

Power Laws in Government Budgeting

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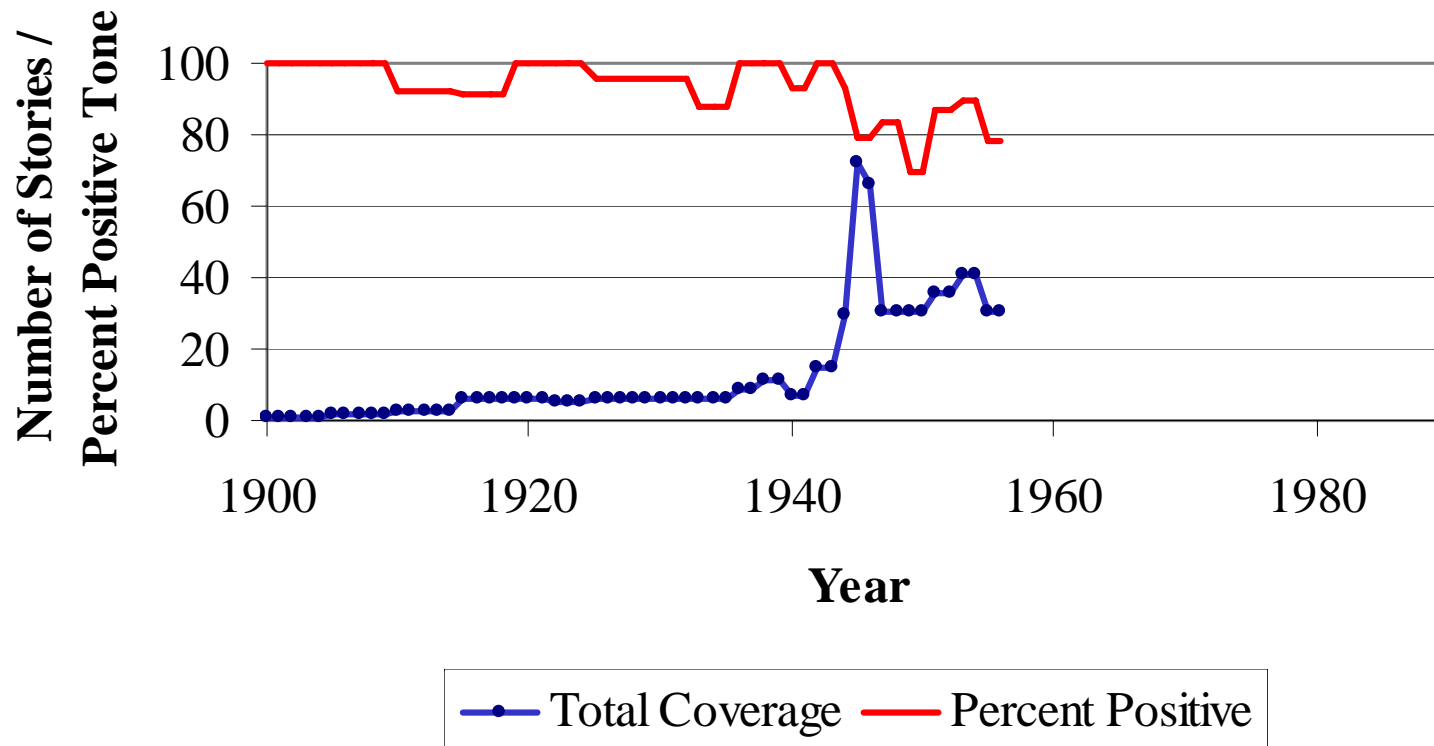
Policy Agendas Project

www.policyagendas.org

- Supported (sometimes) by NSF since 1994
- Allows analysis and distribution of datasets on many types of governmental activities from 1947 to present
- All data today from this source
- Major long-term collaborator: Bryan D. Jones of University of Texas, Austin

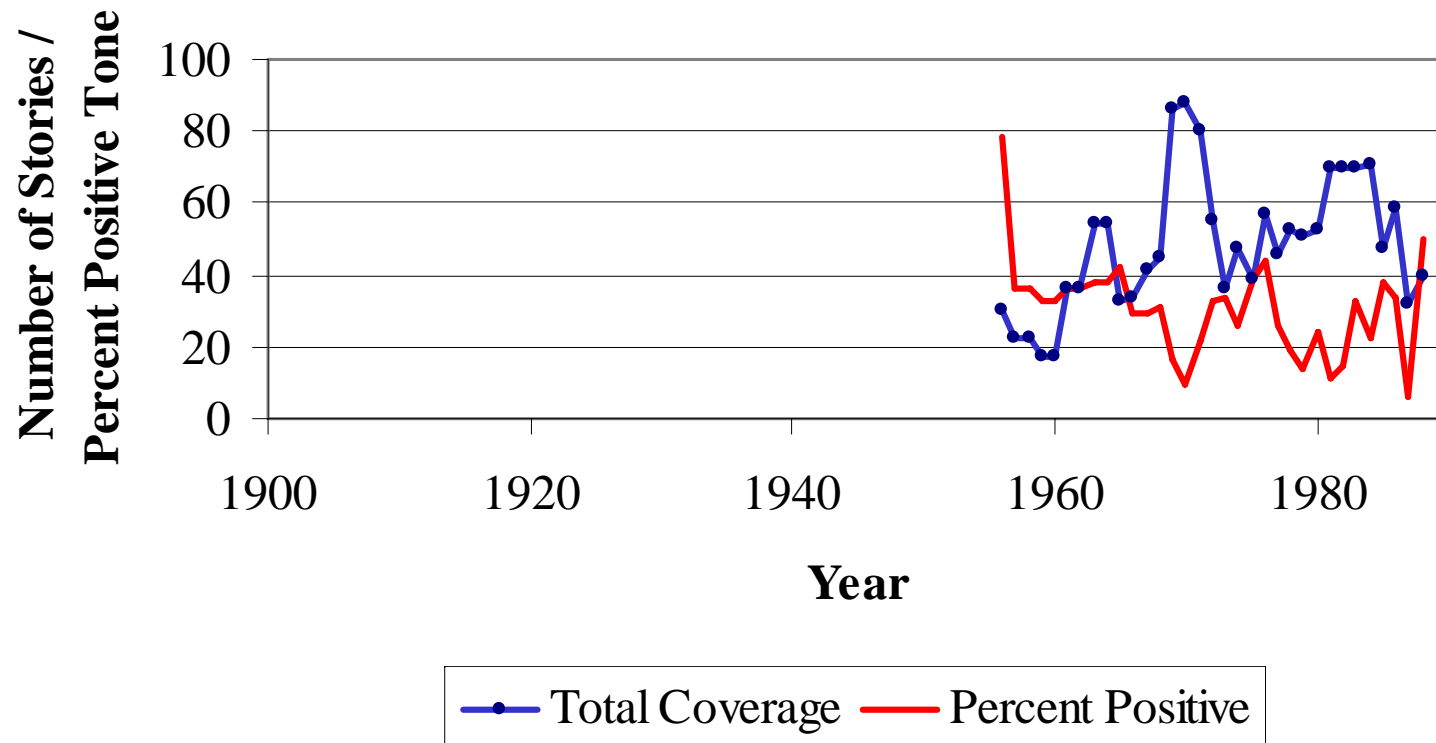
Pesticides: Looking good after World War Two

Media Coverage of Pesticides, 1900-1990



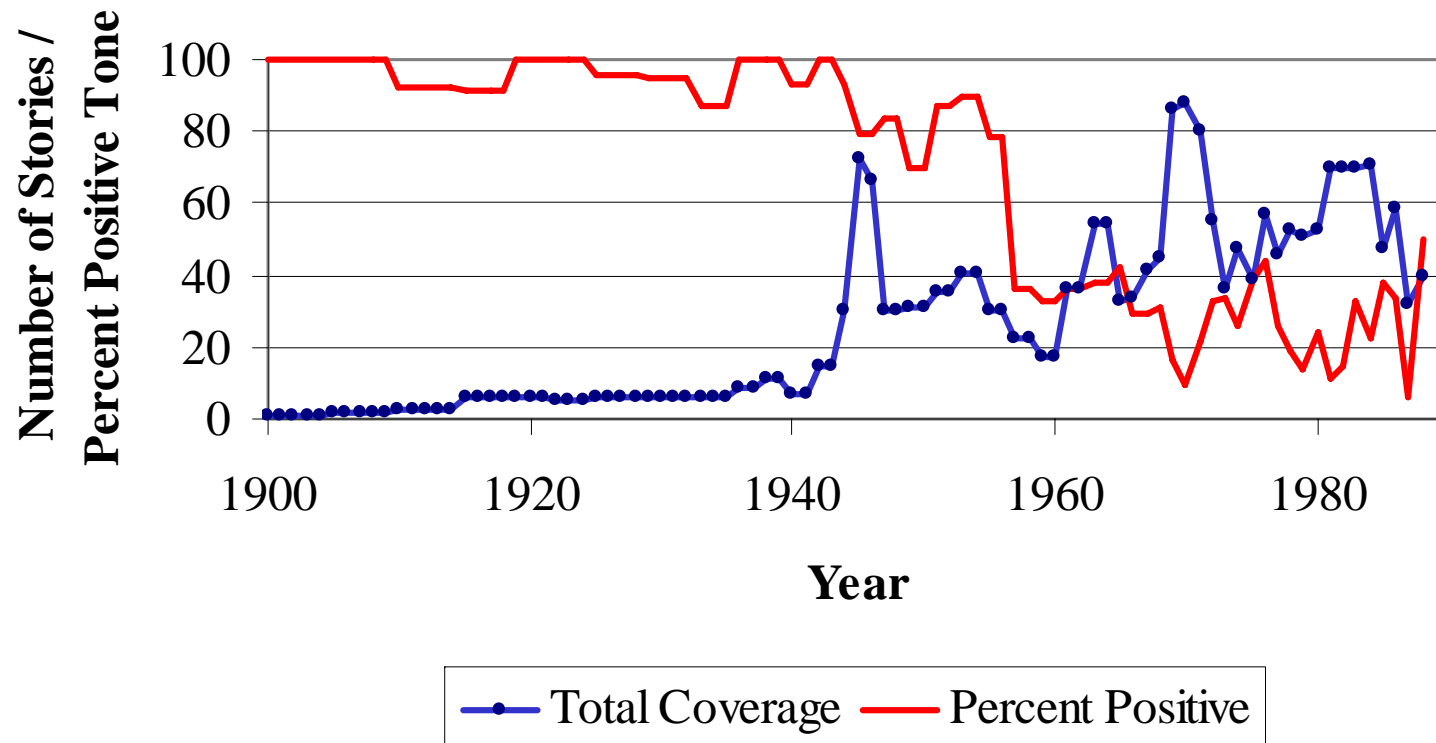
Pesticides: No longer such good news after 1956

