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One problem, three solutions: A simulation analysis of alternative Western defense policy options

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ONE PROBLEM, THREE SOLUTIONS:
A SIMULATION ANALYSIS OF
ALTERNATIVE WESTERN DEFENSE
POLICY OPTIONS

by

Thomas R. Cusack

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ABSTRACT

This paper reports on a computer simulation study of the implications of alternative defense spending policies on the part of the Western Alliance. The recently developed GLOBUS Model, a large-scale computer simulation model incorporating representations of the internal and external political and economic dynamics of twenty-five important states, is the medium through which the study was conducted. Three defense spending options (an American-like 6% per annum real increase, the NATO Guideline of 3%, and a 0% or "freeze" policy) are explored. The implications in terms of the implementation of such policies on (1) the broader international system, (2) East-West relations, and (3) the allocation of resources are assayed. The main long-term effects illuminated are: (1) the higher the option implemented, the greater the level of militarization across the entire system, the greater the long-term levels of international hostility, and, generally, the more concentrated the capabilities and threat throughout the system; (2) a distinct tradeoff between improvement in the West's military capability position and the tenor of East-West relations; and (3) given likely trends in world-wide economic performance, the high option could generate excessively high defense burdens with consequential tradeoff in the ability to supply government social services and transfers.

ZUSAMMENFASSUNG

Unterschiedliche Zuwachsraten der Verteidigungshaushalte der Staaten der westlichen Allianz wurden dieser Simulationsstudie zugrunde gelegt und hochgerechnet. Dies geschieht mit Hilfe des kuerzlich entwickelten Weltmodell GLOBUS, in dem inner- und zwischenstaatliche politische und wirtschaftliche Prozesse von 25 wichtigen Nationen abgebildet sind. Es wird von drei Optionen fuer Verteidigungsausgaben ausgegangen, die jeweils analysiert werden: sechs Prozent jaehrlicher realer Zuwachs analog zu den in den letzten Jahren in den USA beobachteten Steigerungsraten, die drei Prozent jaehrlicher realer Zuwachs gemaess der NATO-Richtlinie, und null Prozent Steigerung real pro Jahr, d.h. Einfrieren des westlichen Verteidigungsetats. Die Konsequenzen, die diese drei Optionen (1.) auf das internationale System, (2.) die Ost-West Beziehungen und (3.) die Staatshaushalte haben, werden ermittelt. Die wesentlichen langfristigen Effekte bestehen darin, dass (1.) der Militarisierungsgrad global zunimmt, je hoeher die realen Steigerungsraten der westlichen Verteidigungsetats sind. Entsprechend damit variiert das Niveau internationaler Feindseligkeit und die Konzentration der militaerischen Machtpole und der

Bedrohung. Es gibt (2.) einen klar erkennbaren trade-off zwischen der Verbesserung der militaerischen Machtposition des Westens und dem generellen Ost-West Klima. Auf der Grundlage wahrscheinlicher weltwirtschaftlicher Entwicklungen kann (3.) die sechs-Prozent Option exzessive Verteidigungskosten nach sich ziehen. Diese wirken sich dann auf die Moeglichkeiten der betroffenen Staaten aus, Sozialleistungen und "transfers" bereitzustellen.

INTRODUCTION

Coalitions are formed on the basis of common interests. Oft times, though, the common problems that confront the members of a coalition evoke contradictory positions with respect to their solution. In the past, the Western Alliance frequently has been confronted with such situations. The most recent episode, the introduction of new theater nuclear forces, remains contentious. And, of course, there is the traditional and indeed seemingly perpetual problem within this alliance of the question of burden sharing, most frequently defined in monetary terms. As an issue, the latter goes to the very core of any common effort. In recent times, a number of solutions have been advanced. All of these solutions are founded on the premise that they would enhance the security of the Alliance and help reduce tensions within international politics.

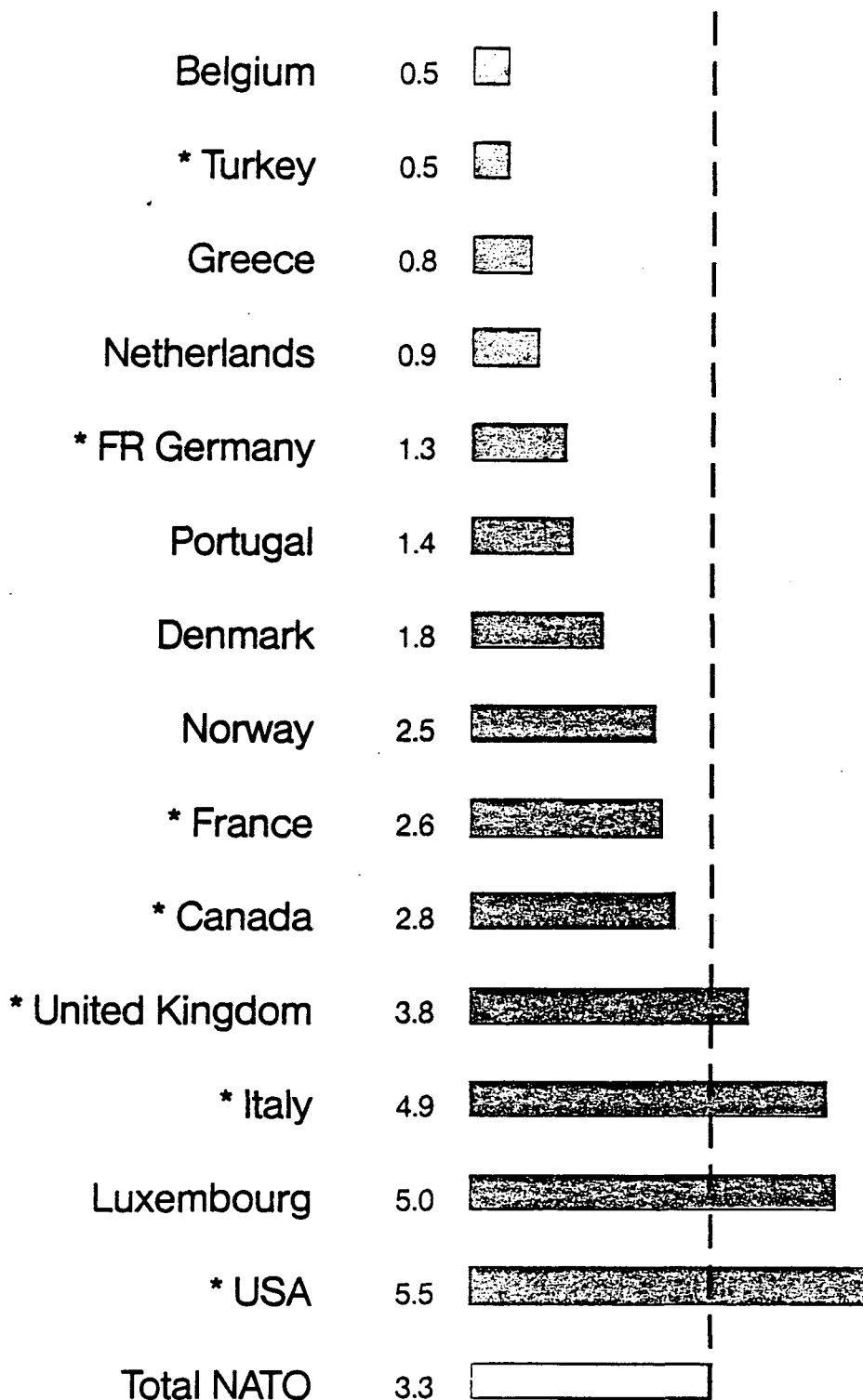
In the late seventies, in reaction to what was seen as a diminution in the relative conventional force capabilities of the Western Alliance, a proposal was put forward and accepted that the member states of the NATO Alliance should adopt and implement a policy of regularly increasing their real outlays to defense. The operational aim of the proposal was to elevate this spending at a rate of 3% per annum and in so doing, enhance the conventional force capabilities of the Alliance, which, in turn, would improve

the Alliance's power relative to the Eastern Bloc. As a consequence this was expected to reduce the potential for hostile behavior on the part of the Eastern Bloc. While adopted as a guideline, acceptance was not universal. Indeed, opposition to what came to be called the "3% solution" arose. On the one side, many argued that such a policy is counterproductive with respect to its purposes, and costly beyond the means of those who would bear it. On the other side, opposition was founded on the argument that the "solution" was no solution at all in that it was insufficient to redress the imbalance that confronted the West, and, thus, would only increase aggressive behavior on the part of the East, thereby elevating both the level of international tensions and the threat to the West.

For a variety of reasons, the pattern of implementation amongst the Alliance members has been divergent. Economic stagnation, competing resource claims, and shifts in national policy stances have produced different performances. As can be seen in Figure 1, the guidelines were effectively implemented by some and not by others but the outcome, when seen in terms of the whole Alliance, has been an annual average growth rate of more than 3% in real terms. To a great extent, surpassing the goal at this level was the product of the largest member, the United States, going well beyond the guideline figure because of the present administration's efforts to create a "rearmed

FIGURE 1

AVERAGE ANNUAL PERCENTAGE INCREASES IN DEFENSE SPENDING (1976-78 AVERAGE TO 1983)



* GLOBUS-Nations

America."

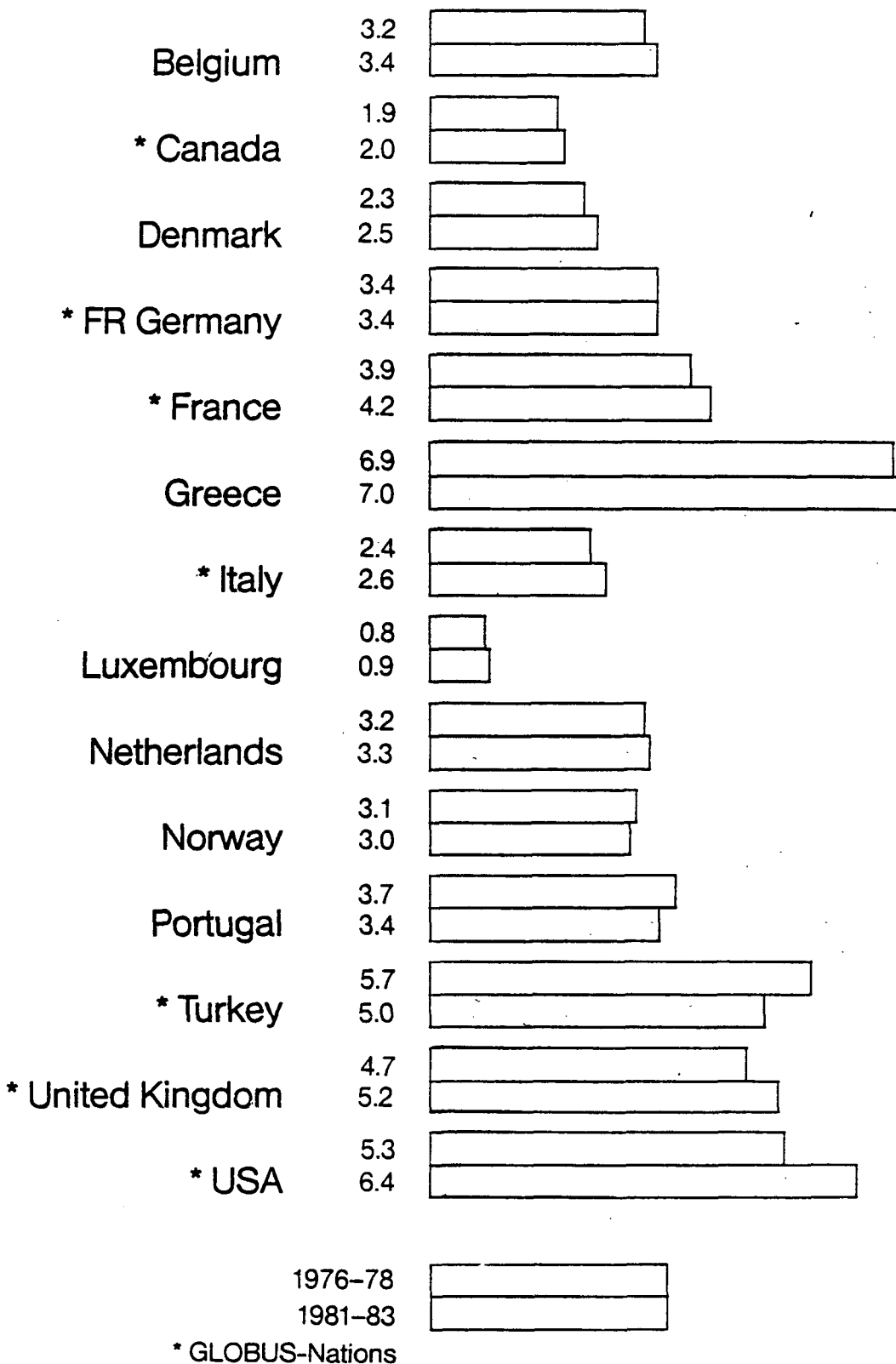
What were the consequences? As Figure 2 demonstrates, the efforts undertaken by the members of the Alliance have generally resulted in an increased burden on their economies. Defining this burden as the share of gross domestic product going to defense, 10 of the 14 countries on this table have experienced increases in that burden. In one instance the burden remained the same and in the remaining three it decreased.

