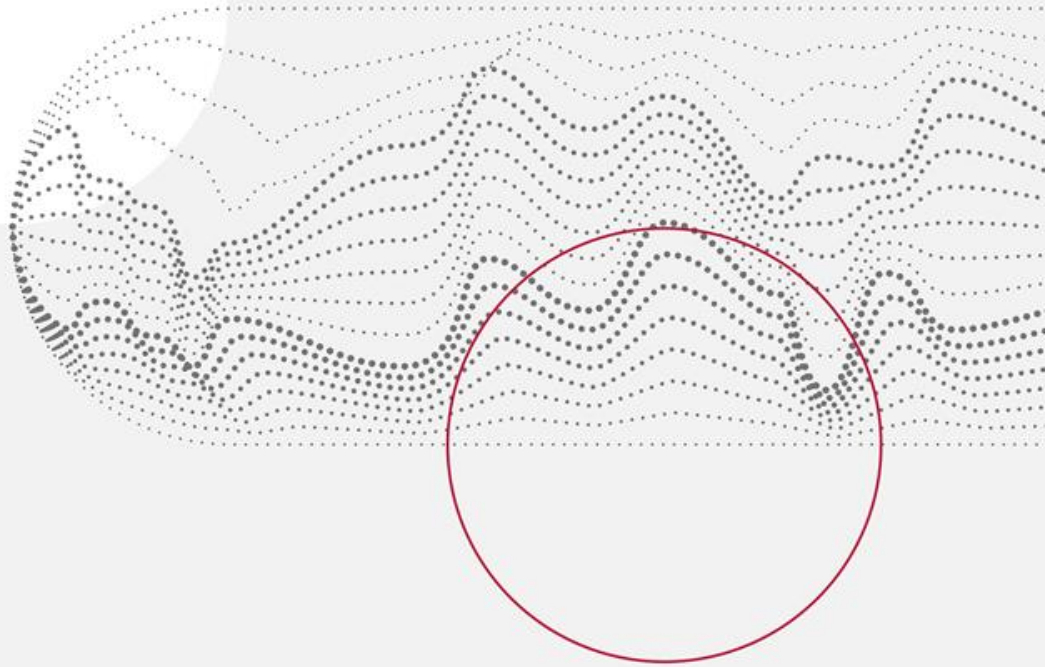
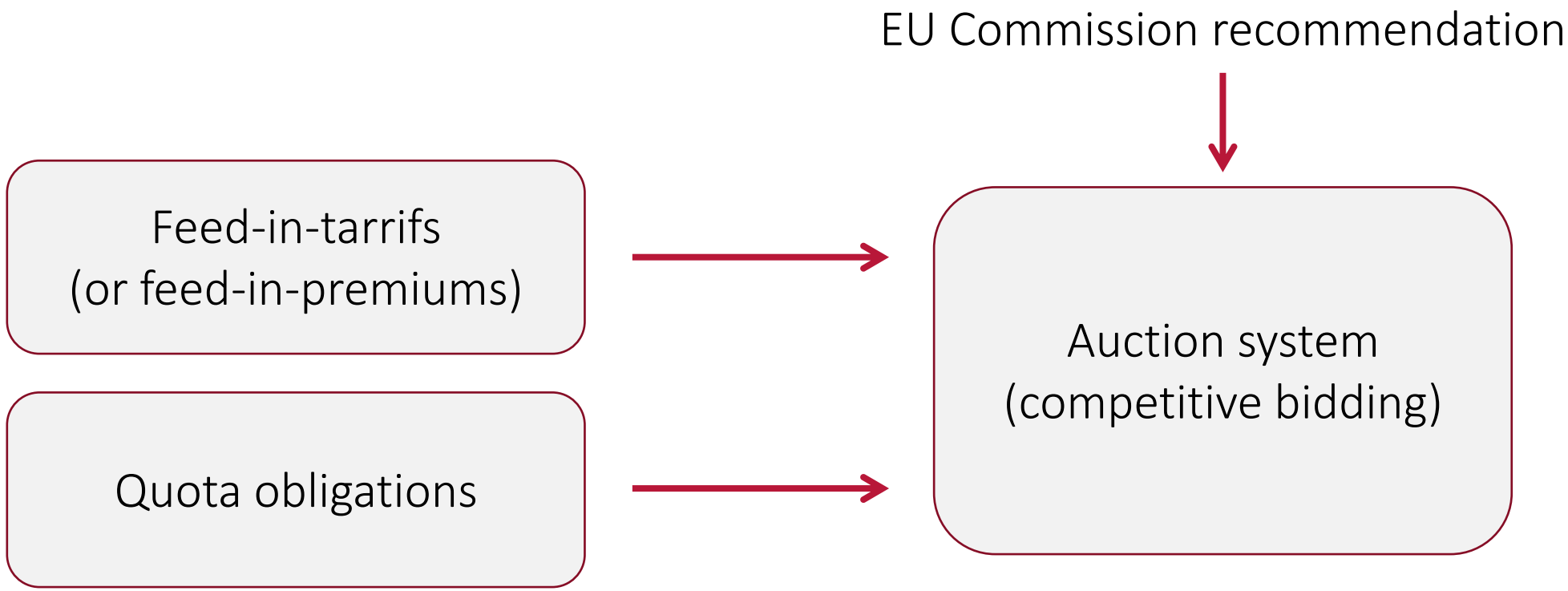
instytut
badań
strukturalnych