Media Coverage of Pesticides, 1900-1990



Pesticides: From green revolution to nobody's baby

Media Coverage of Pesticides, 1900-1990



The problem of attention scarcity

- “Prime Minister’s portfolio”: everything imaginable
- Division of labor allows governments to do many things simultaneously, unlike individuals
- However, high-level attention remains scarce
 - Prime Minister’s time
 - Space on Page One of newspapers, TV, radio
 - Election platforms of parties and candidates
 - Public concern
- Most policies, most of the time: continue the status quo while attention focuses on more urgent priorities
- Any policy, occasionally: a crisis

A threshold model of attention

- Threshold of “urgency”
 - Determined by space, how many problems can be on the agenda, and competition, how many other problems are already there
- Below the threshold: Under-response
 - No reason to call into question dominant paradigm
 - Status quo policy rubber-stamped
 - Only marginal responses to emerging trends in the severity of underlying problems
- Expectation: Stability, hyper-incrementalism

A threshold model of attention

- Over the threshold: “Alarmed discovery”
 - SQ policy obviously demands reconsideration
 - Core policy assumptions may be challenged
 - “Issue-definitions” can be revised dramatically
 - Pesticides example from above
 - Death penalty: from morality to innocence, DNA, errors
 - Among experts, previously dominant coalition may be discredited, challengers may gain power, credibility
 - No clarity on how rapidly to adjust, but clear need to “do something”
 - Tendency to over-respond

Disproportionality of Inputs to Outputs

- When a crisis *does* occur, how much of a response is enough?
- Current fiscal crisis is a great example, but it is not uncommon
- Often, it is completely unclear how much one might want to “respond” to some new signal
- Recent example: pornography “scandal” at NSF leads a Member of Congress to propose \$1.5B reduction in budget. Why in billions rather than in millions???

Bounded Rationality

- These ideas of disproportionality should be quite general to many kinds of human decision-making.
- However, they should not apply to “simple” decisions.
- Where is the boundary between simple and complex?
- Government decision-making is clearly well beyond this threshold, and that is our focus.

Some Data

- US Federal Budget, 1800 to Present (one observation per year)
- US Federal Budget, 1947 to present (62 categories of spending, so about 3,000 observations)
- Similarly organized datasets for other systems
 - National-level systems
 - US States
 - Municipalities
 - School Districts in Texas
 - Municipal governments in Benin, national government in South Africa, other developing countries

The US Government, 1801-2000

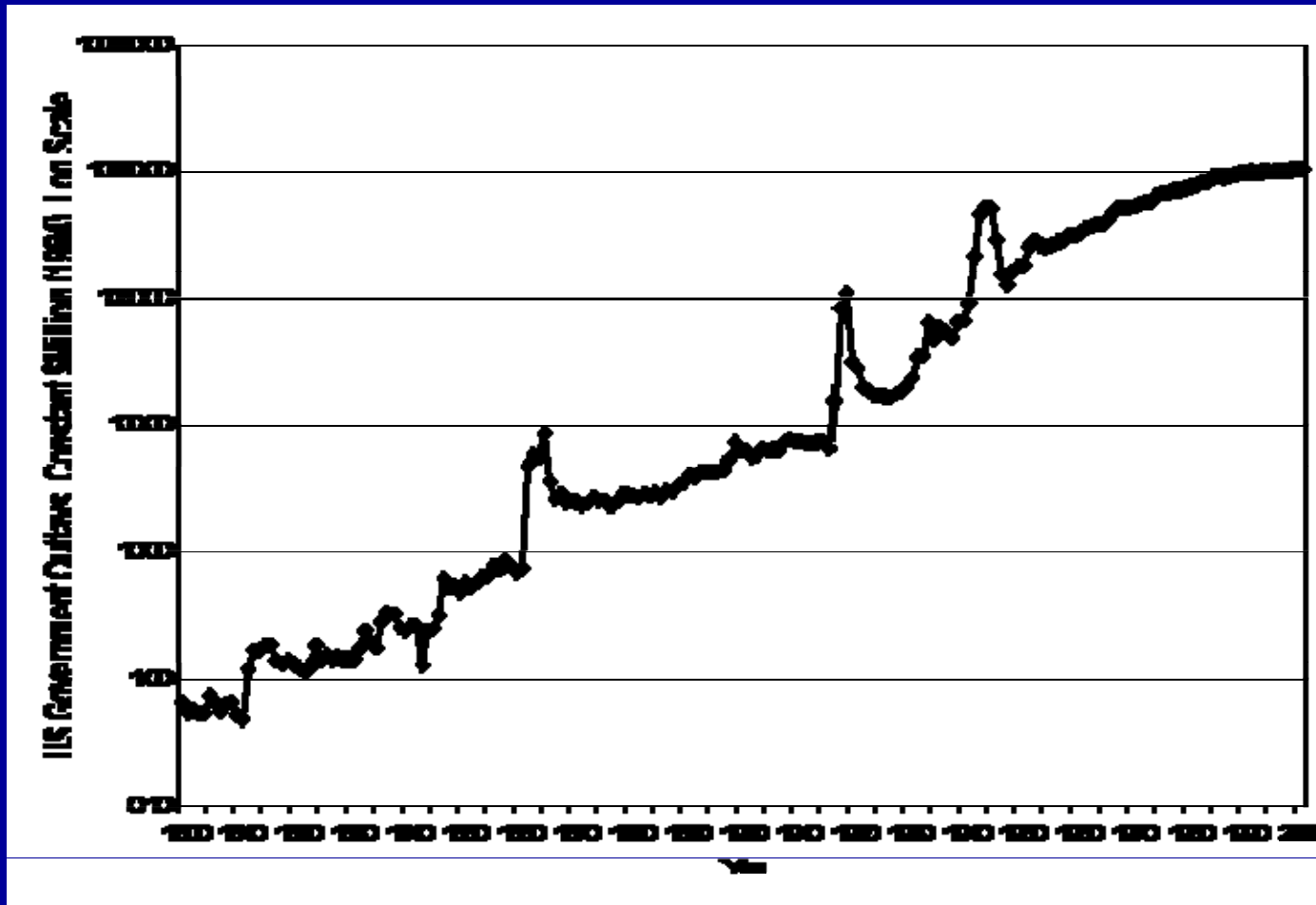


Figure 2.1. US Federal Budget Outlays, Annually from 1801 to 2000 (log scale). Data are corrected for inflation and show a 13,000-fold increase over time.

