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ABSTRACT

A FORMAL MODEL OF INTERNATIONAL COOPERATION

by

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Previous explanations of international cooperation
(functionalism, neo-functionalism, and collective goods
approaches) provide alternative interpretations of the
process and have generally been applied to specific types
of cooperative activity, such as regional integration or
alliance behavior. An argument is presented that these are
not strictly competing explanations, but rather focus on
different aspects of a general process of cooperation
between states. A two-nation model of international
cooperation is developed that attempts to capitalize on
the similarities in earlier explanations while resolving
their differences. The central feature of the model is a
cybernetic interpretation of cooperative decision-making.
A reaction process represents the environmental forces
acting on cooperation. Within this, decision-makers are
assumed to monitor a small set of indicators, and to
respond in patterned ways to maintain these within
acceptable levels. The impact of an intergovernmental
organization on cooperation is also considered.

The parameters of the model are estimated for British-
French, French-German, and British-German cooperation. On
the basis of the conceptual arguments and the empirical

results, the following major conclusions are reached. First, the model represents a plausible interpretation of the general process of international cooperation. Second, the model accurately reproduces the course of cooperation for the cases investigated. Specifically, reaction processes are an important element of cooperation and the cybernetic interpretation of decision-making succeeds in capturing the fluctuating nature of cooperation. This results in instability in the process: cooperation tends neither to increase nor decrease over time, but varies about a particular level. These results lead to the final major conclusion: the narrowness of decision-makers' attention under the cybernetic model and the instability of the process suggest that cooperation is very resistant to change or influence. The dissertation concludes with suggestions for refining the model and clarifying the nature of the processes cited, and with a consideration of the implications of the results for the international system and for the behavior of states within that system.

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CHAPTER I. THE STUDY OF INTERNATIONAL COOPERATION

Introduction

The fundamental questions in international relations
research concern war and peace: the causes of conflict
and the conditions of peace. Yet, in the search for the
causes and cures of international violence, students of
international politics have generally slighted the study of
cooperation between nations. Two routes to peace have
received attention. The first is direct: identify the
causes of international conflict, with the goal of making
it possible to eliminate them. The second approach is to
focus on the development of cooperative relations between
countries, and to hope that cooperation is able to displace
conflict as the primary mode of behavior. The lack of
research on cooperation, however, means that these
processes are poorly understood, and this approach raises
some important questions, including what underlies coopera-
tion between countries, what forces guide it, and the limits
of cooperative efforts.

These questions came to the fore in Europe immediately
following World War II. The European states faced political
and economic chaos, and the issue was how to pursue re-
construction. There were a number of attempts made at
organized cooperation between the European states: the

Organization of European Economic Cooperation, formed to
administer Marshall Plan aid; and the Council of Europe,
intended to deal with political problems. These efforts
culminated in the formation in 1952 of the European Coal
and Steel Community, the first element of what would later
become the European Community. The driving force behind
these efforts was Jean Monet, working from the ideas of
David Mitrany. It was thought that formal organization
was a way to prevent the recurrence of war, which had
devastated Europe twice in the twentieth century.

Political scientists rapidly realized something new
was occurring, and began to study this new form of organ-
ized political cooperation. As noted above, these efforts
had their intellectual origins in the functionalist ideas
of David Mitrany (1966, first published in 1946). Mitrany
argued that by focusing cooperation on specific, narrowly
defined problems, political differences between states
would be minimized and cooperation would succeed relatively
easily. As a result, countries would be motivated to
cooperate on a continually increasing number of issues.
During the early 1950s, however, it was apparent that
cooperation was a much more difficult process than Mitrany
had foreseen; countries were failing to proceed smoothly to
ever higher levels of cooperation. It came to be recog-
nized that cooperation between states was, above all, a

political process. The publication of Ernst Haas's seminal
study of the European Coal and Steel Community (Haas, 1958)
gave birth to a substantial body of literature on regional
cooperation, an approach that came to be known as neo-
functionalism. The neo-functionalists worked to illuminate
the political forces influencing European efforts at coopera-
tion. This research contributed a great deal to our
understanding of events in Europe, but the ideas presented
were so closely tied to the European experience that they
did little to expand our understanding of cooperation more
generally. In the 1960s, collective goods theorists began
to apply economic theory to the study of international
cooperation (e.g., Olson and Zeckhauser, 1966). This
approach was rigorously theoretical, but seemed to many to
be missing the empirical referents needed to help us under-
stand actual cooperative processes. Then, in the early
1970s, the study of cooperation between countries faded
away. Yet the questions posed above are still important and
remain unanswered. To attempt to provide answers to these
questions through the development of an explanation of
general processes of international cooperation is the goal
of this research.

The remainder of this chapter is devoted to two

tasks. The first is a review of the previous literature on international cooperation. This provides an outline of the current state of our understanding of cooperative processes between countries, and permits the identification of the major problems and limits of this earlier research. The second task is an explicit statement of the goals and approach of this dissertation.

Review of the Literature

The central concern of this review is with the basic arguments of earlier research, their contribution to our understanding of cooperation, and the major weaknesses of these arguments. In preparing this brief summary of the literature, it has proven necessary to uphold the principle expressed by the Chadwicks (1932:xix) in the preface to their <u>Growth of Literature</u>:

> If we had read more widely, we would not have completed this book...which might have been the better course. The amount of time at our disposal is limited; we have preferred to give as much of it as possible to the primary authorities.

It is therefore necessary to apologize to the very many scholars whose work is not here acknowledge, and has often not been adequately assessed.[1]

The first two bodies of literature, the functionalist and neo-functionalist, consist of research on regional integration. There is agreement among integration studies

that their focus is on the "process whereby a group of
people, organized initially into two or more independent
nation-states, come to constitute a political whole"
(Pentland, 1973:21). Integration research was stimulated
by post-World War II cooperative efforts in Western
Europe, and the development of integration writing is
closely tied to the European experience.

The functionalists (see especially Mitrany, 1966 and
1975) concentrate on the self-sustaining dynamics of the
cooperative process. Social problems on a large scale
(the functionalists emphasize economic problems) are
thought to present strong pressures for cooperation.
Successful cooperation in one area then generates further
cooperation in other areas. Termed spillover, this is an
argument that states get "locked in" to cooperative efforts,
and find it increasingly difficult to disengage themselves
from such activities. The functionalists thus view
cooperation as a largely automatic phenomenon, and
minimize the role of political factors in the cooperative
process.

The second approach to regional integration, that
termed the neo-functionalist, was stimulated by early
studies of European integration (especially Haas, 1958).
This perspective accepts the fundamental functionalist
notion of the dynamics of expanding cooperation, but

argues that the expansion of cooperation is not automatic. Instead, cooperation involves explicitly political decisions and evaluations on the part of individual states: integration is a "political process characterized by the continual balancing of interests and reconciliation of conflicting forces" (Lindberg and Scheingold, 1970:4). The neo-functionalists are thus led to introduce such factors as evaluations of the costs and benefits of cooperation. The conceptual nature of these costs and benefits and how they influence cooperation, however, is never made explicit. As a result, neo-functional research suffered a proliferation of variables, such as the development of cross-national interest groups (Haas, 1958), the symmetry of size and power of states (Schmitter, 1971), and the degree of dependence on other nations (Nye, 1965 and Alker and Puchala, 1968).

Perhaps their most important contribution, the neo-functionalists argue that successful cooperation requires institutionalized interaction, and require an inter-governmental organization with supranational authority (Lindberg, 1971 and Nye, 1971). Integration research has come to focus on the growth and operation of such an institution, which significantly narrows their study of the more general phenomenon of international cooperation.

Their work has also been characterized by competing arguments and inconsistent research results (compare, for example, Deutsch et. al., 1967; Inglehart, 1967; and Lindberg, 1967). Caporaso (1972:34) finds this due to the lack of structure in integration research; there has been a failure to state explicitly the relationships being examined, and the work lacks a central conceptual logic.

The third category of literature focuses on the application of rational choice models to the study of international cooperation. Rational actor models posit that each decision-maker evaluates the costs and benefits of every possible course of action and their associated outcomes, and selects that alternative that maximizes benefits. Most applications of rational choice models to the study of international cooperation have concentrated on the concept of collective goods as the object of cooperation between states. Collective goods analysis concerns itself with the decisions of individuals to contribute to the provision of a collective good. Such decisions are a function of the value placed on the good and the costs of contributing to its provision; the contribution is defined by the point at which marginal cost is equal to a marginal value, leading to an equilibrium in the level of one's contribution. As others also

contribute to the provision of the good, however, the contribution of an individual can be reduced without reducing the value derived from the good. This leads, in the aggregate, to the suboptimal supply of the collective good. First introduced to political science by Olson (1965), the guiding application of collective goods analysis in international politics is Olson and Zeckhauser (1966). Their focus is on the suboptimal supply of the collective good by an alliance unless a set of rather stringent conditions are met. Other work (Ruggie, 1972; Brown et. al., 1976; and Chamberlin, 1974) relaxes the assumptions in an effort to extend the results of Olson and Zeckhauser.

Recently, the collective goods approach has been criticized for using concepts that may be inappropriate. Specifically, it has been argued that the properties of the collective good itself -- jointness of supply and nonexclusion -- are not applicable in the context of international interaction. Rather, there is a need to specify the precise characteristics of the good under consideration, which may more closely approximate those of a private good than a purely public good (Snidal, 1979; Oppenheimer, 1979, and Simowitz, 1976). These problems would seem more severe in studies of general international cooperation than in the more specific problem of alliances,

which has been the subject of most collective goods analyses. The major exception to this is Ruggie (1972). He examines international cooperation to solve domestic problems as a function of national capabilities and the costs and benefits of cooperation. In spite of the problems of collective goods analysis, it offers one major strength. It is the only approach to international cooperation that provides a central theoretical logic, deriving behavioral predictions from a set of prior assumptions.

A second set of criticisms of collective goods approaches to the study of international cooperation centers on the demands placed on actors by the assumption of rationality. Treating decision-makers as rational requires that they be able to gather and process large amounts of complex information in an efficient manner. This, it is argued, is simply not realistic (see, for example, Steinbruner, 1974 and Allison, 1971). An alternative view of the decision-making process which is thought to resolve these problems has been suggested. The cybernetic interpretation of decision-making assumes that actors have a limited ability to handle information. Decision-makers are seen as defining a limited number of variables as critical, and their goal is to maintain these in an acceptable range. These factors are monitored, and

when they move out of the desirable range, the actors respond in patterned ways to restore them to acceptable values. The cybernetic model, then, is one of highly focused attention and programmed response, and thus avoids the preference ordering, explicit calculation of alternatives and outcomes, and the optimization required by the rational choice model (Steinbruner, 1974:Chapter 3).

This characterization of previous work on international cooperation has been brief, but it is sufficient to indicate the major lines of thought that have developed. These approaches all demonstrate weaknesses that limit their contribution to our understanding of general processes of cooperation. All have tended to develop within the context of a specific problem, whether regional integration, international organizations, or alliances. These are all limiting cases, and the ideas presented have never been considered as applicable to cooperation between nations more generally. Each approach also faces significant conceptual problems. Major concepts have been very restrictive and perhaps inappropriate to the study of international cooperation. For the functionalists and neo-functionalists, the focus on regional integration limits them to cooperation that appears to be leading to the creation of new political units. The functionalist approach is also apolitical. Cooperation is seen as an

automatic phenomenon, and there is no role for political factors in cooperative decisions. The concept of a collective good is quite restrictive. The international system is not a market economy, and international politics may deal more with private goods than collective goods.

These problems carry over and influence empirical work. The functionalists tend to see any sign of increased cooperation as evidence of spillover, and thus as support for their argument. The ad hoc explosion in the number of variables introduced by the neo-functionalists has destroyed any semblance of parsimony and by explaining everything, they in fact explain nothing. Perhaps most important, these approaches provide very different views of the cooperative process and how it occurs, and have been treated strictly as alternative, competing explanations of international cooperation. The result of these problems is that efforts to this point have failed to generate a systematic explanation of how and why nations cooperate. Resolving these problems is the task that lies ahead.

A Formal Modeling Approach

The purpose of this research is to develop an explanation of international cooperation. The approach taken is to isolate the crucial factors influencing

cooperation identified in earlier research. An argument will then be provided assembling these into a formal model that is amenable to empirical evaluation. Before this procedure can be outlined, however, it is necessary to define what is meant by the term international cooperation.

International cooperation is conceived here as a process of states working together in pursuit of national goals that they could not achieve as easily by acting on their own. Three elements of this definition require emphasis. First, cooperation is a process. The explanation thus attempts to account for a phenomenon that occurs over time, rather than a discrete event such as a military or trade agreement. Second, cooperation is an activity of states. This means that the actors of interest are governments, and such forms of international interaction as trade or social communication (mail flows, labor mobility, etc.) do not constitute international cooperation. Finally, states cooperate in search of their own goals. Specifically, following Ruggie (1972) it is assumed that states cooperate in order to enhance and expand their national capabilities.

The formal modeling approach to an explanation of international cooperation involves an explicit statement

of relationships based on assumptions about behavior. That is, an explanation of cooperation between nations will be proposed, and empirical work is designed to evaluate the adequacy of the explanation. The issue is the source of the assumptions that constitute the explanation of international cooperation. It would be possible to propose an entirely new explanation. Before this leap is taken, however, there is a need to organize and evaluate existing models. This is the approach taken here.

The model of cooperation proposed in the next chapter rests on two notions about previous research. First, the arguments presented in earlier work can be generalized beyond the specific context in which they were developed. The neo-functionalist notions of spillover and political evaluations of costs and benefits, for example, do not necessarily apply solely to interaction that occurs within the framework of an international organization. Second, previous attempts to build explanations of international cooperation are not simply alternative, competing explanations, but rather address different aspects of the cooperative process. Functionalist ideas of spillover, for example, contain an idea of a reaction process between countries and a sense of automatic decision-making. The

neo-functionalists add to this a crude notion of costs and benefits, and a contextual factor in the intergovernmental organization. The collective goods theorists focus on a sophisticated view of how decisions are made. Thus, there seem to be three general elements of earlier explanations: a reaction component, a decision-making component, and a contextual factor in the international organization.

There are three principle tasks involved in building this model of cooperation. The first is to review previous research on cooperation with the goal of isolating the key elements of each approach. This will include identifying the points on which earlier explanations are in agreement and the points on which they contradict one another. The second task is to provide a logic relating the common and competing elements of earlier research in a coherent, unified model of the cooperative process. Finally, it is necessary to evaluate the adequacy of the model. The result will be a synthetic model, built from the combination of earlier ideas in new ways.

The value of this synthetic model-building approach has been demonstrated in the arms race and arms expenditure literature. The seminal work in this area is Richardson's (1960) simple two-nation model of an arms

race. Richardson focuses on the dynamic interaction of
states; how the actions of one state are influenced by
and responded to by the decisions of another state. The
result is the classic action-reaction model that posits
a high degree of symmetry and reciprocity in the inter-
actions of nations and that finds the source of arms
races to lie largely in the international system.

Another class of explanations of arms races finds
the source of behavior in domestic political processes.
The organizational process model (Allison, 1971;
Rattinger, 1975; and Lucier, 1979) views decisions as the
output of large organizations that function according to
standard patterns of behavior that change only slowly or
with a substantial shock. The usual interpretation is
that this implies incrementalism in policy-making. The
bureaucratic politics model (Allison, 1971; Huntington,
1961; and Kanter, 1972) cites the multiplicity of actors
involved in the decision-making process. Each actor is
thought to have a distinct set of interests and objectives,
and decisions are reached through bargaining among them.
These models thus suggest a variety of sources of arms
expenditure behavior, including the international
environment, the decision-making process, and the domestic
environment.

Ostrom (1978b) develops a synthetic model that attempts to reconcile these competing explanations. He conceives of arms expenditure decision-making as a set of distinct steps, beginning with military service requests (the reactive link to the international environment), and ending with supplemental Congressional appropriations. Each organization is seen as having a simple decision rule (the organizational process element), and the final budget is the result of the combined influence of all organizations (the bureaucratic politics factor). An empirical evaluation of this model suggests that it is superior to earlier single factor explanations of defense expenditures.

The similarities between the arms race research and the cooperation literature are clear. Both present a series of separate explanations that are generally considered as independent and strictly competitive. No single explanation is particularly satisfactory, either conceptually or in terms of empirical support. Ostrom's reactive linkage model resolves many of the difficulties in the arms race and arms expenditure literature. It is hoped that by sorting through the literature on international cooperation, identifying the core elements of each approach, and synthesizing them into a coherent model

of the cooperative process, the same can be accomplished here for research on cooperation between nations. The goals of this research are, first, to develop an explanation of international cooperation that is more general than earlier efforts confined to specific types of behavior, such as integration or alliances; and, second, to provide grounds on which to judge whether the proposed explanation is superior to previous efforts to explain the phenomenon of cooperation.

The chapters that follow are devoted to developing and testing a synthetic model of international cooperation. The next chapter undertakes a more extensive discussion of existing research, isolates the crucial elements of each approach, and provides an argument assembling them into a new model of the cooperative process. The model cannot be characterized as representing any single approach. Rather, it draws on all of them, seeking the best elements of what has been done before. Chapter III is a methodological chapter. It identifies the cases to be used for analysis, the operational procedures used for measurement, the techniques applied to estimate the parameters of the model, and the means for judging the adequacy of the explanation. Chapter IV reports the results of this empirical test. The coefficients of the model

are estimated and discussed in terms of the previous
literature. This constitutes a test of earlier
explanations. Chapter V attempts to extend this
interpretation of the model beyond the existing literature.
This will facilitate an understanding of the implications
of the model and the directions future research might take.
The concluding chapter returns to the larger questions of
international cooperation addressed above. The
contribution of this model to the study of cooperation
is considered, avenues of possible future research are
discussed, etc. Most important, the final chapter
considers the implications of this research for the nature
of the international system and for the relations of
nation-states within that system.

Notes to Chapter I

1. The major works that have been slighted are those
   growing out of Deutsch (1954) and Keohane and Nye
   (1977). This research, however, suffers weaknesses
   similar to that of the literature reviewed. Deutsch
   concentrates on the development of popular feelings
   of amity between national populations. Keohane and
   Nye focus on aspects of interdependence in specific
   policy areas. This severely limits their relevance
   for the study of more general cooperative processes
   between nations.

CHAPTER II. A FORMAL MODEL OF INTERNATIONAL COOPERATION

Introduction

The goal of this chapter is to develop a synthetic
model of international cooperation. The procedure will be
to examine more closely each body of literature identified
above, with the aim of isolating the crucial elements of
each approach. This discussion will treat each of the
basic components of the model -- reaction processes,
decision-making, and the IGO -- separately. This
organization encourages a ready comparison of the arguments
found in earlier research. It will then be possible to
provide a more elaborate consideration of the model
itself: how the various components relate to each other
as well as to previous work, how they tap different aspects
of the cooperative process, their interpretation, etc.

In approaching the development of the formal model of
international cooperation, a number of limitations will
be imposed for the sake of manageability. First, the
focus will be primarily on the development and evaluation
of a two-nation model of cooperation. This restriction
permits concentration on relatively simple directed
behavior between nations, which in turn allows greater
conceptual clarity in the formulation of the model. This is
because the target of cooperative behavior is more narrowly

and clearly defined; it is easier to define goals and alternatives in relation to a single state than it is in reference to a group of states. It can also be argued that much of foreign policy is conceived of as bilateral relations rather than as regional or other multilateral relationships. This is often the case even within the context of intergovernmental organization such as the European Community, where, for example, French-German agreement can be the determining factor in Community policy.

A second fundamental issue relates to the structure of the proposed model. The basic concern is with the nature of the cooperative process: the sources of cooperative behavior between nations and the primary influences on such activities. International cooperation is viewed as a process that arises from the evaluations and decisions of an individual state in pursuit of national goals; it is a state activity. Thus, the model will be specified at the national level, providing a separate equation for each nation. As cooperation is a mutual process, however, these equations are interdependent. The resulting model, then, will consist of a pair of simultaneous equations.

The Logic of Synthesis

The argument to this point is that previous research on international cooperation has concentrated on different aspects of the process. Earlier explanations thus differ on the crucial elements underlying cooperation, focusing variously on reaction processes, decision-making, or international organizations, and present both common and competing arguments about the nature of cooperative activities. The goal in building a synthetic model is to identify the similarities in the earlier literature while resolving the differences. This synthesis, however, requires a framework or logic for combining these factors into a unified view of the cooperative process.

The cybernetic decision-making paradigm provides such a structure. Steinbruner (1974:50-51) notes that the cybernetic model specifies a "simple decision mechanism, but one with considerable logical power." The cybernetic view of decision-making is based on the notion of information feedback. The first feedback loop connects the actor to the environment; it "carries simple environmental input and in effect represents the process of perception" (Steinbruner, 1974:54). The decision-maker does not operate in isolation. Rather, decisions are made with a perceived environment that is outside of the state and not under

its control. Simple, programed behavior adjustments
are made on the basis of this input. As the environment
changes, there are minor adjustments to behavior. Thus,
the environment supplies a fundamental structure within
which states make decisions and that serves, in a sense,
as a base for behavior.

The second feedback loop provides the information
on which the decision-maker relies. This element
consists of those variables seen as critical by the
decision-maker and monitored by him. When these variables
move outside a range defined as acceptable, the actor
responds in simple, routine ways to restore the critical
variables to a desired level. It is this activity that
produces major changes in the system. (This interpretation
of cybernetic decision-making is taken from Steinbruner,
1974:50-57). Thus, the environment provides the basic
course of behavior, which is modified by responses to
changes in the values of a few critical variables.
According to this view, then, behavior is a function of
three factors: the environment, the critical variables,
and the manner in which decision-makers react to changes
in those variables.

The sources of cooperation cited by previous
research are closely parallel to these elements of a
cybernetic decision process. The reaction processes favored

by the functionalists and neo-functionalists provide the environmental input. States do not cooperate in isolation; cooperative acts are directed at another state or set of states, who are expected to respond in some manner. These responses are received from the environment; they are outside of the immediate decision-making setting. The nature of these actions and responses provides a structure to a cooperative relationship within which decisions about cooperation are made. As the environmental factor, then, action-reaction processes are responsible for the basic course of cooperation.

The decision-making elements of earlier work constitute the second feedback loop. The costs and benefits of cooperation suggested by the neo-functionalists and elaborated by the collective goods theorists represent the critical variables monitored by the decision-makers. States cooperate for a purpose; there are goals they wish to achieve. At the same time, cooperation entails costs: the partner in cooperation also has goals which are sought through collective activity. Cooperation is thus a process of give-and-take: a state seeks its own goals while it is expected to assist another state in fulfilling its aims. These factors address the fundamental purpose of international cooperation, and it is reasonable to expect states to monitor both the degree to which their

own goals are achieved and the expenses incurred in aiding others. All three bodies of literature present arguments about how decision-makers respond to changes in these variables.

The third factor found in earlier research is the impact of an intergovernmental organization. The neo-functionalists tend to treat it as an environmental influence independent of states, while collective goods theorists view it as a decision-making element. The latter view is adopted here. The reasons for this will be more fully developed below, but are based on the notion common to both the neo-functionalists and the collective goods theorists that an IGO can help structure the evaluation of costs and benefits and the way in which decision-makers respond to changes in those variables. Thus, the impact of an international organization is through decision-making processes, while environmental forces operate independently of decision-making activities. It is clear that the basic forces influencing international cooperation cited in the literature fit neatly into a cybernetic view of decision-making. With this interpretation, cooperation is a function of reaction processes, decision-making elements (costs and benefits and the reactions to changes in these), and a contextual factor in the IGO, which has an impact on the decision-making process.

