# “Green Paradoxes”

Paris 2015 and Beyond
Cooling the Climate Debate

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- Partly based on:

F. van der Ploeg and C. Withagen (2015): "Global Warming and the Green Paradox: A Review of the Adverse Effects of Climate Policies", *Review of Environmental Economics and Policy*, 9, pp. 285-303, 2015

# Pricing carbon

- Curbs fossil fuel demand
- Switches demand from CO2 intensive to less CO2 intensive fossil fuel
- Substitutes renewables for fossil fuel
- Leads to more fossil fuel left in the crusat of the earth
- Increases attractiveness of CCS
- Moves directed technical progress to green growth

# Green Paradoxes

Well-intended policies may lead to adverse outcomes.

What if

- a carbon tax is not implemented, or does not reflect the social cost of carbon?
- backstops (renewables) are subsidized?

# Hans Werner Sinn

# Green Paradox: counter-productivity of green policies


Sinn, H.-W. (2008). "Public policies against global warming: a supply-side approach", *International Tax and Public Finance*, 15, 360-394.

**Focus on demand for carbon ignores supply of carbon.**

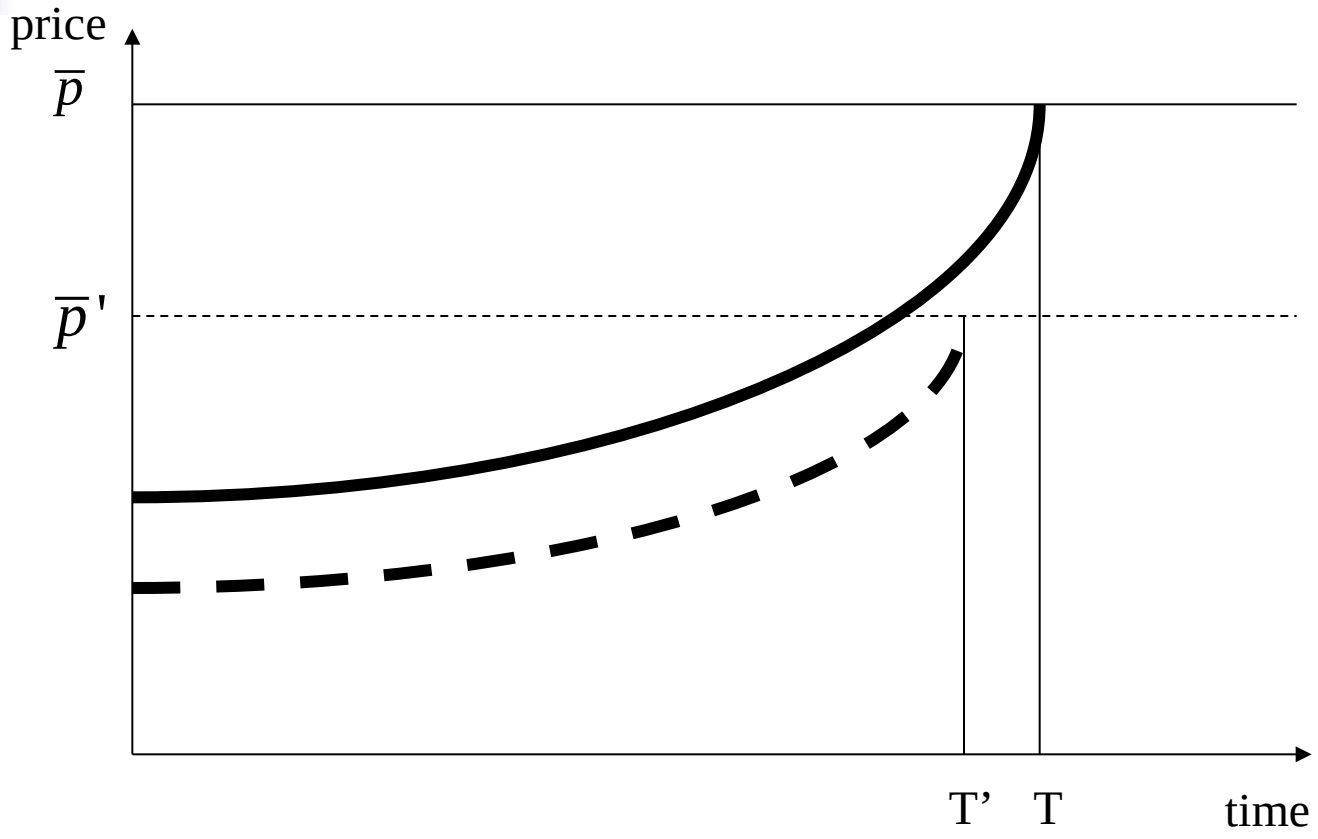
# Green Paradoxes

- Weak: initial extraction goes up.
- Strong: green welfare goes down.
- Super strong: social welfare goes down.

