NAZLI CHOUCRI with the collaboration of Robert C. North

9. In Search of Peace Systems: Scandinavia and the Netherlands; 1870-1970

ABSTRACT

This investigation draws upon conflict theory and analysis for insights concerning the development and maintenance of peace systems.

Peace systems are not devoid of conflict. Conflict emerges whenever individuals, groups, or nations come into contact. One distinguishing characteristic of a peace system is the institutionalization of non-violent modes of behavior and conflict resolution. Testing for the prevalence of peace systems is based on three distinct but related considerations: first, isolating the determinants of warfare; second, identifying those situations which do not conform to what are thought of as conflict and war-prone systems; and finally, examining the relationships among those variables that are crucial in conflict systems and noting the extent to which their behavior does not conform to a conflict model.

The investigation centers around three Scandinavian countries and the Netherlands. The former provide a marked contrast with major powers, and the latter serves as something of a contrast to the Scandinavians. The analyses combine an historical approach with more recent empirical methods of inquiry. Causal modelling procedures are employed to estimate the parameters of a conflict model (partially validated in earlier analyses) while employing data for these four countries. Our results indicated that most links in a war-prone conflict model do not hold for Sweden and Norway and few links are significant for Denmark and Holland. The variable effects of population dynamics and technological development become apparent as do alternative "paths" to military preparedness.　　　　　　　　　　　　　　　　　　■

POPULATION, RESOURCES, TECHNOLOGY, AND INTERNATIONAL BEHAVIOR

This chapter represents a convergence of two intellectual traditions—conflict analysis and peace research. On the one hand we have an interest in identifying the origins, nature, and dynamics of conflict and warfare among nations; and on the other a deep concern for peace systems. Our purpose is to work toward an operational theory of international dynamics—one which will account for the peaceful resolution of conflict and the absence of war as well as for conflict and warfare. In any investigation of this kind the "causes" of war and the conditions for peace become highly interdependent, as they are in the "real" world.

We proceed from the assumption that the roots of conflict lie deep in the configuration of national attributes and, by extension, in the relative distributions of national capabilities within the international systems. These two sets of considerations define the parameters within which psychological, sociological, and political variables become important determinants of actions and reactions. Differences in national capabilities are therefore related and sometimes give rise to differences in behavior. Major Powers tend to have certain types of capabilities and they behave and are expected to behave in some ways and not in others. Historically, for example, Great Powers (as well as many Lesser and Small Powers) have tended to be war-prone. Thus, certain characteristic attitudes and behaviors on the part of the world's strongest Powers are likely to be markedly different from those exhibited by Lesser or Small Powers.[1] These attitudes and behaviors and also some of the influential attributes are also likely to be quite different from the attitudes, behaviors, and influential attributes of countries that are candidates for consideration as "peace system" nations.

We would expect a peace system to be characterized by the institutionalization of non-violent modes of international behavior and conflict resolution. For purposes of analysis, however, peace systems must be further identified in terms of particular kinds of (1) national attributes, (2) behavioral predispositions, and (3) patternings across national predispositions.[2]

The analysis that follows focuses on four Small Powers—Sweden, Norway, Denmark, and the Netherlands (at least three of which suggest rough approximations of peace systems nations) and searches for stable relationships among various indicators of national capability as well as changes over time and evidence for the existence of a national profile that is empirically distinguishable from those of the Major Powers. To the extent that the behavior of these states as Small Powers differs from the behavior of Major Powers, we would expect

1. The relationship between national capability and international behavior is a central theme in the International Relations literature (Aron, 1967, Organski, 1968; Renouvin and Duroselle, 1967; Rosecrance, 1963; Wright, 1965a). The essays in the volume, especially those by Wallace and by Rummel, bring the empirical perspective to bear most directly upon this issue.

2. There have not been any satisfactory definitions of peace systems, partly because of the nature of the phenomenon. (See Galtung, 1969, for a treatment of this problem.)

their attributes and characteristics also to differ; hence, uncovering the nature of these differences is an important, if only preliminary, step toward the identification of peace systems.

The development of conflict and war-prone systems is predicated, in large part, on the gradual convergence of determinant variables. Such systems crystallize to the extent that the "causes" of violence are neither weakened nor transformed into conditions for non-violent modes of behavior. In the same fashion, the development of peace systems is predicated on the absence of significant convergence or mutual reinforcement among various "causes" of violence and on the extent to which habitual modes of international behavior are non-violent in nature. Peace systems, however, are not devoid of conflict. Conflict emerges as soon as, and as long as, two or more individuals, groups, or nations come into contact.[3] But a unique characteristic of a peace system is the non-violent nature or mode of involvement in conflict.

Testing for the prevalence of peace systems is based on three distinct considerations: first, isolating determinants of warfare; second, identifying those situations which do not conform to what are thought of as violent conflict or war-prone systems; and, finally, examining the relationships among those variables that are crucial in a war-prone system and noting the extent to which the behavior of these variables in a peace system deviates from their behavior in a violence model. Thus, a model of peace systems will be one in which the greatest number of links in a war-prone conflict model appear to be non-significant or to provide negative effects on conflict-related variables.

The model used in our subsequent analysis is based on the proposition that the roots of international violence can be found in the distribution of attributes and capabilities of individual nations insofar as these continue to have an impact on, and even perhaps condition, their position relative to others in the international system. The crucial variables are population, resources, and technology, where technology refers to the general level and rate of development of human knowledge and skills in a society. A combination of growing population and developing technology imposes rapidly increasing demands upon resources. To meet these demands a society tends to develop specialized capabilities. The greater the unsatisfied demands and needs in a society and the greater the capabilities, the higher is the likelihood that national activities will be extended outside territorial boundaries.[4] Such efforts undertaken beyond the home territory may be expressed in any one or a combination of different modes—exploration, commerce, investment, extraction of minerals, warfare, and so forth. The mode (or combinations) of such external behavior will condition both eventual outcomes and the nature of relations among nations. Historically, many such expansions of effort beyond home territories have given rise to colonial-type wars against low-capability people and sometimes indirectly to wars with a rival Power.

3. See McNeil (1965) for different perspectives on conflict behavior.
4. See North in collaboration with Choucri (1971) for an extended discussion of the effects of population in the international system.

War-prone systems thus tend to develop when two or more countries with high capabilities and unsatisfied demands extend their interests and psycho-political borders outward and develop the feeling that such interests ought to be protected. There is then a strong probability that sooner or later the two spheres of interests will intersect. The more intense the intersections, the greater is the likelihood that competition will assume military dimensions. When this happens we may expect the competition to become transformed into conflict and perhaps an arms race or cold war. Thus, as we have argued elsewhere, major wars often emerge by way of a two-step process: in terms of internally generated pressures or external expansion of interests and activities and in terms of reciprocal comparisons, rivalry, and conflict between two (or more) Great Powers on a number of salient dimensions (Choucri and North, 1972).

Conflict relationships may be depicted, in a highly simplified way as follows in Figure 1.

Peace systems represent a variant of this basic model and are likely to develop when modes of international behavior generated by internal demands and pressures are such as to avoid giving rise to spheres of influence that need to be defended and thus to intersections among such spheres or to military competition. This does not mean that competition is avoided altogether, but rather that it is channelled through non-violent, low-threat modes of action. In
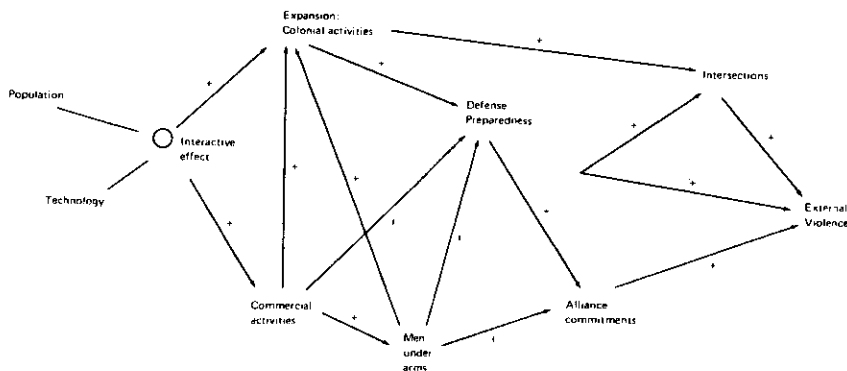

Figure 1. Linkages Between National Capabilities and External Behavior: A Conflict System Model [a]

a. This diagram is presented for illustrative purposes only. It is a simplified statement of the dynamics under consideration. For the sake of brevity further interactions, feedback effects and mutual dependencies are omitted although it should be recognized that they operate at every stage. It might also be noted that the expansion variables are bound by our empirical analysis of a specific conflict situation (Europe, 1870-1916) and that at different periods and with different nations other variables may be more appropriate. However, the general sequence of the dynamics pointed is independent of operational definitions. Finally, the diagram is meant to summarize the theoretical arguments in the text and not to provide an arrow diagram for direct translation to statistical equations.

the context of Figure 1, such relations are characterized not by positive feedback and explosive dynamics but by inverse effects and negative feedback loops at some critical junctures.

We suggest that the differences between war-prone and peace systems might be attributed to four considerations: the type and extent of demands that are generated internally; the general capability of the system to translate demands into actions; the nature and characteristics of the capabilities which the system has developed; and the modes within which international behavior is undertaken. Therefore, theoretically at least, the underlying structure of variables in a war-prone conflict system is similar to that of peace systems; the difference lies in initial values, coefficients, and levels and rates of change.

Our emphasis on internal capabilities should not be construed to imply a necessary one-to-one correspondence between population level, technological achievement, military capability, and so forth on the one hand and international behavior on the other. It may be obvious to assert, for example, that the behavior of a Major Power is determined in large part by those attributes that make it a Major Power (and similarly for smaller states). But changes in a nation's attributes may well be conducive to changes in behavior.

