## Chapter 7. Crisis Management By Governments

> Democratic government has the innate capacity to protect its people against disasters once considered inevitable, to solve problems once considered unsolvable. (F D Roosevelt, inauguration speech 1937.)

> Given the large number of components that combine in non-additive fashion, ... our knowledge of how to design these (institutional) systems will continue to grow, but will never be complete. A soon as one design has proved itself in one environment, innovations in strategies adopted by participants or changes in the environment in which a humanly designed system is in operation will produce unexpected results. (Ostrom 2005: 255).

### On the Demand for Governmental Crisis Management

Uncertainty can produce unpleasant surprises and losses greater than normal for the same reason that pleasant surprises produced profits in Knights classic treatment of profit. The nature of surprise does not imply that one is completely blind-sided by an event, it simply means that some of the factors required to properly make rules, set aside reserves, or fund an insurance pool are unavailable before the surprise takes place. The fact that the existence of such missing factors or extraordinary possible losses is recognized allows one take steps to reduce future losses.

In some cases, governments have a cost advantage at crisis management. For example, whenever there are economies of scale in response, in coordination, or if coercive power is required to address the anticipated problems governments may be able provide crisis management services at a lower cost than individuals or private organizations can.

In addition to these technological features of crisis management, other cost advantages for a subset of voters may be created throug the fiscal system as was the case for social insurance. When a service is provided in a more or less uniform manner but financed through a progressive tax system low income persons get the service at a discount over what they would have had to pay in the private sector even if there are no technological advantages from government supply. The latter tends to increase reliance on governments as crisis managers beyond that attributable to governmental economies.

### Standing Routines for Crisis Management

Many of these steps that governments can take to reduce losses from crises are similar to those available to private persons: rules and reserves. For example rules will be made to reduce the likelihood of a loss or mitigate losses. The latter may include responses to a crisis as it unfolds that are prudent and so reduce losses from a broad range of unpleasant surprises. Such rules may include the use of reserves of equipment, supplies and manpoweer, both regarding the extent to which accumulating them appears to be useful, and how to deploy them when a crisis occurs.

It bears noting that one can expect to be surprised and plan to respond to tem because surprises are often similar enough to allow them to be addressed with similar routines, although the details are never the same. That crisis include both novel and familiar aspects also allows past methods to be revised and applied to the new event, rather than requiring an entirely new approach to be worked out. Their novelty implies that responses are unlikely to be judged to be completely optimal after the fact, although they may have significantly reduced losses.

The common features of broad groups of crises allows governments to have standing routines for addressing classes of crises already tasked to them. For example, each new fire or automobile accidents presents new challenges. Yet they are similar enough to past accidenes and fires that first responsers have a variety of routines that reduce losses. They are able to do so impart because they can be modified by persons on site to address the novel aspects of the problems at hand.

Nonetheless, applying old routines to entirely new problems, as with the fires in the World Trade Center associated with the 9-11 terrorist attack, may fail completely, because major innovations rather than refinements of existing methods may be required to address a crisis. The required innovations may be too great to be imagined and implemented in the time available.

Necessity is the mother of invention, but necessity alone is not sufficient to generate success, as the victems of many life-threatening crises demonstrate. In some cases, a large crisis can overwhelm the standing routines and reserves of equipment and manpower for moderating the effects of crisis.[73]

## Economies of Scale in Crisis Response

On contrast between responses to crises and ordinary insurance is the extent to which economies of scale exist. Ignoring administrative costs, there are always economies of scale in risk pooling. The greater the pool of insured, the more predictable is the annual rate of loss and the prudent size of insurnce funds. In contrast, the reserves that are deployed during times of crisis do not always exhibit such economies of scale. Some crises are best responded to by those affected. Others by private organizations at the local level, and others at the level of a community or region.

