Punctuated Equilibrium and Institutional Friction in Comparative Perspective

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Abstract

We explore the impact of institutional design on the distribution of changes in outputs of governmental processes in the US, Belgium, and Denmark. Using comprehensive indicators of governmental actions over several decades, we show that in each country the level of institutional friction increases as we look at processes further along the policy cycle. If government attention and activities were proportionate to social inputs, then annual changes in these would be distributed Normally, because annual changes in the aggregate of thousands of factors that serve as inputs to government must be so, through the Central Limit Theorem. In each country, we show that those institutions that impose higher decision-making costs show progressively higher kurtosis values, with no institutions producing Normal distributions of policy changes over time. The results suggest that a punctuated equilibrium model of policy change is widely applicable, resulting from boundedly rational human behavior in a complex social environment.

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A Model of Institutional Friction

Governments in the modern age deal with a wide array of conflicting, unrelated, and poorly understood social issues including fostering technological innovation and economic growth, protecting human rights, providing opportunities for citizen participation in public affairs, delivering the mail, curing cancer, fighting large-scale war, providing health, education, and welfare services, and interpreting scientific evidence about issues such as global warming, genetic engineering, and the likely future cost of hydrogen fuel cells.[1] Further, trends toward greater complexity are apparent everywhere, not only because the issues themselves have become more technically sophisticated, but also because governments today are involved in a greater number of different activities than was once the case. Over the past decades, all governments have faced increased complexity as new functions have been added, new constituencies mobilized, and new problems thrown onto the public agenda, sometimes violently. The US government, for example, pays significant attention to issues of energy, space exploration, health care, transportation, the environment, crime, and foreign commerce; each of these issues was either completely absent or represented only a trivial proportion of total attention in the early years after World War Two (Jones and Baumgartner 2005). Similarly, the Danish government paid little attention 30 years ago to issues which today attract significant political attention, including health, law and order, and refugees and immigrants (Green-Pedersen 2006). The same applies to the Belgian government that, only during the 1990s, saw

[1] Some of the data used here were originally collected by Frank R. Baumgartner and Bryan D. Jones, with the support of National Science Foundation grant number SBR 9320922, and were distributed through the Center for American Politics and Public Policy at the University of Washington and/or the Department of Political Science at Penn State University. Neither NSF nor the original collectors of the data bear any responsibility for the analysis reported here. The authors express their appreciation to the NSF and their respective universities for previous support which makes this analysis possible.

its attention to asylum-seekers, traffic safety, crime, and other issues grow considerably (Walgrave et al. 1995).

Although all governments face a dizzying and growing array of issues, constitutional designs differ dramatically. Most governments have seen few changes in overall structure except for the multiplication of specialized agencies and institutions which implement the new functions that have been added over time (for the US, see Light 1995 and 1999; for Denmark, see Christensen and Yesilkagit 2006; for Belgium, see Depré 1984). In this article we address an entirely new research question: In the face of increased complexity, are some governmental designs more efficient than others? Political scientists have no idea. We take some important first steps in answering these questions here.

Our paper builds on recent work by Bryan Jones and various colleagues (Jones, Sulkin, and Larsen 2003; Jones and Baumgartner 2005) developing what Jones and Baumgartner term a model of attention-shifting. It fits into a broader literature assessing the fit of a punctuated equilibrium (PE) approach to policymaking, which Baumgartner and Jones (1993) argued was a useful way to explain the combination of stability and change observed in US politics. More recent assessments, building on the attention-shifting model, suggest that the PE model may be much more broadly generalizable. We test the attention-shifting model (and by extension, the PE theory) with comprehensive assessments of hundreds of thousands of observations concerning government activities in all areas of public policy for three western democracies. Before turning to our empirical study and data, we first address the conceptual questions that motivate our approach.

Considering the overwhelming complexity of issues with which governments deal, changes in the combined set of inputs to government can be demonstrated, through the Central

Limit Theorem, to have a Normal, or Gaussian, distribution. That is to say, if we could construct a hypothetical index representing changes over time in the severity of all the different problems government might be expected to deal with, this distribution would have the shape of a classic bell-shape curve. Some problems would have gotten worse, some things would have improved, and because there are thousands of problems, each of which is assessed at best imperfectly through multiple indicators, and no single one of them overwhelms the entire government at any one time, the combination of them, through the workings of the Central Limit Theorem, would be Gaussian.

Jones and Baumgartner (2005) develop this argument in three different ways: First, theoretically; second, with simulations; and, third, with examples drawn from actual series such as the crime rate, inflation rate, and other cases where particular social or economic indicators are widely used in government. The results of these analyses show that one can develop a very simple indicator of the overall efficiency of government decision-making processes. Since the social *inputs* to government can be demonstrated to have a Normal distribution in their first differences, we can look at the distribution of annual changes in the *outputs* of government and see if these are distributed Normally as well. If the institutions were seamlessly and efficiently reacting to each new problem as it arose, and had no tendency to continue to act on problems that are no longer very severe, then the distribution of outputs from government would reflect perfectly the distribution of inputs. Jones and Baumgartner term this a "proportionate decision-making model." It can be used as the limiting case of perfect efficiency. In such a case, with seamless translation of signal to response, the distribution of changes in government outputs

would exactly reflect the distribution of changes in social inputs; no friction would be apparent.[2] The system would be comprehensively rational, perfectly efficient.

Large organizations dealing with a large number of poorly understood problems are not proportionate decision-makers, Jones and Baumgartner argued. Rather, the cognitive architecture of choice and the institutional design of specialization of function create powerful status-quo biases and induce various levels of "friction" in the decision-making process. Friction means that the decision-maker under-responds to changes in the severity of problems when these remain below some threshold of urgency, focusing attention instead on those few areas where concerns are so great that they must be attended to immediately. Any organizational leader will delegate most decisions to subordinate managers responsible for routine administration of issues within their areas of authority, getting personally involved (and possibly redefining priorities) only in that subset of issues that appear to demand the greatest attention. In complex environments where thousands of potential problems vie for limited space on the political agenda, powerful filters must be in effect. An attention-shifting model helps explain the tendency for occasional large-scale changes to be made in policy priorities in those few areas where attention becomes focused but for most issues, most of the time, to be the object of decentralized and routinized decision-making with little deviation from the status quo.

An attention-shifting model is *disproportionate* rather than proportionate: As a given social indicator becomes more troubling over time, the model predicts no response whatsoever during the early periods—the issue is "off the radar screen" and government may not even track its severity in any systematic manner at all. After the severity of the issue has passed some

[2] Note that the same analysis applies to any system with fixed or even proportionate decision costs (Jones and Baumgartner 2005, 154). What we see are decision costs which are disproportionate to the input series.

threshold, on the other hand, there may be a rush to make up for past inattention to the issue by dramatically increasing policy outputs directed to it. The issue may be systematically tracked and a specialized agency or bureau may even be created to focus on it. Attention to the problem becomes institutionalized. Governments may grow more and more complex through this process of continued institutionalization of monitoring and responding to various problems, but they can never institutionalize attention to all relevant dimensions of all relevant social problems. New ones will inevitably rise up. Because attention is often institutionalized, there is a double-inefficiency. Not only is government slow to pay attention to new policy problems, but, once established, policies may be continued long after the severity of the problem which justified them in the first place has declined. Reactions to improvements in the state of the world, by reallocating attention or resources to other areas with more severe problems, or more rapidly growing ones, are slow. Institutional friction in the forms of sunk costs, long-term budgetary commitments, identification with means rather than ends, and bureaucratic inertia makes it hard for governments to reduce attention to issues that are improving just as it inhibits them from paying attention to problems that are just emerging (see Lindblom 1959; Wildavsky 1964; Simon 1997). Governments are sticky. They are slow to respond to new policy problems and they are slow to withdraw from policy areas that no longer merit prioritized attention.

