Does Allocation Matter? Effects on Output and Abatement

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Parsing Allocation Issues

- Endowment Effects
- Behavioral Effects
  - Output and abatement
  - w/ or w/o a market
- Trading Effects
- Effect of Updating

Types of Allocation

Program	Allocation By Whom	Consideration	Basis
US SO_2	Centralized (Federal)	Free	Fixed
US NOx (OTC)	Decentralized (States)	Free	Fixed and updated
EU ETS	Decentralized (Member States)	Almost entirely free	Fixed w/L-T updating

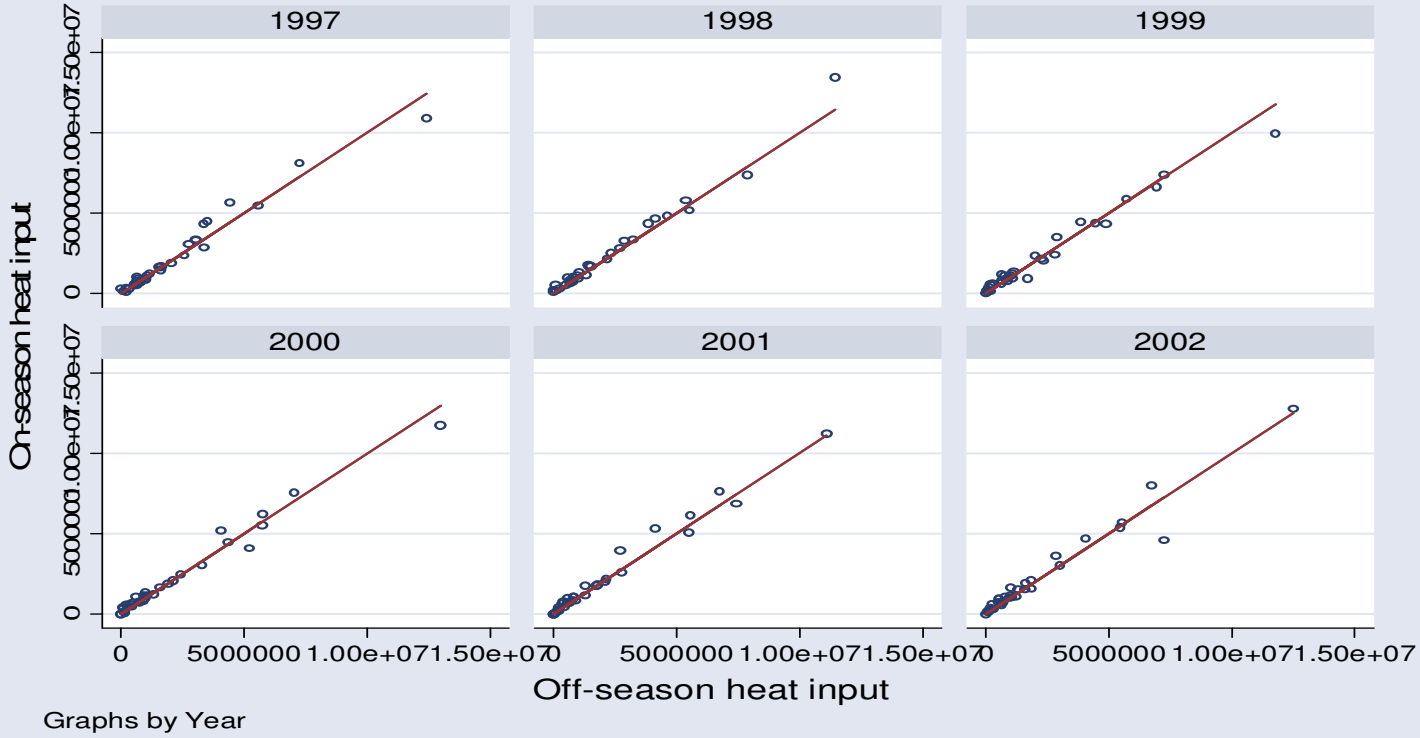
Cost of NOx Emissions @ $1000/ton

Fuel & Cost	Fuel Cost $/mmBtu	NOx Rate lb/mmBtu	Emission Cost $/mmBtu	Percent Increase
Coal	$1.50	0.5 – 1.0	$.25 - $.50	17%-33%
Oil	$3.00	0.4	$0.20	7%
Gas	$2.50	0.05	$0.025	1%

