DOMESTIC CONFLICT AND THE OVERTHROW OF GOVERNMENTS

An Exponential Decay Model Applied to Latin America, 1946-1966

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What processes underlie the decline and fall of governments? What factors lead to their extralegal and often violent overthrows, whether by military uprising or popular revolution, brief palace coup or prolonged civil war? Can such overthrows be predicted with any degree of certainty?

One plausible hypothesis is that government control is diminished by various types of domestic conflict: anti-government demonstrations, riots, general strikes, political assassinations, etc. Such events do not necessarily bring the government to an abrupt end, under this model, but rather serve to hasten its eventual demise.

The purpose of this paper is to explore the hypothesis--that domestic conflict foreshadows the overthrow of a national government--not as a causal model but as a predictive device. There will be no speculation here about the extent to which conflict might "cause" the overthrow of a government, only an examination of the extent to which an occurrence of conflict makes such an overthrow more likely during a subsequent period of time. An overthrow might be more likely because the incident of conflict itself causes a weakening of the government, because the incident serves as a superficial indicator of other underlying government problems, or because of some still more complex causal interactions.

Since it is unlikely that many incidents will bring the immediate overthrow of a government, I shall employ a model of "shock" and exponential decay, under which the probability of an overthrow is greatest at the instant of conflict, and then declines exponentially over time. In other words, if this model is realistic, the days immediately following an incident of conflict are the critical ones for a government, and the longer a government survives these first days, the greater is the probability that it will survive (all other factors remaining constant), at least until it is affected by another event.

Since experimental testing of this model is of course impossible, an artificial (and necessarily imperfect) "laboratory" must be constructed. For this purpose, I have chosen Latin America for a 21-year period, 1946-1966. There are three major reasons for this choice:

First, Latin America affords a large number of different cases: 20 countries sovereign throughout the period mentioned, over a fourth of all such countries for which this is true. At the same time, these countries represent a certain similarity of experience, perhaps the closest we can come--using actual history--to controlling for exogenous variables. The assumption that the 20 countries do not differ in the likelihood of an overthrow is tested below.

Second, the years 1946-1966 in Latin America are relatively homogeneous, i.e., free of area-wide cataclysmic events or exogenous disturbances (like world wars or regional depressions). The assumption that the 21 years do not differ in at least the likelihood of an overthrow is also tested below.

Third, accurate data are available on many different types of domestic conflict for all 20 Latin American countries during all 21 years in question.

In summary, although the necessary assumptions of statistical independence of events and equality of parameters for the resulting 420 "country-years" (20 countries x 21 years) will be only approximately realized, it is doubtful that hypotheses concerning macro-societal events like the overthrows of governments will ever be tested under conditions much more closely approaching those of an experiment.

1. Definitions and Data

I shall consider, as independent variables, eight types of domestic conflict:

(1) antigovernment demonstrations
(2) assassination attempts
(3) general strikes
(4) government crises
(5) guerilla warfare incidents
(6) purges
(7) revolutionary attempts
(8) riots

This paper will examine the relationship of these eight variables to a dependent variable, successful government overthrows (unsuccessful overthrows are included with revolutionary attempts). Successful overthrows will also be treated as an independent variable, for the purpose of testing whether one overthrow affects the chances of another. All of the data were gathered by the Center for Comparative Political Research, State University of New York at Binghamton, and published by Arthur S. Banks.[1]

Banks defines what I here call "successful overthrows" (his term is "coups d'etat") as "the number of extraconstitutional or forced changes in the top government elite and/or its effective control of the nation's power structure in a given year. The term 'coup' includes, but is not exhausted by, the term 'successful revolution.' Unsuccessful coups are not counted."[2]

The other eight variables were operationally defined by Rudolph J. Rummel,[3] whose definitions are here abridged:

(1) Antigovernment demonstrations. "Any organized peaceful, public gathering of at least one hundred people for the primary purpose of displaying or voicing their opposition to governmental policies or authority. This does not include political party rallies or general strikes. Student

strikes aimed at the government are considered anti-government demonstrations. A demonstration which involves the use of force is categorized as a riot."

