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INTERNATIONAL CONFLICT PROCESSES: A SYSTEM VIEW

NAZLI CHOUCRI

Introduction

One of the serious limitations of contemporary political analysis lies in the too frequent separation of politics from its ecological context. The conceptual tools at our disposal are adequate only for analyzing what is overtly and evidently political. Is it not possible, however, that the underlying determinants of political behavior are such that results might be predetermined long before they become fully apparent? Is it not also possible that what we term political is only a small, albeit crucial, part of the dynamics that produce conflict and cooperation, instability and stability, war and peace?

It is our contention that a thorough understanding of the systems of relationships — ecological, demographic, economic, and technological — that lie at the roots of politics is absolutely essential before raising those abstract questions that pertain to morality, ethics, peace, order, and stability. Of critical importance is the delineation of those processes that lead to conflict and warfare among nations in a way that would eventually assist in raising these appropriate moral and ethical queries. Without a sound empirical base, ethical discourse remains akin to speculation or intuitive exercise.

Our basic premise is that no one single cause ever determines international violence — that war instead often results from a series of developments that originate in the most basic attributes and capabilities of nations. It is further assumed that until the linkages between national characteristics and international behavior are empirically charted, it will not be possible to analyze the ways in which national decisions are shaped by predictable trends over time rather than by unique circumstances and idiosyncracies. Both, of course, are not mutually exclusive. A crucial task, therefore, is to determine the relative importance of the general versus the unique and specific. Our strategy is twofold: To look into the dynamics of crisis in order to isolate the underlying conditions for the development of specific conflict situations, while simultaneously developing empirical models of national behavior to note the extent to which patterns of conflict and warfare emerge from general patterns of national attributes and characteristics.

This paper summarizes recent investigations into the roots of conflict and warfare that have been jointly undertaken at Stanford University and

the Massachusetts Institute of Technology. In the following pages we shall discuss the philosophical and conceptual frameworks underlying our investigations, point to some recent findings, and chart out those lines of inquiry that appear to be necessary prerequisites for the understanding of international behavior.

*International Conflict Processes: Long-Range Dynamics and Short-Range Effects**

There are many separate "causes" of international conflict. Scholars point alternatively to the aggressive tendencies of mankind, psychological drives, domestic causes, competition for trade or resources, military expansion or conquest, the drive for power, and so forth. Clearly, many of these factors have been important at one time or another, in one war or another. But this does not help us in understanding how the various "causes" of war are interrelated. Our objective over the past years has been to develop empirical models of conflict and warfare, distinguishing between longer-range causes and shorter-range, more immediate effects.

The key variables affecting national behavior are *population*, *resources*, and *technology*. Technology refers to the general level and development rate of knowledge and skills in a society. Our initial proposition is that differential rates of population growth, combined with differential rates of technological growth, contribute to the competition and sometime to conflict between nations with grossly unequal access to resources and technological capabilities.

Population acquires political implications when the combination of growing population and developing technology places increasing *demands* upon resources, resulting in internally-generated *pressures*. The greater the pressures, the higher is the likelihood that national activities will be extended outside of territorial boundaries. If two or more countries with high capability and high pressure tendencies extend their interests and their psycho-political border it is highly probable that the two opposing spheres of interest will *intersect*. The more intense the intersection, the greater the chance that competition will assume *military* dimensions. When this happens, competition may be transformed into conflict, and perhaps even in an *arms race* or cold war. At the more general level of abstraction, provocation can be considered the final stimulus for large-scale conflict or violence. But an event will be considered as provocation only in a situation that has already been dominated by expansion, competition, armament tensions, and increasing levels of conflict behavior.

* This section is based on Nazli Choucri and Robert C. North, "Dynamics of International Conflict: Some Policy Implications of Population, Resources and Technology," *World Politics*, Supplementary Issue, (Vol. XXIV, Spring, 1972), pp. 80-122.

We have argued elsewhere that major wars emerge partly as a result of pressures generated internally in a state, and in partly as a result of the rivalries, comparisons, and reciprocities inherent in interactions among nations. Internal and external dynamics are closely related, and associated with as well as highly constrained by, the basic distributions of capabilities and attributes that form the profile of nations. In those terms, a crisis is only the top of a pyramid composed of these interrelated elements. Our investigations seek to identify in some systematic way the longer-range causal networks leading to war, to isolate the points where alternative paths may have made a difference, and to manipulate key variables in ways that might have yielded different outcomes.

We found in our investigations: (1) that the dynamics underlying the development of conflict situations are highly volatile; (2) that they change over time; and (3) that longer-range causes differ from shorter-range, more immediate considerations. Rarely is a declaration of war a random phenomenon: it is the consequence of developments which, we have argued, originate in aggregate demographic, ecological, technological, and economic considerations.

This does not mean that the effects of human cognition, volition, or idiosyncracies are unimportant or need to be minimized or ignored. Quite the contrary: We do recognize that leader's perceptions of their nations' capabilities (wheter accurate or inaccurate) are equally and sometimes even more important than "reality". However, we must emphasize that leaders operate within a highly structured environment that remains largely invariant in a short span of time. Thus, while perceptions are important in shaping national policies and preferences, the outcomes of policies are generally determined more by the "realities" of a situation than by the nature or content of the perceptions forming them.

Nor does this mean that dynamic processes leading to conflict are irreversible, inevitable, or certain, but that, as conflict situations develop and as the system moves farther along the conflict spiral, the probabilities of reversals, de-escalations, and the like become progressively weaker, thereby constraining the ability of individuals — or national leaders — to modify the outcomes. If this process is correctly specified — and it remains to be fully supported empirically — it amounts essentially to a progressive loss of decision latitude.

