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**Working Paper — Digitized Version**

## The evolution of power, threat, and security: Past and potential developments

WZB Discussion Paper, No. IIVG dp 84-103

**Provided in Cooperation with:**

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*Suggested Citation:* Cusack, Thomas R. (1984) : The evolution of power, threat, and security: Past and potential developments, WZB Discussion Paper, No. IIVG dp 84-103, Wissenschaftszentrum Berlin (WZB), Berlin

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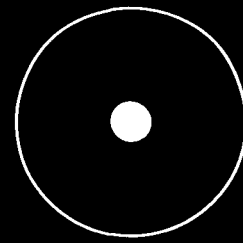
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IIVG/dp 84-103

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PAST AND POTENTIAL DEVELOPMENTS

by

Thomas R. Cusack

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Wissenschaftszentrum Berlin

IIVG/dp 84-103

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Publication Series of the International Institute  
for Comparative Social Research/Global Developments  
Science Center Berlin  
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## ABSTRACT

This paper describes the development of the international military situation over the past three decades and explores the potential for its transformation under different assumptions regarding economic conditions and the character of international relations. Using newly derived indices in the conventional military area, an assessment is made of the shifting tides in the power, threat and security situation that has confronted twenty-five important states in the international system during the recent past. The past is then contrasted with some possible alternative developments. These developments are assayed using a global simulation model, GLOBUS, developed at the Science Center Berlin.

## ZUSAMMENFASSUNG

Die Entwicklung der internationalen militaerischen Gesamtsituation der letzten 30 Jahre wird in diesem Papier nachgezeichnet. Zugleich wird der Frage nach dem zukuenftigen Wandel dieser Lage in Abhaengigkeit der wirtschaftlichen Rahmenbedingungen und der internationalen Beziehungen nachgegangen. Auf der Grundlage neu entwickelter Indices konventioneller, militaerischer Macht erfolgt eine Bewertung des wechselhaften internationalen Machtgefueges, der Bedrohung und der Sicherheitssituation der wichtigsten 25 Staaten des internationalen Systems in der juengeren Vergangenheit. Der Ablauf in der Vergangenheit wird dann einer Reihe moeglicher zukuenftiger Entwicklungen gegenuebergestellt. Diese Entwicklungen werden mit Hilfe des Weltmodells GLOBUS, das am WZB entwickelt wurde, simuliert.

## INTRODUCTION

In an anarchic international system power is viewed as a factor critical to the survival of the state. Who possesses it and who threatens or seems to threaten its use are genuine concerns to those who guide the foreign policies of their nations. Concern takes many forms, but it frequently manifests itself in policies designed to enhance a nation's own power position. Such reactions have the potential to evolve into a mutually stimulative relationship between or among two or more states. Each state ensnared in such a relationship acts as if it sees its security threatened by the power of another or others; each hastens to counter that threat by increasing its own power with the consequence that the other or others sees itself or see themselves, in turn, threatened. There is some evidence to suggest that such a vicious spiral culminates in war as one or more states seek to prevent an opponent from gaining hegemony (Wallace, 1982).

The way in which power is distributed within any system is thought to be a rather important factor in the way that system operates. Balance of power theorists suggest that relatively egalitarian distributions are more likely to foster peaceful relations among states. With an equally plausible stance are those who maintain that systems wherein power is distributed in an inegalitarian or hierarchical manner are those most prone to preserving peaceful relations among member states. Although the evidence is somewhat

mixed, at least one study would suggest that the latter has characterized the 20th century (Singer, Bremer, and Stuckey, 1972; Siverson and Sullivan, 1983).

Interest in military power, in the way it is distributed, and in the real or perceived threat it poses have marked the endeavors of a fair number of international relations scholars. Studies focusing on the accumulation of arms, the likelihood that arms races lead to violent confrontation, and the more general nexus between military power and conflict have flourished during the past score years. Unfortunately, this interest in military power has not led to any extensive effort at the development of direct measures of military power. More frequently, items such as defense expenditures or composites of many variables--most of which have no direct relation to military power--have been employed in these studies. Although the use of such surrogates is clearly a second-best solution, or perhaps no solution at all, only a few scholars have attempted to develop direct measures (Lambelet, 1973; Luterbacher, Allen, and Imhoff, nd; Mihalka, 1975, 1980). These efforts, however, have been fairly limited and restricted in scope. For the major share of research in this area, then, we are confronted with results of at best questionable utility.

It is not likely that the importance of military power will diminish in the near future. And the list of questions detailed below, which will be addressed in this paper,

attest to this consideration.

Has the international system become more militarized? By this we mean to what extent has the accumulation of arms across the system accelerated or decelerated? Regardless of constancy or change in the overall amount of capabilities within the system, the distribution therein may have changed in significant ways. As noted above, the degree of concentration and its change through time has been suggested as important in the preservation of international peace. Has this distribution been altered in any significant way? Is power becoming more or less concentrated and at what speed?

Of course, systemic distributions are not the only ones that draw the attention of practitioners and theorists alike. Certain sets of states ostensibly have been engaged in competitive efforts to counter threats to their security through the accumulation of military power. Has, for instance, the balance of military capabilities between East and West undergone significant change through the past decades? Have particular dyads within this intensely conflictual subsystem experienced shifts in the relative power position of their components? Has, as some argue given the great expansion in North to South arms trade, a shift in the relative military capacity of the Third World occurred?

Often the possession of power is confused with the intention to use it. Whatever the potential, a degree of certainty arises because through actions and statements the intended purpose of that power is signalled by states. Threat, while it relies upon power, must be seen in light of the international context within which the latter is possessed. While, for example, East Germany, West Germany, and France all possess significant military power, the conflictual and cooperative ties maintained by these states reveals a great deal about the object of the potential use of their military power. The past thirty years have witnessed significant ebbs and flows in conflictual and cooperative relations among states. In combination with the potential for change in power distributions, this suggests that the distribution of threat within the system may have undergone transformation. How concentrated has threat been in the system? Have changes occurred in ways that signal growing concentration or appreciating diffusion of threat? At another level, and at least equally important is the question: who threatens whom? While systemic characteristics reveal potentially dangerous situations, less macroscopic analyses may help illuminate changing tides in the threat relations among specific states and in the position of one or more states in the system.

Power and the expression of actions and statements that signal hostile intent combine to produce a threat situation.



It is frequently argued that threat engenders a counter-response, part of which is the accumulation of power to counter that threat. The intended purpose is to ensure or enhance security. These propensities, however, can be severely constrained by resource limitations. The evolution of threat as well is not only dependent upon power, but is also influenced by developments in the tenor of relations between states. Under alternative assumptions regarding both of these considerations, we might expect to see rather varied patterns in power and threat distributions. We will explore some possible developments in the distribution of power and threat, given some experimentally controlled situations, by using a global simulation model designed in part to address such problems.

It should be pointed out that the context within which this work was undertaken imposes some critical restrictions on the nature of what is reported here. The work itself was produced in conjunction with the GLOBUS Project at the Science Center Berlin. GLOBUS is a project that is attempting to construct a simulation model that can be employed for issue analysis centering on questions dealing with political and economic behavior within and among twenty five major states in the international system. Most of the analysis reported on below focuses only on these twenty five states. It is our contention that this set of states constitutes a significant and highly active subsystem of the

global system of political and economic relations. While questions concentrating on this restricted set of states cannot fully reflect the reality of a system at least six times as large, we do believe many of the results reported on below, even when addressed at a level of analysis higher than the dyadic, will reveal useful information on the broader global system.<sup>1</sup>

In what follows we provide information on questions relating to military power, threat and security in an international subsystem composed of twenty five of the largest and most internationally significant states in the global system during the period extending from 1950 to 1980. The states that comprise this subsystem are enumerated in Table 1 below.<sup>2</sup> The next section of this paper briefly addresses the manner in which we have measured military power. A more detailed explanation has been provided in an earlier paper (see Cusack, 1981). Having described the measurement effort and some of its direct results, certain descriptive information on the concentration of power in this subsystem, rankings and changes in individual and dyadic configurations is put forward. The section that follows this overview of the power situation for this three decade period sets forth a description of the way in which military threat may be assessed. This concept attempts to reveal the combination of power and hostile intent. Again, the focus is the twenty five nation GLOBUS subsystem. Succeeding this section is a

TABLE 1

COUNTRIES IN GLOBUS  
SYSTEM

1. ARG - Argentina
2. BRA - Brazil
3. CAN - Canada
4. CHN - China
5. CZE - Czechoslovakia
6. EGY - Egypt
7. FRG - Federal Republic of Germany
8. FRN - France
9. GDR - German Democratic Republic
10. IND - India
11. INS - Indonesia
12. IRN - Iran
13. ITA - Italy
14. JPN - Japan
15. MEX - Mexico
16. NIG - Nigeria
17. PAK - Pakistan
18. POL - Poland
19. SAF - South Africa
20. SAU - Saudi Arabia
21. TUR - Turkey
22. UKG - United Kingdom
23. USA - United States
24. USSR - Soviet Union
25. VEN - Venezuela

description of an extrapolative exercise intended to reveal the potential for reconfiguration in the military power distribution within this subsystem. The last section attempts to summarize some of the more significant findings of the paper.

## POWER

There are few disciplines as obsessed with a single concept as is international relations with the notion of power. It is not an exaggeration to opine that power and the power politics paradigm pervades much of our thinking, research and writing (Vasquez, 1983). Even while our efforts are so guided, all too frequently our attention flies from the centrality of this concept and we fail to apply ourselves to the critical problem of measuring power. There are many forms and shapes that we attribute to this conceptual deity, but usually any idol will do for liturgical purposes. In the realm of power politics (where, by power, we mean or intend some notion that reflects military power) this failure is all too often the case.

Most work on arms accumulation has focused on the resource allocation question. While we view this as important and worthy of study, it is clearly not the only major question in this area. In addition, it is apparent that this traditional focus has critical implications for the way in

which analysts operationalize certain important concepts; as a consequence, the conclusions they draw from their work are necessarily affected. A clear example of this is to be seen in the vast literature dealing with empirical studies of arms races. In attempting to represent the stimulative factors influencing decisions in the allocation of more or less resources to defense, analysts have almost exclusively represented these as some measure of the defense spending efforts of a nation's putative competitor(s). As a solution to the problem of operationalizing a key concept, this has a certain attraction. Data (of varying quality) are widely available on defense expenditures. But do these figures provide an adequate representation of the military capabilities of a state (the putative stimulus)? The question is rarely asked and even less frequently answered. Defense allocations and changes in these allocations over time may provide some indication of a competitor's strength and intentions. They also say a great deal about the economic situation of that state, the budgetary processes and stresses and strains therein, and the values of political decision-makers. Other factors may also be at work. If decision-makers did stop to think, then an increment in the level of spending of an opponent may have very little direct connection to the stimuli which invoke a response in their own nation's defense spending.

Although it is not a widely held opinion, there is good

reason to assume that a certain level of defense spending in one country does not, when matched in another, buy the same amount of military capability (see, e.g., Lee, 1977; Holzman, 1982; and Becker, 1977). Nations have different basic endowments, their price structures, indeed the mechanisms determining their prices, are often very different, and they face different types of security problems. As a consequence, they are prone to spend their defense budgets in different ways. While these differences may, in part, reflect the "responsiveness" one nation has for another's defense outlays, the essence of the stimulus-response relationship is likely to be poorly captured in an equation system incorporating another's defense spending as the primary international stimuli. The somewhat mediocre performance of the classic arms race formulation when relying on defense expenditure data, despite the imposing variety of sophisticated econometric tools brought to bear in assessing its performance, suggests a need for a reorientation in approach (Stoll, 1982; Russett, 1982).

There are two principal choices here. On the one side, the notion that the arms of an international opponent influence decisions to arm or disarm, to spend more or less on the nation's own military establishment, can be rejected as a significant element in the arms accumulation process. On the other side, alternative measures of key concepts ought

to be developed and used in evaluating the performance of the model. The first choice entails a rejection of the theory while the second entails its acceptance as a potential explanation, the validity and utility of which has yet to be demonstrated. We prefer the second.

What clearly is needed is a measure of the opponent nation's military capabilities, not the costs it confronts. Costs are a central consideration in defense spending decisions; but the question of costs is one decision-makers are likely to attend to only when considering their nation's own defense program. If two states are racing each other to arm, the comparison of defense spending levels is unlikely to be the central focus of decision-makers' concerns. What both sides' money buys, what has been purchased in the past and remains employed, and what consequence these two things have for their relative capabilities are the critical considerations.

Certainly a replacement for the monetary measuring stick is required. Some steps in this direction have already been taken by a number of scholars. To date, however, work in this area has not advanced very far and further effort is clearly required. The following pages serve to summarize a recent attempt at grappling with this problem.