(2) <u>Assassination attempts</u>. "The politically motivated murder or attempted murder of a high government official or politician. Among high governmental officials are included the governors of states or provinces, the mayors of large cities, members of the cabinet, and members of the national legislature. Among high politicians are included members of the inner core of the ruling party or group and leaders of the opposition."

(3) <u>General strikes</u>. "Any strike of industrial or service workers which involves more than one employer and that is aimed against national governmental policies or authority. A strike is not considered general unless at least 1,000 workers are involved. General strikes do not include those strikes whose nature is to force the government or private industry to grant wage or working concessions."

(4) <u>Government crises</u>. "Any rapidly developing situation which threatens (excluding revolution) to bring the immediate downfall of the present government. Such situations are usually evidenced by the declaration of military law, state of seige, or the suspension or abrogation of the constitution. A vote of no confidence by a parliamentary majority, or the forced resignation or impeachment of top officials are also considered major government crises. A new major government crisis is not counted unless at least three months of stability have intervened since the previous crisis."

(5) <u>Guerilla warfare</u>. "Armed activity on the part of bands of citizens or irregular forces aimed at the overthrow of the existing government. Such activity may take the form of sporadic attacks on police posts, small villages, government patrols, or military barracks. A country is also considered to have guerilla war when sporadic bombing, sabotage, or terrorism occurs."

(6) <u>Purges</u>. "The systemmatic elimination by the political elite either of opposition within their ranks or of opposition within the country by jailing or execution. 'Elimination of opposition' refers to the arrest, jailing, exiling or execution of opposition leaders. The arrest or execution of non-leader members of opposition groups does not constitute a purge. If the elimination of opposition continues over a period of time without a relaxation of more than three months, then it is one purge. 'Arrest' is considered synonymous with 'jailing' and carries no idea of time detained--the fact of arrest <u>per se</u> is sufficient to indicate a purge."

(7) <u>Revolutionary attempts</u>. "Any armed successful or unsuccessful attempt on the part of a group of citizenry to form an independent government (not including colonial rebellions), or any illegal or forced change in the top governmental elites or any attempt at such a change. This may be in the nature of a coup d'etat, or an attempted take-over on a grand scale, involving pitched battles between opposing forces. When an attempt to overthrow the government, however, involves only scattered and irregular forces who attack from hiding, it is categorized as a guerilla war."

(8) <u>Riots</u>. "Any violent demonstration or clash of a large group of citizens. The term 'violence' refers to the use of physical force, and 'large' means at least one hundred people involved. The existence of a riot is generally evidenced by the destruction of property, people being wounded or killed, or by the use by the police of riot control equipment such as clubs, guns, or water cannons. Arrests <u>per se</u> do not indicate a riot. Riots of a distinct anti-foreign nature are categorized as anti-foreign demonstrations" (and hence are excluded from this study of domestic conflict).

For each country-year with occurrences of one or more of these nine types of domestic conflict, the same and succeeding years were examined for an overthrow of the country's government. Overthrows that occurred after four years were considered in the residual category of overthrows after "5 or more years" (for analytic purposes that will become obvious below). In the few instances where more than one overthrow occurred within the five-year period, the temporally first overthrow was considered as the end of that government.

Since the data end in 1966, only domestic conflict occurring in the period 1946-1962 was included in the analysis. This was to permit governments experiencing conflict in the last year (1962) to be followed for the necessary five years (1962-1966) for evidence of an overthrow (other conflict in this latter four-year period was ignored). Hence the analysis included variables (types of domestic conflict) from only 340 country-years (20 countries x 17 years, 1946-1962).