At the same time, however, we also recognize that the perceptions of a nation's capabilities held by its leaders (accurate or inaccurate as the case may be) are equally, or perhaps more, critical than "reality" (White, 1968; De Rivera, 1968). This latter consideration is likely to be especially important in the shaping of a policy, whereas outcomes are conditioned more by the "reality" of things and only secondarily by the perceptions of national leaders. The two tend to be highly interconnected. The nature of the dependency is, of course, an important question, but it far exceeds the limitations of the present study.

The following analysis is concerned primarily with the effects of population growth, resources, and technological development on (1) the consolidation of military capabilities (reflected in budgetary allocations to defense and in the size of the armed forces), (2) the pursuit of two different modes of external behavior (commercial activities versus colonial expansion), and (3) the relationships between these two factors.

INTERNATIONAL DYNAMICS: LINKAGES IN A CONFLICT SYSTEM

Our recent efforts to untangle initial dependencies among variables have centered around the Major European Powers during the forty years or so prior to the outbreak of World War I. These analyses have been tentative and have indicated that deeper and more complicated dynamics were involved than we had initially thought. We attempted to measure the properties of particular war-prone conflict systems in terms of the configuration of coefficient characteristics, but we have not as yet extended our analysis to other domains nor demonstrated empirically the differences, if any, between Major and

non-Major Powers. Nonetheless, our investigations have yielded important methodological and substantive results.

We have examined mutual dependencies between internal and international variables by specifying key links in the chain of developments leading to international conflict and by constructing equations for domestic capabilities, extnesion of a nation's activities outside its own boundaries, the types of behavior that immediately precede violence, and then violence. We have also experimented extensively with alternative formulations of the basic theoretical framework and have submitted different models to the empirical test. The strength and direction of coefficients relating key variables yielded some indication of relative fits (Choucri and North, 1969). The most significant variables contributing to colonial expansion were population growth, technological development, and the interactive effect of population and technology. These linkages seem to hold for the six Major Powers and "explain" much of their expansionist thrusts at various periods from 1870 to 1914.[5]

At the same time it also became apparent that there were some significant links between technological growth and colonial expansion on the one hand and defense preparedness on the other. Of course mutual dependencies are not to be precluded, and evidences of simultaneous effects are pronounced. On balance, however, the most important "causes" of increasing defense allocations appeared to be both internal and external to the nation state. The internal variables are predominantly technological, in combination with the bureaucratic effects associated with defense preparedness (best represented by the constraints on this year's budget imposed by last year's allocations). The external factors appear to be twofold: first, the gap or difference between a nation's defense preparedness and that of its rivals, and second, the intensity of intersections among their respective spheres of influence.[6]

5. The results have been presented and discussed fully elsewhere (Choucri and North, 1971; North and Choucri, forthcoming.) The dependent variable employed in this analysis was colonial population (as an indicator of expansion) although colonial area is equally appropriate, and the independent variables are home population, home area, steel production, and interactive effect of population and production, imports and exports, and defense expenditures. We found strong evidence for the prevalence of break points (or shifts in the underlying dynamics) with the empirical data producing better "fits" at different sub-periods than for the forty-five years as a whole. For example, between 1870 and 1900 the colonial populations under British control more than double in size, and 75 percent of the variance in this expansion can be accounted for mainly by the differences between population growth in relation to home territory, by technological advancement, by the combined effect of population and technology, and by military preparedness. For France about 85 percent of the variance in colonial expansion from 1902 to 1914 can be accounted for mainly by technological advancement, by the interactive effect of population, and by military capability. Well over 60 percent of the variance in German expansion until 1892 can be accounted for by these variables. Similar patterns are evident for Russia, Italy, and, to a lesser extent, Austria-Hungary as well, although in the latter case expansion was severely constrained by geographical and political considerations.

6. The analysis of armament competition has been given considerable attention among more empirically oriented scholars (Alker, 1968; Caspary, forthcoming; Lagerstrom and

Not unrelated to the above are the considerable effects of defense preparedness and intersections among spheres of influence on the intensity of violent interactions among nations. One critical junction, therefore, seems to be the point at which nations extend their behavior outside territorial boundaries and the mode of behavior selected. Intersections thus follow directly from expansion; expansion is conditioned by internal demands for resources (and markets) and by defense preparedness; expansion of interests contributes to violence; and defense preparedness contributes, in turn, both to expansion and to external violence.[7]

The dependence of external behavior on internal attribute characteristics thus becomes a partially validated hypothesis. While we recognize that the 1870-1914 conflict situation cannot be generalized indiscriminately to all conflict systems, the implications of such empirical relations should not be minimized. How the nature of these relationships changes over time and across nations is still very much of an empirical question, but we expect the coefficient characteristics relating attribute variables for the smaller states to differ from those for Major Powers. Thus, as noted earlier, the types of linkages between domestic and external variables for nations in a peace system are likely to be different than those for nations in a conflict and war-prone system.

Peace system nations, such as the Scandinavian countries, deviate sharply from the Major Power pattern in that they have consciously endeavoured not to become involved in ongoing global conflicts nor to engage in international warfare. Thus, the possibility of finding alternative patterns of international relations which minimize the probabilities of violent eruptions is convincingly raised by these countries' behavior. For example, the reciprocal dependencies between expansion, military preparedness, and external violence evident between the Major Powers do not hold, if only because the Scandinavians have

North, 1969; Mitchell and Choucri, 1969; Moll, 1968). Our own analyses have concentrated on systematic comparisons of three different types of military competition equations, comprising the results and evaluating these accordingly. The first, a national dynamics equation, stipulates that military competition results primarily from dynamics internal to the nation-state; the second, an interaction equation, suggests that military competition results from comparisons of gaps or differences between a state's defense capabilities and those of its adversaries or rival; and the third, that competition and arms race dynamics result primarily from processes of an international nature. The results indicated that each set of dynamics (as represented by those equations) provided some explanatory power. Over 80 percent of the variance in the dependent variable is accounted for by this equation for each of the Major Powers. The incorporation of break points in the analysis by redefining the adversaries to reflect the changing political situation resulted in consistently good "fits" for the period as a whole.

7. These interdependencies were apparent in the results for the equations depicting expansion, intersections, military competition, and violence (North and Choucri, forthcoming). Furthermore, changes in the explanatory power for each equation supported the hypothesis that different dynamics operate at different stages in the development of a conflict system (see Choucri and North, 1972, for comparative R^2; North and Choucri, forthcoming, Part V, for coefficients and related statistical data and information).

not at any time in the past century initiated organized external violence or colonization ventures. Furthermore, their dominant modes of external behavior appear to be limited to commerce, shipping, involvement in international organizations, peacekeeping, and similar enterprises which minimize the probabilities of intersections with other powers and, by extension, the development of the causal sequence associated with the eruption of large scale violence and warfare. For our purposes the Scandinavian regional sub-system may best be considered as a partial, or imperfect yet prototypical, peace system, leaving the concept still not fully defined but nonetheless clearly enough distinguishable from the conflict and war-prone system characteristic of Major Power interactions between 1870 and 1914.

To the extent that these states reflect a distinct profile of national attributes, capabilities and purposive behavior, the investigations reported in this paper should shed light on some important issues relevant to conflict and cooperation, peace and war, theory and analysis. Our purpose is to move toward empirically-based assessments of some of the properties of a peace system without claiming as yet deep insight into the "causes" of the emergence or decline of such a system.[8]

The Netherlands present an additional perspective on the issue of war-prone and peace systems. On the one hand, Holland today shares Small Power status with the Scandinavian countries; on the other, it has, until very recently, shared with the Major Powers the status of Colonial Power. Two-way comparisons of this nature are likely to be extremely useful, a consideration which we return to in a subsequent section when explicit comparisons of the attributes, capabilities, and the behavior of the four countries in this study are undertaken.

THE SCANDINAVIAN COUNTRIES AND THE NETHERLANDS: HISTORICAL OUTLINE

Essentially, the Scandinavian countries "opted out" of ongoing conflict and war-prone systems long ago and as a result of internal and external transformations have substantially modified the patternings of their international relations. This process took place over a considerable span of time with several turning points at different historical periods, each of them resulting in a considerable reduction of external violence (Woods and Baltzly, 1915; Wright, 1965a). From the mid fifteenth century to the early 1700's, Sweden, Denmark and Holland were almost continuously involved in war--a pattern extending several centuries back.[9] Especially in the case of Sweden, this aggressiveness coincided with

8. For a discussion of the Scandinavian countries from the perspective of integration theory see Deutsch et al. (1957). Haas (1970) and Nye (1970) provide important theoretical insights.

9. Sweden was almost constantly in a state of war or turmoil (civil as well as external) from 800 to 1814. The Viking period (800-1060) best illustrates this above judgment: Scandinavia was relatively overpopulated; methods of agriculture and cattle breeding were

rapid population growth (with overpopulation relative to domestic resources available at the time), and in a search for external resources. At the turn of the eighteenth century, however, their war involvements diminished gradually, though consistently. For the Scandinavian countries, especially, the Napoleonic wars marked a turning point in terms of the direct participation in warfare and conquest (Wright, 1965a: 641-647). The change is not central to our discussion, but it does point to the adaptive capability of nations, a capability which may have important implications for the potential development of peace systems. Danish foreign policy in the mid-nineteenth century followed a sharp military defeat and a substantial loss of territory and resources.[10] Increasingly, the Scandinavian countries thus diverted their capabilities to predominantly non-violent patterns of international behavior (Wuorinen, 1965, Oakley, 1966).

By the outbreak of War in 1914 "the foreign policies and relations of the Scandinavian nations . . . had long been such as to place them outside the mainstream of Big-Power agreements or alliances; they were designed to maintain peace and neutrality and to avoid undertakings likely to create friction or endanger cordial relations with other states" (Wuorinen, 1965: 29). It appears, therefore, that the transition from war-prone to peace systems had been largely completed by that time.

When war broke out in 1914, Denmark, Norway, and Sweden declared a position of neutrality—a status that left them vulnerable to the point where their rights as neutrals were repeatedly violated by the belligerents. During the Second World War the Scandinavian countries were even less fortunate than in the first. Russian pressures culminated in the invasion of Finland, and Germany occupied Denmark and Norway. Only Sweden remained relatively uninvolved. But Swedish neutrality was predicated almost entirely on Russian and German benevolence, and the price of neutrality was high.

