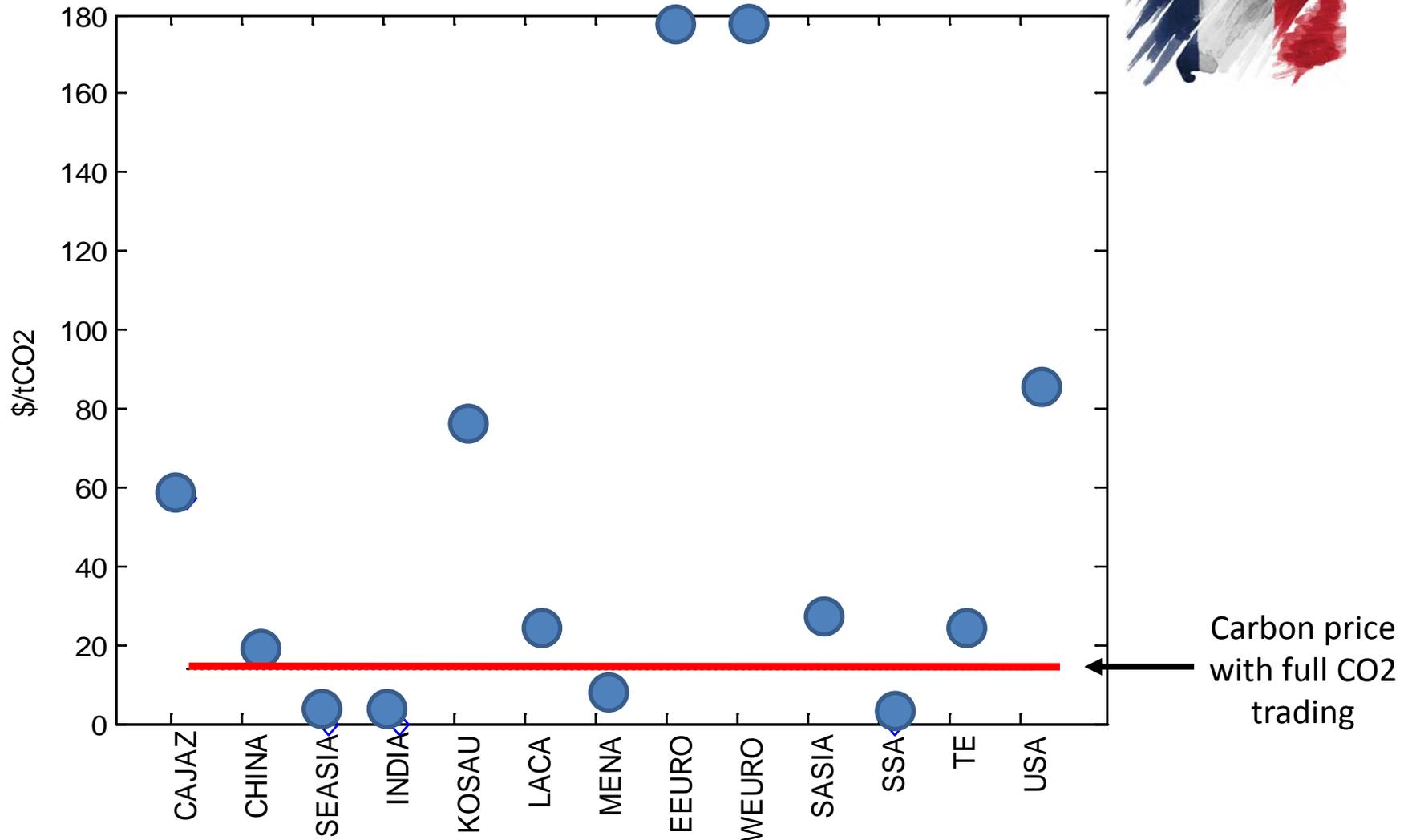


# How can ambitious emission reductions be achieved from 2030 onward?



- Phase-out of coal
- Remove subsidies to fossil fuels
- Diffusion of energy efficiency improvements
  
- Efficient allocation of abatement efforts
- Carbon Pricing → Resources to support R&D and investments
  
