What Do Economists Have to Say About the Clean Air Act 50 Years After the Establishment of the Environmental Protection Agency?

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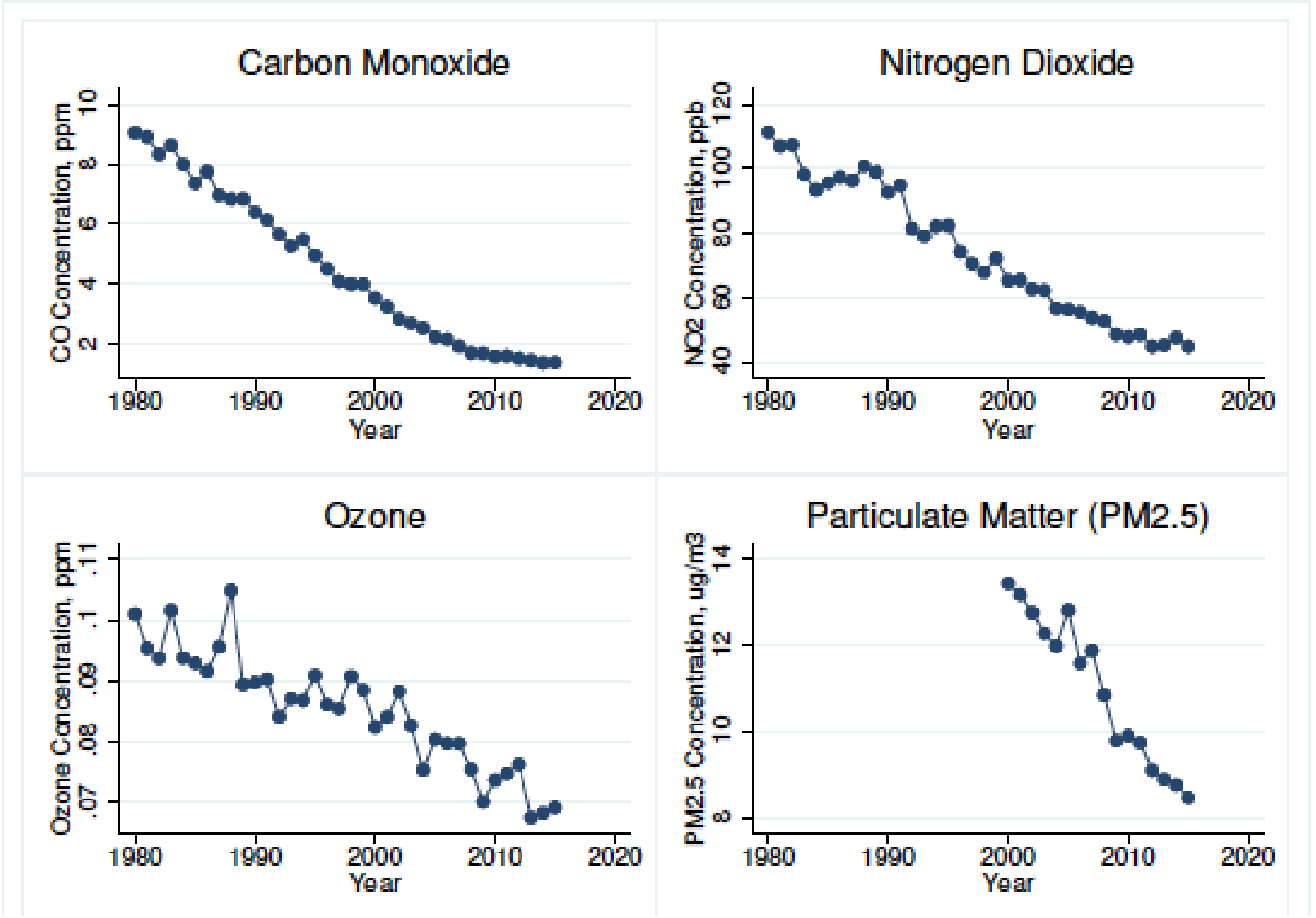
50 years of policy change in one minute

- The original CAA mechanism: EPA designates counties as being in nonattainment if they exceed thresholds for criterion air pollutants and mandates abatement measures.
- 1977 amendments: “New Source Review," regulates pollution sources in *attainment* counties. In nonattainment areas, new stationary sources required to purchase offsets. Established major permit review requirements.
- 1990 amendments: updated NAAQS, broadened EPA enforcement power, created new market-based mechanisms (e.g. SO^2, allowance-trading program). New tail-pipe emissions standards, mandated lead-free gasoline, established new auto gasoline reformulation requirements and evaporative emissions standards, mandated new gasoline formulations to reduce ozone.
- 1990 amendments allowed regulation of 189 hazardous air pollutants for the first time.
- Further changes – PM2.5, Tier 2 standards for auto emissions, NOx Budget Trading Program →Cross State Air Pollution Rule.