In our approach to the problem of conflict, with its focus on the *longer-range* factors that constrain national behavior and determine how much can be accounted for by such considerations, we are left with a residual that may be attributed to volition, preferences, decisions, policies, and the like. Conventionally, this residual is thought of as comprising politics. We are arguing for a broadening of our definition of politics by going beyond that residual and by incorporating the overall system structure as well.

Thus, in any discussion of values, preferences, choices, or priorities, it is necessary to address oneself as much to the residual as to the underlying aggregate substrate.

This approach might be thought of as *ecological statistics*, whereby the objective is to map out the linkages between ecological, demographic, and technological considerations on the one hand, and political factors on the other, and to specify the interrelationships between politics, economics, resources, technology, and conflict among nations. *This is not determinism*. It is an explicit attempt to formalize the constraints on national behavior and on political outcomes. The purpose is to reduce our uncertainties concerning future outcomes *within some range of probability*. The philosophical tone is thus one of probabilism. Thus, whatever value the intellectual effect might have, it is explicitly recognized as predictive and probabilistic and not prescriptive and deterministic. Any questions of values, morality, or ethics raised in this context must be viewed in appropriate probabilistic terms.

*Quantitative Analysis of International Conflict Processes**

In operational terms, the problem is one of (1) observing *trends* over time in the underlying ecological, demographic, technological, economic, military, and political variables; (2) isolating the *relative weights* of these variables in contributing to conflict and warfare; (3) developing *models* of these interrelationships; (4) *testing* these models against empirical data from different historical situations and cases; (5) observing the results and abstracting *functional relationships*; (6) *reformulating* the model, taking into account misspecifications, changes occasioned by changes in the phenomena under investigation, and so forth; and (7) respecifying the model for purposes of *forecasting* and *prediction*. Our investigations have progressed through four of these seven stages, and we are continuing work on the remainder. The following paragraphs summarize our results to date.

Our most extensive analysis has involved a statistical investigation of the forty-five years prior to the outbreak of war in 1914, with the pur-

* This section draws upon Robert C. North and Nazli Choucri, *Nations in Conflict: Prelude to World War I* [in preparation], sections of which have been summarized in Nazli Choucri and Robert C. North, "Causes of World War I: A Quantitative Analysis of Longer Range Dynamics," in Klaus Jürgen Gantzel, Gisela Kress, and Volker Rittberger (eds.), *Großmachtrivalität und Weltkrieg: Sozialwissenschaftliche Studien zum Ausbruch des Ersten Weltkrieges und Historiker-Kommentare* (Gütersloh, Bertelsmann Universitätsverlag, in press).

pose of determining the extent to which aggregate ecological variables conditioned the developments which led to World War I. This involved the development of a somewhat reliable measure of conflict behavior, as well as the collection of aggregate data on demographic, economic, military, commercial, and diplomatic interaction variables. The analyses of these statistics were guided by our assumptions and accompanying hypotheses as to where the roots of conflict lay and what kinds of relationships might have existed among variables at different stages in the development of conflict situations. A simplified version of our model is noted in Figure 1.

The relationships among the variables — depicted by arrows — are derived from statistical (multiple regression) analyses that sought to determine the extent to which one variable effects another in terms of strength and direction of influence. The “causal” interpretation is deeply rooted in the assumptions underlying the general linear model and its variants in econometrics. While not necessarily arguing causation, these same linkages might be thought of in terms of functional relationships. This is an issue that we will return to later.

Without dwelling upon our specific findings, the general outcomes of our investigations might be summarized as follows. We found: (1) that in each of the six European powers (Great Britain, France, Germany, Italy, Austria-Hungary, and Russia), at different stages during this forty-five year period, rates of change in population and/or in industrial growth contributed to the expansion of activities outside of territorial boundaries in the form of colonialism; (2) that colonial expansion occasioned intersections among the respective spheres of influence, as well as increased incidences of violent behavior among the Powers; (3) that colonial expansion contributed to increases in the military allocations of the Powers; (4) that the various Powers reacted differently — in some cases, expenditures appeared to be generated primarily by internal growth (Great Britain and Germany), and in others by external factors (France); (5) that increases in military allocations tended to contribute to increases in prevailing levels of conflict among the Powers; (6) that there were systematic effects tending towards increased violence that we could not account for, and that these effects were external to the model and represented an area of unknowns; and (7) that the model as noted in Figure 1 rarely held for the forty-five years as a whole, but that different aspects of it held for different periods. From this we realized that there were some underlying shifts in the system which still needed to be explained.

This brief summary hardly does justice to the subject matter or to the quantitative investigations. Whatever the regularities in the ecological data, we cannot readily generalize from the specific pre-World War I case to other, more recent historical situations, nor can we extrapolate into the

