



Allocating Pollution Load Reductions Between States:

What's Fair, What's Efficient, and
How Can we Agree to Get There?

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- Associate Professor of Business Economics at the Smeal College of Business Penn State
 - PhD in Social Science from Caltech
 - Economic & Political Theory
 - Research Interests
 - Mechanism Design & Experimental Economics
 - Work with Jim Shortle on issues in Environmental Regulation
 - Worked on complex auction design related to FCC spectrum auction.
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Objectives

- The decisions made by each state in implementing the Chesapeake TMDL will drastically impact the success/failure of the program.
 - Since punishing non-compliance is costly and time consuming, an ideal system should engender **voluntary participation** by all states.
 - There are a number of **factors that are not traditionally considered** by regulators & economists that should be considered when deciding on final policy.
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Chesapeake TMDL Highlights

- TMDL for each state and waterway determined by scientific analysis to improve Chesapeake Bay water quality.
 - “pollution limits are further divided by jurisdiction and major river basin based on state-of-the-art modeling tools, extensive monitoring data, peer-reviewed science, and close interaction with jurisdictional partners.” (Source: EPA)
 - While focus is on Chesapeake Bay, TMDL will also improve water quality on the various waterways.
 - Implementation of regulations to obtain TMDL left to states.
 - States developing Watershed Implementation Plans (WIP)
 - States have the ability to regulate both point and non-point sources.
 - EPA regulation of point sources may interact with state regulation.
 - Failure to meet TMDL standards by states may result in punitive action by the EPA.
 - Exact nature of EPA actions is not determined at this time.
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Problem: Costs & Benefits are Highly Asymmetric

- Some states (e.g. Maryland & Virginia) are likely to receive a much greater benefit from Chesapeake Bay ecosystem improvements than others.
 - Other states such as Pennsylvania are being asked to bare a large portion of the burden of emissions reductions without a direct link to benefits.
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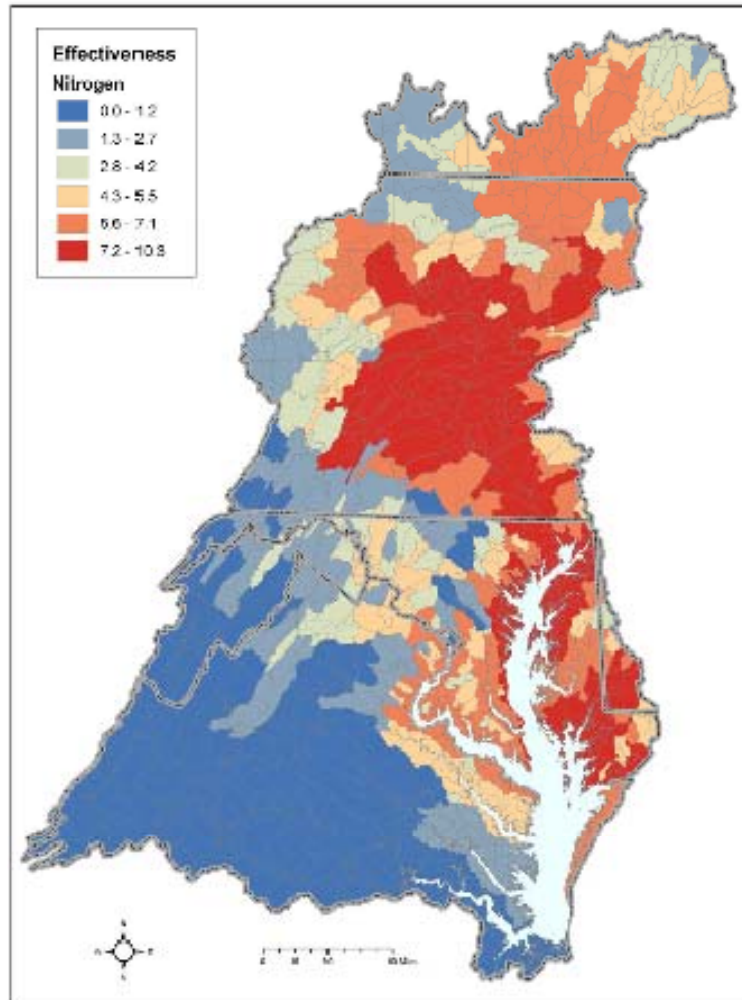
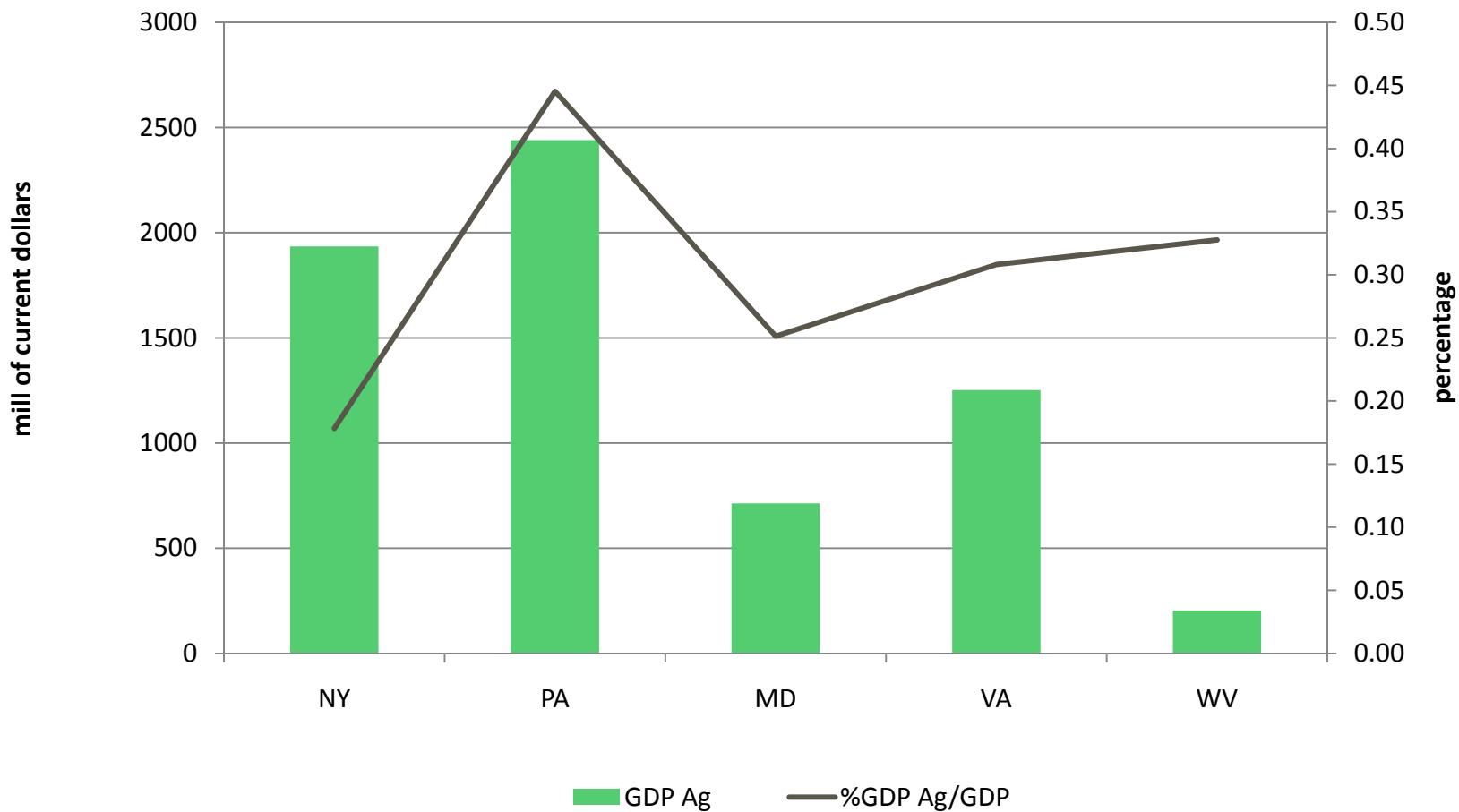


