

Issues for Financing Transformation Investments

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What is Climate Finance?

- **Assumes a decision to make investments and bear costs.**
 - Whether with caps, carbon taxes, subsidies, regulatory interventions, whatever... in short, some shadow prices.
- **How to design the channels that enable the investment flows to go where they are needed at lowest cost?**
 - In many cases, if you set a price that makes the activity profitable, they will come.
 - But not always!

Example: Sequestration

- **Sequestration can potentially help reduce atmospheric concentrations.**
 - Biosequestration, geologic sequestration, ocean sequestration.
- **A Question of Permanence.**
 - Is the sequestration long-lived? If not permanent, is it long enough lived to be useful?
 - How long is enough?
 - Depends on the projected time path of the social cost of carbon: Herzog, Caldeira and Reilly (2003)
 - This is a big issue.
 - How do we structure financing to properly incentivize investment and management of sequestration projects?
 - This is another big issue.

Environmental Bonding

- **A classic financial structure.**
 - Mill (1972) and Solow (1971).
- **Used in the U.S for various mining and drilling activities, and for nuclear decommissioning:**
 - GAO (1986, 1988, 2005 and 2008), Pennsylvania Department of Environmental Protection (2000) GAO (2003), Gerard (2000) and Boyd (2002).
- **Discussed for carbon sequestration.**
 - Edenhofer, Held and Bauer (2004), Held, Edenhofer and Bauer (2006) and Gerard and Wilson (2007)

Operation

- **Credit for avoided emissions at the time of injection, equal to the quantity sequestered times the social cost of carbon.**
- **At the same time, establish an escrow account to fund any potential liability from future release of carbon.**
 - Any releases require debits equal to the quantity released times the then current social cost of carbon.
- **Through time...**
 - Account earns income. Potentially available for payout.
 - Must maintain the escrow account through time at a sufficient level. With a rising social cost of carbon, the potential liability for already sequestered carbon rises, requiring an increasing balance in the account.
- **Net cash flow depends on the income earned versus the addition required.**

Toy Model & Heroic Assumptions

- **Project:**
 - @ $t=0$, discrete injection of Q tons, at cost $\$K/t$ CO₂e.
 - Costless management.
 - @ $t=H$, discrete release of all Q tons.
- **Risk-free rate of interest**
 - Constant at $R\%$.
 - Rate earned on the escrow account.
- **Social Cost of Carbon (SCC)**
 - @ $t=0$, social cost of carbon (SCC) = $\$C/t$ CO₂e.
 - Through $t=B$, SCC grows at a constant $R\%$ per year.
 - @ $t=B$, SCC is constant.

Implications for Bonding

- **No cash payouts until $t=B$.**
 - There is no realized value from sequestration unless the carbon remains sequestered past $t=B$.
 - This is NOT what many proposals for REDD+ type projects imagine.
- **Sequestration is a long duration investment.**
 - A problem?
 - We have many other long duration investments, especially in real estate and infrastructure. Investors are typically insurance companies or similar.
 - Cash flows BETWEEN entities on the value chain are OK, but not net external cash flows.

Institutional Challenges

- **Bonding has had mixed results.**
 - U.S. mining liabilities have often been underfunded.
 - U.S. nuclear decommissioning have generally worked, so far.
- **Similar long-horizon funding problems have had mixed results.**
 - Pension funding, medical insurance liabilities.
 - Complicated questions about the different rates: growth rate for the social cost of carbon vs. rate earned on escrow.
- **Risk is a big issue.**
 - Social cost of carbon is stochastic: Daniels, Litterman and Wagner (2015).
 - A challenge for bonding, since CONTRIBUTIONS to the escrow account may be required.

My Inventory of Climate Finance Issues

- **1. Financing R&D.**
 - Classic public goods problem. Unique issues for climate finance?
- **2. Financing adaptation.**
 - Classic public goods problem. Unique issues for climate finance?
- **3. Inefficient institutions.**
 - Old frictions under new stress: energy efficiency investments.
 - New challenge: sequestration
- **4. Immature capital markets in many developing countries.**
 - Role of government funding channels and how to optimize.

Gripes

- **The Health of the Overall Financial System.**
 - The vast majority of climate investments will be readily funded through the standard financial system. Not an problem.
 - Don't do stupid shit. Even in the name of green. Really. Don't.
- **A Low Price for Carbon is the Main Problem.**
 - But it is not a finance problem per se.
- **IPCC AR5**
 - Agenda shaped by politics, not science.
 - Omits many of the main climate finance issues.
 - Traffics in fallacies.
 - Tying sources and uses - High Level Advisory Group on Climate Change Financing (AWG)
 - Social value of transferring private risk to governments.
 - Substitution of headline numbers for hard facts.

The End