- Development and diffusion of new technologies (CO<sub>2</sub> removal, energy storage,.....)
- Enhanced climate finance
  
- **Both R&D and Finance can play an important role in future agreements to support the formation of climate clubs**

# PARIS AGREEMENT MARGINAL ABATEMENT COSTS IN 2030: EFFICIENCY GAINS ARE AVAILABLE



# R&D, Finance and Climate Clubs

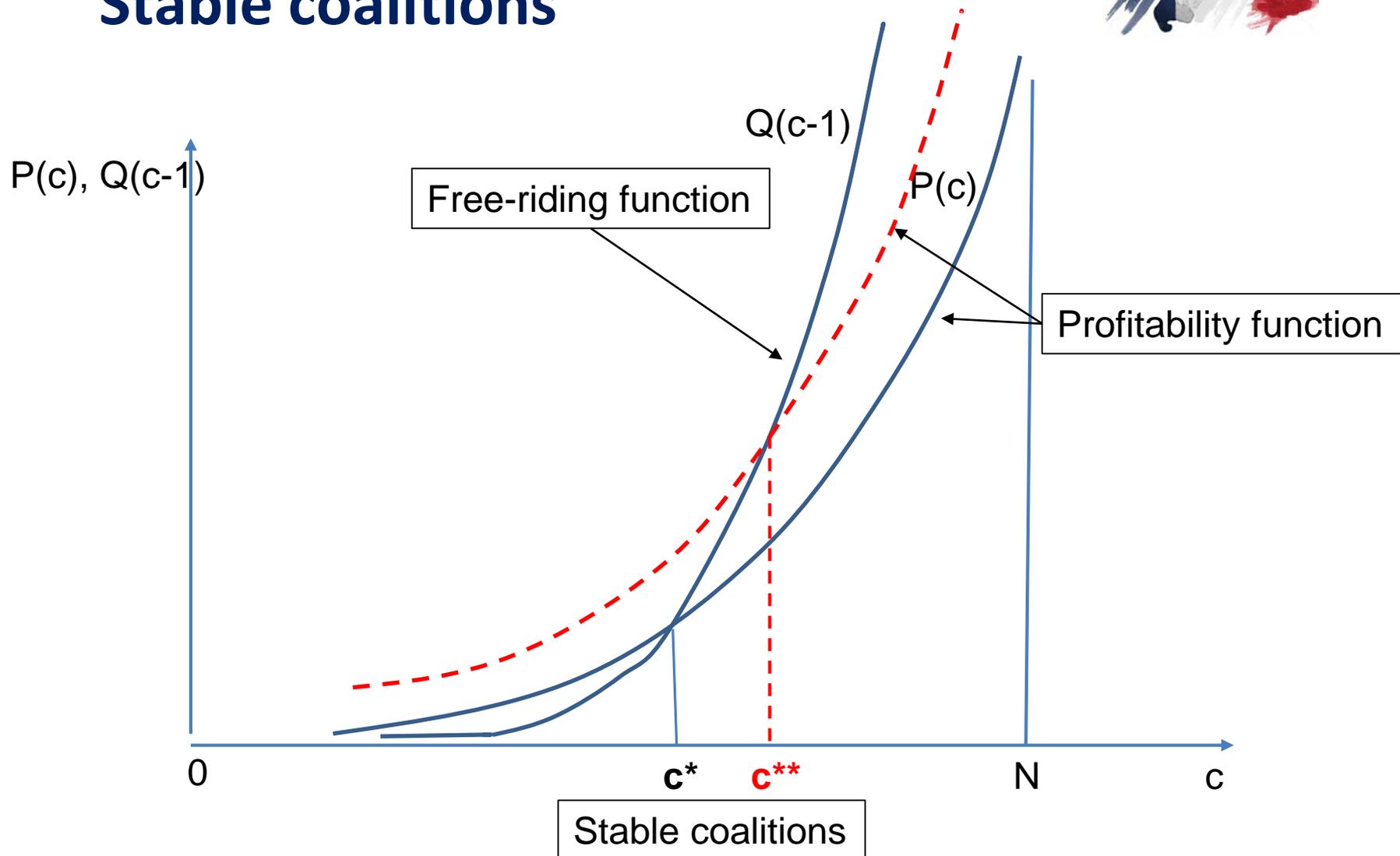


- Climate clubs crucially depend on the existence of excludable benefits for members or sanctions for non-members
- Given the low likelihood of trade sanctions to non-members, R&D investments and climate finance are two important sources of excludable benefits
- An R&D club or a finance club can provide important benefits to club members, benefits from which non-members can be excluded
- **Examples: club green funds or insurance schemes, patents available to club members only or joint R&D programs (e.g. the Apollo program)**