Figure 6B-1. Sub-basins across the Chesapeake Bay watershed with the highest (red) to lowest (blue) pound per pound nitrogen pollutant loading affect on Chesapeake Bay water quality.

Agriculture Differs By State

GDP of agriculture and as percentage of the GDP of all industries, 2009



What is Efficient?

- Emission reductions should not only depend on the effectiveness of reductions upon Chesapeake Bay water quality but economic factors such as the relative costs/benefits of such reductions.
 - Emission reductions might be higher than what is preferred by low benefit or high cost states.
 - need to incentivize these states to accept more reductions.
 - Should consider waterway externalities as well
 - incentivize upstream states to improve water quality for downstream states.
 - There are a number of policy approaches (taxes, subsidies, markets) that can *in theory* achieve an efficient reduction in emissions.
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Problem: The Theory May Not Work For State Level Decisions

- There are a number of reasons why states may be unable or unwilling to take actions that result in efficient emissions reductions requirements across states.
 - Politics
 - Money is not clean water
 - Fairness and other considerations

Key: States cannot be expected to behave as rational economic actors!

Politics Matter

www.baltimoresun.com/news/opinion/editorial/bs-ed-epa-chesapeake-20110317,0,6715806.story

baltimoresun.com

The bay 'diet' draws fire

Our view: Chesapeake Bay cleanup effort has a rare chance at success — if Congress allows EPA to do its job

5:04 PM EDT, March 17, 2011

The U.S. Environmental Protection Agency's effort to put Chesapeake Bay states on a "pollution diet" represents the most hopeful effort toward cleaning up the estuary in a generation. So why are House Republicans so invested in sabotaging it?

That the GOP would like to thwart the EPA on any number of fronts is clear enough. The House attempted to block funding of the EPA's Chesapeake Bay Total Maximum Daily Load (TMDL) restrictions on nutrients and sediment earlier this year, and only opposition from the Senate has prevented a general evisceration of the agency's budget.

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Farmers & Politics

The Christian Science Monitor - CSMonitor.com

Farmers, EPA clash over Chesapeake Bay regulations

Stricter Chesapeake Bay rules may hurt farmers, who say they're already doing their part to clean it up.



As the Environmental Protection Agency (EPA) launches a new effort to clean up the Chesapeake Bay, farmers find themselves swept up in the largest and most ambitious water-restoration project ever attempted in the United States.

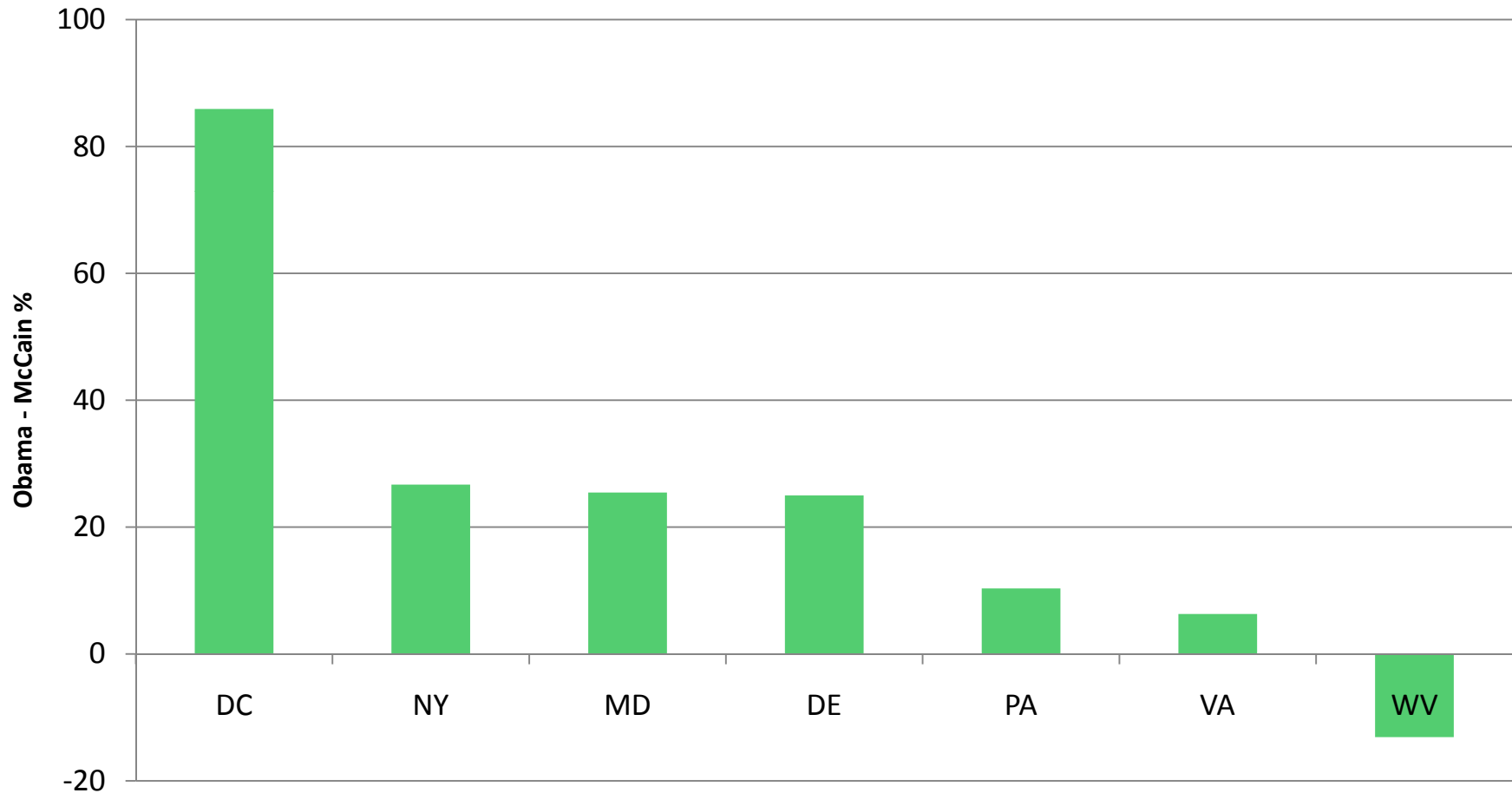
(Michael Bonfigli / Special to the Christian Science Monitor)