The US Budget since 1800: A High-Cost Policy Process

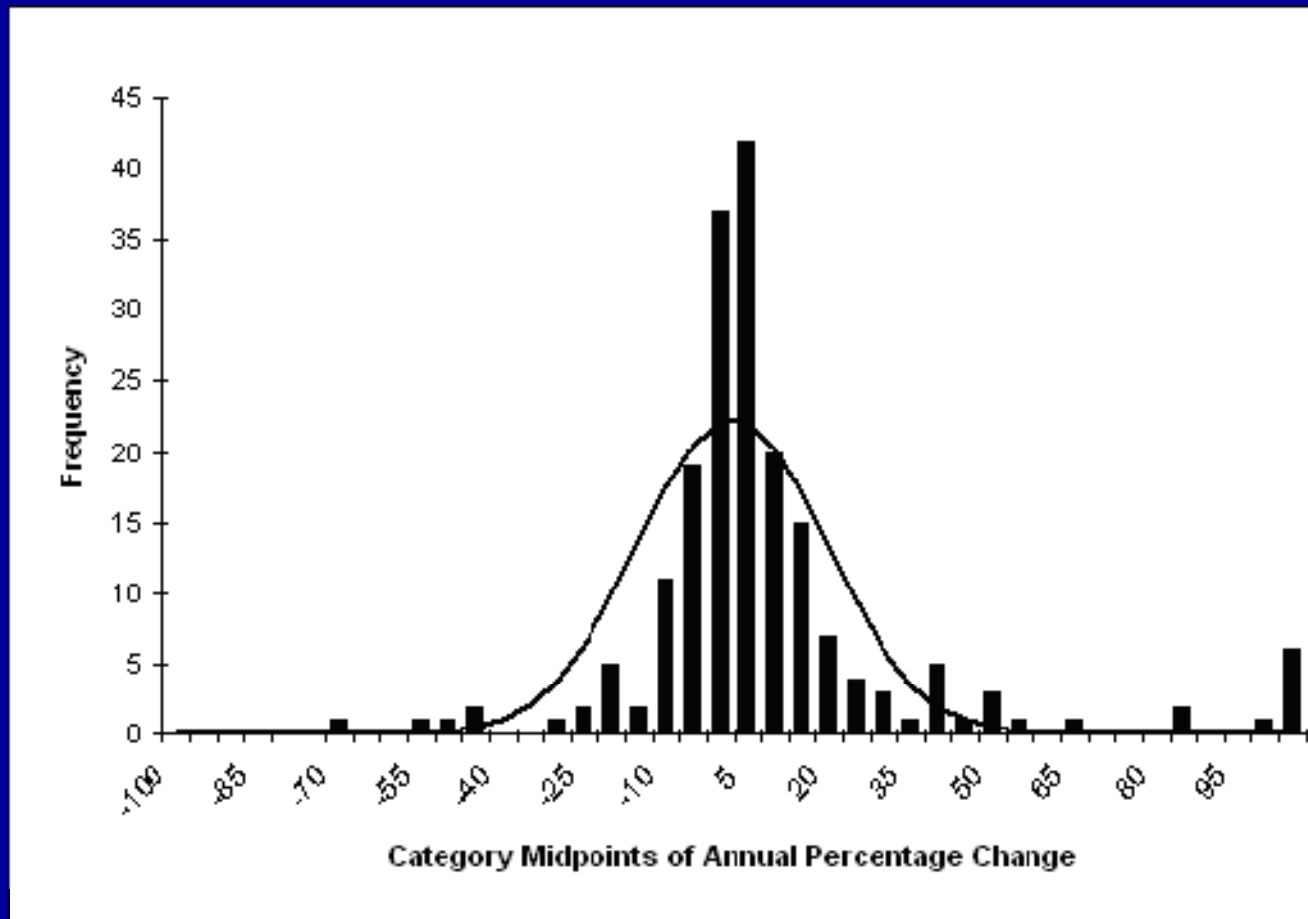


Figure 12.6. Annual change in Real US Budget Outlays, 1800-1994.

The Distribution of Budget Change, Defense and Domestic Outlays, 1800-1988

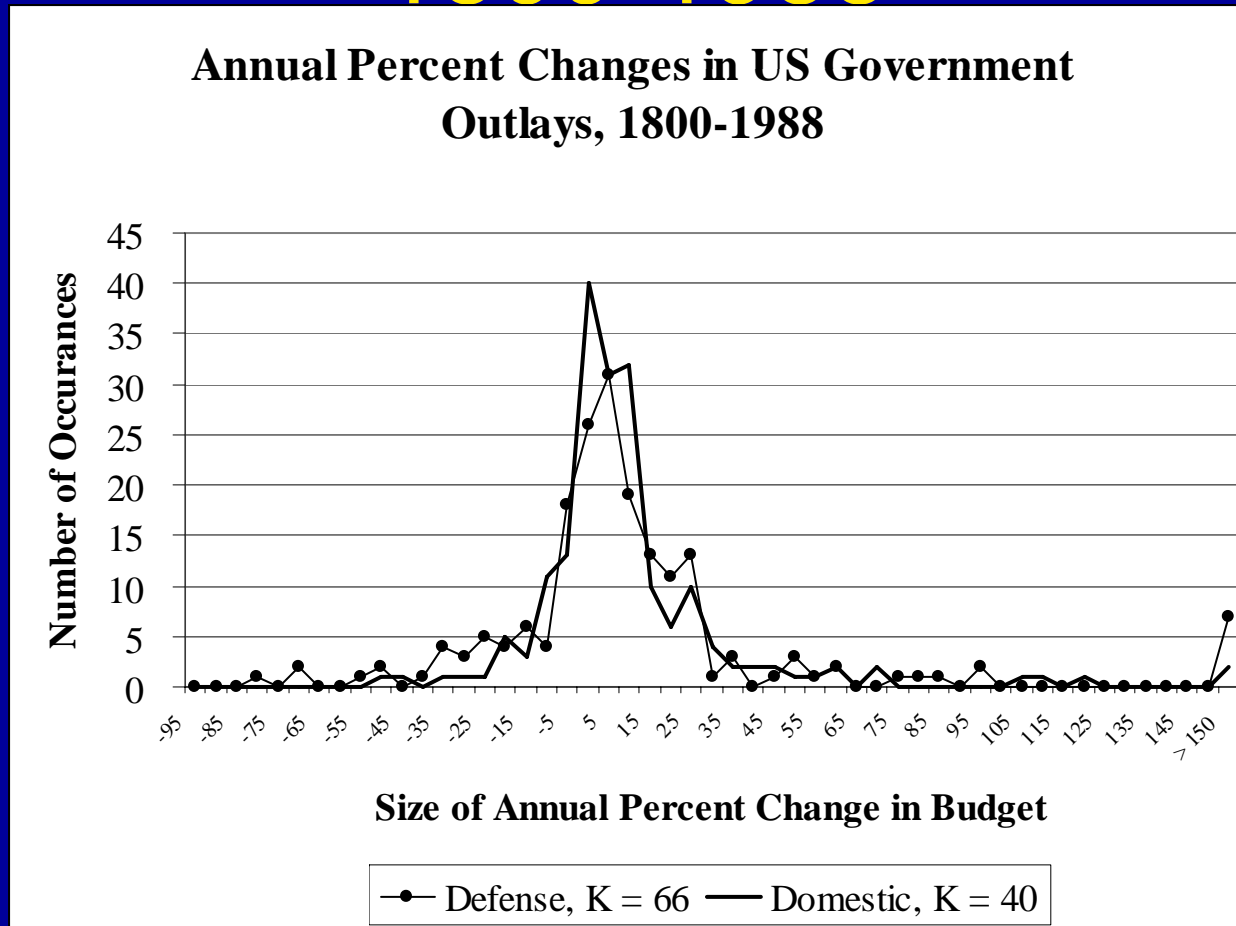
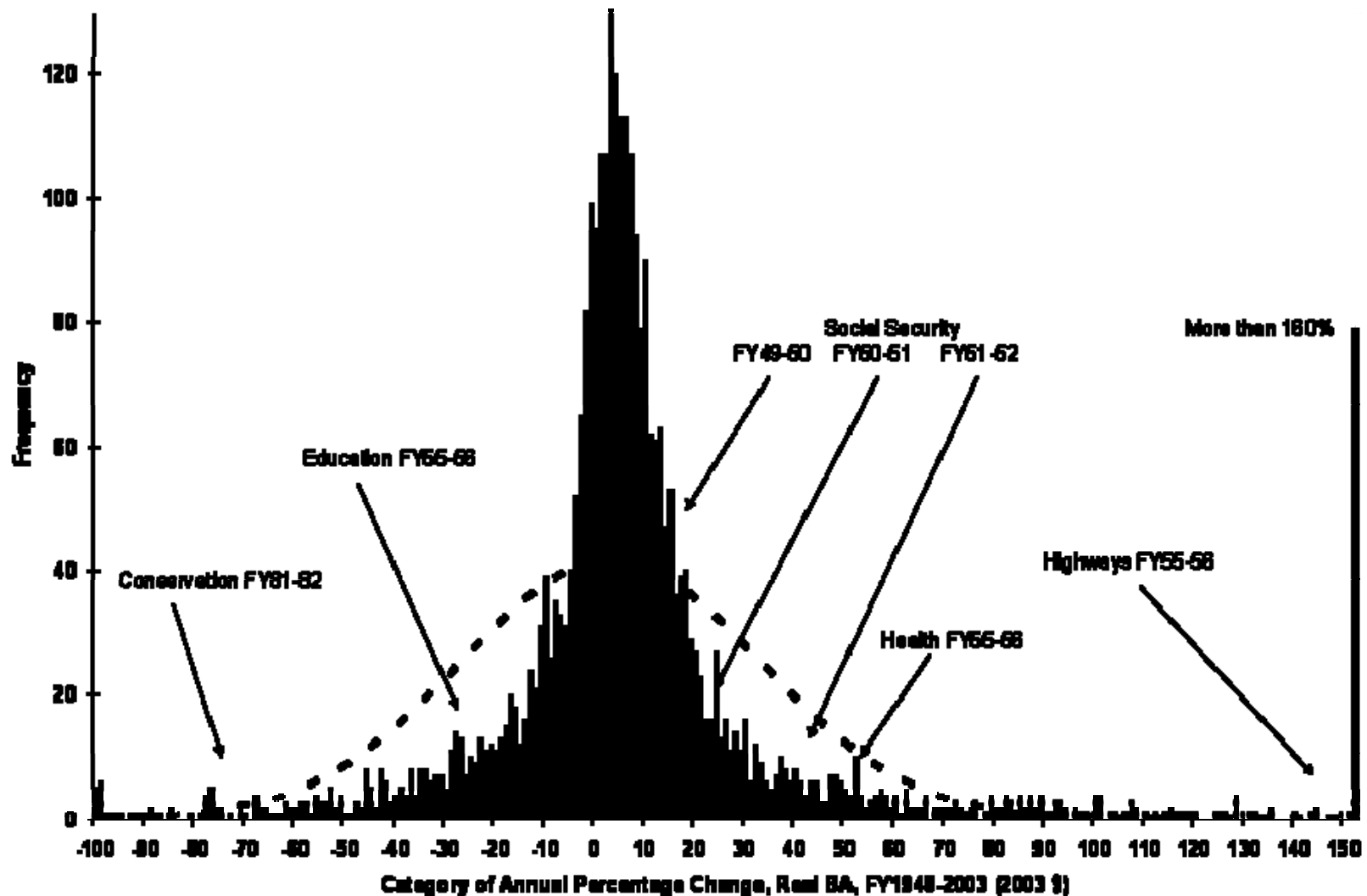