Although the best response to a fire, crime, or other crisis is often capital intensive, and no household or neighborhood can afford to maintain the required capital out of its own funds, it is not the case that a single large pool of fire trucks can reduce losses from fire better than a small pool of such equipment that is closer to the crisis at hand. A state fire department with all of its equipment in a single location would not be able to respond fast enough to limit damage from

[73] For example, had the fire teams been able to put out the burning jet fuel as easily and quickly as ordinary fires are addressed, the two tallest buildings in New York City would not have collapsed and nearly three thousand additional persons would have survived the surprise attack to tell their stories.But this was not possible with the equipment available in the time before the building structures were critically weakened. See Eagar and Musso (2001) and National Institute of Standards and Technology (NIST, 2002) for analyses of how fire weakened the structure of both buildings leading to their collapse. An overview of the NIST study can be found at: http://www.nist.gov/el/disasterstudies/wtc/.

fires to individual buildings even if they have better capital and better trained crews than local fire departments. Entire neighborhoods might burn to the ground before equipment and manpower arrived from state capitals hundreds of miles away. Speed matters as well as the quality of the response during times of crisis.[74]

In other cases, such centralized responses might be the best possible ones, because of speed of response is less critical or scale of the response is more critical. In other cases, local responses may be impossible because of the nature of the crisis. Here one might note that large scale natural and military catastrophes my completely undermine a localities or regions capacity to respond by destroying needed equipment, manpower, and organization.

Once the best level of response to a class of similar crises have been identified, standing reserves and procedures can be developed. The surprise nature of the problems addressed implies that the results will be imperfect, but none the less, the results will for the most part be superior to that without planning for unpleasant surprises.  add

### A Simple Model of Planning for a Crisis

Suppose that all individuals confront the same loss-generating function in which losses are generated by combinations of stochastically generated exogenous factors, $F_1$ and $F_2$, and policies, $P_1$ and $P_2$, in place at the time of interest.

$$L_t = l( F_{1t} , F_{2t} , P_{1t} , P_{2t} ) \quad (1)$$

Assume that the first derivatives of L are positive, the cross partials positive, and the second derivatives negative. This assures that L is concave.

Suppose also that there is a parallel wealth- or reserve-generating function driven by the same variables:

$$Wt = w( F_{1t} , F_{2t} , P_{1t} , P_{2t} ) \quad (2)$$

Assume that W also has positive first derivatives and cross partials and negative second derivatives. Net additions to individual and social reserves at time t are thus:

$$R_t = w( F_{1t} , F_{2t} , P_{1t} , P_{2t} ) - l( F_{1t} , F_{2t} , P_{1t} , P_{2t} ) \quad (3)$$

Reserves are accumulated when $Rt > 0$ and depleted when $Rt < 0$.

The total reserves at time T, $R_T$, reflect initial endowments and past accumulations and losses:[75]

[74] This is property of crisis management is separate from the question of the optimal level of centralization. A centralized administrative structure may control a many local response teams. The point here is that having one large pool of reserves is often not as good as having a many separate, smaller reserves. Nonetheless, the relative merits of centralized and decentralized decisionmaking procedures are often similar. Some crises are better reponded to by persons nearest the point where the crisis appears, rather than by more distant administrators who will take longer to respond the the problems at hand.

[75] It is interesting to note that the reserve accumulation functions can be strictly concave at the same time that the process generating the exogenous

$$R_T = R_0 + {}_0 \int^T Rt\, dt \qquad (4)$$

The initial endowment of reserves, $R_0$, may reflect environmental resource conditions at the place of interest at the point when a settlement begins, as in Diamond's discussion of the various Pacific Island settlements. Or, it may simply be the existing reserves moment at which the analysis begins or a problem is confronted. Social reserves in this first model are simply N times those of the average individual.

In the case in which reserves and the reserve-generating functions are identical among individuals, anything said about individuals applies equally to society. In this setting, both individuals and society are assumed to be nonviable at time T, if their reserves fall below zero in a period of reserve depletion. Given this survivorship threshold (0) and an assumption that the relevant functions are partly driven by stochastic exogenous factors, an individual and an individual's and community's survival-maximizing policies at time t are those that maximize the accumulation of reserves.

The time series of best policies (strategies) for doing so can be characterized by differentiating equation 3 with respect to P1 and P2 and setting the results equal to zero.[76] These first order conditions, together with the implicit function theorem, imply that the survival-maximizing policy combination at each moment in time can be characterized as:

$$P^*1t = f1(F1t, F2t) \qquad (5a)$$

$$P^*2t = f2(F1t, F2t) \qquad (5a)$$

In this setting, there is a survival-maximizing policy response for all possible states of the world and an ideal policy path for every sequence of states of the world. In a well-run, well-informed community that aims only for long-run survival, it is the policies described by equations 5a and 5b that we would observe to be in place.