Differences in World War II experiences contributed—along with differences in attributes and in earlier experiences—to the adoption of different post-war international postures. In 1948, Sweden, Norway, and Denmark entered into discussions concerning the possibility of military cooperation and reciprocal alignment. Attempts to develop regional organizations were unsuccessful, however, and subsequently Denmark and Norway—the two Scandinavian countries overcome and occupied by Nazi forces—turned to NATO. The international cleavages penetrated deep into regional politics, and therefore they

impractical, and produce was insufficient on a per capita basis. For a general survey of Swedish and Scandinavian history and political development see Andersson (1956) Shirer (1955), Wuorinen (1965), Oakley (1966), and Scott (1950). Changes in Norway's international status over the past centuries do not allow ready comparison with Sweden and Denmark.

10. The war with Prussia in 1864 was the only large scale conflict following the 1814 watershed and resulted in a substantial loss of territory for Denmark—about one third of the pre-war area. Following this war Denmark undertook a concerted effort to modernize (Lauring, 1960).

perceived their own security in a cold war period as not guaranteed either by their own capabilities or by a regional alliance, particularly at a time when United States policy was to make military supplies available only to countries directly associated with its own military alliances. The decision to join NATO, to acknowledge formally the prevailing ongoing military defense system and to participate in it, marked a distinctive new trend for these two countries. In contrast, Sweden's neutrality had, by then, become a well-established policy and prevented the government from envisaging any alliance with the West. From the perspective of the present analysis, Sweden alone remained outside the ongoing Major Power conflict system—the cold war—and, in doing so, continued a pattern of international behavior that had been adopted well over a century earlier.

In 1914 Holland too adopted a neutral position which officially placed the country outside the parameters of the war-prone system. When war broke out again in 1939, Holland's position became untenable, and its neutrality shortlived. When NATO was formed at the end of the war, the Dutch, who had experienced Nazi occupation along with the Danes and the Norwegians, were one of the earliest signatories.

Despite differences in official posture—and to some extent in domestic attributes as well—Denmark, Sweden, Norway, and the Netherlands do not, at the present time, differ significantly in their respective budgetary allocations to defense. The reasons for this similarity might be the following: three of them are in NATO; in Holland's case the loss of colonies necessitated a change in its defense allocations; and Sweden's defense preparations are made in anticipation of NATO assistance in times of crisis. But these considerations do not detract significantly from the basic question of how or why the Scandinavian countries, at least, have worked so consistently to avoid war. Why did they "opt out" after the Napoleonic wars?

An obvious consideration might involve their position as Small Powers hemmed in by Major Powers such as Russia, Germany, Great Britain, and, to a lesser extent, France. But other countries perceiving themselves as "surrounded" have built up their military capabilities, sometimes at the expense of domestic benefactors, and have enhanced their positions further by allying themselves with Great Powers or with coalitions of Lesser Powers. The question remains whether domestic attributes peculiar to the Scandinavian countries have shaped their behavior, or whether the answer lies in some other characteristics of their history or culture or in an accumulation of military experience that persuaded them that warfare was not worth the cost of the effort, resources, and human lives. The following analysis seeks to provide some clues into the nature of peace system nations by identifying some of their distinctive attributes and capabilities.

THE SCANDINAVIAN COUNTRIES AND THE NETHERLANDS: NATIONAL ATTRIBUTES AND EXTERNAL BEHAVIOR; 1870-1970

A first step in the analysis is a comparison of the Scandinavian countries and the Netherlands with each other and with the Major Powers in terms of some critical internal and external variables. The domestic variables to be considered are population, density, national territory home area, and budgetary allocations to defense. External variables include expansion in terms of colonial area and control of colonial populations, and commercial activities in terms of imports and exports and the size of the merchant marine. Table 1 represents some basic data on the levels of some variables for the Scandinavian; Holland, and the Major Powers.

Perhaps the most important variable, and the one showing the greatest contrast between the Scandinavian countries and the Major Powers, lies in the area of numbers. The combined population of Norway, Sweden, Denmark and Finland amounted to no more than 21 million in 1960—approximately 10 million less than Great Britain's population one century earlier, and 17 million less than that of France one century earlier (Wuorinen, 1965: 10). Data on population and density for the 1870-1914 period further illustrate the magnitude of the difference. This is not to imply that the key to peace systems lies solely in small numbers. Neither population nor any other variable, taken by itself, is likely to explain much about the complexities of war, peace, or other aspects of international behavior. But in the long run, over years and decades, we expect outcomes to be partially determined and severely constrained by variable population dynamics (Ehrlich and Ehrlich, 1970).

In more specific terms, the effects of population levels, densities, and rates of growth are mediated by technology and resources, together with the specialized capabilities developed by the society, and these constitute important variables in the pressure calculus.[11] The means by which resources are acquired constitutes a key consideration. For over a century now the Scandinavian countries have channeled their energies toward such activities as commerce, shipping, and shipbuilding, and have placed heavy emphasis on these modes in their efforts to supplement their essentially agricultural economies. Sweden is one of the largest shipbuilding nations in the world, sharing in the equipment of the Norwegian fleet with Holland. At the same time, Norway, Denmark, and Sweden all rank among the ten largest trading nations in the world. Indeed, revenue from shipping has traditionally offset trade deficits. Thus, commerce

11. Although the Scandinavian countries do have something of an internal resource base it is limited and they have traditionally been dependent on external resources. Sweden and Norway are both rich in timber and in certain minerals. Both rely heavily on water power for energy and on dairy produce for food and exports. Denmark is more severely constrained in natural resources, and national production is weighted heavily on the agricultural side. The government publications of these countries provide detailed data and discussion of resources and the level of technological advancement. Additional historical material is provided in the *Statesman's Yearbook* and in Mulhall (1880).

Table 1. Levels of National Capabilities: Some Basic Comparisons, 1870-1914 [a]

	Home Population	Density	Home Area	Colonies[b] Population	Colonies[b] Area	Merchant Marine	Defense as % of Budget Expenditure	Defense as % of National Production
Sweden	4.9	28.5	171.5	–	–	575.00	33.96	2.05
Norway	2.1	16.9	123.5	–	–	1,506.09	20.03	1.31
Denmark	2.2	156.1	14.5	.13	880.3	355.17	27.67	1.76
Netherlands	4.8	381.7	12.6	31.58	740.0	402.74	35.86	2.18
Britain	38.6	319.2	120.9	335.4	9,773.3	8,413.4	38.68	2.96
France	38.3	187.2	204.6	29.9	2,386.3	1,152.0	26.66	4.06
Germany	52.1	248.7	209.9	6.8	778.6	1,173.0	47.99	2.35
Russia	103.4	50.3	2,085.0	121.5	8,540.0	506.7	29.24	3.48
Austria-Hungary	42.6	177.2	240.6	–	–	320.2	86.67	–
Italy	30.7	275.1	111.9	1.4	284.9	973.5	18.67	2.95

a. These figures represent long term averages for the period as a whole.

b. Swedish colonies included St. Barthelemew, 35 square miles and a population of several thousand. Denmark's colonies include Greenland. In the case of Austria-Hungary one might consider Bosnia-Herzgovenia in the context of a colonial relationship, an area of about 22.3 thousand square miles and a population averaging 1.6 million for the period as a whole. Moravia, Croatia and other Balkan areas might also be viewed as colonies. Calculated from 1900-1914; reliable GNP data are unavailable for the earlier years.

Units: Population—in millions; Density—per square mile; Area—in thousand square miles; Colonial population—in millions; Colonial Area—in thousand square miles; Merchant Marine—in thousand metric tons; Defense Budget—as percentage of total budgetary expenditures; —as percentage of GDP for Scandinavian countries and Netherlands and as percentage of national income for major powers.

Sources: The Statesman's Yearbook (1870-1920); Annuaire Statistique de la France (Paris: Imprimerie Nationale, 1932, 1954, 1961); Data for European states reported from national government sources; Almanac de Gotha (1870-1920); and the national Yearbook for individual countries. See references for Scandinavian and Dutch sources and North and Choucri (forthcoming) for detailed discussion of major power sources and data bases.

and shipping provided the main vehicle for international behavior and the acquisition of resources, without the accompanying patterns of conquest, territorial expansion, and colonial domination characterizing Major Powers in the past, and seemingly also without some of the modified war-prone patterns characterizing Major Powers since World War II.[12]

The Dutch case presents a "mixed" profile partly illustrated in Table 3. Holland shares with the Scandinavians a long tradition of commerce and shipping, but it differs from them in terms of population levels, densities, and growth rates, in terms of the internal resources base, and in terms of the modes of external behavior adopted to meet internally-generated demands. With the Major Powers Holland shares a long history of colonization and expansion, but differs primarily in domestic size, level of technology, and industrialization.

The particular combination of Dutch national attributes, characteristics, and external behavior can again best be explained in terms of numbers. Holland is one of the most densely populated areas of the world, and limitations of the internal resource base result in demands and pressure far outstripping available resources. "The Dutch found their country had no stone, no iron, no coal, no timber, and therefore they began the world as fishermen" (Mulhall, 1880: 325). Although fishing has traditionally provided an important backbone for the Dutch economy, land-based produce has always been important. Efforts to increase the total land area by creating polders began as early as the seventeenth century. By the year 2000 approximately 1255 square miles will have been added from all reclaimed lands (Williams, 1963). But land area still remains the single most serious constraint, especially in an agricultural economy. In view of these considerations the Dutch government has traditionally encouraged diverse forms of lateral expansion, such as emigration, commerce, shipping, and colonization.