By Andrew Jenner, Contributor

posted March 7, 2011 at 5:30 pm EST

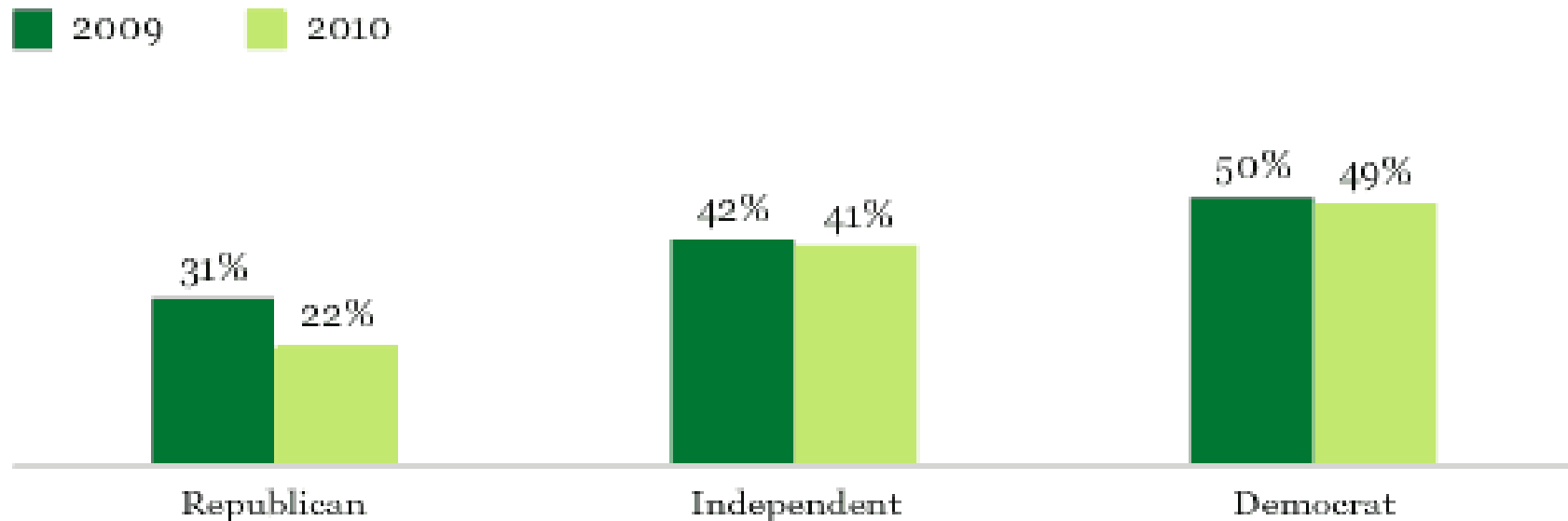
Political Attitudes Differ Across States