Figure 2.7. Annual Percent Changes in Budget Outlays, 1800 to 1988.

Annual Changes in Spending, 62 Categories, Federal Budget, 1947-1999



Generalized Punctuation Hypothesis

Because the reasons for under- and over-reactions to signals have to do with bounded rationality, these patterns should obtain wherever complex decisions are being made

(So any government, even any large organization of any type, should show it, as long as the environment is poorly understood)

A General Empirical Law of Public Budgets: A Comparative Analysis

Bryan D. Jones, University of Texas

Frank R. Baumgartner, Pennsylvania State University

Christian Breunig, Toronto University

Christopher Wlezien, Temple University

Stuart Soroka, McGill University

Martial Foucault, University of Montreal

Abel François, Ecole Nationale des Télécommunications

Christoffer Green-Pedersen, University of Aarhus

Chris Koske, James Madison University

Peter John, University of Manchester

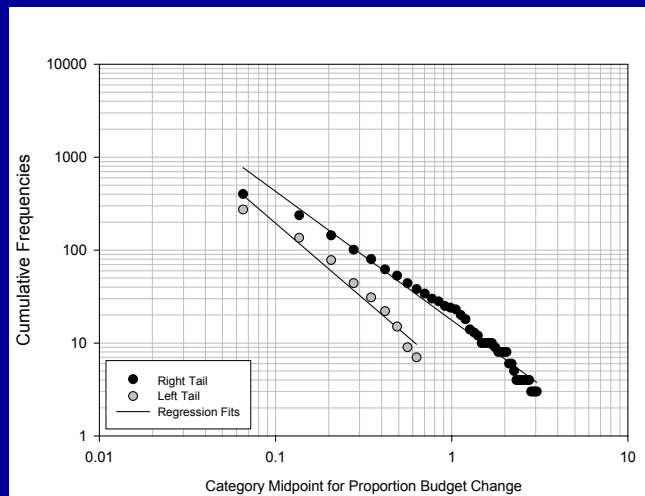
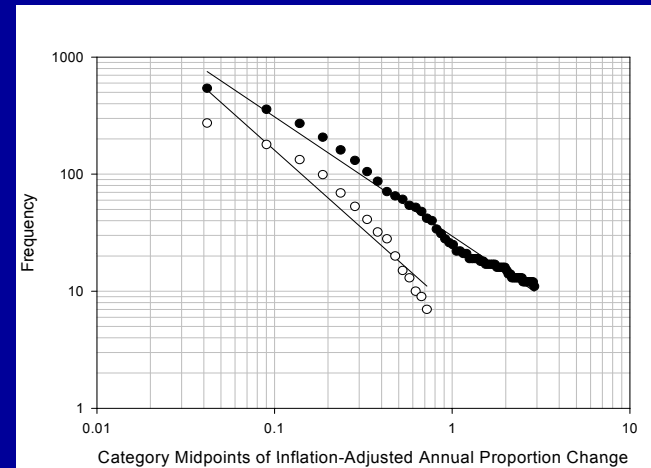
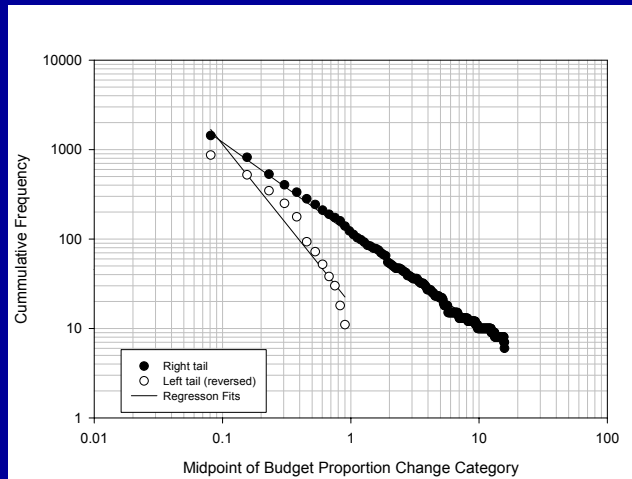
Peter B. Mortensen, University of Aarhus

Frédéric Varone, University of Geneva

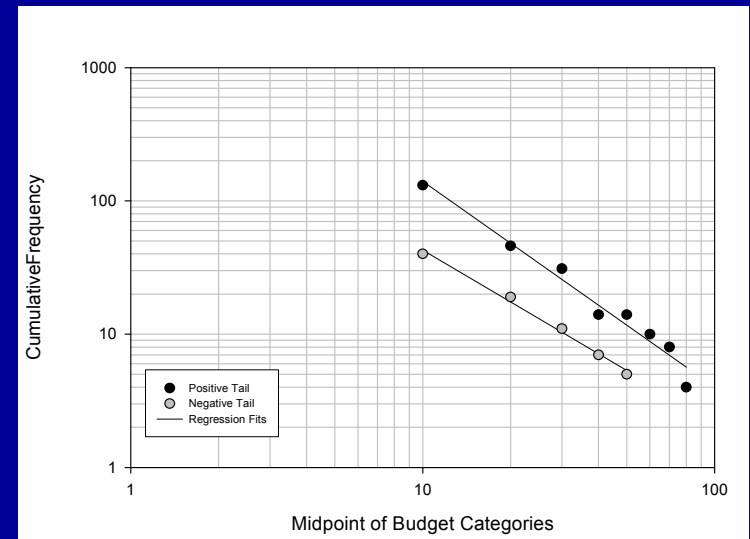
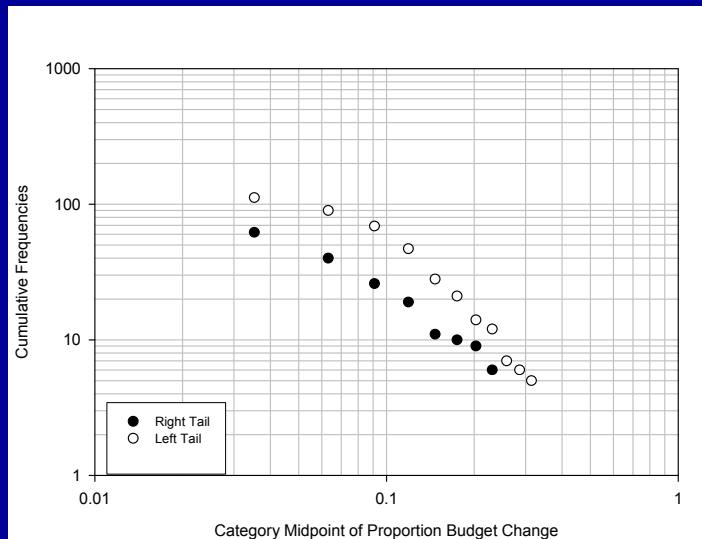
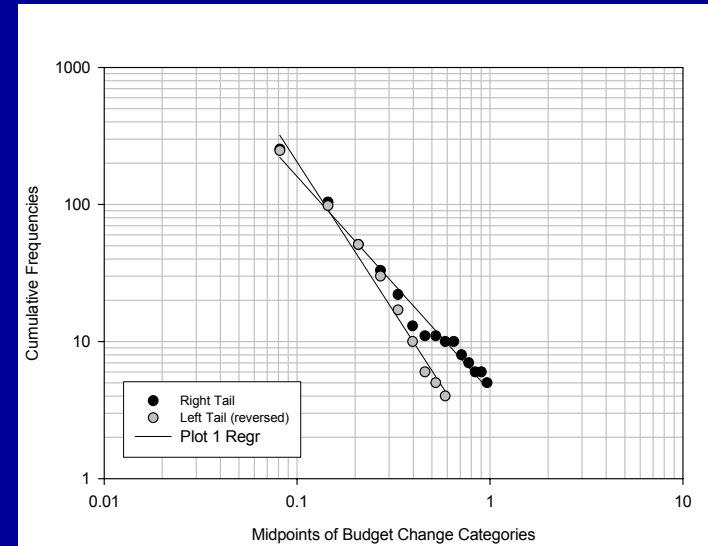
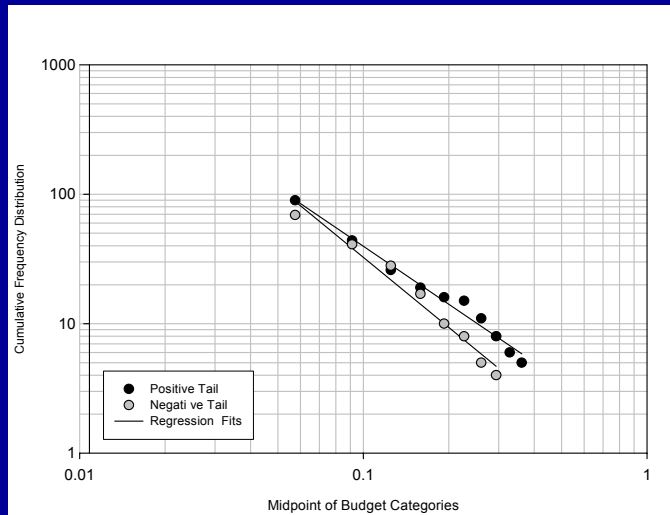
Stefaan Walgrave, University of Antwerp