2. Exponential Model

The model assumed here is that, <u>given</u> the occurrence of a particular event, or events proximate in time, the probability that an overthrow will follow assumes an exponential density with a single parameter, λ. That is, given an event, the probability of an overthrow <u>at</u> time x is

$$f(x) = \lambda e^{-\lambda x}, \text{ for } x \geq 0, \text{ and } 0 \text{ for } x \leq 0.$$

The integral of this function, from 0 to x, yields the corresponding distribution function; i.e., the probability of an overthrow <u>by</u> year x (or in the period 0 to x years after an event) is

$$F(x) = \int_0^x \lambda e^{-\lambda x} dx = 1 - e^{-\lambda x},$$

for $x \geq 0$, and 0 for $x \geq 0$.

Given empirical data, the maximum likelihood estimate of the parameter λ, here denoted by θ, is is

$$\theta = -\ln \left(\frac{\sum_{i=0}^{4} x_i + \sum_{i=0}^{5} i x_i}{\sum_{i=0}^{5} i x_i} \right) .$$

Another statistic of interest for these data is the estimated mean of the density, i.e., the average number of years between an event and the next overthrow of the government. This is the inverse of the exponential parameter λ, as estimated by θ^{-1}. Also of interest is the estimated waiting time after an event until the government can be expected to be overthrown with a given probability. For example, since

$$F(x) = 1 - e^{-\lambda x} ,$$

and since $\exp(-0.693) = .5$, the statistic $.693 \, \theta^{-1}$ is the estimated time (in years) during which the government has a 50 percent chance of being overthrown (similar estimates can of course be made for any degree of certainty). Such estimates have limited meaning without confidence intervals for the estimated θ, however, and no attempt to compute such intervals will be made here (since the data have serious limitations, and since this paper is exploratory in intent).

Before proceeding with the testing of the model, I shall first test the assumptions made earlier that--for Latin America, 1946-1966--the probability of an overthrow is independent of both country and year.

3. Differences among Countries and Years

There were 45 extralegal overthrows of Latin American governments during the period 1946-1966. The number per country ranged from 0 for three countries (Chile, Mexico and Uruguay) to 5, also for three countries (Ecuador, Haiti and Paraguay).

A chi-square test against the null hypothesis that the real probability is the same for all 20 countries yields a value of 22.11, which with 19 degrees of freedom indicates that the probability that the actual distribution could have resulted by chance alone is greater than .25; hence there is insufficient evidence, in these data, to reject the null hypothesis.

Consider now the question of whether the probability of an overthrow is independent of the year. Nine of the 21 years between 1946 and 1966 had exactly 2 overthrows; the range is from 0 (for 1951) to 7 (for 1948). A chi-square test against the null hypothesis that the real probability is the same for all years yields a value of 20.80, which with 20 degrees of freedom indicates that the probability that the actual distribution could have resulted by chance alone is greater than .30. Once again, there is insufficient evidence to reject the null hypothesis.

It must be noted that these two tests involve relatively small expected cell values (2.25 and 2.14, respectively), which makes the chi-square test only approximately accurate. Nevertheless, the margins of error seem large enough to protect the conclusions: neither the individual effects of country nor year will unduly distort the subsequent analysis in terms of "a hypothetical country in a hypothetical year." Although it will be dangerous to generalize specific findings beyond Latin America, 1946-1966, at least we can concern ourselves with general phenomena rather than particular countries or historical events, i.e., with nomothetic history rather than its ideographic aspects.

4. Type of Event (Number Unspecified)

To begin, consider first the question of whether the different types of events (number unspecified) differ in their ability to predict the overthrow of a government. To answer this question, the waiting times (in yearly intervals to 5 years) between the nine different types of events and the next overthrow of the government (in the same country) are compiled in Table I:

TABLE I. Number of Years between Events of Different Types (Number Unspecified) and Overthrow