2010 Election:
Obama McCain % Vote Differential



Environmental Attitudes Differ Across States

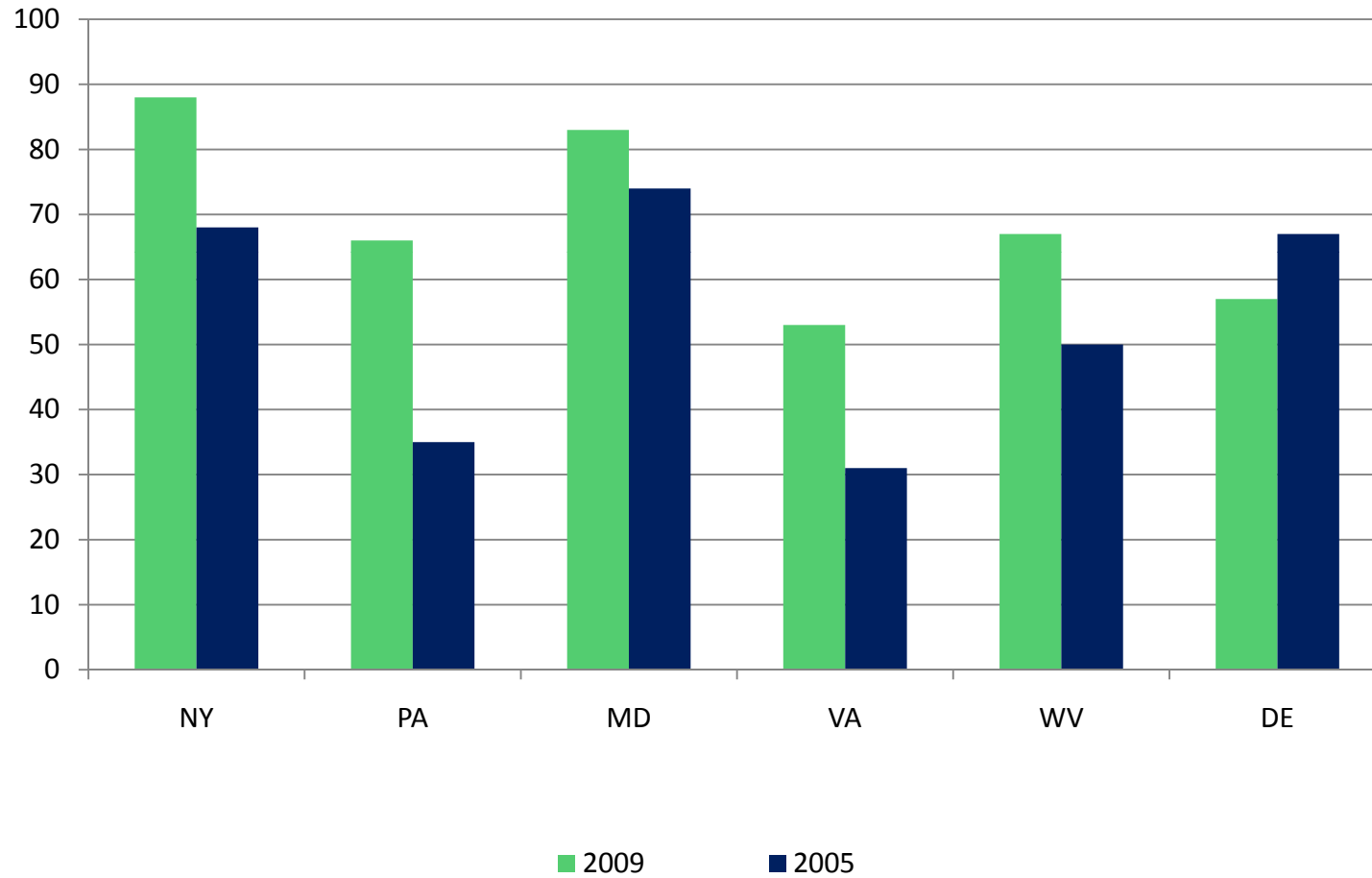
Preference for Environmental Protection Over Economic Growth -- by Party ID



GALLUP®

Average Environmental Scorecard (House of Rep.)

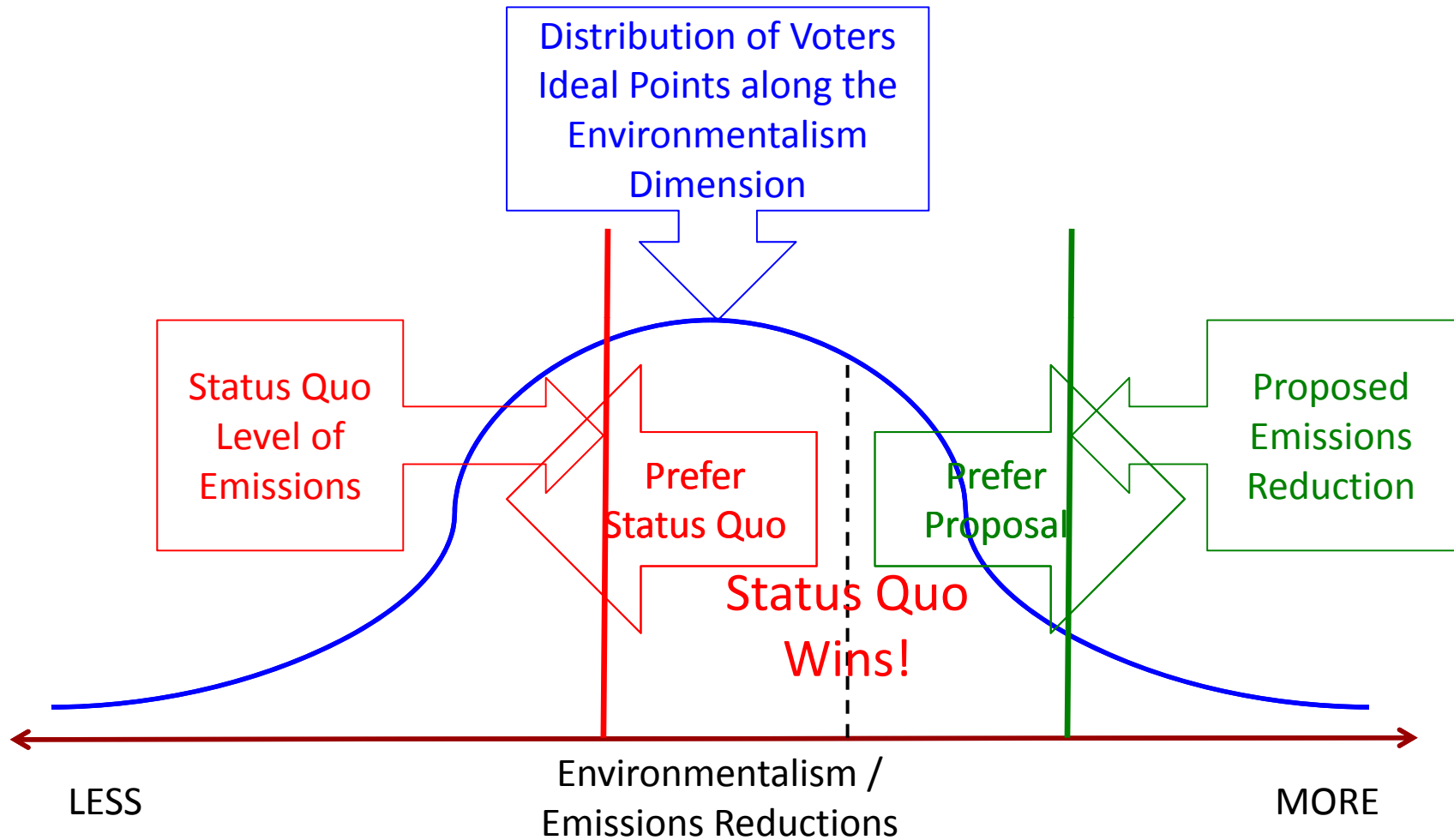
Source: League of Conservation Voters.