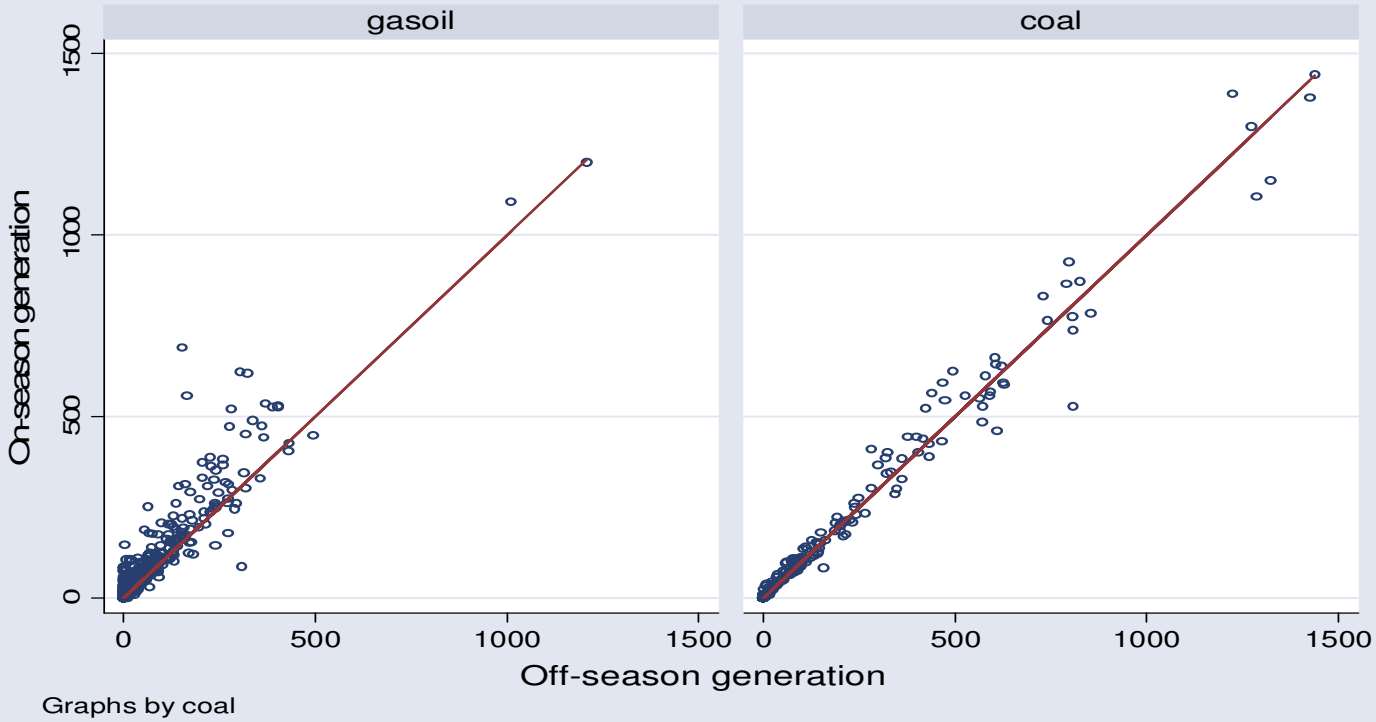
Cost of SO_2 Emissions @ $200/ton

Fuel & Cost	Fuel Cost $/mmBtu	SO_2 Rate lb/mmBtu	Emission Cost $/mmBtu	Percent Increase
Coal	$0.75 - $1.50	0.5 – 5.0	$.05 - $.50	7% - 66%
Oil	$3.00	0.3 – 1.5	$.03 -$.15	1% - 5%
Gas	$2.50	0	None	0%