Even with such perfectly robust plans, however, it bears noting that there are catastrophic states of the world in which even the best possible responses do not

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state variables may be neither concave nor concave, as with the processes that produce the power density of solar radiation at a given location on earth, which resemble sin waves. As a consequence, cyclic time series for reserves are commonplace in agriculture and in many other areas of life, as illustrated in figure 1.

[76] The assumption of positive derivatives for the policy variables in the loss- and wealth-generating functions neglects cases in which the same policies may have opposite effects on wealth and losses (over some range). These sorts of policies tend to imply corner solutions. For example, a policy that increases wealth and diminishes losses over the entire range of interest should be set at infinity. A policy that diminishes wealth and increases losses over the entire range of interest should be set at zero, or if feasible, negative infinity.

produce sufficient reserves to survive. One may ride a tiger for a while, but eventually tire (deplete reserves), lose control, and be mauled by the tiger. The sun may explode, a large asteroid may land on one's village. There are no guarantees that solutions exist for every problem. However, given the assumed partial derivatives, communities with the above plans survive a wider range of calamities than those with suboptimal policy-response rules. Communities with the best possible plans may be said to be robust communities.

Within the "non-catostrophic" or normal range of crises, the time path described by the policy response rule[ $P^*_{1t} = f_1(F_{1t}, F_{2t})$, $P^*_{2t} = f_2(F_{1t}, F_{2t})$ ] achieves viability (positive reserves).[77]

Given the uniform nature of the loss generating phenomena of interest, there would be unanimous agreement to adopt such rules, and to do so at the appropriate level of decentralization assuming that the costs maintaining the appropriate level of reserves is also uniformaly distributed.

### Politically Feasible Responses: Surprises and Imperfect Policy Choices

Unfortunately, such perfectly robust policy rules are rarely possible in a world in which crises are possible. Social and physical systems are complex and may also be partly stochastic. Some exogenous causal factors may not be fully understood. Some of the effects of policy may not be fully understood. The future is not completely known and unpleasant surprises may be confronted by individuals, organizations, and societies. Moreover, the politics of such rules may be difficult because the effects are not uniform within the community of interest.

For example, under a progressive tax system too many rather than too few reserves would be held, which will make the rule and socity more, rather than less robust. If, however, the distribution of losses is also non-uniform, the combination of progressive taxes and uneven losses may generate deficient as well as excessive reserves.

There are also a number of nonfiscal reasons why communities may fail to adopt policies that maximize survival prospects. They may not know or be able to observe the causal factors (state variables) on which the best policy choice depends. They may not be able to fully control all the relevant policy variables, because of institutional or technological constraints. They may have other goals that conflict with survival.

In a two-factor, two-policy world, it is plausible that all decision makers completely understand their wealth- and loss-generating functions: the exogenous processes that generate the state variables, the range of exogenous factor values that they may confront, the entire range of policy responses that may be adopted, and the effects of those policies on states of the world for all possible values of the exogenous factors. Such settings are the ones normally examined in economic and game-theoretic models. In such cases, all decision makers have complete and

[77] This is the optimistic universe characterized by Diamond (xxxx) toward the end of his book on collapse.

optimal plans of action that specify the best possible response for every possible situation, as described in equations 5a and 5b.

However, perfectly robust policy response rules are less likely to be feasible in settings in which the number of exogenous causal factors is very large, the process generating them complex, and the number of possible policy responses is also very large. Information and planning costs and/or the nature of processes generating the states of the can rule out the existence of completely robust plans. Some of the processes generating state variables may be non-ergodic or very long term phenomena, and therefore many possible states of the world and losses associated with them would not been experienced and may not have been predictable ex ante.

Decision makers may, for example, have experienced many spring floods, but not a 200-year flood (one taking place only once every 200 years). In such circumstances, both surprises and crises may occur. Indeed, they may be commonplace, rather than the exception. New plans may have to be devised and adopted rapidly, without much preparation, as the water rises to levels never before experienced.

