The Carbon Bubble: Climate Policy in a Fire-Sale Model of Deleveraging by Comerford and Spiganti

Discussion

Manoj Atolia
International Monetary Fund
&
Florida State University

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Overview

- Fossil fuel stock vastly larger than cumulative allowable emission.
- **Carbon Bubble:** The valuation of fossil fuel assets is a bubble.
  - So is also the valuation of companies using cheap fossil fuel.
- A quantitative economic analysis of implications of bursting of the carbon bubble.
- Amplification of bursting of carbon bubble through financial sector
  - specifically through financial accelerator mechanism
  - modeled as in Kiyotaki and Moore (1997).
- Feedback effects of macroeconomic effects of bursting of carbon bubble
  - on transition to carbon-free world
  - via impairment of investment in green technology, precisely when such investment is needed the most.
- What policies can mitigate the effects of this adverse spiralling mechanism?

Policy Analysis

What policies can mitigate these adverse consequences?

1. Tax Funded transfer of investors' debt to government.
   - Good even otherwise.
   - Transfer 90% of debt.
   - Price of capital rises by 17% (versus 39% fall without.)
   - Cumulative investment in zero carbon energy: 50% higher
   - Welfare: 5% higher (Enterpreneurs: +73%; Savers: -11%)
2. Subsidizing Investment: Untargeted (could be targeted.)
   - "Black box" distortion makes subsidy not beneficial otherwise.
   - Optimal subsidy boosts productivity by 45%.
   - Price of capital falls by only 2%.
   - Cumulative investment in zero carbon energy: 40% higher
   - Welfare: $>$ 3% higher (Enterpreneurs: +49%; Savers: -7%)

Policy Analysis: Contd.

What policies can mitigate these adverse consequences?

3. Government guarantees on investors' borrowings.
   - Free lunch
   - Optimal guarantee: 20%.
   - Price of capital falls by about 25%.
   - Cumulative investment in zero carbon energy: 8% higher
   - Welfare: About 3% higher (Entrepreneurs: +19%; Savers:0%)

4. Deception: Announcing carbon budget, $\hat{S}$, larger than 2°C target requirement.
   - Free lunch
   - Optimal $\hat{S}$: Consistent with 28% write off of high energy capital (versus 50%)
   - Price of capital falls by about 15%.
   - Cumulative investment in zero carbon energy: 12% higher
   - Welfare: $>$ 2% higher (Entrepreneurs: +17%; Savers:0%)

Comments: The big picture

Are there some rational reasons why carbon assets are not being priced at zero?

World's Largest Carbon-Capture Plant to Open Soon

Towers will grab gas emitted by a huge coal power plant, but use it to pump oil out of the ground

The Petra Nova carbon capture system is under construction at the W.A. Parish Generating Station, a coal-fired power plant southwest of Houston (*pictured above*). *Credit: ROY LUCK Flickr CC BY 2.0*

On schedule, on budget.

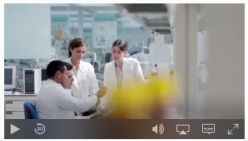
It's a tall order for any new technology, but for a commercial carbon capture and storage (CCS) system, it might be the start of a revolution.

Comments: The big picture

Are there some rational reasons why carbon assets are not being priced at zero?

Scientists Accidentally Discover Method to Turn Carbon Dioxide Into Ethanol

Justin Worland • Oct. 19, 2016



Scientists Accidentally Discover Method to Turn Carbon Dioxide Into Ethanol

A team of scientists in Tennessee accidentally discovered a new method to convert carbon dioxide to ethanol, a finding that could aid the development of new methods to fight climate change.

Overview of Approach

- Aggregrate Economy

$$Y = A\tilde{F}(K, L) = A\tilde{F}(K, 1) = AF(K) \tag{1}$$

$$P_k = H(A) \tag{2}$$

- Aggregrate Economy with resources

$$Y = AF(K; X) \tag{3}$$

$$P_k = H(A; X) \tag{4}$$

- Aggregrate Economy with two types of capital

$$Y = A \times \min\{F(K; X_1), G(Z; X_2)\} \tag{5}$$

$$P_k = H(A; X_1, X_2) \tag{6}$$

- What happens if X_2 falls due to government regulation and there are financial frictions?

Comments: Motivation and model

What is the nature of financial frictions being captured by the model?

- **Motivation:** What assets are being mis-priced and, being collateralized, will lead to "fire-sale" dynamics?
  - Primarliy: fossil fuel assets, i.e., "unburnable carbon"
  - Also: companies using cheap fossil fuel
- **Model:** What assets are present and are being collateralized?
  - Physical capital which is in constant supply and does not depreciate over time.
  - Energy capital that is created from goods, but is not collateralized.
- The model has a **steady state** (in fact, a continuum of them), in absence of no action.
  - How does one think of this vis-a-vis the real world where current situation cannot be considered as a steady state, in light of a finite supply of fossil fuels?

Comments: Data/Calibration and model

- **Model:** Technologies
  - Dirty:
  $$y_t = (a^H + c) \times \min(k_{t-1}, z^H_{t-1}) \tag{7}$$
  - Clean:
  $$y_t = (a^L + c) \times \min(k_{t-1}, z^L_{t-1}) \tag{8}$$
  - $a^H > a^L > 0$
- **Data/Calibration:**
  - Calibration assumes:
  $$a^L = c$$
  - Data from EIA: "fossil fuel generation costs around 10% less per unit of energy supplied."
  - Calibration, therefore, sets
  $$a^L = c = 0.9a^H \qquad \Longrightarrow \qquad a^L + c = 1.8a^H \qquad \text{and} \qquad a^H + c = 1.9a^H$$
- Perhaps there is scope to improve calibration here.
  - Different 'ϕ' instead of different 'a' for dirty and clean technology?

Further Research

1. Relaxing the assumption of "fixed K"
   - It may help mitigate large swings in asset/capital price.

2. Including explicit financial intermediation
   - It will allow for effect of impairment of intermediary balance sheets due to bursting of carbon bubble on the macroeconomy.