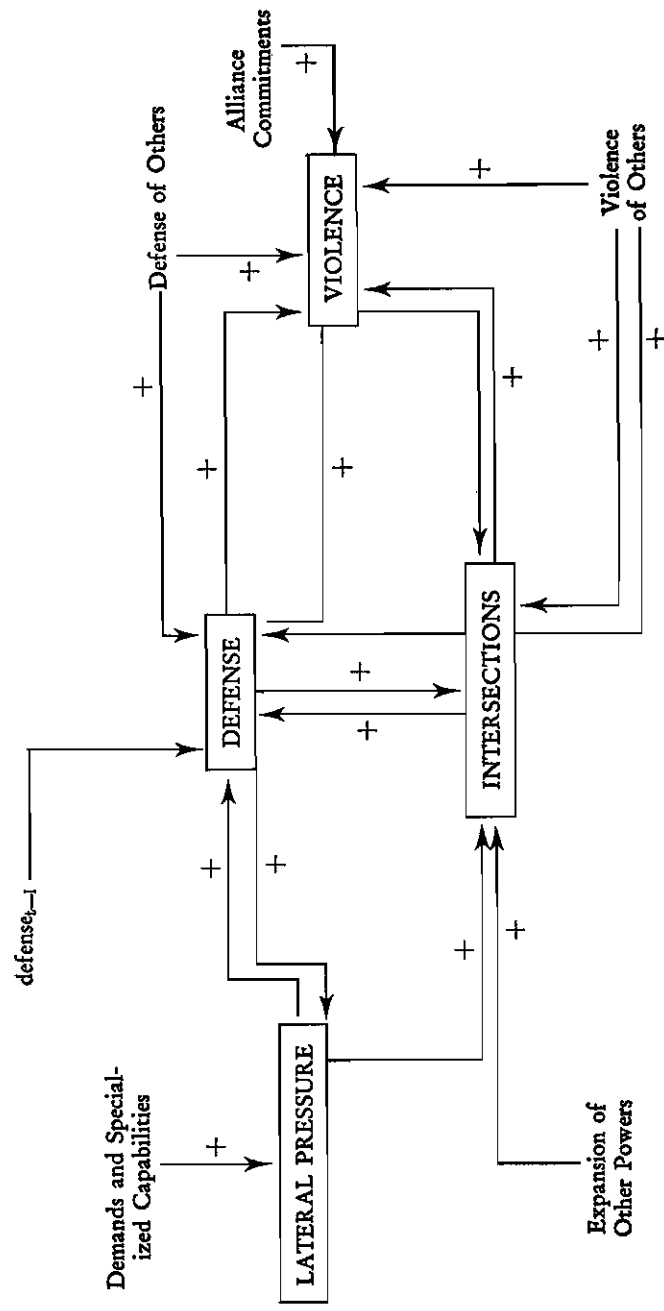


Figure 1
GENERAL MODEL
1870-1914

future the patterns that appeared in the past. This concern has led us to investigate of the interwar period, and, subsequently, the post-World War II period. The critical link in the "causal" network leading to conflict appears to be the point at which nations extend their activities outside of their national boundaries and their choice of a *mode* of expansion, whether trade, militarism, investments, peacekeeping, etc.

A profound awareness of the contextual bounds inherent in any historical analysis led us to take a particularly close look at the Japanese case during the interwar period in order to uncover the underlying trends (if any) in the ecological, demographic, and technological profiles of Japan on the one hand, and its actual behavioral patterns on the other. If there is anything that most distinctly characterizes the Japanese interwar situation, it is the sharp but unmistakably exponential nature of her expansion and stationing of troops in China and Asia. Also compelling is the equally sharp but gradual and unmistakably high increase in Japan's GNP, population, industrial production, and importing of raw materials between 1921 and 1939. By 1935, troops stationed overseas had increased on a gentle upward swing. Two years later, the curve looked exponential. We cannot as yet infer causation between internal growth and external expansion, but we approach this issue as a question open to empirical investigation.

While the pre-World War I case with the six Major European Powers and the interwar case with Japan can only point to some interesting characteristics of warring nations, it is by contrast to the ecological and behavioral profiles of the Scandinavian countries over the past centuries that meaningful differences in terms of propensities for conflict and warfare might be discerned. The European Powers and Japan were, comparatively at least, characterized by high levels and rates of population growth, industrial output, and military expenditures. The Scandinavian countries were characterized by low levels and rates of population growth, and lower levels and rates of output and military expenditures. Additionally, the Major Powers were generally deeply involved in alliance commitments, while the Scandinavian nations seemed to be free of such ties. And, finally, the Major Powers were exhibiting various sorts of large-scale expansionist tendencies — in part for political reasons and in part to acquire resources — most notably in terms of colonial expansion, but the Scandinavian nations relied more on trade than on territorial aggrandizement. The important point here, at least on the basis of *prima facie* and some empirical evidence, is that there appears to be some general coincidences and contrasts between Major Power attributes and behavior and Scandinavian attributes and behavior.

These comparisons such as these lead to questions concerning the characteristics of war-prone versus peace-prone systems. The proposition is that the mode of resource acquisition chosen to meet internal resource needs

might provide some clues concerning the eventual development of one or another system of international relations.

This issue becomes especially pertinent in today's world, where most of the advanced industrial societies are dependent upon resources (energy and mineral) acquired externally for continued economic growth, and these are basically located in low income, low technology areas. As long as resources are plentiful, their prices remain manageable, and the flow is not severely impeded, we can expect the advanced industrial states to employ relatively noncoercive means of resource acquisition. But if one, or all, of these considerations change, rendering the meeting of resource demands more costly, propensities for coercive modes of acquisition might be greater. The possibility of serious international political repercussions emerging from resource shortage should not be dismissed prematurely. Thus, while politics cannot be reduced to economics, it would be a serious mistake to overlook possible linkages from demography, ecology, technology, and economics to politics, and from politics to these aggregate societal effects.