(Forthcoming, October 2009, *American Journal of Political Science*)

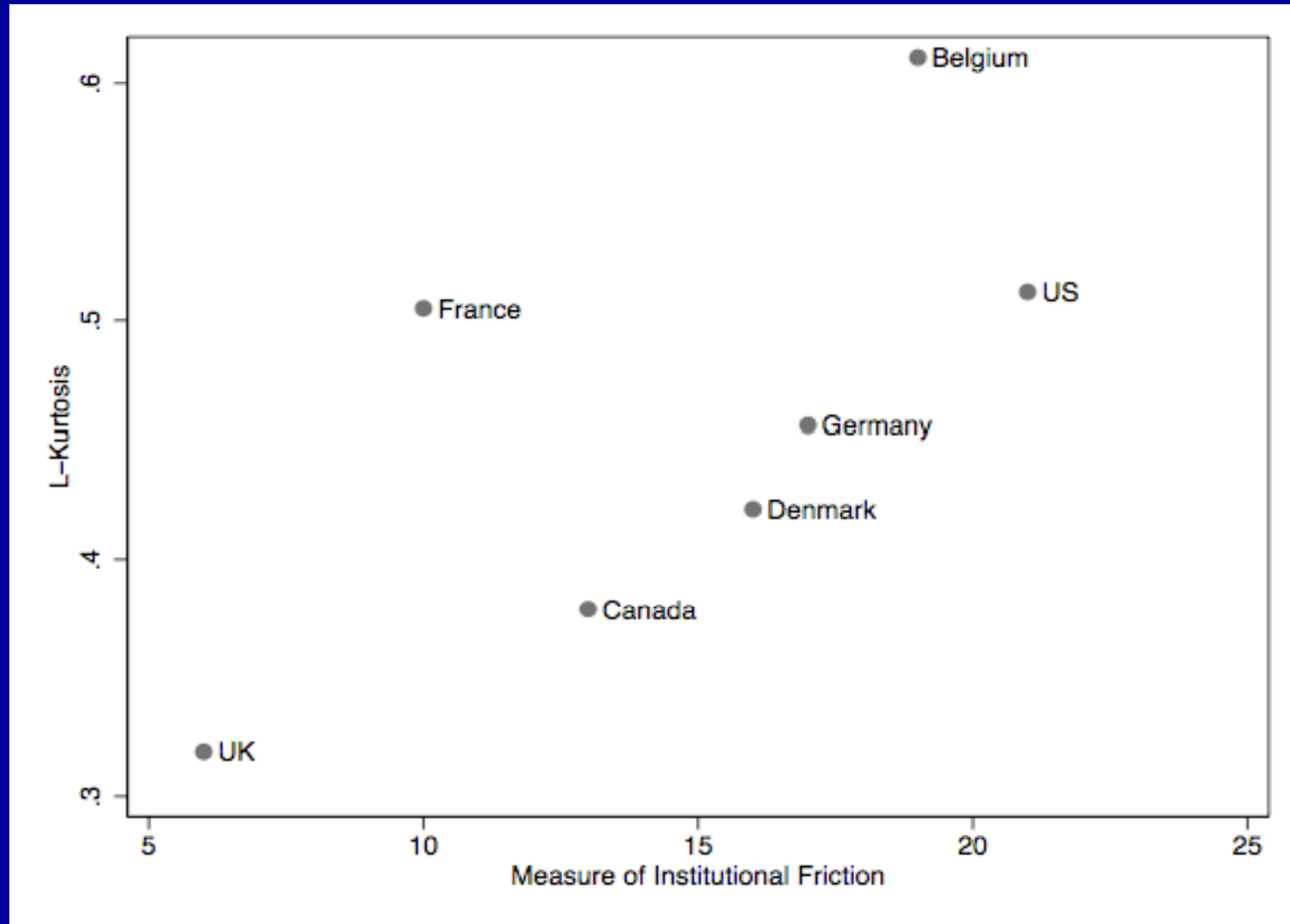
US, France, Germany



UK, Denmark, Canada, Belgium



Institutional Design Adds Greater or Lesser Amounts of “Friction”



The Progressive Friction Hypothesis

Decision-making processes that have higher “friction” (e.g., decision-making costs) should produce distributions with progressively higher kurtosis.

Assume Gaussian inputs.

If Outputs are not transformed, they will be Gaussian as well.

The more the transformation, the more extreme the output distribution.

Punctuated Equilibrium in Comparative Perspective

Frank R. Baumgartner, Pennsylvania State University

Christian Breunig, University of Toronto

Christoffer Green-Pedersen, University of Aarhus

Bryan D. Jones, University of Texas

Peter B. Mortensen, University of Aarhus

Michiel Nuytemans, University of Antwerp

Stefaan Walgrave, University of Antwerp

(Forthcoming July 2009, *American Journal of Political Science*)

US, Belgium Denmark

I. Input Series (lowest friction)

- Elections, President (US)
- Elections, House (US)
- Elections, Senate (US)
- *New York Times* stories (US)
- Elections, Parliament (DK)
- Radio News (DK)
- Elections, Parliament (B)
- Demonstrations (B)
- Newspaper stories (B)
- TV Coverage (B)

II. Policymaking Processes

(Higher decision costs, more friction)

US: Bill introductions, hearings, executive orders, CQ stories, laws

Denmark: Questions to Minister, parliamentary interpellations, parliamentary proposals, bills, laws

Belgium: Party platforms, government agreements, bills, parliamentary interpellations, executive orders, laws

III. Policy Outputs

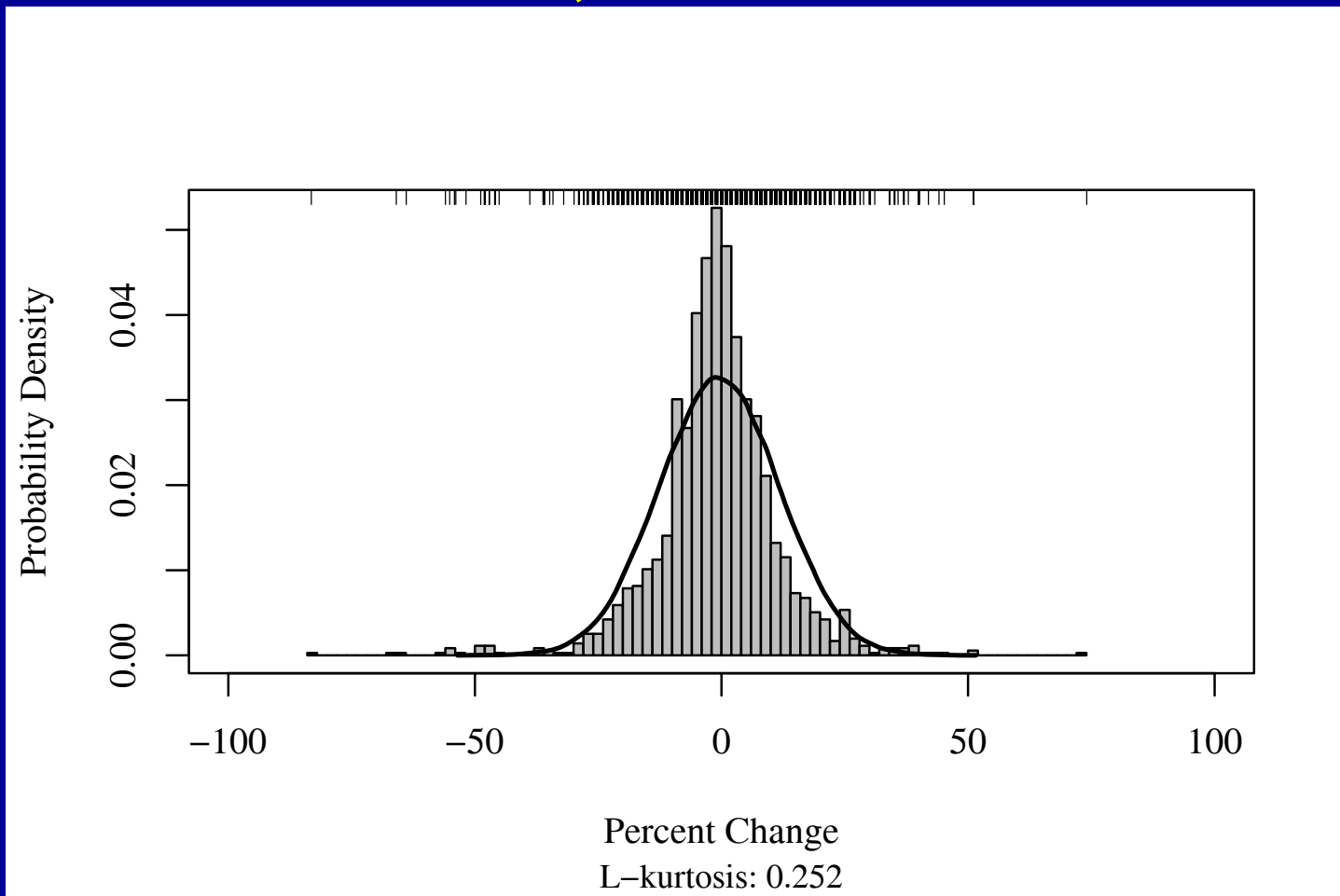
(Highest friction expected)