Cybernetics thus provides a means to synthesize diverse and competing elements of previous explanations of cooperation into a coherent view of cooperative processes. This approach places the state within an international environment, which guides the course of cooperation. At the same time, decision-makers monitor the costs and benefits of cooperation, and alter their behavior when these move out of an acceptable range. An international organization can have an impact on the manner in which these evaluations and responses are made. These decision-making elements, then, can modify the basic reaction process. The resulting model takes a variety of influences, and assembles them into a unified interpretation of international cooperation. The remainder of this chapter is devoted to specifying more precisely what the various factors are and how and why they are thought to affect cooperative behavior.

Reaction in International Cooperation

Reaction processes are the first component to be introduced to the model. This is the environmental element of the cybernetic model: forces outside of the state and not under state control that influence cooperation. This factor is thought to provide a base level of international cooperation against which states make decisions to increase

or decrease their cooperative activities. Two types of
processes immediately present themselves for consideration:
reactions to cooperation received and reactions to conflict
received. Because the arguments surrounding these
processes are somewhat different, they are discussed
separately.

The notion of action-reaction processes has long
been a fundamental element of thinking in international
politics. At its simplest, this is merely a recognition
that the actions of other states influence one's own
behavior. An early rigorous statement of this conception
of interaction is found in the stimulus-response models
of the Stanford Studies of Conflict and Integration (see,
for example, North et. al., 1964 and Holsi et. al., 1968).
These studies argued, for example, that states express
hostility if they perceive themselves to be the target
of hostility (Zinnes, 1968). The first formal statement
of such an interactive model of behavior is found in the
work of Richardson (1960) on arms races, and the research
generated by that work (reviewed in the previous chapter).
In addition to an explicit statement that the behavior of
one state serves as a stimulus to the other, this research
also makes clear the interactive nature of this process.
Behavior is seen as mutually reinforcing over time, with

dynamic properties that can be identified.

The response to this body of research has been gradually to posit a more general action-reaction process of hostility and conflict (Zinnes, 1976). Surprisingly, however, this notion of an action-reaction process has seldom been generalized beyond studies of conflict to include cooperative international behavior. Cooperation is an interactive process between two or more states; it is a process of mutual bargaining, concession, and agreement to the benefit of both parties. Thus, cooperative acts directed toward a nation, indicating a willingness to engage in such interaction, encourage that nation to respond in kind in the hope of also deriving benefits.

The idea of a reaction component to international cooperation can also be derived from much of the functional and neo-functional literature on integration. The functionalists assume that states share a common outlook and purpose for cooperation, as well as a close similarity in the means by which they approach solutions to mutual problems (Mitrany, 1966:18-19). The result is that cooperation will be a successful means of problem-solving to the benefit of all parties. Cooperation will thus expand; cooperation by one nation is returned by cooperation from another, creating a peaceful, self-sustaining international process.

The neo-functionalists accept this basic view, but go even further in attempting to establish an action-reaction element in the cooperative process. The essence of integration, according to the neo-functionalists, is collective decision-making, which is best handled within the context of an intergovernmental organization (Lindberg, 1971, and Nye, 1971). In providing for institutionalized interaction, the neo-functionalists seek formally to establish and reinforce the reaction component of cooperation by providing an arena in which decision-makers can meet to resolve their differences. The IGO thus serves to facilitate cooperation by linking the decisions of states within the organization.

The logic of a reaction process as one element underlying international cooperation can be established more simply, however. The very act of cooperation indicates that states are seeking their goals through collective activity. They thus depend on the assistance of others to reach their objectives. If this contribution toward the attainment of goals is not provided, cooperation will fail in its purpose. If other states are willing to assist, in search of their own goals, cooperation holds some likelihood of being successful, and will be pursued. As a result, high levels of cooperation received are returned by high levels of cooperation, and low levels of

cooperation are likewise reciprocated.

A second aspect of the reaction component of international cooperation concerns the role of conflict between nations, and it is here that we encounter the first major debate over the nature of relationships. One view holds that cooperation and conflict are both part of the same general process of international interaction. Weede (1970), for example, argues that violence is a function of contact and, by implication, interaction. If this view of international relations is accurate, as interaction increases, both cooperation and conflict can be expected to increase.[1] There has also been an argument that cooperation in fact generates conflict (e.g., East and Gregg, 1967). As part of the process of negotiation and bargaining, differences are identified that lead to increased friction; this is a "familiarity breeds contempt" argument.

A second view contends that conflict and cooperation are fundamentally different types of behavior (see, for example, Ward, 1982); they are not merely different aspects of the same basic process. This notion is often defended by pointing to the seeming ease with which states simultaneously maintain both cooperative and conflictual relations: the United States and the Soviet Union

exchanging accusations and sanctions over martial law in Poland while conducting arms reduction talks, or Israeli-Iranian conflicts over Palestinian issues while Israel serves as an important arms supplier for Iran. If cooperation and conflict are different processes, it is reasonable to posit a reaction process between them. This is the view taken by the functionalists. They argue that as cooperation expands, the relative amount of conflict will decline and become less alient to decision-makers. More importantly, as conflict declines, a positive atmosphere comes to prevail, enabling the expansion of cooperative efforts (Mitrany, 1966:63).

Thus, it is thought that states react to both cooperation and conflict. While cooperation is introduced as a simultaneous reaction determined within the cooperative system, conflict is here treated as a separate process: it is generated outside of the process of cooperation. Because responses to such influences are rarely instantaneous (see, for example, Chatterji, 1969), conflict is introduced to the model as a lagged variable; a state reacts to the level of conflict received in the previous period. As this increases, there will be less incentive for cooperation. With the incorporation of the reaction terms, the model becomes:

$$Y_{12t} = \beta_{11}Y_{21t} + \beta_{12}C_{21t-1}$$

$$Y_{21t} = \beta_{21}Y_{12t} + \beta_{22}C_{12t-1}$$

where: Y_{ijt} = level of cooperation directed by nation i toward nation j at time t,

C_{ijt-1} = level of conflict directed by nation i toward nation j at time t-1,

β_{i1} = cooperative reaction coefficient for nation i,

β_{i2} = conflict reaction coefficient for nation i.

Cooperative Decision-Making

The action-reaction process alone, however, does not suffice as an explanation of international cooperation. States do not react blindly or automatically to the behavior of others, and the action-reaction component fails to provide an interpretation of how or why cooperative decisions are made. While the reaction process is thought to be a very important element in any relationship of cooperation, additional factors also influence the decisions of states to cooperate with others.

The cybernetic model suggests that these additional forces lie in the decision-making process itself. Two factors are important: the routines by which states make decisions about cooperation, and the variables that stimulate these decisions. In the case of international

cooperation, an IGO also has the potential to influence the decision-making process. The manner in which decisions are made contains a view of the dynamic character of the cooperative process itself. The major factors influencing these decisions are the costs and benefits of cooperation for the state, and an international organization can influence the evaluations of these.

Perhaps the major contribution of the functionalist writings on integration is their description of the process by which international cooperation proceeds. Their argument begins with the premise that shared economic and social problems on a large scale present strong pressures for cooperation.[2] Originally viewed in terms of international trade, functionalists argue that increased trade leads to common problems, which in turn stimulates cooperative efforts to deal with them (Hansen, 1966:245). Successful cooperation in one area then generates cooperation in other areas, leading to a "spreading web of international activities and agencies" (Mitrany, 1966:28-56). This expansion of cooperation is possible because states share common problems, and because cooperation is focused on economic and technical issues, minimizing the role of politics. This focus on apolitical aspects of international relations is a fundamental assumption of the functionalist approach. It is thought to be accomplished by linking

authority to specific tasks on which there can be broad
agreement. The functionalists thus believe that cooperation
will gradually and continually expand. Called spillover,
this is an argument that states will get "locked in" to
cooperative efforts, and find it increasingly difficult
to disengage themselves from such activities.

The functionalists carry their argument further and
provide a clear indication of the course by which they
expect spillover to proceed. The first stage is
international cooperation on specific technical issues. As
the range of cooperation grows, states will come to
coordinate cooperative efforts between issues, linking
various functional activities. The next step is the
introduction of international planning agencies to expand
cooperation yet further. The final stage in the spillover
mechanism is the acquisition of political authority by
these international agencies (Mitrany, 1966:73-75). In
each case, however, these planning agencies have no
authority beyond their specific function, and their
authority is not formal, but is derived from their
successful performance.

Functionalists, then, believe in the nonpolitical.
Cooperation can be successful if nations set aside their
political differences and concentrate on common problems.

The interests of states are assumed to be similar, and political cooperation is replaced by technical problem-solving. The spillover mechanism results in an incremental style of decision-making in which attention is directed toward an ever expanding set of problems. The functionalists thus rely on the efficiency of technology and the feasibility of technical agreement as the driving force behind international cooperation.

A major revision of functionalist thinking, and the dominant approach to the study of regional integration, is neo-functionalism.[3] Where the functionalists tend to see any sign of increased cooperation as evidence of spillover, robbing it of any explanatory value, the neo-functionalists devote considerable attention to reassessing the spillover process and to providing reasons for expecting cooperation to expand. Two types of spill-over mechanisms are specified. Pure spillover develops from the notion that problems are necessarily related in the modern world. Similar to the original functionalist concept, this is an argument that successful cooperation to solve one set of problems creates a new set of problems requiring further cooperation (Nye, 1971a:200 and 1971b: 67). For example, a reduction in tariff barriers and an increase in trade volumes can create tensions between national systems of taxation and incentives for industry

and agriculture, issues that require further cooperation for their resolution. The neo-functionalists also consider "cultivated spillover," or the deliberate linking of problems for political reasons (Nye, 1971b:68 and Lindberg, 1971:56). Cooperation is in part a bargaining process; concessions made in one bargaining arena may be linked to concessions received from the cooperative partner in another arena in an effort to achieve some balance of payoffs from the cooperative process. To the degree that such linkage occurs, it would tend to increase the amount of cooperation. Thus, in providing reasons rather than merely expectations, the neo-functionalists have provided some explanatory force for the concept of spillover.

These arguments present an interpretation of the dynamics of the cooperative process. To the extent that such spillover effects operate, the result would be a gradual and steady expansion of international cooperation. This conclusion is arrived at through a particular view of the decision-making process. States are thought to be tied to cooperation, decision-makers becoming convinced of the need for and success of cooperation, and, unwilling and unable to break with cooperative efforts and proceed independently, always moving forward toward more extensive cooperation in what is essentially an incremental manner.

On the rare occasions when spillover has been incorporated into a formal model, it has been introduced as a lagged effect of cooperation, this thought to capture the incremental nature of its influence (see, for example, Alker, 1971:270). A somewhat different formulation will be used here, based in part on neo-functional research.

The respecification of the spillover mechanism is intended to serve two purposes: a more subtle and realistic view of the decision-making process, which in turn allows greater latitude for the behavior of states. The functionalist notion of incremental spillover assumes states respond to the level of cooperation in the previous period by increasing their cooperation. This places heavy demands on the ability of decision-makers to gather and process information, and allows only growth in cooperation. The alternative suggested by the neo-functionalists is that the mechanism of spillover can result in both the growth of cooperation and the decline of cooperation (called spillback by the neo-functionalists). This is thought to operate much like the original spillover process. States can see cooperation declining, realize that it is not proceeding and producing positive results, and continue to abandon it as an approach to problem-solving. This view is quite similar to that expressed in the cybernetic model of decision-making. Rather than seeking

and evaluating information about the level and success of cooperation, states monitor a limited set of indicators, in this case the recent trend in cooperation, and respond in patterned ways (Steinbruner, 1974:47-87).

The dynamics of international cooperation are thus arrived at through a particular view of the decision-making process. Both the functionalists and the neo-functionalists tie present cooperation to past behavior. By allowing for both spillover and spillback processes, however, the neo-functionalists offer a more plausible and flexible view of cooperation, while still incorporating the original functionalist concept. This is the view adopted here. States are seen to respond not to the previous level of cooperation, but to trends in cooperation, expressed as change in cooperation during the previous period. With the addition of the dynamic element, the model becomes:

$$Y_{12t} = \beta_{11}Y_{21t} + \beta_{12}C_{21t-1} + \beta_{13}\Delta Y_{12t-1}$$

$$Y_{21t} = \beta_{21}Y_{12t} + \beta_{22}C_{12t-1} + \beta_{23}\Delta Y_{21t-1}$$

where: Y_{ijt} = level of cooperation directed by nation i toward nation j at time t,

C_{ijt-1} = level of conflict directed by nation i toward nation j at time t-1,

$\Delta Y_{ijt-1} = (Y_{ijt-1} - Y_{ijt-2})$,

β_{i1} = cooperative reaction coefficient for nation i,

β_{i2} = conflict reaction coefficient for nation i,

β_{i3} = spillover coefficient for nation i.

Reaction processes and spillover effects alone, however, still convey a sense of automatic, apolitical cooperation. This, in fact, is the view of the functionalists, whose model of cooperation is essentially one of economic determinism. A major aspect of the neo-functionalist development is the rejection of such a view, arguing instead that the cooperative process is inherently political, moderated by explicitly political decisions on the part of the nation-state. This re-introduction of political factors to the cooperative process leads the neo-functionalists to argue that national decision-makers will evaluate the costs and benefits of cooperation, and that this will influence the nature of future cooperative efforts (Nye, 1971b:83-84 and Lindberg, 1971:109-113). This is a recognition that cooperation is not seen as inherently good, but is based on a paragmatic assessment of its consequences for the nation-state.

The cybernetic model of decision-making also suggests the importance of costs and benefits. While reaction processes in the environment and the manner in which

decisions are made influence cooperation, these decisions are not made in a vacuum. Rather, decisions are based on a limited amount of information derived from tracking a few key factors. Costs and benefits perform this role in cooperative decision-making. Thus, the degree to which international cooperation imposes costs on and yields benefits to the state are crucial elements of international cooperation.

The neo-functionalists, however, simply cite the importance of costs and benefits. It is also necessary to provide reasons why costs and benefits are important, and an explanation of how they influence the cooperative process. This effort will be guided by collective goods approaches to international cooperation. Following an initial specification of the general nature of costs and benefits, the concepts will be refined to reflect more precisely the nature of their linkages with cooperation.

As nations cooperate, they are drawn more closely together. The pursuit of national objectives through international cooperation makes a state dependent to some degree upon others for the achievement of those goals (Ruggie, 1972:878). This interdependence imposes costs on the nation-state through a general loss of autonomy. This is not a formal loss of sovereignty, but rather a problem of framing and carrying out domestic policy. The

pursuit of a collaborative course makes a state reliant
of the partner in cooperation for the goods and policies
that will help it reach its goals. As this reliance
increases, a nation becomes more sensitive to the actions
of the other state; goal attainment is no longer under
purely domestic control. This factor can reduce the range
of options available to decision-makers. This conception
of costs as a constraint on alternatives is a common theme
in the collective goods literature (e.g., Ruggie, 1972)
and in research on interdependence (e.g., Keohane and
Nye, 1977).

　　To overcome these constraints, the pressures for
cooperation must be strong. These pressures are conceived
as the benefits a state receives as a result of cooperating
with others: the greater the benefits, the greater the
inducement for cooperation. It is commonly noted (for
example, Lindberg, 1971:110-111 and Ruggie, 1972:887-888)
that two general types of benefits are available from
cooperation: public goods and private goods. Benefits
here will be defined in the sense of private goods, a
decision made on both conceptual and practical grounds.
It is frequently argued that the concept of a pure public
good is highly restrictive; there is a need to specify
the precise degree to which a good under consideration
meets the jointness of supply and nonexclusion principles

(Ruggie, 1972; Simowitz, 1976; and Snidal, 1979). This is clearly an unmanageable task given the range of international cooperation being considered. It has also been suggested that the concept of public goods may be inappropriate to the study of international politics: the international system is not a market economy, and international interaction usually focuses not on the provision of a public good but on regulating the production and supply of private goods (Ruggie, 1971:875 and Snidal, 1979:563). This is particularly true in the case of international cooperation. It was argued above that states cooperate in the pursuit of national objectives. Specifically, following Ruggie (1972), they cooperate in order to enhance and expand their national capabilities. The benefits from cooperation, then, are purely domestic; one state is excluded from sharing the national capabilities of the other.

Defining costs as the loss of autonomy through a constraint on options and benefits as the expansion of national capabilities is only a beginning, however. Before these factors can be measured and their impact on cooperation assessed, it is necessary to provide a more refined conceptual view of how costs and benefits arise in a cooperative environment. Specifically, costs and

benefits will be viewed in an economic sense. This
emphasis follows logically from the functional and
neo-functional focus on economic cooperation as the
beginning core of integration; economic cooperation is
the first stage of further cooperative efforts. This
approach also seems to reflect the support of national
capabilities that we seek to evaluate, and seems
particularly appropriate given the importance of economic
issues in post-World War II relations between countries.
Given that cooperation makes states interdependent for the
achievement of their goals, plus the dominance of economic
issues in this relationship, suggests that a primary source
of costs and benefits arises from international trade.

Cooper (1980:5) provides an excellent statement of
the problems of trade interdependence: the question

> is how to keep the manifold benefits of
> extensive international economic inter-
> course...while at the same time preserving
> a maximum degree of freedom for each nation
> to pursue its legitimate economic objectives.

The benefits of international trade lie in specialization,
which in turn increases productivity. Trade alters the
marginal costs of commodities, allowing a state to divert
valuable resources to the production of those products for
which it enjoys a comparative advantage relative to the
trading partner, while contracting those industries in

which it is comparatively disadvantaged (Ingram, 1970:15). The resulting efficiency increases productivity. At the same time, as Spero (1981:82) notes, such relationships make national economies much more sensitive to external events and policies. Trade responds quickly to changes in incomes and prices in the trading countries, changes which appear most rapidly in the balance of international payments. Yet the capacity of states to deal with trade problems is limited. Some techniques (increased tariffs and quotas, for example) would limit the amount of trade and reduce the benefits received. Thus, states may be forced to take more purely domestic actions that they might otherwise prefer to avoid (Cooper, 1980: Chapters 1 and 3). Trade, then, yields benefits through the better use of resources, and imposes costs through constraints states are unable to influence and by reducing their ability to manage their economic affairs in their own way.

The primary importance of the collective goods literature lies not in the nature of costs and benefits, but in its specification of the manner in which these influence behavior. Using the concepts developed above, states pursue collective action -- cooperate -- in order to develop their national capabilities. This same activity, however, also limits the policy alternatives available to decision-makers. There is a level of cooperation at which

further collaborative efforts result in a reduction of alternatives that is valued more than the enhancement of capabilities produced by the additional cooperation. Because the costs of such added cooperation are greater than the benefits, states will not proceed to ever higher levels of collective activity. Rather, cooperation will come to stabilize around the level at which the marginal reduction of alternatives is equal to the marginal expansion of national capabilities. Thus, costs, benefits, and cooperation are all thought to reach an equilibrium level. As costs increase relative to benefits, states will be motivated to decrease their level of cooperation. As benefits grow in comparison to costs, cooperation will tend to increase. Incorporating costs-benefits, the model becomes:

$$Y_{12t} = \beta_{11}Y_{21t} + \beta_{12}C_{21t-1} + \beta_{13}\Delta Y_{12t-1} + \beta_{14}CB_{12t}$$

$$Y_{21t} = \beta_{21}Y_{12t} + \beta_{22}C_{12t-1} + \beta_{23}\Delta Y_{21t-1} + \beta_{24}CB_{21t}$$

where: Y_{ijt} = level of cooperation directed by nation i toward nation j at time t,

C_{ijt-1} = level of conflict directed by nation i toward nation j at time t-1,

$\Delta Y_{ijt-1} = (Y_{ijt-1} - Y_{ijt-2})$,

CB_{ijt} = costs-benefits of nation i of cooperation with nation j at time t,

β_{i1} = cooperative reaction coefficient of nation i,

$$\beta_{i2} = \text{conflict reaction coefficient of nation } i,$$

$$\beta_{i3} = \text{spillover coefficient of nation } i$$

$$\beta_{i4} = \text{cost-benefits coefficient of nation } i.$$

Supranational Decision-Making

One additional factor has the potential to influence the cost-benefit calculations regarding international cooperation. The neo-functionalists argue that the spillover process is moderated by political factors. They go further, however, and suggest that there must be some mechanism encouraging states to cooperate. This is best accomplished through an intergovernmental organization with some supranational authority. Lindberg and Sheingold (1970:7) provide the clearest statement: neo-functionalism

> ...establishes some prerequisites to
> effective problem-solving which involve
> a partial but direct threat to the auton-
> omy of the nation-state. Specifically,
> it is argued that one must begin with a
> real delegation of authority to a supra-
> national agency.

An IGO is thought to provide a regular arena in which decision-makers can meet and develop shared values and expectations, thus encouraging cooperation. In helping states to expand their view of the world, the IGO serves to reinforce the connection between the interests of individual states and the longer-term collective interests

of the group. In this sense, it is an effort to overcome the logical force of the free-rider problem. This factor is of such importance to the neo-functionalists that the growth and operation of such an IGO is the core of their definition of integration, and is the phenomenon they are trying to explain. This, however, means they never consider explicitly the impact of a supranational agency on cooperation beyond that which occurs within the organization.

As states pursue national goals in the arena of an IGO, a tension is introduced between national decision-making and the regulation of national independence that occurs as a result of membership in the supranational organization. Gordenker (1969) notes that this has not paralyzed international organizations, but it is likely to have negative consequences for broader international cooperation. As cooperative decisions are taken in an international organization, the responsibility for policy shifts from national decision-makers to international actors. If the IGO has supranational authority, its decisions further commit states to certain courses of action. This results in a further reduction of alternatives in a manner similar to, but more formal than, that which occurs as a result of economic interdependence. It is, in essence, a partial abrogation of sovereignty. It is

commonly believed (Nye, 1971:91-97 and Ruggie, 1972:878) that this will be resisted by national leaders. The major costs associated with a supranational IGO, then, are considered to be the loss of sovereignty and reduction of options due to the transfer of decision-making authority to the international organization. The greater the binding decision-making authority of the IGO, the greater the costs.

There is considerable debate over the impact of supranational IGOs on cooperation. The functionalists simply dismiss it as an important factor. Because cooperation is to the benefit of all countries, governments are not concerned with questions of sovereignty (Mitrany, 1966:163). For the neo-functionalists, the IGO is crucial for the organizing influence it exerts.[4] Their study, however, focuses exclusively on cooperation within organizations, which raises questions about its applicability to broader forms of international cooperation. The collective goods literatuture suggests that supranational decision-making has the potential for significantly reducing the range of options available to states, and should be treated as a cost. This is the approach adopted here. It is the most general view of the impact of an IGO, treating it as a contextual factor rather than as a necessary ingredient of cooperation. Also, by assessing the role of

international organizations in terms of their influence on national decision-making, it conforms more closely to the current notion of cooperation as the pursuit of national goals. With the incorporation of the term representing the influence of an IGO, the complete model becomes:

$$Y_{12t} = \beta_{11}Y_{21t} + \beta_{12}C_{21t-1} + \beta_{13}\Delta Y_{12t-1} + \beta_{14}CB_{12t}$$
$$+ \beta_{15}IGO_t$$

$$Y_{21t} = \beta_{21}Y_{12t} + \beta_{22}C_{12t-1} + \beta_{23}\Delta Y_{21t-1} + \beta_{24}CB_{21t}$$
$$+ \beta_{25}IGO_t$$

where: Y_{ijt} = level of cooperation directed by nation i toward nation j at time t,

C_{ijt-1} = level of conflict directed by nation i toward nation j at time t-1,

$\Delta Y_{ijt-1} = (Y_{ijt-1} - Y_{ijt-2})$,

CB_{ijt} = costs-benefits for nation i of cooperation with nation j at time t,

IGO_t = supranational decision-making authority of the IGO to which both nations i and j belong, at time t,

β_{i1} = cooperative reaction coefficient of nation i,

β_{i2} = conflict reaction coefficient for nation i,

β_{i3} = spillover coefficient for nation i,

β_{i4} = cost-benefit coefficient for nation i,

β_{i5} = IGO coefficient for nation i.