Given the trends and patterns generated by quantitative data and analyses of specific historical situations, we still need to delineate the various linkages from ecological factors to political ones. The conventional statistical paradigms pose serious obstacles to theorizing about complex systems of relationships, and the clues generated by multiple regression analyses provide only a starting point for the theoretical developments basic to an understanding of the implications generated by growth — in population, technology, resource needs, and resource utilizations — for national behavior and international relations.

Questions of ethics, values, and morality — in short, the “what ought to be” — can best be examined only if the “what is” and its implications are well understood. To date, we have only the vaguest notions concerning the workings of large-scale social systems. And we are only vaguely aware of the extent to which the decisions we make today might have unanticipated repercussions — possibly negative — on tomorrow's outcomes. Not only is it necessary for us to broaden our conventional view of social systems; we must also examine the workings of systems over long and short periods of time. We shall argue, in the next few pages, that the intellectual tools are now available for such enterprise, and that it is incumbent upon us to examine these problems critically, noting wherever possible their relevance for the analysis of future outcomes. We must identify *where* in a complex system different kinds of *policies* might be utilized to bring about different kinds of *outcomes* *.

* See Donella H. Meadows, et al., *The Limits of Growth* (New York, Universe Books, 1972) for an extensive discussion of the implications of continued growth for the global environment.

Because the human mind is not capable of tracing higher-order effects in complex systems, because it is easier to think in linear, additive terms than in nonlinear, nonadditive terms, and because we know that the reality we are trying to depict and model is basically neither linear nor additive, it has been necessary to supplement our statistical and quantitative analysis with a methodology developed recently at M. I. T. and designed specifically for the analysis of complex systems. This has been termed system dynamics. A brief sketch of the basic ideas is noted here.

System dynamics is a simulation approach to social systems which accommodates multiloop, nonlinear feedback structures. A feedback system is influenced by its own behavior, being controlled by the interdependence of negative and positive feedback, and by stimuli external to the relations modeled. Because growth in social systems and social phenomena — as in all systems — cannot continue forever, it becomes necessary to identify the ways in which the system reaches equilibrium. For this reason, it is important to analyze the *functional* relationships among constituent variables of a model for the purpose of identifying the nature of the operating feedback loops, the time delays involved, and related linkages. Within the context of Figure 1 above, then, what is essentially at issue is the intricate relationships among population, resources, technology, expansion, and military behavior, which are depicted in linear and additive terms, but, in actuality, these relationships are highly nonlinear, interactive, and, in all probability, nonadditive as well.

We are seeking to model the *linkages* among ecological, demographic, technological, and economic variables and their non-linearities in a way which will allow us to determine their relative effect on external behavior and foreign policy. We also want to specify the *functional* interdependence among these variables and the ways in which changes in one factor might produce changes in another. The modeling procedure underlying system dynamics is basically self-contained in so far as data requirements are minimal and there are no restrictions beyond setting initial levels of key variables and specifying their theoretical and functional interdependence. Variables effect each other through the effects of their respective rates of change. These are given as decision rules and not as fixed data points.

Such a brief sketch cannot do justice to the methodology. Suffice it to stress the philosophical divergence between system dynamics and statistical analysis. However, the two paradigms are neither philosophically inconsistent nor mutually exclusive. Functional relationships that are speci-

* This section draws upon Nazli Choucri, Michael Laird, and Dennis L. Meadows, "Resource Scarcity and Foreign Policy: A Simulation Model of International Behavior" (M. I. T., Center for International Studies, 1972).

fied in a theoretical and *a priori* stance need to be validated against empirical data with the use of statistical methods. In the last analysis, the issue is not statistical analysis, econometric analysis, or system dynamics, but how to bring the strengths of individual approaches to bear upon the problems at hand. The remaining sections of this paper are devoted to a discussion of recent efforts at M. I. T. to reformulate the problems and issues noted above in terms that bear more closely upon external realities than has been the case so far.

*A Nonlinear Feedback Model of International Conflict Behavior **

This section describes in verbal terms the ways in which we sought to decompose the problem at hand by modeling the interrelationships among *internal* sources of foreign behavior as well as the effects of *external* stimuli on internal factors. The critical factors modeled included population, productive capital and technology, lateral pressure, resource utilizations, trade, and military expansion. The procedure was to focus on each of these factors, to treat them individually as separate sectors of an overall model, to specify key variables in each sector and their interrelationships, and to delineate the ways in which different sectors relate to and affect each other.

A critical consideration in our analysis of international conflict involves the explicit recognition of the long-range effects of population dynamics. We sought to capture the effects of a growing population through the consideration that the larger the population, the greater the per capita resources needed and the lower the per capita economic investments of a society. Thus, starting from a balance between economic and population growth, we proceeded to specify that if economic growth were faster than population growth, the result is increased investments, consumption, and resource usage. If, in contrast, population growth exceeded economic growth, the result is economic and social stagnation. In the one case, the implications are obvious. In the other, they make themselves felt over long periods of time as greater growth implies greater resource utilization and, by extension, increasing resource shortages.

The linkages from population to production and technology are summed in the rates of change of the population and economic variables. A growing population places demands on the consumer output on the one hand, and on economic investments on the other. In some general sense, these are two mutually exclusive paths of resource allocations: The greater

* This section is also based on Choucri, Laird, and Meadows, "Resource Scarcity and Foreign Policy." The modeling efforts described were undertaken largely by Michael Laird.

the consumer output, the lower the outputs for investments, and the reserve obviously holds. Aside from this interplay, the key considerations affecting economic growth are the labor force, industrial capital, and the accessibility of mineral and energy resources. Resource utilization is thus an intrinsic part of economic activity. And it is the need for resources — traced to population growth on the one hand and to economic productivity on the other — that is viewed as predisposing the extension of national activities outside of territorial boundaries, which has been termed *lateral pressure*.