US: total annual outlays, budget changes
by 62 categories (data previously shown)

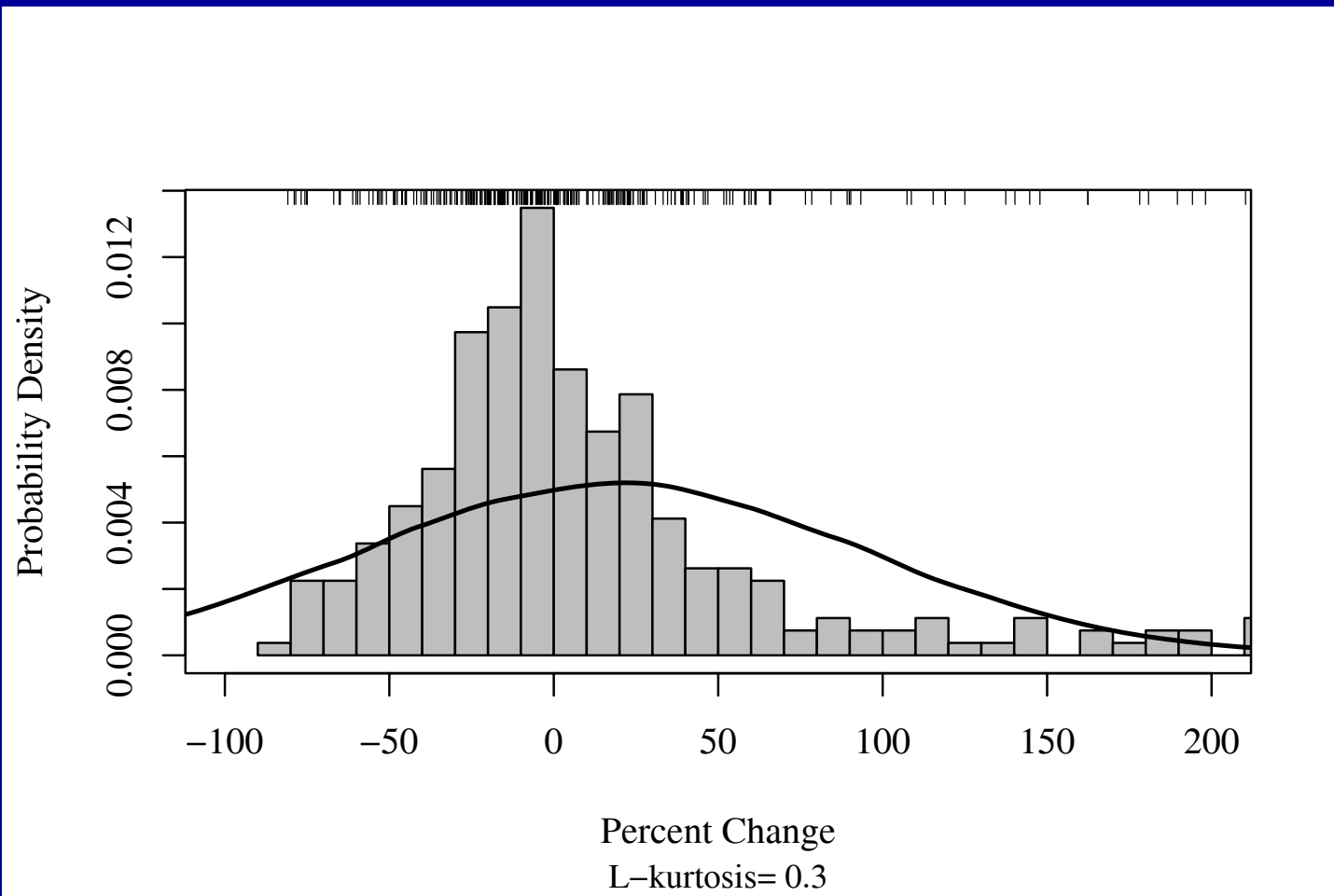
Denmark: appropriations, outlays

Belgium: budgets

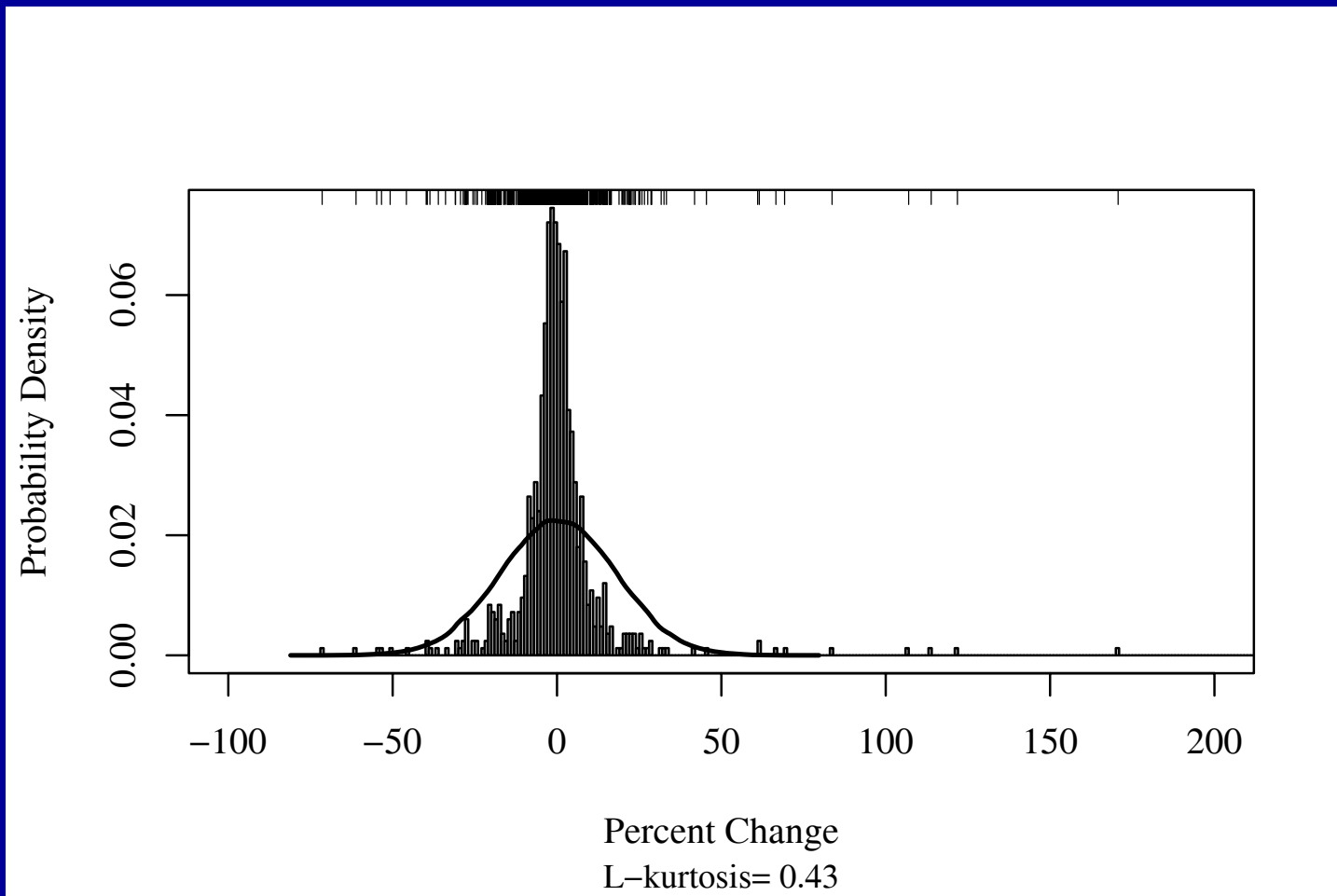
Example 1: Annual percent change in election results, US Presidential elections, 1828-2000.