A Model of International Cooperation

The equations presented above represent one possible combination of the major arguments regarding international cooperation found in earlier research. The goal of this modeling procedure has been to identify the major elements of this earlier work, and to relate them to cooperation in a systematic manner.

The cybernetic view of decision-making provides a logic for this procedure. Behavior is treated as arising from a collection of forces, including environmental elements, the way in which decisions are made, and the variables most salient to decision-makers. Each is thought to have its own impact on cooperation. Thus, there are a variety of factors affecting cooperative behavior, at several different levels. The model is specified at the national level, recognizing that cooperation is an activity undertaken by individual states in pursuit of their own goals. Three major components of international cooperation have been identified. The reaction terms are intended to capture the interactive nature of the cooperative process. Seeking goals through collective activity clearly indicates the mutual nature of the process, and suggests that states depend to some degree upon others to help them achieve their goals. If this participation is not forthcoming,

states are unlikely to continue this approach. Second,
it is apparent that the manner in which cooperative
decisions are made might contain dynamic forces that influ-
ence the process. Success in solving problems through
cooperation may reinforce the value of a cooperative
approach, encouraging higher levels of cooperation.
Similarly, the failure of cooperation could lead the process
into a gradual decline. The spillover term represents a
defensible view of how cooperative decisions are made.
Finally, there is strong evidence that international
cooperation imposes costs on states as well as yielding
benefits in the form of goal attainment. If these costs
are large relative to the benefits, there is little
reason to pursue a collaborative course. The concepts
of costs and benefits were narrowed to reflect the types
of evaluations thought to be most important to decision-
makers.

This model also offers a way to look at a number of
potentially contradictory and complementary views of the
process of international cooperation. The functionalists
have drastically simplified the world by concentrating on
the assumed success of cooperation, a conclusion reached
only by dismissing the inherently political nature of the
process: the competing goals, aspirations, and needs of

states. Neo-functional research has focused on behavior
that occurs within an IGO, with little concern for how
these processes influence individual states. And collec-
tive goods theorists have attempted to specify rigorous
models of national decision-making, but have applied
highly restrictive concepts and ignored external factors
that may impinge on the decision-making process. As a
result, each approach has devoted itself to an understanding
of a single aspect of the process of international
cooperation, and they have generally been considered
competing explanations of the phenomenon. It is the premise
of this research, however, that these approaches need not
be considered separately as alternative explanations of
cooperation. Rather, they are complementary views of
different aspects of the process. By conceiving of
cooperation as a function of the sources of and constraints
on national decisions, and by assembling these explanations
of various aspects of cooperation into a unified view of
the process, this model provides a more complete and more
general specification of international cooperation.

The previous research does, however, present a number
of competing arguments. This, too, is largely a result
of considering one aspect of cooperation to the exclusion
of others, but some of the differences derive from actual

disagreements over the nature of relationships. Functionalists see the successful cooperative interactions of states leading to a steady expansion of cooperation. The neo-functionalists accept this, but argue that the process is dependent on evaluations of the costs and benefits of cooperation by the individual states. The collective goods approach suggests that cooperation is dependent only on costs and benefits, and that the cooperative process will level off at an equilibrium point, beyond which cooperation yields greater costs and benefits. Table 1 presents a more rigorous, formal statement of these competing arguments. This provides the grounds for interpreting and evaluating earlier explanations of international cooperation.

The argument underlying the model developed above, however, is that these earlier efforts address individual parts of the cooperative process. Thus, reasons have been provided why each factor can be expected to have an influence, and it is hoped that together they can provide a more successful and coherent representation of the processes underlying international cooperation. The model, however, must also be evaluated empirically, and procedures for testing are considered below.

TABLE 1

PREVIOUS CONCEPTUALIZATIONS OF KEY FACTORS
UNDERLYING INTERNATIONAL COOPERATION

Coefficient	Approach		
	Functionalism	Neo-functionalism	Collective Goods
Cooperative reaction	$\beta_i > 0$	$\beta_{i1} > 0$	$\beta_{i1} = 0$
Conflict reaction	$\beta_{i2} < 0$	$\beta_{i2} < 0$	$\beta_{i2} = 0$
Spillover	$\beta_{i3} > 0$	$\beta_{i3} > 0$	$\beta_{i3} = 0$
Costs - Benefits	$\beta_{i4} = 0$	$\beta_{i4} > 0$	$\beta_{i4} > 0$
IGO	$\beta_{i5} = 0$	$\beta_{i5} > 0$	$\beta_{i5} < 0$
Dynamic path	unstable-growth	unstable-growth	stable

Notes to Chapter II

1. A further implication of considering cooperation and
    conflict part of the same fundamental process is that
    the level of cooperation, as used here, is an in-
    appropriate dependent variable. Rather, one would
    study the level of interaction, or, if specifically
    interested in cooperation, the proportion of inter-
    action that is cooperative.

2. This assumption is neither as simple nor as straight-
    forward as it may seem. Choucri and North (1975),
    for example, argue that population growth, economic
    development, etc. present pressures for "lateral
    expansion," which produces conflict among states.
    Thus, extensive and common social problems can equally
    plausibly be viewed as the occasion for conflict.
    The point of the functionalists, however, and the
    importance of their argument here, is that cooperative
    efforts also offer a possible (and preferable) means
    of resolving such disputes.

3. The neo-functional literature is voluminous. The first
    expression of the neo-functional approach was Haas's
    study of the European Coal and Steel Community (Haas,
    1958). For other major neo-functional work, see
    Haas and Schmitter (1964), Schmitter (1969 and 1970),
    Nye (1971b), and the volumes by Lindberg and Scheingold
    (1970 and 1971). A review and wide-ranging critique
    of neo-functional efforts may be found in Haas (1975).

4. It should be noted that this argument has been carried
    to its logical conclusion. One approach to integration,
    what Pentland (1973) terms the federalist approach,
    argues that international integration only occurs with
    the formation of an overarching supranational insti-
    tution: "A political community is thus a state, an
    administrative-economic unit, and a focal point of
    identification" (Etzioni, 1965:4; also see Etzioni,
    1962). This approach has enjoyed little currency
    among international relations scholars.

CHAPTER III.   PROCEDURES FOR ANALYSIS

Introduction

Models are of little value if they lack any corre-
spondence to actual behavior. The task of this chapter is
to specify the prcedures that will be employed to
evaluate empirically the model of international cooperation
developed in Chapter II. This involves three major elements.
The first is to translate the individual terms in the model
into operational measures that reflect the concepts embodied
in them. Second, it is necessary to outline the techniques
by which the coefficients of the model will be estimated.
This involves both the means by which reliable estimates
of the parameters of the model will be derived, and the
standards by which the adequacy of the model -- how well
it represents the cooperative process -- will be judged.
Finally, the procedures for determining the dynamic
properties of the cooperative process itself will be
reviewed.

The Cases for Analysis

At the outset, it is necessary to choose the nations
for which models will be estimated. The cases for analysis
are the three pairs of nations involving France, the
Federal Republic of Germany, and Great Britain. The

selection of France and Germany can be defended on several grounds. Most previous studies of international cooperation, particularly integration research, have focused on Western Europe. Thus, there is an opportunity to compare the current model to earlier explanations. Further, France and Germany are dominant members of the European Community; it has become a truism that French-German agreement is a necessary condition for action by the EC. Given the importance of this relationship for the larger European environment, the model for French-German cooperation becomes even more important. Models will also be estimated for French and German cooperation with Britain. Britain is chosen because it is part of the same regional system as France and Germany, but did not become a member of the European Community until 1973. This will allow the comparison of cooperative processes within the context of an IGO to cooperation in the absence of a supranational organization. It will also permit the investigation of the impact of the introduction of an IGO to a cooperative relationship.[1]

A second introductory task is the specification of the time period for which the models will be estimated. Data for the model of British-French cooperation are gathered from January 1, 1948 through December 31, 1978. Data for models involving Germany are gathered from 1950

through 1978. The 31 year time period for the British-French model is dictated by the available data on cooperation. The shorter time period for models of cooperation with Germany is because Germany did not become self-governing until September, 1949. While the different time periods will reduce somewhat the comparability of the models, this is offset by the expansion of the data base. In addition, beginning the British-French data in 1948 includes the early years of their post-War cooperative efforts, just as the early years of cooperation with Germany are incorporated by beginning the data for models involving Germany in 1950.

Operational Procedures

Cooperation and Conflict

The endogenous variables in the model are the levels of cooperation directed by one nation toward another nation. A variety of measures of cooperation between countries have been used in the past: social communication, such as mail volume and labor mobility (Deutsch, 1954); public opinion (Inglehart, 1967 and 1971); and trade data (Clark and Welch, 1972). Such attitude and transaction measures are inappropriate here, however, because they fail to tap the key aspects of international cooperation,

focusing instead on what are essentially private interactions between national populations.

Rather, what is sought is an indicator of official government acts of cooperation directed by one nation toward another. Events data provides the only such measure of general, directed government behavior. Specifically, the measure to be used is the number of cooperative acts directed by nation i toward nation j, weighted for intensity, and aggregated into an annual measure. The data are drawn from the Conflict and Peace Data Bank (COPDAB), assembled by Azar. For current purposes, this is the best of the available events data sets. COPDAB covers a 31 year time span, while other events data projects use much shorter periods (World Events-Interaction Survey) or use randomly selected quarters (Comparative Research on the Events of Nations). COPDAB also uses the most extensive list of sources of all events data projects.

Events data sets are built from information on the acts of government reported in the news media. It is thought to provide the most direct measure of official behavior possible, and is able to distinguish various types of behavior (such as cooperative or conflictual, intensity of interaction, or issue-area). In spite of these substantial advantages, the issues surrounding the use of events data are both difficult and controversial. An important

problem is source coverage, or whether the events gathered accurately reflect actual behavior. There are two aspects to this problem: the news media inevitably select events to report, and the researcher selects which sources to use in gathering data. The latter problem is under the control of the researcher, and can be reduced by expanding the number of sources relied upon. The COPDAB project uses over 70 sources, including both the general media (New York Times, Deadline Data, etc.), and regional sources (e.g., The Times (London), The Guardian, Le Monde, The Economist). Such extensive source coverage minimizes the probability of missing events that are reported. The former problem is inherent in the nature of events data; some acts are never reported by governments, and some are never reported by the media. Two considerations suggest that it is less of a problem than it appears. The events omitted are likely to be those relatively less important events of low intensity; more important events, which are weighted more heavily and which dominate the data, are likely to be reported. Also, to the degree that the nature of the omitted events is consistent over time, any bias introduced to the data will also be consistent, and the major patterns in the data should be preserved. Aggregating the data over annual periods will also help reduce this problem, as shorter time spans are

more sensitive than longer periods to discontinuities due
to omitted events.

The difficult decisions for the researcher begin
once the events have been gathered. These decisions center
on how to treat the individual events in the development
of a measure. The first issue concerns the weighting of
events. The need for weighting is clear: all events do
not reflect the same intensity of cooperation (or conflict),
and the measure should reflect these differences. The
problem is how these weights should be assigned. There
is no theory of events data that can provide guidance, so
the researcher must rely on more ad hoc, judgmental
procedures. The COPDAB project utilizes a 15-point scale
of cooperation and conflict, ranging from total war (the
most conflictual event) to voluntary unification of
nation-states (the most cooperative event). Each point
of the scale is thought to represent a distinct type of
behavior in terms of the intensity of cooperation or
conflict embodied in the act. Eighteen expert judges
were then asked to assign numerical weights to the scale
points. The scale and the final weights assigned for
international cooperation are presented in Table 2. The
weights reflect the relative cooperativeness of various
types of events as determined by the judges. The assigned
weights form a ratio scale. Thus, an economic-industrial

TABLE 2

COOPERATIVE BEHAVIORS AND WEIGHTS

Behavior Type	Weight
Neutral or non-significant acts	1*
Minor official exchanges	6
Official verbal support	10
Cultural-scientific agreement	14
Economic-industrial agreement	27
Military, economic, or strategic support	31
Major military alliance	47
Voluntary unification	92

SOURCE: Azar (1980)

*This point forms an anchor for the rest of the scale and is not included in the measure.

agreement between states was judged to be nearly twice as cooperative as a cultural agreement. A full description of the scaling and weighting procedures may be found in Azar (1980) and Azar and Havener (1976). These are the weights used in the current measure of international cooperation. The annual aggregate data on cooperation for the three models are presented in Figures 1-6.

This weighting procedure could also have some undesirable effects. It is possible that a highly cooperative act could be overwhelmed in an aggregate measure by the sum of many less cooperative acts. This does not seem to be the case in the current measure, as it consists largely of cooperation at relatively low and equal levels of intensity. An examination of monthly data by issue-area, where such a highly cooperative act is most likely to appear, fails to indicate the presence of such an event. An issue closely related to this problem is the potential for cooperation to be self-limiting. This might occur if highly cooperative events were sufficiently successful at solving problems as to leave few issues remaining for further cooperation. The extreme case, of course, would be the unification of states, which would by definition eliminate all possibilities for international cooperation between the formerly independent countries. It is impossible to argue that such a phenomenon has occured in
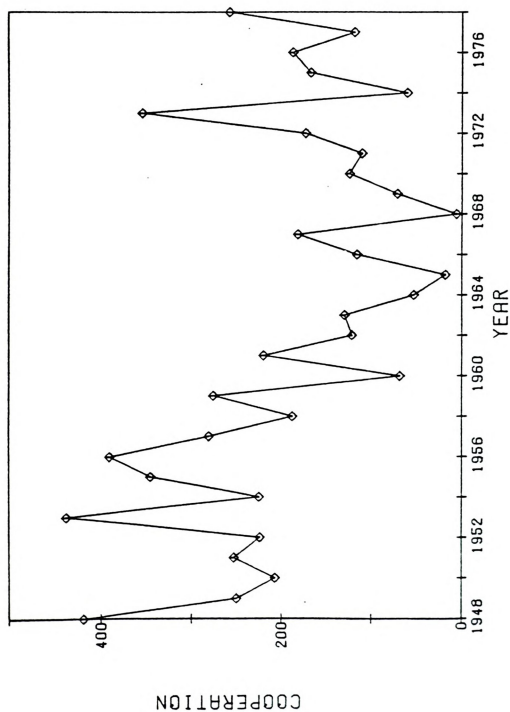
Figure 1. Cooperation, Britain to France
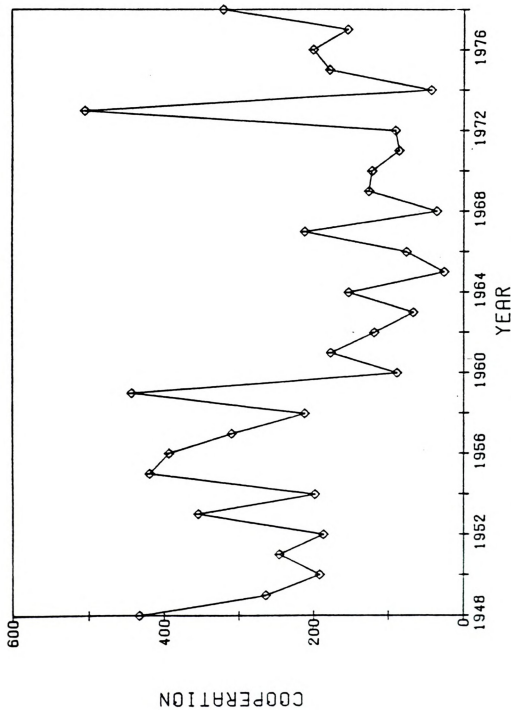
Figure 2. Cooperation, France to Britain
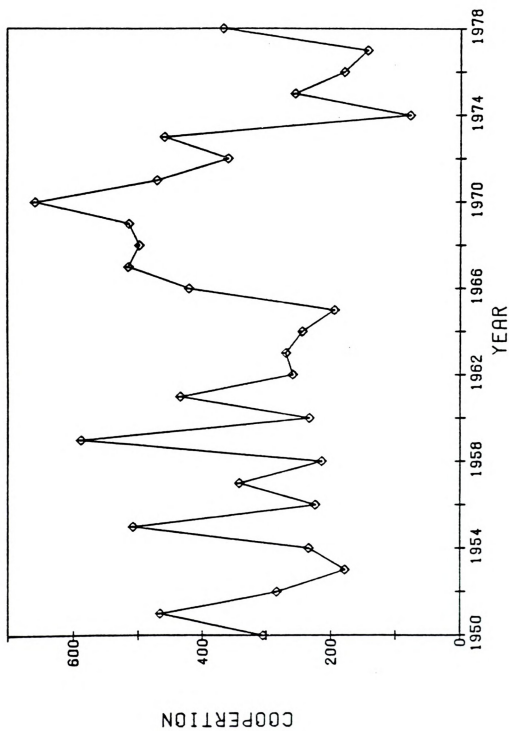
Figure 3. Cooperation, France to Germany
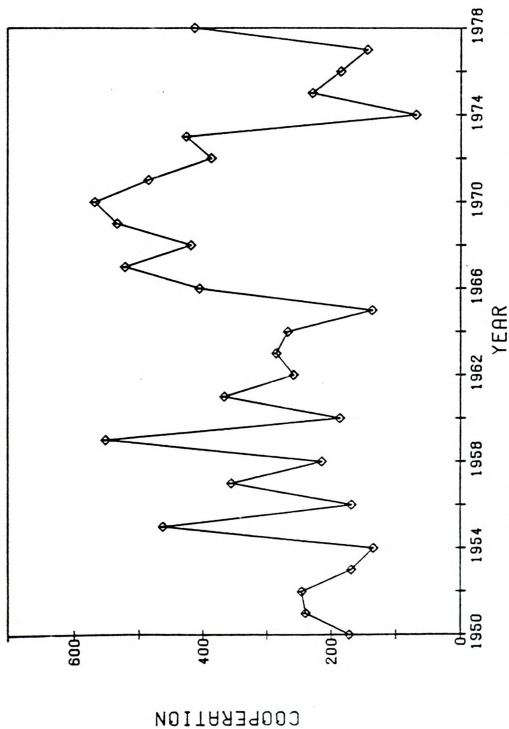
Figure 4. Cooperation, Germany to France
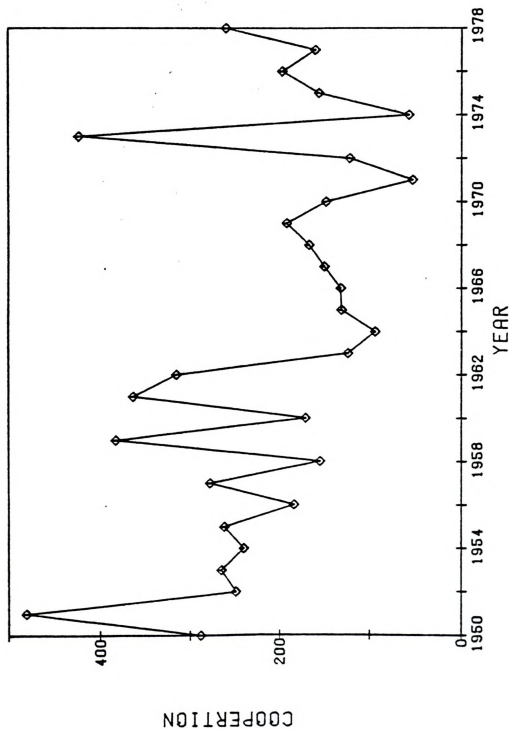
Figure 5. Cooperation, Britain to Germany
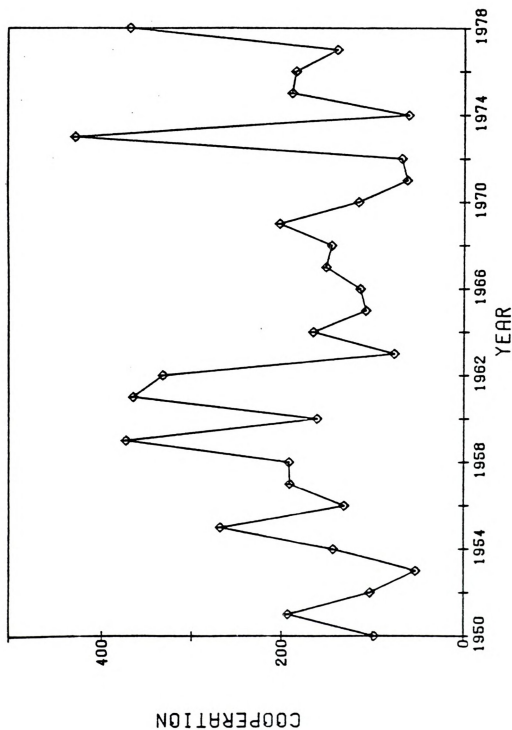
Figure 6. Cooperation, Germany to Britain

Europe. First, such highly cooperative events have not
taken place. European cooperation occurs at relatively
low levels of intensity. Second, cooperative efforts
have not been so successful as to remove issues from future
consideration. Indeed, two of the most highly cooperative
events in post-War Europe -- the formation of NATO and
the EC -- have had the opposite effect, introducing a
range of new issues and problems requiring cooperation for
their resolution. This is precisely the result predicted
by the neo-functionalists (e.g., Nye, 1971b:67). While
this does not suggest that such self-limiting effects will
not occur in the future, it does indicate that it is not
a problem within the time span and events of the current
research.

A second issue concerns the aggregation procedures.
It might be argued that cooperation in specific issue-
areas (military, economic, political, cultural, etc.) would
be a more appropriate dependent variable than cooperation
aggregated over issue-areas. There is, however, no
compelling reason to disaggregate the measure by issue-area.
Indeed, the conceptual development of the concept of
spillover suggests that cooperation will expand and
broaden the range of issues considered, and that such
effects are most likely to appear in the aggregate measure
(on this point, also see Caporaso, 1972:40).[2] In

addition, levels of cooperation in any given issue-area
are quite low, and unrepresentative of the overall pattern
of cooperation.

Considerable attention has been devoted to the
measure of cooperation because it is a crucial element of
the model. It is the dependent variable, it appears as
the reaction term, and it forms the basis of the measure
of spillover. The events data-based measure of cooperation
used here is appropriate in a number of respects. First,
it is a direct measure of official government behavior
directed at another state. Second, it is able to capture
the general pattern of cooperative behavior. As such,
it includes a variety of types of behavior over a range
of different issue-areas. Measures derived from events
data are the only available measures that can make such
claims. Nevertheless, there are alternative ways of
handling events data. Events data contain two particularly
important pieces of information: the frequency of events
and the intensity of events as reflected in the weights.
Both aspects are vital to the notion of cooperation develop-
ed here. Thus, such simple measures as a frequency count
of events or the mean intensity of events are inappropriate
because they ignore an important element of cooperation.

Given the need to incorporate into the measure both

the frequency and intensity of events, the remaining issue
is the potential for a discrete event to indicate
continuing cooperation. In such a case, a cooperative event
at time t implies cooperative relations at time t+1,
cooperation which is not included in the annual weighted
aggregate measure. Such forces might be incorporated by
measuring cooperation as a cumulative weighted frequency,
with the weights of events declining with increasing time
from initiation. Several major conceptual problems
militate against such a procedure, however. First, many
events (e.g., verbal statements of support or joint
military maneuvers) might legitimately be treated as
discrete or nearly discrete cases of international
cooperation. Second, if it were possible to identify events
embodying continuing cooperation, it would be necessary to
define the endurance and the rate of decline of intensity
of such acts. Lacking explicit grounds on which to base
such definitions, it would be necessary to proceed on an
ad hoc, case-by-case basis. The resulting measure would be
such a diverse collection of events and weights as to be
virtually uninterpretable as an indicator of cooperation.
Thus, for reasons of clarity and straightforward interpre-
tation as a measure of current cooperation, this study
relies on the simple annual weighted aggregate indicator
of international cooperation.