Impressive reductions in criterion air pollutants

Figure 1: Trends in Air Pollution in the United States, 1980 to 2015



The CAA has resulted in cleaner air

- Henderson (1996): nonattainment designation improves air quality ~10-15%.
- Market based programs may have had larger effects. E.g. Deschenes et al. (2017) finds a 40% reduction in NOx emissions.
- Market based programs have problems too: e.g. Chan et al.-- (2018) SO^2 permits can be traded between low population/low abatement cost areas and high population/high abatement cost areas, which reduces gains to health relative to equal reductions across areas. Fowlie (2010) – interactions of market programs with existing regulation can reduce effectiveness.
- Less research on mobile emissions standards or the HAPS program.
- Shapiro and Walker (2018) find that virtually all of the observed reduction in pollution since 1990 can be explained by environmental policy rather than increases in trade or offshoring.

How should we value cleaner air?

- Housing prices (do they fully capitalize benefits?)
  - Requires full information about pollution levels and the effects of pollution.
  - Difficult to track value of housing in areas with few sales.
  - People may not be able to move (e.g. credit constraints).
- Worker/student productivity
- Effects on crime and other outcomes (e.g. from de-leading gasoline)
- Health effects
  - Short and long-term effects on mortality and morbidity, especially in infants and the elderly

Putting a dollar value on benefits

Estimates of the value of a “statistical life”

- Problems with using the same value for everyone
- QALYs (Quality Adjusted Life Years) also involve strong assumptions.

- Avoidance causes observational estimates to underestimate benefits.
- Estimates to date value separate components of CAA policy not combined benefits.

Regulatory Costs of the Clean Air Act

- We want the monetized change in social welfare from the reallocation of resources from the production of goods and services to pollution abatement activities (Hazilla and Kopp 1990).
- Private expenditures on compliance costs or engineering cost estimates are insufficient measures of economic costs.
- Total costs should also include monitoring and enforcement.

Approaches to Measuring Regulatory Costs

1. Use microeconomic methods to identify causal effects.

- Limitations: Attainment areas may be poor counterfactuals for nonattainment areas. Some new approaches to this problem from macro and international economics.

2. IO studies of a single industry that are used to estimate counterfactuals with and without regulation. Used especially in the electricity generation market.