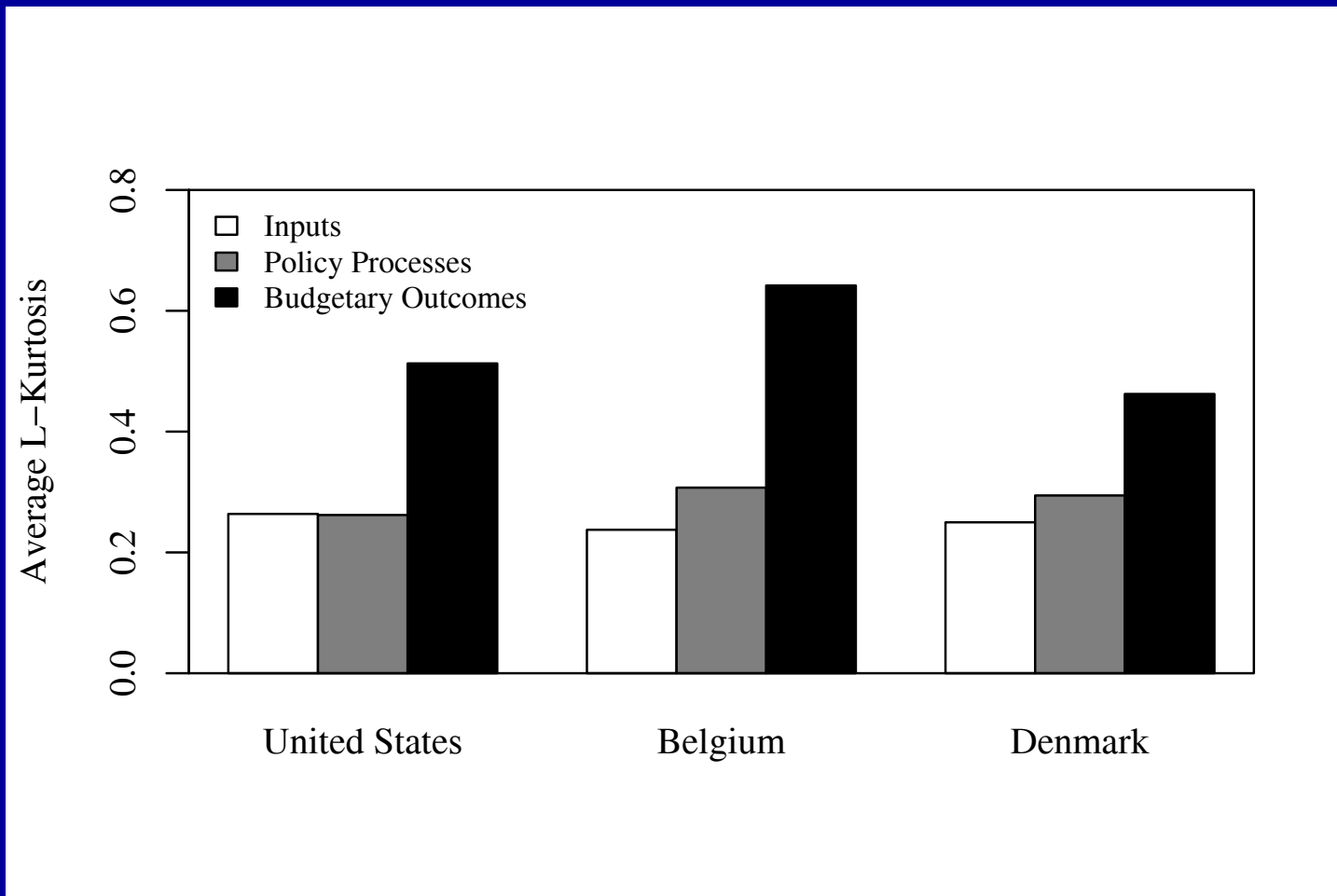
Example 2: Annual percent change in attention, Belgian interpellations and oral questions, 1991-2000.



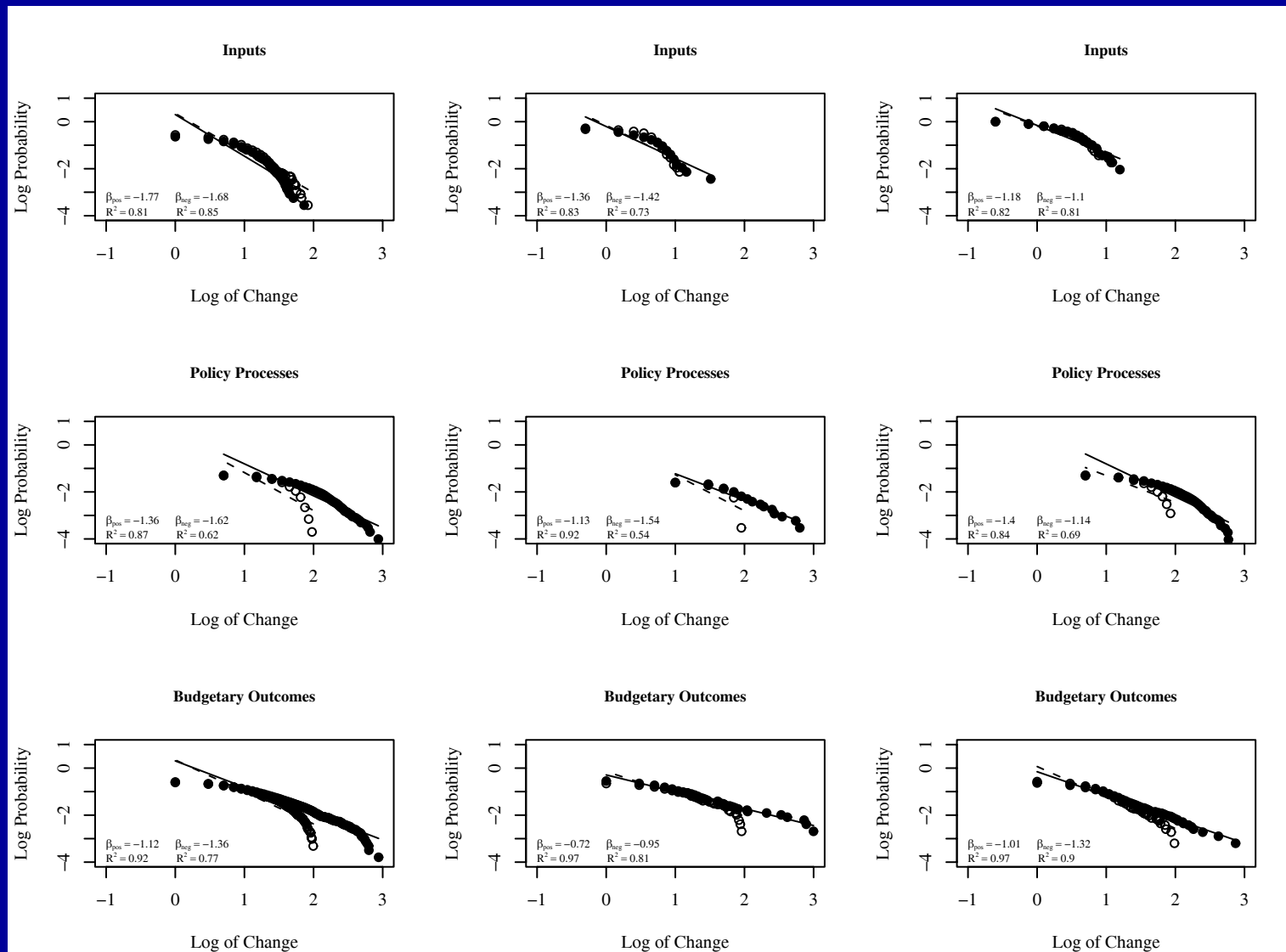
Example 3: Annual percent changes in central government spending in Denmark 1971-2003.