The conflict term is similar to the concept of cooperation in that it is also intended to capture the official government acts of one nation toward another. Thus, for similar reasons, the measure of conflict is also based on events data drawn from the COPDAB project. The measure is the number of conflictual acts directed by nation i toward nation j. weighted for intensity, and aggregated into an annual measure. All of the discussion regarding the strengths and weaknesses of an events-based measure of cooperation applies here as well, and it is only necessary to consider the weighting procedure for acts of international conflict. Again, expert judges are used to assign numerical weights indicating the intensity of conflict to the various points of the scale of conflict behavior, and the resulting weights form a ratio scale. The various types of conflict behavior and their weights are presented in Table 3; the conflict data are presented in Figures 7-9.

Costs-Benefits

The neo-functionalists and the collective goods theorists agree that the costs and benefits of cooperation can influence the nature of the cooperative process. An important preliminary point needs to be made with respect to the notion of costs and benefits developed in Chapter II.

TABLE 3

CONFLICTUAL BEHAVIORS AND WEIGHTS

Behavior Type	Weight
Neutral or non-significant acts	1*
Mild verbal discord	6
Strong verbal hostility	16
Diplomatic-economic hostile actions	29
Political-military hostile actions	44
Small scale military acts	50
Limited war acts	65
Extensive war	102

SOURCE: Azar (1980)

*This point forms an anchor for the rest of the scale and is not included in the measure.
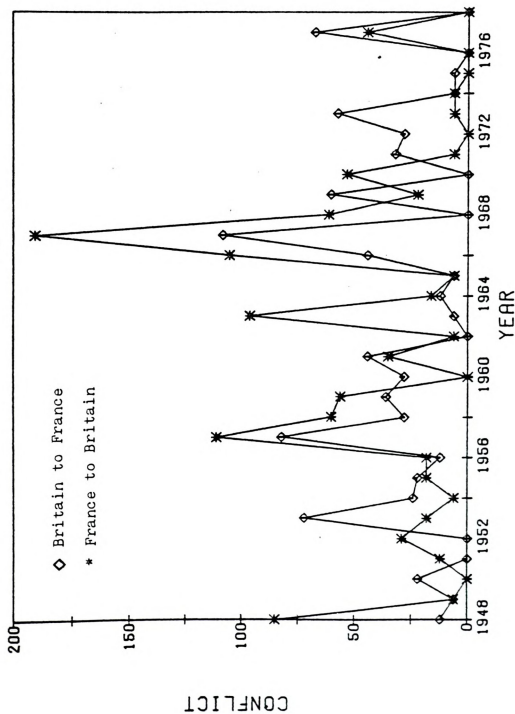
Figure 7. British-French Conflict
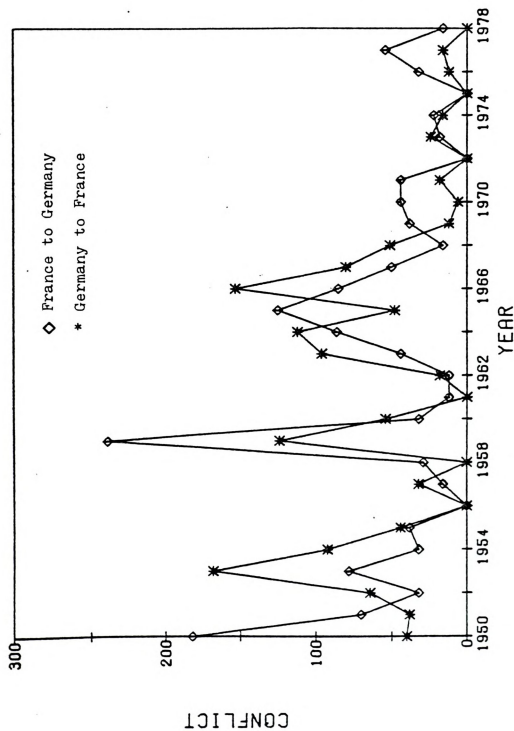
Figure 8. French-German Conflict
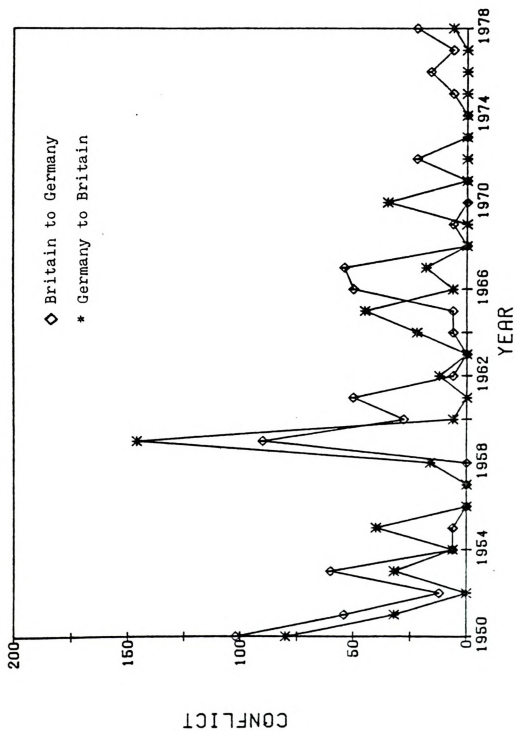
Figure 9. British-German Conflict

Increased cooperation yields both increased costs and increased benefits. This close relationship between the two will make it difficult, if not impossible, to evaluate the independent effects of costs and benefits on cooperation. For this reason, a composite indicator that weighs costs and benefits together will be developed, and they are represented as a single factor in the model.

Chapter II developed the concept of costs-benefits in economic terms, specifically international trade. Trade imposes costs on the state through increased sensitivity to the economic policies and conditions of the trading partner, and yields benefits by encouraging a reallocation of resources, which results in greater efficiency and increased production. These effects can also be seen in the simple concepts of imports and exports. Exports expand the available market, enabling increased production and the expansion of the national economy, while imports introduce a dependence on others for needed goods and services. There is agreement among specialists in international economics (e.g., Cooper, 1980 and Spero, 1981) that disequilibriums in international trade relationships appear most quickly in the balance of payments. The balance of payments responds quickly to economic conditions in the trading countries, and is seen as the most important indicator of trade problems (Cooper, 1980:15). As such, it is a factor

that is watched and treated seriously by decision-makers, and it is reasonable to argue that the balance of payments reflects the ability of national authorities to manage the costs and benefits of international trade.

The simple balance of payments between a state and its cooperative partner is an inadequate measure of costs-benefits, however. Other factors, such as general economic growth and increases in overall trading levels, will have an impact on the evaluation of the balance of payments. For example, a given balance of payments deficit has a different importance and different implications for national policy if the size of the domestic economy and the volume of international trade doubles. Thus, it is necessary to control for such factors. The measure of costs-benefits for a state is that state's balance of payments with the cooperative partner as a percentage of exports to the cooperative partner. The measure is thus the difference between costs and benefits as a percentage of benefits. The data, presented in Figures 10-12, are taken from the International Monetary Fund series, Direction of Trade, 1948-1978.

This measure has the desirable properties. The core of the measure is the state's balance of payments with the partner in cooperation, the relevance of which was
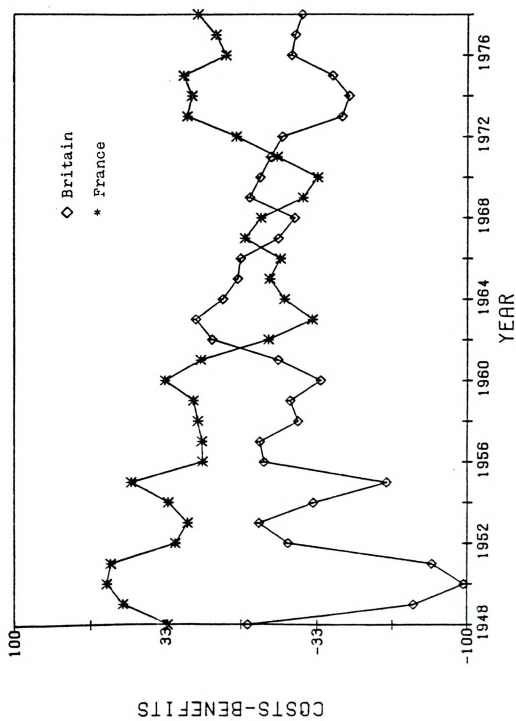
Figure 10. British-French Costs-Benefits
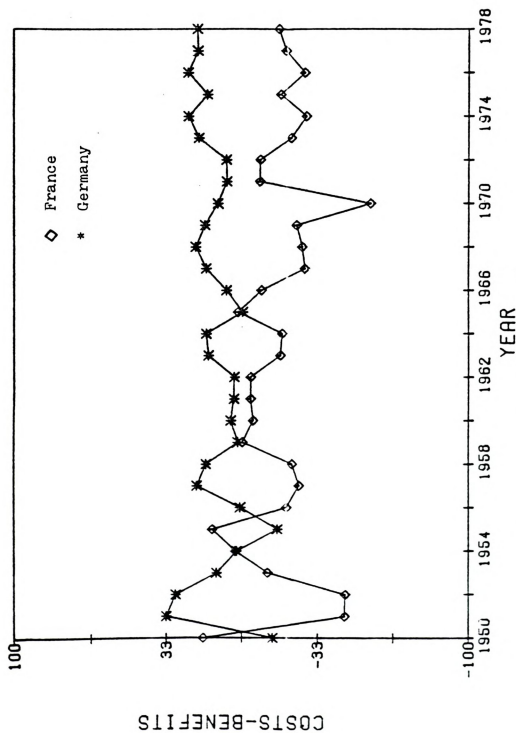
Figure 11. French-German Costs-Benefits
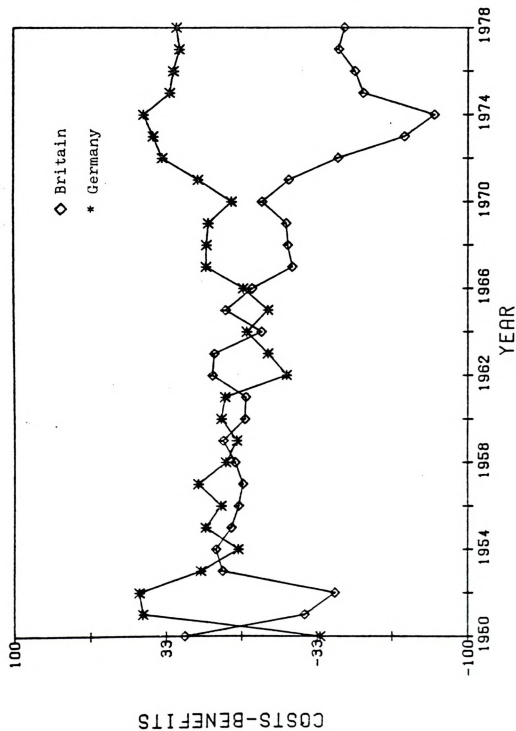
Figure 12. British-German Costs-Benefits

considered above. The use of exports to standardize the measure serves directly to control for the level of trade between the two countries, and indirectly controls for general economic growth. The behavior of this measure is also consistent with the development of the concepts of costs and benefits. If imports and exports are equal, indicating a balance of costs and benefits, the measure takes on a value of zero. If imports are greater than exports, suggesting greater costs (dependence) than benefits (expansion of capabilities), the measure is negative. Similarly, if exports are greater than imports, indicating greater benefits than costs, the measure is positive. Thus, as the measure increases, the cooperative relationship is producing greater benefits relative to costs, and cooperation should increase. As the measure declines, the costs of cooperation relative to the benefits are growing, and cooperation should decline.

The measure of costs-benefits should reflect the relative weights of the expansion of national capabilities and the restriction of national autonomy arising from a cooperation relationship. Furthermore, as the cybernetic model makes clear, it should reflect these factors in a way that is of salience to national decision-makers. The measure used here fulfills these requirements. Economic issues have been of primary importance between Western

European states. The trade-based measure is sensitive to the economic relationship between countries, and reflects both the costs and benefits of international economic intercourse. It is also recognized as important by decision-makers. As such, it is reasonable to argue that it captures the major elements of the costs and benefits of international cooperation in Western Europe.

Supranational Decision-Making

Both the neo-functionalists and the collective goods theorists agree that the presence of an intergovernmental organization with supranational authority can have a substantial impact on the cooperative process (although they disagree on the nature of this impact). The important element of this factor is the ability of the IGO to make decisions that are binding on the member states. This concept is measured as the number of legally binding decisions made in a given year by the elements of the European Community (EC). The birth of what would later become the EC came in 1952 with the formation of the European Coal and Steel Community (ECSC). The European Economic Community (EEC) and the European Atomic Energy Community (Euratom) began operation in 1958. On July 1, 1967, the three organizations merged to share common institutions, giving rise to the EC. The types of binding

decisions made by the various elements of these organizations are reported in Figure 13; these are the decisions included in the measure.[3] The data for 1953-1964 are reported in Fisher (1969). The decisions for 1952 are gathered from Parlement Europeen (1965), _Annuaire, 1963-1964_; decisions for 1965-1966 from the _Bulletin of the European Economic Community_ (Commission of the European Economic Community, 1965-1967); decisions for 1967-1973 from the _Bulletin of the European Community_ (Commission of the European Community, 1967-1974); and decisions for 1974-1978 from the _Official Journal of the European Community_ (Commission of the European Community, 1974-1979).

The measure is defined in terms of the EC because the EC is unique among European international organizations in one important respect: it is able to impose decisions on the member states against their will. Other organizations, such as the Organization for European Economic Cooperation, require unanimity for a decision. Thus, no decisions can be imposed on a state against its will, there is no loss of sovereignty, and such an IGO fails to reflect the supranational decision-making authority required by the concept. In contrast, the EC precisely fulfills this notion. Decisions in the various Councils of Ministers are made through a weighted majority voting scheme, by which binding decisions are imposed on all members.[4] Most

Dates	Decision Body	Decision Type
1948-1951	None	None
1952 to 1 July 1967	ECSC	
	Council of Ministers	General Decisions Individual Decisions
	High Authority	General Decisions Individual Decisions
	EEC	
	Council of Ministers	Regulations Decisions
	Commission	Regulations Decisions
	Euratom	
	Council of Ministers	Regulations Decisions
	Commission	Regulations Decisions
1 July 1967 to 1978	EC	
	Council of Ministers	Regulations Decisions
	Commission	Regulations Decisions

Figure 13. Types of binding decisions made by the EC.

decisions, however, are made by the Commissions (High
Authority in the case of ECSC), which use simple majority
voting. The Commissions are best described as international
bureaucracies more dedicated to the smooth, effective
operation of the organization than to maintaining or
advancing the interests of individual states. In addition,
the member states are not directly involved in Commission
decision-making. The result is that the Commission acts,
without the direct constraint of the members, to further
EC goals and policies rather than the individual goals and
policies of the members (Lindberg and Scheingold, 1970:82-
90).

It should be noted that this form of supranational
decision-making did not begin until 1952, with the formation
of the ECSC. Thus, the variable takes on a value of zero
for the years 1948-1951. In addition, Britain did not
become a member of the EC until 1 January 1973. Prior
to this, there was no supranational IGO linking Britain
with either France or Germany. For this reason, the
variable takes on a value of zero for both the British-
French and British-German models until 1973. This factor
also holds another implication for the model. Britain
was not a member during the formative period of the EC.
Rather, Britain joined an established, relatively stable
organization. As such, the major impact on international

cooperation between Britain and France and Germany is less the growth of supranational decision-making than the simple introduction of a supranational IGO to the process. For this reason, the IGO variable for models of British-French and British-German cooperation is treated as a dummy variable: it takes on a value of zero prior to 1973, representing the absence of a supranational organization, and is set equal to one for the years 1973-1978, indicating the presence of such an international organization. Thus, the coefficient of the IGO variable in the French-German model indicates the influence on cooperation of a unit change in the number of binding decisions made by the EC. For the British-French and British-German models, the coefficient represents the impact on cooperation of British membership in the EC. The data on EC decision-making are presented in Figure 14.

Supranational decision-making is thought to have an impact on cooperation because it limits the state's ability to pursue its own course of action by formally giving others a voice in making policy that it must follow. The measure taps this effect directly by assessing the actual number of decisions imposed on the state. As this increases, a state is further restricted in its independence. This will be resisted by decision-makers, and
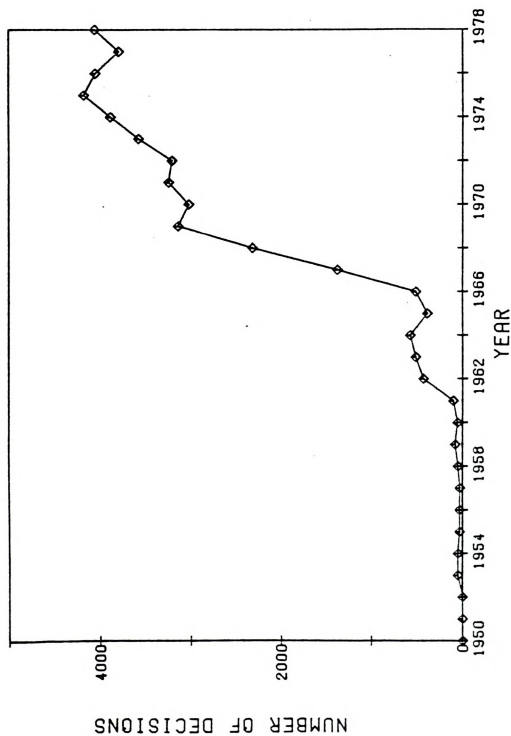
Figure 14. EC Decision-Making

should tend to depress levels of cooperation.

A summary of all the measures, data sources, and the expected impact of each variable on cooperation is presented in Table 4.

Estimation Procedures

Estimation Techniques

Prior to considering the procedures by which the parameters of the model are estimated, it is necessary to introduce a constant and a stochastic term. The constant can be justified on conceptual grounds. France, Germany, and Britain are geographical neighbors and are part of the same regional system; they can be expected to engage in a certain amount of interaction independent of a dynamic cooperative process. The constant includes this factor in the model. The stochastic term allows for a random disturbance in the cooperative process. Human behavior is rarely deterministic. The error term allows for this variability and accounts for the influence of any omitted variables. Adding these terms, the model becomes:

$$Y_{12t} = \alpha_1 + \beta_{11}Y_{21t} + \beta_{12}C_{21t-1} + \beta_{13}\Delta Y_{12t-1} + \beta_{14}CB_{12t}$$
$$+ \beta_{15}IGO_t + e_{1t}$$

$$Y_{21t} = \alpha_2 + \beta_{21}Y_{12t} + \beta_{22}C_{12t-1} + \beta_{23}\Delta Y_{21t-1} + \beta_{24}CB_{21t}$$
$$+ \beta_{25}IGO_t + e_{2t}$$

TABLE 4

DEFINITIONS, OPERATIONALIZATIONS, AND DATA SOURCES

Variable	Measure	Source	Expected Impact on Cooperation	
Y_{ijt}	Number of cooperative acts, weighted for intensity, directed by nation i toward nation j during time t.	COPDAB (Azar, 1980)*	$\beta_{i1} > 0$	
C_{ijt-1}	Number of conflictual acts, weighted for intensity, directed by nation i toward nation j during time t.	COPBAD (Azar, 1980)*	$\beta_{i2} < 0$	
ΔY_{ijt-1}	$Y_{ijt-1} - Y_{ijt-2}$	COPDAB (Azar, 1980)*	$\beta_{i3} > 0$	
CB_{ijt}	$\dfrac{Exports_{ijt} - Imports_{ijt}}{Exports_{ijt}} \; 100$	International Monetary Fund, Direction of Trade, 1948-1978.*	$\beta_{i4} > 0$	

TABLE 4 - Continued

Variable	Measure	Source	Expected Impact on Cooperation
IGO_t (France-Germany)	Number of binding decisions made by the EC during time t.	1952: Parlement Europeen (1965)	$\beta_{i5} < 0$
		1953-1964: Fisher (1969)	
		1965-1966: Commission of the EEC (1965-1967)	
		1967-1973: Commission of the EC (1967-1974)	
		1974-1978: Commission of the EC (1974-1979)	
IGO_t (Britain-France and Britain-Germany)	1948-1972: 0 1973-1978: 1		$\beta_{i5} < 0$

*These data were acquired through the Inter-University Consortium for Political and Social Research.

Because the model is a system of interdependent equations, ordinary least squares (OLS) in an inappropriate estimation technique. The problem is the presence of an endogenous variable on the right-hand side of each equation. This is a stochastic variable that is correlated with the disturbance, with the result that OLS yields biased and inconsistent estimates. Therefore, it is necessary to use a technique appropriate to simultaneous equations. The model is over-identified, so two-stage least squares (2SLS) is a suitable approach to estimation.

Given the time series nature of the data, serial correlation among the residuals is likely to be the most serious statistical problem influencing the estimation process. With an autocorrelated disturbance, 2SLS still yields consistent estimates of the structural form parameters, but estimates of the variance-covariance matrix of the coefficients are inconsistent. The result is that hypothesis tests are no longer accurate, and any inferences made of the basis of the results are likely to be misleading. Durbin's h, suitable for equations which include an explanatory endogenous variable, is used to check for the presence of serially correlated residuals.[5] In the presence of autocorrelated residuals, 2SLS is combined with a psuedo-generalized least squares (GLS) technique. The procedure is to use the structural form residuals to

estimate the autocorrelation coefficient. This is used to set up the augmented structural form equations, which account for the autoregressive error. These are then solved for the augmented reduced form, which are used to create instruments for the endogenous variables on the right-hand side of the augmented structural form equations. The augmented structural form is then estimated using the Cochrane-Orcutt procedure. This technique is fully discussed in Kmenta (1971:587-588). This 2SLS, psuedo-GLS procedure incorporates the time dependent nature of the error term into the model, and yields consistent estimates of the variance-covariance matrix of the structural form parameters.[6]

An additional problem that can interfere with the interpretation of the results is multicollinearity, or linear relationships among the independent variables. To the extent that the problem occurs, the parameter estimates will be unbiased, though their estimated variances will be inflated. This serves to make the standard hypothesis tests more conservative. A more serious implication, though, is that close relationships among the independent variables make it difficult to separate their independent effects of the dependent variable. The presence of multicollinearity is tested via the Farrar-Glauber procedure.

For each equation, each independent variable is regressed on all the other independent variables. The highest R^2 value is taken as an indication of the degree of multi-collinearity (Kmenta, 1971:390). Little can be done about multicollinearity, other than to recognize its presence and to consider its impact on the results. Due to the nature of the data, it is not possible to expand the data set in hopes of reducing the degree of multicollinearity; nor is it possible to eliminate a variable from the model, as this would lead to specification error, and would be likely to increase the extent of serial correlation.

Model Evaluation

Once the coefficients of the model have been estimated, the immediate task is to evaluate the adequacy of the model. The question is how well the model represents the process it is intended to portray. Two primary means will be relied upon to evaluate the model. First, the actual values of cooperation will be plotted along with the values generated by the model. This provides visual evidence of how well the model is able to track the actual course of cooperation.

A more rigorous test of the model is to compare the standard deviation of cooperation to the root mean square

error (RMSE) of the predictions of the model. The
standard deviation is a measure of the dispersion of a
data series about its mean. The root mean square error
is the average dispersion of a series of forecasts around
the actual values:

$$\text{RMSE} = \{n^{-1} \Sigma (P_t - A_t)^2\}^{\frac{1}{2}}$$

where: P_t = the predicted value at time t,

A_t = the actual value at time t,

n = the number of forecasts.

