Corporate Taxation and Carbon Emissions

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Is our tax policy favoring dirty industries?

- Economists' favorite tool to address climate change: direct CO_2 taxes.
- These are not forthcoming, but a plethora of other taxes already exist.
  - Do these on balance favor or discourage the emission of CO_2?
  - What are the emission effects of changing tax policy (for other purposes)?
- This paper: Our corporate tax policy already favors dirty industries by making debt tax-deductible.
  - Dirty industries (happen to?) have more tangible assets $\rightarrow$ Tangible assets serve as better collateral for debt financing $\rightarrow$ Debt financing is tax-favored $\rightarrow$ Dirty industries receive an implicit subsidy!
- **Very clever insight and convincing empirical analysis!**

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Figure: Property plan equipment (firm) x CO_2 over sales (industry)

Dirty industries have more debt

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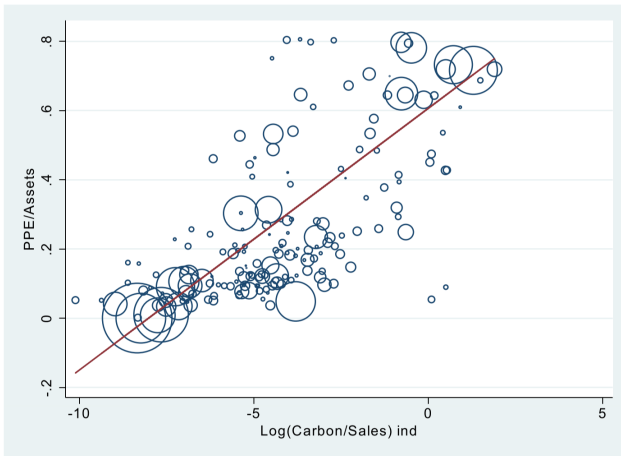

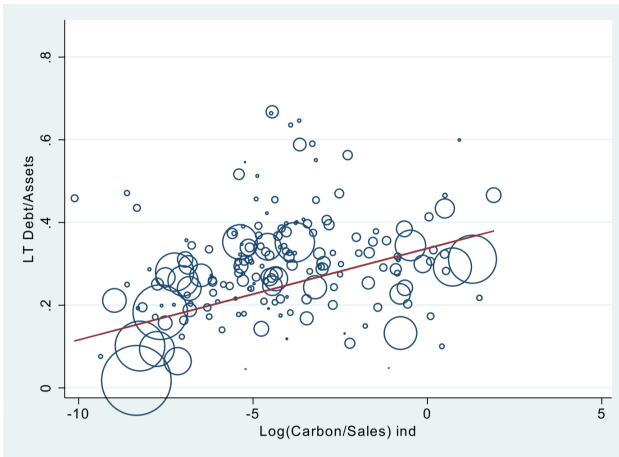Figure: Leverage (firm) x carbon over sales (industry)

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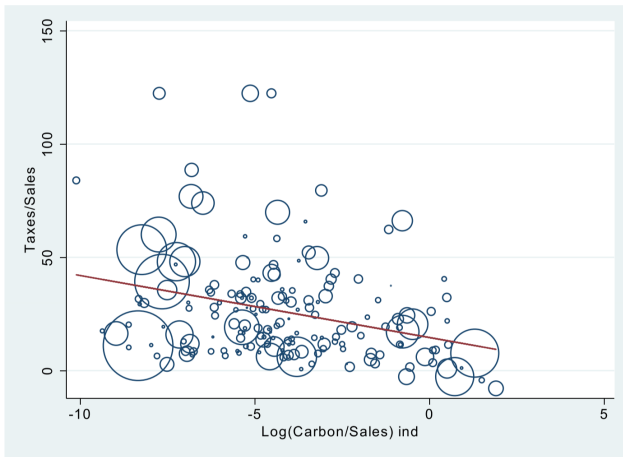- Paper argues that
  - Mechanism is through higher tangibles and debt
  - Largely happens across industries
- That's welcome and supports the hypothesis, but is not necessary for overall argument: Negative relationship between carbon intensity and taxes is inefficient, (almost) regardless of why and whether it is a firm - or industry-level effect.

Reflections

- Is taxes over sales really the right measure? Markups, intermediate input share etc. differ. Does model take that into account?
- Any model must face tradeoffs
  - Added features here: input/output tables, numerous taxes, endogenous labor. Not all of these matter quantitatively
  - Missing features: i) Agg prod function is Cobb-Douglas, ii) Explicit welfare analysis.
- Somewhat of a shift towards the latter might be worthwhile. I'll discuss both in turn.

The importance of energy-intensive sectors.