Dutch colonial expansion began as early as 1602 with the acquisition of the Dutch East Indies. In 1870 Holland controlled over 600,000 square miles of overseas territory, with a population of over 18 million. At the outbreak of World War II Holland controlled about 840,000 square miles and a population of well over 70 million. At its height the empire included Indonesia, Surinam, and the Netherlands Antilles. Although the Dutch Empire never approximated the British or French in size, its possessions were strategically located, densely populated, and a ready source of raw materials.[13]

12. The contrast in terms of territorial expansion is especially worthy of emphasis. Norway controls three uninhabited Antarctic islands and several similarly populated Arctic territories. Sweden has, in the past century, had no colonies aside from a brief control of St. Bartholomew—a total area of 35 square miles. Sweden's historic union with Norway, 1814 to 1905, might be mentioned, although Norway was not in this case a colony. Denmark controls Greenland (about 84,000 square miles) and the Faroe Islands (540 square miles). The Islands of St. Thomas, St. John, and St. Croix in the Virgin group (within an area of 100 square miles) constituted a Danish colony from 1754 until 1919, when they were bought by the United States. Denmark also controlled Iceland until 1944.

13. For data on the resource base of the Netherlands East Indies see Boeke (1946). It might also be noted that two Caribbean colonies, Curacao and Aruba, have a higher per

Table 2. Rates of Change: Some Basic Comparisons, 1870-1914[a]

	Home Population	Prod.[c]	Colonies Area[d]	Colonies Pop.[d]	Imp.[c]	Exp.[c]	M.M. ton	Army[c] Budget	Navy[c] Budget	Defense as % of Budget Expenditure	Defense as % of National Production
Sweden	.69	3.13	—	—	3.81	3.63	3.07	4.40	4.77	.22	1.27
Norway	.80	3.89	.00	.29	3.69	4.54	1.49	3.11	5.92	-1.29	.79
Denmark	1.09	4.15	—	—	3.70	4.05	2.71	.98	.28	-.19	-1.57
Netherlands	1.12	2.06	.44	2.10	2.14	2.25	3.49	2.20	1.09	-.05	-.25
Britain	.89	2.24	.71	3.30	2.26	4.41	1.80	4.41	22.30	.63	1.92
France	.13	3.04	6.08	5.57[b]	1.55	1.37	2.80	6.55	3.82	2.10	2.37
Germany	1.15	2.49	6.20	9.11	2.36	2.12	1.40	11.91	9.97	9.97	10.96
Russia	1.46	2.32	.08	1.79	3.15	2.15	2.90	6.45	3.82	2.60	5.26
Austria-Hungary	.80	—	-.43	—	3.59	3.35	1.50	6.89	6.38	5.55	—
Italy	.65	2.84	5.60	19.75[b]	3.96	3.95	.50	3.98	7.11	1.93	2.05

a. These figures represent the average percentage change over the 45 years. See Table 3 for additional comments.

b. For Germany the rate is calculated as of 1885, for Italy as of 1890.

c. Rates of change are based on value expressed in standardized 1906 values in U.S. dollars. Undeflated figures in native currencies show slight discrepancies for imports and exports, and army budget. Discrepancies in navy budget are most evident for Germany where the deflated figures standardized to comparable 1906 U.S. dollars are higher than the undeflated figures in German marks. The advantage of transforming all budgetary or monetary data to a common and standard currency lies in the resulting comparability thus allowing for common interpretation of statistical analysis. The trends for the deflated and undeflated values are identical. Wholesale price indices for 1901-1910 = 100 were used for deflation and then conversion to common currency was subsequently undertaken. This second step is not necessary when comparing rates for change, but only when comparing absolute levels in actual currency value (and not as a percentage of national GNP). For the four smaller countries production is indicated by GNP; for the six Major Powers the indicator is national income. National income statistics are not readily available for Austria-Hungary.

d. By 1877 Sweden no longer possessed colonies, so that presenting a rate of change might lead to misspecification.

Sources: Same as Table 1.

The loss of colonies after World War II necessitated a considerable readjustment on the part of the Dutch. This readjustment took primarily the form of further industrialization, industrial investments, technical developments in agriculture, greater reliance on the productivity of the national rather than the colonial population, and a shift of emphasis from the colonies to western Europe. Although the loss of colonies marked an important turning point in Holland's international orientation, the Dutch adjustment to this change demonstrates once more the adaptive capability of nations.

As might be expected, the levels for most variables are significantly higher for the Major Powers for Holland and the Scandinavian countries—except perhaps in the case of merchant marine tonnage. Surprising is the fact that, with all the other differences among Holland, the Scandinavian countries, and the Major Powers, their respective percentage budgetary allocations to the military during the 1870-1914 period do not differ greatly.

The key to this paradox might be that allocations to defense in peace system nations are characterized not so much by distinctive levels or percentage of total budget or of national product but by low rates of change. Although their percentage military allocations were not significantly different from those of the Major Powers for 1870-1914 period the rates of change for Holland and the Scandinavian countries were markedly lower. The periodic sharp increases characterizing Major Power budgets are not apparent for the other four states. In fact, Norway, Denmark, and Holland all exhibit negative rates of change (decreases in percentage allocations), and Sweden's increases are quite marginal. Thus, there is little evidence of the escalatory reaction processes of the pre-World War I Major Power conflict system.

Comparative rates of change in allocations to the military, rates of change in trade, in shipping, in population, and in expansion are presented in Table 2. For the Scandinavian countries the most rapid growth is to be found in imports, exports, and merchant marine tonnage; for Holland it is to be found in imports and exports, but also in colonial expansion. For the Major Powers, colonial expansion and the percentage of total budgetary allocations to defense underwent the most rapid growth. Despite the previously-noted vast discrepancies in population levels, the rates of change on that dimension are not significantly different.

During the 1950-1967 period Norway, Denmark, and the Netherlands contributed substantially lower proportions than did the Major Powers or most other NATO members.[14] Although the average levels of Defense/GNP were

capita income than Holland (*New York Times Almanac*, 1970: 922). See Vandenbosch (1955) for a survey of Dutch Foreign Policy over the past century.

14. For example, in 1955 the figures for Norway (4.4 percent), Denmark (3.6 percent), and the Netherlands (6.2 percent) contrasted sharply with the figures for the United States (11.1 percent), Great Britain (9.4 percent), or France (7.6 percent). These figures are quite representative of the differences in defense allocations during the post-war years (1950-1967).

markedly lower, the mean percentage rates of change were not. One obvious reason for this incongruity lies in the initial levels: with considerably lower levels and Defense/GNP ratios, any increases or decreases represented comparatively greater changes.[15] While these differences in levels can be explained largely in terms of size in conjunction with the rationale of alignment, they might also be attributed to the hypothesized structure of peace system nations. In this case, unfortunately, the imperatives and consequences of alliance policies become theoretically and empirically confounded with the expected attributes of peace system nations.

Viewed from a slightly different perspective—defense allocations as a percentage of total budgetary expenditures—this general pattern exhibited by Norway, Denmark, and the Netherlands is apparent as far back as 1870; with few exceptions, defense allocations over the past century have been relatively stable and even declining as domestic social-welfare programs have risen. For Sweden the pattern is slightly different—initial increases until mid 1920's and then sharp decreases thereafter, followed by a rise for World War II and a decline since 1950. (See Table 3 for comparative rates of change.) The percentage defense/total budgetary expenditures for the Scandinavian countries and Dutch are presented in Figure 2.[16]

THE SYSTEMATIC ANALYSIS
OF INTERNATIONAL DYNAMICS

Our investigations of the 1870-1914 war-prone Great Power system yielded evidence of strong linkages among the determinant variables. We would therefore expect a peace system to be characterized by relatively weak linkages

15. These comments should not detract from our earlier discussion of the 1870-1914 period. The inferences drawn in the two contexts are not strictly comparable. In the pre-1914 case the long range levels of defense expenditures (as a percentage of total budgetary expenditures) were not dissimilar for the Major Powers and the peace system nations, but the rates of change were markedly and significantly lower for the Scandinavians and Holland. In the post World War II case the levels of defense expenditures (defense/GNP) are vastly different, but rates of change are not. Thus, while we have argued earlier that rates might provide some clues into the structure of peace system nations, tnese should properly be considered in the context of appropriate levels. (Statements concerning levels and rates are made from calculations of Defense/GNP data presented in Russett, 1970: 103-104.)

16. Percentages such as these are, at the very best, rough approximations. Differences in definitions, operational measures, budgetary categories, and organization account for a margin of error, the exact nature of which is difficult to determine. Differences in sources may account for an additional increment of error. For example, Norwegian government statistics calculate percentage allocations at an average of 5 to 8 percentage points lower than in Figure 2 (*Norway Historical Statistics*, 1968: 450-53). We have chosen the higher figure as a more stringent standard of comparison with other Powers. The same general observations hold for the Netherlands as well. The use of GNP as a common denominator alleviates this problem to some extent.
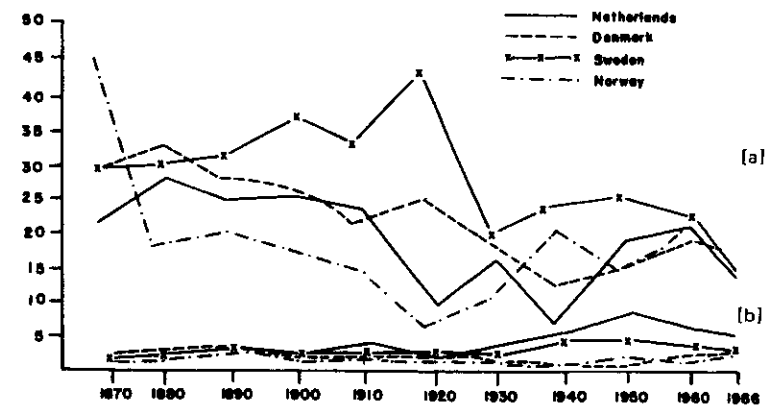
Figure 2. Military Expenditures as a Percentage of Total Budgetary Allocations[a] and as a Percentage of Gross Domestic Product[b]

Source: Same as Table 1.
a. Calculated on the bases of data for defense expenditures and for total budgetary expenditures.
b. Calculated on the basis of GDP and defense data.

throughout this whole process or by negative linkages (thus contributing a reversal, or diffusing the process before it becomes expressed in additional increments of allocations to defense needs). In short, where links are strong and significant, a war-prone conflict system is considered to prevail or, perhaps more accurately, a potentially war-prone system. Where links are weak, non-significant, or negative, the conflict system is called to question and a peace system is posited. Different national profiles and different patterns of international behavior may thus result from different combinations of attributes and capabilities.