NO_x Output Effects
Coal Plants

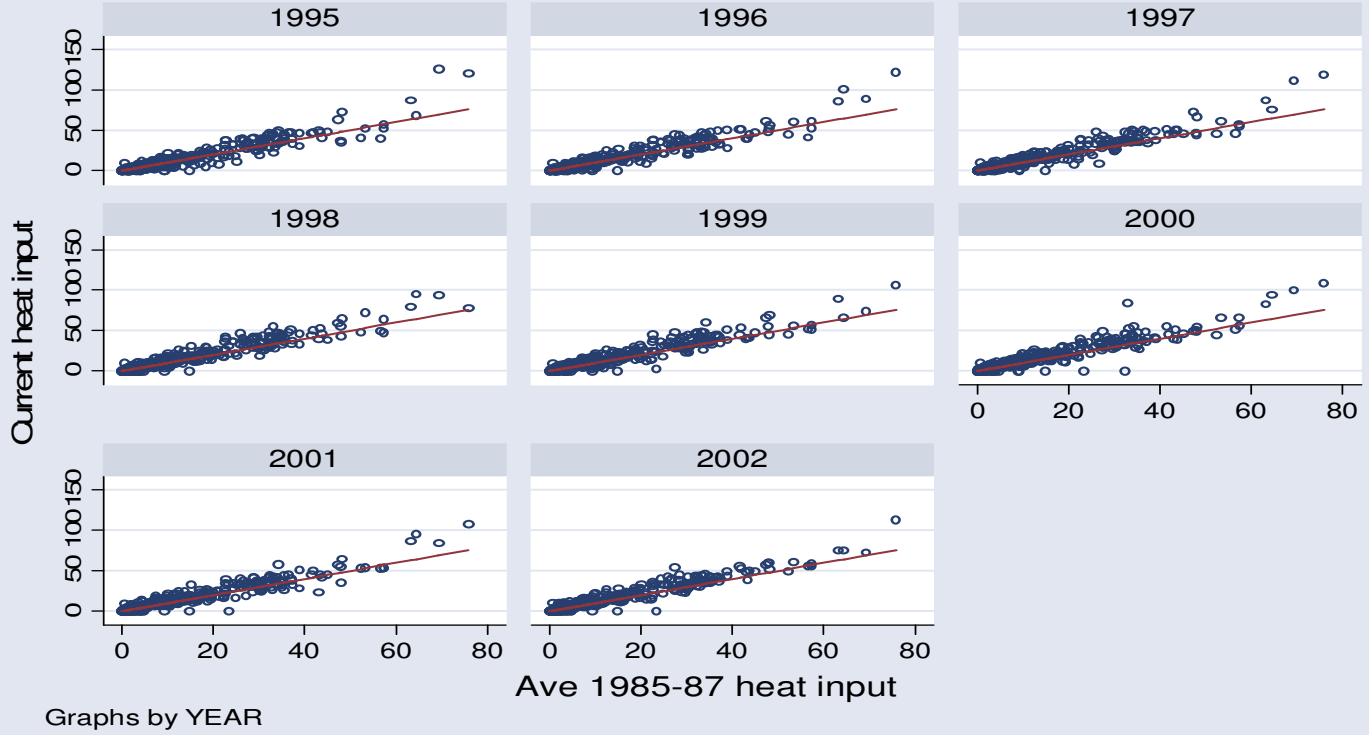


NO_x Output Effects by Fuel
All program years



SO_2 Output Effects

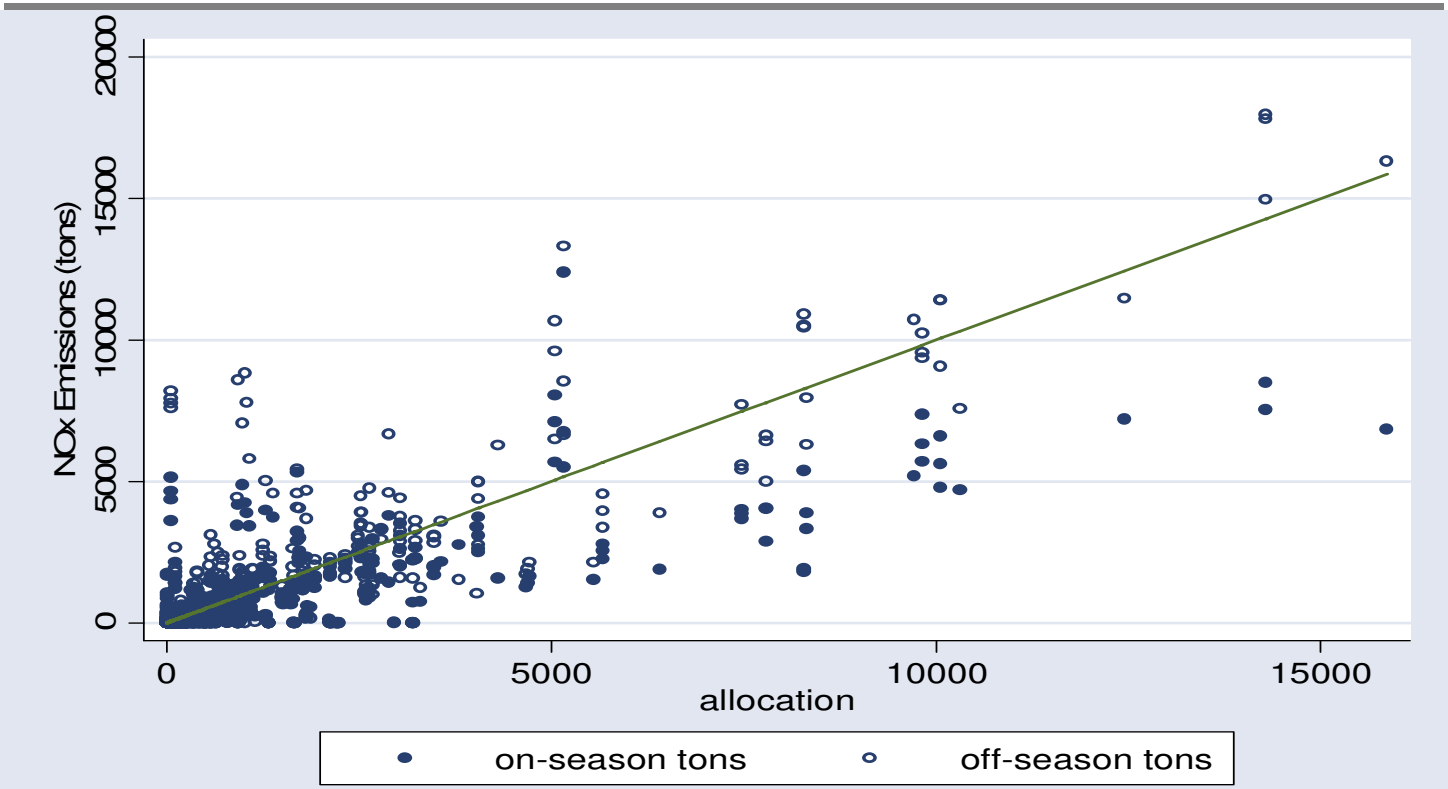
Phase 1 units, 1995-2002