3. Computable GE models for counterfactual analyses of costs/output under different regulatory regimes.

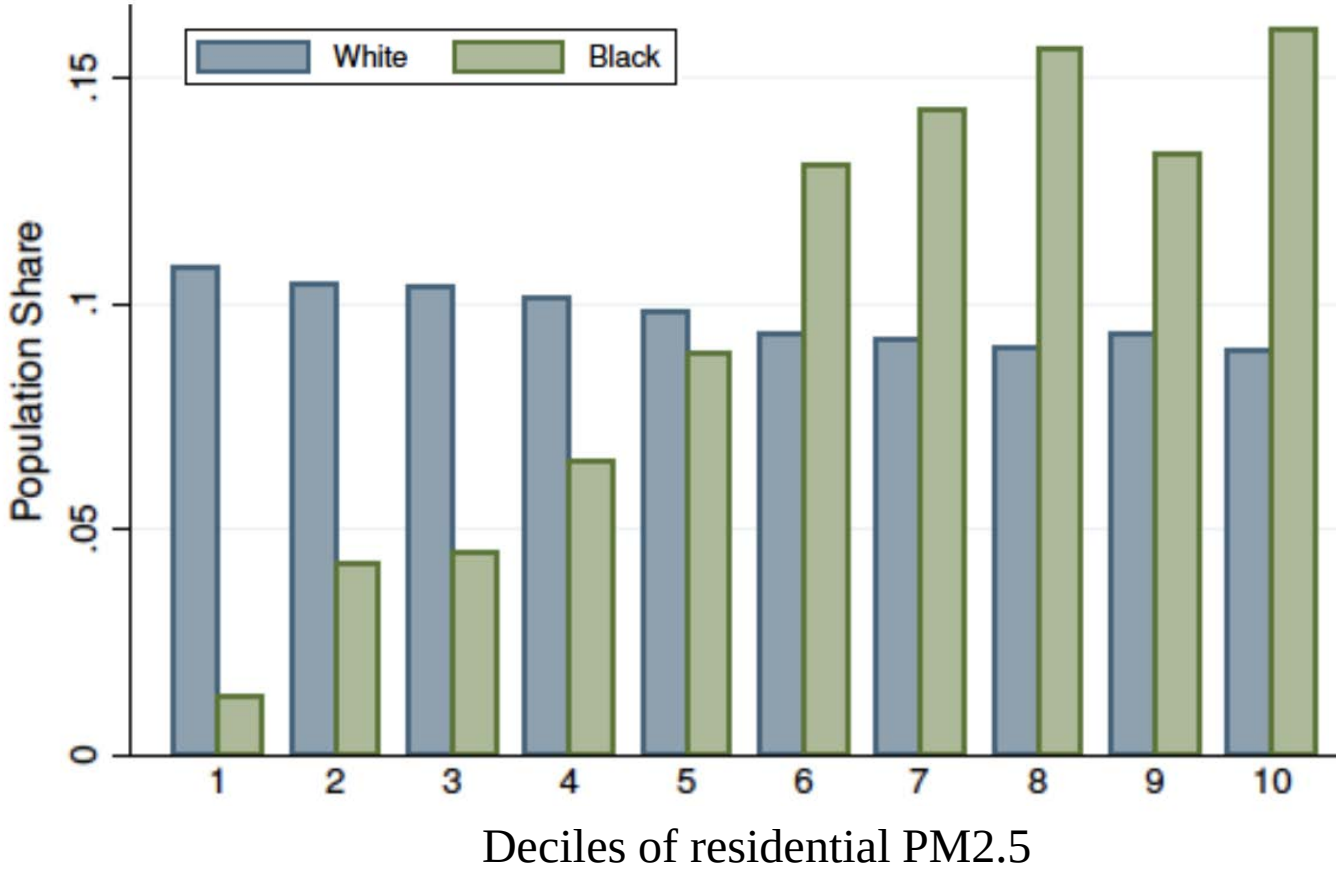
- Require many untestable assumptions. International trade has made a number of advances emphasizing model parsimony and empirical tractability.

Economists have systematically over-estimated the future costs of regulation and under-estimated the benefits.

- Firms creatively find lower cost ways to comply.
- Regulations increase the return to innovation in abatement, and endogenous technical change reduces abatement costs. (E.g. Popp, Newell, and Jae, 2010).
- The health benefits of reduction in pollution are larger than we thought. E.g. the Acid Rain Program targeted the health of lakes. But >95% of the realized benefit is due to the coincidental reduction in human exposure to particulates.

Distributional effects of the CAA

- Poor and minority households are more exposed to pollution and therefore likely to gain more from the targeted nature of the CAA.
- Costs may also be borne disproportionately but evidence is lacking.
  - Regulation could raise consumer prices and/or transportation costs
  - Could accelerate the switch to capital-intensive technology, reducing demand for unskilled
  - Renters miss out on economic rents generated by cleaner air
  - Cleaner areas may gentrify, raising rents.



Source: Currie, Walker, Voorheis, 2019

Concluding thoughts

- The CAA reduced air pollution which improved health and wellbeing.
- The law imposed substantial costs, which are greater than measured compliance costs alone.
- Costs could have been much lower if the regulators had relied more of flexible market mechanisms vs. command and control.
- Benefits are likely to have greatly exceeded the costs, given available estimates, but it is simply not possible to add up the total benefits and/or the total costs, although the EPA has tried (EPA 2011).
- Researchers should focus on contributing parameters that can be used in “apples to apples" comparisons across studies (e.g. dollar per ton of pollution reduction).

Some opportunities for future research

- How should the CAA deal with greenhouse gas emissions?
- The Trump administration rolled back many air quality regulations. Biden may reverse this. Many natural experiments!
- Dramatic improvements in technology for measuring air quality allow measurement with unprecedented speed and granularity.

  - E.g. satellite technology + machine learning to predict ground-level pollution at a fine resolution (Di et al. (2016)). Also, new, low-cost pollution monitors and “crowd-sourced" pollution measurement (see e.g. Fowlie 2019).