Progressive Institutional Friction in Three Countries



Elections, laws, and budgets in the US (left), Belgium and DK (right)



A Preliminary Model

$$R_t = \beta S_t \quad \text{if } S_t + \sum_{0 < k} S_{0 < k} > C; \quad \text{otherwise } R_t = \lambda S_t$$

Where: R_t = Response ; S_t = Input signal

The parameters:

C = Threshold ($0 < C > 1$)

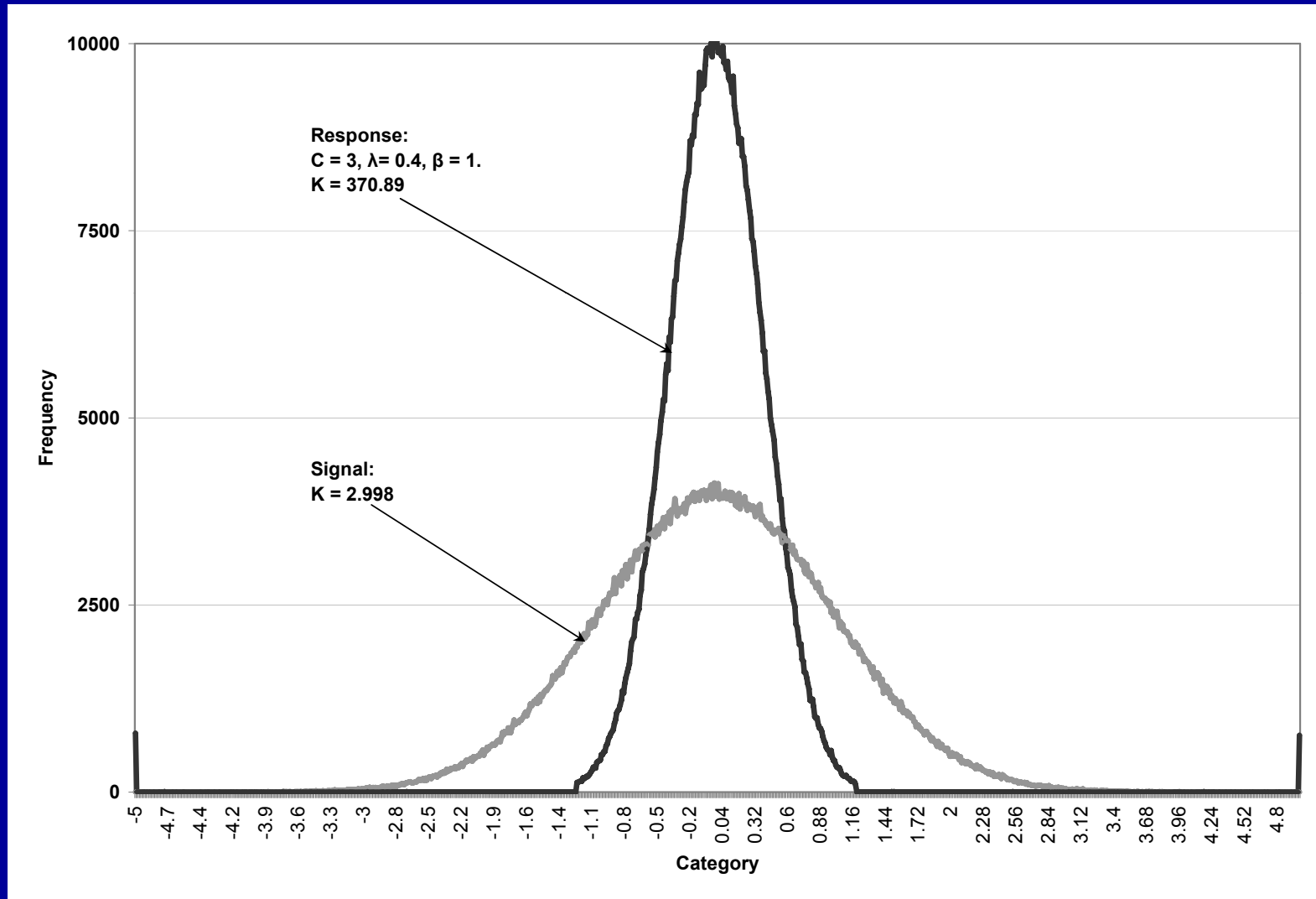
λ = friction ($0 < \lambda > 1$)

β = amplification ($0 < \beta > 1$)

$0 < t > k$ (time varies from zero to k)

$S_t = N(0,1)$ (inputs are standard normal)

Sample Model Results



Extending this simple model

Work with Bryan D. Jones, U Texas, Austin;

Péter Érdi Kalamazoo College Center for Complex Systems Studies and Hungarian Academy of Science; and

László Zolányi, Hungarian Academy of Science

Problems (some already fixed):

Left and right tails not symmetrical

“Acceleration” parameter tends to be greater than merely the accumulated signal

(That is, the simulations never produce enough extreme values)

Model improvements

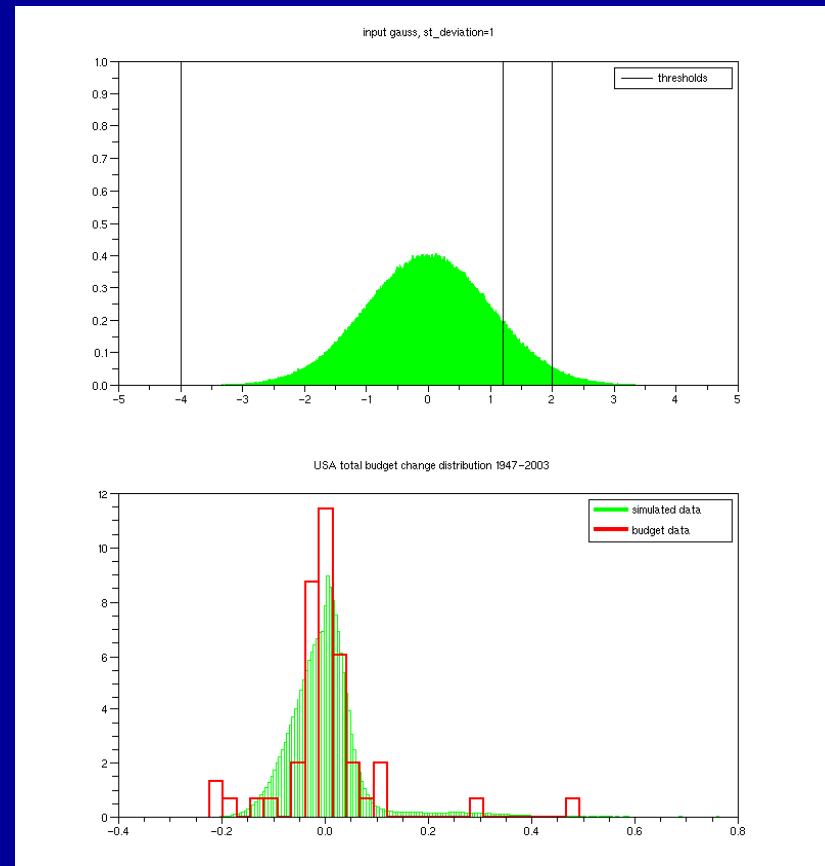
Different thresholds for negative and positive

Two positive thresholds, with a higher acceleration parameter above the second threshold.

Thresholds themselves can be made random, to avoid abrupt breaks in the simulated outputs

Some results:

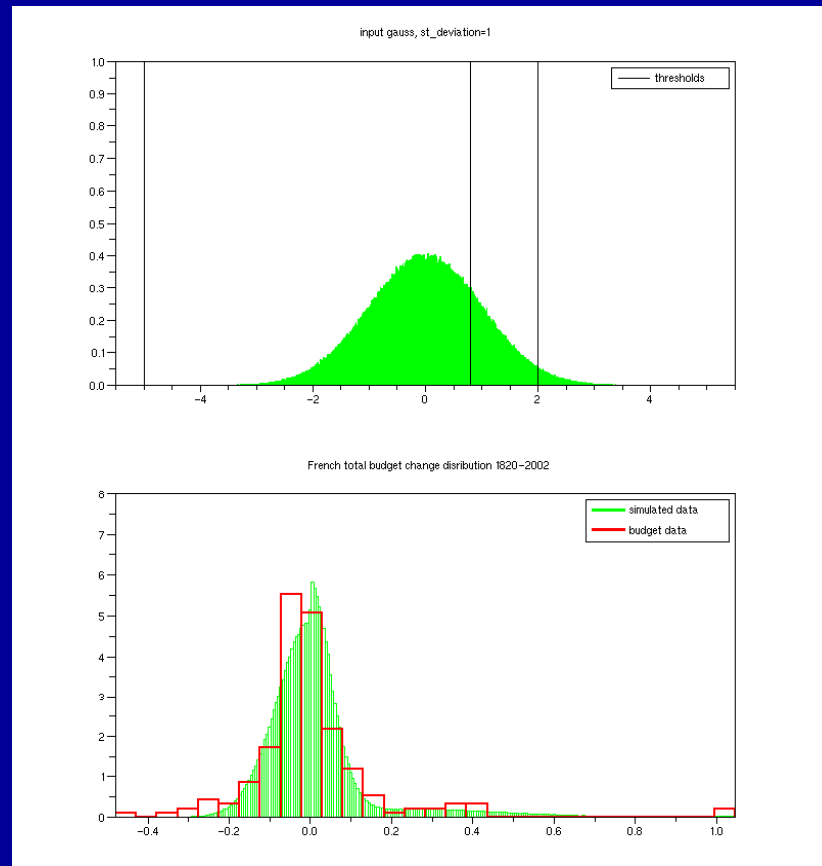
Fitting a simulation to the US data



Upper: Gaussian inputs and the 3 thresholds as vertical bars

Lower: Actual US budget distribution (green), simulated data (red bars)

Fitting to the French Data



Upper: Gaussian inputs and the 3 thresholds as vertical bars

Lower: Actual French budget distribution (green), simulated data (red bars)

Government Budgets as Power Laws

Seems a general rule

Seems due to bounded rationality,
complexity

Not clear what is the combination of:

- a) Friction, or status-quo bias
- b) Cascades, mimicking, or preferential attachment that leads to the fat tails

Remaining Issues

What is the line between simple and complex in human decision-making?

Can we design institutions that are more efficient? Do we want to?

Can we get direct measurements of decision making costs?

Why do budgets produce power laws but virtually all other distributions are less extreme?

Questions, Comments welcome

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