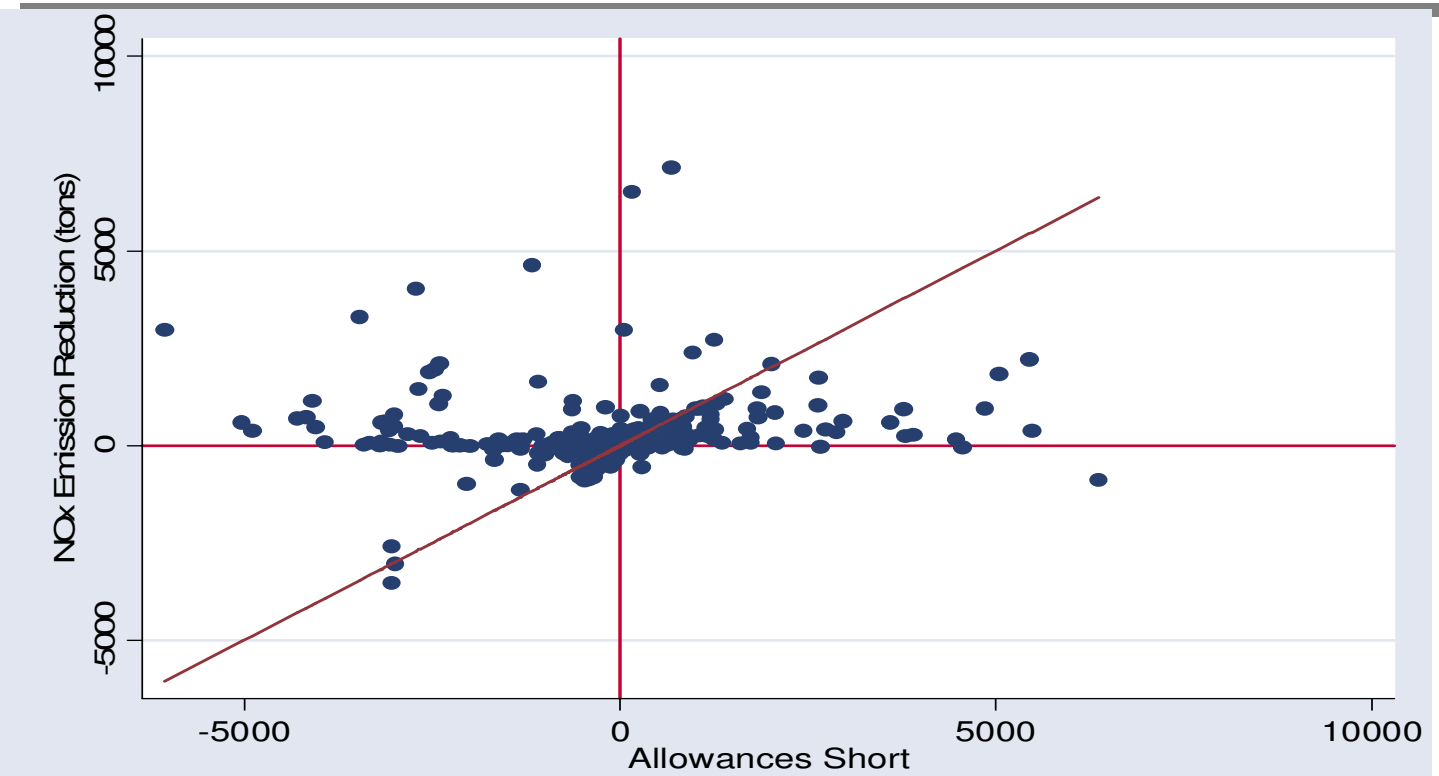
Summary on Output Effects

- Little evidence that output is significantly effected by a cap
- Other factors dominate, especially for electric utilities
  - Gas/oil units show greater output increases