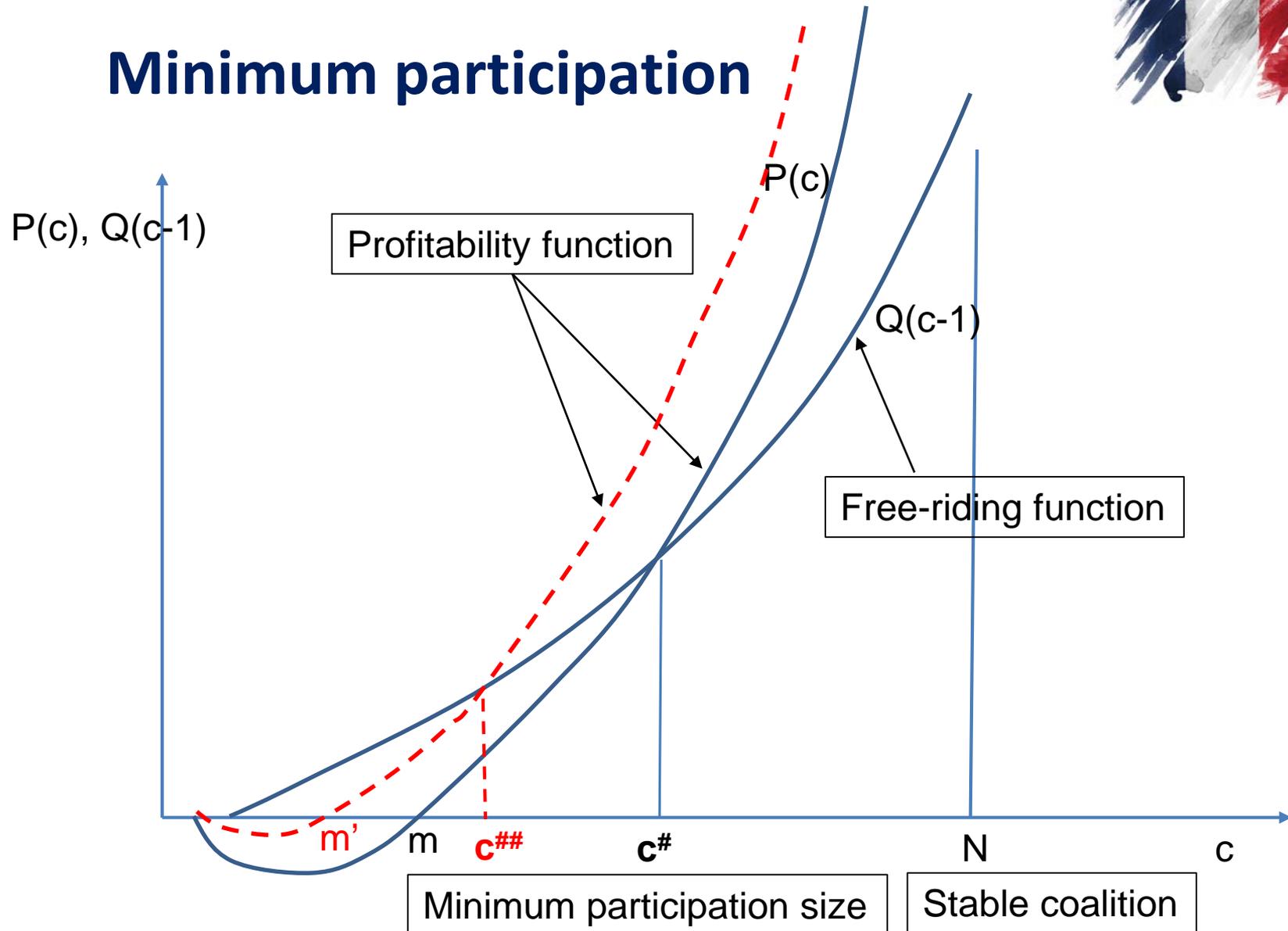


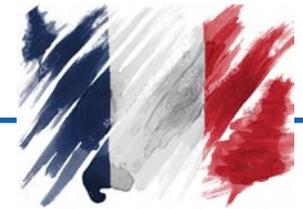
# Stable coalitions





# Minimum participation





- R&D investments and climate finance can therefore be used to provide multiple benefits, e.g.:
    - New financial resources to support transition to low carbon economy
    - Technological innovations without which the 2°C target cannot be achieved
- and
- Incentives for climate club formation, which otherwise would not emerge

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Thank you!

[www.carlocarraro.org](http://www.carlocarraro.org)



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Back up slides