The effort to construct and maintain a conventional military force capability requires states to take into account a

variety of factors. Basic, of course, are those which directly lend themselves to the organized execution of coercive acts. Here, as with most other human endeavors, capital and labor are central ingredients. Capital, in this instance, meaning weapons and associated equipment, facilitate the efforts of the humans engaged in carrying out military tasks. Neither capital nor labor alone is sufficient to accomplish the objectives of the system and both must be combined in some meaningful way. The manner in which they are combined derives directly from the more ethereal factor of doctrine and the more prosaic element of the organizational structure that characterizes the system.

With respect to the first two factors, capital and labor, two principal elements combine to determine the effectiveness of each in generating or producing military capability. On the one side is the sheer quantity of resources engaged. On the other is the quality of these resources. In the case of capital, the principal determinant of quality is usually the technology involved. The quality of the human component, labor, in terms of its susceptibility to organization, its facility with the technology of destruction, and its willingness to engage in the act of violence also plays a important role.

We have enumerated six elements that in their own way contribute to the final determination of the military power of a state. To varying degrees, each has been the subject



of study (Quigley, 1983; Knorr, 1970). In terms of systematically compiled information, the range of variation is even greater. This consideration has had to play a central role in the efforts we have made at measuring capability.

We have been forced to consider only two elements of the six. These are the quantity of labor and the quantity of capital. As is pointed out below, even these two variables pose tremendous problems with respect to data availability.

The operational formula we have used in assessing the conventional military capability of a state takes into account the quantity of labor and capital employed. It is similar to a rather simplified production function and takes the following shape:

$$\text{CAPABILITY} = \text{CAPITAL}^b \times \text{LABOR}^{1-b}$$

- where:
- CAPABILITY = conventional capability index;
- CAPITAL = military capital index;
- LABOR = military labor index;
- b = elasticity of capital .

Thus, we assume that capability is a weighted product of the quantities of capital and labor employed within the military sector. The weighting, which operationally has been set to .5, implies an equal measure of effect with respect the contributions of both capital and labor.

In order to index both military capital and labor, and thus derive a conventional capability score, we originally attempted to analytically derive a composite score for each. These composite scores represented the underlying dimension of quantities in the land, naval, and air components of the military establishments. On the labor side, this meant essentially the number of people actively under arms in each of the three services. On the capital side, a real dearth of information restricted us to the measurement of the quantity of the principal capital item in each of the services. With respect to land forces, the number of tanks were counted. The quantity of sea forces were represented by the number of major surface combatant vessels. Air force capital quantities were represented by the number of fighter and non-strategic bomber aircraft. Initial analysis was restricted to the period 1962 to 1980. The restriction permitted reliance on a source of data, THE MILITARY BALANCE, published annually by the International Institute for Strategic Studies, which was relatively rich and forthcoming in the details required. Still, the scope of the BALANCE's coverage was not complete even for this narrow period. Consultation of most other sources did not prove very useful since, in the main, they relied on the BALANCE for their own information. A few scattered pieces of information were, however, derived from these other sources. With 19 years and 50 countries in our sample, 950 observations for each of the six variables were required.

We succeeded in acquiring simultaneous observations for 88% of the labor variables and 62% of the capital variables. These data were subjected to principal components analysis and a single dimension for both capital and labor were uncovered. In each instance, the range of loadings on each component was relatively narrow, and thus the contribution of any standard unit of a particular variable to the score a country received on one of these dimensions was relatively equal.

Our initial efforts, then, led us to a set of useful measures representing the quantities of capital and labor employed for conventional purposes. This, however, represented but a initial step. Two sources of dissatisfaction existed. One, within the time frame of the study, 1962-1980, nearly forty percent of the country year observations could not receive a capability score while one, the other, or both of the component indices were missing. Two, the temporal domain was felt to be too restricted. An effort was undertaken to deal with both these problems. First, further search for missing component variable observations was undertaken. Second, the data set was extended back to 1950. The first effort brought little success. The second brought only partial success. The latter partial success needs to be described because its results led to a redirection of effort. In the main, our

search for information on capital items for the period from 1950 to 1961 bore little fruit. We were more successful in acquiring information on the personnel items. But even here, information on individual service strengths proved somewhat scanty, and when available, not infrequently inconsistent (across sources or in comparison with information on total military personnel). Our major success was in acquiring nearly complete information on total military personnel.

Given these conditions, we decided on a two-step procedure to develop an initial set of estimates for conventional military capability. First, in measuring the labor component, an index based simply on the single item of total personnel was substituted for the three service index. This new index was again standardized and rescaled. Second, the country specific average capital to labor ratios for those observations with data on both the capital and the (revised) labor items present were computed. These ratios were then used to calculate a nominal level of capital where missing data existed on that item. With the newly defined labor index and the bootstrapped index of capital, the capability scores were then recomputed. With this approach, we were able to develop a capability score for all of the possible observation points (31 years x 50 countries = 1550 observations).

Table 2 provides an overview of the results of the

TABLE 2  
CONVENTIONAL MILITARY CAPABILITY,  
Rankings and Scores, 1950-1980

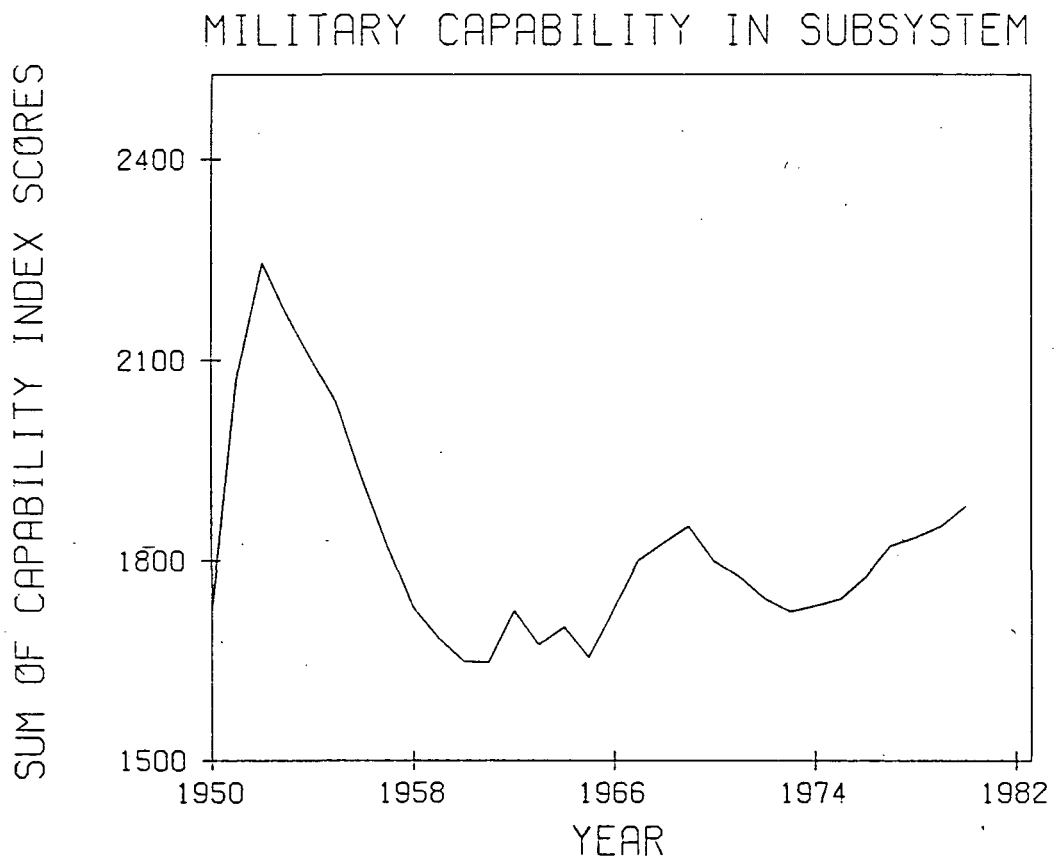
	1950	1955	1960	1965	1970	1975	1980
1.	USR 639.8	USR 863.1	USR 533.7	USR 468.7	USA 489.4	USR 532.9	USR 552.7
2.	CHN 401.6	USA 424.1	USA 358.2	USA 413.2	USR 488.0	USA 329.4	CHN 357.8
3.	USA 215.3	CHN 241.0	CHN 180.0	CHN 199.7	CHN 223.3	CHN 261.3	USA 309.9
4.	UKG 84.0	UKG 98.6	FRN 120.8	FRN 65.6	IND 59.7	IND 67.1	IND 67.7
5.	FRN 70.1	FRN 94.5	UKG 63.2	IND 56.0	FRN 59.6	FRN 58.5	FRN 59.8
6.	TUR 67.4	POL 42.2	CZE 43.5	UKG 53.6	FRG 59.3	FRG 56.0	FRG 58.0
7.	POL 46.1	TUR 41.9	TUR 42.9	FRG 50.2	UKG 47.5	TUR 42.7	TUR 55.4
8.	CZE 35.9	CZE 35.9	JPN 42.6	TUR 43.6	TUR 47.1	POL 42.5	ITA 45.6
9.	BRA 27.3	ITA 32.0	FRG 35.5	POL 41.0	ITA 41.6	UKG 41.7	UKG 41.7
10.	ITA 23.7	JPN 31.7	IND 34.5	ITA 39.3	JPN 40.9	ITA 40.9	JPN 41.6
11.	INS 22.1	IND 25.2	ITA 32.3	JPN 36.5	POL 35.5	JPN 39.8	POL 40.8
12.	IND 22.0	ARG 21.7	BRA 28.5	CZE 30.1	EGY 29.9	EGY 35.1	PAK 34.2
13.	PAK 18.3	PAK 14.8	POL 28.1	BRA 23.7	CZE 27.7	PAK 30.8	EGY 33.8
14.	IRN 9.9	CAN 14.7	ARG 19.0	EGY 22.6	PAK 23.2	BRA 29.2	CZE 28.7
15.	ARG 9.1	BRA 12.7	IRN 18.0	ARG 19.3	BRA 22.9	CZE 27.6	IRN 28.4
16.	EGY 8.2	IRN 11.1	EGY 17.7	CAN 15.7	ARG 20.6	IRN 22.8	BRA 28.3
17.	CAN 5.9	EGY 10.2	PAK 17.3	GDR 15.5	GDR 17.0	GDR 19.6	GDR 22.5
18.	SAU 4.1	INS 7.3	CAN 15.7	INS 15.2	IRN 15.2	ARG 19.6	ARG 17.8
19.	MEX 4.0	SAU 3.5	GDR 15.2	PAK 14.7	INS 13.5	CAN 9.6	INS 12.0
20.	VEN 2.7	MEX 3.5	INS 11.7	IRN 9.9	CAN 12.2	INS 8.2	CAN 10.7
21.	SAF 1.6	VEN 2.7	VEN 3.6	SAU 5.4	SAF 7.7	VEN 7.1	SAF 8.6
22.	GDR 0.0	SAF 2.5	MEX 3.6	MEX 4.9	MEX 5.0	SAF 6.2	MEX 7.5
23.	FRG 0.0	GDR 0.0	SAF 3.5	VEN 4.8	VEN 4.6	MEX 5.4	VEN 6.5
24.	JPN 0.0	FRG 0.0	SAU 3.2	SAF 4.2	NIG 4.4	SAU 4.7	SAU 6.4
25.	NIG 0.0	NIG 0.0	NIG 0.1	NIG 0.2	SAU 3.4	NIG 4.4	NIG 4.8

measurement effort. Data are presented on the power capability index score for each of the twenty five countries at five year intervals. At each observation, the countries are also ranked in terms of their standing. The results reveal a heavy concentration of conventional military power in the top ranks. At no point during the three decade period do we see the same set of three states, the Soviet Union, the People's Republic of China, and the United States with less than sixty (60) percent of the power in this system. The respective capability levels of these three states has not, however, been static--nor has their share of the total amount of capabilities in this system. Early on the two socialist states ranked clearly above the United States. With the passage of time, the US increased its absolute and relative position, reaching the top by 1970 (during its involvement in the Vietnam War) and then retreated in both absolute and relative terms returning to its original third ranking position. Throughout the period, the Soviet Union managed to maintain almost continuous enjoyment of the top rank, with, again, the 1970 exception. However, in absolute terms, its capability has shifted markedly through time, peaking in 1955, diminishing tremendously by 1965, and moving back upward thereafter. Chinese power diminished significantly in the fifties and began an upward movement in the sixties paralleling the trajectory of the Soviets.