Thresholds in the policymaking process are not simple hurdles a policy issue must leap to gain attention. They are contingent themselves on a network of interacting variables, causing context to matter. If policymakers are attending to a problem, it can be easier to attract attention to a related issue than to issues not seen as related. This facet of organizational decision-making allows advocates to try to attach their favored issue to a "rising star." Many issues only tangentially related to homeland security have been redesignated as critical because of the flow

of resources there. Similarly, during periods when official attention is focused intently on one set of issues (such as during times of war or economic crisis), it may be particularly difficult to put other issues onto the agenda. So thresholds are contingent. More importantly for this paper, the contextual nature of thresholds means that simple estimation procedures are not good ways to proceed; a threshold estimate for time 1 may be invalid at time 2.

The statistical signature of a disproportionate response model such as the friction model is extremely simple: In response to a Normal distribution of inputs, the decision-making process transforms the data by *reducing* those values below some threshold and by *amplifying* those values above the threshold (and the threshold itself is time-sensitive). The resulting distribution of outputs has a high kurtosis value. Compared to the Normal, such a distribution has a higher central peak, weaker shoulders, and more cases in the extremes. Such distributions are often called "fat tailed" or "extreme value" distributions and are not uncommon in many natural processes where friction models operate (on leptokurtic or "power-law" distributions in general, see Barabasi 2005 or Watts 2003 for excellent overviews; see Zipf 1949 or Simon 1955 for earlier works).

The most striking characteristic of a leptokurtic distribution, at first glance, is its extremely high central peak. But a leptokurtic distribution differs from a Normal distribution with a very low standard deviation (which could, after all, also have a huge central peak if its standard deviation were small enough) because the distribution with high kurtosis will simultaneously feature great numbers of cases far out in the tails: even five or more standard deviations away from the mean, in an area where the Normal distribution would have no values whatsoever. The simultaneous occurrence of many cases in the center and large numbers in the extremes makes a leptokurtic distribution strong evidence of a PE process.

Our measures of policy response include all manner of changes, both increases and decreases. Governments may expand attention to new issues with greater alacrity than they withdraw attention from established areas. We can assess these dynamics easily by looking at the left- and right-hand tails of the distributions we will explore in the empirical section below. Contrary to some popular myths, governments do indeed withdraw attention from established policy areas, though these dynamics are indeed less punctuated than those associated with growth in attention.

Different decision-making processes may introduce different levels of friction. Some may be relatively efficient, distorting the input distribution only slightly, producing an output distribution with only a small tendency toward higher kurtosis. (Indeed, if there are only a few dozen observations, as is often the case with annual change data, the resulting distribution may look very close to Normal, with just a few "extra" outliers.) As institutional friction is enhanced, the kurtosis value of the output distribution will be greater—the output distribution will exhibit more distinctly the high central peak, weak shoulders, and fat tails of an extreme-value series. Assessing the shape of the distribution of changes in outputs is a straightforward method of assessing the efficiency, or the proportionality, of the decision-making process. Kurtosis, the statistical measure of the peakedness of a distribution, is the simplest single indicator for friction. In this research we use relatively large numbers of observations so that we can observe even small deviations from the Normal, and we study a range of policy distributions, some of which deviate quite substantially from the Normal because they are extremely "sticky."

In this paper we look at the full range of activities of three national governments across several decades, comprehensively assessing their attention and actions across hundreds of distinct policy areas. While the method may not work in more limited settings, because it is

possible that the input series would not themselves be Normally distributed but heavily affected by exceptional, severe stochastic shocks to the system, we are not faced with that problem here. Further, we look at a range of processes in each of three countries and assess the differences in efficiency across the institutional settings. We select institutions that deal comprehensively with the full range of government activities. Therefore we can be sure that the social inputs to which these institutions are responding are identical. That is, within any country, the differences that we observe among the various institutional processes cannot possibly be due to differences in the inputs, since the inputs are common to all of them. With these explanations in place, we move now to explaining our empirical approach.

Testing the Friction Hypothesis in Comparative Perspective

The discussion about friction above and the work previously published dealing with the US make clear two hypotheses. Jones and Baumgartner (2005, ch. 7) refer to the "General Punctuation Hypothesis" as follows:

H_1: Output change distributions from human decision-making institutions dealing with complex problems will be characterized by positive kurtosis.

This implies that we should *universally* observe positive kurtosis whenever we look at indicators of change in the activities of governments. Only in the simplest of cases would we expect that governments would be able to react proportionately to all those changes affecting their environments. A Normal distribution would imply proportionate responses to social inputs.

The second hypothesis might be called the "institutional friction hypothesis" and allows a greater number of empirical tests:

H_2: The more friction that an institution imposes, the higher the kurtosis of its output distribution.

This second hypothesis allows for multiple tests because the level of friction apparent in various institutional settings may range from low to high and as it gets higher we should expect the resulting output to have increasing levels of kurtosis. Because institutional costs are lower in what we have termed the input series, higher in the parts of the policy process that require coordination among multiple actors or heavy bureaucratic procedures to be followed, and highest in those institutional processes such as budgeting that come only at the end of a long and complicated series of processes, we can propose the *progressive friction hypothesis* as follows:

H_3: Kurtosis values will increase as one moves from input to process to output series.

The friction model has previously been addressed in the US context, and it has been confirmed. Jones, Sulkin, and Larsen (2003) showed that US institutions could indeed be arrayed in a line from lower to higher kurtosis and that this corresponded to their place in the policy cycle. Jones and Baumgartner (2005) updated and confirmed these tests as well. But the US presents perhaps a poor choice for developing a general model of institutional friction. After all, the system features separation of powers, multiple veto players, a complicated budgetary process giving significant autonomy to many actors, and a level of social and economic diversity which may not be comparable to other countries. On the other hand, the cognitive arguments that are at the core of the attention-shifting model are universalistic, as are the more general arguments about institutional friction. Different institutional structures may impose different levels of institutional friction, but all human institutions are affected by similar cognitive architectures and limitations. We know of no constitutional regime or institutional structure that allows fully proportional responses to social inputs. Further, even if different countries have different levels of friction because of different institutional design, we can still test if different institutions within a country are more efficient than others. Our theory suggests that policy

monitoring functions should always be more efficient than policy making functions and that policy output functions should have the highest levels of friction. This pattern should obtain within any country, even if average levels of friction were different from country to country.

Initial studies of budgetary outputs show important commonalities across many institutional structures. Baumgartner, Foucault, and François (2006) assessed the distribution of changes in French government spending patterns from 1820 to present, with more detailed ministerial data from 1868, and found strong support for a PE model. Levels of kurtosis were similar to the US findings (and remained in place when periods of war or foreign occupation were excluded from the analysis; major stochastic shocks do indeed increase kurtosis but when these are excluded the analysis showed that internal causes of kurtosis remained clearly apparent and the effects were nearly as strong). Breunig (2006) has shown similar results in studies of Germany, Denmark, the UK and the US. Jones et al. (2006) looked at national budgets in the US, France, Germany, UK, Canada, Denmark, and Belgium as well as Danish local government spending, US state budgets, and spending by Texas school districts. In each of the series explored, a power-law distribution was found.