Optimal RES differentiation under technological uncertainty



Jakub Sawulski, Jan Witajewski-Baltvilks

RES support in EU countries – shift from FIT and quotas to auctions



Auctions are successful only under some conditions

Advantages

- Reveal the real cost of technology (ensures cost-effective level of support)
- Give reliable and long-term income for investors
- Increase transparency

Disadvantages

- Lack of competition may lead to overcompensation
- High competition may lead to underbidding, resulting in contract failures
- High transaction costs are a barrier for small-scale developers

Literature: Maurer and Barroso 2011, IRENA 2013, del Rio and Linares 2014, Elizondo-Azuela et. al. 2014, European Commission 2014, Held et. al. 2014.

Auction design is the key determinant of its effectiveness

- Supply and demand specification:
  - auctioned targets/scope/volume
  - technological/size/actors/geographical diversity
  - prequalification criteria
- Winner selection process:
  - price-only or multicriteria award, pricing rules, price ceilings, minimum price
- Contract characteristics:
  - duration, penalties for non-complience/delays, updating of remuneration over time

Auction design is the key determinant of its effectiveness

- Supply and demand specification:
  - auctioned targets/scope/volume
  - technological/size/actors/geographical diversity
  - prequalification criteria
- Winner selection process:
  - price-only or multicriteria award, pricing rules, price ceilings, minimum price
- Contract characteristics:
  - duration, penalties for non-complience/delays, updating of remuneration over time

Auctions can be either technology-neutral or technology-specific

Technology-neutral auctions	Technology-specific auctions
Different technologies compete among each other in the same auctions	Bidding process is limited to selected technology or group of technologies
Maximum cost-efficiency and low risk of undercontracting, but only mature technologies are promoted	Provides diversification of energy-mix and incentivise innovation, but the competition may be too low
Only few examples of occurrence, e.g. in Brazil and Netherlands	Widespread practice, more often applied than technology-neutral

Auction system introduced in Poland is rather unique

Categories of installations in Polish auction system:

- With capacity >3504 MWh/MW/year
- With capacity >3504 MWh/MW/year and CO2 emission <100kg/MWh
- Using waste in producing energy
- Using solely biogas in producing energy
- Owned by members of energy cluster
- Owned by members of energy cooperative
- Other

Research question

Should governments support development of a wide range of different RES, or instead focus on supporting selected few?