The modeling of this predisposition involves recognition of the effects of two factors: investments in a society allowing to expand its activities externally, and sufficient domestic resources allowing to marshal its energies in the desired direction but, at the same time, providing sufficient constraints so as to make the resource need felt even stronger. In each case, the resource factor is a crucial one. The availability of internal resource needs is the key at this juncture: Resources are needed for industrialization, but increasing industrialization places added pressure on the resource base, thus exacerbating the tendency for acquiring external resources.

In order to simplify the modeling task, we have captured the actual manifestation of the predisposition for outward movement (lateral pressure) in two ways while realizing that there are many different avenues possible for a nation's external behavior. The behavioral dimension that we have chosen is the military/non-military one. In each case, the processes involved no longer pertain only to one nation's internal growth, but to the relationships among nations, whether the "other" is explicitly modeled or treated as an external stimulus, exogenous to the model. In the case of the non-military mode of resource acquisition and trade, we began with a model tracing the linkage between an advanced industrial state and other countries. In a world of finite resources, the net effect of increasing demands for external resources by advanced industrial states is to place unavoidable limitations on the long-range availability and accessibility of raw materials in the world at large, including other developed and less-developed countries. If we wanted to appreciate fully the implications of these considerations a systematic comparison of alternative trade policies and of the internal implications of these policies for each of the trading partners (the advanced states and its partner) would be necessary.

The alternative model of resource acquisition, through military behavior, follows directly from the amount of investment in the military domain. This rate, in turn, is determined largely by the output per capita and by the level of the population. The set of dynamics intervening between population, resource limitations, and industrial output *vis à vis* increased allocations to the military pertain to a society's predispositions to extend behavior outward. However, as noted above, this pressure itself is highly

influenced by industrial output and resource utilization. Increasing allocations to the military is thus a concomitant of increased industrial growth, increased resource needs, and increased lateral pressure.

What prevents this process from continuing indefinitely — that is, greater and greater allocations to the military — is the associated increase in costs. These costs are both internal and external. Internal costs make themselves felt in the domestic economy, while external costs are generated primarily as a result of resistance by other Powers and by increases in their own military allocations. The higher the costs, the greater a society's propensity to reassess its behavioral patterns and national priorities, perhaps adopting new modes of resource allocation or external behavior. As presently modeled, increasing costs lead to a retrenchment along the military dimension, and a deemphasis of the military, or reallocation of resources toward nonmilitary modes of behavior, and, by extension, lower costs as well.

In a very fundamental sense, the relationships outlined here point to the intricate interdependence of these dynamic processes. Indeed, everything seems to be related to everything else. But in the real world that we are trying to model, things are rarely discrete; they are highly intricate and interdependent. We are doing immeasurable injustice to the realities of such situations by modeling them in a highly simplified manner such as this. But even this level of simplicity is not easy to deal with. So far, we have modeled these relationships clearly enough so that it is possible to inquire into the effects of changes in population level on external behavior, or on military allocations, or on resource utilization, and so forth, as it is possible to inquire into the effects of modifying any other key variable in the model. The major objective of this modeling procedure is to investigate the implications and consequences of changes in levels of key variables and, more importantly, in their rates of change. The latter are treated essentially as policies, the implications of which are the subject of our research. A simplified version of the flow diagram for this model is presented in Figure 2. The linkages noted relate population, resources, industrial output, and international behavior.

*Resources Needs and International Behavior: A Test Case **

Preliminary work along the lines described above focuses on advanced industrial states. Much of this work is highly experimental, and the conceptual framework as well as the simulation models are undergoing continuous changes and revision. It hardly needs to be emphasized that the current version of the model has a zero predictive value for any spe-

* This section draws upon the appendix of Choucri, Laird, and Meadows, "Resource Scarcity and Foreign Polity."