The investigations reported in this chapter are restricted to one set of relationships depicted earlier in Figure 1. We shall be concerned primarily with the effects of population and technology on allocations to defense and on the pursuit of different modes of external behavior, and with the interrelationship among these variables. The final dependent variable in this analysis is the defense budget. At the theoretical level, however, we are interested in drawing inferences regarding the nature of peace systems and the underlying attributes and capabilities of peace system nations, and therefore the linkages between theoretical concerns and operational procedures are less direct than would be optimally desirable. Nonetheless, a first order approximation of the underlying theoretical dynamics may clarify some of the issues at hand.

Internal demands and pressures do not necessarily result directly, if at all, in territorial expansion, or in a growing military establishment, or in violence. However, expanding patterns of commercial, financial, diplomatic, and other

Table 3. Three Scandinavian Countries and the Netherlands: 1870-1970 Average Annual Percentage Rates of Change for Different Time Periods[a]

	Sweden	Denmark	Norway	Netherlands
Population—Home				
1870-1966	.65	1.02	.80	1.23
1870-1914	.69	1.09	.80	1.12
1916-1938	.44	1.18	.73	1.35
1940-1966	.77	.78	v84	1.31
Area—Home				
1870-1966	.04	.15	.04	.04
1870-1914	.07	.05	.06	.02
1916-1948	.01	.48	.01	.04
1940-1966	.01	.01	.02	.07
Imports				
1870-1966	5.61	6.76[a]	6.25[a]	16.98[b]
1870-1914	3.79	3.70[a]	3.69[a]	2.16
1916-1938	8.19	7.34	4.18	19.53
1940-1966	6.23	8.68	10.03	22.21
Exports				
1870-1966	5.82	5.32[a]	5.35[a]	10.77[b]
1870-1914	3.62	4.05[a]	4.54[a]	2.26[b]
1916-1938	5.54	5.42	2.36	15.22
1940-1966	9.50	6.22	8.55	11.21
Merchant Marine (ton)				
1870-1966	3.22	3.34	3.40	4.00
1870-1914	3.07	2.71	1.49	3.49
1916-1938	2.72	3.60	5.08	7.12
1940-1966	3.87	4.12	4.97	2.14
GDP				
1870-1966	3.65	4.32[a]	3.73[a]	4.33[b]
1870-1914	3.12	4.15[a]	3.89[a]	2.08[b]
1916-1938	4.83	4.60	3.05	5.24
1940-1966	3.48	4.20	4.20	4.68
GDP per capita				
1870-1966	2.96	3.31[a]	2.86[a]	2.92[b]
1870-1914	2.40	2.93[a]	2.92[a]	.60[b]
1916-1938	4.34	3.55	2.30	3.85
1940-1966	2.66	3.39	3.29	3.28
Defense Budget % of total exp.				
1870-1966	1.08	2.38	.71	.08
1870-1966	.22	−.19	−1.29	−.05
1916-1938	2.90	6.03	−.56	1.01
1940-1966	.88	3.29	4.93	−.50

	Sweden	Denmark	Norway	Netherlands
Defense Budget % of GDP				
1870-1966	3.19	2.40	2.79	1.98[b]
1870-1914	1.27	−1.57	.79	−.25[b]
1916-1938	3.59	4.57	−1.38	2.06
1940-1966	5.86	6.79	9.51	3.04

a. Based on deflated values starting 1890 for Norway and Denmark and 1900 for the Netherlands. The unavailability of wholesale price index makes it difficult to push the deflated series back to 1870. Equivalent rates of change for undeflated prices are generally slightly lower except for the interway period when undeflated figures are consistently higher.

b. Monetary values are standardized to base year 1953 = 100 and the rules of change are computed on the basis of standardized native currencies. Slight discrepancies with rates in Table 2 are due to the conversion factor.

Sources: See Table 1 and Bibliography.

activities often create expanding areas of national interest, which may serve as substitutes for expansion of territory. It is quite possible that such activities may provide—as do all expansionist tendencies—claims for national defense and for a growing defense establishment. Still, some nations may select modes of behavior which do not require as great a dependence on defense preparedness, and it is precisely the weakness of links to defense that might yield useful insights into the structure of peace systems.

In the context of this study, war-prone dynamics can be evaluated in terms of the comparative effects of two alternative paths to defense: from population and technology through colonial expansion, or from population and technology through commerce and shipping—or variations thereof. These are, of course, not the only relevant paths, but they provide a useful point of departure. When translated in operational terms for empirical analysis these lines of inquiry give rise to the following system of equations: [17]

17. It is assumed, first, that the key relationships are additive both in coefficients and in co-terms (although interactive effects may be incorporated in an additive framework); that all relationships are linear; that the error or disturbance terms are uncorrelated with each other; and that the disturbance term is uncorrelated with the independent variables. Also assumed is the absence of collinearity among the independent variables, as well as the absence of severe autocorrelation within each time series.

Data for each observation are recorded at two year intervals, from 1870 to the present, yielding a total of 49 data points. We are not entirely satisfied with this bi-annual recording, nor are we satisfied with the specific choice of measures for some of the variables. For example, to maintain some consistency with earlier Major Power analysis we operationalized production (or technology) as the total output of iron and steel in metric ton, although we also employed GNP as a more direct measure of this variable (as noted below). Furthermore, in cases where colonial expansion is absent we have omitted both the variable and the corresponding equation. This decision is based on the consideration that serious problems arise with matrix inversion and with collinearity when a variable remains at a constant zero over time.

$$X_2 = P_{21}X + u$$
$$X_4 = P_{42}X_2 + u$$
$$X_5 = P_{52}X_2 + P_{53}X_3 + u$$
$$X_6 = P_{63}X_3 + P_{64}X_4 + P_{65}X_5 + u$$
$$X_7 = P_{75}X_5 + P_{76}X_6 + u$$
$$X_8 = P_{83}X_3 + P_{85}X_5 + P_{86}X_6 + u$$

where

$X_1 = \Delta$Population

$X_2 = \Delta$Production (as an indicator of technology)

$X_3 = \Delta$The interactive effects of population and production

$X_4 = \Delta$Merchant marine (tonnage)

$X_5 = \Delta$Expansion (colonial population)

$X_6 = \Delta$Trade (exports-imports)

$X_7 = \Delta$Men under arms

$X_8 = \Delta$Defense (percentage of budgetary allocations accorded
to the military)

P = path coefficient or standardized beta weight.

While the "real" world is not easily decomposable as implied here, it is still possible to isolate, with a minimum of distorting effects, some empirical interrelationships and causal dependencies. One such perspective underlying causal modeling or econometric analysis is that the "real" world is indeed decomposable and that unidirectional equations capture something of this reality. A second perspective views reality as more dynamic and less readily decomposable and thus stresses reciprocal effects.[18] In the first case, relationships are conceived as essentially hierarchical, and in the second as simultaneous or mutually dependent. While these two approaches are not mutually exclusive, as Franklin Fisher (1963) points out in this discussion of block recursive systems, and each has certain advantages and limitations, they do lead to different modelling procedures.[19] In the hierarchical case the appropriate statistical method for estimating the coefficients by regression analysis is ordinarily least squares. In the reciprocal case alternative procedures are adopted depending on the nature of the reciprocity and on the dynamic relationships modelled.

The model in Figure 3 approximates more closely the first perspective in that a series of sequences is posited and the flow of causal reasoning is depicted as unidirectional (frequently a necessary simplification at early stages of investigation.) At the same time, however, any causal interpretations of the model rest upon the a priori restrictions in each equation (in terms of zero coefficients and

18. This is a brief and highly simplified statement of these arguments. A more extensive treatment of these issues is discussed elsewhere (Choucri, 1970). The most authoritative sources are to be found in the econometric literature over the past two decades (see especially Ando, Fisher and Simon, 1963; Liu, 1955, Wold, 1953).

19. Franklin Fisher's resolution of this issue in terms of block recursive systems has important theoretical and empirical significance (Fisher, 1963; Blalock, 1969).
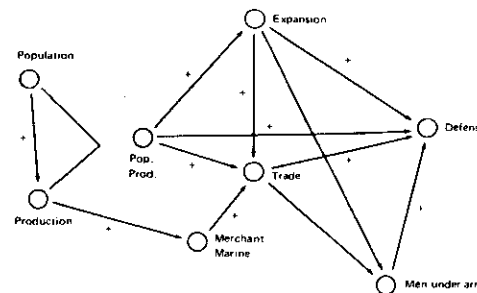
Figure 3. Linkages for Comparison with Peace System Nations: A Hypothesized Structure of International Dynamics[a]

a. In Figures 3-10 solid lines represent statistically significant paths and broken lines signify hypothesized but not empirically verified relationships. We have used t = 2.0 as a rough approximation of the critical region for significance rather than more rigid and formalized decision criteria. Solid lines with no coefficients indicate that there were very small (less than 0.001) though larger than the standard errors. Plus and minus signs indicate the direction of the effect. It might be recalled that for our purposes the absence of significant links is just as important, if not more so, than the presence of statistically significant paths.

relations among the variables) and upon the assumptions underlying the structure of each equation (in terms of linearity, additivity, and the nature of the disturbance or error.)[20] Although identifiability is generally thought of in the context of complex models, fulfilling the requirements for identifiability constitutes an important component of any model-building and estimation effort, as is the specification of reciprocal effects and mutual dependencies.[21] (These issues are discussed later.)

Our use of delta or change variables $(X_t - X_{t-1})$ is based on the consideration that changes tend to delineate international dynamics more precisely than do absolute levels. This is particularly important in view of our initial proposition—that differentials in rates of change are conducive to eventual outcomes, and that imbalances in rates of population growth and technological advances provide the initial impetus for the development of conflict systems.