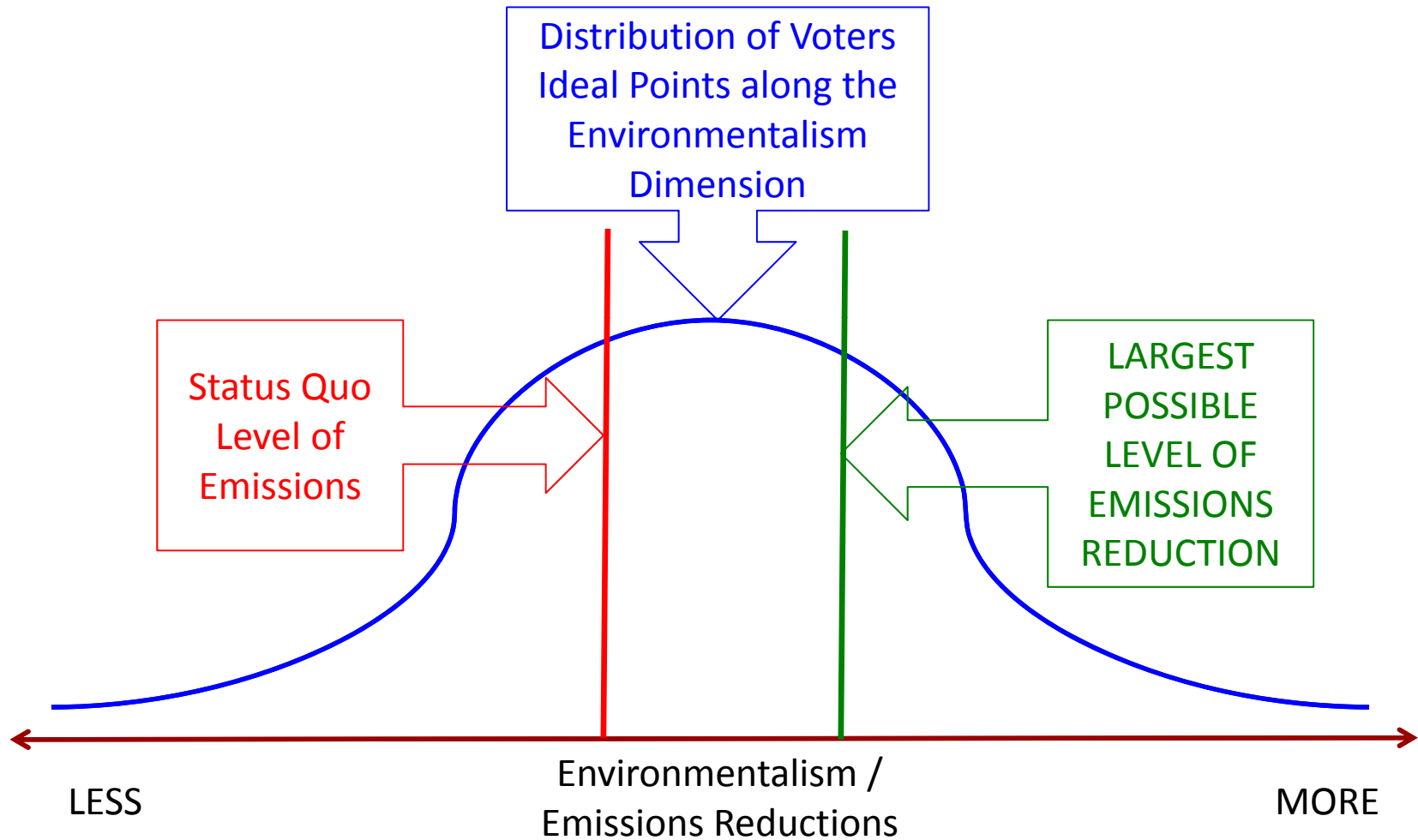
Results of Political Processes

- Political decision makers decide on policy based upon likelihood of (re)election.
 - Short run: status quo TMDL acts as a constraint for policies that may be acceptable at the state level.
 - State level differences dictate different levels of emissions reductions that are politically feasible.
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State Politics in the Short Run