### Social Dilemmas: Commons Problems and Coordinated, Managed, Solutions

The crises analyzed above are exogenous ones in which all persons in a community confront similar losses and can independently address the crisis through their own policy choices. We now shift to cases in which addressing a crisis requires some coordination or management, such as required by a variety of social dilemmas. In most social dilemmas, the crisis is at least partly endogenous in the sense that extraordinary losses are partly the consequence of the joint decisions (policy rules) of the individuals in the community of interest.

This shift in focus allows us to explore the importance of governmental institutions for recognizing and coping with crises. The analysis continues to assume that individuals are all interested in maximizing prospects for survival, but in the context of social dilemma, even such persons may adopt policies that place themselves and their community at greater risk than necessary. Governments may also induce crises, but this possibility is not taken up until section III of the paper.

The dilemma of greatest relevance for the resource management and environmental issues focused on in Diamond's book is the classic commons problem. The above net-reserve accumulation functions can be used to analyze commons problems by interpreting the known causal factor (F1) as the total use of some common resource by other persons in the community of interest and the policy decision as an individual's own use rate of the commons. In a two-person society, the exogenous factor confronted by person A is the use of the commons by person B and vice versa. Policy 1 is each person's own use rate. In a larger N-person community, the exogenous factor would be the use rates of the N-1 other persons in the community.

The nature of a commons problem is such that beyond some collective use rate U*, the total output of the commons falls, although the typical individual's

own harvest increases, if other users do not increase their usage. Although problems are not associated with every commons setting, there are many in which the Nash equilibrium use rates are excessive and net output from the commons is below the maximal output.

At the symmetric Nash equilibrium each person in a community of size N chooses:

$$P'1t = f1((N-1)P'1t \mid P02t, F02t) \quad (7a)$$

and, when there is a problem, the total usage is:

$$N\ P'1t > U^* \quad (7b)$$

Modest overusage problems reduce the accumulation of reserves, which places the society at somewhat greater risk of failure than it needs to be, but not at an existential risk. However, there are clearly cases in which a commons problem can completely undermine a society's prospects for survival, as when the resource in question is the only source of food or water in the region of interest. The result in either case is similar to that depicted in figure 2 in which the reserve accumulation function is reduced for each individual (and thus the community as a whole) and reserves may be depleted, rather than accumulated, over the period of interest.

Because such commons problems are themselves relatively common, a variety of methods for addressing resource overuse problems have been adopted by societies throughout history, as indicated by Ostrom's case studies and analysis (1990, 2005). Most require collective action of some kind to create standing institutions for limiting access or otherwise changing incentives to overuse the commons of interest.

One widely used solution is the introduction of formal use rights of various kinds, as with rights "to use and exclude." In addition to privatization, communities may regulate access through resident user fees, permits, and norms of various kinds. These may be applied uniformly, so that individual use rates falls from P'1t to U*/N, or they may be applied in an asymmetric fashion in which some users receive greater access than others, with a total usage equal to or below U*.

Which type of solution is chosen, if any, will vary with the process through which policies are chosen in the community of interest ¾ that is, with the type of government in place, and whether the government recognizes the overuse problem and adopts policies to address it.

## Crisis and Collapse

Jared Diamond (2011) does an excellent job of reminding us that societies do not last forever. They may be destroyed or undermined through war, a dearth of resources, and unsustainable political decisions. By doing so, he reminds us that long-term survival should not be taken for granted, although he regards himself to be an optimist by suggesting that long-term survival is possible. As a professor of

physiology and geography, his book naturally tends to focus on physical causes of collapse, although he acknowledges many other possibilities. Other possibilities somewhat neglected in his book include exogenous meteorological shocks (changing climate and/or unusually bad weather), institutional competition, and changes in economic circumstances.

His narrative centers on natural resource constraints and resource management problems. The Greenland case was evidently largely induced by northern hemispheric cooling.[78] After more than three centuries of life in Greenland, farm crops became even less certain than usual and emergency supplies from other communities were limited by ice flows, reducing both the average standard of living and reserves for withstanding unusually bad years. Although temperatures warmed in the following century, the colony evidently never recovered. A more dramatic, albeit smaller and less famous, instance of collapse occurred 30 miles from where this piece is being written, where a small prosperous town was erased by rare, very strong, river floods, and fires between 1886–88 and never recovered. The flood destroyed a good deal of the capital stock of the town, which undermined its economics (milling, logging, and tourism), and evidently the capital could not be easily replenished in the post-flood economic environment, in part because the perceived risks in that particular valley had been reassessed.