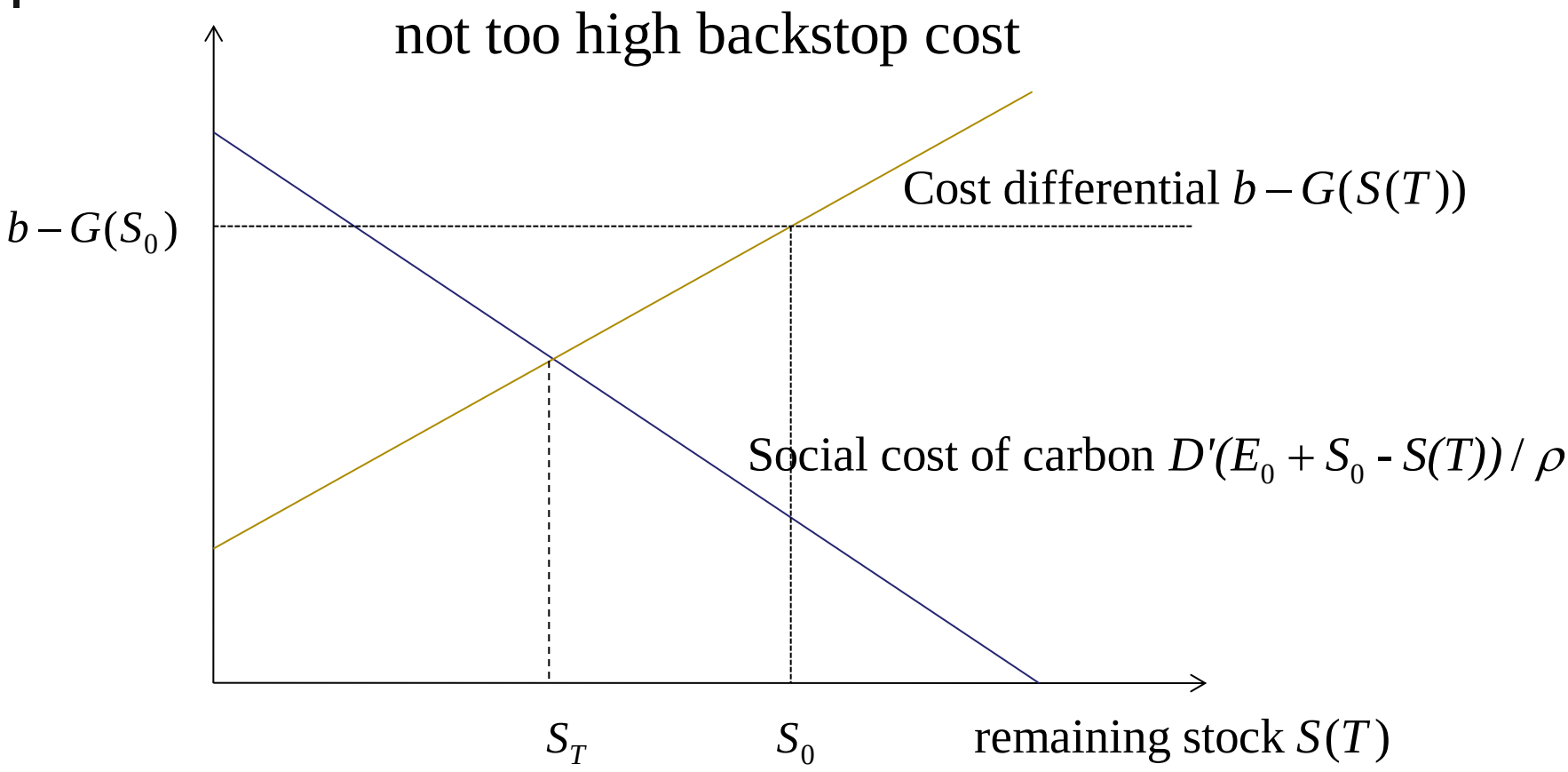
# Hotelling

Harold Hotelling

# Hotelling with backstop



# Stock-dependent extraction cost



# Comparative statics

- Lower backstop price lowers *MB:*

  Higher remaining stock

- If global warming is acute:

  Higher remaining stock

- More patience:

  Higher remaining stock

# Additional issues

- Upward sloping supply of renewables
- Dirty backstops
- Imperfect substitutability
- Capital accumulation and economic development
- Multiple countries/regions
- Imperfect competition. Strategic behavior
- Innovation

# Upward sloping supply of renewables

Two effects.

- Higher subsidy on renewables increases supply of renewables.
- With constant marginal extraction cost all fossil fuel is exhausted. Hence lower fossil fuel price.

→No green paradox.

# Dirty backstops

- Coal, tar sands
- Typically oil→oil+coal→coal in optimum
- Typically oil→coal in market economy
- Subsidy is bad in market economy
- With clean renewables, subsidy on renewables needs to be high.

# Substitutability

- Coal, oil and carbon-free renewables.
- Future tax on coal depresses oil price today and thereby demand for coal.
- No green paradox.

# Capital accumulation

- Green growth model with capital accumulation.
- In a ‘poor’ economy marginal utility of consumption is high, marginal damages are low. Green paradox occurs but doesn’t harm welfare much.

# Multiple countries

- Oil-importing and oil exporting regions.
- Making the interest rate endogenous: may lead to attenuation but also to amplification of the green paradox.
- Countries with different policies: green paradox might be mitigated

# Different carbon taxes

Inelastic demand 10

$$10T_1 + 10T_2 = S_0$$

$$p_0 e^{rT_1} + t_1 = b$$

$$p_0 e^{rT_2} + t_2 = b, t_2 < t_1$$

$$t_2 \uparrow \Rightarrow p_0 \downarrow, T_1 \uparrow, T_2 \downarrow$$

Higher climate cost

Lower social welfare

# Imperfect competition

- Reversal of the green paradox
- Limit pricing

# Innovation

- Uncertainty on breakthrough technologies
- Directed technical change
- Kick-starting green innovation

# Conclusions

- Stranded assets
- Optimal carbon taxes
- Empirics