during the summer (priced) season than coal, but always so
- Now, does the allocation to units determine unit emissions and abatement?

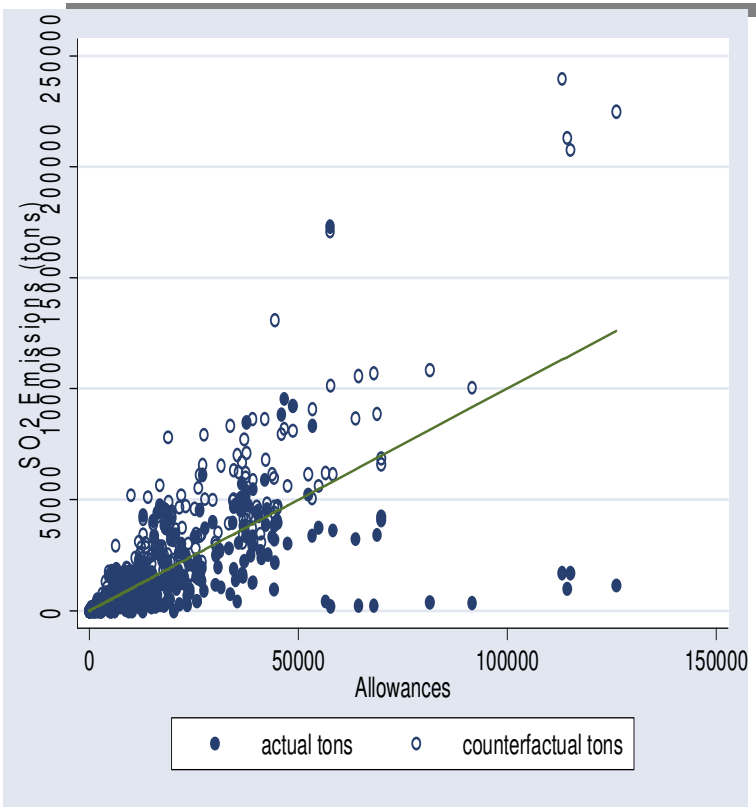
NO_x Emissions & Allowances All States, All Years