Below the top three we can see a variety of patterns. Britain and France, two traditional major powers remained in the upper reaches of the hierarchy but clearly stayed embedded in the ranks of the middle powers. India and the Federal Republic of Germany made significant progress in acquiring power through the period and thus succeeded in replacing Britain and France at the top of the middle-ranking powers. In the main, large and/or developed countries tend to cluster toward the higher reaches while small and/or developing states fall toward the bottom. Obviously, the ability of a country to supply inputs to military power have had a significant impact on its absolute and relative standing within this hierarchy. But the information displayed here suggests that policy and purpose have also played a role.<sup>3</sup>

While the information in Table 2 reveals both stability and change, it is difficult to form a clear picture of trends and developments from it alone. Let us return to the questions outlined in the introduction and proceed with a more detailed analysis. A principal question that can be addressed relates to the concern over the rising militarization of the system. To what extent has the total amount of capabilities in the system increased during this period? Figure 1 allows us to examine this question. The tale it tells is rather surprising. Contrary to the widely held image of a progressively militarized system, we can see

FIGURE 1





some sharp reversals of movement in the total level of arms in the system during this three decade period. The Cold War, or more precisely, the events in Korea, sparked a great surge in the overall level of arms. This surge peaked very quickly and almost as quickly a tremendous decline ensued. By the early sixties, the nadir was reached with the overall level of capabilities in the system slightly less than that which existed in 1950. Within the sixties, an erratic upward movement began which, after a notable reversal in the early seventies, continued with the overall level of capabilities in the system 14% greater by 1980.

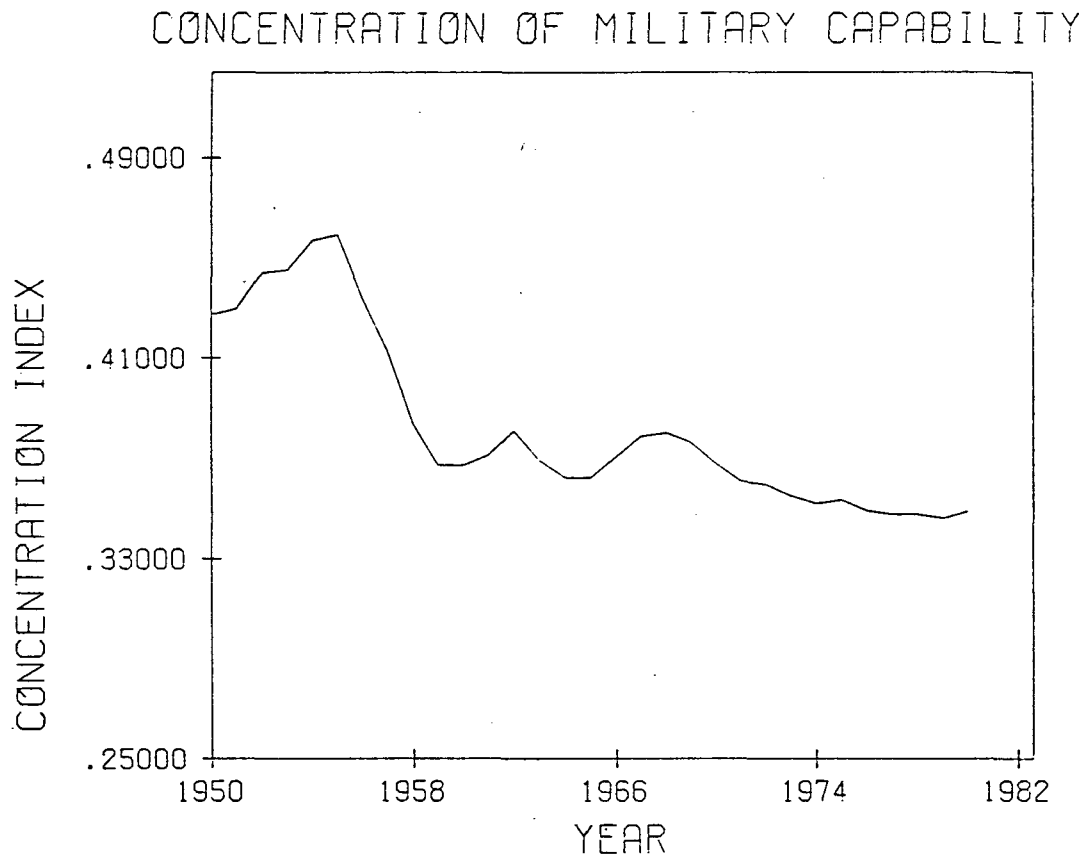
Table 2 revealed some fluidity in the power shares held by individual nations. Has this been reflected in any persistent movement in the degree to which power is concentrated? Figure 2 provides an answer to this question. Ray and Singer's (1973) index of concentration:

$$CON = \sqrt{\frac{\sum_{i=1}^n (S_i)^2 - \frac{1}{n}}{1 - \frac{1}{n}}}$$

where: n = number of nations in the system;  
 Si = nation i's share (.00 to 1.00)  
 capabilities in the system.

is used to answer this question.

FIGURE 2

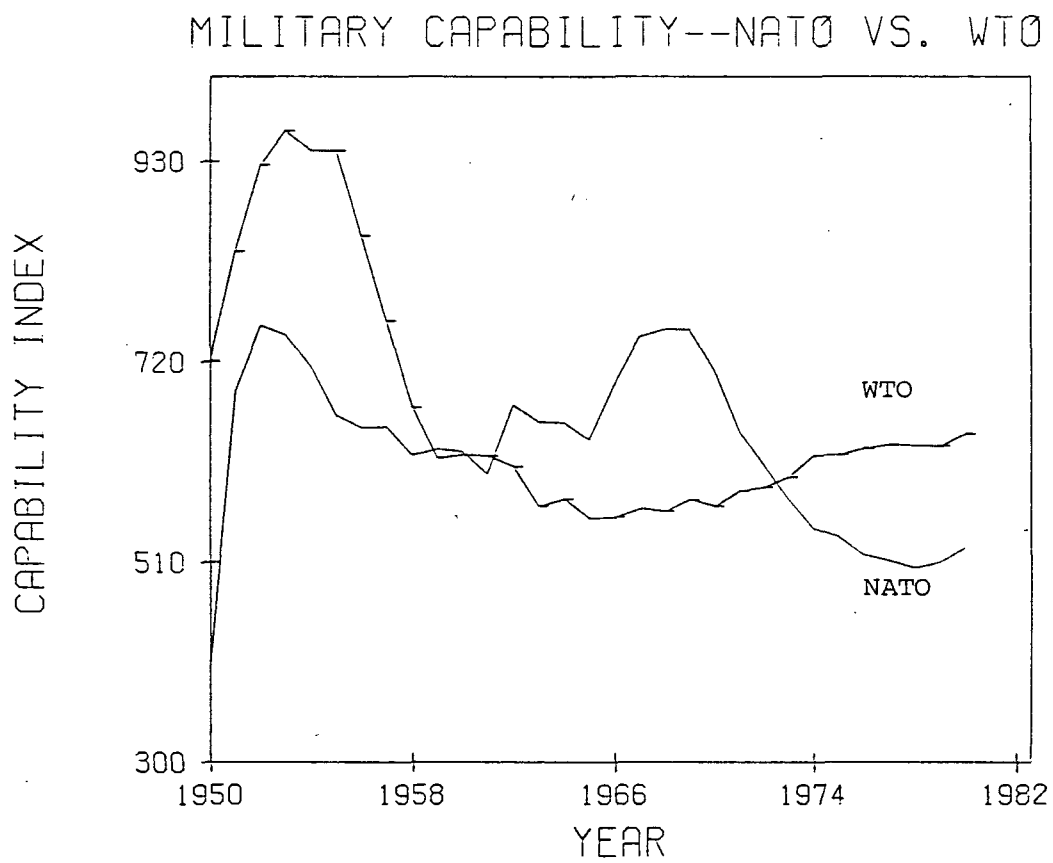


This index ranges in value from zero (0), indicating perfect equality among the states, to 1.0, a situation wherein one nation possesses all of the capabilities. The degree of power concentration in the system under study ranged from a high of .460 to a low of .346 with an average value of .383. Over time, it is apparent that the concentration of power in the system has diminished. The apex of concentration was sited in the mid-fifties, at the peak of the Cold War. After a rather sharp drop during that time, an almost steady and modest diminution in the degree of power concentration has taken place.

At the systemic level, then, we can observe a significant depreciation in the extent to which power has been concentrated. What, however, did this mean in terms of some of the major divisions that have marked the international system during this period? Has, for example, the East-West balance undergone any significant alteration?

Figure 3 displays the movement in the aggregate level of conventional power of the NATO and Warsaw Pact groupings. (It should be noted that the six major states within NATO and four of the major states in WTO are included within our sample. Turkey, a NATO country, has been placed in the LDC grouping labelled South.) What can be seen here is a picture of flux and an image somewhat contradictory of the conventional view. An early surge in the capabilities of both alliances is apparent. However, the East Bloc's

FIGURE 3



supposedly persistent predominance in conventional capabilities actually disappeared by the end of the 1950's. At that time, a surge in the West Bloc's armament efforts, which toward the mid-sixties, reflected American participation in the Vietnam War, placed the East at a disadvantage. The partial demobilization resulting from the US extricating itself from the Vietnam quagmire, and a sagging effort throughout the NATO alliance, along with a modest but steady buildup in the East Bloc reversed the situation once again by 1973. Toward the very end of the period one can detect a modest reversal in the path followed by the West. Despite this movement to and fro, the most striking aspect of these results is the contradiction they pose to the generally accepted view, at least in the West, of an outsized advantage in conventional military power possessed by the East. On the contrary, throughout most of this period, both sides have remained relatively close to one another, and for at least one third of this period, the West has actually possessed a greater level of conventional capabilities.

If the East-West conflict is the center-piece of international relations, then the shifting tides of comity and enmity need to be considered in this assessment of the balance of power that has held between these two coalitions. Clearly the orientation of China, one of the three principal powers, has played a significant role in the strategy and

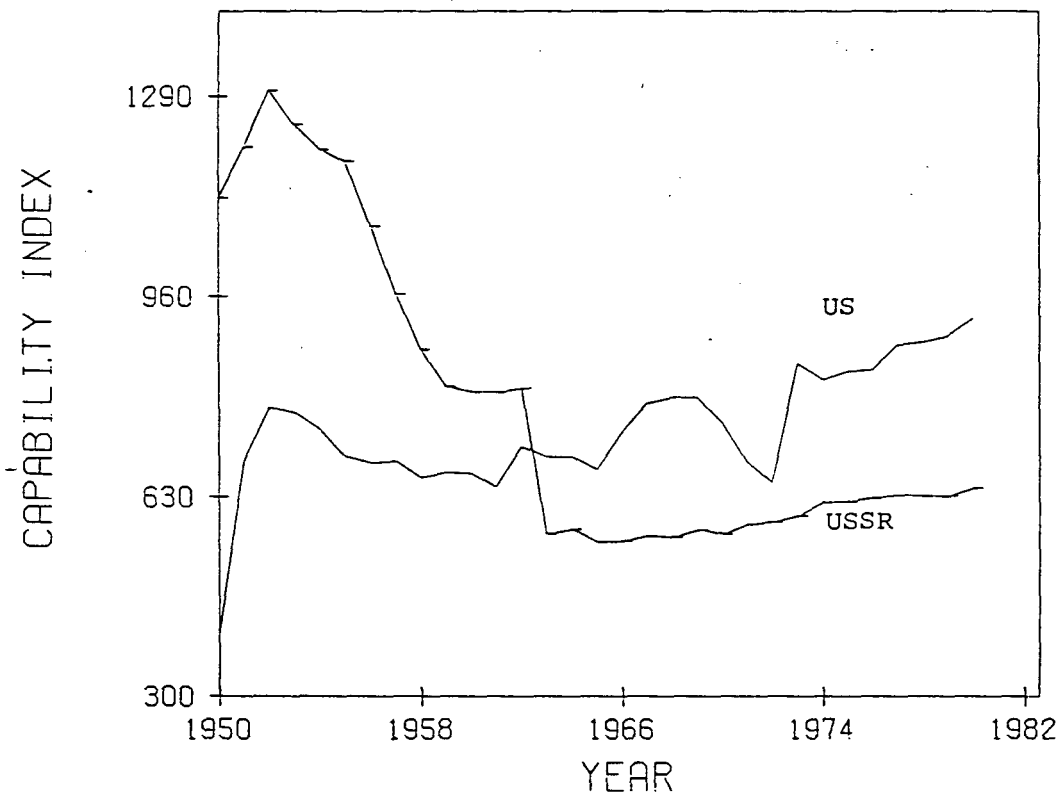
tactics of those involved. Where once China stood as an implacable enemy of the Western camp and an integral element in the Socialist fraternity, its orientation has undergone a number of transformations. The immediate successor policy seemed to be one where it effectively wished plague on both houses. This, in turn, was followed by an alignment suggesting that for many purposes it was an implacable enemy of its former friends and, at least, a silent partner to its former enemies. What has this meant for the balance of military power between these two sides?

Redefining the membership of the two blocs so that China is included in the assessment of the Soviet-led group's capabilities until 1961, and then in the American after 1972, a somewhat different picture emerges (see Figure 4). The East group's preponderance was clearly a fact of the 1950's. China's exit, of course, dramatically diminished the strength of the Soviet-led group and its later inclusion in the American-led group halted the second reversal of relative positions. Despite the increase in WTO capabilities during the seventies, this switch allowed the American-led grouping to maintain a significant margin of superiority.