The comparison of the standard deviation and the RMSE, then,
is a comparison of the mean and the values predicted
by the model as predictors of cooperation. If the RMSE
is less than the standard deviation, the model is judged
an adequate representation of the process of international
cooperation. An additional, and somewhat controversial,
evaluation procedure, based on the forecasting ability of
the specified model in comparison to a naive model, will
be developed and presented in an appendix.

The Dynamic Analysis

Previous studies of international cooperation make
competing arguments about the dynamics of the process.
The growth in cooperation predicted by the functionalists

and neo-functionalists and the stability of the process forecast by the collective goods theorists are, in a sense, the fundamental results of their efforts. While the estimated coefficients of the model can help answer questions about how the process of cooperation operates and about the major influences on it, the issue of stability properties begins to address the implications of the model. The question of stability is whether the process as modeled results in a growth, decline, or equilibrium in the level of international cooperation over time. Stability properties can thus aid in the development of expectations about the future course of cooperative efforts. Determining these stability properties is the purpose of the dynamic analysis.

The first step in the dynamic analysis is to expand the difference term in each equation of the model:

$$\beta_{i3} \Delta Y_{ijt-1} = \beta_{i3} Y_{ijt-1} - \beta_{i3} Y_{ijt-2}$$

Because the equations now include lagged endogenous variables, the model specifies not only how the current values of the endogenous variables are generated, but also how the time paths of the exogenous variables and the disturbances determine the time paths of the endogenous variables (Kmenta, 1971:589 and Goldberger, 1964:373). This time dependence is formulated explicitly in the fundamental

dynamic equation for each dependent variable, which
includes exogenous variables and a single endogenous
variable, whether current or lagged. The fundamental
dynamic equations of the model are of the following
general form:

$$Y_{ijt} = \delta_1 + \mu_{i1}Y_{ijt-1} - \mu_{i2}Y_{ijt-2} + \mu_{i3}Y_{ijt-3}$$
$$+ k_{i1}C_{ijt-1} + k_{i2}C_{ijt-2} + k_{i3}C_{jit-1}$$
$$+ k_{i4}C_{jit-2} + k_{i5}CB_{ijt} + k_{i6}CB_{ijt-1} +$$
$$+ k_{i7}CB_{jit} + k_{i8}CB_{jit-1} + k_{i9}IGO_t$$
$$+ k_{i10}IGO_{t-1} + \nu_{it}$$

where:
$$\delta_i = \{\gamma_{i1}(1 - \gamma_{j5}) + \gamma_{i4}\gamma_{j1}\}$$

$$\mu_{i1} = (\gamma_{j5} + \gamma_{i5})$$

$$\mu_{i2} = (\gamma_{i5} + \gamma_{i5}\gamma_{j5} - \gamma_{i4}\gamma_{j4})$$

$$\mu_{i3} = (\gamma_{i5}\gamma_{j5} - \gamma_{i4}\gamma_{j4})$$

$$k_{i1} = \gamma_{i1}$$

$$k_{i2} = (\gamma_{i4}\gamma_{j3} - \gamma_{j5}\gamma_{i2})$$

$$k_{i3} = \gamma_{i3}$$

$$k_{i4} = (\gamma_{i4}\gamma_{j3} - \gamma_{j5}\gamma_{i3})$$

$$k_{i5} = \gamma_{i7}$$

$$k_{i6} = (\gamma_{i4}\gamma_{j6} - \gamma_{j5}\gamma_{i7})$$

$$k_{i7} = \gamma_{i6}$$

$$k_{i8} = (\gamma_{i4}\gamma_{j7} - \gamma_{j5}\gamma_{i6})$$

$$k_{i9} = \gamma_{i8}$$

$$k_{i10} = (\gamma_{i4}\gamma_{j8} - \gamma_{j5}\gamma_{i8})$$

$$\nu_{it} = (\omega_{it} - \gamma_{j5}\omega_{it-1} + \gamma_{i4}\omega_{jt-1})$$

The γ's and ω's are the estimated reduced form coefficients and error terms, respectively, defined in Appendix A.

These equations are the basis for determining stability. The issue is what happens to the level of cooperation when the exogenous variables are held constant. The process is stable if, when the exogenous variables are held constant over time and the disturbance is disregarded, cooperation settles down to some constant level. The process is unstable if it displays explosive growth, steady decline, or a regular fluctuation. If the exogenous variables are held constant, the fundamental dynamic equations become third-order nonhomogenous difference equations:

$$Y_{ijt} - \mu_{i1}Y_{ijt-1} + \mu_{i2}Y_{ijt-2} - \mu_{i3}Y_{ijt-3} = \text{constant}$$

The characteristic equations are of the form:

$$\lambda_i^3 - \mu_{i1}\lambda_i^2 + \mu_{i2}\lambda_i - \mu_{i3} = 0$$

Stability depends on the roots of these characteristic equations: the process is stable if and only if the

absolute value of every root is less than one (Chiang, 1974:599). Calculating the precise characteristic roots of third and higher order difference equations is a tedious process; it is also unnecessary, as the Schur Theorem enables the qualitative determination of stability properties (Chiang, 1974:599-600). The Schur Theorem states that the roots of an nth-degree polynomial (third-degree, as applied to this model) will all be less than one in absolute value if and only if the following three determinants are all positive:

$$\Delta_1 = \begin{vmatrix} 1 & \mu_{i3} \\ \mu_{i3} & 1 \end{vmatrix}$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & \mu_{i3} & \mu_{i2} \\ \mu_{i1} & 1 & 0 & \mu_{i3} \\ \mu_{i3} & 0 & 1 & \mu_{i1} \\ \mu_{i2} & \mu_{i3} & 0 & 1 \end{vmatrix}$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & \mu_{i3} & \mu_{i2} & \mu_{i1} \\ \mu_{i1} & 1 & 0 & 0 & \mu_{i3} & \mu_{i2} \\ \mu_{i2} & \mu_{i1} & 1 & 0 & 0 & \mu_{i3} \\ \mu_{i3} & 0 & 0 & 1 & \mu_{i1} & \mu_{i2} \\ \mu_{i2} & \mu_{i3} & 0 & 0 & 1 & \mu_{i1} \\ \mu_{i1} & \mu_{i2} & \mu_{i3} & 0 & 0 & 1 \end{vmatrix}$$

It should be noted that the Schur theorem provides the necessary and sufficient conditions for a dynamic process to be stable. Thus, the process of cooperation is stable if and only if all three of these determinants are positive.

This set of procedures, while seemingly complex, has a simple purpose. The model developed in Chapter II makes certain claims about the nature of the process of international cooperation. The techniques discussed above are a means of providing empirical content to the model, with the goal of evaluating these claims.

Notes to Chapter III

1. An additional reason for the selection of Western
   European countries for analysis is methodological.
   Reliable data are available over time for Western
   Europe, and these data are highly comparable. This
   is not the case with many areas of the world.

2. It is true, of course, that the functionalists argue
   that cooperation will begin with economic issues, then
   expand, culminating with political cooperation. Even
   a brief examination of the data by issue-area provides
   no support for this position. Cooperation in Western
   Europe after World War II begins simultaneously with
   economic, military, and political issues, refuting
   the functionalist notion of a beginning and an end
   point to cooperation. Further, cooperation in these
   issue-areas continues throughout the period under
   study, while cooperation on other issues (cultural
   affairs, physical environment, etc.) is an inter-
   mittent phenomenon.

3. Briefly, the Commission proposes "legislation" to the
   Council, and supervises the implementation of Council
   decisions. Thus, the Commission serves as both the
   initiator and the administrator of Community policy,
   while the Council is responsible for enacting policy.
   Two forms of Council and Commission decisions are
   binding on members: "Regulations bind the member
   states directly and have the same strength as national
   laws. Decisions, addressed to a government, an
   enterprise, or an individual, bind the parties named"
   (European Community Information Service, 1974).

4. In Council voting, France, Germany, Britain, and
   Italy have ten votes each; Belgium and the Netherlands
   have five votes each; and Denmark, Ireland, and
   Luxembourg have two votes each. A decision requires
   41 votes cast by six countries. Thus, a coalition of
   large states is unable to dominate the voting process.

5. In three of the equations, Durbin's h is not appropriate
   because it involves the square root of a negative
   number. In these cases, the alternative procedure
   suggested by Ostrom (1978c:52) was applied. In each
   case, this test indicated that the 2SLS-GLS estimation
   procedure produced errors that were not serially
   correlated.

6. All estimation, whether standard two-stage least
    squares or 2SLS, psuedo-GLS using the Cochrane-
    Orcutt procedure, was executed using the Time Series
    Processor package of computer programs.

CHAPTER IV. THE EMPIRICAL TEST

Introduction

It is now time to use the data and procedures described in Chapter III to evaluate empirically the model of international cooperation. This proceeds in two stages. First, the three two-nation models are estimated and evaluated. This discussion focuses rather narrowly on technical issues: how well the model represents the cooperative process. The purpose of this procedure is to test the adequacy of the model rather than to interpret the estimated parameters. The second stage of the analysis is to interpret the individual coefficients and to consider the nature and role of reaction processes, decision-making elements, and international organizations in cooperation between states. This procedure includes deriving the fundamental dynamic equations and determining the stability properties of the process of cooperation. It will then be possible to draw some general conclusions about the process of international cooperation and about the functional, neo-functional, and collective goods explanations of the phenomenon.

Estimation and Evaluation of the Model

This section is devoted to the estimation and statistical evaluation of the model. The three structural models are estimated and the impact of potential statistical problems is considered. The models are then evaluated according to the procedures outlined in Chapter III.

The estimated coefficients and the associated statistics for the three structural models are presented in Tables 5, 6, and 7. The two problems most likely to interfere with the interpretation of the parameters are serial correlation and multicollinearity. Durbin's h indicated significant serial correlation in all but one of the models (German cooperation toward France).[1] In each case, the application of a generalized least squares technique produces residuals that are serially independent.

Table 8 presents the Farrar-Glauber tests for multicollinearity. The table reports, for each equation, that independent variable most strongly related to the other independent variables in the model. The strongest multicollinearity is represented by an R^2 of .46 in the equation for French cooperation toward Britain. This is, at worst, a moderate level of multicollinearity that should not interfere with subsequent interpretation. With some confidence that these problems do not cripple the analysis, it is

TABLE 5

STRUCTURAL ESTIMATES OF BRITISH-FRENCH
COOPERATION, 1950-1978

Equation		Britain	France
Technique		2SLS-GLS	2SLS-GLS
Constant	α_i	32.98	49.50
	(SE)	(28.93)	(53.80)
	(t)	(1.14)	(.92)
Reaction	β_{i1}	.95	.68
	(SE)	(.14)	(.28)
	(t)	(6.88)**	(2.44)*
Conflict	β_{i2}	-.59	.25
	(SE)	.23)	.54)
	(t)	(-2.53)**	(.46)
Spillover	β_{i3}	.05	-.24
	(SE)	(.09)	(.12)
		(.56)	(-1.98)*
Costs-Benefits	β_{i4}	.19	.89
	(SE)	(.41)	(.89)
	(t)	(.46)	(1.00)
IGO	β_{i5}	-50.60	27.07
	(SE)	(-22.89)	(27.62)
	(t)	(-2.21)*	(.98)
Durbins's h		-.20	NA

```
 * p  <.05
** p  <.01
```

TABLE 6

STRUCTURAL ESTIMATES OF FRENCH-GERMAN
COOPERATION, 1952-1978

Equation		France	Germany
Technique		2SLS-GLS	2SLS
Constant	α_i	−.0063	40.10
	(SE)	(47.21)	(45.57)
	(t)	(−1.29)	(.88)
Reaction	β_{i1}	1.23	.81
	(SE)	(.14)	(.11)
	(t)	(8.96)**	(7.27)**
Conflict Reaction	β_{i2}	.30	−.13
	(SE)	(.25)	(.21)
	(t)	(1.22)	(−.63)
Spillover	β_{i3}	−.21	−.26
	(SE)	(.10)	(.14)
	(t)	(−2.08)*	(−1.87)*
Costs-Benefits	β_{i4}	−.09	.13
	(SE)	(−.11)	(.11)
IGO	β_{i5}	−.0063	−.0063)
	(SE)	(.0067)	(.0064)
	(t)	(−.94)	(−.99)
Durbin's h		.41	.19

 * p <.05
** p <.01

TABLE 7

STRUCTURAL ESTIMATES OF BRITISH-GERMAN
COOPERATION, 1952-1978

Equation		Britain	Germany
Technique		2SLS-GLS	2SLS-GLS
Constant	α_i	61.79	76.03
	(SE)	(64.36)	(54.70)
	(t)	(.96)	(1.39)
Reaction	β_{i1}	.83	.52
	(SE)	(.32)	(.27)
	(t)	(2.63)**	(1.89)*
Conflict Reaction	β_{i2}	-.11	.20
	(SE)	(.48)	(.67)
	(t)	(-.23)	(.30)
Spillover	β_{i3}	-.02	-.34
	(SE)	(.04)	(.13)
	(t)	(-.24)	(-2.68)**
Costs-Benefits	β_{i4}	-.06	-1.86
	(SE)	(1.05)	(1.10)
	(t)	(-.06)	(-1.69)
IGO	β_{i5}	-50.45	103.76
	(SE)	(26.59)	(73.59)
	(t)	(-2.01)*	(1.41)
Durbin's h		NA	NA

*p < .05
** p < .01

TABLE 8

FARRAR-GLAUBER TESTS

Equation		Strongest Multicollinearity	
Actor Target	Dependent Variable	Significant Relationships	R^2
Britain France	Costs-Benefits	None	.18
France Britain	Cooperation Received	Costs-Benefits	.46
France Germany	IGO	Cooperation Received	.41
Germany France	IGO	Cooperation Received	.41
Britain Germany	Conflict Received	Spillover	.31
Germany Britain	Conflict Received	Spillover	.20

possible to consider the success of the model in
representing the process of international cooperation.

Simple plots of the actual values of cooperation and
the values predicted by the equations provide visual evi-
dence of the ability of the model to track the process of
cooperation between states. Figures 15-20 present these
plots for each equation. For each of the six equations,
the values of cooperation predicted by the model follow
closely the actual values of cooperation between states.
Not only do the predicted values replicate the level of
cooperation, the models also track the year-to-year
changes in cooperation. Thus, on the basis of visual
evidence, it is possible to say the model captures some
important elements of the dynamics of cooperation between
states.

A more rigorous test of the adequacy of the model is
a comparison of the standard deviation of each data series
with the root mean square error of the predicted values
(see Table 9). In each case, the RMSE of the predicted
values is substantially lower than the standard deviation,
indicating that the model is a more accurate predictor of
international cooperation than the mean of cooperation. A
more complex forecast evaluation of the model is presented
in Appendix B. While this is a somewhat controversial
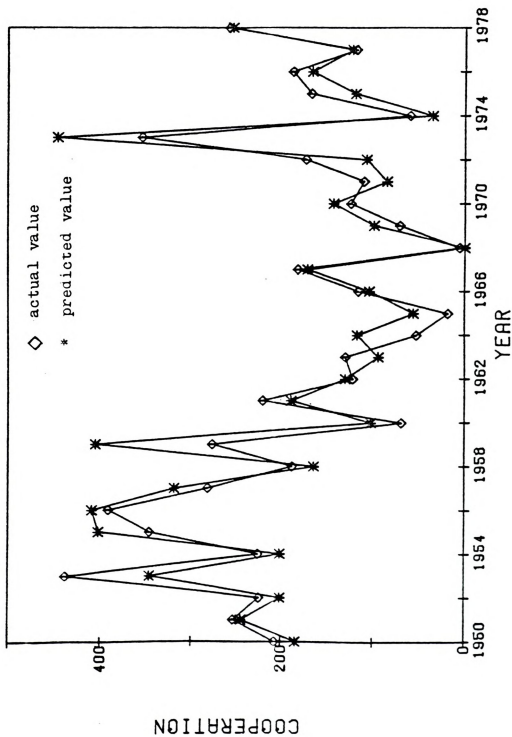
Figure 15. Actual and Predicted Values of Cooperation, Britain to France
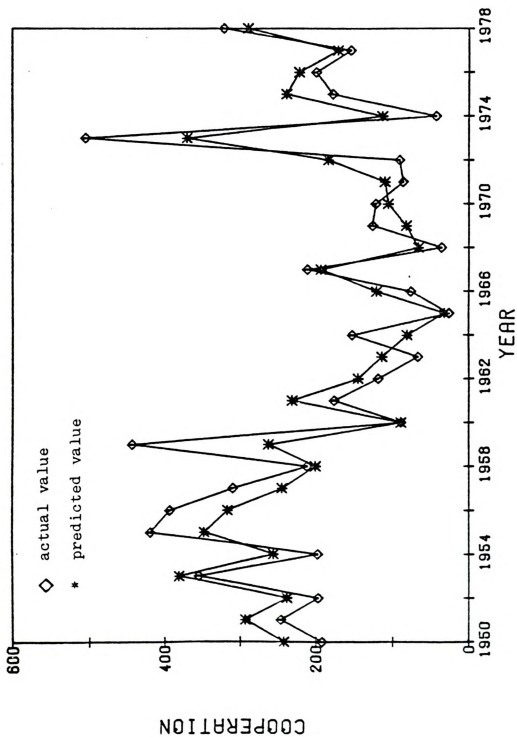
Figure 16. Actual and Predicted Values of Cooperation, France to Britain
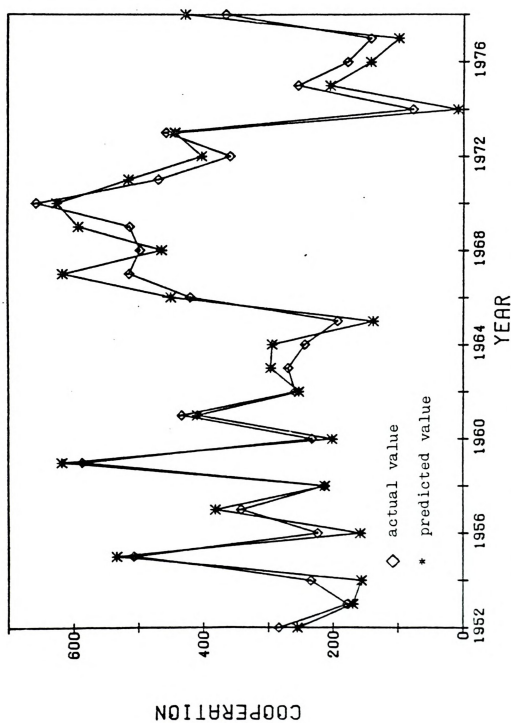
Figure 17. Actual and Predicted Values of Cooperation,
France to Germany
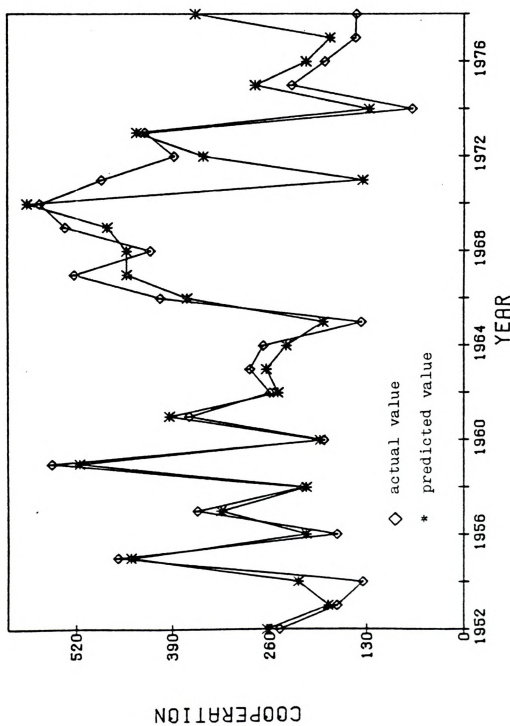
Figure 18. Actual and Predicted Values of Cooperation, Germany to France
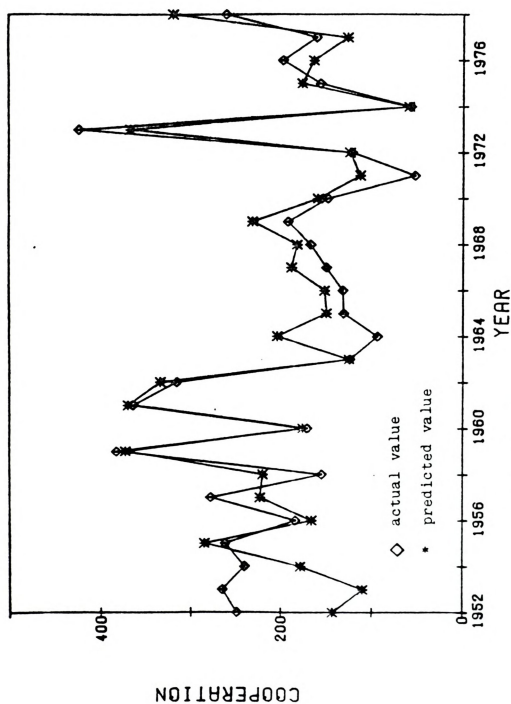
Figure 19. Actual and Predicted Values of Cooperation, Britain to Germany
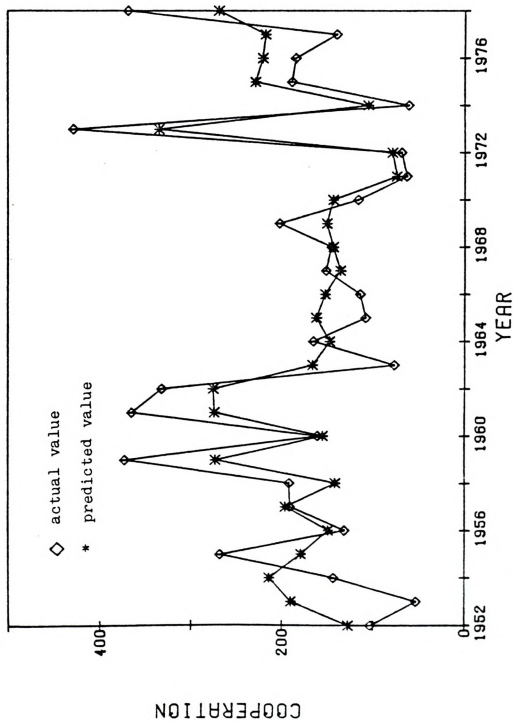
Figure 20. Actual and Predicted Values of Cooperation, Germany to Britain

TABLE 9

STANDARD DEVIATION AND RMSE OF
ESTIMATED MODELS

Equation			
Actor	Target	Std. Dev.	RMSE
Britain	France	106.9	46.4
France	Britain	125.4	62.7
France	Germany	147.0	47.5
Germany	France	143.4	39.9
Britain	Germany	107.5	53.3
Germany	Britain	99.8	61.9

technique, the results of the forecast evaluation are
consistent with the results above, that the model does well
in capturing some important elements of the cooperative
process. Thus, based on the visual evidenve in the plots
of actual and predicted values, the comparison of the
standard deviation of the data series with the RMSE of
the predicted values, and the forecast evaluation, the
model is judged an adequate representation of the process
of international cooperation. The next stage of the
analysis is an interpretation of this process.

Interpretation of the Models

This section is concerned with the interpretation of
the estimated parameters of the model. The focus of the
discussion is on the substantive meaning of the coefficients:
what they can tell us about the process of international
cooperation and the theoretical implications of the results.
The model consists of three basic components: a reaction
process, including responses to both cooperative and
conflictual behavior; a decision-making element, based
on the evaluation of costs-benefits and an interpretation
of the dynamics of the decision process (spillover); and
the impact of supranational decision-making in an IGO.
This discussion will treat each of these three components
individually. Then, following the derivation of the

dynamic properties, it will be possible to draw some more
general conclusions regarding the status of the earlier
explanations of cooperation.