# What reference price for carbon?

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The answer depends on:

- Technology availability
- Timing of actions
- Architecture of the agreement
- Distributional implications

# Data sources

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IPCC WGIII AR5 data base, publicly available at

<https://secure.iiasa.ac.at/webapps/ene/AR5DB/dsd?Action=htmlpage&page=about>

- 15 IAMs
- 1000 scenarios, spanning different climate targets and different policy architectures, and technological availability

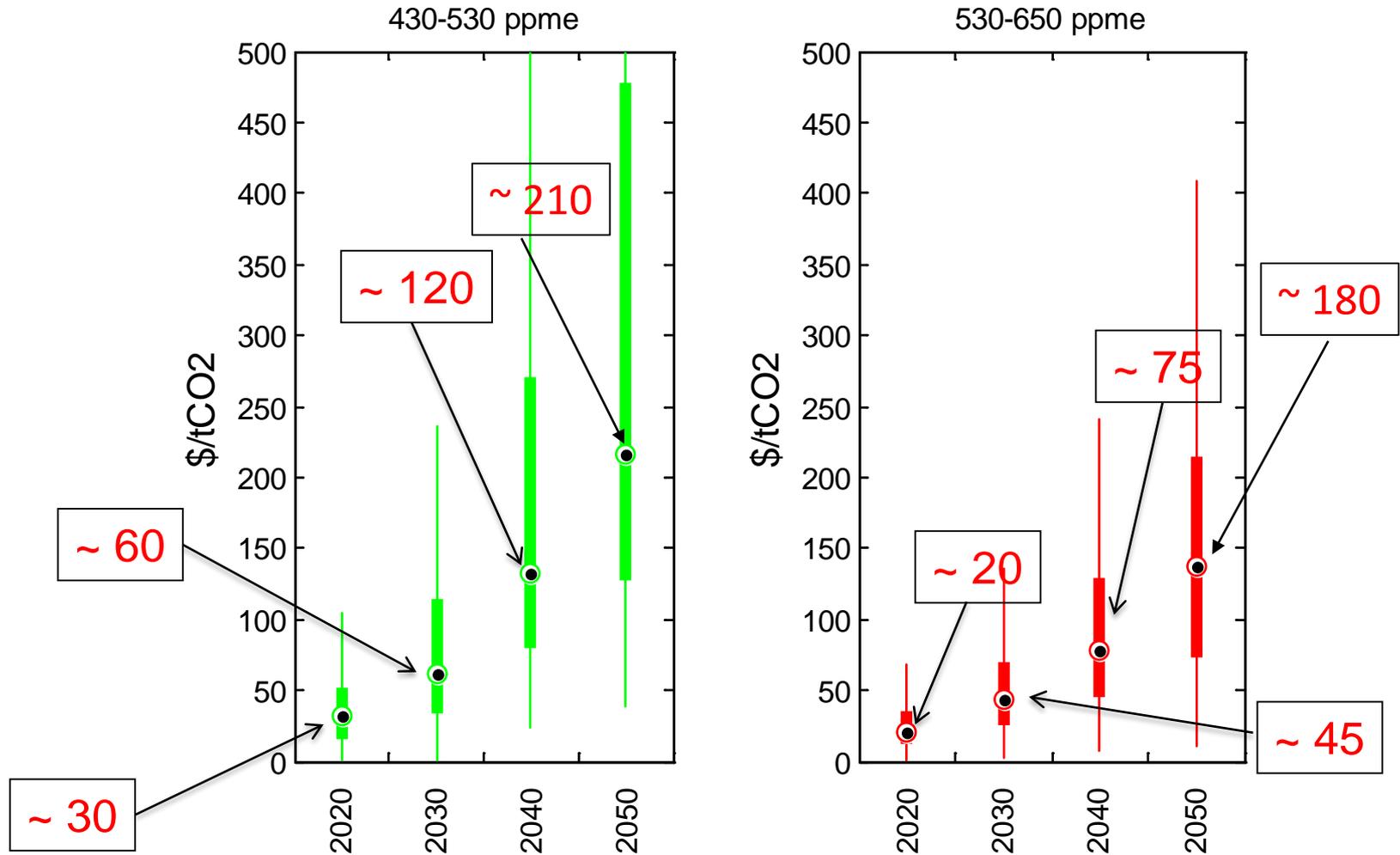
LIMITS MIP (Tavoni et. al, Nature Climate 2015)