In sum, in every case where investigators have looked at budget change distributions using the friction approach, they have found strong evidence for PE processes (see also John and Margetts 2003; Jordan 2003; Mortensen 2005a; Breunig and Koski 2006). The generalized punctuation hypothesis, at least for budgets, seems well confirmed. But budgets come at the end of a long process of decision-making, reflecting complex negotiations among many actors. Perhaps the legislative process is more straightforward, or perhaps parliamentary leaders are better able to implement their governmental agendas than in the US. If so, then we should see important differences from the US results when we look at a range of governmental procedures

in other countries like Belgium and Denmark. In this respect, Denmark represents a unified political system with a unicameral national parliament, dominated by strong political parties. Belgium is also a parliamentary system dominated by political parties but a federal one with a bicameral parliament. This paper therefore presents new and relevant tests.

Considering the US roots of the friction hypotheses, a number of important unanswered questions remain that can only be addressed through comparative analysis. For example, it is empirically unclear whether the complex separation of powers and federal structure of the US government should produce higher or lower levels of friction than unified parliamentary systems. On the one hand, the multiple veto-points and concurrent majorities of the US system seem to point clearly to higher friction values because they would appear to raise decision costs. On the other hand, the multiple access points of the US government may in fact allow it to evolve over time in reaction to changing social pressures. Federalism may reduce the stakes of national politics, making national policies less costly than where a single decision must be made universally applicable across the national territory. That is, where policies are the result of dozens of local decisions rather than just one national one, these decisions may be made more easily as each one mobilizes a smaller and less diverse constituency. Another difference is in the role of political parties. The powerful parties that dominate some national political systems, like Denmark and Belgium, could make access to the agenda very difficult (or disproportionate), but decision-making once initial agenda-access has occurred may be very simple (Walgrave et al, 2006). If this were the case we might observe high kurtosis in the monitoring functions of government but no further increase when we move from monitoring to law-making, for example. Our point here is not to say which of these hypotheses is correct, but simply to point to the vast potential of a comparative approach in answering these and similar questions. By assessing

governmental efficiency in a new and comprehensive way, we open the door to a wide range of comparative analyses. Rather than propose these specific hypotheses we explore these questions empirically in the section that follows. The literature gives little guidance on what to expect.

Our friction approach requires that we rank the institutions of government by the degree of friction that they impose. Many activities in all governmental settings are relatively low-cost; these reflect efforts to monitor or to discuss social issues but do not require coordinated action. We expect monitoring functions in general to be low-cost in all three countries. Oral questions in Parliament, for example, require little more than a single MP's arousal of attention for whatever reason. Written questions to ministers in Parliamentary settings impose few costs for similar reasons. Similarly, media coverage in most systems can shift from topic to topic with few institutional costs. Some decision-making processes are relatively simple as well; Presidential executive orders in the US require only one signature, for example. Congressional hearings in the US are scheduled by a decentralized set of committee and subcommittee chairs; they fall in a middle range in terms of cost as they are rarely spontaneous and do require planning, but are not so onerous as to impose similar costs as the passage of legislation.

Those processes that require multiple actors to coordinate their activities, that impose high costs such as long delays, significant investment in time and study, or are subject to multiple veto-players should have higher friction and therefore show higher kurtosis in their distributions of outputs. The passage of laws requires significant concurrent majorities in the US, less so in Denmark or Belgium (but is still more difficult in those countries than purely monitoring functions such as questions). Executive orders in Belgium may have high costs as they are adopted officially by the entire cabinet, acting as a group (rather than, as in the US, requiring only a single signature). Budgets, in all cases, are the highest cost activities.

Monitoring functions should be low-cost; decision-making functions higher cost; and resource allocation actions should be highest-cost.

The Generalized Punctuation and Progressive Friction Hypotheses in Comparative Perspective

As already mentioned, we have collected data that allow us to study change in policymaking attention for a number of institutions of government in the three countries. In each case, the data were coded in a manner that ensured that period-to-period changes could be assessed for each institution. Full details are given in Appendix 1. Figure 1 gives an overview of all the data series and presents them in the order one should expect based on the logic behind the progressive friction hypothesis. The measures of institutional attention are not exactly the same across the three countries, partly due to data limitations but also partly due to differences in political institutions—neither Belgium nor Denmark for instance has anything identical to Congressional hearings. However, for all three countries we have multiple measures of input, process and output data allowing a robust test of our argument for all three countries.

(Insert Figure 1 about here)

Each of the series is defined in similar ways and each covers a very large number of observations. One of our series, annual US budget outlays since 1800, has only 187 observations. The other series are typically based on several thousand observations, with the US congressional hearings, *New York Times*, statutes, Congressional Quarterly stories, US Budgetary Authority, and statutes databases each based on several tens of thousands of observations, and the bills and elections data each based on more than 100,000 observations each. While the Danish and Belgian data are not as extensive, they too are based on thousands of underlying observations, as our Appendix makes clear. In each case, we categorize the events

into a consistent series of topics and look at the distribution of changes from period to period across all the topic categories.

We are interested in the distribution of percentage annual changes. Election results are measured from election to election, not by year. In all cases, we use the "percentage-percentage" method of calculation, which assumes a fixed total level of governmental capacity to attend to issues (see Jones and Baumgartner 2005). Of course, the total size of a governmental agenda is not absolutely fixed. When we use the percentage-count method of calculation, reflecting this, the pattern of our results is similar, in particular the pattern of increasing friction as we move from inputs to policy processes to budgetary outputs. In general, our results are robust with respect to a wide range of details in specification and calculation, though the details are subject to change.

Figures 2 through 4 give examples of three of our series. We present the number of annual changes of various sizes as a histogram, and we overlay a Normal curve with a similar standard deviation. The series are, in order, US House elections, Senate hearings, and budget authority across 62 categories of spending by the US federal government.

(Insert Figures 2 through 4 about here)

The deviations from Normality are obvious in these three series, each progressively more so than the previous. It is also clear that the various series have different standard deviations, but Normal curves can have any level of variance. Kurtosis measures the relative peakedness of the distribution compared to a Normal distribution and the number of extreme values relative to values near the mode; the variance of the distribution is a related but different question. We present two measures for kurtosis, K and L-K. L-K is a scale-free measure of the same concept, more stable statistically and less affected by single outliers. We find the L-K measure to be the

most accurate single indicator of kurtosis, but we also present the K scores because these are more familiar in the literature. Both reflect the general shape of the distribution, but neither does so perfectly. Therefore, we supplement this hypothesis testing with an analysis based on cumulative frequency plots, which in contrast to the single statistical measure of kurtosis allows us to assess the shape of the entire distribution (see below).

(Insert Tables 1 through 3 about here)

Tables 1 through 3 present the K and L-K scores for each of the series listed in Figure 1 above, along with the total N on which the calculations are based. (Ns in the table refer to the number of annual changes times the number of categories. The overall number of observations on which these annual calculations is based is much higher.). The tables show that all the series have significant kurtosis thus clearly supporting hypothesis 1. Looking at the US data (table 1), those with the lowest levels of punctuation are the election series, followed by House bill introductions and executive orders. New York Times stories are relatively highly punctuated, showing perhaps some significant staying power of individual topics on the agenda for years at a time. Congressional procedures, reflected in hearings and CQ stories, have some significant friction associated with them. (The Senate bill introduction figure appears an anomaly; note the difference between the K and LK score.) Finally, budgetary figures are both very high on the scale of friction. While each series is not precisely arranged according to order, in general there is significantly more friction associated with those processes that come further along the policy process.