While the East-West struggle remains a central focus of international activity, the division between North and South continues to grow larger in its importance. Conflicts among the states of the South and between these states and those

FIGURE 4

MILITARY CAPABILITY--US AND USSR GROUPS



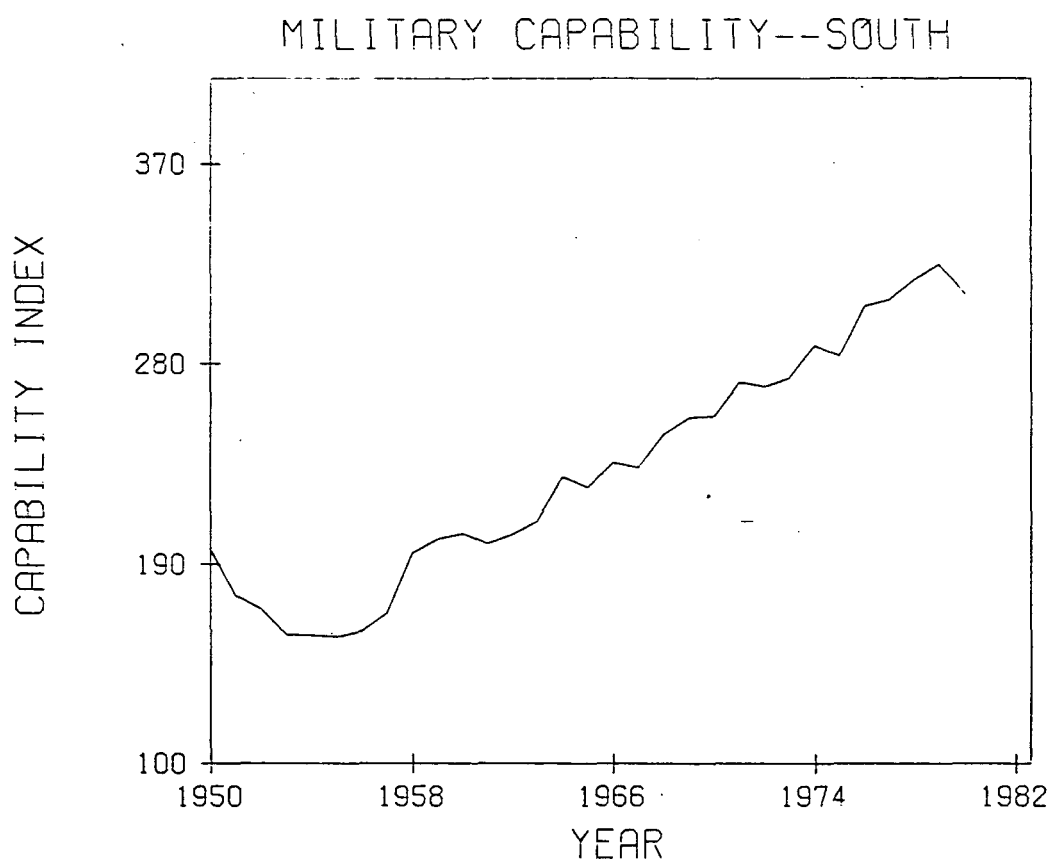
of the North no longer have a peripheral quality. And clearly the growth and redirection of international arms trade would suggest the possibility of a shift in the relative military might of North and South. Figure 5 charts the progress or movement in the joint capabilities of the fourteen Third World countries in the system under study (note that China is not included). As can be seen, a fairly sharp decrease occurred early on with a number of nations demobilizing part of their military apparatus. The nadir was reached in the mid-fifties, whereupon a steady movement upward ensued with the level of capabilities in 1980 being twice as great as those possessed in 1955. Indeed, the low point in the South's share was, in 1955, with 7.7% of the capabilities in this sample of states. By 1980, the share had grown to 16.6%.

#### THREAT

Power can be counted and power counts. But any foreign policy strategist needs, and will use, clues to assess just how much power is arrayed in a threatening manner against his or her state. Paranoid policy sometimes may have a reasoned basis; its application must, however, be considered abnormal and exotic. Worst case analysis may lead one to suspect the whole world stands in complete opposition, but experience and a degree of reasoned calculus should lead one to a different conclusion. Where anarchy and the rules of the jungle apply, all is not lost. Those very attributes



FIGURE 5



and rules frequently play to one's advantage. In international relations and the system of power politics, such too is the case. While some states are seemingly irredeemable enemies, others are, for whatever sound political reasons, friends. Such considerations matter. When assessing threat one surely needs to emphasize the power of the former and one can at least discount that of the latter. Flux is, as well, part of the human condition. Yesterday's enemy may be today's friend or something in between. Yesterday's friend may be somewhat less friendly. As intentions change, so too must the assessment of threat change.

As we have seen above, power also changes. And so in assessing the threat posed against his or her state, the foreign policy strategist needs to take into account these two dynamics. Following Singer (1958), we propose that military threat can best be assessed by the multiplicative formula:

$$\text{THREAT} = \text{CAPABILITY} \times \text{INTENT}$$

The absence of one or the other must lead to the assessment that no threat exists. It is only the presence of both that entails a threat situation.

In a system composed of only two states the application of this principle is straightforward. Complications arise when the system is larger than two states. How should threat be

assessed in a system with more than two states? As Deutsch and Singer (1964) have demonstrated, this question is at the heart of some principal quandries. Bipolar systems have an elegant degree of simplicity. The strength and actions of the principal elements matter in a straightforward way. However, increase the size of the system and complexity sets in. The complexity arises on two sides. On the one is the question of against whom do you direct your actions and power. On the other is the problem of determining who poses a threat by the combination of its strength and actions or signals. The former is a profound matter of policy. The latter is a question that at one level answers itself.

Any state, regardless of its power, can pose a threat equal at a maximum only to the level of power it can call upon. In stark and simple terms, that is its own power and no other. Some states may pose no threat at all, either because they have no power or because they choose or fall into a policy that signals no intention to use whatever power they may possess. In a multipolar system, the simple and direct threat that a state poses can be seen as the proportion of all the indicatively hostile signals it emits in combination with the power it possesses. At a maximum, the threat it poses against state X is equal to all the power it has--and this is indicated by the concentration of all the hostility it directs into the system exclusively

upon state X. At a minimum, it poses no threat at all to state X for one of two reasons: (1) it possesses no power; (2) it expresses no hostile intent toward state X. Maxima and minima are not only extremes, they are also likely not to be universals. In multipolar systems it is quite likely that a mixture of extremes and intermediate values are represented. Rare would be the state with no power. Rare as well is the state that emits no hostility. Peculiar, though clearly interesting, would be the state that focuses all of its hostility against only one other state to the exclusion of all other possible targets of enmity. Any one state may divide its potential threat in a variety of ways, all presumably based on sound calculation, but all in the end summing to the power it possesses--should it choose to present a hostile stance to a hostile world.

In attempting to capture the way in which any one state attempts to calculate the threat posed against it in a system composed of more than one other state, we have settled on the following revision of Singer's formulation:

$$\text{THREAT}(\rightarrow j) = \frac{\sqrt{\sum_{i=1}^n \text{INTENT}(i \rightarrow j)}}{\sum_{j=1}^n \text{INTENT}(i \rightarrow j)} \times \text{CAPABILITY}(i)$$

In other words, the threat that any one state perceives as

being directed toward it is the sum of the proportion of hostile intent directed toward it by each state in the system, weighted by the power of each state manifesting hostile intent toward it. As Deutsch and Singer note, the attentive capacity of any state is limited and must be divided amongst all states in its relevant system. There is no reason to believe that such a constraint does not as well hold with respect to the power possessed by a state. Claude (1962) once pointed out that in such a system the mistrust that a state holds is "directed not against power per se, but against particular holders of power." While the question of how much power others have must be asked in formulating an assessment of the security position of a state, more must be known. It is the habit within such an environment, then, to mold and form one's perceptions and one's policies in light of not only the answer to "'How much power do they have?'" but as well the response to "'What are they likely to do with their power?'" Richard Ashley (1980) suggests a "'threat assessment' logic" focuses decision-makers' attention on "the international configuration of conflict for indicators of the changing directions to which others' military capabilities are committed." This allows the weighting of the "relative concentration of others' conflict behavior within the system." The formulation put forward above represents such a scheme. However, it requires further explication.

The term INTENT used above is meant to convey the degree of hostile intention that one state manifests toward another. Since, however, the state is not constrained to focusing all of its hostility on only one of many possible targets, the hostile intent it directs toward any one serves as but a component part of the measure that reflects the share of its power targeted against any particular state. In turn, conflictual acts need to be seen in the context of the relations between states. Cooperative acts are also exchanged between states. Indeed, it is one of the hallmarks of inter-state relations that both types of acts are widely present in many dyadic configurations. States that are usually considered staunch opponents not only vary the level of conflictual acts they direct toward one another; they also frequently engage in cooperative forms of behavior. It is as well the case that an alliance relationship between two states is no guarantee against conflict of interest and the expression of behavior that derives therefrom.

Hostile INTENT, then, must be seen in light of the mix of both conflictual and cooperative acts that a state directs towards another. To assess the level of hostile intent that any state, *i*, directs toward another, *j*, we use the following weighting formula:

$$\text{INTENT}(i \rightarrow j) = \text{HSENT}(i \rightarrow j) \times \frac{\text{HSENT}(i \rightarrow j)}{\text{HSENT}(i \rightarrow j) + \text{CSENT}(i \rightarrow j)}$$

where: HSENT(i → j) = i's conflictual acts  
directed toward j;  
CSENT(i → j) = i's cooperative acts  
directed toward j.

This weighting scheme discounts hostile behavior that occurs within the context of a cooperative relationship. Holding the level of hostile behavior constant, the signalled hostile intent diminishes as cooperative acts increase.

In order to measure INTENT, it was necessary to rely upon a source of data which provided information on the flow of cooperative and conflictual acts between the states in our sample. The COPDAB events data set was used. Based upon a weighting scheme which aggregated event flows into annual measures of conflict and cooperation, intent scores were constructed for the 25 state system for the period from 1950 to 1978 (see D. Smith, 1983, for a description of aggregation procedure for conflict and cooperation scores). These individual intent scores were then employed to construct scores of relative INTENT which were then used to weight the capability scores to derive a THREAT measure. An example of the relative INTENT scores is provided in a system-wide matrix presented in Table 3 below.

With these relative intent scores and the military capability scores provided in the last section, it is

	USA	CAN	MEX	VEN	BRA	ARG	UKG	FRN	FRG	GDR	POL	CZE	ITA	USR	NIG	SAF	IRN	TUR	EGY	SAU	CHN	JPN	IND	PAK	INS	SUM
USA	****	.013	.000	.000	.000	.040	.001	.006	.001	.021	.000	.000	.001	.537	.000	.067	.000	.004	.071	.000	.080	.136	.021	.000	.000	1.00
CAN	.192	****	.000	.000	.000	.000	.553	.000	.000	.000	.000	.000	.000	.244	.000	.000	.000	.000	.000	.000	.011	.000	.000	.000	.000	1.00
MEX	.019	.000	****	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.981	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
VEN	.175	.000	.000	****	.000	.000	.000	.000	.789	.000	.000	.000	.000	.036	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
BRA	.365	.000	.000	.000	****	.004	.000	.104	.359	.000	.000	.000	.000	.016	.000	.000	.000	.000	.000	.000	.000	.152	.000	.000	.000	1.00
ARG	.669	.000	.000	.000	.001	****	.051	.000	.000	.000	.000	.000	.089	.191	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
UKG	.020	.000	.000	.000	.000	.000	****	.000	.000	.064	.000	.000	.000	.730	.000	.186	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
FRN	.045	.000	.000	.000	.000	.000	.131	****	.023	.227	.000	.000	.025	.248	.000	.126	.000	.000	.000	.126	.000	.000	.000	.047	.000	1.00
FRG	.029	.000	.124	.000	.000	.000	.060	.001	****	.150	.000	.187	.001	.137	.000	.124	.000	.000	.000	.000	.000	.000	.000	.000	.187	1.00
GDR	.067	.000	.000	.000	.000	.000	.119	.000	.801	****	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.012	.000	.000	.000	.000	1.00
POL	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	****	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
CZE	.444	.000	.000	.000	.000	.000	.196	.000	.194	.000	.000	****	.051	.000	.000	.000	.000	.114	.000	.000	.000	.000	.000	.000	.000	1.00
ITA	.040	.000	.000	.000	.000	.000	.001	.001	.000	.000	.000	.000	****	.756	.000	.201	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
USR	.352	.001	.000	.000	.000	.044	.009	.011	.009	.000	.000	.000	.073	****	.000	.000	.000	.017	.000	.000	.475	.009	.001	.000	.000	1.00
NIG	.127	.000	.000	.000	.000	.000	.441	.178	.127	.000	.000	.000	.000	.000	****	.127	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
SAF	.524	.000	.000	.000	.000	.000	.376	.000	.000	.000	.000	.000	.000	.000	.000	****	.000	.000	.000	.000	.000	.000	.000	.000	.000	1.00
IRN	.019	.000	.000	.000	.000	.000	.863	.000	.000	.000	.000	.000	.000	.000	.000	.000	****	.000	.000	.000	.000	.000	.118	.000	.000	1.00
TUR	.601	.028	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.372	.000	.000	.000	****	.000	.000	.000	.000	.000	.000	.000	1.00
EGY	.999	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	****	.000	.000	.000	.000	.000	.000	1.00
SAU	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.727	.000	.000	.273	****	.000	.000	.000	.000	.000	1.00
CHN	.347	.001	.000	.000	.000	.000	.002	.008	.000	.000	.000	.000	.000	.429	.000	.000	.000	.000	.000	.000	****	.135	.077	.000	.000	1.00
JPN	.624	.000	.000	.000	.000	.000	.027	.000	.000	.000	.000	.000	.000	.113	.000	.000	.000	.000	.000	.000	.236	****	.000	.000	.000	1.00
IND	.117	.000	.000	.000	.000	.000	.067	.000	.000	.000	.000	.000	.000	.036	.000	.040	.000	.000	.000	.000	.000	.176	.000	****	.054	1.00
PAK	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.524	.000	.000	.000	.000	.186	.000	.000	.000	.000	.000	.000	.000	.290	****	1.00
INS	.412	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.041	.000	.000	.000	.000	.000	.000	.547	.000	.000	.000	****	1.00