Resource costs were not the only point of contention. At least equally important was the disagreement over the security consequences of alternative options. The effect on the relative capabilities of the two alliances as well as the level of tension were at issue. With respect to the capability question, controversy remains. Pronouncements arguing that an improvement has occurred are balanced by statements contending that no improvement or a deterioration has taken place. There is general agreement, though, that the level of tensions between the two alliances, particularly between the leading members of each, has reached alarming levels.

What might have occurred had an alternative policy target been selected and implemented? What might we expect the long-term consequences of any of these options to be? These questions have significant practical importance and deserve

FIGURE 2

AVERAGE DEFENSE BURDEN OF NATO MEMBERS



to be addressed. Our intention in this paper is to address them by using a simulation model, GLOBUS, in order that we might explore the implications of the divergent defense spending policy options. The purpose of this exercise, it should be stressed, is not to foretell the future. It is, instead, a systematic effort to evaluate options using a theoretically based model designed to address questions of national and international political economy. In the pages that follow we will provide the results of some analyses which were designed to simulate the implementation of three different Western defense spending options. These options include: (1) the implementation of a defense spending program by all the leading Western states which would have been similar to that undertaken by the present American administration (the 6% option); (2) the uniform implementation of the NATO Guideline option (3%); and (3) the implementation of a "freeze" in defense spending levels (the 0% option).

The core of this study is modelling the implementation of three counter-factual policy alternatives by seven Western powers. The results of the counter-factual simulations are examined in the light of three general questions:

(1) What impact might these policy choices have within the broader international system, particularly in terms of the overall accumulation of arms and their distribution as well as in terms of the tenor of international relations?

(2) What impact might these policy choices have on the character of East-West relations both in terms of the security of each bloc, in a military sense, and the tenor of their relations?

(3) Finally, what might these policy choices imply with respect to the allocation of resources?

GENERATING LONG-TERM OPTIONS BY USING SIMULATION (GLOBUS)

GLOBUS, the simulation model employed in this study, has been designed to carry out issue analysis centering on questions dealing with domestic and international political and economic behavior¹. The utility of the model rests on its capacity to examine stresses and strains governments might confront in coping with the complex political and economic environments that surround these institutions. The model includes representations of twenty-five nations and their governments. Included in the model are basic interactions both within and between nations. Five sectors are the principal foci. Each sector incorporates representations of the policy and response functions of government in a specific substantive area or mixtures of such functions and the environmental processes in an area. Cross-sectoral linkages are also represented. Indeed, these cross-sectoral linkages are critical elements of the model. The five sectors include: domestic politics, domestic

economics, international politics, international economics, and government resource allocation.

An preliminary overview of the GLOBUS Model is available in a recent paper by Bremer(1984). Space constraints do not permit any comprehensive description of the model here. To place our analysis in context we will, however, give a brief description of some of the more central elements of the model insofar as they directly impinge on the present experimental focus.

Defense allocation decisions are modelled as an integral part of a complex budgetary process (Cusack,1982,1984a,b). Along with a variety of civilian spending programs, defense spending decisions are modelled as being the product of the development and specification of a desired spending level which is finalized in light of the competing aspirations of governmental agencies and fiscal authorities as well as the bargaining power of the actors involved in the budgetary process (see Figure 3). Desired spending levels in the defense area follow from calculations in the defense sector with regard to depreciation in existing capabilities, the prices that are confronted in the purchase of these capabilities, an assessment of the security situation faced by the state, and a goal with respect to the level of security desired.² The security situation of the state is defined in terms of the threat posed against the state and the capabilities it has available to it. Threat itself

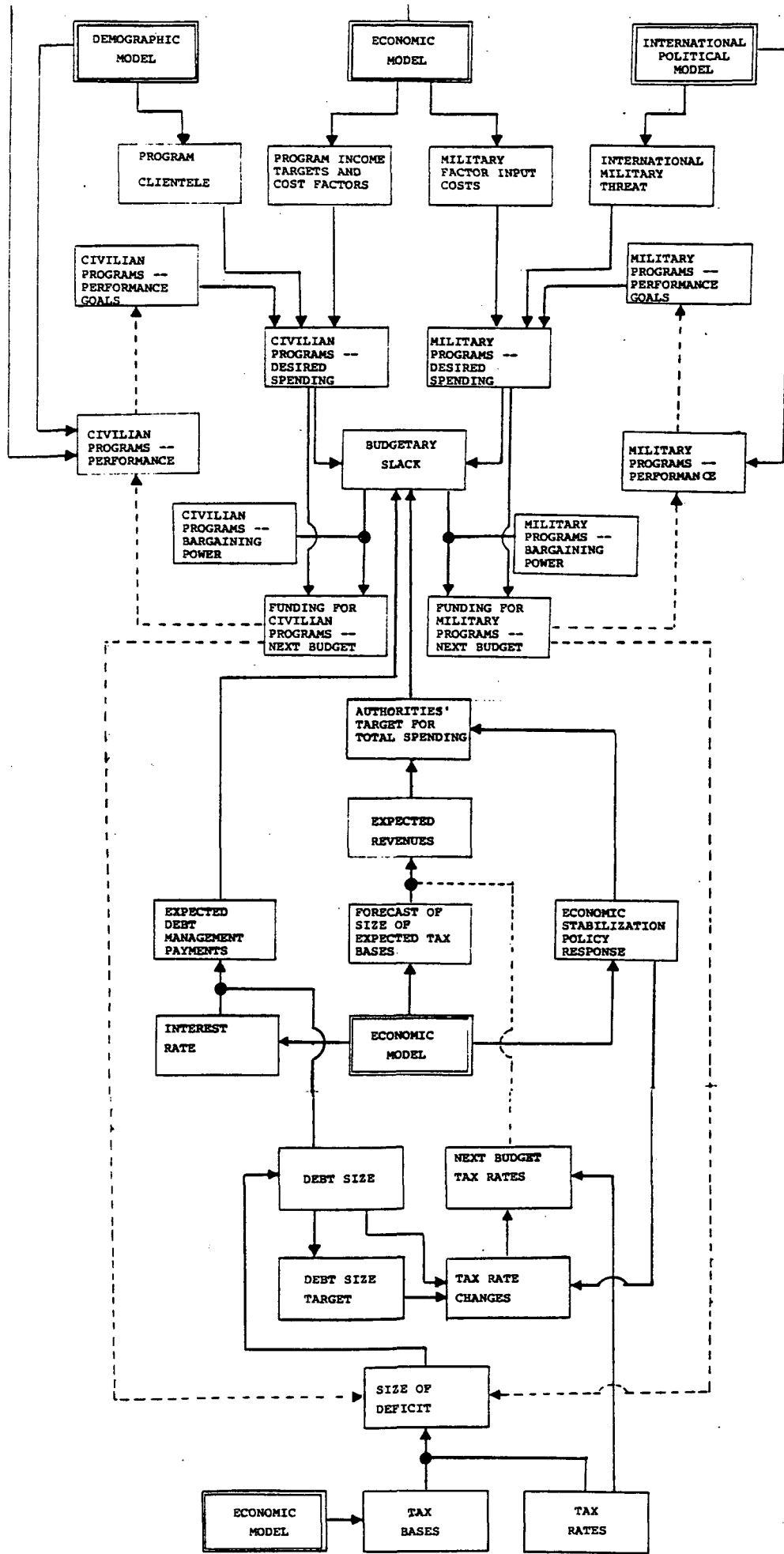


Figure 3
Major Linkages in the GLOBUS
Budgetary Module

represents an assessment of the hostile intent of other states in the system and the capabilities of these other states.³

Internal and external forces are at work in the finalization of the defense budget. Assessments of security requirements, an external consideration, and bureaucratic inertia, representing the desire of the defense sector to stake its claim on government resources, an internal consideration, combine to produce the aspiration level for defense spending. Competition for these same resources generated by other government programs, plus limits beyond which fiscal authorities are unwilling to go, and the relative bargaining strength of all of these actors, again, all internal factors, ultimately determine the level of defense spending.

Helping to shape the international environment that impinges on this allocation process are the dynamics generating hostility and cooperation on the part of the twenty-five states in the system (Smith, 1984b). Based on an action/reaction model, the exchange of hostility and cooperation moves in response to fluctuating international and domestic political and economic factors which influence the calculations that states make as to how they should respond to hostility and cooperation being directed toward them (see Figure 4).

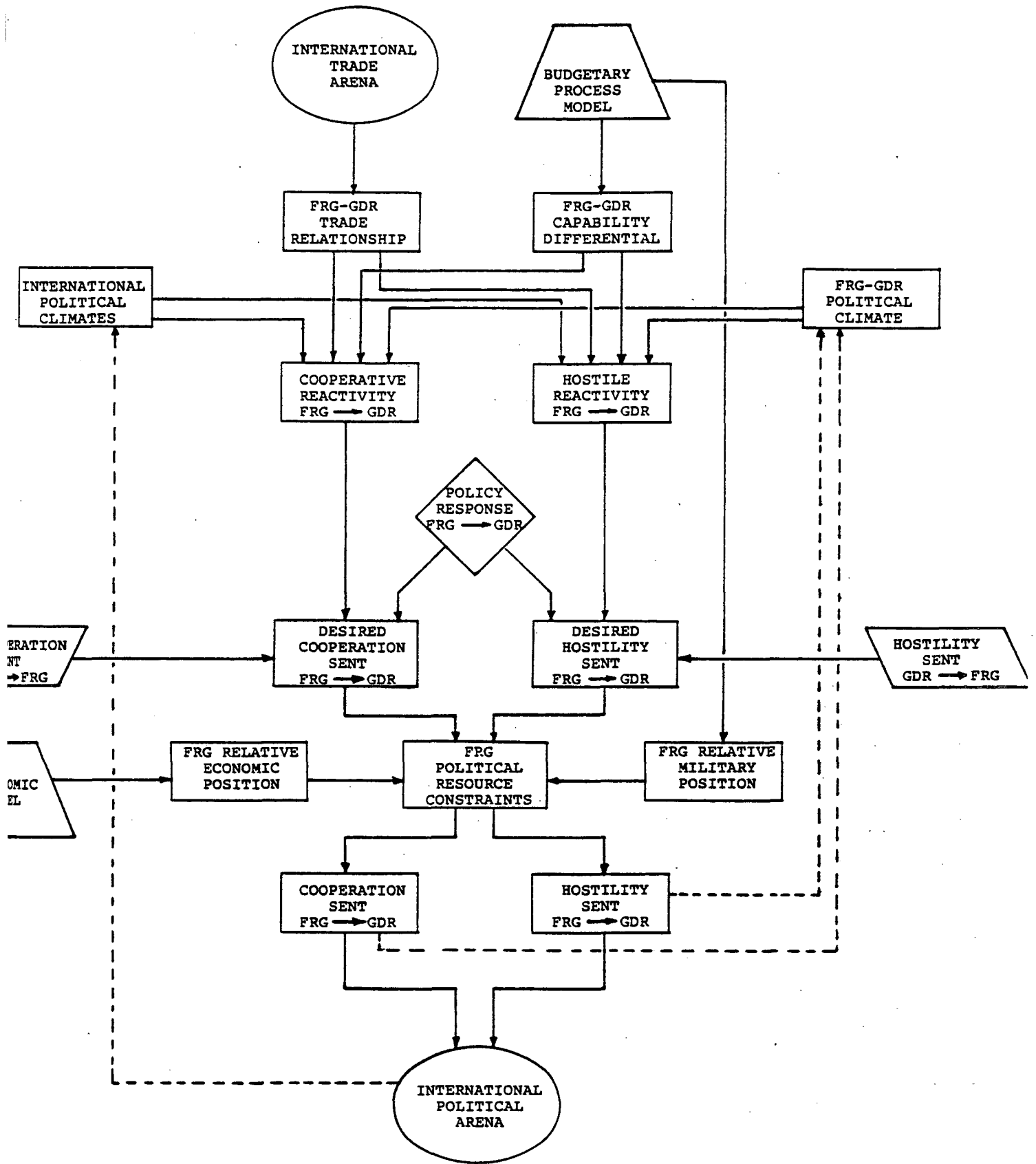


Figure 4 :
 Representation of a
 Dyadic Relationship
 in the GLOBUS Inter-
 National Political
 Module

Defense spending, which produces the military capabilities of these states, enters into the decisions governments make with respect to how they will orient themselves vis-a-vis others in terms of hostility and cooperation. In turn, other states spending decisions, along with their manifest foreign policy orientations, mold the threat environment for the state and thus work to shape the spending decisions of other states.