EVENT	0-1	1-2	2-3	3-4	4-5	5+	N	θ	θ^{-1}	χ^2_4	PROB-VALUE
Successful overthrow	4	1	2	2	3	19	31	.097	10.32	2.075	p > .25
Guerilla warfare	10	4	8	4	6	35	67	.130	7.71	2.971	p > .25
Riot	16	16	14	9	8	70	133	.130	7.67	1.039	p > .90
Purge	15	17	13	8	6	65	124	.133	7.54	2.630	p > .25
Assassination attempt	7	6	2	1	3	21	40	.136	7.34	4.388	p > .25
General strike	9	2	6	4	5	26	52	.138	7.26	3.859	p > .25
Demonstration	9	8	4	5	3	29	58	.143	6.97	1.460	p > .75
Government crisis	18	11	9	6	5	40	89	.168	5.94	2.400	p > .25
Revolutionary attempt	27	13	9	7	3	47	106	.180	5.55	11.114	p < .05
RANDOM YEAR	31	30	28	22	19	210	340	.097	10.32	.605	p > .95

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Maximum likelihood estimates (θ) of the hypo-
thesized exponential parameters are also included,
along with the reciprocals of these estimates (re-
call these are the distributions' estimated means,
or, the expected number of years between the event
and the next overthrow). Chi-square values from
tests of the goodness-of-fit of the resulting cum-
ulative exponential distributions, along with the
corresponding prob-values, are also included in
Table I.

As can be seen, there is no reason to reject
the hypothesized cumulative exponential distribu-
tions (even at the .25 level) for 8 of the 9 types
of events. Only in the case of revolutionary at-
tempts (i.e., direct attempts at an overthrow) is
there good reason to reject the exponential hypo-
thesis (since there are only about 3 chances in
100 that the data could have come from the esti-
mated distribution). The differences between the
empirical and predicted values suggest that the
lack of fit is due mainly to the large number of
overthrows in the first year of a revolutionary
attempt. In other words, such attempts are too
successful to fit the exponential model (27/106 or
25.5 percent succeed in the first year). More
will be said about revolutionary attempts in Sec-
tion 5, where the number of attempts is taken into
account.

The other eight types of events appear to have
a positive relation to the probability that the
government will be overthrown (though the relation
is not necessarily statistically significant in
this study). That is, domestic conflict reduces
the mean waiting-time until the next overthrow
from the over-all estimated average (i.e., for a
randomly-chosen year) of 10.32 years. The esti-
mated mean waiting-times after events range from
5.55 years for revolutionary attempts (for which
the fit is poor, as we have seen), and 5.94 years
for government crises, to 7.71 years for guerilla
warfare, perhaps surprisingly the poorest predic-
tor (aside from a successful overthrow) of an im-
pending overthrow. The fact that so immediately
serious a form of conflict as guerilla warfare is
the poorest predictor suggests that conflict it-
self may not directly cause the overthrow of gov-
ernments, but merely serves as an indicator of
more profound government problems. Guerilla war-
fare would tend to occur, under this hypothesis,
in the absence of the preconditions for less se-
vere forms of conflict (which are themselves bet-
ter indicators of an impending overthrow).

The relative merits of the nine types of events
as predictors of an overthrow are illustrated in
Figure I. Only the estimated cumulative exponen-
tial curves are shown, since space is insufficient
to include the 45 point estimates. The curve for
revolutionary attempts is included, for compara-
tive purposes, even though evidence does not sup-
port the fitted exponential. Again, the figure is
merely illustrative, and no claim is made that any
of the curves is statistically different from that
for a randomly-chosen year.

As can be seen in Figure I, there is great sim-
ilarity of relationships to overthrows among six
different types of events: guerilla warfare inci-
dents, riots, purges, assassination attempts, gen-
eral strikes, and antigovernment demonstrations.
In addition to revolutionary attempts, only gov-
ernment crises appear to be substantially better