Table 2 presents the results for Denmark. The individual series range in kurtosis with the election series being the lowest, parliamentary questions and bills being moderate, and

interpellations (which can only be done by parties, not individual MPs) having higher friction. Finally, the two budgetary measures have very high kurtosis scores, similar to the US.

Table 3 presents the Belgian results. They provide further support of the generalized punctuation hypothesis, and also illustrate the progressive institutional friction idea we have seen in the other two countries. Each series shows significant kurtosis values, with the policy input series (demonstrations and media coverage) being relatively low; the policy series (parliamentary activities), higher; and the budgetary series, very high in the scale of kurtosis, just as in the other series. According to the K score, there is one anomaly in the Belgian series, that of TV news coverage. The Belgian data are based on only 10 annual measurements of change so we do not want to make too much of any individual series. Still, this one value stands out and we believe this may be due to strong mimicking effects in the case of nightly news programs. Mimicking (or cue-taking) from other programs or from the morning newspapers is likely much stronger on nightly TV news because: 1) the news hole is much smaller on TV than in the newspapers; 2) competition for the most newsworthy stories is more intense; 3) agreement on what is newsworthy or visibly exciting is greater; and 4) the agenda is partially set by the various newspapers appearing in the morning, which is common knowledge for the TV news producers by the time of their broadcasts. While these do not follow from a model of institutional friction, the mimicking and cue-taking effects present here may produce the higher kurtosis values that we see here. In any case, the TV news series does seem to deviate from the general pattern but the others series are generally in the order that we expect and hence confirm the progressive friction hypotheses.

Tables 1 through 3 above make clear that the generalized punctuation hypothesis is strongly supported. Our review of 30 different institutional outputs in 3 countries shows not a

single one that is Normal. These data are based on hundreds of thousands of underlying observations across several decades of recent political history. Further, the progressive friction hypothesis is generally borne out as well. While each and every series is not precisely in the order we expected, on average we can see that the input series, the policy series, and the budgetary output series cluster into low, higher, and highest values of friction. Figure 5 summarizes these results.

(Insert Figure 5 about here)

Figure 5 shows simple averages of our K and L-K measures for the input, policy, and output series. Statistical measures of kurtosis (K) are not perfect since outliers can strongly affect the statistical summary indicators. L-Kurtosis (L-K) corrects for some of this but in any case the two series show similar trends. The series strongly support the progressive institutional friction hypothesis. Budgetary outcomes in all three countries are extremely heavy with a status-quo orientation and highly likely to be affected by sudden changes, just as the punctuated equilibrium model predicts. These tendencies are noticeably weaker in the "earlier" series, the processes of which involve weaker institutional friction. Input series in each country are much closer to Normal than the other series.

Estimating the Underlying Probability Distribution

We can explore these tendencies in greater detail by looking at the cumulative frequency distributions of each of our series of data, rather than only the kurtosis measures as in Figure 5. This allows us to estimate the underlying probability distribution that has generated our

observations. Figure 6 illustrates our findings for one input series, one process series, and one output series in each country.[3]

(Insert Figure 6 about here)

The plots in Figure 6 show the cumulative frequency of annual percentage changes of various sizes, the same data that we have analyzed above. (Negative changes are multiplied by –1 in order to display them on the same scale as the positive changes.) The data are presented on a log-log scale. Normally distributed series would start high then curve sharply off, dropping almost vertically as the log of the percentage change grows. To the degree that the data array in a straight line on the log-log plot, they follow a Paretian distribution, or a power-law function, indicating both a strong tendency for small changes to dominate as well as much greater than expected numbers of cases far out in the tails of the distribution. A power-law distribution is a clear indication of a punctuated equilibrium process. The test is identical to that of looking at kurtosis values or the shape of a frequency distribution; indeed the underlying data are the same. In contrast to a single statistical measure of kurtosis, however, this presentation of the data allows us to see the entire distribution.

A power-law distribution is one that follows the following form:

$$X \sim k\,\tau^{-\alpha} \qquad \text{(eq. 1)}$$

Where X is the cumulative frequency of values above some value, τ,

k is a constant,

τ is a range of observed values, and

α is an empirically derived estimate.

[3] Figure 6 presents Presidential election results for the US, parliamentary elections for Denmark and Belgium, laws, and budgets. The series are similar to others we might have presented. In our web appendix [cite to be added, but attached for review], we present full distributions for all 30 data series listed in Table 1.

If we transform simply by taking the logs on both sides of this equation we have:

$$\log(X) \sim \log(\mathrm{k}) + \alpha \log(\tau) \qquad \text{(eq. 2)}$$

Plotting such a relationship on a log-log scale produces an equation as follows:

$$X \sim \mathrm{k} + \alpha\tau, \qquad \text{(eq. 3)}$$

which is a straight linear regression where k is an intercept term, α is the slope of the line, and τ is the range of observed values, as before. So a very simple graphical test can determine if a relationship fits a power-law test. There are two things to look for: whether the series array along a straight line for some or all of their ranges, and the slope of that line. Extreme-value series indicative of a power-law function will array on a perfectly straight line over several orders of magnitude. Normal distributions, which have a lower kurtosis and relatively few extreme values compared to what we see here, will show a sharp downward curvature in a log-log presentation, not fitting a straight line in any range at all. If the data do fit a straight line, we can also assess the slope of the line. The greater the proportion of extreme values, the flatter the line. K, the constant term, is also of interest as it can distinguish series with generally higher or lower numbers of extreme values.

Again it is clear that none of the series is Normal. In each case, we find that budgets (presented in the bottom row of the figure) do indeed array on a straight line for several orders of magnitude. Policy process series array along the line display a power function for the middle parts of the series, but the tails do not follow power functions. Input series in each country show a much sharper drop-off; they are clearly not Paretian. Further, the slopes of the lines are increasingly flat as we move from inputs to process to output series, indicating that more and more cases are falling in the tails, and hence are extreme punctuations. Finally, we can see that the negative tails of the distributions always have steeper slopes than the positive tails. As Jones

and Baumgartner (2005) discussed, this may reflect the fact that governments are quicker to surge into new policy areas than they are quick to drop their attention to established policy areas.

Overall, this more detailed graphical presentation confirms the general patterns presented in Tables 1 through 3 and in Figure 5. We provide a complete series of frequency distributions, semi-log and log-log presentations of all 30 of the data series we have explored in our web appendix.

Conclusions

We have shown evidence for the first time on the generalized punctuation and the progressive friction hypotheses over 30 different government processes in three countries. We have strongly confirmed the generalized punctuation idea and provided strong evidence for the increasingly punctuated nature of policy change series as one moves from the input and monitoring functions of government to policymaking roles and finally to budgetary outputs. In each of the three systems we have explored here, we see similar patterns. Policy change comes with a heavy emphasis on re-creating the status quo, but with occasional and unavoidable periodic updates as policies are dramatically changed from time to time. The distribution of change is far from Normal thus reflecting substantial institutional costs of decision-making.

Modern governments face enormously complex policymaking tasks. Thousands of problems simultaneously vie for political attention. Millions of civil servants work simultaneously on various issues. Autonomous institutions within government work at all times to implement policies and to monitor the environment, noting newly rising problems that may need attention in the future. No government is able to adjust immediately and proportionately to the rise of new problems and the decline of old ones, however. The comprehensive data we have presented here for three different countries are the first of their kind. They provide strong

evidence for the general nature of the punctuated equilibrium model of policy change, showing its applicability in diverse settings.

