To Build or not To Build? Capital Stocks and Climate Policy

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Irreversibility and Investment Decisions

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- Transport Infrastructure
- Telecommunications
- Design and shape of cities

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Irreversibility and Investment Decisions

Cities best exemplify the costs of delaying action on climate change and locking into resource-intensive infrastructure and behaviours. Cities in emerging economies are building the bulk of their infrastructures in the next two or three decades. The urban form they lock in to will have a massive impact on their resilience to resource costs for decades and centuries to come.

Dimitri Zenghelis and Nicholas Stern, *The Guardian*

Irreversibility and Investment Decisions

- Power plants: fossil fuel based versus renewable

$1tn could be wasted on 'unneeded' new coal plants, report warns

Investment in 1,500 new coal plants around the world could be wasted if action on climate change and pollution prevent them from being used

In China, existing plants are now used just 50% of the time, coal use is falling and new permits and construction have been halted in half of the nation's provinces. Photograph: Johannes Eisele/AFP/Getty Images

Irreversibility and Investment Decisions

March 30, 2016 7:59 am

Energy companies warned against building new power stations

Pilita Clark, Environment Correspondent

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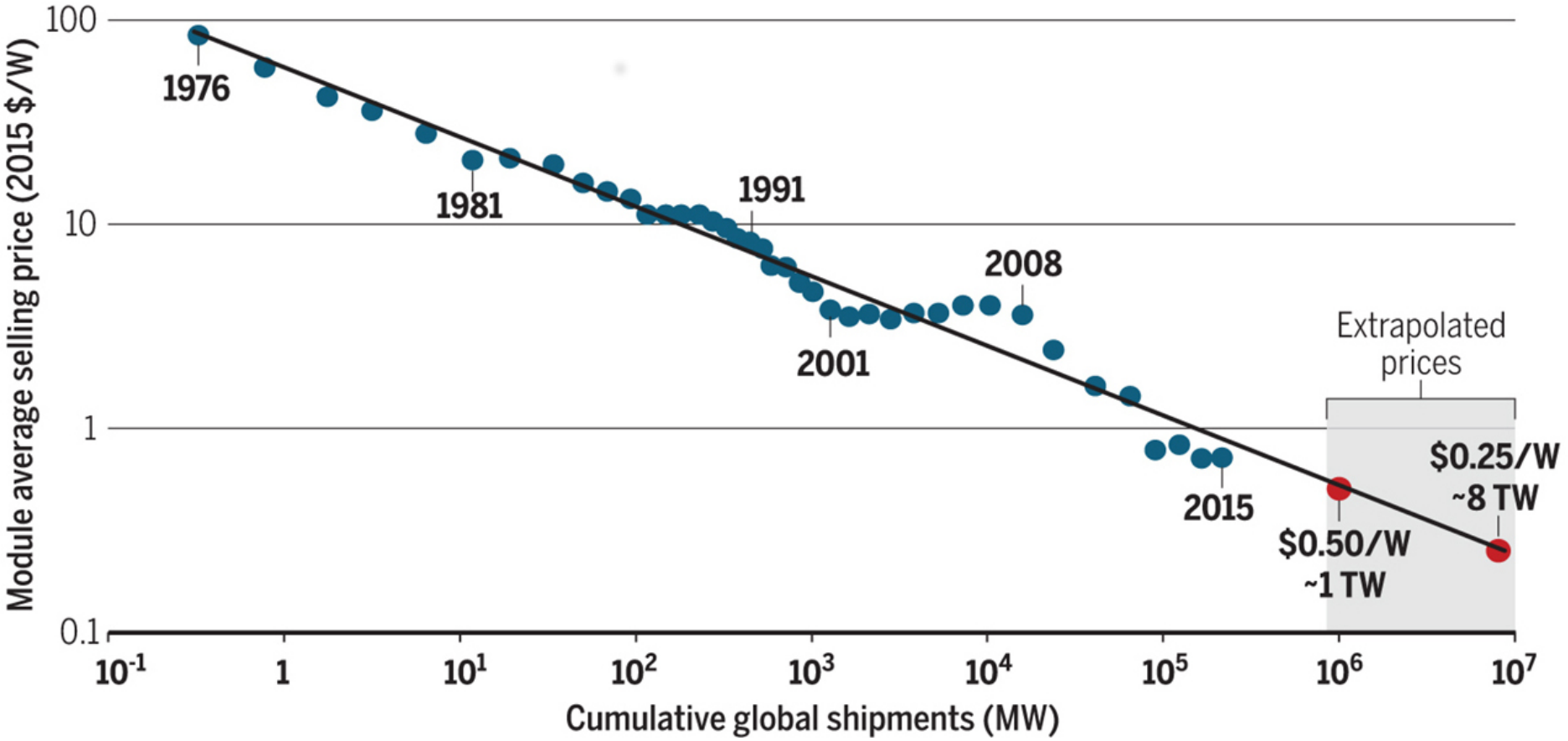
Energy companies can keep building new coal and gas power stations for only one more year if the world is to avoid dangerous levels of global warming, Oxford university researchers have found.