FIGURE I. Estimated Cumulative Exponentials for
Events of Different Types (Number Unspecified)
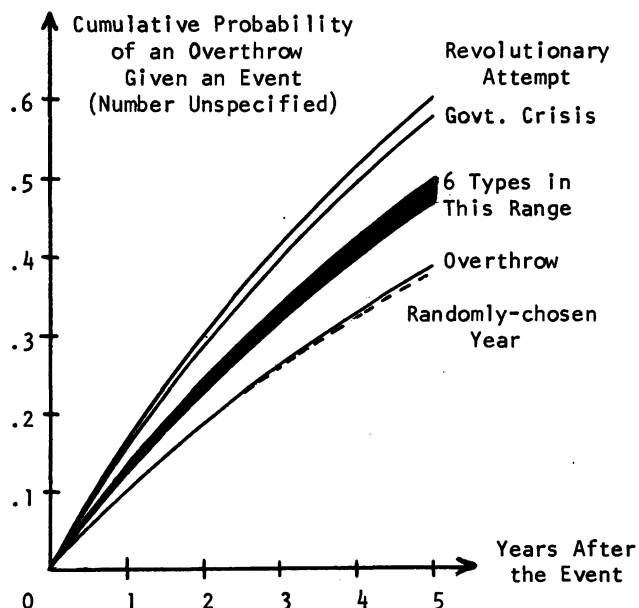
indicators of an impending overthrow than the six
types of events in this range. On the other hand,
successful overthrows appear to be the poorest of
all types of events in indicating a subsequent
overthrow, with an estimated parameter (.097) vir-
tually identical to that for a randomly-chosen
year.

A plausible explanation (which cannot be tested
with these data) is that this apparent lack of re-
lation for successful overthrows is caused by two
simultaneous and countervailing factors: although
successful overthrows are more likely to occur in
countries that have overthrows (a positive rela-
tion), they always mark the beginning of a new at-
tempt at a government (unlike the other eight
types of events), and this postpones subsequent
overthrows for a time while the new government
"runs its course" (a negative relation). The net
effect, under this hypothesis, is no relation at
all--though of course this remains speculation un-
til a proper study is conducted.

Since at least six of the eight types of events
are similarly positively related to overthrows,
the results of this section suggest that the types
of events might not be as important indicators of
overthrows as the sheer numbers of such events.
It is to this new hypothesis that I now turn.
First, I shall consider the number of events of
the single most efficacious type, revolutionary
attempts.

5. Number of Revolutionary Attempts

A total of 106 of the 340 country-years under
consideration contained revolutionary attempts.
Of these, 69 had only 1 revolutionary attempt, 37
had 2 or more (the high being 6 such attempts in
Ecuador during 1947).

The model that all 106 country-years come from
the same exponential distribution (with respect to
the waiting-time until the next overthrow) was

tested in the previous section and rejected. I now distinguish country-years with 1 and 2 or more attempts, and the model (Ω) that both of these groupings come from exponential distributions (possibly different) against the alternative hypothesis (H) that they come from the same exponential distribution.
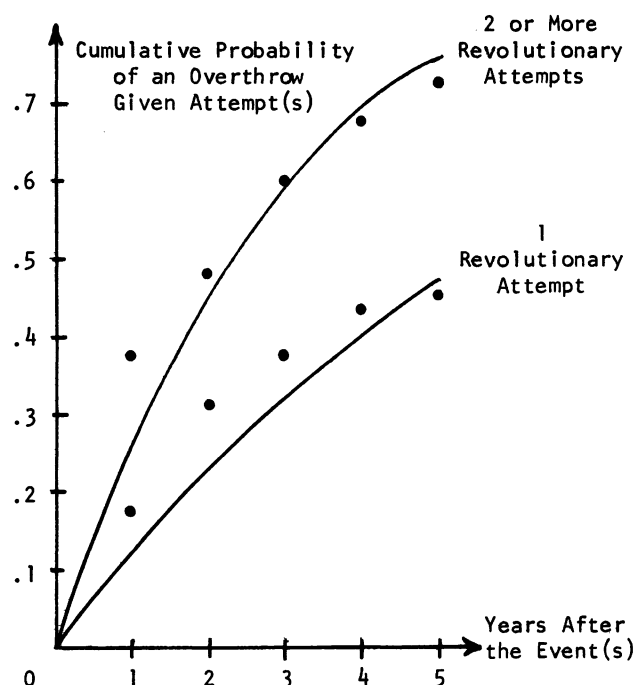
A Neyman restricted chi-square test[4] of Ω, against the more restrictive H, was computed. The chi-square value under Ω is 11.254, with 12 - 2 - 2 = 8 degrees of freedom. The prob-value is about .20; i.e., the probability of getting so large a chi-square value or larger, if the two groupings do come from exponential distributions (possibly different) is .20--not small enough to reject Ω.