We allow uncertainty to enter the cost function in two ways

Uncertain magnitude of the learning by doing effect

$$\ln(Cost_i) = -\tilde{\boldsymbol{y}}_{\boldsymbol{i}} \ln(Capacity_i)$$

$$\ln(Cost_i) = -y_i \ln(Capacity_i) + \tilde{\boldsymbol{\eta}}_{\boldsymbol{i}}$$

Possibility for an exogenous random technological shock

Proposition 1

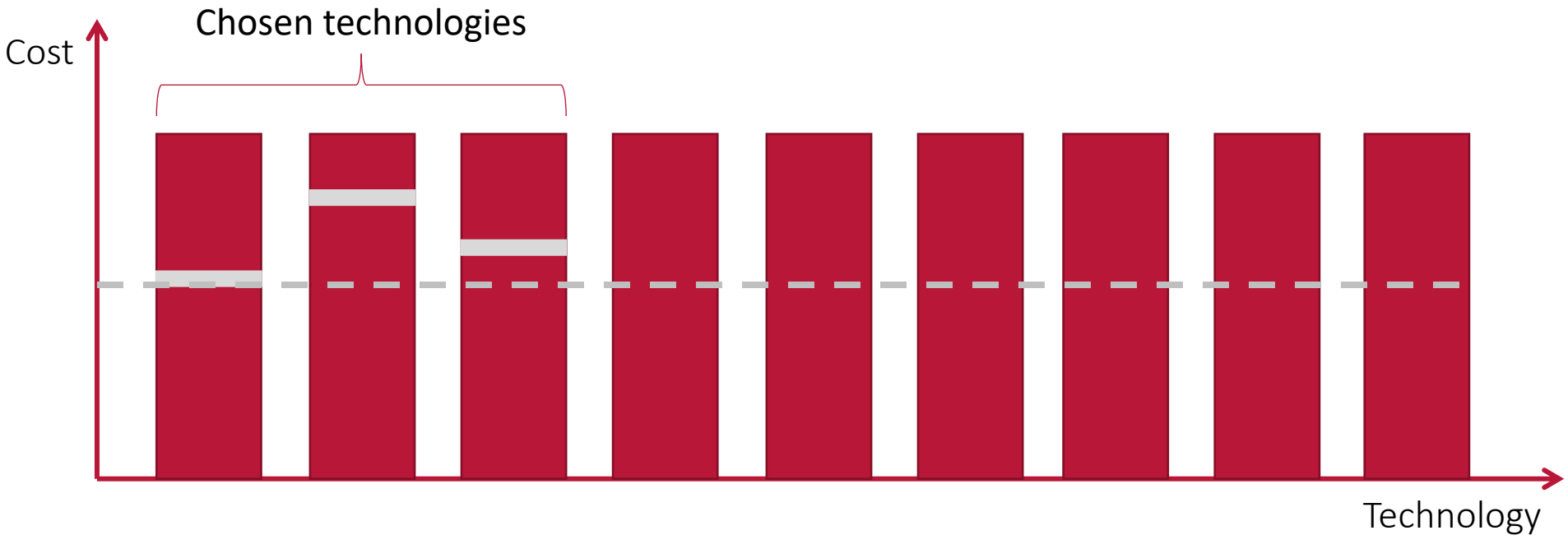
In the presence of uncertainty on the learning rate, expected cost of the winner technology decreases with the number of technologies with the positive investment in the first period. When there is no uncertainty, there is no benefit from the larger differentiation between technologies.

Proposition 1

In the presence of uncertainty on the learning rate, expected cost of the winner technology decreases with the number of technologies with the positive investment in the first period. When there is no uncertainty, there is no benefit from the larger differentiation between technologies.