TABLE 3



possible to calculate dyadic threat scores and aggregate these into a single threat measure for each nation. Table 4 presents observations for every five years for the countries in our sample. It should be noted that the scores reported here represent a five year moving average of the annual threat measure. As can be seen in Table 4, threat like power has not been equally distributed throughout the system. Rather, one observes a hierarchical distribution similar to that which held for power. The average value of the concentration index in the instance of threat was, however, slightly lower relative to power (.337 vs. .383). The movement in the concentration of threat (see Figure 6) was nonetheless similar to that for the concentration of power. This suggests some degree of rigidity in the distribution of hostile intent across the system. As with power, the level of concentration in threat appears to have steadily diminished during the period under study.

In terms of East-West comparisons, Figures 7 and 8 provide some useful information. Throughout the period, NATO has been, on average, a target of nearly twice as much threat as WTO. However, the dynamics of the threat situation confronting these two groupings has been notably different. Threat against NATO moved almost consistently downward with the low point, approximately 560 (reached in 1978), less than half that directed toward it at the peak of the Cold War. On the other side, the Warsaw Pact experienced a

TABLE 4  
 CONVENTIONAL MILITARY THREAT,  
 Rankings and Scores, 1955-1978

	1955	1960	1965	1970	1975	1978
1.	USA 689.5	USA 490.6	USA 532.8	USA 396.3	USA 420.0	USR 431.8
2.	USR 337.9	USR 363.4	USR 253.8	USR 375.6	USR 302.0	USA 374.3
3.	UKG 237.9	UKG 167.5	CHN 210.3	CHN 367.6	CHN 297.2	CHN 203.3
4.	CHN 190.0	FRN 130.4	IND 116.9	FRG 86.6	IND 165.7	SAF 132.0
5.	FRN 127.1	FRG 123.0	FRG 104.4	GDR 73.3	PAK 94.2	JPN 94.1
6.	FRG 116.5	EGY 110.6	FRN 98.6	FRN 62.5	EGY 70.3	IND 70.8
7.	EGY 99.7	CHN 91.7	EGY 70.0	IND 58.7	SAF 58.8	FRG 52.2
8.	JPN 48.3	GDR 61.4	INS 69.1	EGY 53.4	TUR 50.6	EGY 52.0
9.	CZE 46.0	IND 48.5	GDR 41.4	UKG 53.0	FRG 47.3	FRN 40.7
10.	IND 33.7	TUR 30.8	UKG 40.0	CZE 49.2	FRN 42.8	UKG 40.5
11.	GDR 32.2	IRN 24.8	PAK 30.6	JPN 45.4	JPN 34.7	GDR 39.2
12.	IRN 29.2	PAK 24.7	POL 12.1	PAK 31.9	UKG 32.8	TUR 38.2
13.	TUR 24.3	JPN 23.8	CZE 11.8	SAF 28.4	GDR 26.5	PAK 34.1
14.	PAK 23.0	VEN 11.2	SAF 11.0	CAN 13.7	CZE 17.6	CAN 27.8
15.	ITA 16.6	POL 10.5	TUR 9.9	POL 22.8	POL 14.9	ITA 27.2
16.	POL 12.2	CZE 10.4	SAU 9.0	INS 15.9	ITA 12.4	CZE 27.2
17.	ARG 10.2	ITA 8.5	JPN 8.4	NIG 13.8	CAN 11.2	IRN 23.8
18.	SAU 10.1	INS 7.3	BRA 7.9	ARG 12.6	INS 10.3	ARG 12.2
19.	VEN 8.2	SAU 7.2	ARG 7.0	ITA 11.7	SAU 5.3	SAU 8.5
20.	INS 4.7	BRA 5.3	VEN 6.8	TUR 5.9	ARG 3.2	NIG 7.7
21.	BRA 4.0	ARG 4.2	ITA 6.0	SAU 5.1	MEX 2.5	POL 7.4
22.	CAN 2.2	SAF 3.2	IRN 5.0	VEN 2.9	BRA 2.4	BRA 6.9
23.	SAF 1.4	CAN 2.9	CAN 3.3	MEX 2.5	IRN 1.8	INS 5.0
24.	MEX 0.2	MEX 1.5	MEX 2.7	BRA 1.7	VEN 0.2	MEX 4.6
25.	NIG 0.0	NIG 0.2	NIG 0.8	IRN 0.7	NIG 0.2	VEN 4.1

FIGURE 6

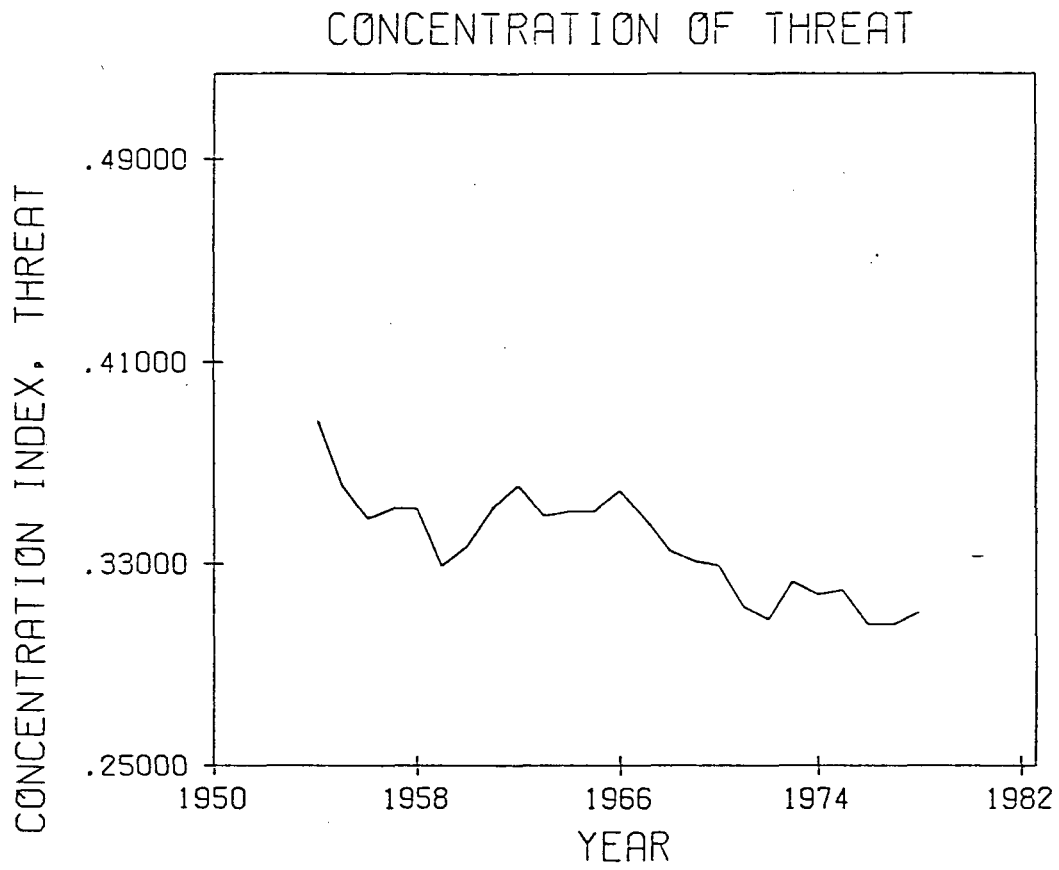


FIGURE 7

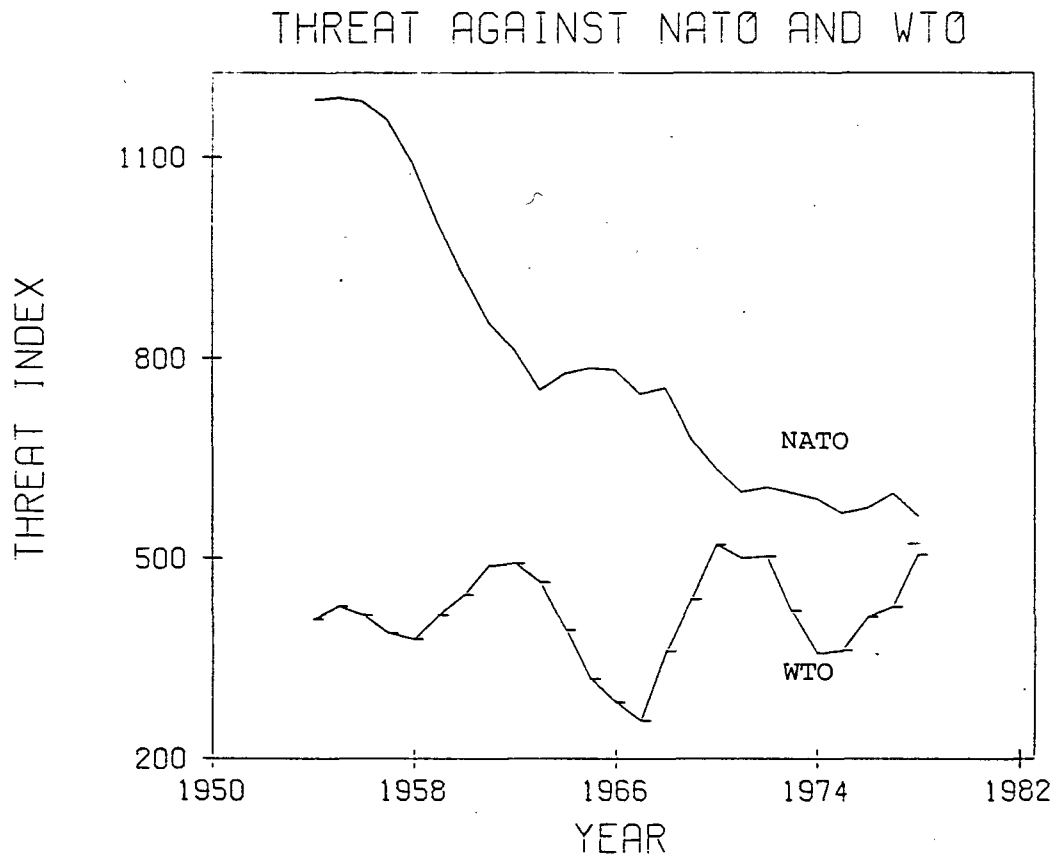
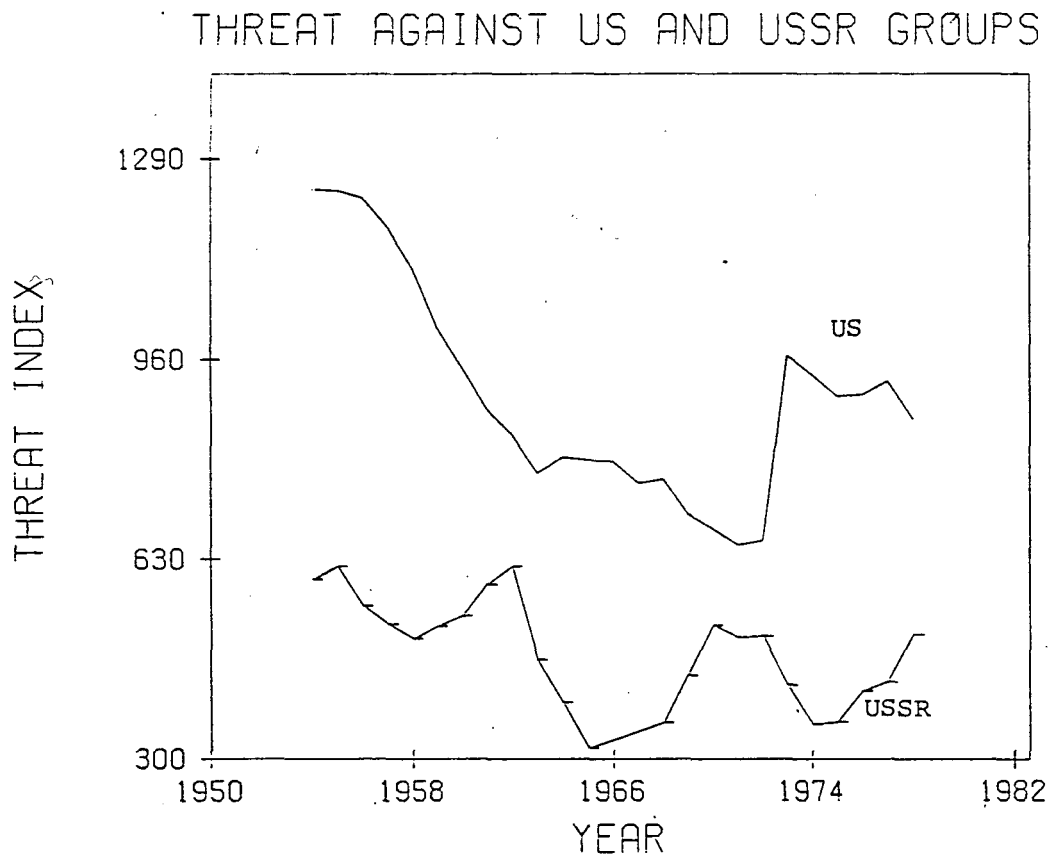


FIGURE 8



markedly cyclical movement in the level of threat posed against it with clear peaks occurring in the early sixties, early seventies, and late seventies.