We have raised some entirely new questions in the study of comparative public policy, and perhaps raised more new questions than we have answered. However, we have clearly brought answers to two important questions with which we started. First, we have confirmed the generalized punctuation hypothesis. Looking at dozens of processes across three nations and covering several hundred thousand observations, we have not found a single distribution in all these government procedures that corresponds to a Normal distribution. Second, the degree of punctuation in these distributions increases, as we hypothesized, as one moves from social monitoring functions and inputs to policy processes and finally reaches its highest values in the budgetary outputs of government. Thus, we confirm the progressive friction hypothesis as well.

A punctuated equilibrium view on the nature of government was first developed with reference to the US, with its complicated set of separated powers, federalism, and diverse social and economic life. Political, governmental, and administrative actions in Belgium and in Denmark show remarkably similar patterns to those in the US, however. This suggests that the root causes of punctuated equilibrium may be deeper than only institutional design. General features which all governments share include limited attention in the face of complex social environments. The cognitive limitations of all governments, compared to the complexity of the issues with which they must all deal, may be the greatest similarities of all. Of course, governments are designed in different ways and some of these institutions and procedures may be substantially more efficient than others, but the main variation, our analysis suggests, occurs within national political systems.

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Tables and Figures

Table 1. Levels of kurtosis for 13 government activities in the US.

Data series	N	K	L-K
Elections, Presidency (by county)	1778	8.24	0.25
Elections, US House of Representatives	18355	7.17	0.30
Elections, US Senate	1327	6.14	0.22
New York Times stories	1072	26.87	0.28
Bill introductions, House	912	12.66	0.21
Bill introductions, Senate	969	66.00	0.23
Hearings, House	1091	26.89	0.33
Hearings, Senate	1078	34.21	0.27
Executive Orders	607	12.17	0.25
Congressional Quarterly Almanac stories	994	28.03	0.29
Statutes	1007	21.02	0.25
Total annual outlays, US federal budget	187	56.04	0.54
Budget Authority for 62 programmatic budget categories	3106	66.47	0.48

Note: Normal distributions have a K value of 3 and an L-K score of ≈0.123.
For Tables 1–3, N's reflect the number of annual change values times the number of categories. The underlying number of events on which the annual change scores are calculated is typically much higher.

Table 2. Levels of kurtosis for 6 government activities in Denmark

Data series	N	K	L-K
National parliamentary elections	218	5.71	0.25
Parliamentary interpellations and proposals	1080	42.40	0.35
Questions to the Minister	815	14.94	0.27
Bills	1069	13.57	0.26
Appropriations	792	198.25	0.49
Outlays	832	86.95	0.43

Table 3. Levels of kurtosis for 12 government activities in Belgium

Data series	N	K	L-K
Elections	274	9.00	0.14
Demonstrations	202	10.77	0.30
Newspaper stories	270	11.92	0.19
TV Coverage	210	30.82	0.31
Party platforms	510	13.42	0.26
Parliamentary interpellations	267	10.83	0.30
Government agreements	48	12.48	0.38
Written questions in Parliament	269	14.57	0.23
Bills	246	16.51	0.32
Laws	169	15.51	0.29
Executive Orders	239	27.61	0.32
Budgets	245	57.75	0.64

Figure 1. Overview of Data Series Ranked in Terms of Institutional Friction

	US Distributions	Danish Distributions	Belgium Distributions
		Input series	
Lowest friction	Elections, Presidency Elections, US House Elections, US Senate *New York Times* stories	National parliamentary elections	Elections Demonstrations Newspaper stories TV Coverage
		Policy process series	
	Bill introductions, House Bill introductions, Senate Hearings, House Hearings, Senate Executive Orders *CQ Almanac* stories Statutes	Parliamentary interpellations and proposals Questions to the Minister Bills	Party platforms Parliamentary interpellations Government agreements Written questions in Parliament Bills Laws Executive Orders
		Budgetary outcome series	
	Total annual outlays Budget Authority by category	Appropriations Outlays	Budgets
Highest friction			

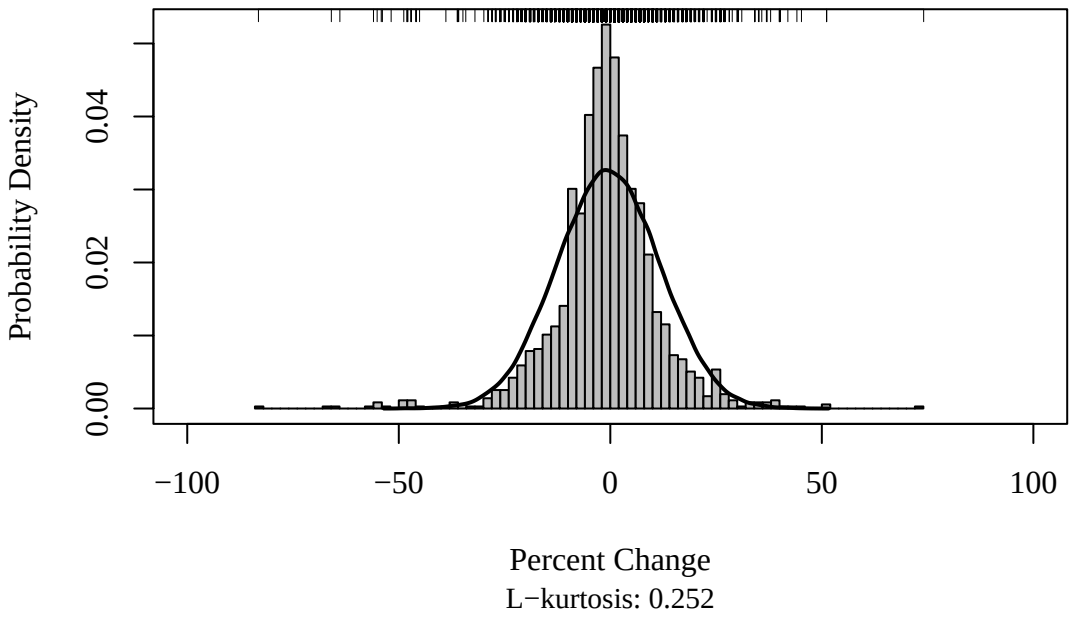


Figure 2. Annual percent change in election results, US Presidential elections, 1828-2000.

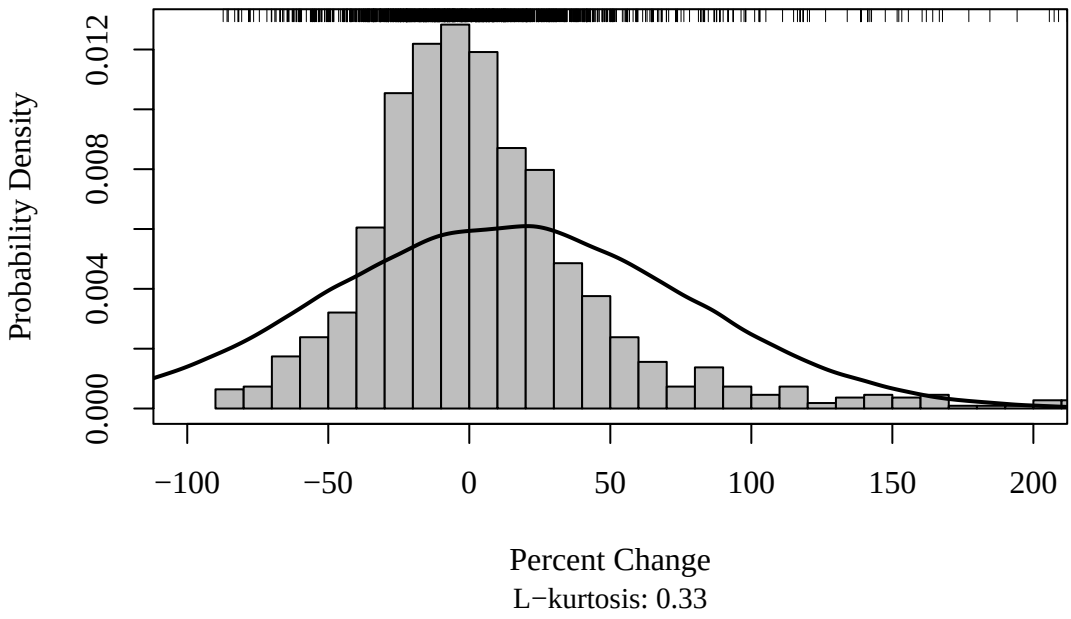


Figure 3. Annual percent change in attention, U.S. House hearings, 1946-2004.