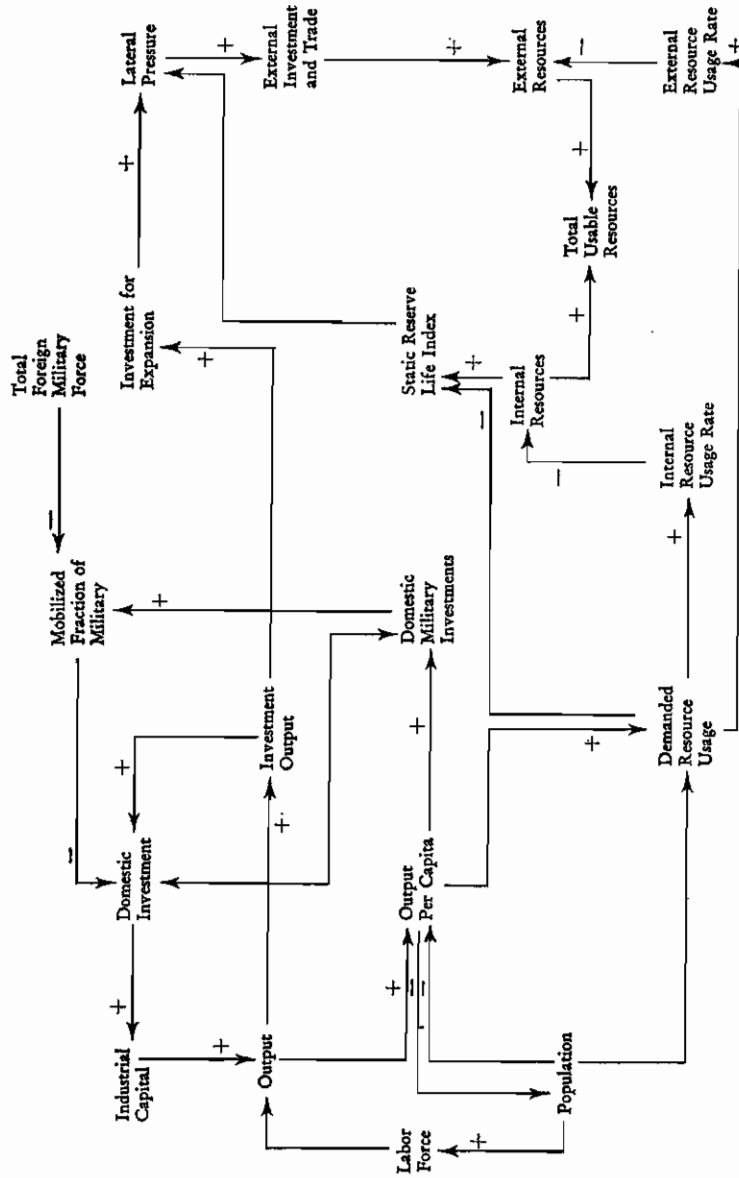


Figure 2
Simplified Causal diagram of factors linking population, resource usage,
industrial output and international relations

cific nation. The simulations are useful only as they may be compared with historical trends and intuitive expectations for clues to the misspecifications or omissions of important relationships.

Two case studies are currently being developed — one modeling Japan and the other the United States — and they provide the initial tests for the viability of the modeling procedure and the usefulness of the underlying conceptual framework. More detailed description of the analysis and results are noted elsewhere*. We will only briefly summarize some of the major trends and implications. In so doing, we shall focus upon the United States case, emphasizing the internal sectors of the model — those depicting domestic growth processes leading to external expansion.

Of the six runs undertaken that have covered the period of a century, two are sufficiently illustrative of the thrusts of these investigations:

The first run represented the basic United States model with a population of 200 million and other level and rate variables set at "reasonable" United States approximations. In the simulation over an initial period of 100 years (base 1970), lateral pressure increased sharply for forty-five years because of rapid internal growth, and then less so during the remaining years; usable resources reserve increased during the first twenty years, and then dropped off sharply as returns on external investments decreased and as the external resource extraction rate decreased. See Figure 3 for plots of key variables.

In a subsequent run, we *increased* the foreign costs, or those costs incurred in the process of extending influence outside of territorial boundaries and, at the same time, allowed the United States to extract resources from the external environment. We found that very serious behavioral differences emerged over time when foreign costs were increased. Lateral pressure tapered off; greater emphasis was placed on internal investments and on investments in internal capital; output per capita increased appreciably as the simulation was run over the 100 year period, and the net effect of these relationships was that output per capita was high enough to allow the population to cope with increasing external costs of external resource extraction. Thus, while an initial drop in lateral pressure and external investments occurred (resulting in greater emphasis upon internal investments), *in the long run* the outcome was such that *increasing* in output per capita enabled the United States to cope with *increased* foreign costs.

In short, the same behavior as in the first run emerged again, but during the latter part of the 100 year period rather than (as had been the case

* The Japan case is currently the subject of Michael Laird's M. S. Thesis for the Alfred P. Sloan School of Management, M. I. T.

Figure 3
The Basic U.S. Model

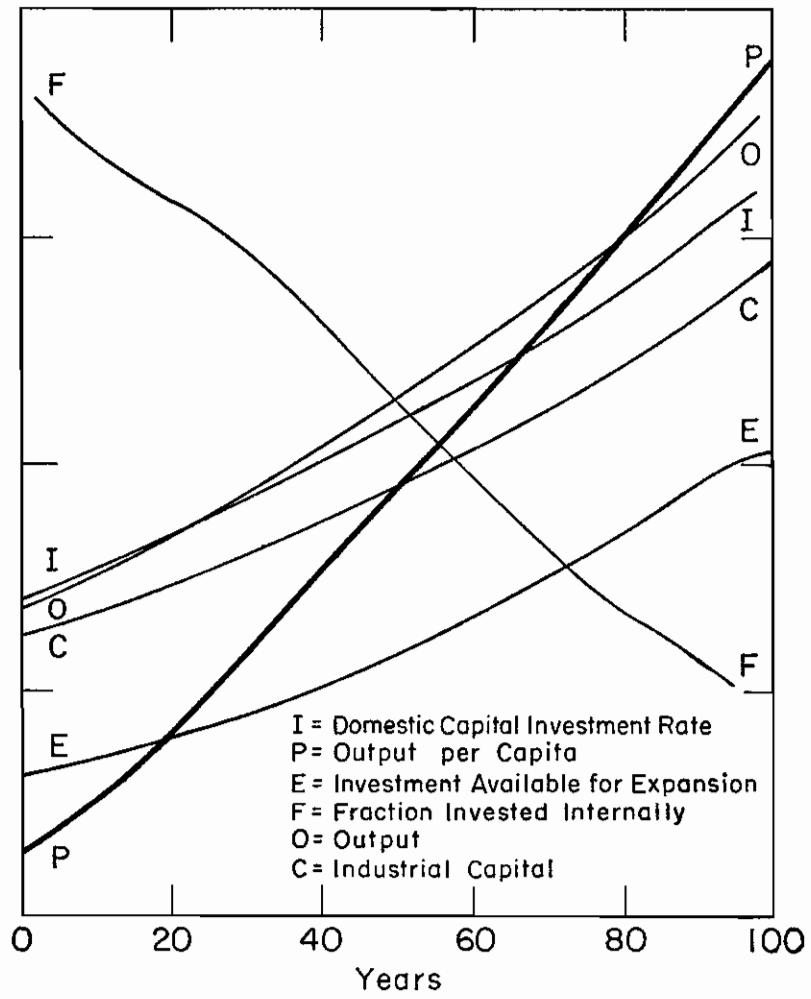


Fig. 3 (continued)