In both cases, an exogenous natural shock (the Little Ice Age and floods) may be said to have undermined the sustainability of a community by depleting reserves (food stocks and other capital) and increasing perceived risks associated with particular places. This paper attempts to shed some light on these and other similar cases in which communities are undermined by exogenous shocks and policy choices.

This chapter develops a relatively lean model of collapse and uses it to analyze the institutions and economics of surviving crises. Space considerations necessitate a somewhat brisk and tight analysis. Section I develops a model that provides economic and informational foundations for crisis, crisis management, and collapse. The analysis provides a framework for analyzing crisis and collapse from a rational choice perspective. The model focuses on the accumulation and depletion of reserves in settings in which the choice environment is not fully understood. The analysis generates a number of general conclusions and provides a useful point of departure for additional research. Section II briefly describes social dilemmas that require organized responses. Overcoming such problems requires governments or similar organizations. Section III suggests that governing decisions can cause crises in cases in which the interests of government officials are not well aligned with those of "their" communities. Section IV suggests that some governmental institutions are likely to be relatively more effective at

[78] Diamond mentions the fact that the Inuit survived through this period, although they faced similar difficulties. However, even if the Norwegian-Icelandic settlers had mimicked the Inuit, it could still have been said that the original Scandanavian–based society collapsed largely as a result of climatic change.

promoting the accumulation of reserves; detecting, addressing, and surviving crises; and thereby avoiding collapse. Section V summarizes the results of the analysis.

The analysis suggests that political institutions for ameliorating short-run and long-run crises share a number of properties, as do many of the standing policies for avoiding a collapse. Although crisis and collapse may occur even when a society's political institutions and policies are perfectly robust, a society is far more likely to survive unpleasant surprises, if it has institutions in place that encourage the accumulation of reserves and assures an early detection of and effective response to crises.

To provide a bit of structure for the analysis of crisis and crisis response, a model is often useful. A model focuses on a subset of factors thought to be important so that relationships among factors can be better understood. The model below focuses on a choice setting that is prone to exogenous shocks of various kinds that require reserves to survive. The analysis focuses on informational problems and other policy problems that affect the probability of survival in such settings; however, as a point of reference it first analyzes a setting in which there are no policy mistakes.

Reserves are stocks of natural and/or accumulated resources that can be drawn on for sustenance during difficult times. "Difficult times" may be generated by exogenous factors that cause unusual losses, unusually poor conditions for producing goods and services that can be used for reserves, or a combination of the two. During most of human history, winter has been a period in which reserves were depleted and summer is a time in which they are replenished in communities located well north or south of the equator. Many firms in the West, similarly, have seasonal sales that account for the bulk of their profits and hope to weather the remainder of the year on reserves accumulated during that period.

In principle, each person or organization in such communities may have different wealth- and loss-generating functions, and those functions may each be driven by a large number of exogenous factors and control variables. Nonetheless, a model that includes uniform wealth- and loss-generating functions with just two exogenous factors and two control variables sheds light on many key issues and can be easily extended to account for greater complexity.

## Conclusions: Robust Routines for Dealing with Crises

Sensible policies for democratic crisis management are essentially similar to those for individuals. Policy makers should attempt to avoid big mistakes. A well-designed constitution should be crisis proof. It should be designed to handle the urgent unforeseen problems in a manner that does not threaten its fundamental decision procedures and constraints. Urgency implies that streamlined decision processes can be productive during times of crisis. However, emergency powers should not used as a method of circumventing normal constitution practices. The standing procedures of crisis management should also allow persons other than those charged with crisis management to determine when the crisis has

ended so that the normal decision processes are reinstated. (An example of such an architecture is provided by the U. S. constitution, which gives Congress the power to declare war, but makes the President the commander in chief. Moreover, a war can only be continued with Congressional, approval insofar as Congress controls funding for the military on a year to year basis.)