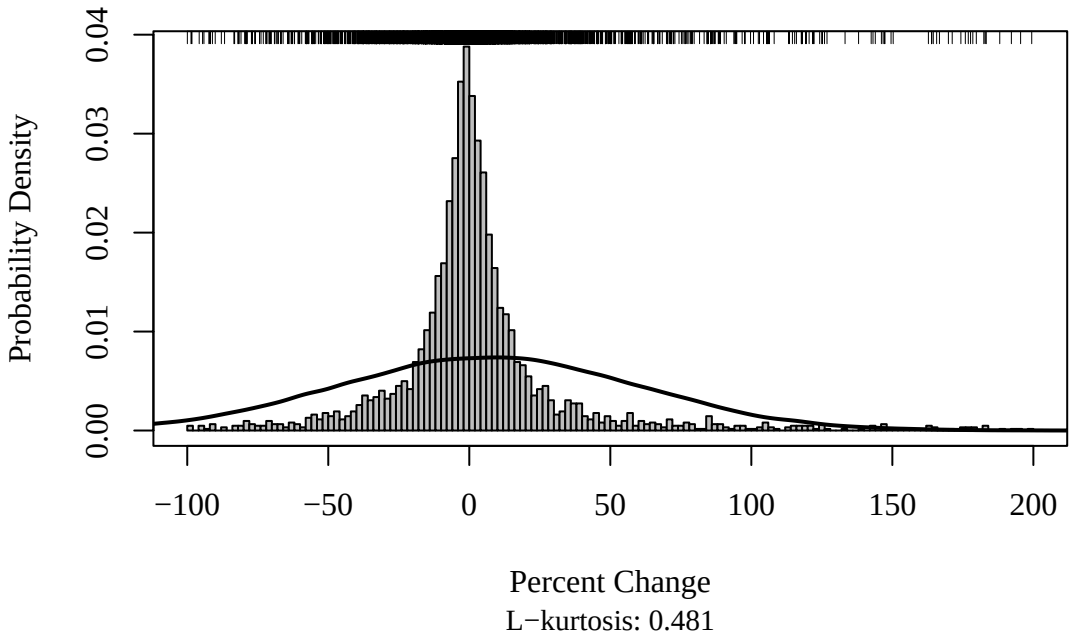
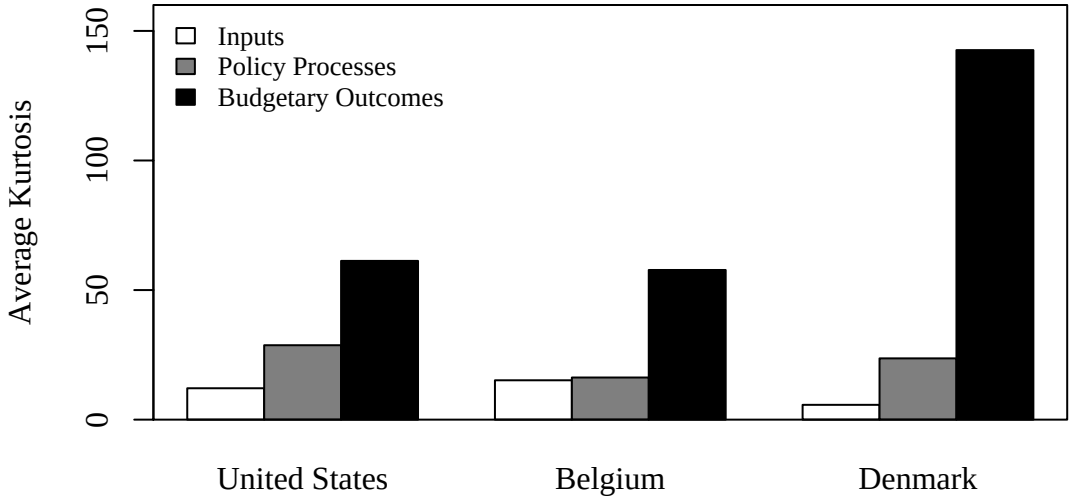


Figure 4. Annual change in Budget Authority of the US federal government, 1948-2004.