- 6 IAMs
- 2 non cooperative scenarios with different pledges (mimicking INDCs)
- 2 fully cooperative scenarios (450 and 500 ppm eq)
- 3 burden sharing schemes (tax, per capita convergence, equal costs)

All data publicly available

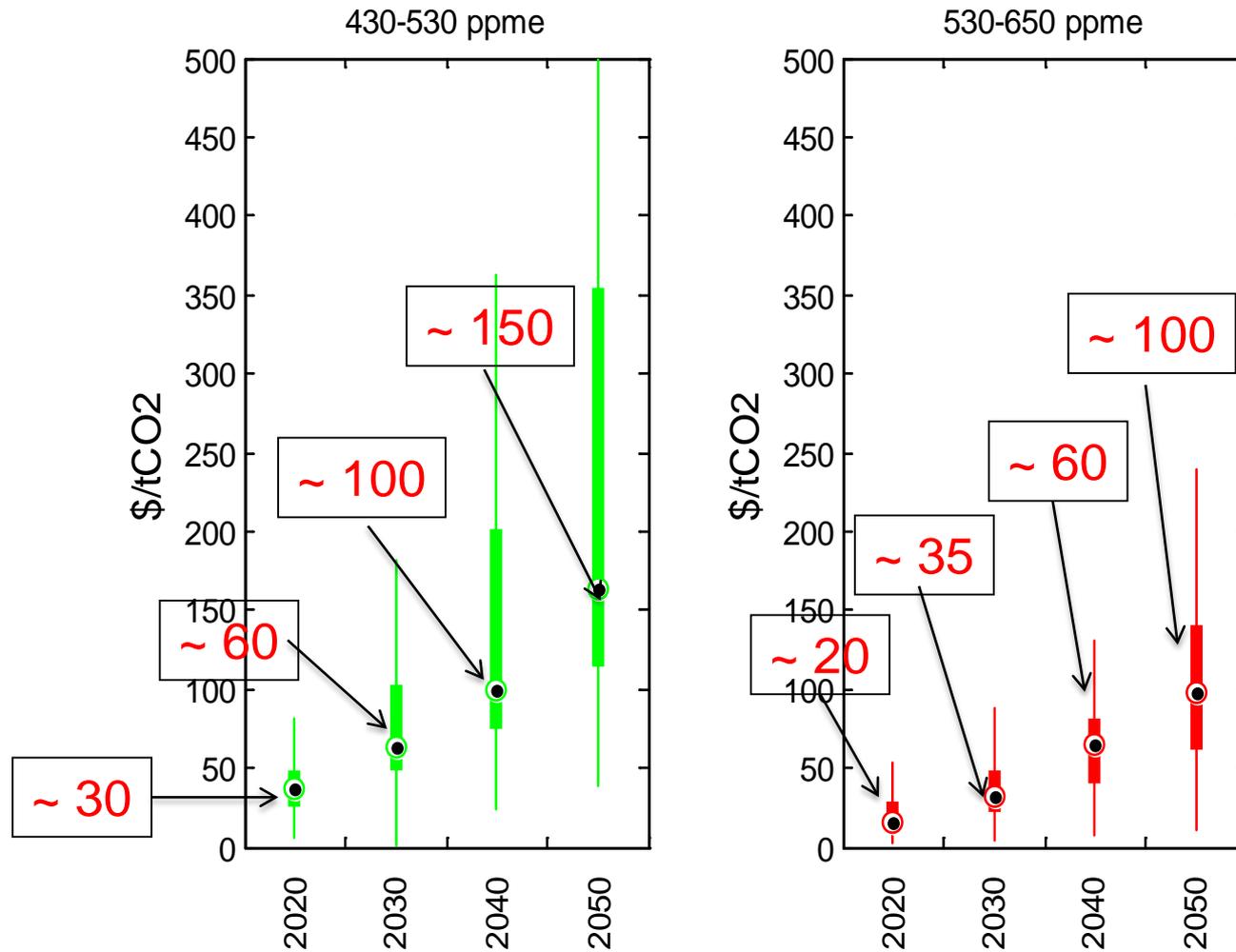
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# Global carbon prices for different climate objectives