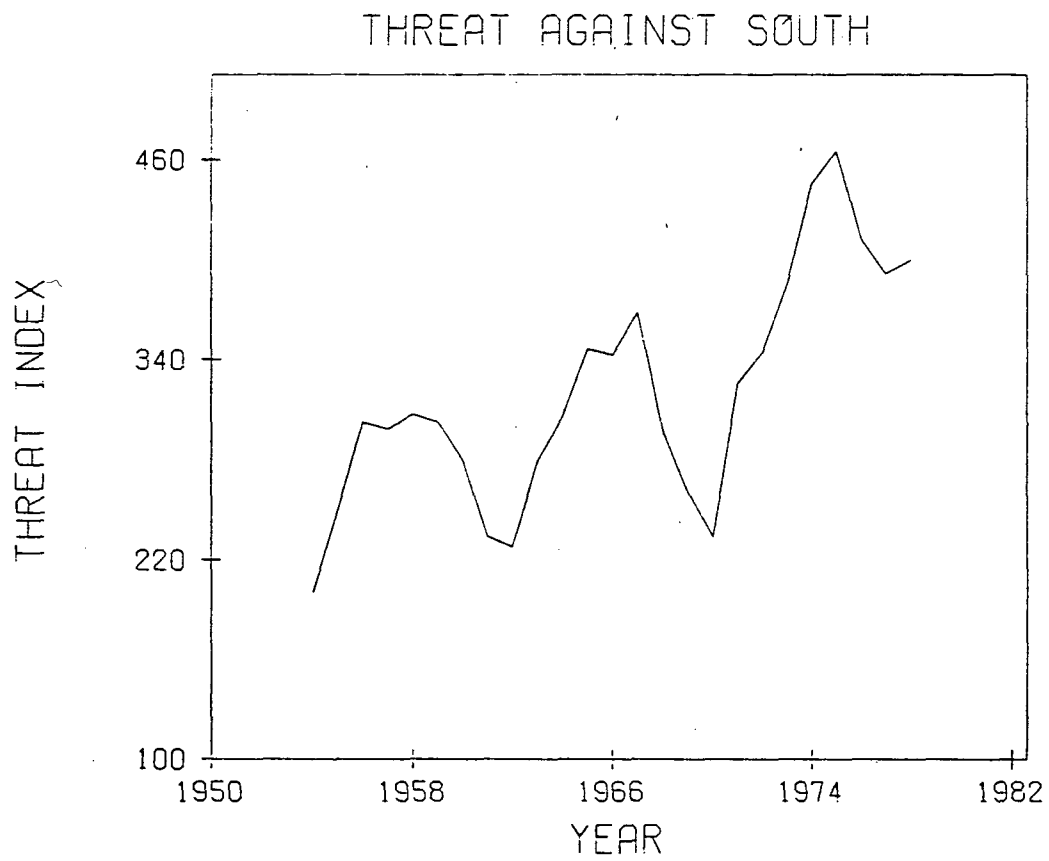
Comparison of the more broadly defined groupings with a peripatetic China and Japan consistently included in the American-led group provides a somewhat different picture (see Figure 8). While the American-led group gained in terms of power comparisons with the inclusion of China, the threat position of such a coalition altered dramatically and in a very unfavorable way with the level returning to heights reminiscent of the Cold War.

The long term downward trend in threat directed toward the West and the cyclical movement in threat directed toward the East is of course mirrored in the experience of the South group(see Figure 9). The overall trend in threat directed toward this set of states has been upward. The peaks for the Eastern group have been the troughs for the South, and vice versa.

#### SIMULATION ANALYSIS

The purpose of this section is to provide a perspective on possible developments in threat and power configurations within the subsystem we have been examining. We caution the reader that the results provided in this section are tenuous in the extreme and that they in no way serve to inform us as

FIGURE 9



to what the future may hold. Still, we have used the term possible developments. What we mean to convey is the notion that using some plausible sets of assumptions, and employing a simulation model incorporating a relatively rich set of decision making and processual rules, we are in the position to examine the implications of some widely shared notions of how political-economic systems work within regimes of markedly different constraints and opportunities.

This undertaking is possible with the use of the GLOBUS Model developed at the Science Center Berlin. Space constraints do not permit any comprehensive description of this model. Interested readers are referred to a paper by Bremer (1983) outlining the general character of the project and to the documentation of the embryonic version of this model (IIVG/GE, 1983) for an intimation of the model's general structure. The model's final form is now coming into shape and extensive descriptions of its structure and results from its use are in the offing.

The GLOBUS Model has been designed with the intention of exploring the stresses and strains governments might confront in coping with the complex political and economic environments that surround them. The model includes representations of twenty-five nations and their governments. It attempts to represent some basic political and economic interactions both within and between nations. There are five sectors within the model. Each sector



represents either the policy and response functions of government in a specific substantive area, or a mixture of such functions and the environmental processes of an area. The five sectors have been denominated in the following way: domestic political, domestic economic, international political, international economic, and government resource allocation.

The domestic political sector portrays the dynamics of popular opposition to government and the imposition of sanctions by government on the population. The domestic economic model mainly focuses on the way in which the forces of economic supply and demand equilibrate and the manner in which economic growth or stagnation proceeds. In addition, a limited set of government policy response functions are incorporated in order to represent the way in which governments attempt to cope with deteriorating international economic positions. On the international side, the international economic model focuses on the forces at work in shaping the pattern of international trade. Represented here are those purely economic factors and processes as well as governmental policy which tends to introduce bias into what supposedly is an economically rational undertaking in a large and varied market. The international political sector focuses exclusively on the policy functions used by governments in orienting themselves towards other states in the international system. The principal outputs of this

sector are the levels of hostility and cooperation, in the form of event volumes, that governments direct toward one another. The fifth sector focuses on government resource allocation. Here attention is centered exclusively on government policy and response functions and, in particular, on the way in which governments extract resources from their societies and employ them for a variety of purposes.

The principal element within the GLOBUS Simulation structure that directly acts to influence the factors that concern us here is the budgetary model. We turn to a brief description of it. The model represents the development of a government budget. It portrays the decision making involved in setting expenditure levels and altering the rates of revenue raising. Budgeting is depicted as a set of interrelated activities wherein forces at different levels of government seek to satisfy their interests. As structured in the model, this activity is represented in part by a process where the political leadership and those responsible for the financial activities of the government develop and attempt to impose their preference for the overall sum of budgetary outlays. Standing in opposition to this preference as well as in competition with each other are the different sectors of the government responsible for major functions and programs. These competitors attempt to advance their interests and perform their responsibilities in part by acquiring the budgetary resources they calculate as being

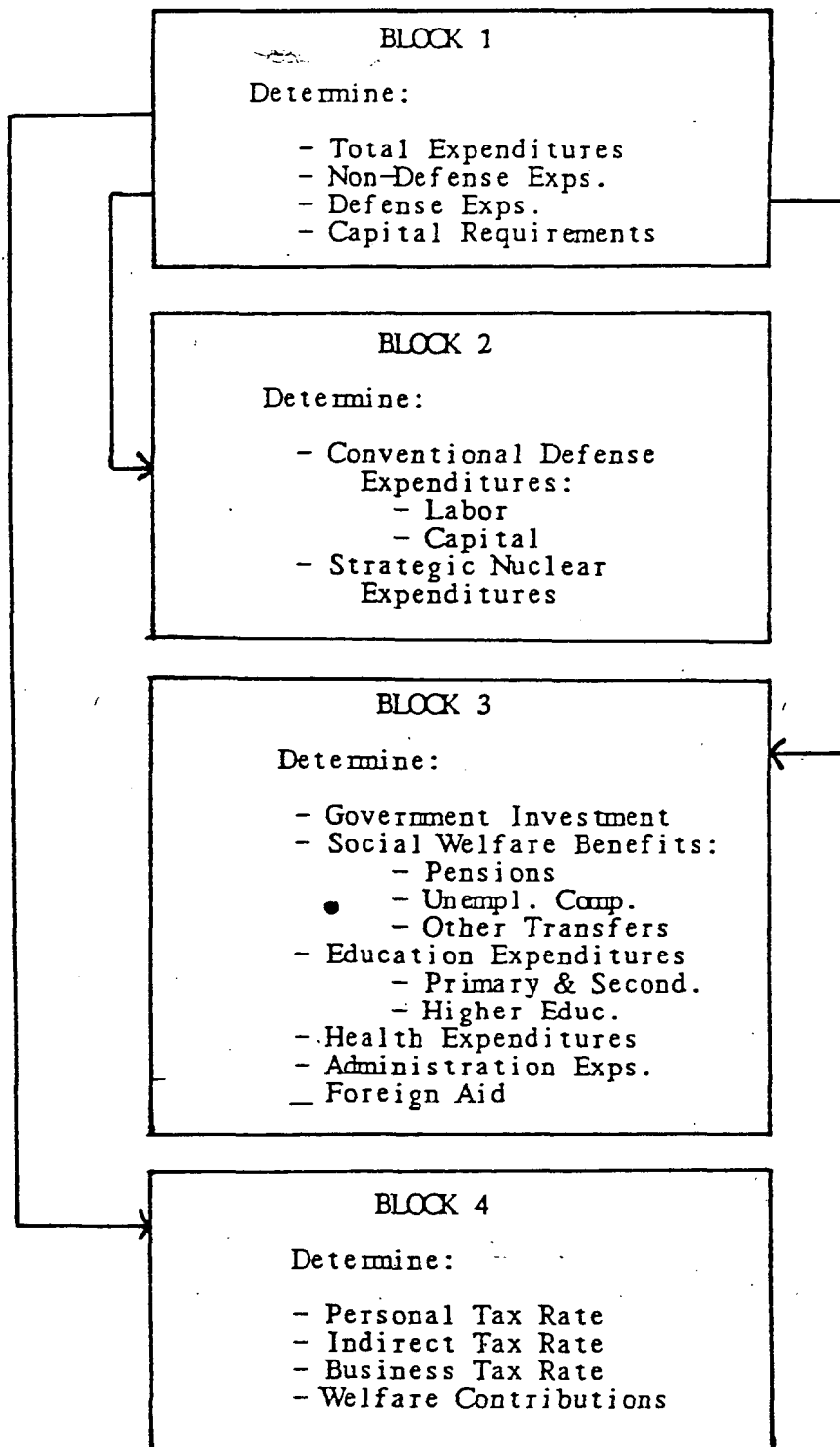
necessary. On the revenue side, decisions are modelled as a combination of intention and drift. Their basis is seen to follow from the leadership's (and other financial authorities') desire for maintaining the fiscal solvency of the government and the leadership's stabilization policy concerns.

The formal representation of the budgetary decision making process is divided into four major parts or blocks. This division is intended to capture some very distinctive features of the budgetary process. The division has as well been heavily influenced by our desire to structure the model in such a way as to enhance our ability to provide an empirical basis for important decision making parameters.