The estimated coefficients and associated statistics
for the three models are presented in Tables 5-7. Each
country reacts positively and significantly to cooperation
received. The strength of this reaction, indicated by the
value of the coefficient, is also rather consistent, tending
to fall in the range of .68 to .95. The German reaction
to cooperation received from Britain is somewhat weaker
at .52, and the French reaction to cooperation received
from Germany is considerably stronger at 1.23. These
results are not surprising: there are strong grounds to
believe in the existence of a reaction process, and several
empirical studies, using a variety of measurement pro-
cedures, previously have identified such processes (see,
for example, Ward, 1982). These results strengthen this
interpretation and reinforce the view of cooperation as
a mutual process between countries. It is apparent that a
reaction process is a major element of international
cooperation.

There is also reason to believe that countries react
to conflict received. Only British reaction to conflict
received from France is statistically significant. For all
the remaining conflict reaction terms, the coefficient is

statistically insignificant, and the sign of the co-
efficient is as likely to be positive as negative. Thus,
it is not possible to argue that higher (lower) levels of
conflict tend to reduce (increase) the level of cooperation
between countries. These results do support the notion
that cooperation and conflict are different processes,
but there is no apparent relationship between them.

The decision-making component of the model consists
of the spillover term and the costs-benefits term. The
spillover term is statistically significant for French and
German behavior toward each other, and for the behavior
of each toward Britain. In each of these cases it is
negative and very consistent in strength, ranging from
-.21 to -.34. The spillover coefficients for British
behavior tword France and Germany are statistically
insignificant and close to zero in size (.05 and -.02,
respectively). Focusing for the moment on French and
German behavior, the results indicate that if cooperation
increases in one period, it tends to decline in the next,
and that periods of decreased cooperation are followed by
periods of growth in cooperation. Thus, international
cooperation is an up-and-down process; there is a dynamic
of fluctuation in the cooperative behavior of states.
(This behavior is also the likely source of the negative
serial correlation identified earlier.) This result

indicates that the process does not operate in the manner
suggested by the functionalists or neo-functionalists:
there is no clear evidence of growth in the level of
cooperation over time. More importantly, this fluctuating
process is precisely that suggested by the cybernetic
view of decision-making. According to this interpretation,
a very limited set of critical variables is monitored by
decision-makers, and behavior is adjusted to maintain
these within an acceptable range. The negative spillover
coefficients for France and Germany suggest that coopera-
tive behavior is adjusted to some such set of goals. This
is an interpretation that will be considered in greater
detail in the next chapter.

The collective goods literature establishes the
importance of costs and benefits as the crucial elements
in decision-making about cooperation. Each of the costs-
benefits coefficients is statistically insignificant.
Given the logical force of the argument, this is something
of a surprise; the costs-benefits of cooperation apparently
have no relationship to cooperative behavior.

The final component of the model is the impact on
cooperation of supranational decision-making within an
intergovernmental organization. This IGO is a contextual
factor seen as important by both the neo-functionalists
and the collective goods theorists. The real test of this

factor lies with the French-German model, since France
and Germany are charter members of the EC and the IGO
variable in this model measures the actual growth of
supranational decision-making within the organization. For
both of these countries, the IGO coefficient is statis-
tically insignificant and very close to zero. It is
clear that the growth of supranational decision-making
has no direct impact on international cooperation, re-
futing the neo-functional view of this factor as an aid
to cooperation and the collective goods treatment of it as
a cost.

Britain joined the EC in 1973, and for models in-
volving Britain the IGO factor is treated as a dummy
variable. Thus, for the British-French and British-German
models, what is being tested is the impact on cooperative
relationships of the introduction of supranational decision-
making. In each model, the IGO coefficient is statistically
significant only for Britain, and indicates that member-
ship in the EC served to reduce British cooperation with
France and Germany by about 50 units per year. This is
a clear suggestion that the introduction of an IGO operates
as a cost in the manner of the collective goods argument.[2]
An alternative explanation of this result would simply be
to argue that upon British membership in the EC, a certain
portion of cooperation was merely transfered to within the

organization. If this were the case, however, there should
be a corresponding decline in French and German coopera-
tion toward Britain, indicated by a similarly negative
coefficient. Such is not the case; British membership
has no statistically significant impact on French or
German behavior toward Britain. This can be explained by
noting that France and Germany had been members of the EC
for over 20 years; British membership was not a major
change for them.

Thus far, the discussion of the estimated parameters
has drawn from a variety of earlier arguments in an
effort to make sense of the results. At first glance,
the statistical results appear rather simple and straight-
forward. Assembling them into a unified argument, however,
reveals a more complex set of relationships. Before a
more general set of conclusions can be drawn, it is
necessary to investigate the dynamic properties of the
process of international cooperation.

The functionalists, neo-functionalists, and collective
goods theorists all present arguments about the stability
of the process of cooperation. The first two approaches
suggest that cooperation between nations will continually
grow, while the latter approach indicates that cooperation
will be stable about some equilibrium point. This is a
fundamental conceptual difference, for the stability

properties of the process hold basic implications for
the future of cooperative efforts.

To determine the stability properties of cooperation
as modeled here, it is necessary to derive the fundamental
dynamic equations and solve for the determinants of the
matrices specified by the Schur theorem. The fundamental
dynamic equation and the Schur theorem matrices for each
of the six estimated equations are presented in Appendix C.

Only for the equations for British cooperation toward
France and Germany is each determinant positive, and thus
indicative of a stable process. In these two cases, if
all the exogenous variables in the model are held
constant, cooperation will settle down to some constant
level. For the remaining equations, one or more of the
determinants is negative. This indicates that these
processes are unstable: in the absence of changes in the
exogenous variables, cooperation does not tend toward an
equilibrium level. The question, of course, is the form of
this instability. There are three possibilities: explosive
growth in cooperation, consistent decline of cooperation,
or fluctuation about some level.

An answer to this question can be suggested by refer-
ence to the data on cooperation (see Figures 1-6) and to
the negative spillover coefficients for the equations that
exhibit instability. It was noted above that these

spillover coefficients (which form the core of the
fundamental dynamic equations) indicate an up-and-down
adjustment in the level of cooperation. The data support
this interpretation: the levels of cooperation rise and
fall with considerable regularity. Thus, while the process
inherent in these four models is unstable, this instability
does not imply the growth of cooperation predicted by the
functionalists or neo-functionalists, but merely a more-
or-less regular fluctuation in the level of cooperation.
While the collective goods literature predicts stability
for the process of cooperation, this instability is
consistent with a cybernetic interpretation of the
collective goods argument. It should also be noted that
this instability applies to the original members of the
EC. Membership in the organization seems not only to
enable the more ready adjustment of behavior, but this
adjustment results in some instability in the process.

  With this understanding of the empirical results,
it is possible to return attention to previous work on
international cooperation -- functionalism, neo-functional-
ism, and collective goods arguments -- in an effort to
assess the contribution of each to our understanding of
cooperative processes. Each will be seen to be an
inadequate description and explanation of cooperation
between states. Yet each makes important contributions

to our understanding of particular elements of the process. Table 10 presents a concise comparison of the results and earlier arguments.

The major contribution of the functionalists is their recognition of a reaction process as an important element of international cooperation. This is consistently supported by the current results: cooperation received is reciprocated by cooperative behavior. This reaction component is a fundamental element of cooperative relations that must be incorporated into any explanation of the phenomenon. The functionalists also link cooperation to conflict, arguing that the growth of one will produce a decline in the other. This link is not supported; conflict and cooperation apparently are independent processes.

The core of the functionalist argument is the concept of spillover, that successful cooperation is reinforcing over time, leading to the continual expansion of cooperation to new issues, and producing a dynamic of growth in the level of cooperation between states. The current results offer no indication of such a spillover process. Rather, increasing cooperation in one period is followed by declining cooperation in the next, and periods of lower cooperation are followed by higher levels of cooperative behavior. The result is a fluctuating level of cooperation instead of the growth predicted by the functionalists. Thus,

TABLE 10

PREVIOUS ARGUMENTS AND RESULTS COMPARED

Coefficient	Previous Argument			Results*
	Functionalism	Neo-functionalism	Collective Goods	
Cooperative Reaction	$\beta > 0$	$\beta > 0$	$\beta = 0$	$\beta > 0$
Conflict Reaction	$\beta < 0$	$\beta < 0$	$\beta = 0$	$\beta = 0$
Spillover	$\beta > 0$	$\beta > 0$	$\beta = 0$	$\beta < 0$ $(\beta = 0)$
Costs-Benefits	$\beta = 0$	$\beta > 0$	$\beta > 0$	$\beta = 0$
IGO	$\beta = 0$	$\beta > 0$	$\beta < 0$	$\beta = 0$ $(\beta < 0)$
Dynamic Path	Unstable-growth	Unstable-growth	Stable	Unstable-fluctuation (Stable)

*If only one set of results is reported, it refers to all six equations. If two sets of results are reported, those presented first are for French and German behavior. Results in parentheses refer to the equations for British behavior toward France and Germany.

while the functionalists make a major contribution by
citing the importance of reaction processes, the central
feature of their argument is refuted, and it is fair to
conclude that functionalism is an inadequate description
of cooperative international processes.

The neo-functionalists accept the basic functionalist
argument regarding reaction processes, spillover, and
dynamic growth in cooperation, but argue that these pro-
cesses are moderated by political factors. The assessment
of functionalism applies here as well, and it is only
necessary to evaluate the neo-functionalists' original
contribution: the role of decision-making as captured by
the costs-benefits term and the impact of an intergovern-
mental organization on cooperation. The results on these
factors are less than straightforward. Instead of the
positive relationship between costs-benefits and coopera-
tion foreseen by the neo-functionalists, there is no
clear relationship between them. Likewise, decision-
making in an IGO has no apparent impact on broader
cooperation. Joining an international organization, however,
as in the case of Britain, serves to depress levels of
cooperation, rather than facilitating cooperative efforts
as the neo-functionalists suggest. As will be discussed
below, this interpretation, while firmly grounded on the
empirical results, is perhaps too simple, and a more

complex, though admittedly speculative, interpretation can be provided. Thus, the neo-functionalists have made an important contribution to our understanding of international cooperation by pointing out that political factors moderate the reaction and spillover processes. They are incorrect, however, on the nature of the relationships between these elements and cooperation.

The collective goods approach focuses solely on decision-making elements: the rational evaluation of costs and benefits. This argument leads them to reject the role of reaction and spillover processes. This is the major weakness of the collective goods argument: in dismissing the reaction process the approach ignores an important element of international cooperation. Collective goods theorists are correct, however, in rejecting spillover as a force for continued growth in cooperation. This is most clearly seen in the results for British behavior, which is stable. Results for French and German cooperation, however, show a systematic fluctuation that the collective goods argument is unable to explain. The results also fail to provide support for the collective goods argument that cooperative decisions are based on a rational evaluation of the costs and benefits of such activity. Perhaps the most important support for the collective goods argument is the lack of a dynamic of

growth in international cooperation. Nevertheless, given the results for the costs-benefits term, it is apparent that this result is not arrived at through the types of evaluations foreseen by the collective goods theorists.

It is clear that previous thinking about international cooperation has outlined bits and pieces of the nature of the phenomenon. Each approach is partially correct and contributes something to our understanding of cooperation, whether reaction processes, decision-making components, or dynamic elements. No body of literature, however, offers a unified interpretation of international cooperation able to reconcile and explain the results reported here. The discussion thus far has focused on the meaning of the individual parameters and on assessing earlier work. Whether an alternative explanation can be put forth that is able to account for these results will be taken up in the next chapter.

Summary of Results

It is now possible to summarize the results of the empirical investigation, and so draw a briefer picture of the process of international cooperation. It is clear that the reaction to cooperation received is a major element of cooperation; it is a reciprocal process. This result is not new, earlier studies (e.g., Ward, 1982) have

also identified a reaction process. The point does,
however require emphasis: a reaction process is the force
that drives international cooperation. At the same time,
there is no apparent reaction to conflict received;
cooperation and conflict are separate, independent processes.

The decision-making component also exerts an influence
over the process, though the results here are rather less
straightforward. While reaction drives the process,
cooperation is moderated by what is apparently a cybernetic
upward and downward adjustment of behavior as indicated
by the negative coefficient of the spillover term and the
instability of the process. This is not a universal
phenomenon, however, as it applies only to members of the
EC. This indicates that the important effect of an
international organization is to clarify relationships and
so enable states to adjust their behavior.

The costs and benefits of international cooperation
have no immediate relationship to cooperative behavior.
Similarly, the growth of supranational decision-making
in an IGO has no direct impact on cooperation, either as
an aid to cooperation as seen by the neo-functionalists,
or as a cost as seen by the collective goods theorists.
The IGO does, however, have some indirect effects. It
provides an environment for learning and socialization,
enabling states to undertake the adjustment of behavior

as noted above. In addition, the introduction of IGO membership in the course of a cooperative relationship is something of a shock, tending to depress levels of cooperation. This is the one clear case of an IGO acting as a cost in the manner of the collective goods argument. It is reasonable, however, to expect this effect to diminish over time as the new member adjusts to this added element of the relationship.

To this point, the model has been treated as a way to evaluate simultaneously the three earlier efforts to explain international cooperation. The model is successful in the empirical sense: it is able to track the actual course of cooperation between Britain, France, and Germany. Conceptually, however, the results have been negative: functionalism, neo-functionalism, and collective goods approaches each point to an important element of the cooperative process, yet each is inadequate as an explanation of cooperative behavior. It is necessary, therefore, to go beyond the existing literature, and to use this basic, "first-cut" model as a guide in suggesting an alternative interpretation of the nature of international cooperation.

Notes to Chapter IV

1. The predominant pattern was negative serial correlation.
    Though somewhat unusual in time series analysis,
    the reason for this pattern can be found in the
    fluctuating nature of the data. This pattern, and
    the reasons for it, will be discussed at some length
    with the interpretation of the estimated parameters.

2. The argument presented above, that the IGO serves a
    learning and socialization function, but that its
    activities have no direct impact on cooperation, would
    suggest that this negative effect of recent membership
    on British behavior will decline over time. Unfortu-
    nately, there is insufficient data after British
    membership to test this proposition.

CHAPTER V. THE PROCESS OF INTERNATIONAL COOPERATION

Introduction

To this point, the discussion of the results has been rather narrowly confined to the meaning of the individual parameter estimates and the status of the three earlier efforts to explain international cooperation. The model, however, has more to offer than just the conclusion that the previous approaches are inadequate. The purpose of this chapter is to suggest an alternative interpretation of the cooperative process that is based on both the results and the conceptual development of the model in Chapter II. It should be recognized at the outset that this discussion is intended to be tentative and suggestive rather than definitive. Further work will be required to clarify the argument and to test it. The second stage of this further exploration of the results is ex ante forecasting. This procedure is useful in examining the implications of the results: what the model says about the future of cooperative efforts. Finally, some suggestions for refining the model will be made. Problems and weaknesses in the model and interpretation will be noted, and some proposals will be made for resolving these.

The Process of Cooperation

In any discussion of international cooperation it is necessary to emphasize the role of reaction processes. Cooperation is a mutual activity, and an important determinant of a state's level of cooperation is the degree of cooperative activity directed toward it. This is perhaps the clearest and strongest result of the present research: a reaction process underlies cooperation between states. This reaction mechanism is, in turn, moderated by decision-making elements.

The decision-making component of the model consists of the spillover and costs-benefits terms, and it is with these factors that the interpretation becomes problematical. A cybernetic view of decision-making was proposed in Chapter II: decision-makers monitor a small set of important variables, and respond in patterned ways in an effort to maintain these within an acceptable range. There is substantial support for this interpretation in the negative spillover coefficients and the unstable nature of the cooperative process in the equations for French and German behavior. These results indicate a regular up-and-down adjustment in the level of cooperation consistent with the cybernetic argument. These results and this interpretation present two important questions. The first concerns the

motivations behind this type of behavior: claims of a cybernetic process should be accompanied by a notion of the standards to which behavior is adjusted. The second is why such a cybernetic process is an element of French and German behavior toward each other and toward Britain, but not part of British behavior toward France and Germany.

It was suggested earlier that decision-makers monitor the costs and benefits of a cooperative relationship, and adjust levels of cooperation in a cybernetic manner to maintain these within an appropriate range. The costs-benefits coefficients, however, are insignificant. This is the evidence used to refute the notion of international cooperation as a rational process assumed by the collective goods theorists; it also challenges the appealing logic that costs-benefits function as the critical variables for a cybernetic adjustment in the level of cooperation.

There are at least two possible reasons for the lack of a relationship between costs-benefits and cooperation. This result may be a logical consequence of the conceptual argument. If decisions about international cooperation are made in the manner suggested by the collective goods liter-ature, with policy-makers balancing the costs and benefits of cooperation, we would expect costs, benefits, and cooperation to reach equilibrium levels. In this case, there would be little variance in these factors, and it

would not be possible to identify a statistical relationship between them. Thus, the failure of the costs-benefits coefficients to exhibit a statistical relationship with cooperation is not necessarily inconsistent with the argument. Nevertheless, this is essentially negative evidence in support of the cybernetic interpretation, and a stronger alternative argument can be offered to explain the adjustment process.

A second interpretation takes its guidance from the limited information-processing ability of decision-makers assumed by the cybernetic model. Cooperation between states represents a complex international relationship. In an effort to simplify and manage this relationship, decision-makers may rely upon the level of cooperation itself as a surrogate indicator of the costs and benefits of cooperation. Thus, rather than monitor a direct measure of costs-benefits, as used in this research, decision-makers may simply recognize (or assume) that cooperation entails a complex set of both costs and benefits, and adjust behavior not to maintain a well-defined set of costs-benefits in an acceptable range, but merely to maintain an appropriate level of cooperation. Thus, decision-makers' attention may be even more narrowly focused than modeled here. Additional support for this interpretation can be found in the answer to the second question: why British behavior

differs from that of France and Germany.

It was noted earlier that the growth of decision-making in the European Communities has no direct impact on the level of international cooperation. The IGO may, however, have an indirect relationship with cooperation. Only for France and Germany -- original members of the EC -- are the spillover coefficients significant. It is possible that membership in the IGO serves to clarify the relationships with other countries: through membership in the organization, the costs and benefits of cooperative relationships become more clearly defined. The learning and socialization effects predicted by the neo-functionalists could be operating. The result, however, is not the neo-functional growth in cooperation, but rather the more ready understanding and adjustment of cooperation as the cybernetic literature suggests. In addition, this process seems to apply to French and German relationships with Britain, suggesting that the learning process is somewhat broader than that confined to members of the organization alone. Britain, becoming a member of the EC only in 1973, did not undergo this process, and was less able to under-take the adjustment in cooperation. Instead, the immediate impact on membership on Britain was the imposition of a large number of Community regulations and decisions, which operated in the manner of a cost as the collective goods

literature would suggest.

It is now possible to sketch briefly the tentative explanation of international cooperation as conceived here. It is appropriate to restate the importance of reaction processes. Cooperative behavior is returned with cooperation; this lies at the root of cooperation between states. This reaction process, however, is moderated and controlled by a cybernetic decision mechanism. Cooperative relations offer benefits to the state in the form of expanded capabilities, enabling a state to solve problems that it would be unable to handle unilaterally. At the same time, cooperation imposes costs by making a state dependent to some degree upon others, with a consequent loss of autonomy. It appears that membership in an international organization serves a learning function, enabling decision-makers to draw the linkages between costs-benefits and cooperation. As a result, decision-makers monitor and adjust cooperation in an effort to control these costs and benefits. This produces a fluctuating instability in the level of cooperation over time. Attention now turns from the nature of the process itself to the implications of this process for the future of international cooperation.

Ex Ante Forecasting

In this section, the estimated model is treated as a true representation of the process of cooperation, and ex ante forecasting, or forecasting into the blind future, is used to explore the implications of the model. The model has already been shown to be accurate in reproducing the path of European cooperation. This makes it possible to use our knowledge of the relationships between the variables to investigate possible future paths of cooperation. Through this procedure, the model is being used as a deductive tool to consider the consequences of the assumptions embodied in the model. The procedures for generating ex ante forecasts are discussed briefly, three alternative scenarios of the future are presented, and the implications of the model for future cooperation between states are considered.

Ex ante forecasting treats a model as true, and combines estimated parameter values with postulated future values of the independent variables to produce estimates of future values of the dependent variables. These estimates then represent the consequences of the model for the future, given the conditions represented by the values assigned to the independent variables. The model of French-German cooperation is used here as the base for forecasting. This

is due to the importance of the French-German relationship for European cooperation generally, and because this model best represents the cybernetic decision process. The forecasts are generated using the procedure described in Appendix B.

The assignment of values to the independent variables clearly plays an important role in determining the values of the forecasts, and it is necessary to outline briefly the means by which such values are defined. Three possible scenarios of the future are defined, and appropriate values through 1990 are assigned to the conflict, costs-benefits, and IGO variables. Data for the reaction and spillover terms are generated by previous values of cooperation. The data for each scenario are presented in Appendix D. After each scenario is described, the forecasts of cooperation it generates are reviewed. It will then be possible to draw some general conclusions about the implications of the model for the future of international cooperation.

The first scenario maintains conditions much as they are at present. While this is uninteresting in itself, it serves as a base against which the two other versions of the future can be compared. All variables are maintained in their current range, fluctuating slightly throughout the period. The forecast results (see Table 11) indicate

TABLE 11

EX ANTE FORECASTS

Year	France			Germany		
	Scenario I	Scenario II	Scenario III	Scenario I	Scenario II	Scenario III
1979	260	272	253	324	330	347
1980	268	289	258	347	365	368
1981	368	404	349	356	388	376
1982	371	398	343	283	316	294
1983	316	357	267	320	351	325
1984	227	279	169	310	354	316
1985	402	461	344	265	313	270
1986	429	483	365	423	470	424
1987	431	496	369	439	495	442
1988	419	480	357	475	523	476
1989	345	406	289	462	520	477
1990	369	424	303	432	475	423

that cooperation continues the patterns of the recent past: the fluctuation in the levels of cooperation continues, with no evidence of substantial growth or decline in French-German cooperation.

The second scenario is based on a possible European future that "conventional wisdom" would suggest would result in the decline of cooperation. In this case, the French-German trade imbalance grows greater: the French deficit deteriorates to approximately twice its recent level, and the German surplus increases by a similar amount. This is not wildly implausible; a continued deterioration of the French economy could produce such a result. Decision-making activity in the EC declines to one-quarter to one-half of current levels, and French-German conflict increases to approximately five times recent levels. Such results could be generated by the economic imbalance. The forecasts generated by such conditions indicate that levels of cooperation increase marginally compared to Scenario I, with a similar pattern of fluctuation over time. While contradicting the usual view, this is readily explained in terms of the model. The decline in the activity of the EC lowers the costs associated with supranational decision-making, with a subsequent increase in cooperation. Similarly, the German trade surplus increases the benefits of cooperation to Germany (it also increases France's cost of

cooperating, but the German costs-benefits coefficient is considerably stronger than that of France). The relatively minor changes in the levels of cooperation produced by this substantial alteration in European conditions is readily explained by referring to the very small size of the coefficients of these variables. Most striking in the results for Scenario II is the continued strong influence of the up-and-down cybernetic adjustment of cooperation.