Obviously, it is sensible to investigate and plan for crises before they happen. Although surprise is a fundamental characteristic of crises, ignorance about crisis scenarios and possible policy responses to them can be reduced by creative analysis and planning. One can never fully anticipate the exact time and place of an earthquake, flood, contagious disease, or terrorist attack, but many responses to such crises are similar regardless of specific details. A careful analysis of real and imagined crisis scenarios allows rapid policy responses to be chosen from a menu of well-understood policy options. For example, an individual crime or fire remains a crisis in the sense that each case is a surprise and calls for an immediate response. However, responses to individual crimes and fires have long been routinized, and, thus, "normal" crimes and fires are no longer regarded to be crises. In this manner, policy research can reduce losses associated with mistakes made during times of crisis; although it cannot entirely eliminate crises or mistakes.

Second, because policy mistakes are unavoidable during times of crisis, the standing procedures for dealing with crisis should allow policy mistakes to be discovered and corrected at relatively low cost. This is, of course, one reason for having regular and routine popular elections rather than electing persons for lifetime terms of office. It is also the reason why emergency policies should have "sunset" provisions so that they expire or are carefully reviewed after the immediate crisis has passed and better information becomes available.

Third, because not all crises can be eliminated, some of the downside risks can be eliminated through insurance like policies. A common method for addressing losses associated with a crisis and with the mistakes of crisis management is ex post social insurance, in which taxpayers "bailout" those whose losses are greatest or deemed most likely to lead to subsequent crises. These programs are not always trivial in size, as evident in the most recent financial crisis. Moreover, ex post insurance, but its nature is a product that is difficult for private markets to provide since the payments go to those damaged by events that were not widely anticipated and so could not be prepaid in the normal way with insurance fees.

Fourth, robust institutions for addressing crises should be crisis proof. It should be designed to handle the urgent unforeseen problems in a manner that does not threaten its fundamental decision procedures and constraints. Standing procedures should allow times of crisis to be identified so that streamlined decision processes are put in place only temporarily. The streamlined decision making should be narrowly focused on the crisis at hand to reduce agency problems and the magnitude of policy mistakes. There should be clear lines of responsibility so that mistakes, malfeasance, and incompetence can be readily identified and punished. The standing procedures of crisis management should also specify persons (other than those charged with crisis management) to determine when the

crisis has ended so that the normal decision processes are reinstated. (Emergency powers are less likely to threaten the constitution in this case.) This is, of course, one reason for having regular and routine popular elections rather than electing persons for lifetime terms of office. All emergency policies should have explicit "sunset" provisions so that policies are carefully reviewed after the immediate crisis has passed and better information becomes available

Democracies differ from leviathan in that the median voter's interest in crisis management concerns not average losses, but his or her own losses and the losses of others insofar as his or her social norms and altruism takes account of them. As a consequence of both factors, democratic governments tend to be tasked with broader responsibilities for crisis management than authoritarian regimes. For example, during poor weather agricultural output tends to fall, as will average food consumption in a manner that cannot be directly affected by government policy. However, the distribution of food can be affected in a manner that limits losses for those with below average income. Democracies evidently have electoral pressures to undertake such policies, which, as Sen (xxxx) suggests, is the reason that there are fewer famines in democracies than in dictatorships.

### Is Crisis Management a Pure Public Good?

The fact that governments often address broad loss generating surprises does not imply that such efforts are efforts to produce pure public goods. Neither the losses nor the crisis management undertaken are necessarily shared by everyone. For example, during a flood, those on high ground are essentially unaffected by the rising water itself, whereas those on low ground are. If the government coordinate or provides methods for persons to leave the flooded areas, most of the methods used affect one person or small groups at a time, as with buses or mass-transit tickets. Similarly, programs to limit the losses of those already harmed during a crisis, by, for example, handing out food, clothing, and tents, are providing private goods rather than public goods.

If in the future, large new capital structures (dikes) are built to limit future losses those services, in contrast, often resemble classic public goods. These are not crisis management, but loss reducing services analogous to rules and regulations discussed in chapter 5. The breath of benefits associated with such programs usually reflects economies of scale associated with some risk reducing services. (Its often far less expensive to build one large dike system than dikes around each house). Economies of scale imply that all may benefit from programs that realize such economies, and in this sense crisis management may have properties similar to a pure public good when everyone in the society faces similar risks. This, however, is not always the case.