The startling finding dashes the widely-held assumption that climate change is a distant problem that today's governments can safely leave to their successors.

Irreversibility and Investment Decisions

Price p_t^H of PV evolves with installed capacity H_t as Arrow (1962):

$$p_t^H = p_0^H \left(\frac{H_t}{H_0} \right)^{-\lambda}$$



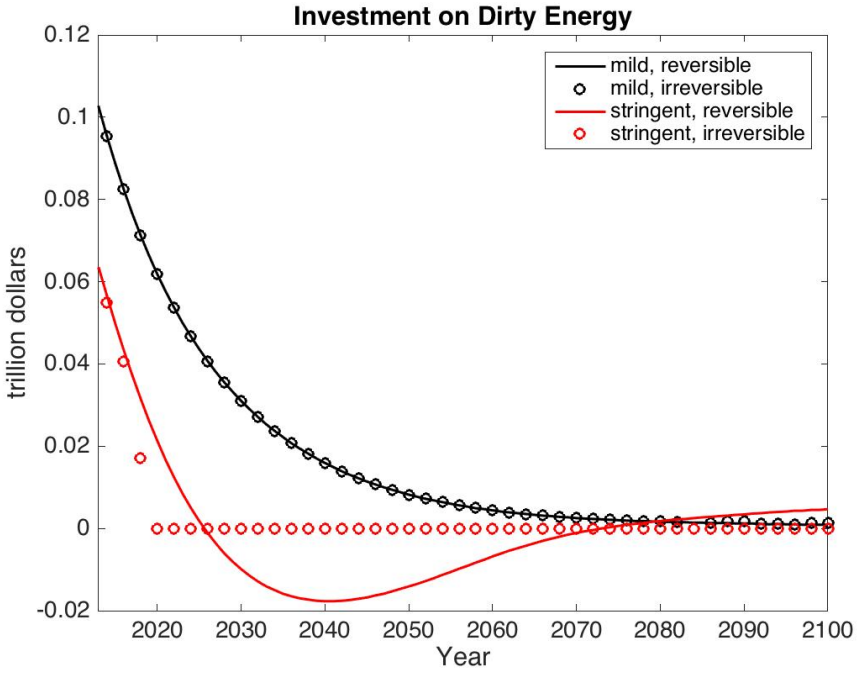
Source: Haegel et al. (2017)