In the effort to decompose our problem it has become necessary to experiment with lagged relationships and with systematic comparisons between rates of change and absolute levels. In each equation the independent variables were lagged by one time period (an admittedly simplified lag structure) for both

20. It might be noted that path analysis and econometrics both converge around the use of regression algorithms. The differences lie in the interpretation and assumptions, and not in the statistics themselves.

21. The problem of identifiability refers to the limits of inferential analysis: whether or not the parameter of a model or an equation can be estimated at all. A clear discussion of the necessary and sufficient conditions for identifiability is provided in Christ (1965), and a more technical presentation in Fisher (1966).

change (first difference) and absolute levels, although for theoretical reasons our preferences have been for the change expressed as $X_t - X_{t-1}$. We worked with standardized variables—zero mean and unit variance, a transformation which greatly facilitates both manipulation of variables and evaluation of coefficients with either path analysis or econometric interpretations, and compared the results with those yielded by non-standardized variables.[22]

In the following section we shall proceed by examining first one way effects and then, later on, mutual dependencies and reciprocal causation. In each case we shall focus primarily on change variables. This is important because one way dependencies allow us to examine relationships piece by piece on the basis of which it may then become possible to develop a viable overall model, individual components of which have been initially scrutinized. In many cases, however, one way effects tend to overshadow more intricate types of dependencies and it therefore becomes necessary to look for mutual causation or simultaneous effects. Although hierarchical models are not strictly causal, these can be interpreted as such only if the appropriate a priori restrictions and assumptions are made (Ando, Simon and Fisher, 1963).

Our thinking at this point is incomplete in at least one important respect: we have not taken into account external effects, such as rivals, alliances, and so forth, which may condition the development of war-prone or peace systems. This omission can be justified on the grounds that the Scandinavian situation throughout the past century does not provide a ready analogue to the World War I situation or to most war-prone systems, where alignment patterns are clearly delineated and, by extension, readily incorporated into any systematic analysis of international behavior (Singer and Small, 1968). In the case of the Scandinavian countries, the whole concept of institutionalized adversary is not entirely appropriate, nor have these nations been involved, until very recently, in any alliance—defensive or offensive. This is not to minimize the importance of Germany or Russia or other states in performing the role of an adversary at different historical periods. However, the problems involved in defining the adversary in the Scandinavian case are considerable and might only detract from the main objectives of this analysis.

Summary statistics presented in Tables 3 and 4 provide some insights into the nature of the variables on which the following analysis is predicated. The entries in Table 3 refer to the average annual percentage change throughout the century as a whole and during the 1870-1914, 1916-1938, and 1940-1968 periods. The values in Table 4 represent the correlation coefficients among the variables in

22. Regression coefficients yielded when utilizing standardized variables will be identical to those yielded by absolute levels only if the standard deviation for unstandardized variables were close to 1. The greater the departure from 1—in either direction—the greater will be the difference in the magnitude of coefficients yielded when utilizing absolute levels as opposed to standardized variables. What this means, essentially, is that the strength of estimated relationships may vary in accordance with the properties and structure of the data. Hayward Alker's clarification of this issue is gratefully acknowledged.

model (Figure 3). Table 3 summarizes the extent of variation among the four countries in terms of changes over time, and Table 4 summarizes the extent of interrelationships among key variables.

In Table 3 the least amount of variation over time is exhibited by the population and area variables. The growth in productivity and technology (expressed in terms of GNP and GNP per capita), in trade (imports and exports), and in the size of the merchant marine, though to a lesser degree, provide sharp contrasts to the population and area profiles. (Density rates can, of course, be inferred from these last variables.)

The most striking factors that emerge from Table 4 are, first, that the correlation coefficients drop substantially when computed on the basis of rates of change (perhaps not an entirely unexpected phenomenon); second, that interrelationships between the commerce and defense variables are generally negative and also fairly weak. Strong and positive relationships between trade and defense would have undoubtedly raised serious questions concerning the hypothesized relationship between trade and defense in the attribute profile of peace system nations.

A cautionary note on data and measurement might be advisable. The collection, processing, and analysis of longitudinal data is fraught with problems and with the possibilities of accumulated error. Discrepancies among sources and inconsistencies among data bases make such an undertaking difficult and sometimes hazardous. It is sometimes possible to develop alternative data series for each variable (drawn from different sources), to undertake parallel analyses, and to compare the results (as we have done to some extent with the Major Power data, 1870-1914). However this is often a difficult undertaking. Nonetheless, insufficient attention is generally accorded to measurement error, and to problems of theory and assumptions underlying data collection and processing. Although we are deeply concerned with this set of issues we have not as yet developed adequate estimates of measurement error nor explicit measures of the divergence among data sources. However, we have credited our sources with a certain degree of reliability and consistency, enough to allow us to proceed with some preliminary investigations and to draw some tentative conclusions.

FOUR NATIONAL PROFILES: SWEDEN, NORWAY, DENMARK AND THE NETHERLANDS

Because models specifying one way dependencies do not, by their very nature, take into account reciprocal influences and mutual causation, they represent less than a complete picture of the dynamics at hand. Nonetheless, one way dependency models (estimated through ordinary least squares) do provide some useful insights into the structure of the national systems in question. And in this respect, certain results deserve mention.[23]

23. Those comments are based on an analysis of rates of change. Level variables tend to obscure pertinent relationships, particularly in view of pronounced positive serial correla-

Table 4. Profile of Interrelationships: Correlation Coefficients for Levels and Annual Percentage Rates of Change [a]

Sweden (1870-1966)

	Population Home	Area Home	Production	Merchant Marine	Exports	Imports	Men Under Arms	Defense
Population—Home	1.00 (1.00)							
Area—Home	.80 (-.18)	1.00 (1.00)						
Production	.94 (.10)	.64 (.09)	1.00 (1.00)					
Merchant Marine	.90 (.11)	.60 (.31)	.97 (.17)	1.00 (1.00)				
Exports	.85 (.22)	.56 (-.06)	.95 (-.52)	.97 (-.04)	1.00 (1.00)			
Imports	.87 (.21)	.57 (-.06)	.96 (.65)	.98 (.12)	.99 (.75)	1.00 (1.00)		
Men Under Arms (1870-1914)	-.47 (-.09)	-.49 (-.32)	-.55 (-.35)	-.39 (-.09)	-.42 (.50)	-.49 (-.07)	1.00 (1.00)	
Defense	-.55 (-.03)	-.25 (.08)	-.59 (.19)	-.55 (-.05)	-.54 (-.11)	-.52 (.32)	-.54 (-.35)	1.00 (1.00)

Denmark (1892-1966)

	Population Home	Area Home	Production	Merchant Marine	Exports	Imports	Men Under Arms	Defense
Population—Home	1.00 (1.00)							
Area—Home	.87 (.44)	1.00 (1.00)						
Production	.86 (-.56)	.63 (-.19)	1.00 (1.00)					
Merchant Marine	.88 (-.18)	.63 (.27)	.97 (.12)	1.00 (1.00)				
Exports	.74 (.13)	.53 (.65)	.94 (.16)	.93 (.33)	1.00 (1.00)			
Imports	.73 (.06)	.51 (.64)	.94 (.05)	.93 (.25)	.99 (.76)	1.00 (1.00)		
Men Under Arms (1892-1914)	.27 (.10)	.12 (-.07)	.08 (-.57)	.23 (-.21)	.03 (-.69)	.05 (-.23)	1.00 (1.00)	
Defense	-.32 (-.05)	-.48 (-.26)	-.32 (-.20)	-.31 (-.12)	-.31 (-.38)	-.30 (-.22)	.11 (-.06)	1.00 (1.00)

Norway (1892-1966)

	Population Home	Area Home	Production	Merchant Marine	Exports	Imports	Men Under Arms	Defense
Population—Home	1.00 (1.00)							
Area	.73 (.49)	1.00 (1.00)						
Production	.93 (.04)	.72 (-.15)	1.00 (1.00)					
Merchant Marine	.87 (-.10)	.68 (-.10)	.98 (.18)	1.00 (1.00)				
Exports	.85 (.23)	.70 (-.16)	.97 (.35)	.95 (-.04)	1.00 (1.00)			
Imports	.86 (.26)	.72 (-.07)	.96 (.27)	.95 (-.14)	.99 (.90)	1.00 (1.00)		
Men Under Arms (1892-1908)	.007 (-.17)	-.18 (-.03)	-.28 (-.73)	.36 (.52)	.32 (.68)	-.06 (.20)	1.00 (1.00)	
Defense	-.06 (-.03)	.03 (.21)	.10 (.06)	.15 (-.03)	.22 (-.05)	.24 (-.12)	-.27 (-.55)	1.00 (1.00)

Netherlands (1900-1966)