Table 1 lists the twenty-five nations that constitute the GLOBUS system. In this study we have treated seven of these states as composing the core of the Western Alliance. These seven are: the USA, Canada, the United Kingdom, France, the Federal Republic of Germany, Italy, and Japan. Four states are included in the East grouping. These are: the German Democratic Republic, Poland, Czechoslovakia, and the Soviet Union.

In conducting the analyses, the model was initialized with conditions that prevailed in 1970. Each of the three runs of the model then went forward for 10 full periods before an intervention occurred. At that point, corresponding to 1980, we overrode the normal execution of the resource allocation model in the instances of the seven Western states. The intervention assured that the outcome of each succeeding budget was such as to produce the defense spending level that corresponded to policy option being implemented (i.e., 6%, 3%, or 0% real per annum increase in

Table 1

The 25 GLOBUS Nations

United States of America
Canada
Mexico
Venezuela
Brazil
Argentina
United Kingdom
France
Federal Republic of Germany
German Democratic Republic
Poland
Czechoslovakia
Italy
Soviet Union
Nigeria
South Africa
Iran
Turkey
Egypt
Saudi Arabia
People's Republic of China
Japan
India
Pakistan
Indonesia

defense spending). No other interference with respect to the normal functioning of this or any other sector of the model was undertaken for these countries. No intervention at all occurred with the functioning of any part of the model in the instances of the other eighteen nations in the GLOBUS system.

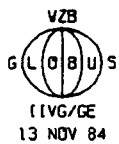
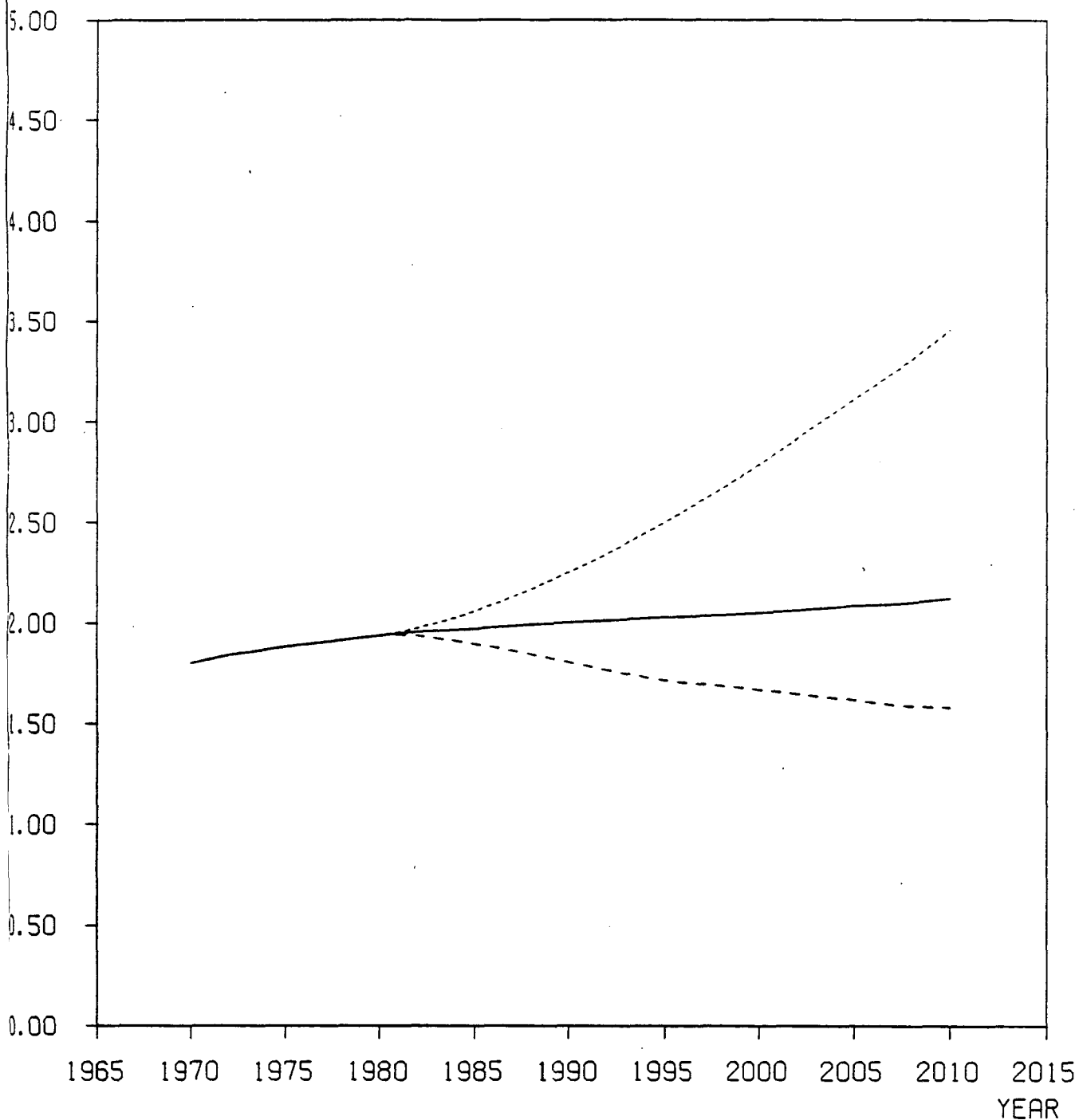
SIMULATION ANALYSIS

Our first interest is in the more systemic level consequences of these alternative policies. The Western Alliance, and indeed the East-West subsystem, make up only part of a larger international system. Both these groupings, though significant and dominant elements, exist within a larger world, influencing and influenced by that larger world. The twenty-five nation GLOBUS system allows us to say something about this greater entity as well as these significant groupings.

Graph 1 charts the development of total conventional military capabilities within the twenty-five nation GLOBUS system during the three different simulation runs. The implementation of these alternative policy scenarios, as noted above, occurs after one-fourth of the run is completed. As the graph demonstrates, the impact in terms of this systemic aggregate, is sharp and clear. Scenario 1, with the implementation of the 6% option generates a 75%

GRAPH 1: TOTAL CONVENTIONAL CAPABILITY IN SYSTEM

[TSD CAPABILITY INDEX UNITS]



LEGEND

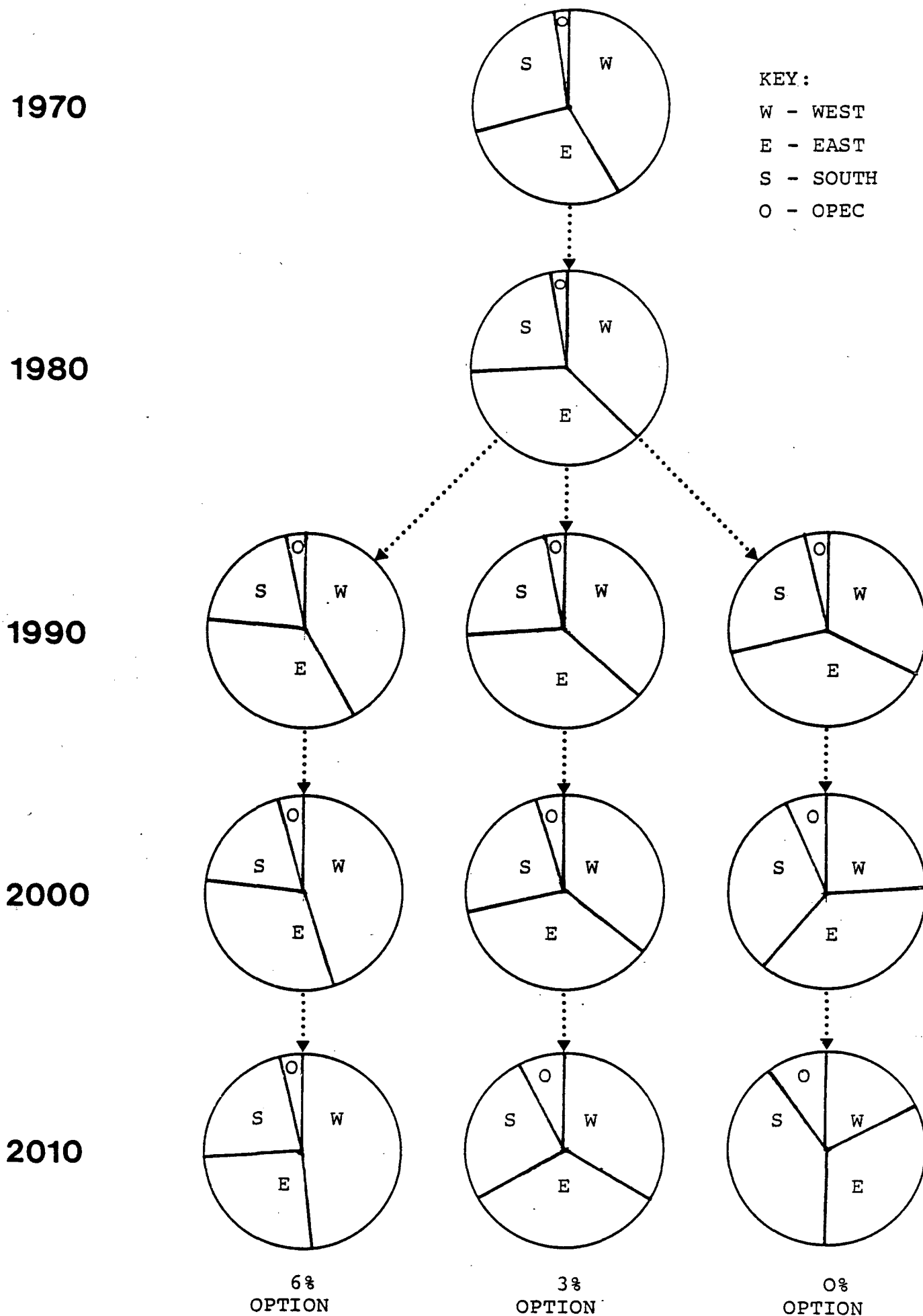
- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

increase in total capabilities during the 30 remaining periods of the run. The 3% option produces only a small increase from the intervention point to the end of the simulation. The "freeze" or 0% option, in stark contrast to the other two, induces a significant outback in the total level of capabilities, taking this aggregate, by the end of the run, to a level lower than that found at the initial period.

Figure 5 and Graph 2 provide information on the distribution of capabilities across groupings of states within the system as well as the concentration of threat therein. Figure 5 charts the evolution of the distribution of power. Under both the 6% and 3% options the long-term tendency is for power to be concentrated in the hands of the West and the East with the South and OPEC groupings (a combined set of 14 countries out of the 25 in GLOBUS) holding a relatively small share. Under the 3% option the latter holding is somewhat larger in the terminal year. Under the 0% option, the power differential between the North (combining the East and West groupings) and the rest of the system is brought eventually to nil, representing a situation of a more balanced power distribution at the systemic level.