Proposition 1

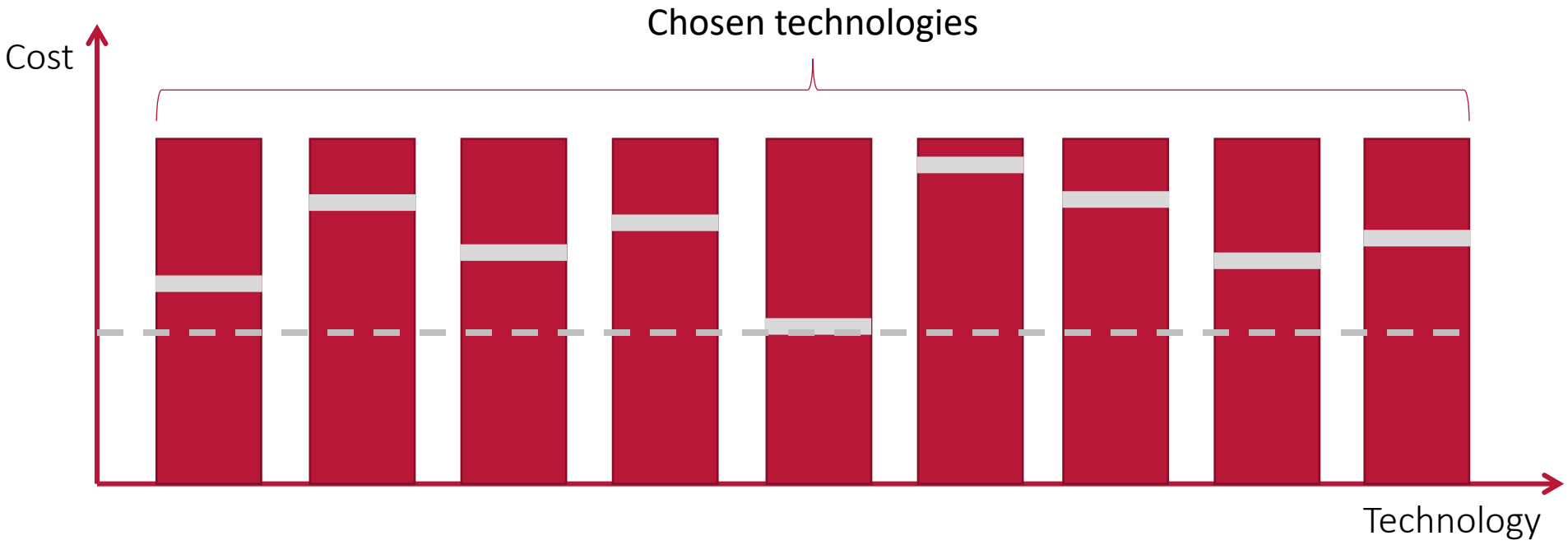
In the presence of uncertainty on the learning rate, expected cost of the winner technology decreases with the number of technologies with the positive investment in the first period. When there is no uncertainty, there is no benefit from the larger differentiation between technologies.



instytut badań strukturalnych

Proposition 1

In the presence of uncertainty on the learning rate, expected cost of the winner technology decreases with the number of technologies with the positive investment in the first period. When there is no uncertainty, there is no benefit from the larger differentiation between technologies.