Under H, the chi-square value is .02, which is in itself sufficient reason (at the .05 level) to reject H. Hence we might stop here and accept Ω. To be more certain, however (or if we were operating at the .01 level), we can complete the restricted chi-square test. The difference between the two chi-square values is 10.28, which is itself chi-square with 9 - 8 = 1 degree of freedom. The prob-value of this result is practically zero, which is strong reason to doubt that the groupings come from the same exponential distribution, as opposed to different ones.

Figure II shows the two hypothetical exponential distributions, fitted by maximum likelihood estimation, along with the actual data points. The pattern of deviations suggests that some model other than the exponential one, possibly with more parameters, might be more appropriate, though this is beyond the scope of the present paper. The point here is that the data are not incompatible with an exponential model as hypothesized and, moreover, that the data strongly suggest the two distributions are different, i.e., that an overthrow will more quickly follow a year with two or more revolutionary attempts than a year with only one. The difference in estimated mean waiting-time is that between 3.40 and 7.36 years, or almost 4 years, as compared to the estimated waiting-time after a random year of 10.32 years.

Data are insufficient to permit extension of this finding for revolutionary attempts to any other individual types of events. Since we have already found (in Section 4) that the various types of events are similarly positively related to overthrows, however, there is some justification in attempting to extend the finding for the number of revolutionary attempts to the total number of all events in a given year (type of event unspecified). It is to this more general hypothesis that I now turn.

FIGURE II. Estimated Cumulative Exponentials for Revolutionary Attempts (1 versus 2 or more)

6. Number of Events (Type Unspecified)

The total numbers of the eight types of events (excluding successful overthrows, which were found in Section 4 to have no strong relation to subsequent overthrows) in each of the 340 country-years, as well as the waiting-time until the next overthrow, is presented in Table II. Maximum likelihood estimates of the hypothesized exponential parameters of each of these five groupings (rows), along with chi-square values for the goodness-of-fit, and the corresponding prob-values, are also shown in Table II.

As can be seen, there is no reason to reject the exponential model for any of the five groupings, even at the .15 level. The greater the

TABLE II. Number of Years between Various Numbers of Events (Type Unspecified) and Overthrow

NUMBER OF EVENTS	0-1	1-2	2-3	3-4	4-5	5+	N	θ	θ^{-1}	χ^2_4	PROB-VALUE
No events	1	4	5	7	6	63	86	.060	16.76	6.398	p > .15
1-2 events	5	8	9	4	6	74	106	.071	14.00	2.718	p > .25
3-4 events	7	6	6	3	0	36	58	.101	9.90	5.061	p > .25
5-6 events	7	5	3	2	3	19	39	.150	6.69	1.375	p > .75
7+ events	11	7	5	6	4	18	51	.210	4.76	.710	p > .95
RANDOM YEAR	31	30	28	22	19	210	340	.097	10.32	.605	p > .95

number of events, the better is the fit to the exponential. Moreover, the estimated mean waiting-times appear to be a monotonically decreasing function of the number of events. Finally, the greater the number of events, the greater is the <u>rate</u> of decrease in the waiting-times. All of these results can be seen in Figure III.

We now have reason to be more confident about the hypothesis of this section: that the <u>number</u> of events (type unspecified) is a good indicator of the likelihood of an overthrow of the government. It remains to determine that the exponential curves illustrated in Figure III are statistically different; i.e., that the probability of an overthrow increases with the number of events.