The concentration of threat in the system, after the policy intervention, tends toward a more equal distribution across all three scenarios (Graph 2)⁴. The trajectories of the 6% and 3% options are relatively similar. Under the 0% option,

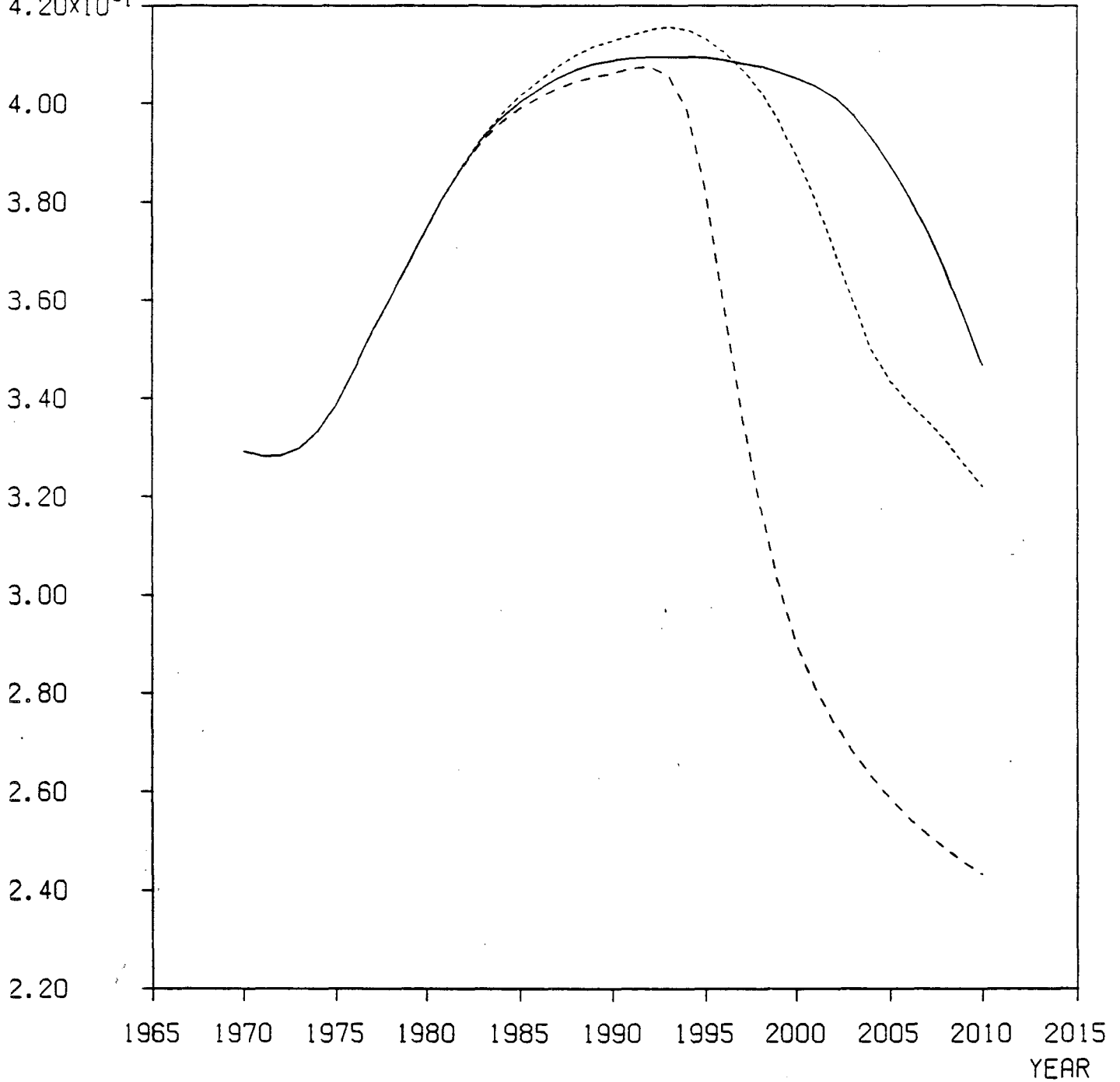
FIGURE 5
 REGIONAL DISTRIBUTION OF CONVENTIONAL
 MILITARY CAPABILITY



GRAPH 2: CONCENTRATION OF THREAT IN SYSTEM

[CONCENTRATION INDEX (0.0 = MIN. CONCEN.; 1.0 = MAX. CONCEN.)]

4.20×10^{-1}



VZB
GLOBUS
IIVG/GE
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LEGEND

- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

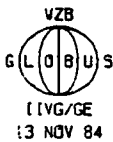
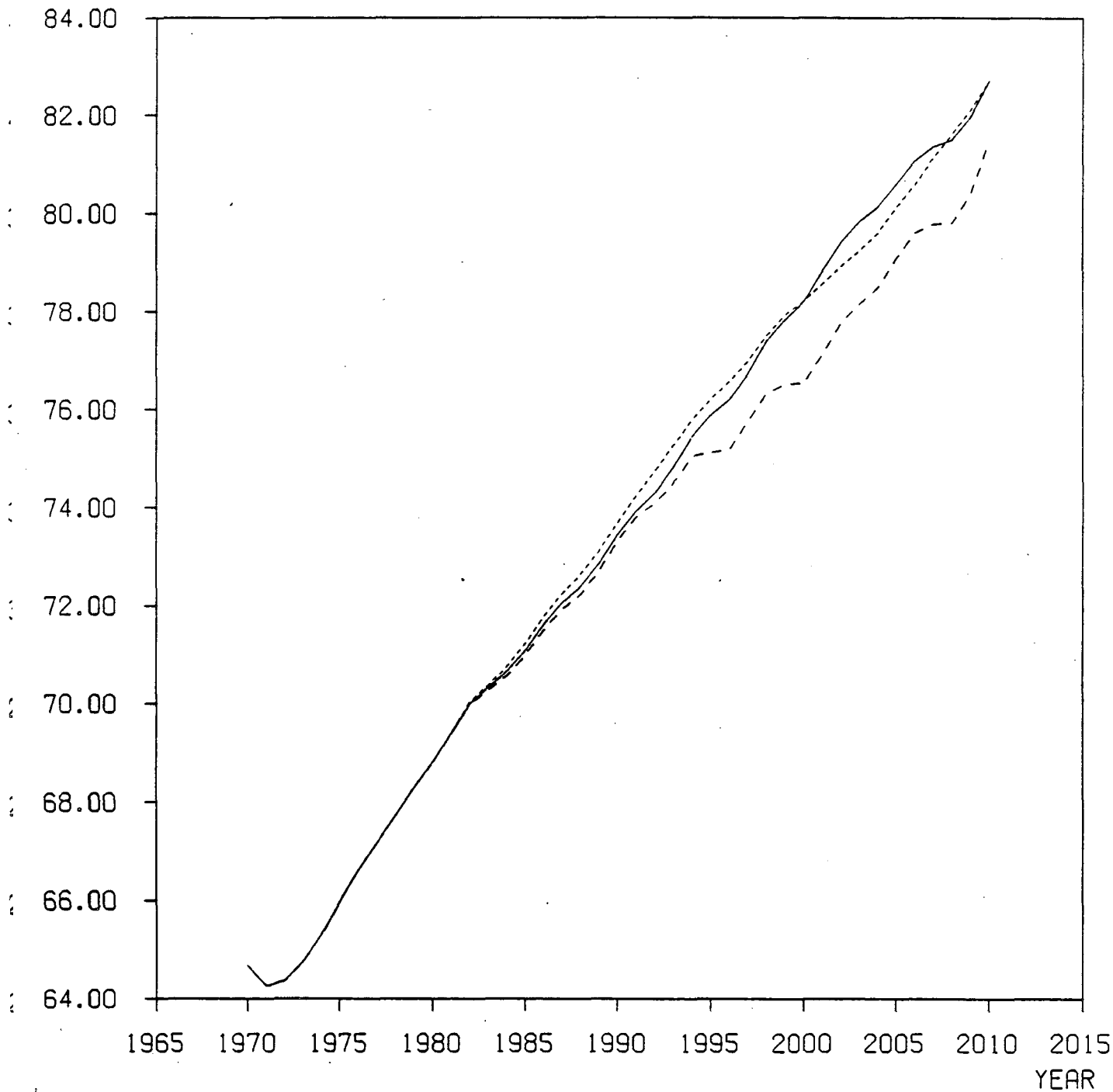
however, a delayed response moves the level of of concentration sharply downward--signifying a notable diminution in the inequality in the amount of threat being directed toward the states in the system.

By the most direct measures, the tenor of international relations is affected in only one clear way. Graphs 3 and 4 chart the total flows of cooperation and hostility in the system. Little or no impact is seen on the developmental path of international cooperation. Conversely, the level of hostility within the system generally differs in light of the defense spending policy option chosen. Implementation of the 6% option induces a higher level of hostility in the system. A levelling off results from the 3% policy option. A decrease and levelling off is apparent with the implementation of the 0% solution.

What lessons might we draw from these results? It is clear that the lower the percent increase in defense spending on the part of the West, the less likely it is that the overall system would spiral forth in a massive arms accumulation effort. This, of course, is not an unexpected result. More interesting, and certainly consequential in its own right, is the impact these alternative options would have on the concentration of both capabilities and threat as well as the relative levels of hostility and cooperation. The long-term impact of both the 3% and 0% solutions is to more clearly diminish concentration on both these dimensions. Such a

GRAPH 3: TOTAL COOPERATION IN SYSTEM

[TSD COOPERATION INDEX UNITS]

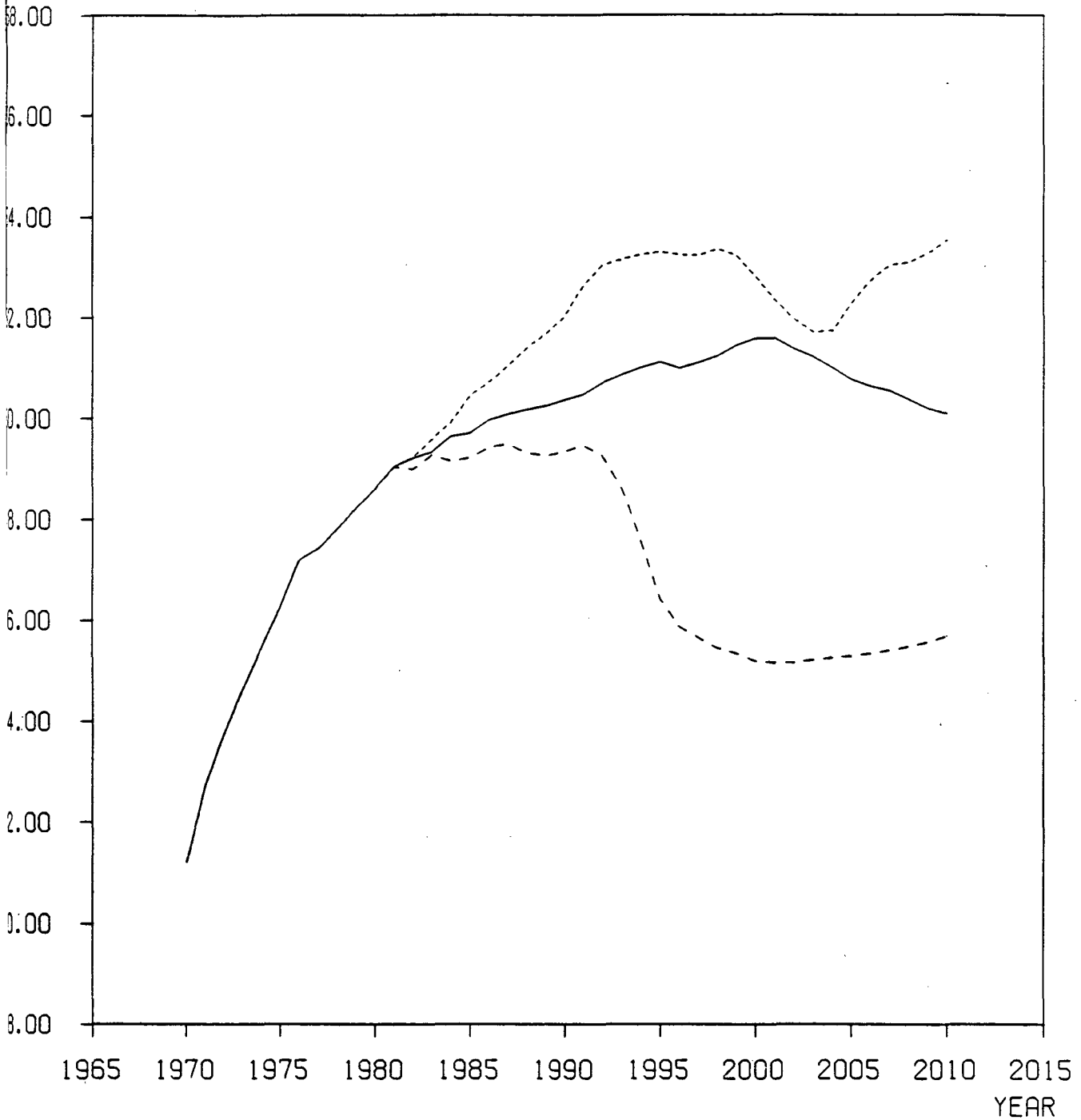


LEGEND

- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

GRAPH 4: TOTAL HOSTILITY IN SYSTEM

[USD HOSTILITY INDEX UNITS]