The third scenario takes European conditions in a direction opposite those of Scenario II. France and Germany achieve a more nearly balanced trade relationship, with France running a slight deficit and Germany a small surplus. Conflict between the two countries is nearly eliminated, and the EC experiences a new growth in decision-making activity, to approximately twice current levels (a possibility if Spain should become a member of the EC, generating decisions necessary to integrate the Spanish economy into Europe). To most, such conditions would provide fruitful grounds for cooperation. The resulting forecasts indicate otherwise. Cooperation in such an environment is marginally lower than in Scenario I. The growth in EC decision-making substantially raises the costs of cooperation and depresses cooperative levels (even with a coefficient of -.0063, a decision rate of 8000 per year lowers cooperation by 50 units). In a similar manner,

the trade balance reduces German benefits, tending to lower cooperation. Again, the fluctuation in the level of cooperation over time suggests the continuing influence of a cybernetic decision process.

The very similar results generated by these widely varying scenarios indicate that variables outside the cooperative process itself -- conflict, costs-benefits, and supranational decision-making -- have at most a marginal influence on the level of cooperation. Empirically, this is explained by pointing to the small size of the coefficients associated with these variables; in most cases they are statistically insignificant. These results are also understandable in a conceptual sense. The cybernetic model suggested that decision-makers' attention is highly focused on a narrow set of indicators; it is reasonable to expect outside variables to have little impact on cooperation. The forecasting results also reinforce the two major positive conclusions of this study: the dominance of reaction processes and cybernetic adjustment in guiding the course of international cooperation. As a result, one must conclude that the cooperative process is very difficult to influence, and that any efforts to stimulate cooperation between states are unlikely to meet with dramatic success.

Refining the Model

While the model presented here has substantial
empirical accuracy and a conceptually meaningful interpre-
tation, it also has limits and weaknesses that severely
restrict claims that can be made on its behalf. The
purpose of this section is to note these weaknesses ex-
plicitly, and to suggest some means for their resolution.
These refinements fall into three primary categories: the
concept and measure of international cooperation, the
clarification of the argument and evidence for a cybernetic
decision-making process, and the possible revision of other
factors in the model, particularly the IGO and conflict
variables.

Chapter III pointed out many of the difficulties of
defining and measuring cooperation. It is clear that
focusing on regional integration, international organ-
izations, or alliances is excessively narrow.[1] What is
required is a measure of overall state behavior, for which
events data currently offers the only possibility.
Nevertheless, the problems involved in such a measurement
procedure are significant, including the relative weights
given to different types of behavior, the importance
of and differences between cooperation in different issue-
areas, the degree of aggregation, etc. These are
fundamental issues with implications for the entire research

process, from the specification of the model, through the interpretation of the results, to the meaning of the results for the behavior of states in the international system. Work to resolve these difficulties, or at least to make clear the biases in alternative measurement procedures, should be a priority activity.

The general approach to dealing with this problem would be the exploration and comparison of various concepts and measures of international cooperation. An obvious alternative, still based on events data, would be to assign all events a weight of one. The measure would thus simply be the frequency of cooperative events in a given time period. There are two arguments underlying such an approach. The first refers to the weaknesses of any procedure for weighting events and the difficulty of defending those weights as relevant in the minds of decision-makers. The second defense of this approach is to argue that it is the occurrence of cooperative events, rather than their precise nature, that is of importance, particularly in decision-makers' perceptions. An alternative approach to refining the measure of cooperation would be to abandon events data altogether, though this is fraught with conceptual problems. Most such alternative measures (international trade, tourism, labor mobility, etc.) clearly fail to reflect purely official government behavior, and thus do not qualify as

measures of cooperation between states. It would also be possible to focus on expressions and perceptions of cooperation through a content analysis of the public documents and speeches of government officials. It is unclear, however, to what degree these reflect actual behavior. It would be appropriate to investigate the behavior of these alternative measures, and to explore the extent to which the differences in the concept of cooperation contained in each is expressed in the measure itself.

The second major limitation of the model relates to the interpretation of the decision-making component as a cybernetic evaluation of the costs and benefits of cooperation. The evidence on this point is mixed and somewhat indirect. The negative spillover coefficients, of course, are strong evidence in support of a cybernetic decision process. The problem concerns the motivations and procedures that produce this adjustment; the evidence relating costs and benefits to this process is indirect. The argument is consistent with both the empirical results and the conceptual development, but strong claims should await stronger, more direct evidence.

To provide this evidence of a cybernetic interpretation of cost-benefit evaluations, these concepts and their measures need to be developed to reflect more accurately the types of costs and benefits of interest to

decision-makers, and to be more sensitive in capturing the sorts of evaluations made. The general trade-based measures of costs-benefits used here are perhaps overly broad and inclusive, incorporating major elements of the national economy as well as important elements of cooperative international relationships. As such, decision-makers may not draw the explicit links between balance of payments problems and cooperation required by the cybernetic view of decision-making. This suggests that future refinements will yield concepts and measures of costs and benefits that are much more narrowly defined, based more on the situation for a given state and specific dyadic relationship than the trade-based measures used here. Now, for example, it may be that the important costs and benefits in the United States-French relationship relate to monetary issues such as interest rates and the stability of the dollar, while those between Britain and France involve agricultural policy and the EC budget. This is a suggestion that the definitions of the concepts and their measures become more context-specific. This would result in some-what reduced generality for empirical work, but reflects the reality that different issues both divide and bind different sets of states. Measures of costs and benefits should account for these differences.

The final set of revisions concerns the remaining variables in the model: the role of an IGO and the impact of conflict on cooperation. The growth of supranational decision-making in an international organization has no direct effect on cooperation, but it was argued that membership in the IGO has learning and socialization effects enabling decision-makers to undertake the adjustment of behavior. While this interpretation is plausible, it should be recognized that the evidence is limited, and it is premature to dismiss the IGO as an important element of the cooperative process. The reduction in British cooperation associated with membership in the EC suggests an alternative conceptualization of the relationship between international institutions and cooperation. Rather than incremental change in decision-making influencing cooperation, it may be that membership in an IGO involves threshold effects. In this view, the important reduction of alternatives and loss of sovereignty comes not from the growth in the number of decisions, but from the extension of international authority to new areas and issues that were previously the province of the state alone. Thus, once national control in a given area is lost, further IGO activity within that area is of little consequence. This is similar to the original functionalist notion of cooperation expanding by issue-area. A measure based on this concept could be created by

developing a list of potential functions or issue-areas
handled by an IGO, and assessing the number of these that
come under international authority at a given time.

The results refute the reactive link between conflict
and cooperation predicted by the functionalists and neo-
functionalists. There are, however, alternative ways to
conceive of a relationship between cooperation and
conflict. First, it should be noted that the events-based
measure of conflict used here is subject to the same
difficulties as the measure of cooperation. Second, there
are means other than a reaction process by which conflict
might influence levels of cooperation. In particular,
the neo-functionalists (see, for example, Nye, 1971a:207
and Haas, 1975:33) suggest that forces external to the
relationship might influence cooperative efforts. In this
context, US-Soviet conflict might increase the strains on
European states and increase their willingness to accept
the costs of cooperation in an effort to insulate thems-
selves from this superpower tension. This is a fundamentally
different view of the role of conflict than the reaction
process developed and tested here.

Weaknesses such as these, however, are usual in early
efforts in a new area of research, and the purpose of
further research efforts is to overcome such problems and
thus expand further our understanding. One advantage

of a "first cut" model such as the one presented here is
that it is able to suggest new ideas, such as the cyber-
netic treatment of cooperative decision-making, as well as
point the way for fruitful future work. The suggestions
made here, especially the refinement of the concept and
measure of cooperation and the clarification of the cyber-
netic decision process, constitute the next steps in such
a research agenda. Another consequence of these weaknesses,
however, is that the present interpretation of the process
of international cooperation must be taken as a hypothesis
that requires further elaboration and testing.

Notes to Chapter V

1. Such narrow definitions of cooperation do offer advantages in defining measures. With a restrictive definition, measures can at least appear "harder." For example, cooperation within an alliance framework could be measured by troop commitments, expenditures, etc. Such narrow areas of cooperation, however, need not reflect the overall character of cooperative relations between states. It should also be noted that such problems haunt definitions of conflict.

CHAPTER VI. CONCLUSIONS

Introduction

The research presented here has conceived of
international cooperation as a process, and has developed
and evaluated a conceptual argument that attempts to
explain how this process occurs. With the results and the
basic interpretation complete, it is now necessary to
direct attention to a somewhat broader set of questions
concerning the implications of this research and its place
within the study of international politics. The next
section evaluates the contribution of this study to our
understanding of international cooperation. It is then
possible to suggest some avenues of future research that
offer some promise of further advancing the study of
cooperation between nations. Finally, the implications
of this research for the international system and for the
relations between states are considered.

The Contribution of this Study

A fundamental notion upon which this research rests
is that characteristics of earlier research present barriers
to the development of a general explanation of the process
of cooperation. The purpose of this section is to consider

whether these barriers have been surmounted and progress has been made toward the construction of such an explanation. Advances toward a general explanation of cooperation have been made in three respects: the conceptualization of international cooperation, the structure and level of analysis of the model, and in the specification of how the process of cooperation occurs.

The first major development in the current model lies in the conceptual view of international cooperation, the definition of that which is to be explained. Previous research has focused on very specialized notions of cooperation, such as the growth of collective decision-making in international organizations (the neo-functionalists) or alliances (the collective goods research). These definitions eliminate a great deal of cooperative behavior from consideration. The concept of cooperation used here is much more general, and is intended to capture the overall nature and level of cooperative relations between countries.

The second step toward the construction of a more general explanation of cooperation may be found in the level of analysis used and in the basic structure of the model. The question here is where the explanation of cooperation is to be found. The functionalists and neo-functionalists account for cooperation by reference to the process itself. The functionalists cite the (assumed) success of cooperation

as responsible for its growth, and the neo-functionalists rely on regional characteristics and linkages through an IGO. Neither approach gives the state much responsibility for the development of cooperation, and neither recognizes that such processes do not occur independently of the states involved. The model developed here accepts that international cooperation arises from the decisions of states and attempts to account for the major influences on those decisions. To the extent that the forces cited by the functionalists and neo-functionalists are important for international cooperation, they are operative because they influence the decisions of the state. This focus on state-level analysis corresponds more closely to where cooperative decisions are actually made.

The collective goods approach also attempts a state-level explanation of cooperation. That literature, however, encounters two major problems. First, the concept of a purely public good deprives the approach of much of its ability to describe actual cooperative processes. Here, the benefits of cooperation are defined as private goods acquired through collective action, and collective goods arguments are used primarily for the decision calculus they provide. This leads to the second difficulty faced by this approach. The collective goods decision-making model relies solely on cost-benefit calculations by the

individual state, and tends to ignore the role of other
actors and the process forces cited by the functionalists
and neo-functionalists. The research presented here treats
cooperation as a mutual activity between states, a factor
incorporated through the simultaneous equation structure
of the model. These process forces, then, are built into
a state-level model of decision-making. These arguments,
of course, constitute a restatement of another fundamental
premise of this research: earlier efforts have concen-
trated on different aspects of the cooperative process, and
need to be gathered together in a synthetic model built
from major components of each approach. These are relatively
simple, obvious elements, but this model is one of the
first to approach international cooperation in this way.
The result is a more widely applicable, general treatment
of cooperation, and a framework for the explanation that
corresponds more closely to the manner in which the
process occurs.

The third advance made in this research depends on
the first two: it is the specification of the factors
influencing the cooperative process. The model consists of
a limited number of variables, grounded in a conceptual
interpretation of the cooperative process, and the
relationships among these variables are made clear. The
functionalists view cooperation as largely apolitical;

the functionalist model is one of economic determinism.
This is incorporated into the model as an explicit reaction
process. Earlier work implies that cooperation involves a
reaction component, but fails to specify and test it as
such. The addition of other variables to the model
indicates that there are other factors in the cooperative
system that influence the reaction process. The neo-
functionalists introduce an ad hoc set of variables to
account for these political factors. The model developed
here relies on the collective goods view of cost-benefit
evaluation, modified by a cybernetic interpretation of
decision-making. This decision component of the model
accounts for the impact of cooperative relations on the
state, and is seen as moderating the reaction process,
guiding the way in which it proceeds. The neo-functionalists
give primary importance to an intergovernmental organization
as a forum for international cooperation. Here, an IGO
is treated as a contextual influence, an institutional
factor that may affect cooperative efforts. By building
from previous research, identifying the key elements of
each approach, and synthesizing them into a single
coherent interpretation of the cooperative process, this
research presents a model that is more general and more
precise in its statement of relationships. In this it
constitutes a significant advance over previous work.

The purpose of modeling is to help us understand actual political processes. In this respect, too, this research contributes to our comprehension of cooperation between countries. The importance of reaction processes in international cooperation is well established. At the same time, it is clear that there are forces which impinge on this reaction process and which tend to limit levels of cooperation. Seeking goals through cooperation with others imposes costs as well as yields benefits, and these costs restrain cooperative activity.

Perhaps the most important contribution of this model to our understanding of international cooperation focuses on this point: the specification of and empirical support for a cybernetic decision-making process. This suggests that the attention of decision-makers is directed much more narrowly at a few important elements of the cooperative process than would be the case under a rational decision-making scheme. As a result, other factors are less likely to influence cooperative efforts. This occurs for two reasons. First, due to the decision-makers' restricted definition of relevant variables, such factors may simply not enter the decision calculus in a way that relates them to cooperation. Second, even if such factors are recognized, the routine patterns of behavior that guide cooperative efforts may not allow for the modification of

behavior to handle these new forces. Thus, in the cybernetic
model, there is a problem first in recognizing fundamental
change in the system, and then in reacting to such change
when it is identified. As a consequence, cooperative
processes between states are likely to be highly resistant
to change. Changes or opportunities that might encourage
cooperation are likely to pass unnoticed. A further result
of the cybernetic decision process is the fluctuating
nature of cooperative efforts. The implications of this
phenomenon are discussed below.

Finally, growth of activity within a supranational
organization has no direct impact on cooperation, though
there is evidence that the introduction of such an IGO in
the midst of a cooperative relationship may be a shock
that tends to depress cooperation, at least for a short
time.

Most of this description of international cooperative
processes is new. It is based on empirical work testing
a conceptually-based model. It is reasonable, then, to
say that the model has advanced our understanding of real
cooperative processes between countries.

Future Research

This research represents early efforts in the study
of a new topic: general processes of cooperation between

countries. As such, it constitutes the beginning of
research rather than the conclusion. It is incumbent on
the student in such a position to indicate what avenues
future research efforts might follow that they may overcome
the limits of earlier work and push out the frontiers of
knowledge. Fruitful new work on international cooperation
could concentrate on either additional empirical research
or on further conceptual development. This section will
present a number of possibilities for future research,
and consider the major problems and prospects of each.

Additional empirical work -- further tests of this
model for other cases of international cooperation -- offers
an obvious possibility for future work. Such efforts
could be justified by noting that this research, like
virtually all the work on regional integration and alliances,
has been done within the context of Western Europe. Most re-
search on cooperation has thus focused on states with
industrial economies and modern, democratic political
systems. This raises questions about the generality of the
results that could be resolved through comparative tests.
This would be relatively straightforward in principle, for
the concepts in the model are general, and are intended
to apply to all cases. The difficulties of comparative
tests of the model involve defining new measures for the
concepts that are relevant in the cases chosen, and in

gathering reliable, comparable data for non-western states.
Such work would provide further grounds for making claims
(or criticisms) on behalf of the model. It is less likely,
however, to increase our abstract understanding of
international cooperation.

The remaining suggestions for future research are
primarily conceptual in nature. This dissertation develops
and tests a two-nation model of international cooperation.
The development of an n-nation model offers a means of
generalizing and expanding this line of research. An
n-nation model raises some fundamental questions about the
nature and targets of cooperative behavior. In a regional
context, for example, do states respond to the behavior
of the region and direct their behavior to the region, or
is cooperation organized on a state-by-state basis? It
may be that regional or international cooperation is better
represented by a series of dyadic models incorporating
some regional or international influences, than by a large
n-nation model. This is essentially a question of how
decision-makers view the world and respond to it. Such
an expansion of the model, however, would best wait until
the two-nation model is more firmly established, both
conceptually and empirically.

A second expansion of the model could address the
larger role of cooperation in the international system.

The results presented here indicate that conflict has no direct impact on levels of cooperation. This does not, of course, say that cooperation has no impact on conflict. Thus, it would seem reasonable to move from a model of cooperation to a model of international behavior generally. This would involve embedding the model of cooperation in a model of conflict. This approach presents two immediate problems. Again, this would require a model of cooperation with greater support. In addition, it requires a model of conflict, which years of research have thus far failed to produce. For these reasons, this activity is also best viewed as a long-term goal.

These suggestions for future research on international cooperation constitute a long-term agenda for increasing our understanding of cooperative processes. The immediate tasks, however, are to resolve the weaknesses in the research presented here. This involves both conceptual work on the nature of cooperation between states, and efforts to refine the concepts and measures of costs and benefits. With the development of a two-nation model in which we can have greater confidence, it will be possible to expand the model to address new questions, such as the pattern of more complex cooperative relationships or the place of cooperation in the larger context of international behavior.

Cooperation and the International System

This final section addresses the implications of this research for the nature of the international system and for the behavior of states within that system. The study of international cooperation is not undertaken merely to satisfy intellectual curiosity, but because cooperation is thought to offer states a means of solving economic, social, and political problems, leading to an increased similarity in the interests of states, and thus reducing conflict. Cooperation is important because most prefer it to conflict as a way to resolve disputes. It is now time to consider what the research presented here has to say about such beliefs. The implications are not encouraging.

Many researchers, particularly the functionalists, argue that as cooperative relations between states expand, states will become more closely tied to cooperative activities and to each other. Conflict then becomes more expensive and will decline as a mode of interaction. The results presented here challenge this normatively appealing logic. Cooperation between states does not tend to grow. Indeed, cooperative processes contain forces which tend to limit further cooperation. As states are more closely drawn together, there is a loss of independence which discourages yet closer relationships. Cooperation also

offers states the opportunity to identify new and perhaps deeper conflicts of interest, which could lead to increased levels of conflict.[1] Thus, hopes that international cooperation will grow and displace conflict are misplaced. Cooperation does not grow, and may actually generate conflict.

The instability in the cooperative process also has the potential to disrupt the international system. Under conditions of instability, the relations between states are changing constantly. This would tend to increase the levels of uncertainty among decision-makers, reducing the amount of reliable information available. Under these circumstances, decision-makers will be less confident of their relations with other states, and more unsure of the responses their own actions are likely to elicit. This could increase the probabilities that distrust and mis-perception will become important elements of the images decision-makers have of one another. Such factors would be likely to increase the level of conflict between states.

The neo-functionalists argue that providing for institutionalized cooperation through an international organization is a means of promoting cooperative relations. The results challenge this notion as well. While an IGO may be successful in dealing with the limited set of problems for which it was created, growth of activity in an

IGO does not promote cooperation outside the arena of the organization. Further, there is evidence that the creation of new IGOs can serve to restrain states from pursuing increased cooperation. Thus, organized cooperation in international institutions would not appear to be a means of encouraging peaceful problem-solving more generally.

These results offer little hope to those who would improve the world by advocating greater cooperation among nations. This is not to say that cooperation is unable to solve problems. Rather, there are forces working to limit cooperation, and that cooperation is capable of creating difficulties as well as resolving them. In a sense, cooperation contains the seeds of its own failure. The reasons for this can be found in the nature of the inter-national system. The nation-state is the dominant actor in international politics. Each state pursues its own interests, however defined, and those interests do at times conflict. A fundamental goal of states is safe-guarding their independence and freedom to pursue their objectives in their own way. Cooperation, however successful, undermines this ability. Thus, until the forces that maintain the state as the major actor in international politics weaken, there is little prospect that cooperation among states will either expand or resolve the most difficult issues dividing them. And there are currently

no grounds on which to predict the demise of the nation-state.

Notes to Chapter VI

1. The classic example of such effects is the European Community. While the EC has been successful in dealing with economic issues, particularly the removal of trade barriers, it has not progressed beyond economic cooperation to cooperate on more purely political issues. In addition, economic cooperation has generated its share of conflict, such as the agricultural crisis of 1965, current debates over contributions to the EC budget, or the French-Italian wine wars.

APPENDICES

APPENDIX A.   THE REDUCED FORM EQUATIONS

The reduced form equations express each endogenous
variable as a function of the predetermined variables and
disturbances. These equations are used to generate the
instrumental variables for the estimation process, the
forecasts used in the model evaluation in Appendix B, and
the ex ante forecasts. In addition, the parameters of the
fundamental dynamic equations are defined in terms of the
reduced form coefficients. The reduced form equations are:

$$Y_{12t} = \gamma_{11} + \gamma_{12}C_{12t-1} + \gamma_{13}C_{21t-1} + \gamma_{14}\Delta Y_{21t-1}$$
$$+ \gamma_{15}\Delta Y_{12t-1} + \gamma_{16}CB_{21t} + \gamma_{17}CB_{12t} + \gamma_{18}IGO_t$$
$$+ \omega_{1t}$$

$$Y_{21t} = \gamma_{21} + \gamma_{22}C_{21t-1} + \gamma_{23}C_{12t-1} + \gamma_{24}\Delta Y_{12t-1}$$
$$+ \gamma_{25}\Delta Y_{21t-1} + \gamma_{26}CB_{12t} + \gamma_{27}CB_{21t} + \gamma_{28}IGO_t$$
$$+ \omega_{2t}$$

where: $\gamma_{11} = (\alpha_1 + \beta_{11}\alpha_2)/(1 - \beta_{11}\beta_{21})$

$\gamma_{12} = \beta_{11}\beta_{22}/(1 - \beta_{11}\beta_{21})$

$\gamma_{13} = \beta_{12} / (1 - \beta_{11}\beta_{21})$

$\gamma_{14} = \beta_{11}\beta_{23} / (1 - \beta_{11}\beta_{21})$

$\gamma_{15} = \beta_{13} / (1 - \beta_{11}\beta_{21})$

$$\gamma_{16} = \beta_{11}\beta_{24}/(1 - \beta_{11}\beta_{21})$$

$$\gamma_{17} = \beta_{14} \ /(1 - \beta_{11}\beta_{21})$$

$$\gamma_{18} = (\beta_{11}\beta_{25} + \beta_{15})/(1 - \beta_{11}\beta_{21})$$

$$\omega_{1t} = (\beta_{11}e_{2t} + e_{1t})/(1 - \beta_{11}\beta_{21})$$

$$\gamma_{21} = (\alpha_2 + \beta_{21}\alpha_1)/(1 - \beta_{21}\beta_{11})$$

$$\gamma_{22} = \beta_{21}\beta_{12} \ /(1 - \beta_{21}\beta_{11})$$

$$\gamma_{23} = \beta_{22} \ /(1 - \beta_{21}\beta_{11})$$

$$\gamma_{24} = \beta_{21}\beta_{13} \ /(1 - \beta_{21}\beta_{11})$$

$$\gamma_{25} = \beta_{23} \ /(1 - \beta_{21}\beta_{11})$$

$$\gamma_{26} = \beta_{21}\beta_{14}/(1 - \beta_{21}\beta_{11})$$

$$\gamma_{27} = \beta_{24} \ /(1 - \beta_{21}\beta_{11})$$

$$\gamma_{28} = (\beta_{21}\beta_{15} + \beta_{25})/(1 - \beta_{21}\beta_{11})$$

$$\omega_{2t} = (\beta_{21}e_{1t} + e_{2t})/(1 - \beta_{21}\beta_{11})$$

APPENDIX B.   A FORECAST EVALUATION

This appendix presents an alternative means, based on
the generation and evaluation of forecasts, for testing
the model.   The standard means of model evaluation in
political science are goodness-of-fit measures, such as R^2.
Such criteria, however, do not necessarily provide evidence
that a model is either "good" or accurate.   As Choucri
notes, R^2 may be high without a good model if the equation
is essentially trivial.   Similarly, a low R^2 does not
necessarily indicate an invalid model (Choucri, 1978:186).
Ostrom (1977 and 1978a) provides examples of how such
measures can be misleading within the context of a Richardson-
type arms race model.   An alternative means for the
evaluation of the model of international cooperation makes
use of forecasting techniques.