First, consider the hypothesis that the waiting times after 0 and 7 or more events come from the <u>same</u> exponential distribution, which means that the number of events is independent of the waiting-time until the next overthrow (at least as may be determined from this set of data). The chi-square for this hypothesis is 27.05, which (with 8 degrees of freedom) has a prob-value of more than .30. Hence we reject the hypothesis that 0 and 7 or more events have the <u>same</u> relation to the waiting-time until the next overthrow, and have no reason to reject the hypothesis that 7 or more events makes an overthrow more likely than does 0 events.

We can conclude that the sheer number of events of the type considered here (type unspecified) is positively related to the likelihood of an overthrow of the government in subsequent years, and might serve as an indicator of an impending overthrow. No attempt will be made to test any of the other pairs of differences between the five fitted distributions, since the several chi-square tests have already more than exhausted the data. The major direction of the finding, that the number of events is positively related to the likelihood of an overthrow, has been established; further specification must await analysis of another, perhaps larger, set of data.

7. Summary and Conclusions

(1) Eight of the nine types of events (the exception: successful overthrows) appear to be positively related to the probability of a subsequent overthrow, though these relations (with the number of events unspecified) are similar and slight (with the possible exceptions of revolutionary attempts and government crises). No attempt was made to test the statistical significance of these relations using the data at hand.

(2) The number of revolutionary attempts (at least the difference between 1 and 2 or more such attempts) was found to be positively related to the probability of an overthrow of the government in subsequent years.

(3) The total number of unspecified events (excluding successful overthrows) in a given year was found to be positively related to the probability of an overthrow. No finer distinctions in this general relation were attempted.

(4) The exponential model for the waiting-time between an occurrence of domestic conflict and the overthrow of that country's government seems to be appropriate. Only once in 17 applications was the model incompatible with the data, even at the .15 level. The single rejection of the model, for any number of revolutionary attempts (Section 4), was reversed when the number of attempts was taken into account (Section 5).

Now that the usefulness of the exponential model has been established, and the outlines of potential hypotheses have been drawn, further study along the same lines would seem warranted.

FIGURE III. Estimated Cumulative Exponentials for Various Numbers of Events (Type Unspecified)
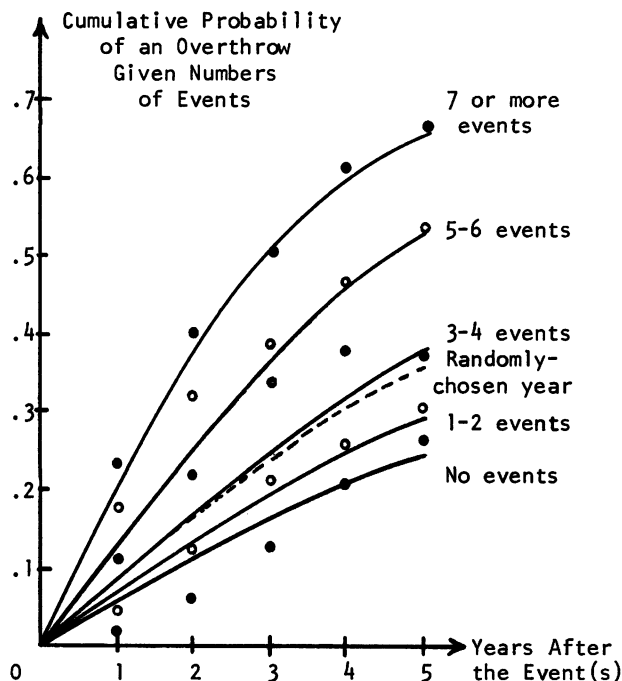
Footnotes

[1] Banks, Arthur S., <u>Cross-Polity Time Series Data</u>, Cambridge, Mass.: MIT (1971). The source of Banks' data is the daily files of the <u>New York Times</u>.
[2] Ibid., p. xv.
[3] <u>General Systems Yearbook</u>, Vol. 8 (1963), pp. 25-26.
[4] Neyman, Jerzy, "Contributions to the Theory of the X^2 Test," <u>Proceedings of the Berkeley Symposium on Mathematical Statistics and Probability</u> (1946), pp. 239-273.