LEGEND

- =3%_OPTION
-=6%_OPTION
- =0%_OPTION

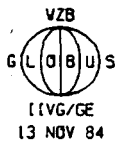
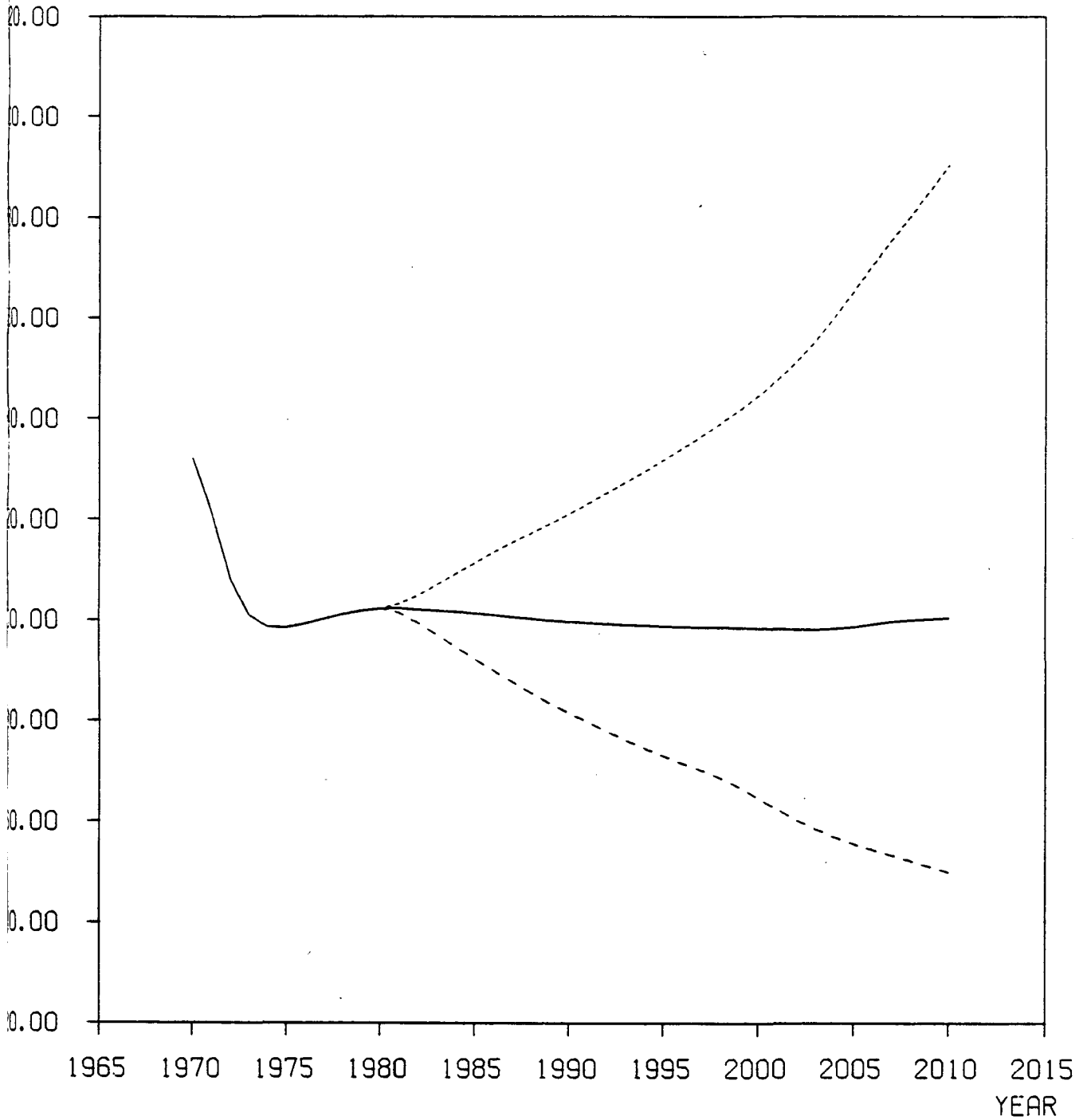
development would be considered by at least some to be conducive to a more stable and peaceful international system (cf., Siverson and Sullivan, 1983). In addition, while a long-term trend in the development of cooperation seems unaffected by any of the three options, the developmental path of hostility seems greatly influenced by the policy option implemented. In effect, the long-term effect of a lower defense spending option could be a less unfavorable mixture of hostility and cooperation.

To a considerable extent, all of these policy alternatives were put forth to solve what was perceived as a deterioration in the security position of the West. This position, of course, can be defined in numerous ways. Some of the more salient include the balance in capabilities between West and East, the balance facing both sides in terms of the capabilities each has relative to the threat that each faces, and the levels of tension in their relations. Let us look at each of these concerns and how the alternative defense spending policy options might affect them.

What are the implications of these alternatives in terms of the relative strengths of West and East? Graph 5 shows that they not too surprisingly imply starkly different results. The 6% option, after 30 simulated years from its implementation brings the West to about a two-to-one superiority over the East. The 3% option hardly affects the

GRAPH 5: WEST-EAST CONVENTIONAL MILITARY BALANCE

[WEST CAPS. RELATIVE TO EAST CAPS.]



LEGEND

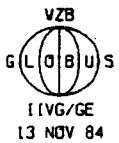
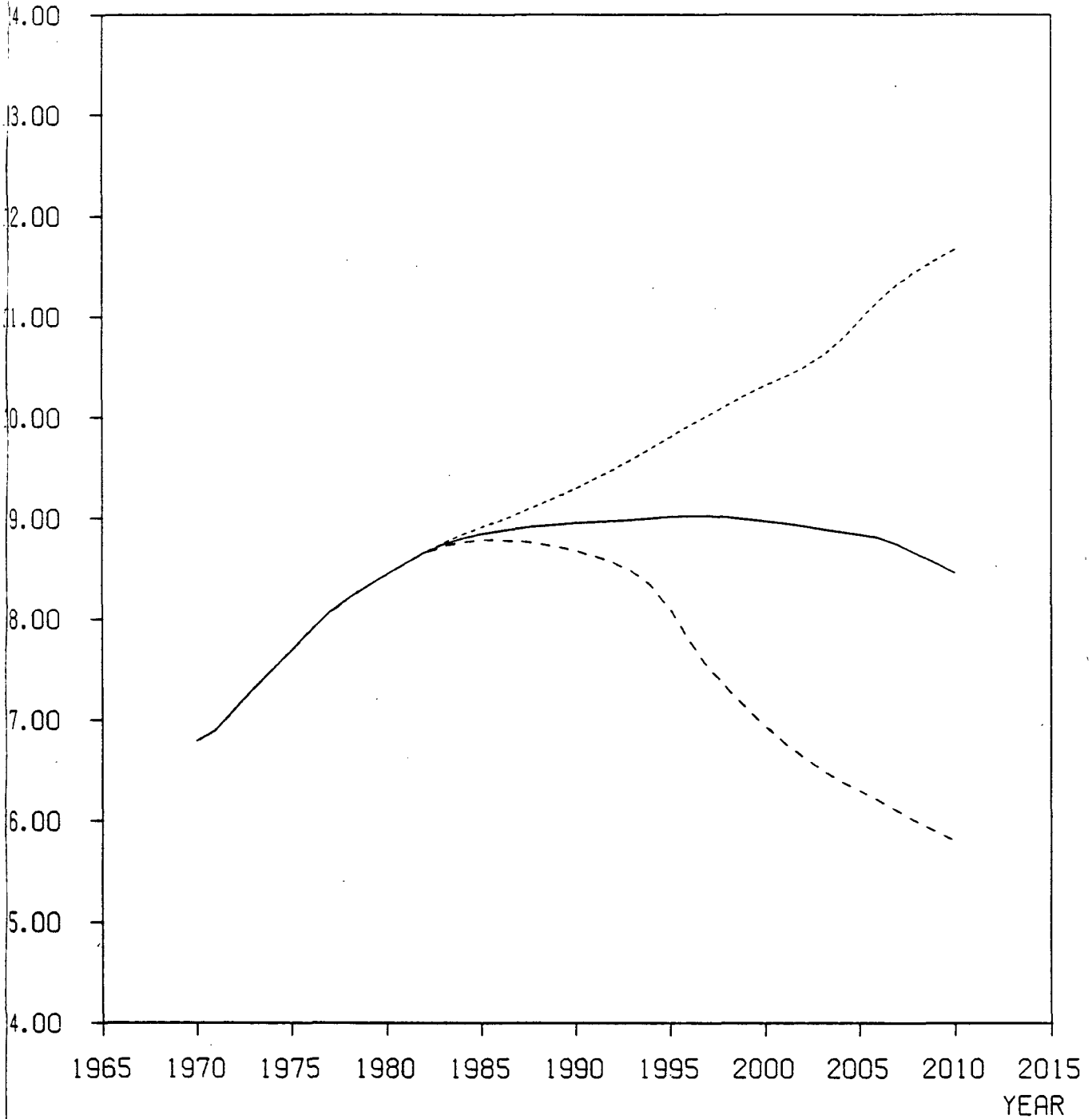
- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

balance between West and East, while the "freeze" option reduces the West's position by about 50% by the end of the run. Security, however, needs to be seen in a broader light. Capabilities are supposedly accumulated to counter threats. As noted in an earlier paragraph, threat tended to become more diffuse throughout the international system under the 0% option. While the West's relative capabilities might diminish in comparison with the East, whatever change would occur needs to be seen in light of the threat that is to be countered by its capabilities. In Graph 6 we see that the direct policy actions taken by the West could have markedly different consequences in terms of the threat that over the long term would be posed against it. Under the 6% option, there is a continuous rise in the threat level. This needs to be contrasted with relatively unchanged or constant level that ensues under the 3% option and the significant decline that occurs with the 0% option.