The four blocks or sectors of the model (see Figure 10) include the following. Block 1 deals with the development of desired spending levels both at the aggregate level, i.e., total spending, and the disaggregated level, spending for programs and program components within the civilian and defense areas. The first block also deals with the reconciliation of these potentially inconsistent spending levels. The second and third blocks deal with the disaggregation of defense and civilian expenditures amongst the different programs in each of these areas; for example, in defense outlays for personnel and capital acquisition in both the conventional and strategic nuclear area and on the civilian side among items such as social welfare transfers,

FIGURE 10

AN OVERVIEW OF THE STRUCTURE  
OF THE GLOBUS BUDGET MODEL



education, investment, and so on. The fourth block includes processes for altering tax rates in light of fiscal and stabilization policy concerns.

This block structure reflects two important features of the model. First, the division into blocks is based on substantive and temporal grounds. From a substantive perspective, while the results of any one block may influence elements in another, the sequence in which the results are produced mimic the sequence generally followed in budget construction. No element or decision in a later block would be prior to any decision within an earlier block. The elements and decisions in later blocks follow from decisions in earlier ones and are constrained by those decisions. In effect, the structure of the model replicates the "funnel" of decision making in budgeting.

Second, time is important. Not only is the mimicking of time in terms of sequential processing vital, but so too is the identity of the time period for decision implementation. During any period a budget is being implemented. During the same period a new budget is being constructed and there is a difference between the two major sets of decisions (those relating to expenditures and those dealing with taxation) in terms of the time in which they will be implemented. On the expenditure side, represented in blocks 1-3, decisions are made for implementation in the next full period. On the revenue side, decisions are made for two full periods ahead.

These latter decisions follow from the expenditure decisions just made and from other considerations. The expenditure decisions, in turn, were constrained by revenue decisions made in the previous period. The staggering of decision and implementation time is based on two considerations. First, revenue decisions in the form of tax rate changes are notoriously slower in their time it takes to implement them. Second, the theoretical position we have adopted places great emphasis on the expectation the government holds with respect to the revenues it will receive during the period for which expenditures are planned and these former are greatly constrained by relative rigidity of the revenue raising instruments it has at its disposal.

The size and complexity of the model does not allow us to provide a full description of the processes contained therein. An overview of the model is provided in Figure 10a. Some of the principal processes are described in the paragraphs below.

Desired total spending is a function of expected revenues and a stabilization policy response. The latter's formulation hinges upon the type of political-economic system being modelled with unemployment and inflation motivating response in western developed economies and savings/investment requirements stimulating action in centrally planned and developing economies. The influence of political support considerations are sometimes

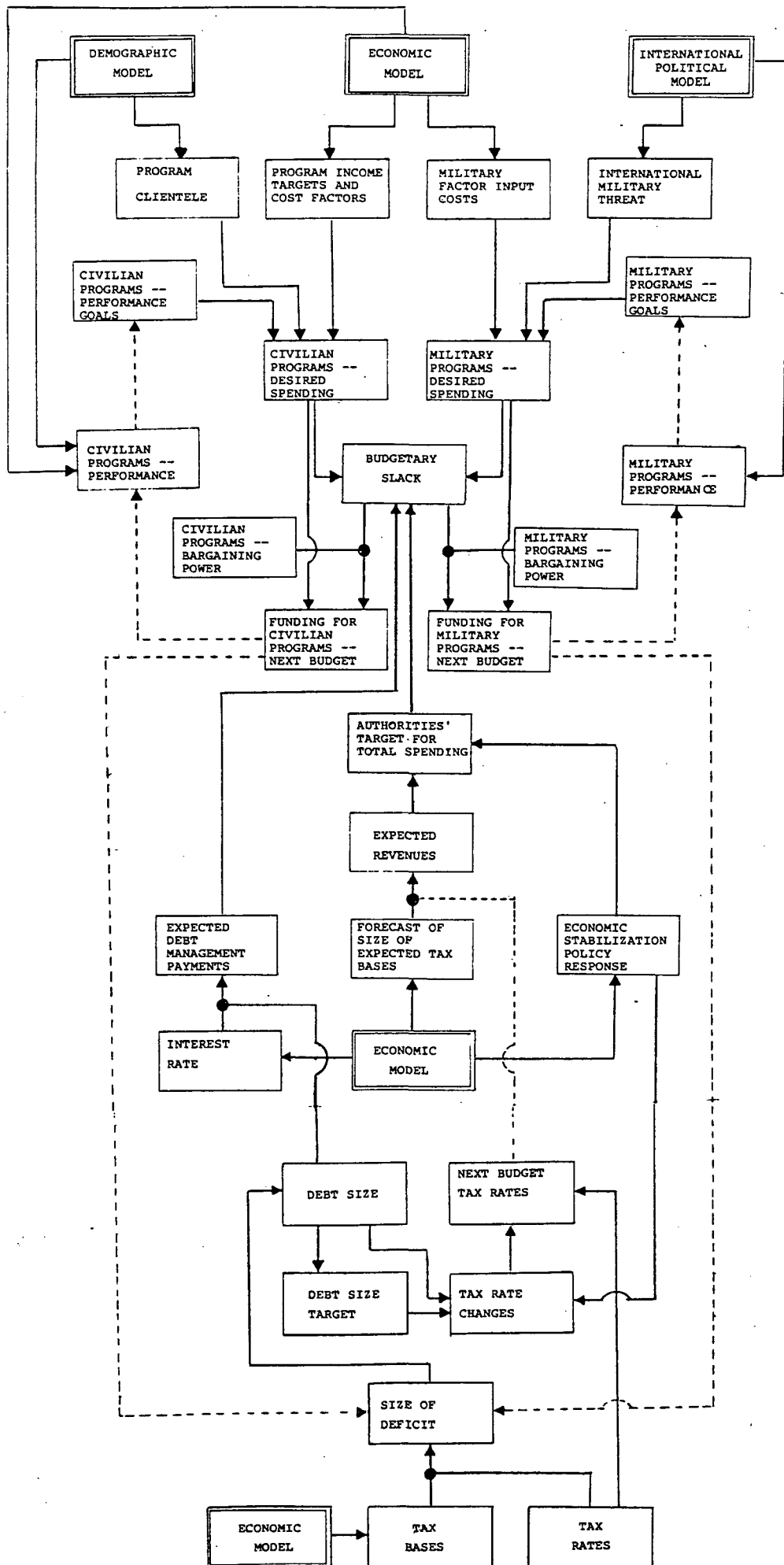


Figure 10a  
Major Linkages in the GLOBUS  
Budgetary Model

represented in the model though in the version used here that has been excluded.

The defense sector and the civilian bureaucracies are each represented as independently formulating desired levels of spending for their individual programs. In the defense sector two major programs are represented: the first deals with conventional defense capabilities and the second with strategic nuclear systems. In each of these programs a security goal (defined in terms of expected threat and own capabilities), a cost calculation, and an assessment of the extent of depreciation in existing capabilities contributes to the development of a desired level of spending. These individual desires are aggregated to produce a total for desired level of defense spending.

The civilian sector includes a larger number of spending programs: social security (with three subprograms), health, education (with two subprograms), administration, foreign aid (where appropriate), and investment. The general process by which the individual programs (and subprograms) formulate desired expenditure levels depends upon a desired performance level, a cost calculation, a consideration of a demographic, or economic, or demographic/economic burden, and, in the social security area, an assessment of the financial position of the overall program. The sum of the individual program requests represent the aggregate of civilian expenditure requests treated as a principal element



in the reconciliation and finalization of the expenditure side of the budget.

Debt management payments also need to be calculated and treated in the reconciliation of the different desired spending levels. In that phase they are treated as mandatory and have the potential for crowding out one or more of the other spending categories.

The reconciliation of the potentially competitive desired spending levels is depicted. The degree to which a particular desire is realized hinges critically on the bargaining strength of the composite actor (as represented in the parameters incorporated in these equations) and the presence or absence of slack in the entire system. This representation is a modification of formulations used in earlier versions of our budgetary models (Cusack, 1982) and draws directly from the work of Fischer and Kamlet (1981).

Having finalized major expenditure levels for the planning period, specific programs are then allocated funds. In the defense sector (block 2), distribution occurs principally between the conventional and (where appropriate) strategic sectors. Further distribution then occurs within the conventional sector with the appropriated funds being divided to acquire new capital (demand is transferred to the arms sector of the economic model) and labor (demand on the service sector). The latter division derives directly from

the desired capital to labor ratio and expected existing capital stock in the upcoming period.

In the civilian sector allocations are made from the planned total for non-defense amongst the various programs and subprograms (block 3). These allocations hinge upon existing program expenditures, requested program expenditures, and the aggregate of existing, requested and finalized total expenditures. Within the simulation model a dampening factor can be invoked to minimize excessive shifts in relative program size.

Resource extraction decisions by government are effectively concentrated in the alteration of taxation rates (block 4). Changes in tax rates are portrayed as following from two considerations. On the one side are forces acting to increase rates of extraction. The principal motive force at work here is the desire to maintain the size of the public debt within reasonable bounds. Exceeding the goal with respect to this boundary induces a decision to increase tax revenues. On the other side, the contraction of the relative size of the budget, emphasizing the restriction of outlay in proportion to expected revenue, arising from a desire to constrict demand (especially from the public sector), leads to a downward pressure on tax rates. Both expansion and contraction pressures converge to produce a decision on the need to alter tax rates, and, if such a "positive" decision is made, to the determination of the

scope and direction of tax rate changes. The scope and direction of these changes, in combination with the anticipated size of the distinctive tax bases and fixed propensities to rely upon alternative tax instruments act to alter future tax rates.

We hope that this synoptic description of the model will suffice to provide the reader with a basic understanding of many of the principal mechanisms incorporated in the model. Most of the other sectors of the GLOBUS Model act in relatively indirect and minimal ways to influence the course of direction to be taken with respect to the concerns that interest us here. There are, however, two principal elements of the model that we suggest should have great bearing on the form and substance of the model's results in this area. On the one side is the overall pace of economic growth that could occur in a subsystem composed of these states. On the other is the degree to which conflictual and cooperative relations amongst such states change.

Both these considerations have been incorporated in the simulation experiments reported here. The question of economic growth should have a significant influence on the pattern of arms accumulation. Financing the demands of the military sector depends upon the relative scarcity of resources. Both varying rates of growth across states as well as alternative basic trajectories of growth could significantly influence capability and threat outcomes. Two

economic growth scenarios have been employed. One envisages growth patterns concordant with the experience of the 1960's and 1970's. Despite the general downturn during the latter decade, the growth tendencies of this entire period were relatively robust in comparison with other periods of modern economic history. The other scenario incorporates a much less sanguine characterization of economic performance. Here we have forced the economic sector of the GLOBUS Model along a growth trajectory that achieves only half the success of the historical record of the 60's and 70's. In other words, we employ a scenario of sluggish economic performance.

The second set of experimental conditions focuses on the conflictual and cooperative ties amongst the states in the subsystem. These have a significant influence on the threat perception of the states which in turn leads to variations in demand for military capability. The alternative scenarios employed here are as follows. In the first instance we freeze the levels of conflict and cooperative flows extant in the initial period of the model run. This effectively holds the structure of international hostility constant. Variations in threat perception arise then only from alternative rates of change in capabilities held by the states in the subsystem. The second alternative allows conflictual and cooperative ties to change through the course of the run. The mechanism driving each of these is a

simple action-reaction decision rule with historically based parameters.

Four experimental runs, then, were undertaken. Experiment 1 incorporated the scenario of low economic growth throughout the system in conjunction with hostile and cooperative flows changing on the basis of an action-reaction mechanism. Experiment 2 used the low economic growth scenario but incorporated the assumption of a fixed or frozen set of relations in terms of hostility and cooperation. The third and fourth experiments employed a high economic growth scenario. In experiment 3 this high growth scenario was combined with a changing international political environment as states react to flows of hostility and cooperation. Experiment 4 joined this high growth scenario with the assumption of frozen hostile and cooperative relations.

What impact might these conditions have on the accumulation of military power? Our focus here is restricted to a narrow set of indicators and questions. One principal interest is in the overall level of capability within the system. What impact might the various regimes have upon the level of militarization within such a system? Would constraints or flexibility with respect to resources dramatically alter this level? Would a pattern of international political interaction based on a persistent action-reaction mode alter the outcome?

The distribution of capabilities in both a general and specific sense could also be affected by these alternative regimes. Would power tend to become more or less concentrated? How would various major groupings of actors cope in these alternative environments?

Our four experimental runs were conducted using the GLOBUS Model. Each experiment was initialized with values corresponding to 1970. The length of each run was thirty periods with a period corresponding to a year. Final period values for a set of indicators produced by each of the experiments are displayed in Table 5.

With respect to the overall level of capabilities within the system the model produces a rather surprising set of results. Under conditions of stagnating economic performance, relatively modest increases accrue. With high growth, rather significant increases obtain (see Figure 11 • for the time paths of this variable in experiments 1 and 3). While both these results could be expected, it is significant to note the extremely modest if not negligible impact of the alternative possibilities with respect to inter-nation political relations. The impact of the alternative international political relations regimes is barely visible.