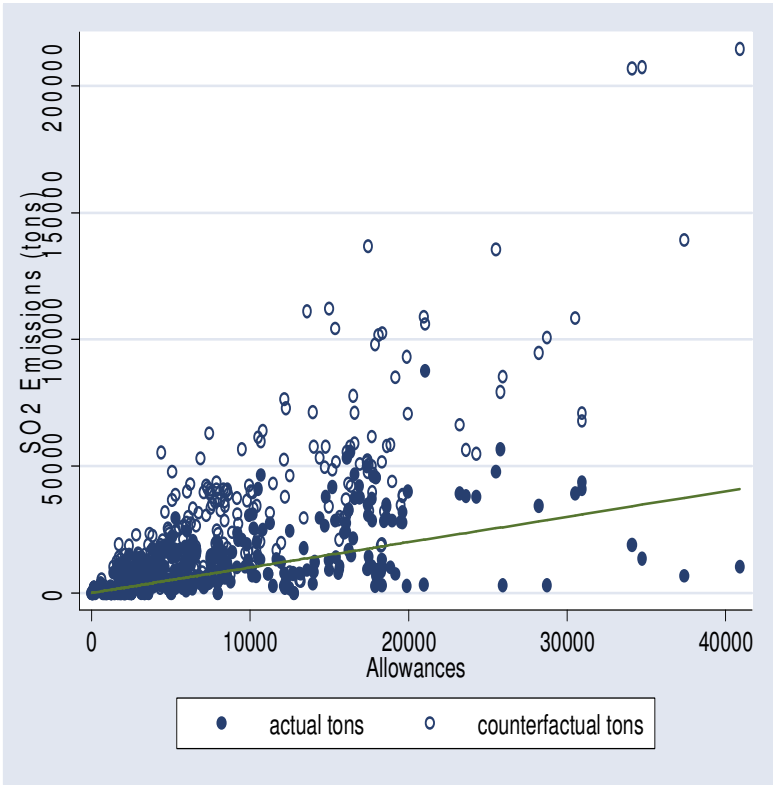


NO_x Emission Reductions and Allowance "Need"

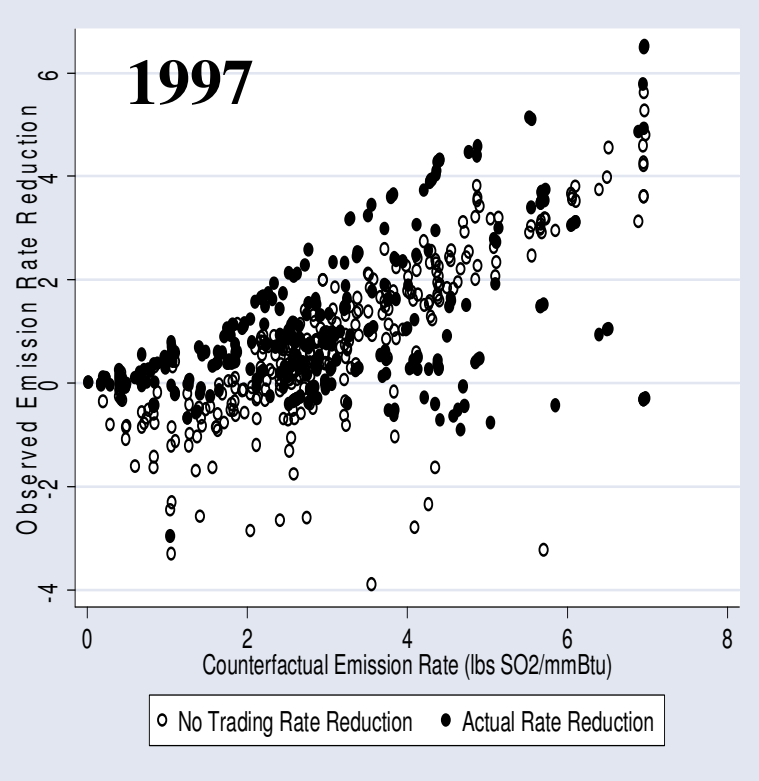


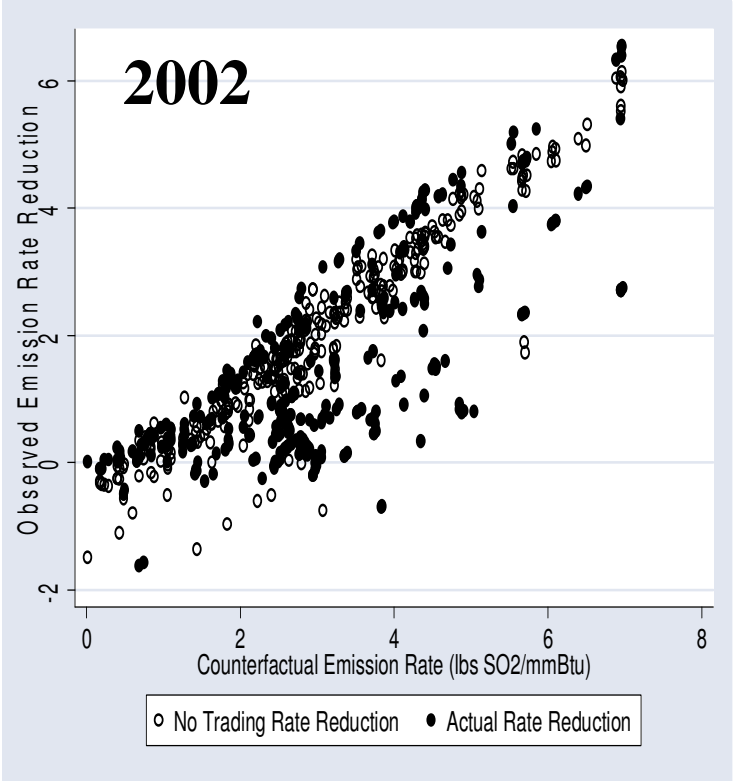
Allocations & SO_2 Emissions
Phase 1 units, 1997 & 2002