Graph 7 shows another aspect of the potential security implications of the three options. Here the capabilities of the West are compared with the threat that might be directed toward it under the three policy scenarios. The 6% solution produces a marked increase in the ratio of capabilities to threat. The 3% option entails little change while the 0% option would see a lowering of that ratio. The implications seem to be the opposite for the East (see Graph 8) with the 0% solution improving its position, relatively little change

GRAPH 6: THREAT PERCEIVED BY WEST

[HRD THREAT INDEX UNITS]

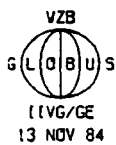
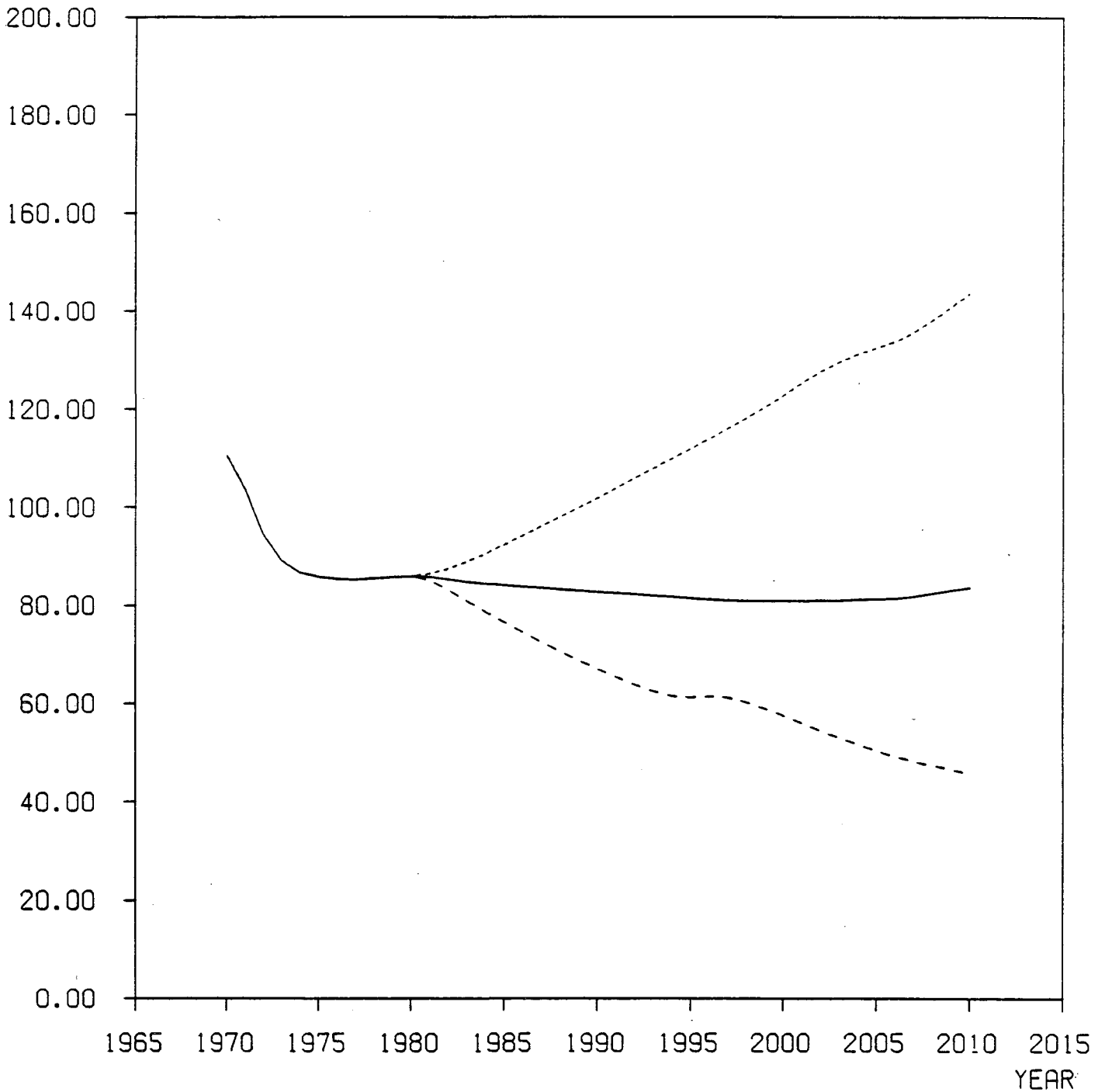


LEGEND

- =3%_OPTION
-=6%_OPTION
- - - =0%_OPTION

GRAPH 7: CONVENTIONAL SECURITY POSITION OF WEST

[% WEST CAPS. RELATIVE TO THREAT PERC. BY WEST]

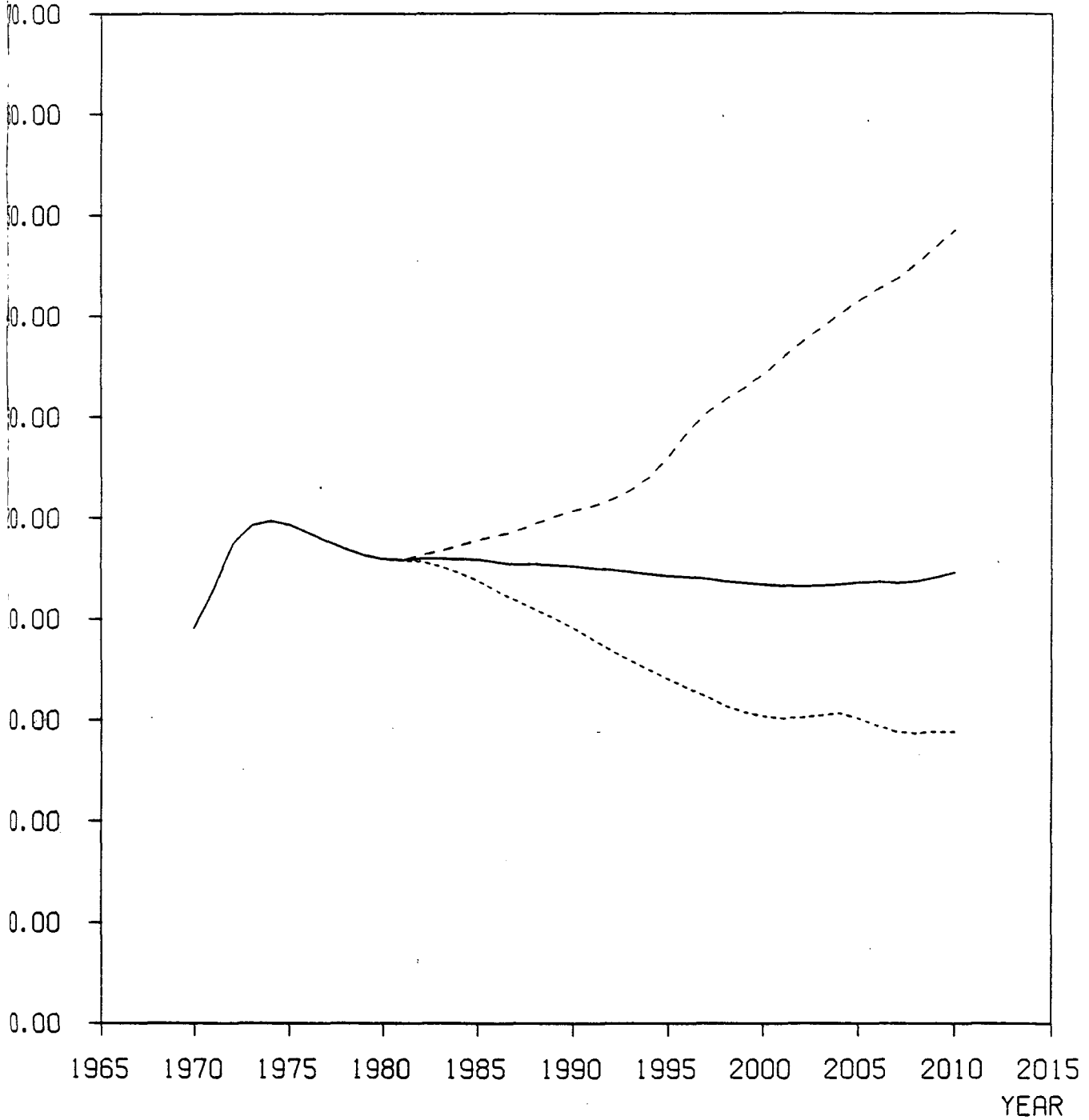


LEGEND

- =3%_OPTION
-=6%_OPTION
- - - =0%_OPTION

GRAPH 8: CONVENTIONAL SECURITY POSITION OF EAST

EAST CAPS. RELATIVE TO THREAT PERC. BY EASTJ



VZB
 6(L) (S) (B) (U) S
 (1) (V) (G) (E)
 13 NOV 84

LEGEND

- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

transpiring under the 3% option and a slight decrease occurring with the 6% option.

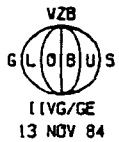
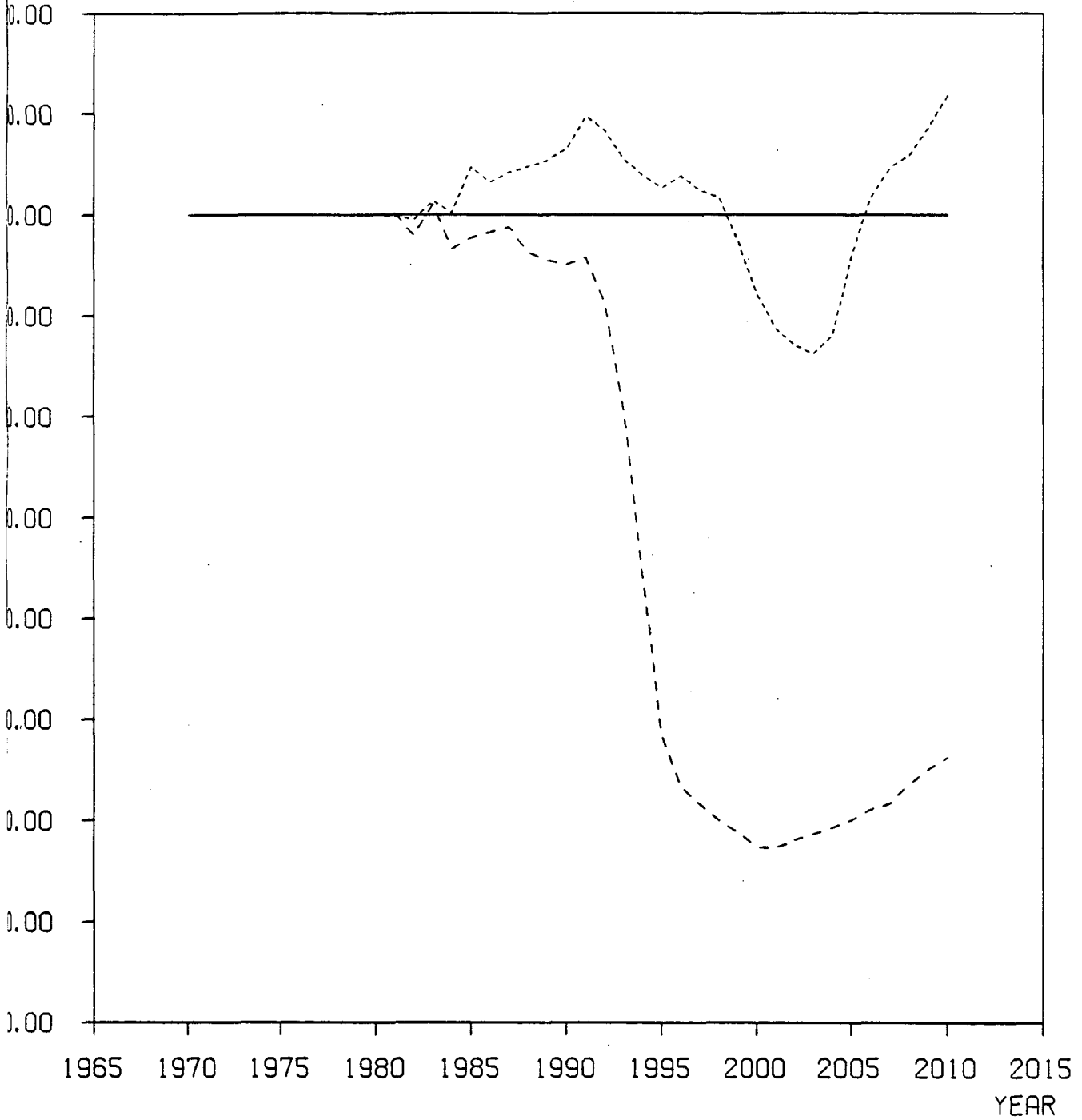
Under all three options the long term tendency is toward an improvement in the the East-West climate as measured by the level of hostility relative to the level of cooperation exchanged between these two groupings--though under the higher options this improvement is not very significant. Appreciable differences are manifested across the three scenarios. Comparing the 6% and 0% option with the 3% as a "base case" (see Graph 9), we can see that for the most part the 6% option would have a less beneficial effect while the 0% option would dramatically better the tenor of East-West relations.