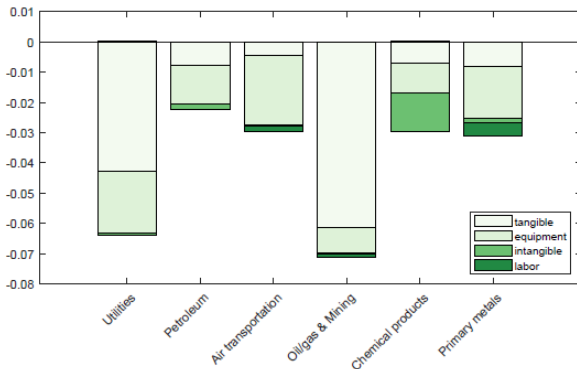- Energy is a big driver of results when moving tax shield:

Figure 1. Response of output and different inputs to a policy that removes the tax shield of debt, for the six most carbon-intensive sectors.

The substitutability of energy and other inputs

- The environmental economists insist that you are not to model:

$$Y = F(\text{Energy}, \text{Other inputs})$$

  as a Cobb-Douglas (Acemoglu, Aghion, Bursztyn, Hemous 2012; Fried, 2018; Hemous and Olsen, 2021, AR)
- You are, however, allowed to model

$$Y = F(\text{clean energy}, \text{dirty energy})$$

  as having a high elasticity of substitution. Solar panels could have even larger tangible assets. Perhaps it will soon be good for the environment that we have debt deductibility!

Tax analysis

- We have a dynamic version of:
  - Consumption is given by:

  $$C(\{\tau_i\}_{i=1}^N) = Y(\{\tau_i\}_{i=1}^N) - rK(\{\tau_i\}_{i=1}^N),$$

  where Y is aggregate output $\{\tau_i\}_{i=1}^N$ is a vector of effective tax ratios and rK is consumption of capital (many other things in the real model: default, property taxes etc.) Model has labor supply, but not very important quantitatively.
  - Emissions are given by

  $$G(\{\tau_i\}_{i=1}^N) = \sum_i e_i Y_i \{\tau_i\}_{i=1}^N),$$

  where Y_i is output in individual sectors and e_i is the per-unit-of-output sector-level of emissions.
  - One would ideally combine these into a welfare function:

  $$W(\{\tau_i\}_{i=1}^N) = C(\{\tau_i\}_{i=1}^N) - \lambda G(\{\tau_i\}_{i=1}^N),$$

  where λ is social cost of carbon.

Tax analysis - cont

- Define the average tax rate $\bar{\tau} = \frac{1}{N} \sum \tau_i$ (or some weighted average):

$$W(\{\tau_i\}_{i=1}^{N}) = \left[\underbrace{W(\{\tau_i\}_{i=1}^{N}) - W(\{\bar{\tau}\}_{i=1}^{N})}_{\text{Cost/benefit of sector-level variation in taxes}} \right] + \underbrace{W(\{\bar{\tau}\}_{i=1}^{N})}_{\text{Welfare for average tax rates}}$$

- Ideally we would like to have $Cov(\tau_i, e_i) > 0$ but in practice it is $Cov(\tau_i, e_i) < 0$. Clearly room for welfare improvements for *given* average tax $\bar{\tau}$.

- However, removing the tax shield does two things: increases overall corporate taxes and sets $Cov(\tau_i, e_i) = 0$. I would like to understand these two separately

Tax analysis - cont

- Why is this important?
- Take the analysis of the paper:
  - Aggregate Consumption declines by 1.91%. Aggregate consumption in the United States is \$14 trillion (BEA)
  - Aggregate Emissions decline by 4.24%. Aggregate emissions is 5000 (this paper) to 6500 (EPA) million tonnes
- What is the cost per unit of carbon reduction[1]:

$$\frac{1.91\% \times \$14\text{trillion}}{4.24\% \times 6500\text{million tonnes} Co_2} \approx \frac{1000\$}{\text{tonnes } Co_2}.$$

- But the social cost of Carbon is somewhere between 30-200 \$/tonne(Nordhaus literature).
- Seems like: Corporate taxation is extremely costly: Corporate taxes should be lowered dramatically (low $\bar{\tau}$) and then (maybe) have some variance within that range. Would be nice to see that analysis formally.

[1]Ignoring usual point about how one is not really allowed to compare steady states like this

Conclusion

- Splendid insight!
  - Compelling and very strong empirical regularities. Convincing story of why this relationship exists.
- Model framework is ambitious and carefully modeled (perhaps some of the features could be extensions in an appendix)
  - I would focus more narrowly on welfare consequences and sensitivity to elasticities of substitution
- Great paper!