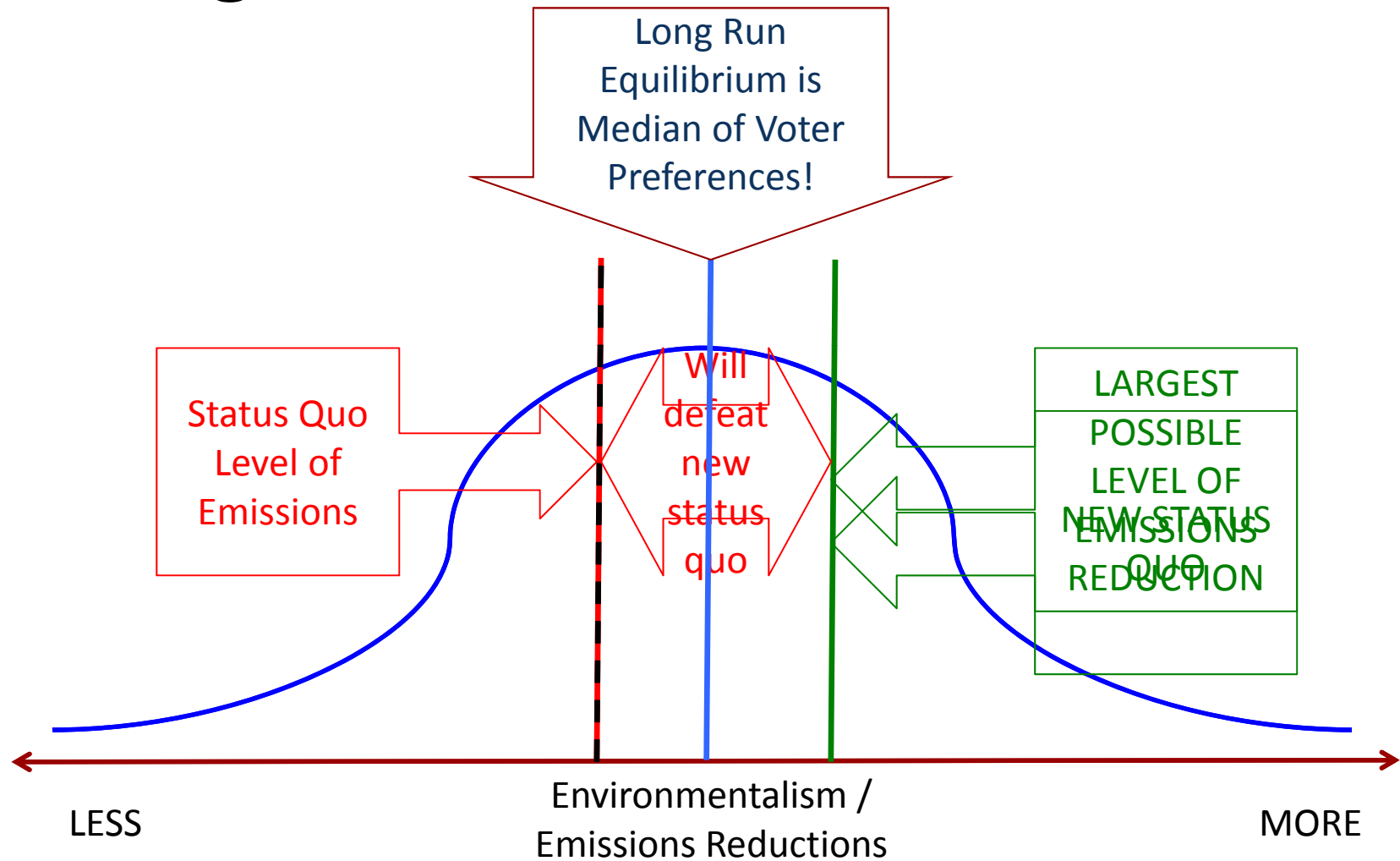
State Politics in the Short Run



Results of Political Processes

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 - Long run: any policy should converge to the preferences of the **median voter** in the state.
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Long Run: Median Voter Theorem



Results of Political Processes

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 - Short run: status quo TMDL acts as a constraint for policies that may be acceptable at the state level.
 - Long run: any policy should converge to the preferences of the **median voter** in the state.
- Likely to matter at both the state and federal level.

So What Can Be Done?

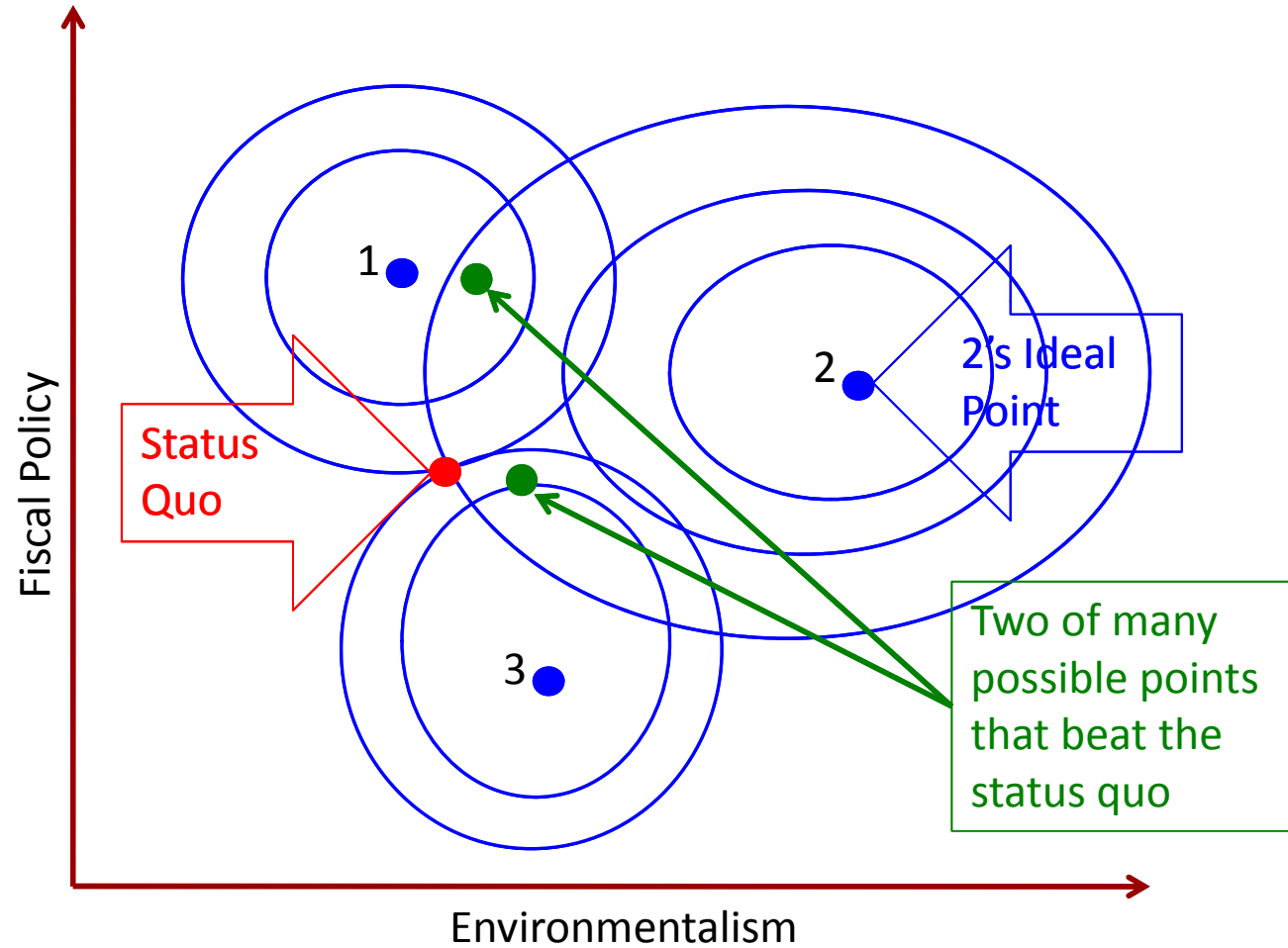
Money: the other dimension

- Typical models of environmental regulation with individuals assume people tradeoff emission reductions with cash transfers.
 - Monetary transfers (subsidies or taxes) between states may not be practical.
 - Even if they are possible (EPA role?), then the results of the political process is even more uncertain.
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Money and the Environment