We see that the results of these experiments suggest that an improved capability position for the West would be purchased only through the implementation of the 6% option. The costs, however, in terms of the absolute increase in the threat that could be directed toward it as well as in the potential failure of the level of tension between East and West to subside significantly might, however, vastly outweigh such a gain.

Other costs need to be assessed. What do these options imply in terms of "crowding out" and "tradeoffs" that would have to be sustained over the long run?⁵ Any defense spending policy option that is implemented needs to be seen in terms

GRAPH 9: EAST-WEST CLIMATE

% DEV INTER-BLOC HOSTILITY RELATIVE TO COOPERATION]



LEGEND

- = 3%_OPT
- = 6%_OPT
- - - = 0%_OPT

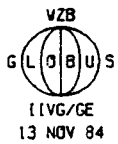
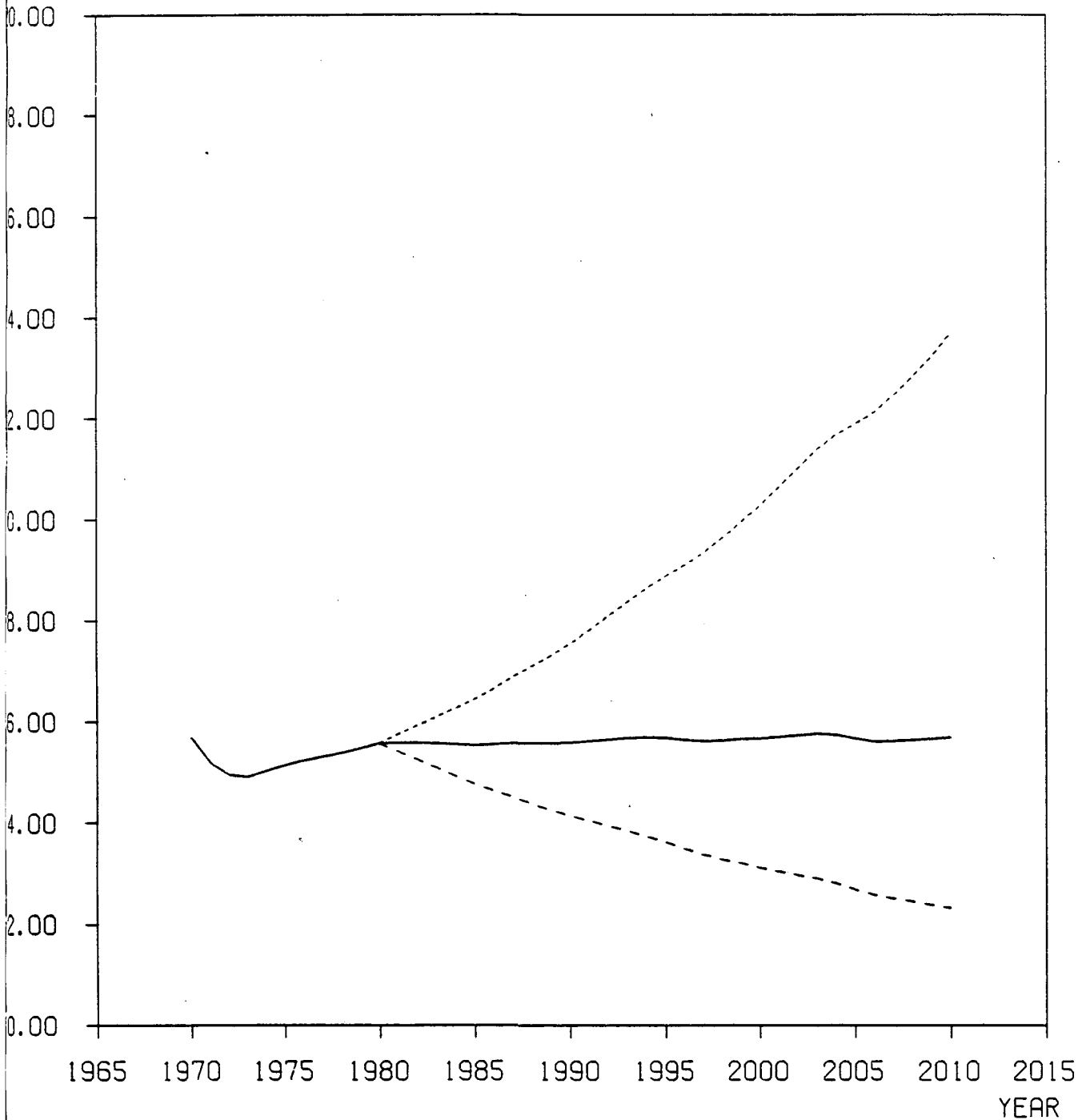
of the resource demands that it makes (cf., Russett, 1970; Cusack, 1983). No effort undertaken by government comes cost free. The paths displayed in Graphs 10 and 11 display in sharp contrast the sort of burdens that might be implied by each of the options. The 6% option, under the economic conditions that are likely to prevail, would drive the defense burden that the Western economies would have to bear to a point well above any previous peacetime experience, taking it to levels generally characterized as synonymous with a "garrison state." The 3% option would entail relatively little change in the overall defense burden while after thirty simulated years the "freeze" option would halve the burden relative to its level from the adoption of the option.

In turn, the pressure or slack that each option would imply in the budgetary process could have telling effects. Only a marginal increase in the share of societal resources going to social programs (social security, education, health) would take place with the 6% option--and this during a time when most would concede that the proportion of the population in need of such programs is likely to grow significantly. Both the 3% and 0% options would seem to allow for far greater expansion of the resources being allocated to these social programs.

The East would appear to mirror these tendencies in its own peculiar way. The defense burden of the East, under the

GRAPH 10: WESTERN DEFENSE BURDEN

% GDP ALLOCATED TO DEFENSE]

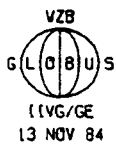
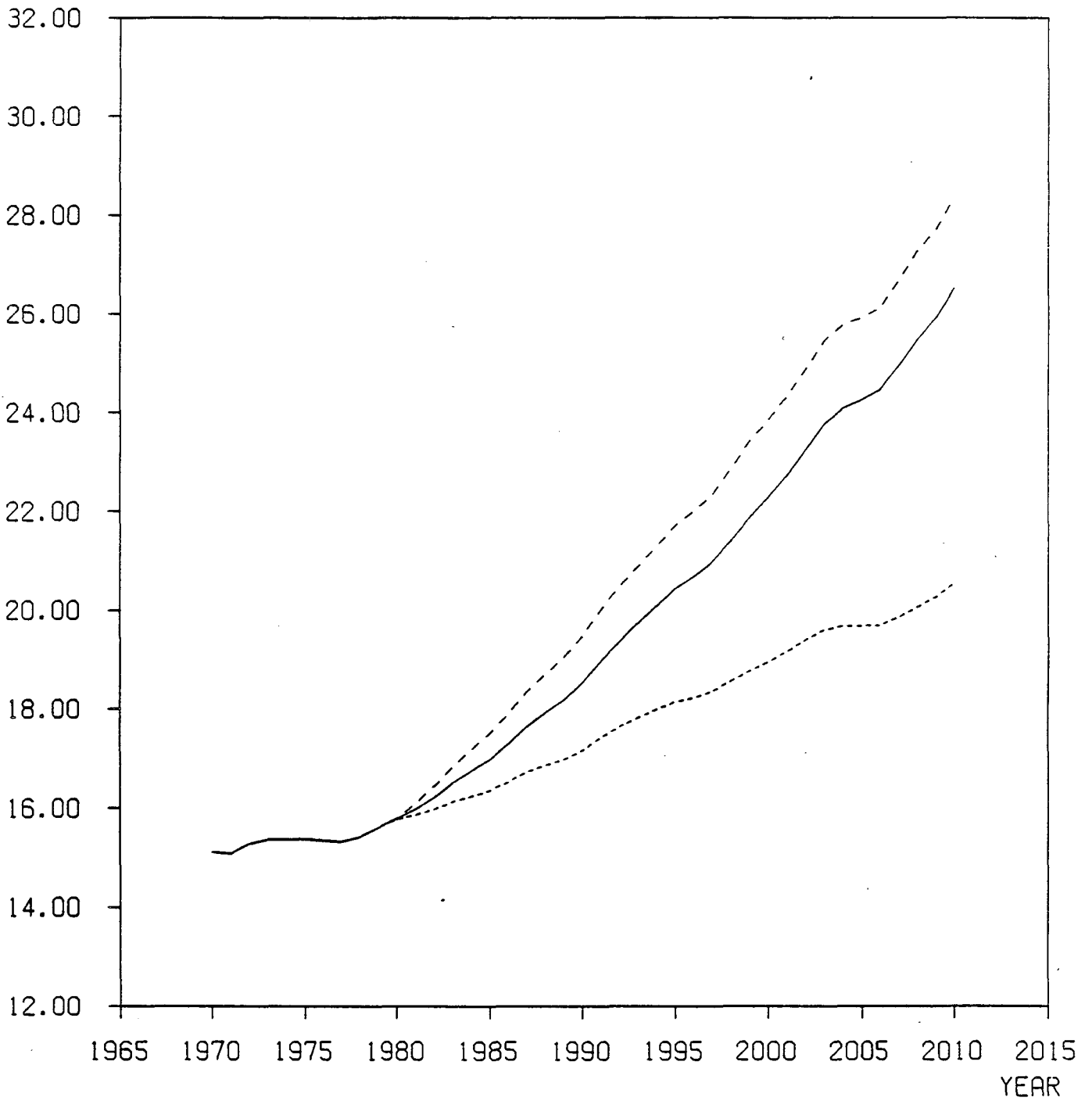


LEGEND

- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

GRAPH 11: WESTERN SOCIAL SPENDING EFFORT

[% GDP ALLOCATED TO SOCIAL BENEFITS AND TRANSFERS]



LEGEND

- =3%_OPTION
-=6%_OPTION
- - -=0%_OPTION

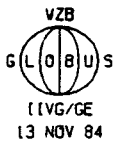
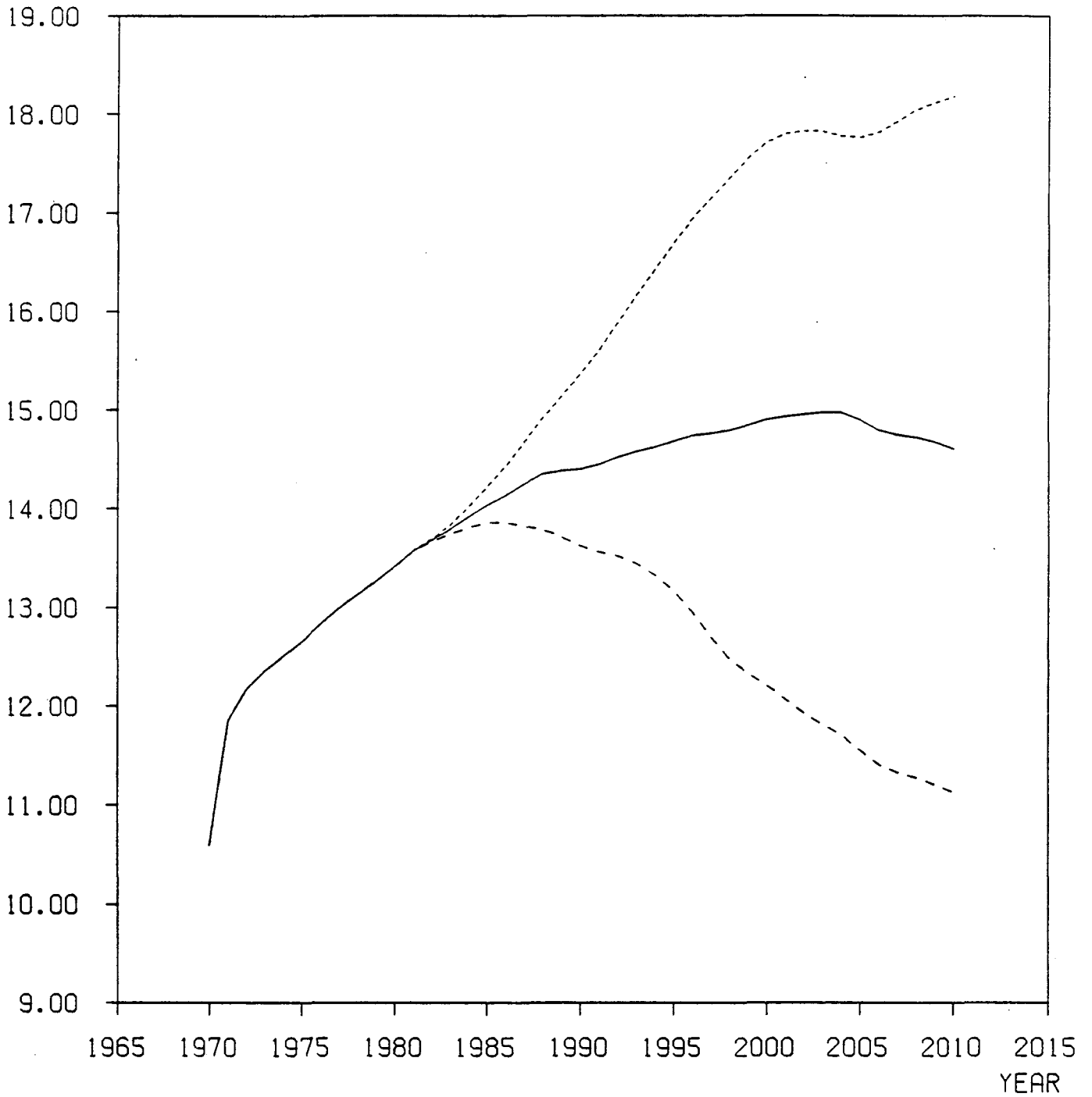
assumption that the West would adopt the 6% solution, would rise from its already great height to an amazingly high level (see Graph 12). Under the 3% solution, some slight increase in the defense burden in the East is at first noticable, though it eventually begins to decline. With the 0% option one could witness a decline in this heavy burden. Correspondingly, the general downturn in the share of resources going to social programs in the East would eventually be halted and reversed under both the Western 0% and 3% options (see Graph 13). It would continue downward with the 6% solution.