Boxplots of model results: the central mark is the median, the edges of the box are the 25th and 75th percentiles, the whiskers extend to approx 5-95%

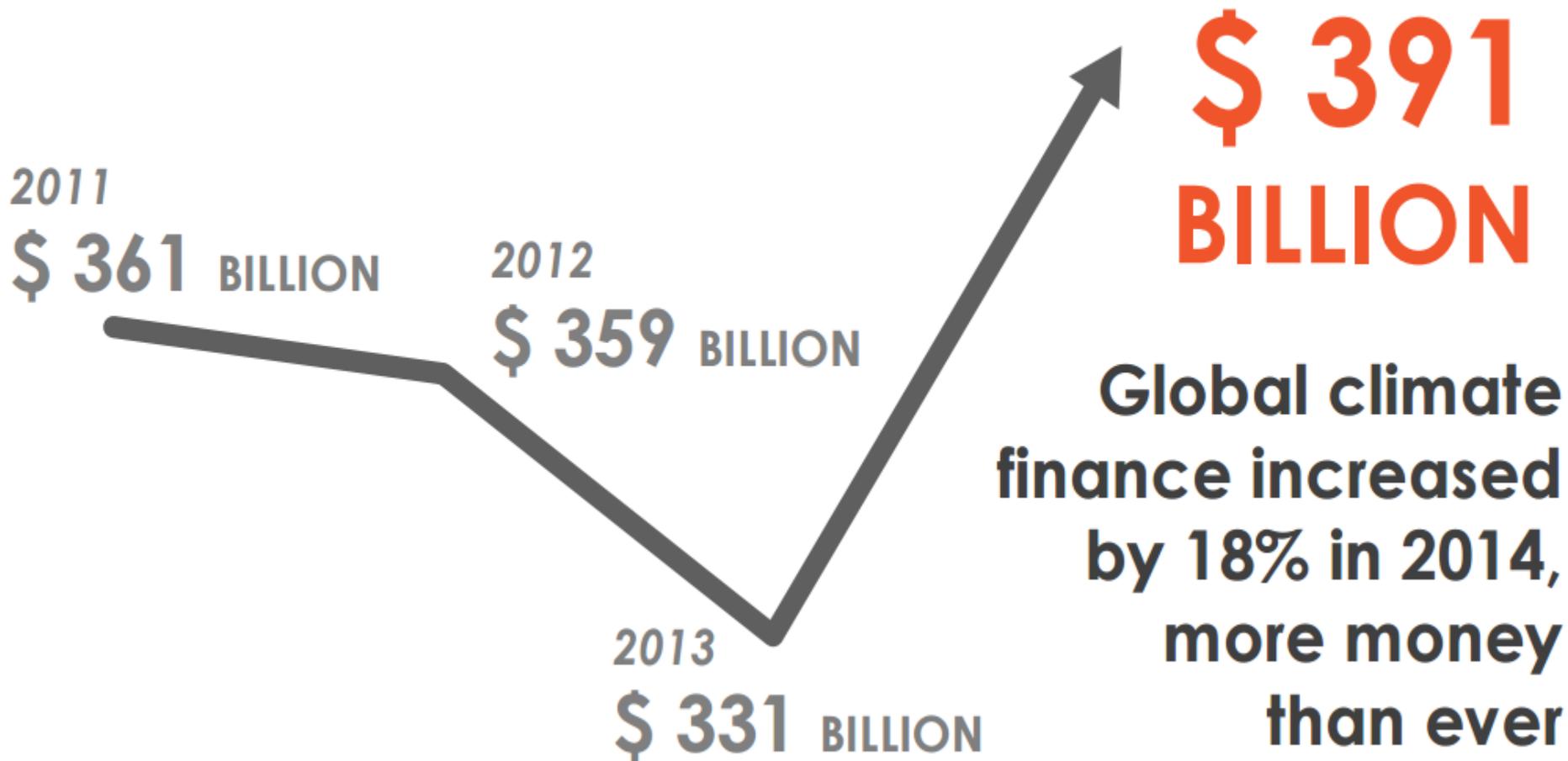
# Global carbon prices: first best scenarios