- Beneficiaries of monetary transfers to or from a state's general budget may be very different than those paying the costs of emissions reductions.
 - State fiscal and environmental policies are separate dimensions upon which voters might make choices.
 - Both are not necessarily correlated. There are liberal Democrats who have little inclination for environmental protection and conservative Republican who care greatly about the environment.
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Multidimensional Voting



Multidimensional Voting

- Fiscal and environmental policy can be leveraged to achieve a *winning coalition* within the state.
 - But behavior is different from traditional models!
 - Long Run: **Chaos theory of voting**
 - Except under very limited conditions for any point there is an alternative proposal that will beat it.
 - Newer theories focus on how we can get around this problem
 - Although chaos theory may explain much of the inaction related to such types of regulation.
 - Economic experiments suggest outcomes that might be more realistic.
-

What can the EPA do to help?

- While the EPA has to deal with its own political issues on the federal front, EPA's administrative choices may dramatically impact the outcome.
 - The EPA sets the status quo TDML
 - Strategic selection of state level TDMLs may encourage more willing state participation.
 - The EPA sets the agenda for state level policy making.
 - This induced structure may provide clues as to where states will end up in the multidimensional case.
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Interstate Regulation Initiatives

- Incentive based regulations that bypass state regulation may solve some of these problems.
 - Interstate emission reduction markets may work well if properly designed
 - Need to consider point v. non-point uncertainty
 - Consider local externalities (location on waterway)
 - **KEY: While a properly designed market may result in efficiencies, the distribution of gains from the market will depend upon the initial assignment of emission permits/reduction requirements. Could be the key to political success/failure!**
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Other Factors

- **Fairness**
 - States and individual's willingness to accept various policies may depend upon perceived fairness.
 - Many ways to measure fairness
- Altruism
- Issue Saliency
- Long run mobility



Other Factors

- Fairness
 - **Altruism**
 - Many calls to lower emissions seem to rely on sense of obligation to improve ecosystems for future generations.
 - Public goods experiments imply this is not insignificant.
 - Issue Saliency
 - Long run mobility
-

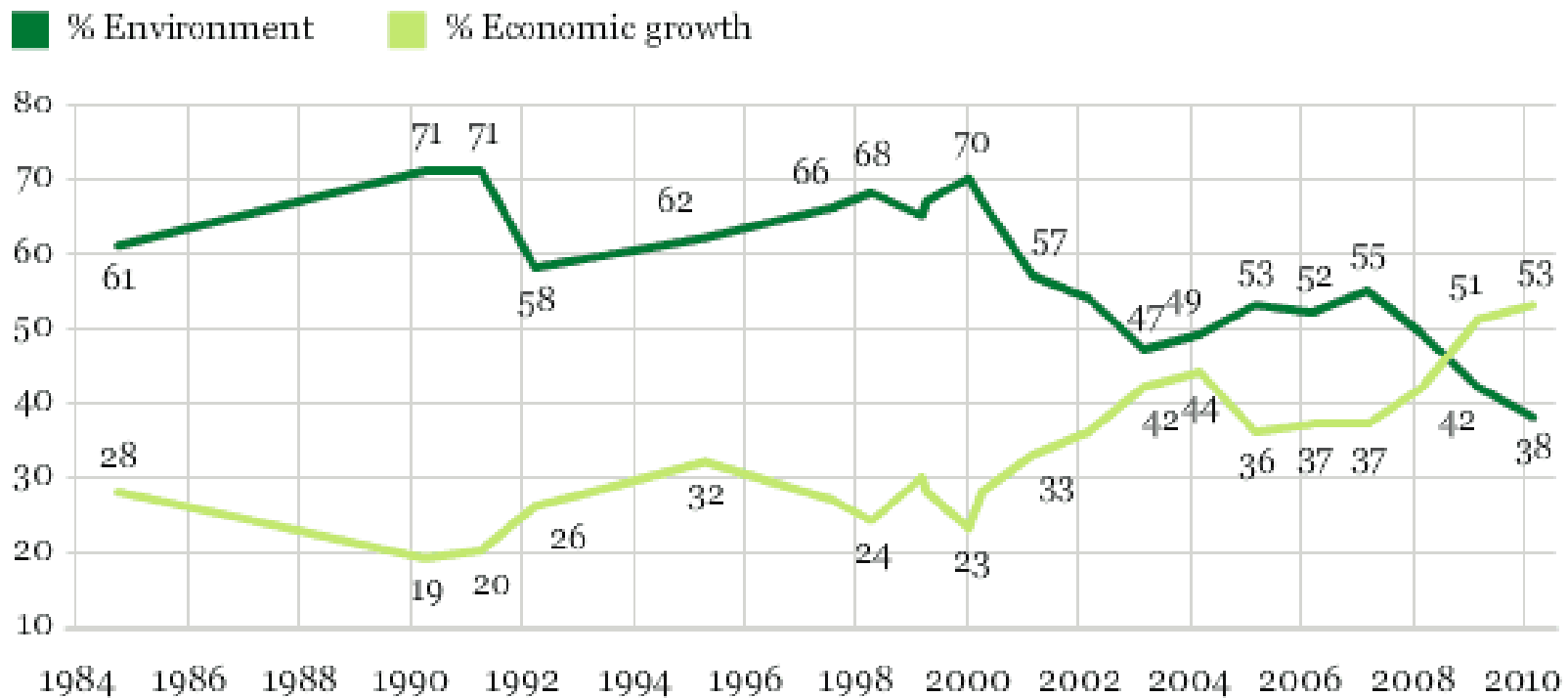
Other Factors

- Fairness
 - Altruism
 - **Issue Saliency**
 - **As issues such as global warming become more important voters might be willing to accept greater burdens.**
 - Long run mobility
 - In the long run voters may move to states with policies closer to their own ideal point.
 - Business and industry may move to states with lowest standards.
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The Importance of the Environment