	Population Home	Area Home	Production	Merchant Marine	Exports	Imports	Men Under Arms	Defense
Population—Home	1.00 (1.00)							
Area	.51 (-.25)	1.00 (1.00)						
Production	.87 (-.29)	.65 (.16)	1.00 (1.00)					
Merchant Marine	.98 (.22)	.54 (-.16)	.90 (.24)	1.00 (1.00)				
Exports	.50 (-.39)	.51 (-.07)	.77 (.67)	.55 (.11)	1.00 (1.00)			
Imports	.50 (-.41)	.52 (.17)	.78 (.18)	.54 (.02)	.99 (.64)	1.00 (1.00)		
Men Under Arms (1900-1914)	-.80 (-.14)	.50 (-.23)	-.80 (-.21)	-.80 (-.25)	-.63 (-.09)	-.55 (.09)	1.00 (1.00)	
Defense	-.52 (.08)	-.39 (-.25)	-.40 (.24)	-.49 (.01)	.06 (.11)	.06 (.36)	.82 (.35)	1.00 (1.00)
Population—Col.	-.50 (-.13)	-.14 (.52)	-.58 (-.03)	-.51 (.04)	-.80 (-.10)	-.79 (-.01)	-.81 (-.05)	-.15 (-.40)

a. The first coefficient is for absolute levels and the second, in parentheses, for rate of change. The actual data base for these computations is 1874-1964, since missing observations in some variables necessitated the loss of some data points and the reduction of the base. The production (technology) indicator is GNP standardized to the base year of 1953. Men under arms coefficients are calculated only for the pre-World War I period. Data for subsequent years are contradictory and incomplete. Defense variable is Defense/Total Expenditures. Colonial variables are omitted for the sake of consistency across countries.
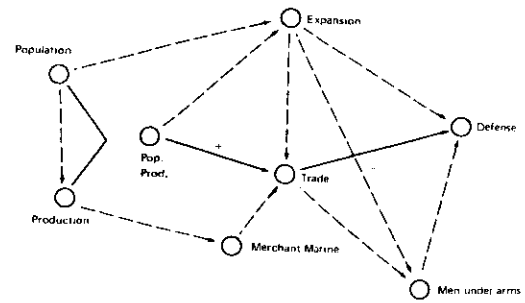
Rates of change and Lagged Independent Variables: the Netherlands
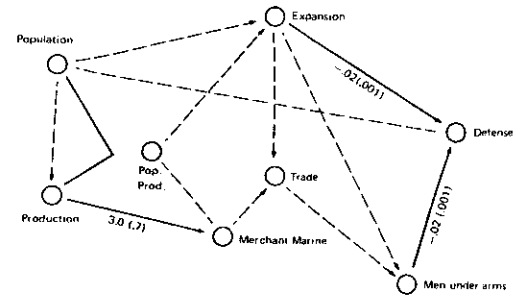
Rates of change and Lagged Independent Variables: Denmark

Figure 4. The Paths to Defense

First: few links in the basic war-prone conflict model appear to be at all significant for any of these countries. Strong effects are scarce, and for each state weak linkages seem to be the rule rather than the exception. This appears to be particularly true when the independent variables are lagged; whatever significant relationships exist tend to wash out by this process of adjustment. It is only when lagged dependencies are omitted—and unlagged independent variables are used—that some semblance of the war-prone conflict model is replicated by the data. Paths to defense are in evidence for the Netherlands and Denmark (Figure 4), but in the case of Norway and Sweden, the only salient paths are from production to trade via the merchant marine (Figure 5).

tion. Various dependencies have become clear when utilizing rates as opposed to levels. However, we have conducted parallel sets of analyses to verify our choice of delta values, a choice which we feel has been justified. There is no evidence of positive or negative serial correlation (as tested by the Durbin-Watson statistic) when utilizing first differences. The resulting coefficients are not distorted by the effects of serial correlation. The assumption underlying the d statistic is that rho, the autocorrelation parameter, is close to 1, an assumption which is often not valid. In such cases it is advisable to respecify the model so as to include variables "causing" serial correlation of the term, and/or to employ iterative algorithms for estimating rho and adjusting accordingly.
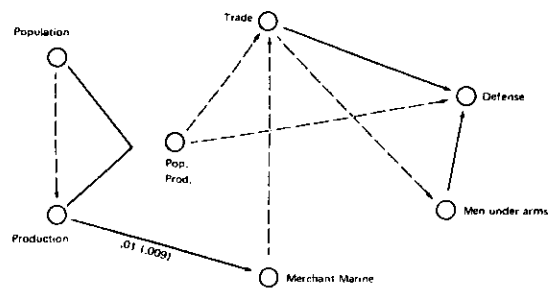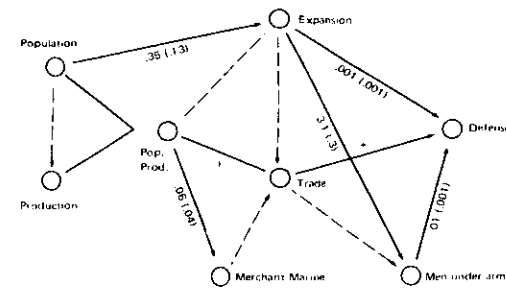
Sweden
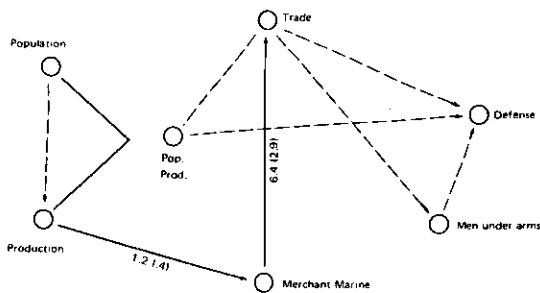
Norway

Figure 5. Rates of Change and Lagged Independent Variables

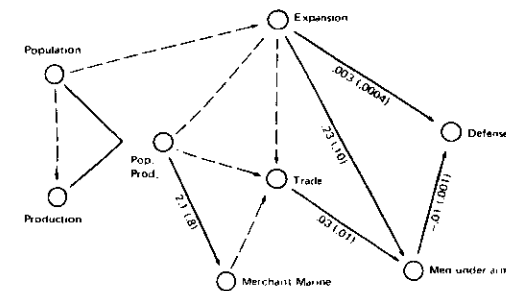Netherlands

Denmark

Figure 6. Rates of Change

Second: at the same time, however, relationships that are statistically significant are very small. With few exceptions coefficients generally range from .01 to .0001. Nonetheless such orders of magnitude can be important, especially when variables are defined as increments of change.

Third: general patterns that do emerge reflect two types of profiles—one characterized by Norway and Sweden, the other by Denmark and the Netherlands. More is involved here than simply a difference in colonial expansion. For the Norwegian and Swedish profiles there do not seem to be any significant linkages to defense regardless of whether lags are or are not utilized (Figure 6). In the case of Denmark and the Netherlands, linkages do appear, and frequently these are both strong and significant (Figure 7). For Holland, the paths to defense are from population to expansion and then to defense, from population expansion to men under arms and to defense, and from population and production to trade to defense. In each case the linkages are positive and significant, though not always large in magnitude. In the Danish case a similar pattern emerges, but the linkage from men under arms to defense is negative.[24]

24. The linkages to and from men under arms are restricted to the pre-World War I period. The discrepancy of estimates for subsequent periods dictated a more cautious

These findings suggest that Norway and Sweden do not, in fact, conform to the model of a war-prone conflict system whereas Denmark and Holland are somewhat closer. The absence of significant linkages among key variables thus underscores the inappropriateness of a war-prone conflict model for the analysis of the first two Scandinavian countries. To infer the structure of a peace system simply from the absence of linkages in a conflict model would be consistent with our initial theoretical specifications, but perhaps premature at this point. Yet the fact that linkages to defense are absent is encouraging—particularly in view of the contrast with the Netherlands. Why this difference arises is still an open question. Again comparative levels and rates of change might provide useful clues.

Identifying variables that can be manipulated for prescriptive purposes is not an easy matter, in part because of the nature of the model, in part because in the "real" world the variables of population and technology and so forth cannot be easily manipulated, and in part because in the case of Norway and Sweden most

approach. We therefore omitted both the variables and the equation for estimation of longer periods.
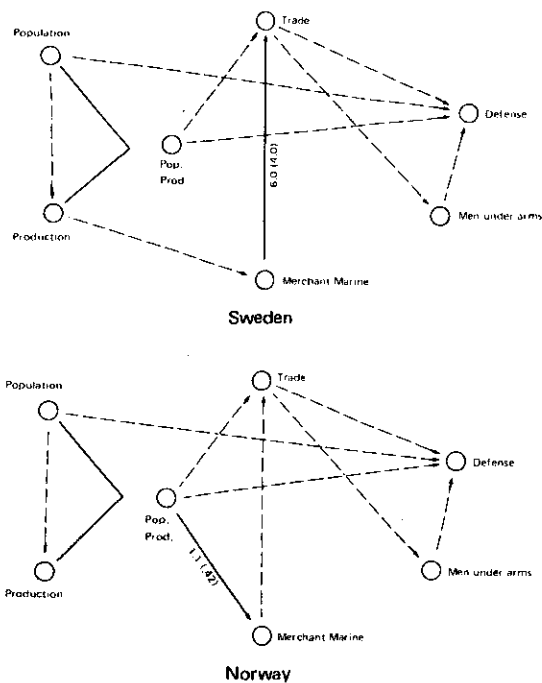
Sweden

Norway

Figure 7. Rates of Change

empirical linkages (though statistically significant) are, at the same time, small in magnitude. This means that even if the first two issues were not problematic in their own right, weak linkages would further hinder our ability to manipulate key variables. But the fact that they are weak is important here. More basic is the consideration that these vairables provide the parameters within which day-to-day decisons are made, and within which a national leader has to formulate official policy. In this respect some variables today are relatively less amenable to manipulation than in earlier decades. National territory is one such example, since colonial expansion is no longer regarded as a viable means of national aggrandizement or modes of lateral pressure, whereas trade and overseas investments do provide more acceptable vehicles for the extension of national influence. That the path from trade to defense is weak is an encouraging finding in any speculations of this kind, thus making explicit the consideration that whereas defense preparedness may be an all too frequent consequence of commercial activities it is not a necessary one. Again, post World War II Dutch adjustment to the loss of colonies provides a useful example.