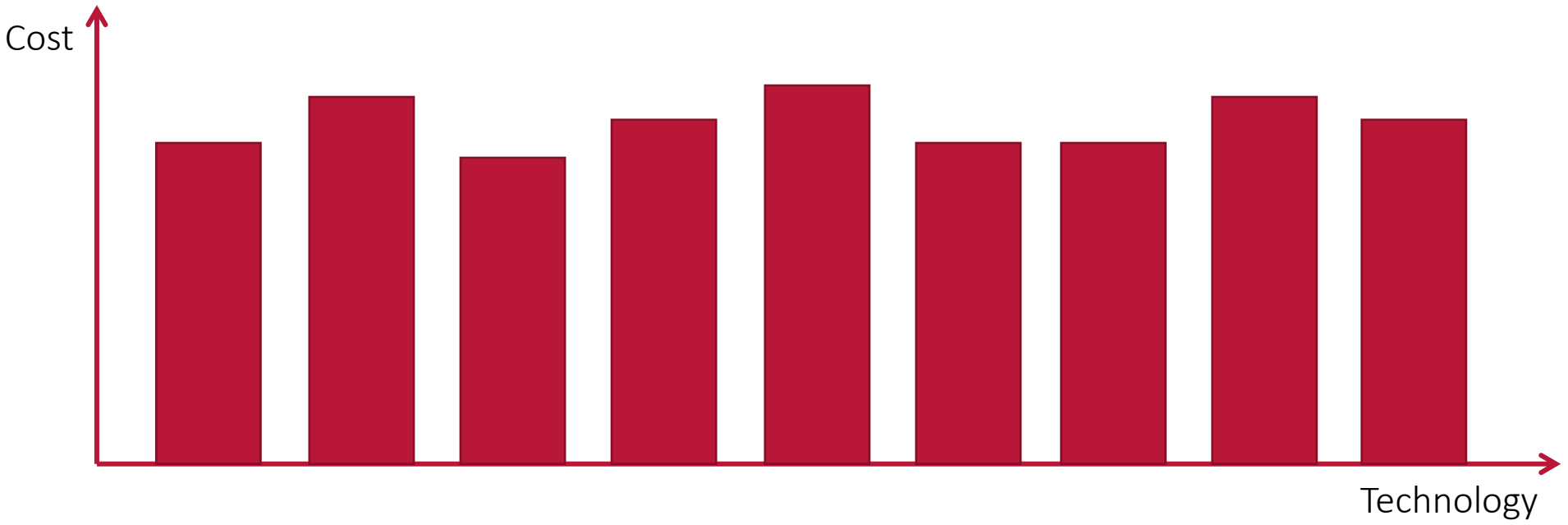
instytut badań strukturalnych

Proposition 2

The uncertainty due to the presence of exogenous shock in the first period increases the cost of differentiation. The uncertainty due to the presence of exogenous shock in the second period will increase the benefit of differentiation.

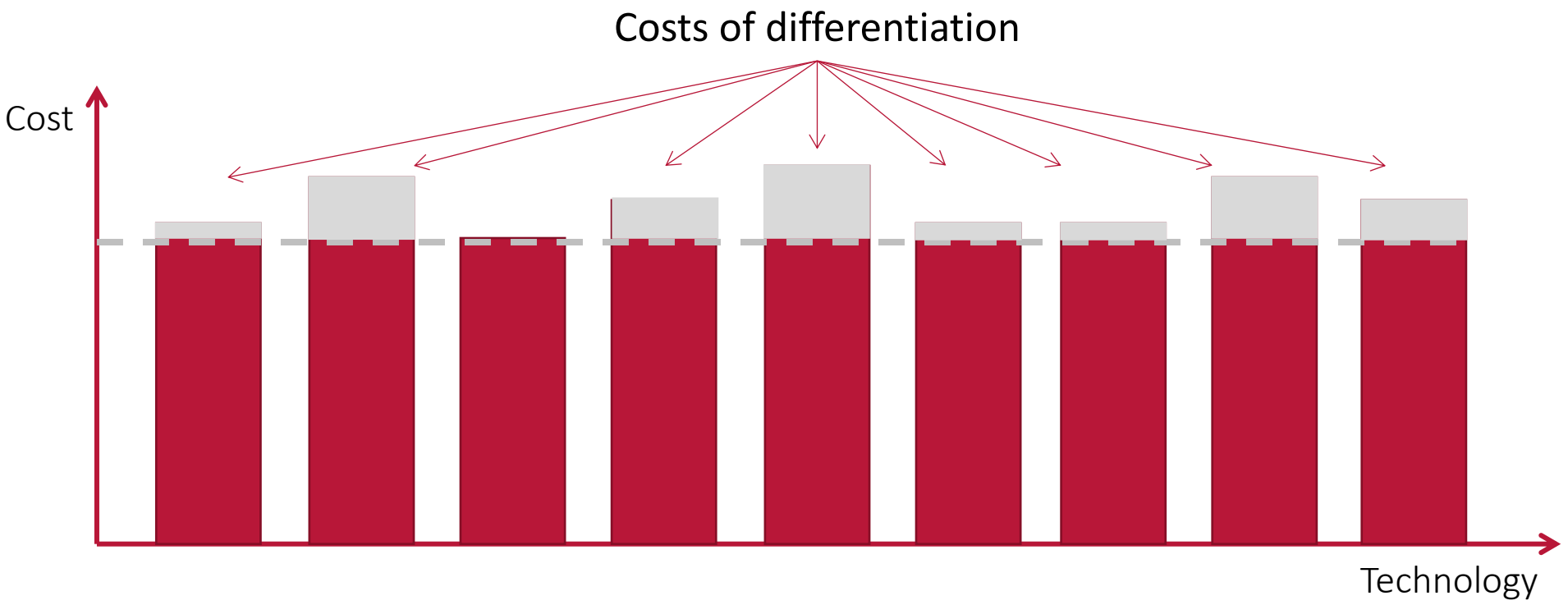
Proposition 2

The uncertainty due to the presence of exogenous shock in the first period increases the cost of differentiation. The uncertainty due to the presence of exogenous shock in the second period will increase the benefit of differentiation.