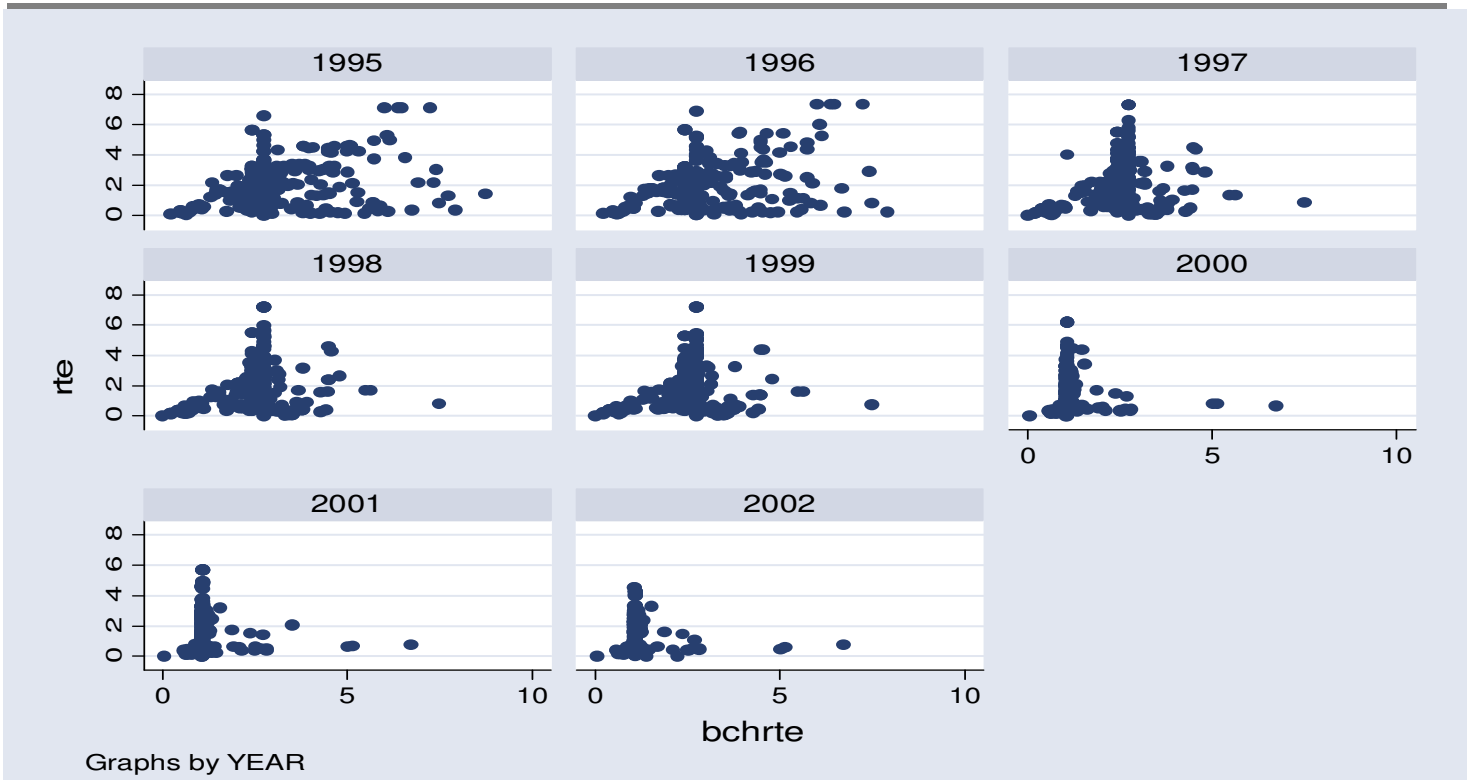


"Required" and Actual Emission Rate Reductions SO_2 1997 & 2002





"Allowed" & Actual Emission Rates SO_2 Program, 1995-2002



Summary on Emissions & Abatement

- In NO_x program, little relation between
  - plant allowances and emissions, or
  - "required" and actual reductions
- More evidence of relation in SO_2 program but diminishes with time.
  - Coincidence of benchmark allocation and cheaper abatement in dirty units
  - Early autarkic compliance