Boxplots of model results: the central mark is the median, the edges of the box are the 25th and 75th percentiles, the whiskers extend to approx 5-95%

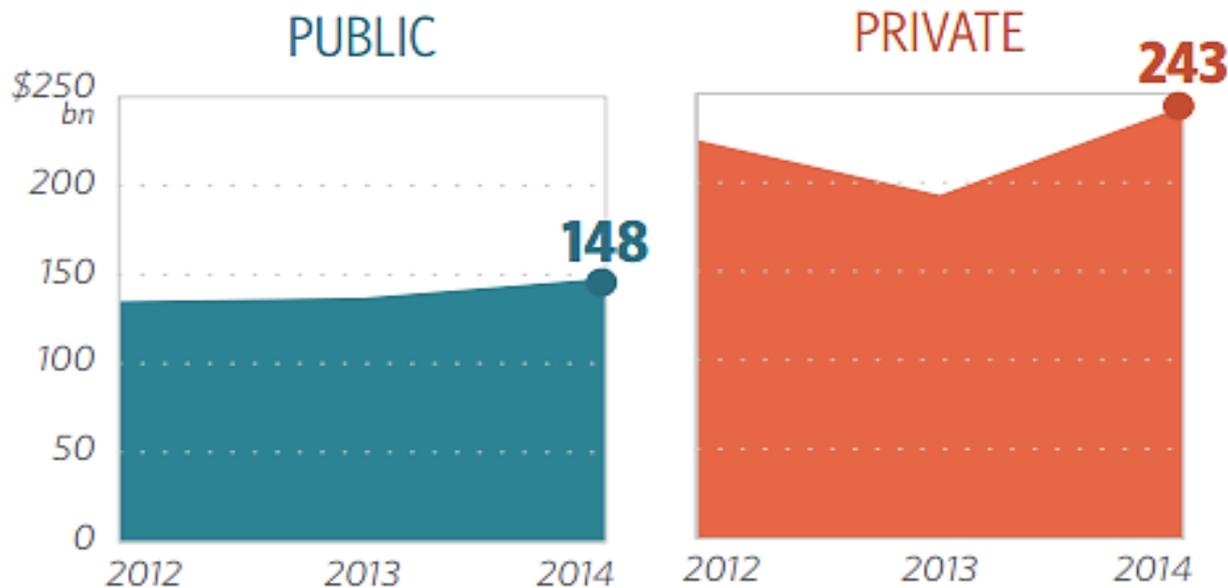
Total climate finance reached \$391 billion in 2014

## TOTAL CLIMATE FINANCE IN 2014



**Global climate finance flows reached at least USD 391 billion in 2014 as a result of a steady increase in public finance and record private investment in renewable energy technologies.**

Figure 1. The evolution of total public and private finance, 2012-2014, in USD billion



Source: CPI analysis.

**In 2014, public actors and intermediaries committed USD 148 billion, or 38% of total climate finance flows.**

# Uses of Climate Financing

93%  
mitigation

- Renewable energy generation
- Energy efficiency in industry and buildings
- Sustainable transport
- AFOLU & livestock management

7%  
adaptation

- Water supply management
- Climate-resilient infrastructure
- Coastal protection
- Disaster risk reduction
- AFOLU & natural resource management