Environmental Protection vs. Economic Growth

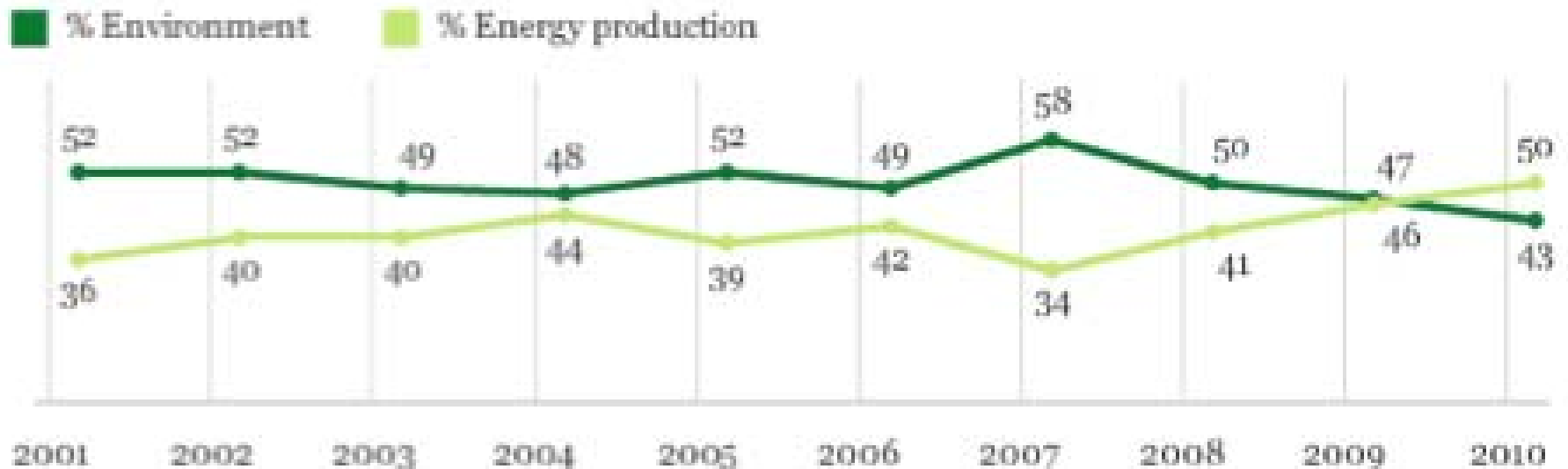
With which one of these statements about the environment and the economy do you most agree -- [protection of the environment should be given priority, even at the risk of curbing economic growth (or) economic growth should be given priority, even if the environment suffers to some extent]?



The Importance of the Environment

Higher Priority for Energy Production or Environmental Protection

With which one of these statements about the environment and energy production do you most agree -- [ROTATED: protection of the environment should be given priority, even at the risk of limiting the amount of energy supplies -- such as oil, gas and coal -- which the United States produces (or) development of U.S. energy supplies -- such as oil, gas and coal -- should be given priority, even if the environment suffers to some extent]?



Conclusions

- State level TMDL requirements cannot be made in an ivory tower.
 - Need to consider economic costs/benefits
 - State and Federal level politics
 - Fairness considerations
 - Ideally these considerations & constraints should be considered when designing incentive-based regulations.
 - Traditionally they are an after thought
 - Need *behavioral mechanism design*
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Conclusions

- This is not Kyoto!
 - The role of the EPA makes enforcing agreements between states possible, but that does not mean the EPA should not consider how to use their enforcement power.
 - The recession/state budget problems doesn't help.
 - There is substantial room for improved thinking along these lines
 - Theoretical, Experimental and Practical
-



Questions?



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Fairness: The Ultimatum game

Two bargainers seek agreement on dividing \$100.

Stage 1. Proposer proposes a division

Stage 2. Responder accepts or rejects (reject implies both players receive 0).

Suppose that you are playing with someone else, whose identity you do not know, one-time only...

Fairness: The Ultimatum Game

Theory Says:

- In Stage 2, the responder should accept any positive offer.
- Therefore, in Stage 1, the proposer should offer very little (\$1) to the the responder.

But ...

An ultimatum (and dictator) game experiment

Forsythe et al., *Games and Economic Behavior*, 1994

Ultimatum game

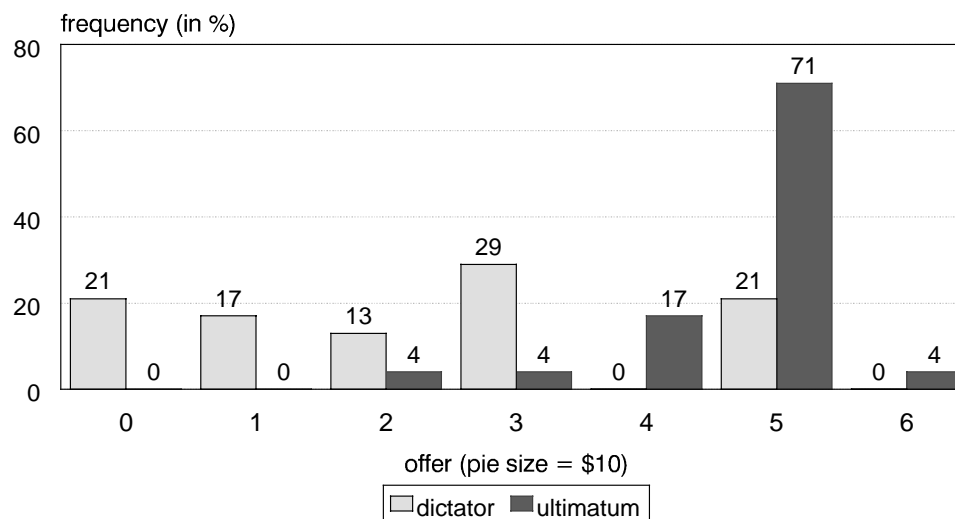
Two bargainers seek agreement on dividing \$10

Stage 1. Proposer proposes a division

Stage 2. Responder accepts or rejects (reject implies both players receive 0).

Dictator game

Eliminate stage 2.



Fairness Concerns

- People will sacrifice efficiency for fairer outcomes.
- Fairness concerns are sensitive to a number of factors
 - Competition
 - Source of comparison (other states)
 - Fair procedures
 - Default outcomes