The Updating Mechanism

- Allowance allocation (usually future) depends on current behavior (usually output) mediated by:
  - Lag till effectiveness
  - The averaging period
  - The discount rate
  - Other specified contingencies

How Updating Affects the Cost of Emissions

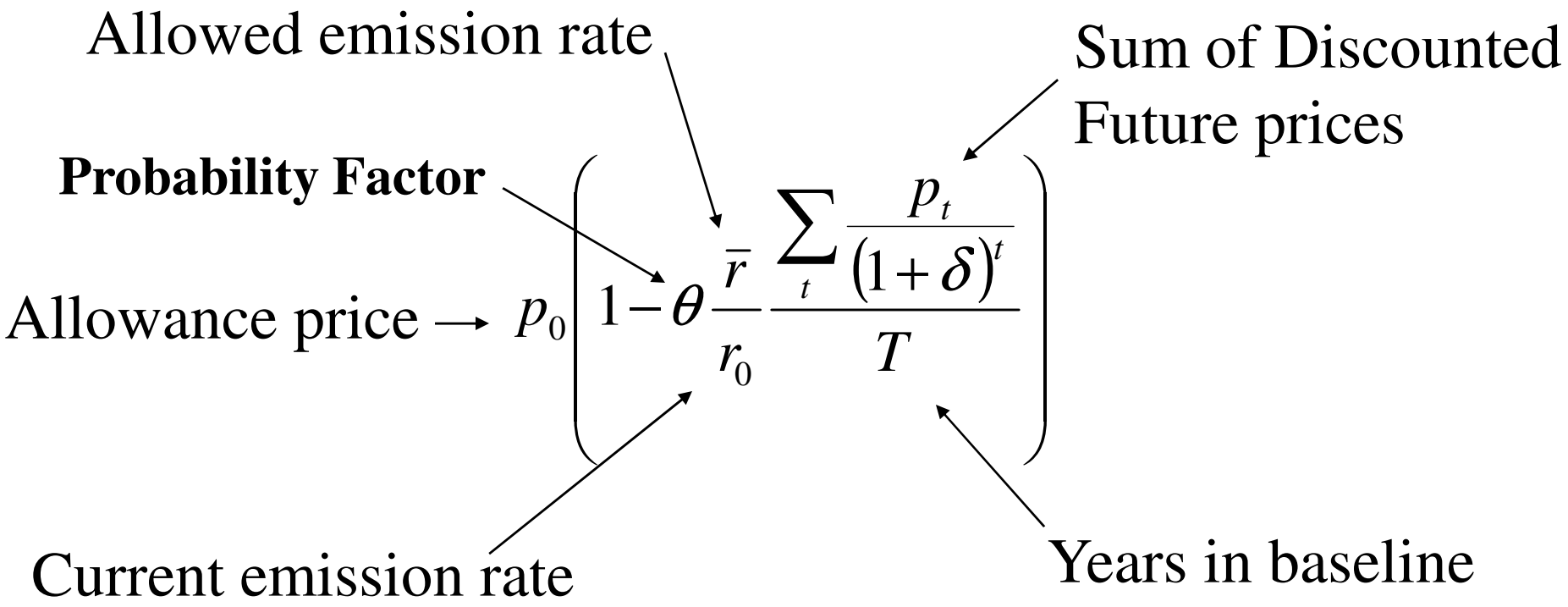
A profit function with emissions cost

$$\pi = vq - C(q,r) - p(1-\delta)[e(q,r) - a(?)]$$

π	Firm profit
v	Price of output
q	Quantity of output
C(…)	Cost function
r	Emission rate
p	Price of allowances
δ	Updating discount
e(…)	Emission function
a(…)	Allowance function

Updating Effects

The NO_x Price with Updating



An Updating Example: New Jersey

- Units with r >= 0.15 lbs NO_x/mmBtu
  - Current allocation = 0.15 x Ave Q (Max past 2 of 3 yrs)
- Units with r < 0.15 lbs NO_x/mmBtu
  - Current allocation = Current emissions
- Oil-fired units at ≈ 0.20 #/mmBtu reduce to < 0.15#/mmBtu during summer season

Summary on Updating

- Aside from minor threshold effects, can't find evidence that updating has an effect on output or abatement
- Possible explanations
  - Cost difference is not so great
  - Can't separate signal from noise in very heterogeneous context
  - Unit operators are not aware of advantage