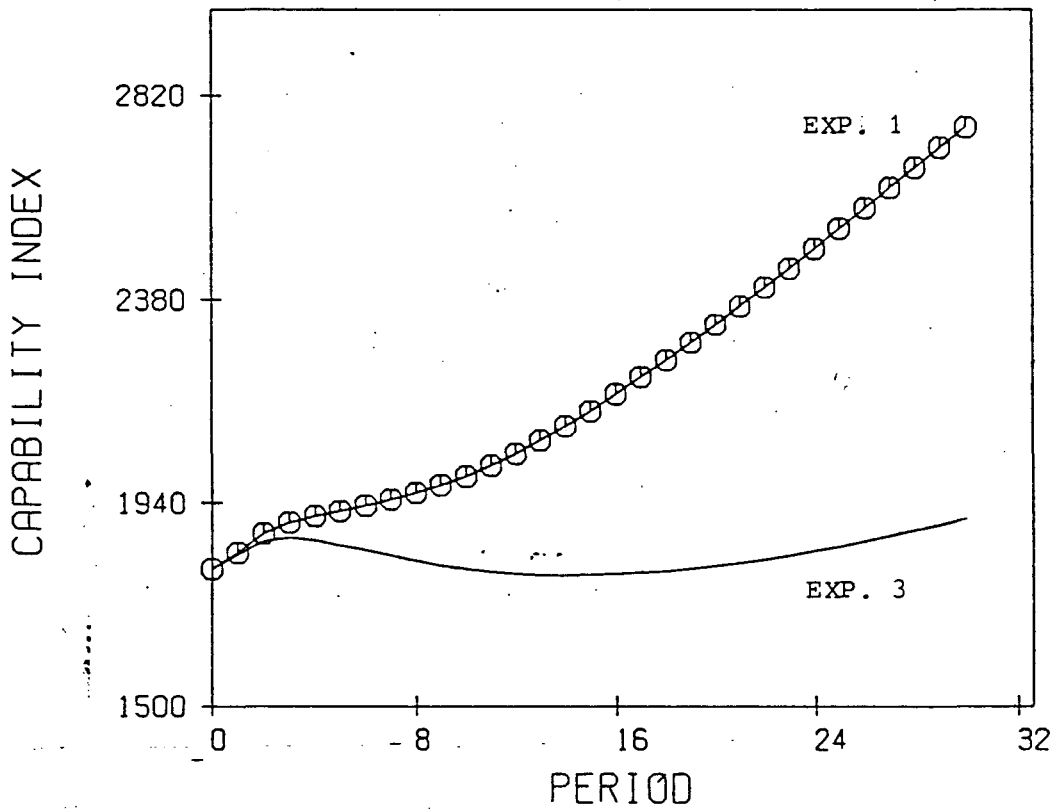
The pattern with respect to the concentration of capabilities is also surprising. There is little change in

TABLE 5  
SIMULATION RESULTS FOR  
AGGREGATE VARIABLES

Variable	Initial Value	Final Period Values For Regime Experiment:			
		Low Growth		High Growth	
		Relations Change	Frozen	Relations Change	Frozen
		Exp.1	Exp.2	Exp.3	Exp.4
Total Capability	1798	1906	1887	2750	2724
Capability Concentration	.369	.373	.377	.366	.372
Threat Concentration	.329	.394	.371	.398	.368
NATO Capability	710	724	727	1029	1031
WIO Capability	568	494	491	742	740
US Group Capability	973	1166	1189	1646	1683
South Capability	257	245	207	360	300

FIGURE 11

TOTAL MILITARY CAPABILITY--ALT. PATHS





the degree of concentration. The low growth scenarios produce modestly higher levels relative to the initial conditions, but the change is quite marginal. Given the minimal change in the total level of capabilities, this is perhaps to be expected. On the other side, the high growth scenarios produced significant growth in the overall level of capabilities but hardly any change in terms of systemic concentration.

Turning briefly to the pattern of threat concentration, one can see a different pattern. Across all experiments there is a noticeable tendency for threat to become more concentrated. There is something of a difference, as well, in that the experiments with changing levels of hostility and cooperation both produce higher levels of concentration.

The experiences of the NATO and Warsaw Pact groupings reflect many of the overall patterns noted above. Significant growth in capabilities accrue in the context of growth and there is no closing of the gap between the two. Economic stagnation modifies the picture slightly with a little growth occurring in the NATO grouping and a noticeable decline in WTO. In the more broadly defined "US group", growth is the hallmark. The extent of military growth is conditioned by the type of economic scenario employed, but both reveal sharp upward tendencies. None of the groupings, in accordance with the more aggregate pattern, as might be expected, are affected by the alternative assumptions

regarding inter-nation relations.

The general pattern is reversed in the South (see Figure 12). Here the results from each experiment are widely divergent. Economic growth still induces expansion while decline in economic performance leads to stagnation in the accumulation of arms. However, the international political context would seem to matter in the LDC case. Here the outcomes are markedly different given the alternative scenarios with respect to the development of inter-state relations.

#### CONCLUSION

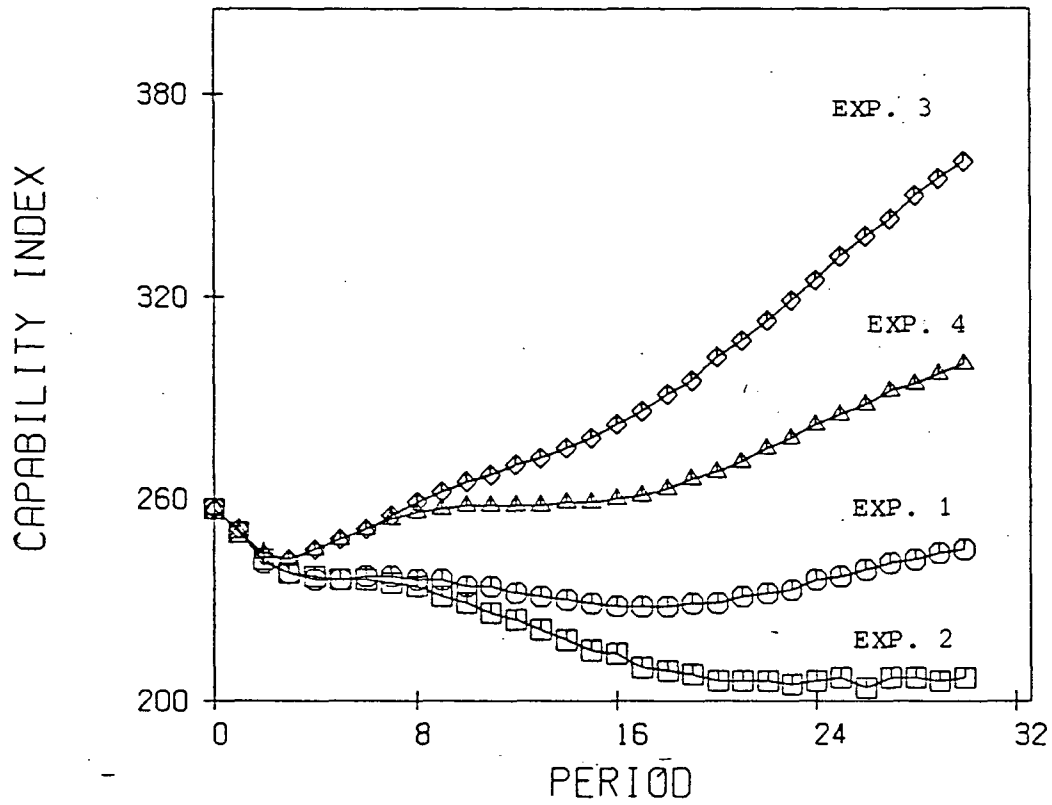
By way of conclusion we would like to summarize some of the more salient results presented within the paper. Let us first review the findings dealing with the past and then turn to a summary of the simulation experiments reported in the last section.

There are a significant number of findings dealing with the thirty years of international political history covered within this study:

1. Looking over the entire period, one can only be impressed with the relative constancy in the total amount of conventional military power within the subsystem. If, however, one shortens the temporal focus and excludes the

FIGURE 12

MILITARY CAPABILITY IN SOUTH--ALT. PATHS



Cold War period, a modest increase can be detected. All in all, though, in terms of the accumulation of arms (and not the outlays for arms), there has been no marked militarization of the subsystem.

2. The concentration of military power has diminished significantly. The apex of concentration was sited in the midst of the Cold War, during the middle fifties. Since that time there has been an almost steady diminution in the degree of capability concentration.

3. Relative to power, threat within this subsystem has been noticeably more diffuse. However, the same decline in the degree of concentration has occurred.

4. Throughout the entire period the West remained within a moderately wide band in terms of its overall conventional military power. A rapid increase occurred early with the onset of the Korean War. The Cold War saw a relatively steady but modest decline in this level. The sixties marked a turn-around which was followed by a rapid increase with the American engagement in the Vietnam War. Demobilization was followed in train with further decline and a modest upturn only toward the very end of the period.

5. Despite these shifts to and fro, the security position of the West steadily moved in a direction toward improvement. This enhanced security position flowed directly from the almost continuous decline throughout the

entire period in the threat directed toward the states in this coalition.

6. If one assumes that indeed the "China card was played" in the early-mid-70's, the total and relative power position of the West improved significantly. Nonetheless, China's own vulnerability to threat from throughout the subsystem lent no aid in improving the "extended West's" capacity to cope with the threat posed against it.

7. Until the mid-60's, the military power of the Warsaw bloc declined persistently from its great heights at the end of the Korean War. Toward the end of the sixties it levelled out and began a slow but steady upward movement. Until the beginning of the seventies, the East enjoyed a relatively advantageous position if one compares its power with the threat that was posed against it. With the passage of the Czechoslovakian experiment, a surge in threat occurred which then moderated during the "detente" of the early and mid-seventies. The level of threat then moved upward again. One can only be impressed with the decline in the relative security position of this coalition through the period under study.

8. The diffusion of power within this subsystem seems to have been critically dependent on the surge in power experienced by Third World countries. Since the middle of the Cold War, i.e., around 1955, the power of these states

has about doubled and their overall share of the total subsystem's capabilities has moved correspondingly, i.e., from around 8% to approximately 17%.

The simulation studies reported here were intended to explore the possible implications of some alternative scenarios with respect to factors generally considered vital to the dynamics of arms accumulation. The studies were conducted with GLOBUS, a global simulation model designed to explore the stresses and strains governments might confront in the political, economic and social arenas. Given the preliminary character of the model, absolutely no claim is intended or implied with respect to any statement being made about the future. Rather, the results from this study should be seen as exemplars of the kind of analysis that could be undertaken with the model. The model is capable of addressing interesting questions with the potential for providing interesting and plausible answers.

Four experiments were conducted. Each experiment incorporated a set of assumptions regarding the potential for economic growth and the character of international political relations. Historically based growth trajectories and rates distinctly lower characterized the economic scenarios. In the political area, a scenario incorporating historically based action-reaction tendencies and another essentially freezing the structure of hostility were

employed.

The results of the experiments were a combination of the expected and the unexpected:

1. The overall level of militarization within the subsystem is particularly sensitive to the level of economic resources while at the same time fairly insensitive to alternative assumptions regarding the dynamics of international political relations.

2. None of the experimental conditions had any impact on the overall level of concentration in capabilities. The concentration of threat grew in each run but tended to grow faster and reach higher levels in those experiments incorporating action-reaction as the determinant of the structure of hostile intent.

3. Capability growth in the East and West appeared singly dependent upon economic growth conditions. The character of international relations seemed to have no effect. On the other hand, while growth certainly affected the levels of capabilities accumulated in the South, this region's arms accumulation was also very sensitive to the character of international relations.

## NOTES

My thanks to Tariq al-Duleimi, Peter Brecke, Stuart Bremer, Gary Flemming, Michael Fromme, Walter Gruhn, Shirley Hart, Barry Hughes, Peter Rindfuss, Dale Smith, and Uwe Zimmer for their help in completing various parts of the research undertaken for this report. Suggestions and constructive criticisms of an earlier draft of this paper were received from Stuart Bremer, Gerhart Bruckmann, Karl Deutsch, Harold Guetzkow, Barry Hughes, Dale Smith, and Lewis Snyder. While I have not had sufficient time to deal with most of these, their help is acknowledged and appreciated. All errors of omission and commission are those of the author.

1. This paper focuses exclusively on what are generally called conventional military forces. A later report will provide information on the measurement and modeling strategies we have employed in the nuclear area.

2. It should be pointed out that the 25 countries comprising the GLOBUS subsystem accounted for approximately 75% of the world's population, 85% of global product, and nearly 70% of total world trade in 1970 (Brecke, 1984). In terms of military outlays, SIPRI credits the GLOBUS countries with over 90% of the world total in that year (SIPRI, 1974).

3. In earlier analysis (Cusack, 1982), we were able to demonstrate the importance of the supply side and mechanisms that influence the supply side (e.g., conscription and the "pricing" mechanisms in centrally planned systems).



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