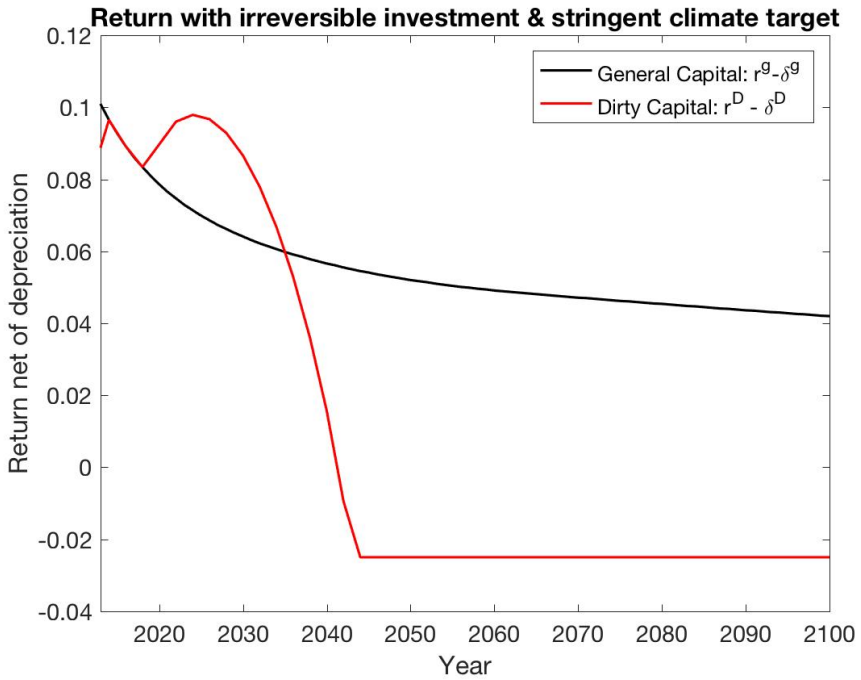
Irreversibility and Investment Decisions

- Suppose demand for a product falls, and investment will become obsolete.
- Suppose another product's price is falling with cumulative deployment.

- Three natural questions arise:
  1. When to stop investing in a sector that will become obsolete?
  2. How much should we invest in the sector which is "learning"?
  3. In the "second-best" world of only one policy lever, which is more important?

Investment and Returns on Dirty Energy Capital





Conclude

- Investment ends before the value drops (and before underutlization begins). Early gains must compensate for later loses
- See also Fouquet (2012) for historical example
- Energy transition depends on stringency of climate policy
- If climate policy is stringent, the Irreversibility Effect advances withdrawal from sector by 7 years.

The Irreversibility Effect

- Investment ends before the value drops
- Emissions are reduced in the short-run
- Follows that capital stock effects on the **demand** side for fossil fuels **enhance** the effect of climate policy.
- Contrast with the "Green Paradox": **supply** side for fossil fuels: **counteracts** the effects of the carbon tax

What Do We Do?: 3 research questions

1. When to stop investing in a sector that will become obsolete?
2. **How much should we invest in the sector which is "learning"?**
3. In the "second-best" world of only one policy lever, which is more important?

The Acceleration Effect

When renewables are characterized by learning externality: subsidy increases with the rate of deployment

- Early withdrawal from the dirty energy sector $\rightarrow$ enhances future deployment of clean technology $\rightarrow$ a greater subsidy in the short-term

What Do We Do?: 3 research questions

1. When to stop investing in a sector that will become obsolete?
2. How much should we invest in the sector which is "learning"?
3. **In the "second-best" world of only one policy lever, which is more important?**

Second-best policies

Consider real-world policy situations:

- Political desire to avoid "picking winners"
- No acceptability of "new taxes".
- Strong lobbying for subsidies / budget concerns to avoid them

Government may find it easier to pick only one instrument. So consider:

- Optimal second-best response with only a carbon tax;
- Optimal second-best response with only a renewables subsidy.

What are the consequences? Which does better?

Welfare Loss from 2nd Best Policy

	Optimal tax zero subsidy	Optimal subsidy zero tax
Reversible investment mild policy	1.90%	1.59%
Reversible investment stringent policy	2.52%	5.59%
Irreversible investment stringent policy	2.49%	3.56%

Table: Second-best policies: welfare loss, % of initial period consumption

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Table: Second-best policies: welfare loss, % of initial period consumption

- Stringent Policy: carbon tax does better.
- Mild Policy: subsidy does better.

Summary

- More ambitious climate policy means that irreversible investments into "dirty" infrastructure should stop, soon. Existing infrastructure will be used, then underutilised.
- Considering **demand** instead of supply for fossil fuels provides an "Irreversibility Effect", counter to the Green Paradox, that reduces emissions earlier.
- Of course, this effect depends on long-term, credible climate policy.
- Learning-by-doing implies we should invest early in renewables, with a higher subsidy if we expect learning or deployment to be high.
- Without this subsidy, the energy sector transition is delayed.
- For mild climate goals, the subsidy is more important than the tax.