Figure 5. Progressive Institutional Friction in Three Countries

A. Kurtosis



B. L-Kurtosis

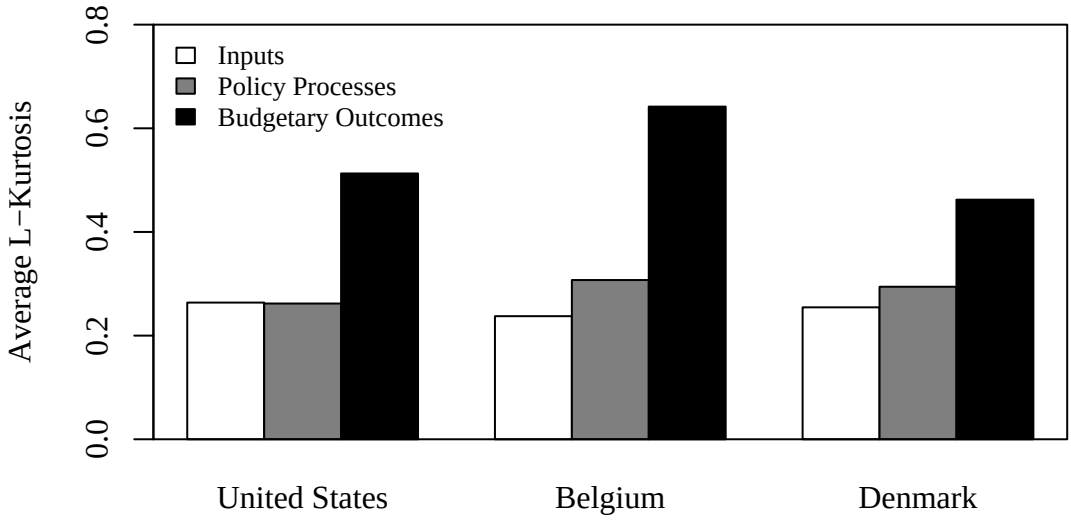
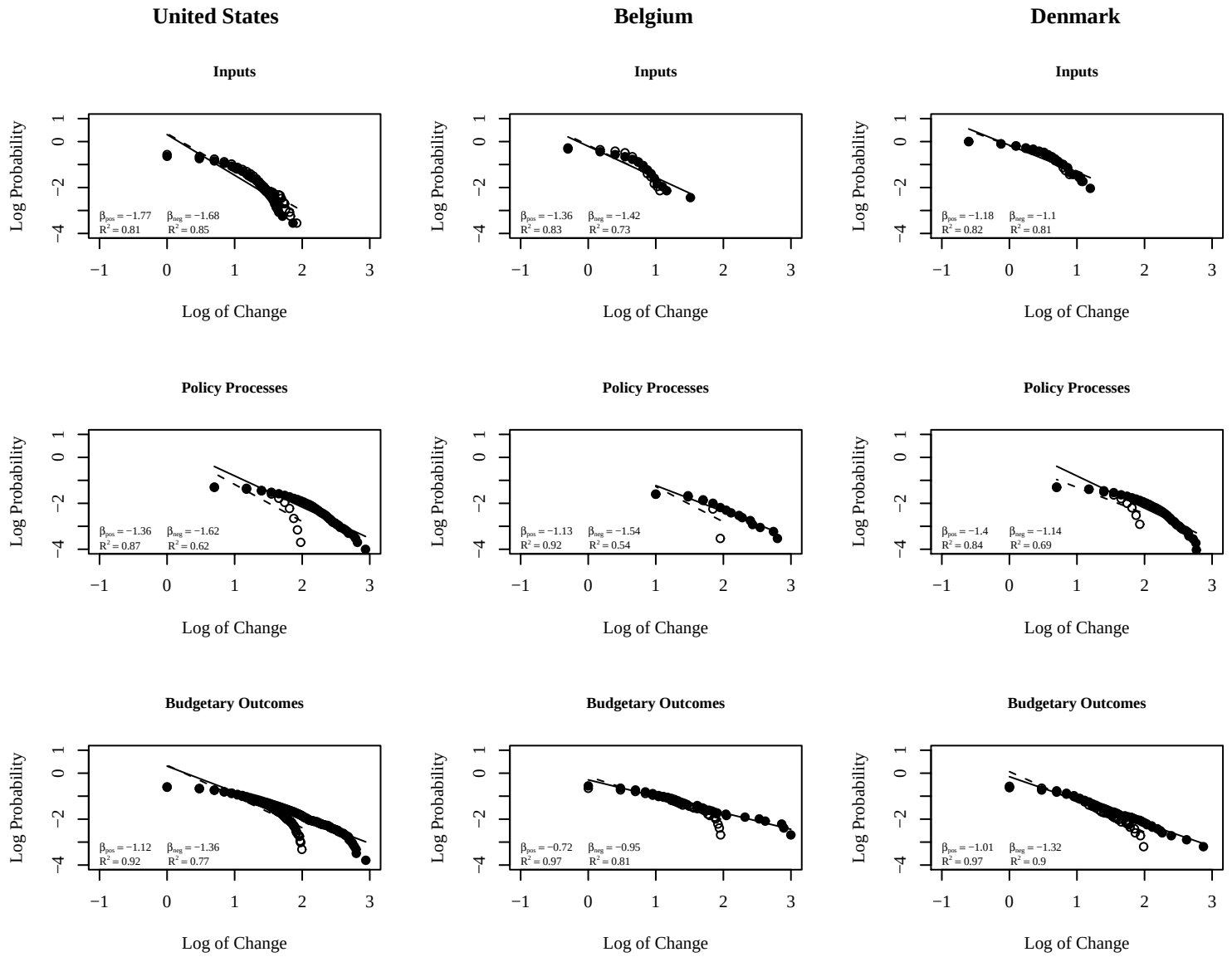


Figure 6. Cumulative Frequency Distributions of Change in 3 Series in 3 Countries.



Note: Solid circles show the positive tail; hollow circles show the negative tail of the distribution. The series are as follows: Input series are National parliamentary or presidential elections, process series are laws, output series are budgets. For a full set of plots for each of our series, see the web appendix.

Appendix 1. Data Descriptions

Progressive Institutional Friction in the US

We use 13 separate indicators of policy change in the US. In each case, we look at year-to-year percentage change in outputs. The data series are as follows.

1-3. Election results (three series). We look at the difference from election to election in the percent of the two-party vote for the Democrat. For Presidential elections, we pool data across all US counties for the period of 1828 to 1992. For elections to the US House of Representatives, we pool across electoral districts from 1898 to 1992. For the US Senate, we pool across seats from 1920 to 1998.

4. *New York Times* stories. Annual percent changes in the percentage of stories across the 19 major content categories of the Policy Agendas Project, 1946 to 1994 (see www.policyagendas.org).

5-6. Congressional bill introductions. Separately for the House and Senate, annual percent changes in the percentage of bills introduced across the 19 major content categories of the Agendas Project, 1947 to 2002.

7-8. Congressional hearings. Separately for the House and Senate, annual percent changes in the percentage of hearings across the 19 major content categories of the Agendas Project, 1947 to 2002.

9. Executive Orders. Annual percent changes in the percentage of Presidential executive orders across the 19 major content categories of the Agendas Project, 1947 to 2002.

10. *Congressional Quarterly (CQ) Almanac* stories. Annual percent changes in the percentage of stories in the CQ Almanac across the 19 major content categories of the Agendas Project, 1947 to 2002. The CQ Almanac is an annual volume reporting on the activities of the US Congress. Widely read in Washington in its weekly edition, the CQ is a standard source for

information on congressional activities. Even failed legislative proposals, if they generated significant congressional debate, are reflected in this measure.

11. Statutes. Annual percent changes in the percentage of laws (excluding commemorative laws) across the 19 major content categories of the Agendas Project, 1947 to 2002.

12. Total Outlays of the US Government. Annual percentage changes in the size of the entire US federal budget, from 1800 to 1994 (one observation per year).

13. Budget Authority by OMB Subfunction. Annual percentage changes in 62 consistently defined programmatic spending categories, from the Agendas Project, 1947 to 2003.

Institutional Friction and Policy Outcomes in Denmark

Danish data come from the Danish Agendas Project. Parliamentary activities are coded according to a modified version of the same topic categories used in the US Policy Agendas Project; there are major 24 topic categories in the Danish series as compared to 19 in the US. Danish parliamentary data are available since 1953, the date of a major constitutional revision (for details see Green-Pedersen 2005). In all, we have six different series for Denmark; one input series; three policy process series; and two budget series.

The input series is Danish election results at the national level. We look at the percentage change in the vote for parties at each election since 1920, when the current election system was introduced. We record the vote share of all political parties receiving votes in a given election. The Danish party system has consisted of five to 11 parties over time; elections have been held every fourth year or less providing us with in total 218 observations across 31 elections from 1920 to 2005.

We report three distinct Danish policy processes series for the period of 1953 to 2003. In order of increasing institutional friction, we look at: 1) questions to the minister, 2) non-

legislative debates in parliament (interpellations and parliamentary decisions) and 3) bills[4] and governmental reports.[5] Where the first two parliamentary series reflect monitoring activities, the third series represent policymaking more directly. Questions to the minister have limited institutional costs. They are a few sentences long and can be asked by any Member of Parliament (MP). Non-legislative debates in parliament impose more costs. The text can be as simple as a question, but they can only be put forward by a party, not an individual MP, and require participation from the entire parliament. Bills and governmental reports take considerable time to put together and the bills require several rounds of parliamentary reading to be accepted.

Finally, we have two budget time series. The first series is based on Statistics Denmark's central government spending data and is measured in inflation-adjusted 2003 kroner. The data are assembled for 14 policy categories but we followed Mortensen (2005b) and excluded the category "other purposes." The resulting 13 categories exist for the 1971 to 2003 period.[6] The second budget series consist of net budget appropriations (*bevilllinger*) published by the Danish Finance Ministry. The data are assembled for 22 policy categories after some categorical adjustment are made in order to adjust for the destruction and creation of government departments over time. These data are available for the 1964 to 2004 period. While the latter series represents spending appropriations, the former represent budgetary outlays.