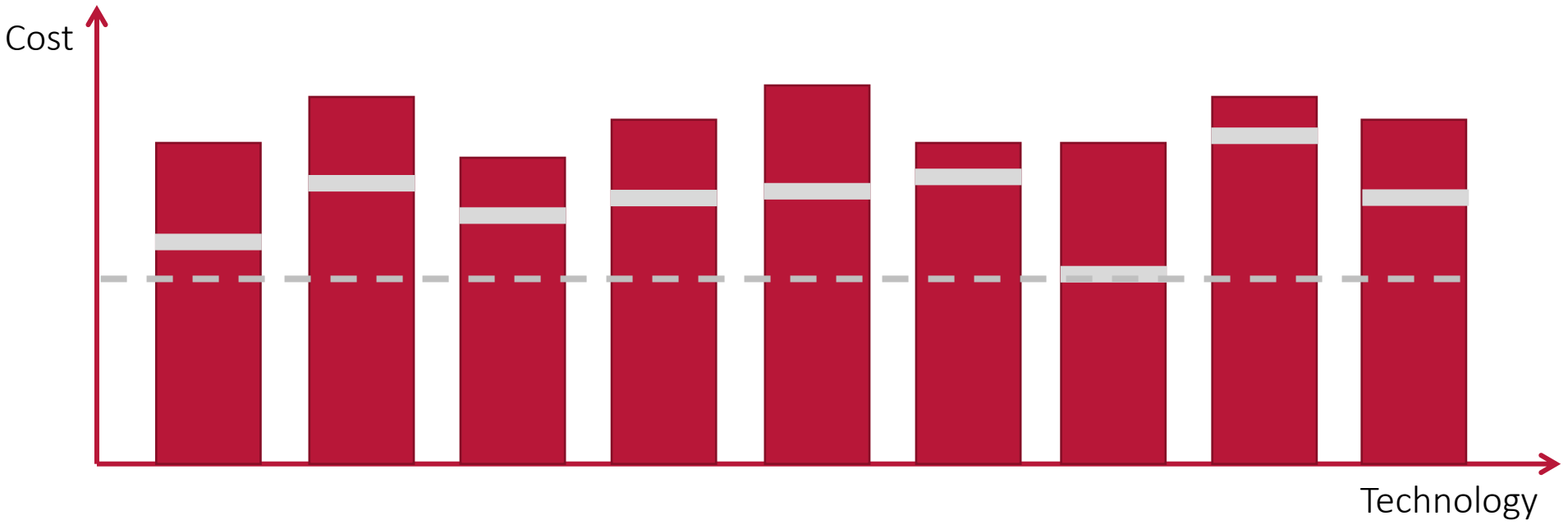
Proposition 2

The uncertainty due to the presence of exogenous shock in the first period increases the cost of differentiation. The uncertainty due to the presence of exogenous shock in the second period will increase the benefit of differentiation.



Proposition 2

The uncertainty due to the presence of exogenous shock in the first period increases the cost of differentiation. The uncertainty due to the presence of exogenous shock in the second period will increase the benefit of differentiation.



Conclusions and policy implications

- RE auctions effectiveness requires making choice between wide range of auction design options
- Uncertainty on the learning rates increases the benefits of differentiation between technologies
- Uncertainty due to the technological shock increases the cost of differentiation in the first period, but it will increase the benefit of differentiation in the second period
- Countries with potentially large learning efects – such as countries at technological frontier – should increase differentiation. On the other hand, peripherial countries should limit differentiation of RE technologies

Jakub Sawulski, Jan Witajewski-Baltvilks

IBS - Institute for Structural Research

jakub.sawulski@ibs.org.pl

jan.witajewski@ibs.org.pl