Ostrom (1978a:66) provides a simple statement of the
logic of basing the evaluation of a model on its ability
to generate forecasts:

> ...given that underlying each model is the
> assertion that it accurately represents the
> manner in which a series of inputs is trans-
> lated into a specific output, a model can be
> evaluated in terms of the accuracy of these
> translations.

Two types of forecasts are commonly used.   Historical fore-
casts test the model's ability to replicate the sample data
used to estimate the coefficients of the model.   Ex post

forecasts evaluate the ability of the model to predict the values of the dependent variables beyond the sample. Thus, the data are divided into a sample period, used to generate the historical forecasts, and a nonsample period used to generate the ex post forecasts. The sample period for the British-French model is 1948-1972, for the French-German model it is 1950-1973, and for the British-German model it is 1950-1972. The nonsample period is 1973-1978 for models involving Britain, and 1974-1978 for the French-German model. The models that include Britain use a sample period through 1972 because Britain joined the EC in 1973. If the sample period was extended to incorporate sufficient data for reliable estimates of the IGO variable, there would be a lack of data to generate ex post forecasts. Thus, the sample period estimation of the British-French and British-German models exclude the IGO variable, and the ex post forecasts do not include this factor. This is unfortunate, but necessary due to the nature of the data. The major impact will be to reduce the accuracy of the ex post forecasts, making the test more conservative. The models are estimated for the sample period. The reduced form of the model (see Appendix A) is then used to generate historical forecasts for the sample period and ex post forecasts for the nonsample period. Judgments about the adequacy of the model rest on the accuracy of these forecasts.

To make this judgment it is necessary to have a standard of accuracy against which the forecasts can be evaluated. This is the function of a naive model. A naive model is a simple alternative representation of the process, not necessarily informed by theory, that serves as an alternative hypothesis and as a standard by which the specified model is judged. Only if the specified model yields more accurate forecasts than the naive model is it accepted as adequate. The naive model used here is a simple first-order autoregressive model:

$$Y_{ijt} = a_i + b_i Y_{ijt-1}$$

This naive model is chosen because it can control for a plausible alternative source of cooperative behavior. It could be argued that the patterns of cooperation are due not to the dynamic process specified, but to economic growth or a general maturing or development of the inter-national system. The naive model is a simple represen-tation of such a developmental process. The naive model is used to generate a second set of historical and ex post forecasts following the same procedure outlined above.

A decision about the adequacy of the model is based on a comparison of the historical and ex post forecasts it generates with the forecasts of the naive model. The fore-casts of the theoretical model are compared to those of the

naive model using the coefficient of inequality, U_d^p , developed by Theil (1966:27):

$$U_d^p = RMSE_{theoretical}/RMSE_{naive}$$

where: p = the type of forecast (historical or ex post)

d = the dependent variable

When the theoretical and naive models produce equally accurate forecasts, $U_d^p = 1$. If the theoretical model yields perfect forecasts, $U_d^p = 0$. When the theoretical model produces more accurate forecasts than the naive model, $U_d^p < 1$; only in this case is the model accepted as adequate. Thus, an overall judgment of the adequacy of the model is based on the twelve values of U_d^p from the historical and ex post forecasts of each equation in three estimated models.

The historical and ex post forecasts are generated from the estimated reduced form of the models. The reduced form coefficients are derived from the estimates of the structural form parameters presented in Tables 12-14. The estimated reduced form of each model is presented below:

<u>British (nation 1) - French (nation 2) model</u>

$$Y_{12t} = 230.18 + .146C_{12t-1} - 1.60C_{21t-1} - .866\Delta Y_{21t-1}$$
$$+ .275\Delta Y_{12t-1} + 1.937CB_{21t} + .158CB_{12t}$$

$$Y_{21t} = 208.56 - 1.058C_{21t-1} + .160C_{12t-1} + .182\Delta Y_{12t-1}$$
$$- .95 \, \Delta Y_{21t-1} + .104CB_{12t} + 2.128CB_{21t}$$

TABLE 12

STRUCTURAL ESTIMATES OF BRITISH-FRENCH
COOPERATION, 1950-1972

Equation		Britain	France
Technique		2SLS-GLS	2SLS-GLS
Constant	α_i	40.39	56.64
	(SE)	(29.70)	(62.93)
	(t)	(1.36)	(.90)
Reaction	β_{i1}	.91	.66
	(SE)	(.14)	(.32)
	(t)	(6.40)**	(2.06)*
Conflict	β_{i2}	-.64	.06
	(SE)	(.23)	(.58)
	(t)	(-2.37)**	(.11)
Spillover	β_{i3}	.11	-.38
	(SE)	(.11)	(.18)
	(t)	(1.00)	(-2.14)*
Costs-Benefits	β_{i4}	.06	.85
	(SE)	(.42)	(.93)
	(t)	(.15)	(.91)

* $p < .05$

** $p < .01$

TABLE 13

STRUCTURAL ESTIMATES OF FRENCH-GERMAN
COOPERATION, 1952-1973

Equation		France	Germany
Technique		2SLS-GLS	2SLS-GLS
Constant	α_i	-120.70	41.09
	(SE)	(98.13)	(45.65)
	(t)	(-1.23)	(.90)
Reaction	β_{i1}	1.50	.78
	(SE)	(.34)	(114)
	(t)	(4.45)**	(5.79)**
Conflict Reaction	β_{i2}	.29	-.14
	(SE)	(.26)	(.18)
	(t)	(1.11)	(-.80)
Spillover	β_{i3}	-.25	-.27
	(SE)	(.11)	(.14)
	(t)	(-2.17)*	(-1.91)*
Costs-Benefits	β_{i4}	.57	.74
	(SE)	(1.02)	(1.01)
	(t)	(.56)	(.73)
IGO	β_{i5}	-.03	.017
	(SE)	(.02)	(.01)
	(t)	(-1.39)	(1.55)

   * $p < .05$

  ** $p < .01$

TABLE 14

STRUCTURAL ESTIMATES OF BRITISH-GERMAN
COOPERATION, 1952-1972

Equation		Britain	Germany
Technique		2SLS-GLS	2SLS-GLS
Constant	α_i	74.09	80.56
	(SE)	(129.98)	(56.34)
	(t)	(.57)	(1.43)
Reaction	β_{i1}	.75	.52
	(SE)	(.35)	(.27)
	(t)	(2.14)*	(1.94)*
Conflict Reaction	β_{i2}	-.03	.02
	(SE)	(.81)	(.63)
	(t)	(-.04)	(.04)
Spillover	β_{i3}	-.08	-.31
	(SE)	(.10)	(.13)
	(t)	(-.74)	(-2.30)*
Costs-Benefits	β_{i4}	.15	-1.77
	(SE)	(1.25)	(1.07)
	(t)	(.12)	(-1.65)

  * $p < .05$

  ** $p < .01$

French (nation 1) - German (nation 2) model

$$Y_{12t} = 347.44 + 1.235C_{12t-1} - 1.706C_{21t-1} + 2.38\Delta Y_{21t-1}$$
$$+ 1.353\Delta Y_{12t-1} - 6.529CB_{21t} - 3.353CB_{12t}$$
$$+ .056IGO_t$$

$$Y_{21t} = 312.09 - 1.33C_{21t-1} + .824C_{12t-1} + 1.055\Delta Y_{12t-1}$$
$$+ 1.588\Delta Y_{21t-1} - 2.165CB_{12t} - 4.353CB_{21t}$$
$$+ .05IGO_t$$

British (nation 1) - German (nation 2) model

$$Y_{12t} = 220.51 + .027C_{12t-1} - .048C_{21t-1} - .381\Delta Y_{21t-1}$$
$$- .126\Delta Y_{12t-1} - 2.176CB_{21t} + .246CB_{12t}$$
$$Y_{21t} = 195.22 - .025C_{21t-1} + .036C_{12t-1} - .066\Delta Y_{21t-1}$$
$$- .509\Delta Y_{12t-1} + .128CB_{12t} - 2.902CB_{21t}$$

Because there is no information on which to assign a value to the error term, it is given its expected value of zero.

The actual values of cooperation and the historical and ex post forecast values from both the naive and the theoretical model, along with the summary statistics, are presented in Tables 15, 16, and 17,. The coefficients of inequality for each of the models, comparing the forecasts of the theoretical models to those of the naive model, are presented in Tables 18, 19, and 20. For each of the

TABLE 15

ACTUAL VALUES AND HISTORICAL AND EX POST FORECAST VALUES
FOR BRITISH-FRENCH COOPERATION

Type of Forecast	Year	Britain			France		
		Actual	Theoretical Model	Naive Model	Actual	Theoretical Model	Naive Model
Historical	1950	207	187	216	192	255	213
	1951	253	254	194	246	279	187
	1952	224	206	217	187	227	207
	1953	438	341	202	355	371	185
	1954	225	230	311	198	228	247
	1955	346	392	203	420	338	189
	1956	391	399	264	394	319	271
	1957	281	315	287	310	260	261
	1958	188	149	231	212	208	230
	1959	276	395	184	444	265	194
	1960	69	93	229	89	120	280
	1961	220	178	124	177	240	148
	1962	122	143	200	119	125	181
	1963	130	88	151	67	119	160
	1964	53	120	155	153	79	140
	1965	18	46	116	26	54	172

TABLE 15 - <u>Continued</u>

Type of Forecast	YEAR	Britain			France		
		Actual	Theoretical Model	Naive Model	Actual	Theoretical Model	Naive Model
	1966	116	102	98	76	126	125
	1967	182	176	148	212	176	144
	1968	6	-43	181	36	52	194
	1969	71	97	92	126	90	129
	1970	124	144	125	122	109	162
	1971	110	90	152	86	116	161
	1972	173	117	144	91	177	147
RMSE[1]			44.73	95.38		59.89	110.58
Ex Post	1973	354	503	177	505	313	149
	1974	60	92	269	43	95	302
	1975	167	165	119	178	215	131
	1976	187	323	173	200	179	181
	1977	118	181	184	154	143	190
	1978	257	295	149	321	250	172
RMSE			71.62	124.86		88.11	191.39

[1]Root Mean Square Error

TABLE 16

ACTUAL VALUES AND HISTORICAL AND EX POST FORECAST VALUES
FRENCH-GERMAN COOPERATION

Type of Forecast	Year	France			Germany		
		Actual	Theoretical Model	Naive Model	Actual	Theoretical Model	Naive Model
Historical	1952	284	210	422	246	275	278
	1953	178	169	331	169	184	282
	1954	234	146	278	135	212	229
	1955	508	599	306	463	419	205
	1956	224	94	443	169	220	433
	1957	342	439	301	356	313	229
	1958	214	180	360	215	223	259
	1959	588	723	296	552	492	261
	1960	233	137	483	187	202	495
	1961	434	491	306	367	367	242
	1962	259	222	406	259	255	366
	1963	270	311	319	286	265	291
	1964	244	278	324	268	246	310
	1965	194	109	311	137	185	298
	1966	421	487	286	406	360	207
	1967	515	611	400	522	471	393

TABLE 16 - Continued

Type of Forecast	Year	France			Germany		
		Actual	Theoretical Model	Naive Model	Actual	Theoretical Model	Naive Model
	1968	498	423	447	419	478	474
	1969	514	577	438	534	499	402
	1970	658	597	446	568	608	482
	1971	470	473	518	485	460	506
	1972	359	378	424	387	370	448
	1973	458	400	369	426	467	380
RMSE			74.38	144.4		39.40	150.4
Ex Post	1974	77	-173	418	69	182	407
	1975	255	130	228	229	306	160
	1976	178	-22	317	185	269	271
	1977	142	-30	278	144	223	240
	1978	366	361	260	413	298	212
RMSE			172.08	182.3		80.24	187.8

TABLE 17

ACTUAL VALUES AND HISTORICAL AND EX POST FORECAST VALUES
FOR BRITISH-GERMAN COOPERATION

Type of Forecast	Year	Britain			Germany		
		Actual	Theoretical Model	Naive Model	Actual	Theoretical Model	Naive Model
Historical	1952	249	130	274	103	126	177
	1953	265	133	216	153	189	161
	1954	240	182	220	143	205	170
	1955	262	279	214	268	184	168
	1956	184	170	219	131	155	190
	1957	278	224	174	191	196	166
	1958	155	212	223	192	146	176
	1959	383	366	192	373	275	176
	1960	171	174	250	161	148	209
	1961	364	365	196	365	265	171
	1962	316	312	245	332	272	207
	1963	124	137	233	77	167	201
	1964	94	212	184	165	144	156
	1965	131	158	177	108	165	172
	1966	132	155	186	114	153	162
	1967	150	184	187	151	131	163

TABLE 17 - Continued

Type of Forecast	Year	Britain			Germany		
		Actual	Theoretical Model	Naive Model	Actual	Theoretical Model	Naive Model
	1968	167	179	191	145	139	169
	1969	192	222	195	202	154	168
	1970	148	158	202	116	147	178
	1971	53	121	191	63	77	163
	1972	122	127	167	69	84	154
RMSE			55.35	88.89		59.22	87.14
Ex Post	1973	424	382	184	429	231	155
	1974	57	84	260	61	19	219
	1975	156	236	168	188	120	153
	1976	197	198	193	184	124	176
	1977	160	169	203	139	116	175
	1978	260	348	368	166	167	
RMSE			52.85	132.39		122.77	154.44

TABLE 18

INEQUALITY RATIOS FOR BRITISH-FRENCH
COOPERATION

Type of forecast	Equation	U
Historical	Britain	.46
	France	.54
Ex Post	Britain	.57
	France	.46

TABLE 19

INEQUALITY RATIOS FOR FRENCH-GERMAN
COOPERATION

Type of forecast	Equation	U
Historical	France	.52
	Germany	.26
Ex Post	France	.94
	Germany	.43

TABLE 20

INEQUALITY RATIOS FOR BRITISH-GERMAN
COOPERATION

Type of forecast	Equation	U
Historical	Britain	.62
	France	.70
Ex Post	Britain	.40
	France	.79

cases under investigation, for both the historical and ex post forecasts, the theoretical model produces more accurate forecasts than does the naive model. In most cases, the improvement in forecast accuracy is substantial; only for the ex post forecasts of French cooperation toward Germany is the theoretical model only marginally more accurate than the naive model. Perhaps the most impressive evidence of the success of the model is that it produces more accurate ex post forecasts of British-French and British-German cooperation than does the naive model, in spite of the fact that there is reason to believe the process of cooperation changed at the beginning of the nonsample period when Britain joined the EC, a change which is not reflected in the models estimated over the sample period data. Thus, the evidence is clear and consistent: the theoretical model is a more accurate forecasting tool than the autoregressive naive model. For this reason, the model is accepted as an adequate representation of the process of international cooperation.

APPENDIX C.   DERIVATION OF STABILITY PROPERTIES

This appendix presents the fundamental dynamic equations (as derived from the reduced form equations) and the Schur theorem matrices for each of the six estimated equations.

British Cooperation Toward France

$$Y_{12t} + .537Y_{12t-1} + .107Y_{12t-2} + .034Y_{12t-3} = C$$

$$\Delta_1 = \begin{vmatrix} 1 & .034 \\ .034 & 1 \end{vmatrix} = 1.0$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & .034 & .107 \\ .537 & 1 & 0 & .034 \\ .034 & 0 & 1 & .537 \\ .107 & .034 & 0 & 1 \end{vmatrix} = .989$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & .034 & .107 & .537 \\ .537 & 1 & 0 & 0 & .034 & .107 \\ .107 & .537 & 1 & 0 & 0 & .034 \\ .034 & 0 & 0 & 1 & .537 & .107 \\ .107 & .034 & 0 & 0 & 1 & .537 \\ .537 & .107 & .034 & 0 & 0 & 1 \end{vmatrix} = .745$$

French Cooperation Toward Britain

$$Y_{21t} + .537Y_{21t-1} - .712Y_{21t-2} + .034Y_{21t-3} = C$$

$$\Delta_1 = \begin{vmatrix} 1 & .034 \\ .034 & 1 \end{vmatrix} = 1.0$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & .034 & -.712 \\ .537 & 1 & 0 & .034 \\ .034 & 0 & 1 & .537 \\ -.712 & .034 & 0 & 1 \end{vmatrix} = .464$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & .034 & -.712 & .537 \\ .537 & 1 & 0 & 0 & .034 & -.712 \\ -.712 & .537 & 1 & 0 & 0 & .034 \\ .034 & 0 & 0 & 1 & .537 & -.712 \\ -.712 & .034 & 0 & 0 & 1 & .537 \\ .537 & -.712 & .034 & 0 & 0 & 1 \end{vmatrix} = -.727$$

French Cooperation Toward Germany

$$Y_{12t} + 127.03Y_{12t-1} - 41.98Y_{12t-2} - 14.78Y_{12t-3} = C$$

$$\Delta_1 = \begin{vmatrix} 1 & -14.78 \\ -14.78 & 1 \end{vmatrix} = -217.33$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & -14.78 & -41.98 \\ 127.03 & 1 & 0 & -14.78 \\ -14.78 & 0 & 1 & 127.03 \\ -41.98 & -14.78 & 0 & 1 \end{vmatrix} = -3.32 \times 10^5$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & -14.78 & -41.98 & 127.03 \\ 127.03 & 1 & 0 & 0 & -14.78 & -41.98 \\ -41.98 & 127.03 & 1 & 0 & 0 & -14.78 \\ -14.78 & 0 & 0 & 1 & 127.03 & -41.98 \\ -41.98 & -14.78 & 0 & 0 & 1 & 127.03 \\ 127.03 & -41.98 & -12.78 & 0 & 0 & 1 \end{vmatrix}$$

$$= -4.6 \times 10^{10}$$

German Cooperation Toward France

$$Y_{21t} + 127.03Y_{21t-1} - 55.59Y_{21t-2} - 14.78Y_{21t-3} = C$$

$$\Delta_1 = \begin{vmatrix} 1 & -14.78 \\ -14.78 & 1 \end{vmatrix} = -217.33$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & -14.78 & -55.49 \\ 127.03 & 1 & 0 & -14.78 \\ -14.78 & 0 & 1 & 127.03 \\ -55.49 & -14.78 & 0 & 1 \end{vmatrix} = 3.27 \times 10^6$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & -14.78 & -55.49 & 127.03 \\ 127.03 & 1 & 0 & 0 & -14.78 & -55.49 \\ -55.49 & 127.03 & 1 & 0 & 0 & -14.78 \\ -14.78 & 0 & 0 & 1 & 127.03 & -55.49 \\ -55.49 & -14.78 & 0 & 0 & 1 & 127.03 \\ 127.03 & -55.49 & -14.78 & 0 & 0 & 1 \end{vmatrix}$$

$$= -4.00 \times 10^{10}$$

British Cooperation Toward Germany

$$Y_{12t} + .633Y_{12t-1} - .023Y_{12t-2} - .012Y_{12t.3} = C$$

$$\Delta_1 = \begin{vmatrix} 1 & -.012 \\ -.012 & 1 \end{vmatrix} = 1.00$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & -.012 & -.023 \\ .633 & 1 & 0 & -.012 \\ -.012 & 0 & 1 & .633 \\ -.023 & -.012 & 0 & 1 \end{vmatrix} = .999$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & -.012 & -.023 & .633 \\ .633 & 1 & 0 & 0 & -.012 & -.023 \\ -.023 & .633 & 1 & 0 & 0 & -.012 \\ -.012 & 0 & 0 & 1 & .633 & -.023 \\ -.023 & -.012 & 0 & 0 & 1 & .633 \\ .633 & -.023 & -.012 & 0 & 0 & 1 \end{vmatrix}$$

$$= .586$$

German Cooperation Toward Britain

$$Y_{21t} + .633Y_{21t-1} - .586Y_{21t-2} - .012Y_{21t-3} = C$$

$$\Delta_1 = \begin{vmatrix} 1 & -.012 \\ -.012 & 1 \end{vmatrix} = 1.00$$

$$\Delta_2 = \begin{vmatrix} 1 & 0 & -.012 & -.586 \\ .633 & 1 & 0 & -.012 \\ -.012 & 0 & 1 & .633 \\ -.586 & -.012 & 0 & 1 \end{vmatrix} = .665$$

$$\Delta_3 = \begin{vmatrix} 1 & 0 & 0 & -.012 & -.586 & .633 \\ .633 & 1 & 0 & 0 & -.012 & -.586 \\ -.586 & .633 & 1 & 0 & 0 & -.012 \\ -.012 & 0 & 0 & 1 & .633 & -.586 \\ -.586 & -.012 & 0 & 0 & 1 & .633 \\ .633 & -.586 & -.012 & 0 & 0 & 1 \end{vmatrix}$$

$$= -.534$$

APPENDIX D. DATA FOR EX ANTE FORECASTING

This appendix presents the data used for the ex ante forecasting procedure. The three scenarios are described in Chapter V.

TABLE 21

DATA FOR EX ANTE FORECASTING

Year	France		Germany		
	C_{12t-1}	CB_{12t}	C_{21t-1}	CB_{21t}	IGO_t
SCENARIO I					
1979	016	-17.1	000	19.4	4100
1980	026	-16.8	018	20.2	4140
1981	008	-16-2	006	19.8	4075
1982	012	-15.8	020	22.0	3900
1983	040	-16.4	032	22.4	3850
1984	028	-18.0	016	23.1	4160
1985	006	-17.7	000	22.8	4220
1986	000	-17.1	006	22.6	4000
1987	016	-17.6	012	21.9	4150
1988	022	-19.1	018	22.1	3980
1989	018	-18.5	010	21.5	4200
1990	010	-17.5	006	20.0	4000

TABLE 21 - <u>Continued</u>

Year	France		Germany		
	C_{12t-1}	CB_{12t}	C_{21t-1}	CB_{21t}	IGO_t

<div align="center">SCENARIO II</div>

Year	C_{12t-1}	CB_{12t}	C_{21t-1}	CB_{21t}	IGO_t
1979	016	-21.0	000	25.2	3200
1980	030	-26.2	016	31.4	2600
1981	054	-25.8	048	30.8	1800
1982	082	-29.1	068	35.6	1550
1983	090	-32.4	082	39.1	1760
1984	100	-40.1	-94	42.3	1490
1985	094	-42.0	088	43.0	1220
1986	122	-46.4	112	45.7	1350
1987	154	-43.2	140	43.5	800
1988	136	-39.7	122	40.6	1075
1989	110	-40.1	098	40.8	1100
1990	098	-38.8	086	39.1	1210

<div align="center">SCENARIO III</div>

Year	C_{12t-1}	CB_{12t}	C_{21t-1}	CB_{21t}	IGO_t
1979	016	-14.3	000	15.0	4600
1980	004	-10.1	006	13.8	4750
1981	002	- 8.4	004	8.8	5310
1982	000	- 4.9	000	5.4	5560
1983	006	- 3.2	010	3.5	7100

TABLE 21 - <u>Continued</u>

Year	France		Germany		
	C_{12t-1}	CB_{12t}	C_{21t-1}	CB_{21t}	IGO_t
1984	004	− 4.0	008	4.6	8060
1985	000	− 4.4	000	4.8	8120
1986	000	− 2.8	000	3.0	8090
1987	004	− 3.5	008	3.2	8250
1988	004	− 3.9	006	4.4	8100
1989	000	− 3.0	002	3.3	7900
1990	000	− 2.0	000	2.4	8000

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