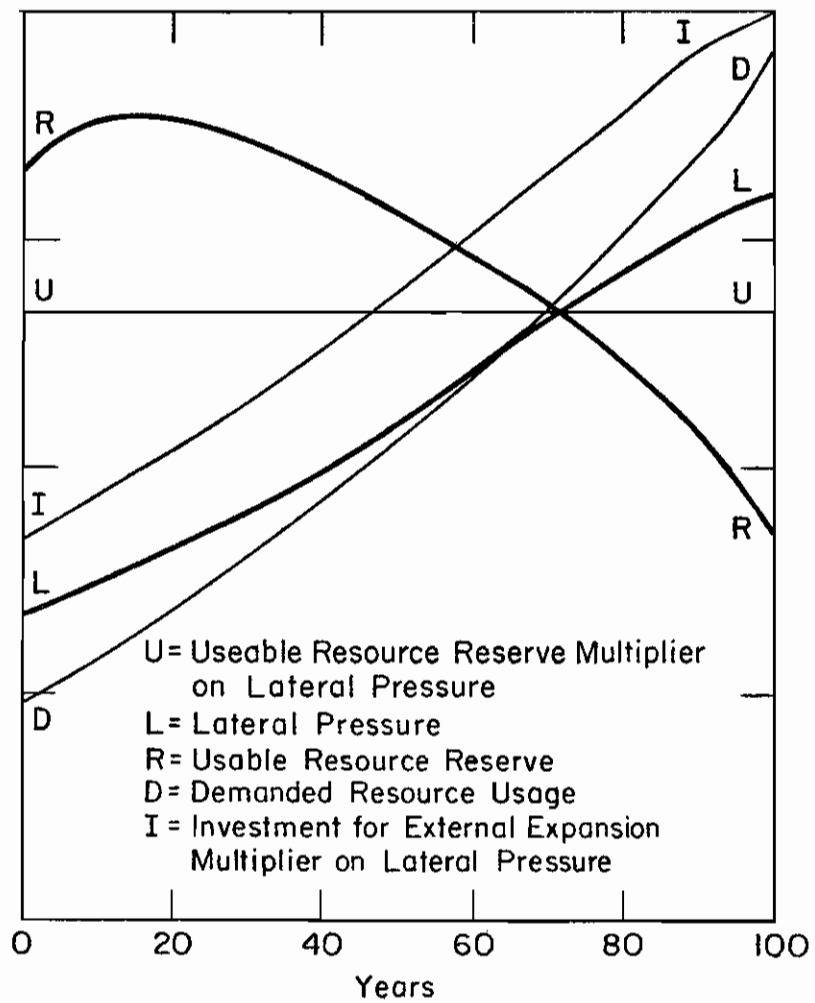
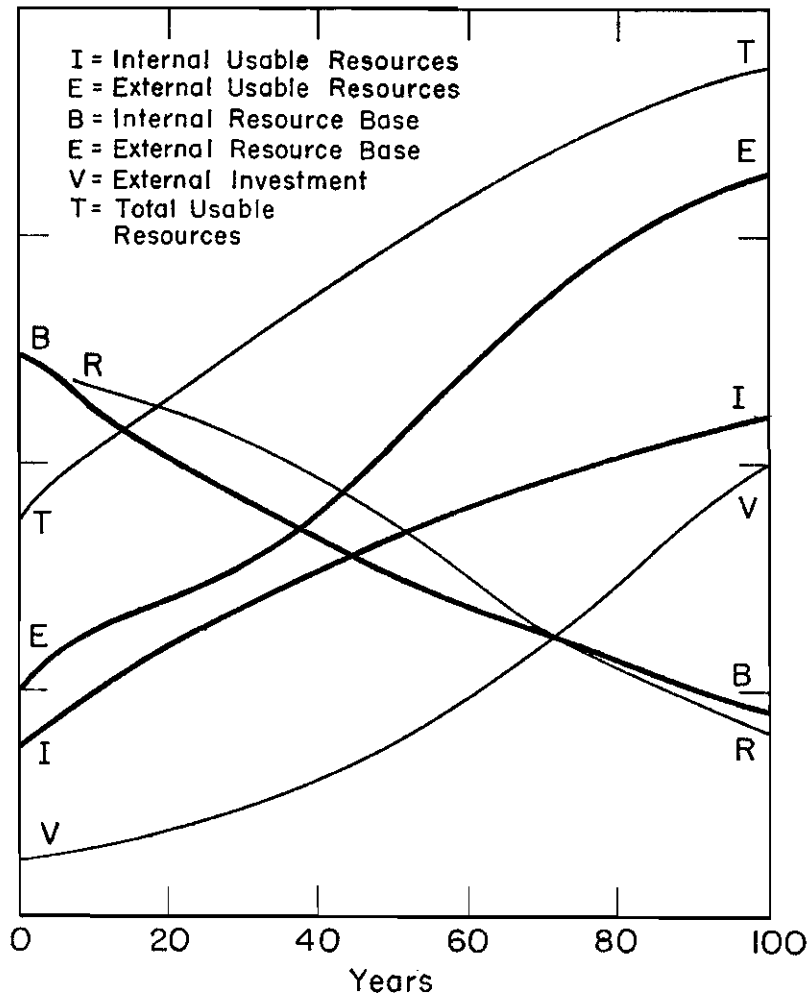


Fig. 3 (continued)



Korrekturanmerkung: Die vierte Zeile von oben muß lauten:
R = External Resource Base

earlier) during the first twenty to forty years. In this run, increased output per capita occurred despite increasing foreign costs because of a commensurate increase in internal investments which, over long periods, allowed the United States to cope with increasing foreign costs and to resume a high level of lateral expansion.