[4] The vast majority of bills in the Danish parliament come from the government and are passed in parliament, so bills in Denmark are virtually equivalent to laws. We do not analyze both.
[5] Governmental reports are comprehensive reports on for instance the state of Danish energy policy from the government to parliament. Like bills they require a substantial bureaucratic effort.
[6] The dataset follows the registration principles for national accounts data outlined by the United Nations Statistics Division. The full dataset consists of 14 main functional categories and 34 sub-categories based on a modified version of the international COFOG classification system used consistently by Statistics Denmark from 1971 to 2003. Data are adjusted for inflation using the national Danish Consumer Price Index (CPI).

Institutional Friction and Policy Outcomes in Belgium

Belgian data come from the Belgian Political Agenda-Setting Project (Walgrave, De Winter et al. 2005)[7]. We have 11 data series covering a broad array of political processes. All Belgian data only cover the 1991–2000 period. So we have, unless mentioned otherwise, 10 consecutive years leading to nine year-to-year percentage changes in outputs. The N's on which change calculations are based are very high, so we believe the Belgian data to yield reliable indicators of policy change in Belgium. All Belgian results are based on a coding system containing 30 major content categories. The Belgian codebook was *not* the same as the US or the Danish codebook; Belgian data were collected entirely independently from the original US Agendas Project. As the number of topic categories is similar to that in the US or Denmark, and the major topic codes are similar, we believe this difference has no significant effect on our results.

We look at Belgian election, media, protest, and party *input* series (1–5); parliamentary and governmental *policy* series (6–11); finally at *budgetary* output series (12). The Belgian dataset adds significant new types of agendas, especially regarding the input series. First, we can test the friction model on TV-coverage which might display an entirely different dynamic than (single) newspaper coverage. Second, we have data on protest demonstrations, an important source of information for governments anywhere. Third, as political parties are the major players in the Belgian polity, like in most other European democracies, we included a party platform series to assess the nature of change in these documents. Finally, we add a new indicator of the governmental agenda: the government agreement concluded just before government gets confidence from parliament. Belgian newspaper data also include several national newspapers,

[7] Belgian Political Agenda-setting Project (2001-2004) granted by the 'Federale Diensten voor Wetenschappelijke, Technische en Culturele Aangelegenheden' (DWTC). It was conducted by Stefaan Walgrave (coordinator, UA), Lieven de Winter, André Frognier, Frédéric Varone and Benoît Rihoux (UCL), Patrick Stouthuysen (VUB), and Marc Swyngedouw (KUL).

not just one. Belgian data cover a greater number of different agendas but for a shorter time period than the other data series. The series are as follows:

1. Elections. As the rest of the Belgian data only cover the 1990s we use the 1990s elections only. Belgium witnessed only a few general elections in this period; in order to increase the N we relied on election results on district level. Belgium had a reshuffling of electoral districts between the elections of 1991 and 1995 and, thus, we cannot reliably compare between these elections. Consequently we only have two changes in electoral party results per district: 1987-1991 and 1995-1999. We only took the major parties into account, parties with at least one seat in parliament during the period under study. The total N = 274. Data are available from: http://www.elections.fgov.be/

2. Newspaper stories. Annual percent changes in percentage of the stories across the 30 content categories for 5 different Belgian newspapers tabloids and broadsheets with different partisan leanings (*De Standaard*, *De Morgen*, *Het Laatste Nieuws*, *La Libre Belgique and Le Soir*) from 1991 to 2000. We code only the front page of each newspaper (as there were no indexes available). Total N > 66,000 news stories.

3. TV coverage. Entire coverage of the main evening news show on 4 national TV-stations: two public service broadcasting (TV1 and La Une) and two commercial stations (VTM and RTL) in the 1991–2000 period. Friction, we expect, will be low but we anticipate substantial cascades as the TV-market is extremely competitive, as we cover and aggregate results for 4 stations reinforcing potential spikes and, especially, as we found extremely high correlations (+.90) between issue coverage on the 4 channels. Total N > 110,000 TV news items.

4. Demonstrations. All major protest demonstrations in Belgium from 1991 to 2000 (N > 4,000) drawing on media analysis and police records (see Van Aelst and Walgrave 2001).

Demonstrations entail some organizational costs but the decision costs are low as it requires only one organization to stage a protest event.

5. Party Platforms. Topic codes of all sentences and semi-sentences of all 10 Belgian parties according to the methodology of the Comparative Manifesto Project (Klingemann et al. 2002). Total N is > 36,000 (semi-)sentences. Belgium had three general elections in the 1990s (1991, 1995, and 1999) so we covered 30 party manifestos. We expect rather low friction as parties have every interest in reacting to external signals and internal decision procedures are relatively light (Walgrave and Nuytemans, 2006).

6. Written questions. Questions asked by individual MPs to ministers (N > 24,000) in the Lower House (We obtained an electronic file with all parliamentary actions (questions, laws, interpellations) directly from the services of the Belgian lower house and converted and recoded it according to our needs (see: www.dekamer.be)). There are no restrictions and the procedure for asking written question has a very low threshold. We expect low friction.

7. Interpellations and oral questions. These are the means used by opposition parties to challenge the government in the Lower House (N > 10,000). There are very few institutional restrictions but, normally, parliamentary party leaders control the questions and interpellation from their faction. So, some co-ordination and party agreement is required and we expect a moderate amount of friction.

8. Bills. Bills are easy to introduce as one legislator suffices in the Lower House (N > 5,000). Many bills, though, are introduced by parties or even by several parties. More than two thirds of the bills are submitted by the government which is preceded by lengthy and often conflictual negotiations within government. Hence we expect substantial friction.

9. Laws. Laws are difficult to pass, unless they are supported by the government parties in the Lower House (N > 1,200). Success rate of government bills is nearly 100% and as

government introduces most bills (see above) we expect the kurtosis of bills and laws to be very similar, with substantial friction in both cases.

10. Government agreement. This is a sentence-per-sentence analysis of the government agreements of 1992, 1995, and 1999 (N > 1,800). The government agreement is the bible of coalition politics and contains the plans the government solemnly promises to carry out during the term. Often very lengthy negotiations precede it. It may be the most discussed, scrutinized and negotiated text in the Belgian political system. All this makes us expect a very high friction. Yet, the government agreement most of the time is a straightforward mix of proposals parties make in their party platforms. Through the Central Limit Theorem an aggregation of several (even non-Normal) series would lead to a Normal outcome. Moreover, government stayed the same almost the entire period under study which would not make us expect sudden major changes in the agreement. Overall, we expect low to moderate friction here.

11. Executive Orders. Every Friday the Belgian government meets and takes a number of decisions. These are recorded here (N > 6,000). Due to the coalitional logic and the collegial procedure in Belgian governments we expect tough decision-making and thus rather high friction. Friction should be higher than in the presidential system in the US characterized by a single executive actor.

12. Budgets. As in Denmark and the US budgets should be the stickiest processes preceded by lengthy negotiations within government. Belgian budgets were recorded based on the official documents distinguishing all budget functions (N > 12,000).

For more information concerning each of the series used here, including summary statistics, full codebooks, the datasets themselves, and a complete set of histograms, semi-log and log-log plots of the 30 series analyzed here, see our web appendix, available at http://www.personal.psu.edu/frb1/Comp_friction/Comparative_Friction_Models_home.htm