CONCLUSION

Any exercise such as this must be viewed with caution and understood in appropriate terms. A critical perspective needs to be used in interpreting the results reported here. First, this is not an effort at forecasting the future. It is rather an attempt at using a theoretically based model to explore, with a host of restricting assumptions, the implications of altering certain components of that model in certain ways that bear some correspondance to a contemporary political-economic issue. Second, no model, regardless of its complexity and size, can ever give a full and complete rendering of what transpires or may transpire in the social world. The model's usefulness must be seen in its ability to allow us to explore the implications of the ideas we have

GRAPH 12: EASTERN DEFENSE BURDEN

[% GDP ALLOCATED TO DEFENSE]

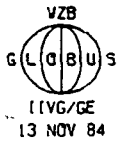
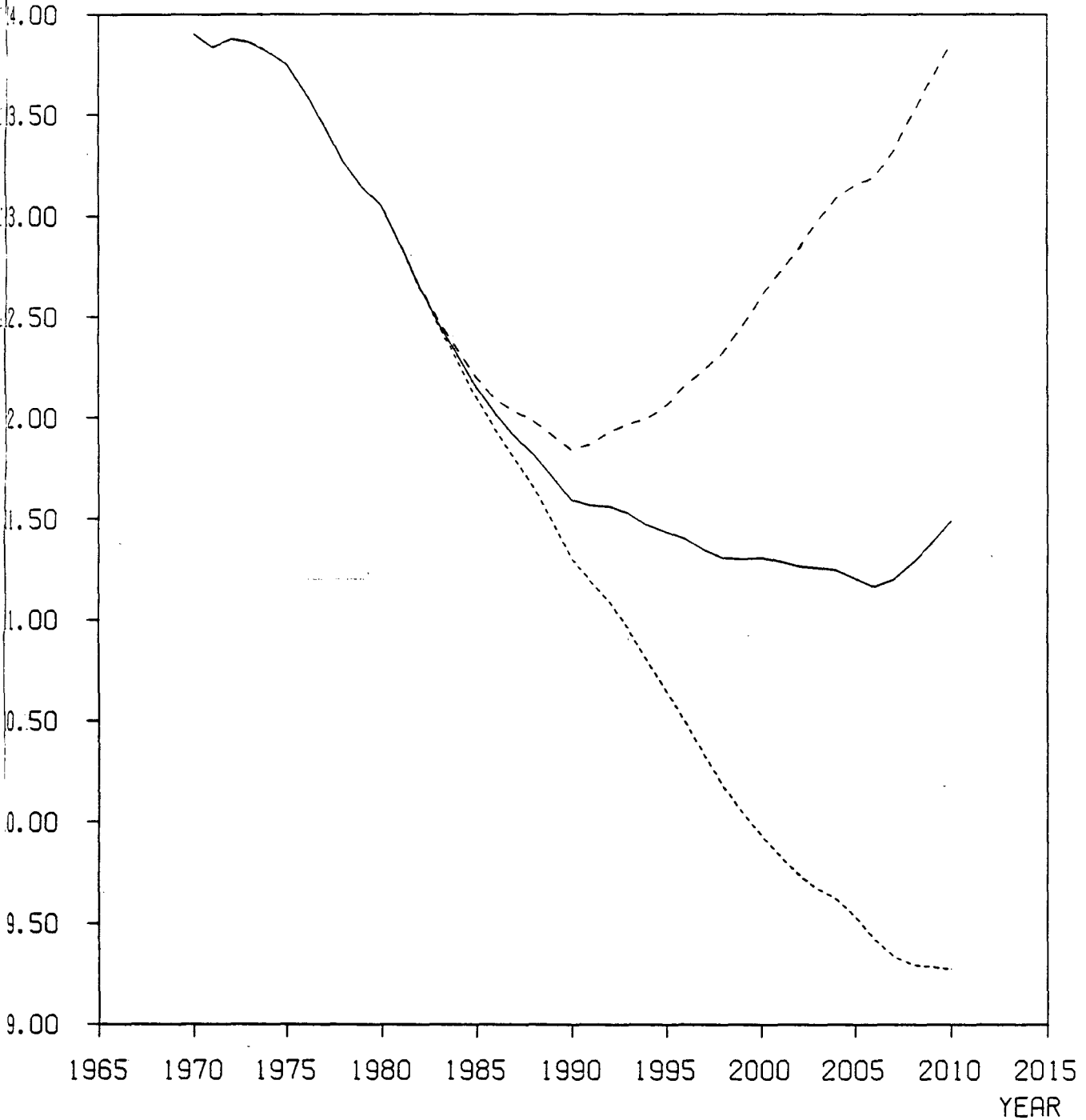


LEGEND

- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

GRAPH 13: EASTERN SOCIAL SPENDING EFFORT

% GDP ALLOCATED TO SOCIAL BENEFITS AND TRANSFERS]



LEGEND

- = 3%_OPTION
- = 6%_OPTION
- - - = 0%_OPTION

built into it. The results generated by the model rest on these ideas. The former can only give us an insight into the problems with which we are dealing. One can hope that these are of value in understanding the problems; one cannot guarantee that such is the case.

The analyses reported here were conducted for the purpose of exploring the long-term implications of alternative defense policy options on the part of a group of states embedded in a large international system: one in which this group stands in a state of mutual antagonism with another group. The three simulations that were conducted implemented alternative defense spending patterns on the part of seven major Western states. The three alternatives included interventions where, starting in 1980, these states altered their real levels of defense spending by 6%, a option comparable to recent American policy, 3%, the NATO guideline adopted in the late 1970's, and 0%, i.e., a "freeze" in defense spending.

The principal results from our analyses can be summarized as follows:

(1) The three options generated markedly different results in the overall level of militarization within the system. In addition, with the lower two Western options, the greater is the long-term tendency toward equality in the overall distribution of power. Across all the scenarios there is

evident a long-term tendency toward a diffusion in the distribution of threat across the system--but this is most pronounced under the 0% option. This latter is important for it could signify the disappearance of situations where some small group of states become the focus of inordinate threat with the potential such a situation has for destabilization. Also evident under the lowest option is a long-term decline in the overall level of hostility in the system.

(2) The three options implied markedly different balances between the two groups with a tradeoff apparent between the relative balance of power between West and East and the level of tension within this subsystem. The 6% option brings in train an improved relative position for the West, in terms of matching East capabilities and meeting the threat directed toward it. But this unilateral policy also results in greater threat being directed toward the West and also militates against the improvement in East-West tensions apparent under the lower Western options.

(3) The 6% option implied a startling expansion of the defense burdens that both West and East would have to sustain, driving both groups well into a pattern of resource allocation corresponding to that of a "garrison state." This option would significantly reduce the resources available for social programs in both groupings, dramatically reducing the long-term growth in the Western Welfare State and

worsening an apparent restricted level of performance in the East.

NOTES

My thanks to Dale Smith and Uwe Zimmer for their help in conducting the study reported here.

1. The use of large scale simulation models for the purpose of exploring political-economic questions is not widespread. However, following in the wake of the development of global models during the 1970's and continuing in the tradition pioneered by Guetzkow (Guetzkow, et al, 1963; Guetzkow and Valadez, 1981) and Bremer (1977), some innovative and interesting work using simulation for purposes of examining political-economic issues is beginning to come forth (cf., Ward and Guetzkow, 1979). Bremer and Mihalka's (1977) study explores problems of peace and war in a highly stylized model used to simulate a large multi-state system. A recent and interesting study, employing a strategic-political-economic multi-nation model (SIMPEST) is reported by Allan and Luterbacher (1983). Here the focus was on alternative developments in Soviet-American relations under a variety of simulated alternative developments. A similar study (Smith, 1984a) focuses again on Soviet-American relations, using the GLOBUS Model, and examines the impact of Reagan's foreign policies on Soviet-American relations and a broader multi-state system. Leontief and Duchin's (1983) analysis employs the input-output based U.N. World Model to examine in some detail the economic implications of a variety of military spending, arms trade, and economic aid scenarios.

2. The focus of this study is on conventional military capabilities. While we recognize the significance and growing importance of nuclear weapons, and indeed include representations of the associated processes in the budgetary area dealing with the accumulation of strategic nuclear capabilities, our position is that the whole nuclear area is fraught with ambiguity and not susceptible, at least within the present confines of our Project, to any extensive and complete representation.

The conventional military capability index employed here is based on a weighted product of the quantities of capital and labor employed in the military sector of the nation. The capital and labor scores are standardized measures which have been described in earlier papers (Cusack, 1981, 1984a). The measured values for the capability index for the seven Western countries included in this study for the year 1970 are: USA, 489.4; FRN, 59.6; FRG, 59.3; UKG, 47.5; ITA, 41.6; JPN, 40.9; and CAN, 12.2. For the four countries included in the East grouping, the values are: USR, 488.0; POL, 35.5; CZE, 27.7; and GDR, 17.0.

3. The threat measure employed here represents an effort at assessing the conventional capabilities that decision-makers might perceive as being potentially directed toward their states in light of the capabilities of other states in a multi-state system and the hostile intentions that these other states signal given the way they distribute their expression of hostility and cooperation within the system (Cusack, 1984a). The threat directed toward j, based on a revision of Singer's (1958) formulation is defined as:

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

where:

n = number of states in system;
 CAP = conventional capability of state i;
 and INTENT(i → j) is defined as:

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

where:

HSENT(i → j) = an index of i's conflictual or hostile acts directed toward j; and
 CSENT(i → j) = an index of i's cooperative acts directed toward j.

The hostile and cooperative indices are based on the COPDAB Data Set (see Azar and Sloan, 1975) and the scaling procedures employed to construct these indices are described in a paper by Smith (1984b).

4. Ray and Singer's (1973) index of concentration, CON, is used here. This index ranges in value from zero (0), indicating perfect equality among the system components, to 1.0, a situation where some attribute is concentrated in the hands of only one of the system components:

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

The measure does not take into account ties that might bind the components of the system. For a discussion of a more elaborate measure which take this facet into account, see Bruckmann (1971).

5. A description of the economic module in GLOBUS, along with details on its linkages to the government resource allocation module as well as information of the characteristic performance of the economies in this environment is available in Hughes(1984).

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