Assessment of these results is a difficult task. Technically speaking, it is not possible to validate a simulation model run beyond the data base. We can only evaluate the structure of the model by comparing simulated values, parameters, rates, and levels with actual values during a period for which empirical data are available. In the case of the United States runs, it is possible to validate the structure of the basic model by setting initial values at 1870, for example, rather than at 1970, and observing the degree of congruence between values generated by the model and known values of key variables. In this way, it would be possible to obtain empirically based assessment of the robustness and performance of the model.

Equally, if not more important, is the need to experiment extensively with alternative values and with structural modifications in different sectors of the model. The objective is to understand the performance of this complex system and to appreciate the ramifications of change. In other words, it is necessary to undertake sensitivity analyses of key relationships so as to evaluate the implications for one part of the system of change in another part. When this is done, it will then be possible to experiment with alternative policy options and alternative decision-rules, and to observe both long and shorter-range consequences. The results of that phase, combined with the critical response of others to this preliminary effort, should lead to the development of an improved theory relating resources to conflict.

Conclusion

The arguments for ecological statistical analysis stated at the beginning of this paper are now reiterated, but modified substantially to combine those arguments supporting the addition to the quantitative perspective of those modeling procedures needed to bring empirical data more closely to bear upon the substantive problems at hand. This convergence of statistical analysis with complex modeling procedures might provide us with some reliable insight into the workings of social systems.

The importance of understanding social and political dynamics cannot be overstated. Since decisions taken to remedy one problem might raise another problem in a different part of the system, it is imperative that we begin to understand the interdependence among the parts and the means by which policies and decisions we make might generate unanti-

culated or negative effects. It is irresponsible, if not actually dangerous, to pass value judgments, make ethical decisions, or draw moral conclusions concerning issues of war and peace in the absence of a sufficient understanding of the potential implications of such recommendations. This is not a plea for apathy or inactivity. Nor is it a lack of concern for the obvious international problems that confront us, but an appeal for caution when venturing in the realm of choices, preferences, ethics, and morality.

*

Wir behaupten, daß ein gründliches Verständnis der ökologischen, bevölkerungspolitischen, wirtschaftlichen und technologischen Bezugssysteme, in denen die Politik wurzelt, absolut unerlässlich für die Behandlung jener abstrakten Fragen ist, die sich mit Moral, Ethik, Frieden, Ordnung und Stabilität beschäftigen. Es ist von großer Bedeutung, jene Prozesse, die zu Konfliktsituationen und zu Kriegen zwischen Völkern führen, so darzustellen, daß eine geeignete moralische und ethische Fragestellung gefunden werden kann. Ohne entsprechende empirische Grundlage nähert sich eine Diskussion über ethische Werte der Spekulation oder einem intuitiven Gespräch.

Wir gehen von der Annahme aus, daß eine einzige Ursache niemals zu einem internationalen Konflikt führt, daß Kriege sich jedoch sehr oft aus einer Reihe von Entwicklungen ergeben, die ihren Ursprung in den wesentlichen nationalen Eigenheiten und Fähigkeiten haben. Weiters wird angenommen, daß solange die Wechselwirkung von nationalen Eigenheiten und internationalem Verhalten nicht empirisch festgehalten worden ist, es nicht möglich sein wird, die Art und Weise zu analysieren, in der einzelstaatliche Entscheidungen eher durch vorhersehbare langzeitliche Trends beeinflusst werden als durch einmalige Umstände und Eigenheiten. Beides schließt sich natürlich nicht wechselweise aus. Es ist daher eine wichtige Aufgabe, die relative Bedeutung des Generellen gegenüber dem Einzelnen und Spezifischen festzustellen. Unsere Strategie geht zweigleisig vor: wir analysieren die Krisendynamik, um die der Entwicklung von Einzelkonflikten zugrundeliegenden Bedingungen zu isolieren, und entwickeln gleichzeitig empirische Modelle für das Verhalten von Staaten, um festzustellen, bis zu welchem Grad sich Konfliktkonstellationen aus generellen Konstellationen von nationalen Eigenschaften und Charakteristiken ergeben.

Der vorliegende Artikel faßt Untersuchungen über die Wurzel von Konflikten und Krisen zusammen, die von der Stanford Universität gemeinsam mit dem Massachusetts Institute of Technology vorgenommen wur-

den. Es wird darin auch der philosophische und begriffliche Rahmen, der diesen Untersuchungen zugrunde liegt, diskutiert, auf neueste Ergebnisse hingewiesen und eine graphische Darstellung der Untersuchungsergebnisse gegeben, die für das Verständnis nationalen Verhaltens unumgänglich erscheinen.

... und die Entwicklung des Völkerrechts

... und des christlichen Internationalismus

3. TEIL

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