These observations are predicated on the initial effects of population growth and technological development. For this reason we proceeded to modify the basic model by reformulating the defense equation in a way as to include both

Netherlands

Denmark
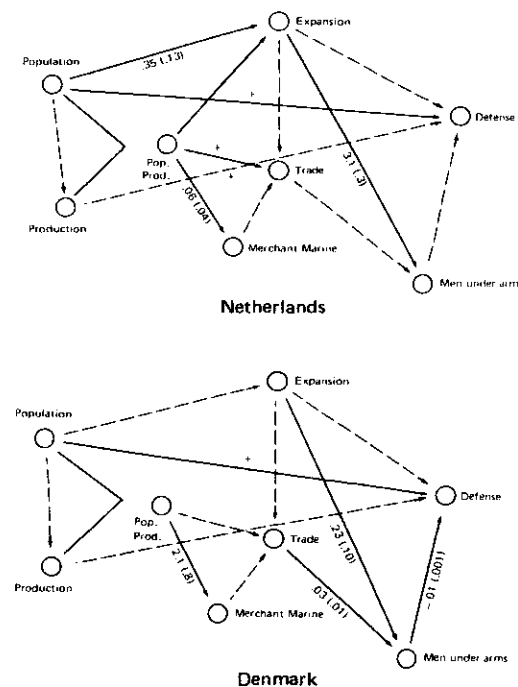
Figure 8. Rates of Change, Including Effects of Population and Production (As Indicated by GNP)

population growth and GNP (as a more direct measure of technological achievement). When this is done two effects become apparent. First, in the case of Denmark and the Netherlands the inclusion of these paths does not change the initial profiles as specified by the basic model (Figure 8). On the other hand, the nature of the Swedish and Norwegian profiles seem to undergo a notable change (Figure 9). Now there does appear to be a direct and significant link from population to defense, but the effects, though positive, are very small in magnitude. Second, in both cases the link from technology (as indicated by national income) is significant—fairly strong, but negative in nature.

We shall discuss some of the further implications of these findings later on. The point to be emphasized here is that, unlike several cases among the Great Powers, overseas commercial activities of the Scandinavian countries have not contributed to the growth of military establishments or led to war.[25]

25. The theoretical linkages for the role of trade in integration and in conflict theories have not been adequately worked out as yet. There is considerable disagreement among scholars concerning the effect of trade on international behavior. (See Russett 1967a: chs. 8, 12.) Many theories of imperialism of course stress the role of trade-seeking in promoting war.
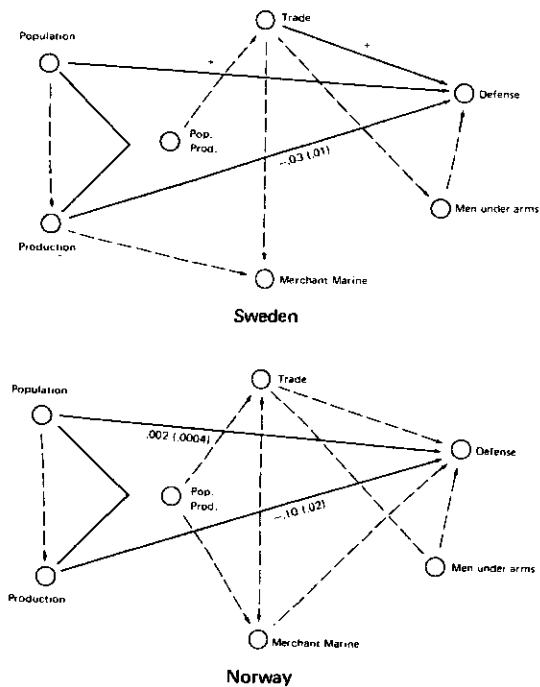
Sweden

Norway

Figure 9. Rates of Change, Including Effects of Population and Production (As Indicated by GNP)

An examination of the residuals in each case yields some indication of the "best fitting" periods—although these are not documented in the above figures—and conversely of the extent to which the resulting diagrams depict generalized relationships. For each of the four states the figures represent dynamics that seem to have been operative from 1870 to about 1948.[26] The post-war period yields a wider scatter of residuals suggesting that inferences drawn for the earlier years need to be modified for the period after 1948.

A second method of inquiring into the validation issue is to estimate the parameters of the models for different periods and then compare the results. When this is done differences among the four countries do tend to disappear after World War II, as does the distinctiveness of the Dutch and Danish profiles. Generally, however, differences between the Scandinavian countries on the one hand and the Netherlands on the other are considerably more pronounced before the Second World War than after.

26. Exactly when the breakpoint occurred would be difficult to determine. Our guess is anywhere between 1940 and 1950.

In what ways are these findings modified when taking into account mutual dependencies and reciprocal relations?

We tried to determine whether the empirically delineated profiles depicted above persist when certain mutual dependencies are taken into account. Needless to say, it is possible to specify the structural relations of a model in very many different ways and with equally numerous assumptions and implications, the only requirements being those for identifiability. A model is identifiable if the number of variables is equal to or greater than the number of coefficients to be estimated. As a general rule, a model is over-identified if the number of regression coefficients exceeds the number of path coefficients, or, alternatively, if the number of predetermined variables exceeds the number of explanatory variables.[27] In such cases as these, more information is available than in cases of just-identifiable models where the number of variables is identical to the number of coefficients to be estimated. At this point, our problem was one of solving for an over-identified model, and one appropriate procedure is two stage least-squares.[28]

Briefly, this mode of parameter estimation involves the following:[29] (1) selecting one dependent variable; (2) computing the reduced form equation for the other jointly dependent variables in the equation using all predetermined variables in the model (this is the first of the two stages); (3) using the computed estimates in conjunction with the predetermined variables to calculate the least squares regression of the selected dependent variable (this is now the second step); and (4) the resulting coefficients are the two-stage least-squares estimates of the parameters in question. The nature—sign and magnitude—of these coefficients becomes the determining criteria for evaluating the results.

More specifically, we have reformulated the basic model as follows:

27. Endogenous variables are those which are explained in terms of other variables in the model; exogenous variables, on the other hand, are predetermined and therefore not defined in terms of any others. One necessary condition for identifiability is that the number of variables excluded from a particular equation be at least equal to the total number of equations less one. This is the order condition. The rank condition stipulates that at least one non-zero determinant of the order (G−1), the number of structural equations less 1, out of the coefficients with which the variables excluded from a particular structural equation, appears in the (G−1) other equations. Hence, in constructing equations for key relationships, it is empirically distinguishable from every other. Equations that are expressed in reduced form—whereby each of the dependent (endogenous) variables is explained in terms of exogenous or other endogenous variables—serve as an empirically based procedure of solving for multiple dependencies. That not all variables are exogenous or endogenous is a function of the particular problem at hand, but that a specific "mix" among these variables be specified is necessary for achieving identifiable parameters and thus isolating those relationships consistent with both model and structural equations, (see Ando, Fisher and Simon, 1960.)

28. Accordingly, ". . . when a relationship is one of several in a simultaneous system, classical least squares estimates of its coefficients will in general be inconsistent. The underlying reason is that some regressors are jointly determined with the regress and hence are dependent on contemporaneous disturbances" (Goldberger, 1964: 292).

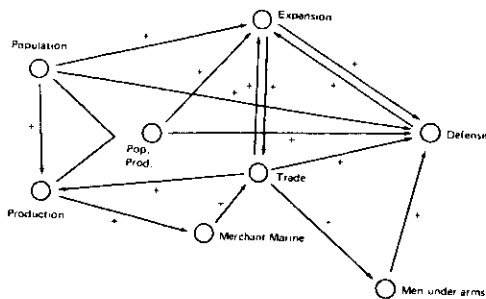29. This discussion is based on Christ (1965: 432-453).

Figure 10. Some Reciprocal Effects and Mutual Dependencies

$$X_2 = P_{21}X_1 + P_{25}X_5 + u$$
$$X_4 = P_{42}X_2 + u$$
$$X_5 = P_{51}X_1 + P_{53}X_3 + P_{56}X_6 + P_{58}X_8 + u$$
$$X_6 = P_{63}X_3 + P_{64}X_4 + P_{65}X_5 + u$$
$$X_7 = P_{76}X_6 + u$$
$$X_8 = P_{81}X_1 + P_{83}X_3 + P_{85}X_6 + P_{87}X_7 + u$$

These relationships are depicted in Figure 10. When the colonial expansion variable is zero, the variable X_5 is omitted from the model as is the equation X_5.

Because Norway and Sweden seem to conform least to the model of conflict and war-prone systems—as depicted earlier in our analysis—we shall devote the remaining discussion to these two countries. What emerges from the resulting analysis appears to be consistent with the earlier discussion of one-way dependencies. Again, the paths to defense from population and from production are significant. Again, these are very small in magnitude. Again, the path from commerce to defense is neither significant nor strong, although the coefficient does approach significance in the case of Sweden. And, again, there does not seem to be evidence of a profile that is at all similar to that of Major Powers.

The implications for the development of peace systems are not entirely clear, in part because of the nature of the final dependent variable, defense, and its relationship to peace system dynamics.[30] Aside from the semi-obvious, namely that a minimal degree of imbalance in rates of change of national

30. Many of our theoretical difficulties in this chapter might be attributed to the discrepancy between the final dependent variable in our statistical analyses and the dependent variable at the theoretical and conceptual plane. At the empirical level we have employed defense budget as a first order approximation of military preparedness and, by extension, of conflict and war-prone processes. At the theoretical level, however, we are basically concerned with the phenomenon of peace systems, where the dependent variable is actual behavior. Despite these difficulties, our lack of success in replicating the model of a conflict and war-prone system with data from the Scandinavian countries might have important theoretical implications pointing to the possibly fundamental differences between war-prone and peace systems which need further exploration.

attributes and capabilities seems to be a necessary condition, that favorable trade may serve to channel external behavior in non-violent directions and that increasing military preparedness does not come as a necessary correlate; what the sufficient conditions are is still unclear. Possibly the one immediately relevant insight emerging from this analysis is that of the various alternative network of relationships that have their origins in population dynamics, some do not result in increasing defense allocations. To suggest that greater emphasis should be placed on paths such as these may be trite, but at least it does assume that the conduct of purposive behavior may, at some point, be predicated on empirical realities.

THE SEARCH FOR PEACE SYSTEMS: SOME SUGGESTIONS AND TENTATIVE CONCLUSIONS

The above analysis does not diminish the probability that a combination of factors, such as their location relative to certain Major Powers and the lessons learned from attempts at conquest and territorial expansion during earlier centuries, strongly influenced the Scandinavian countries toward "opting out" of military alliance and other war-prone arrangements. But the pattern of strong and weak linkages—especially in the Swedish and Norwegian cases—does suggest some further possibilities with respect to the profiles of potential peace system nations. These are admittedly speculative, but they call attention to considerations that may be useful for further research, modeling, and simulation

In our investigations of the Major Powers we have found throughout the model strong linkages among key variables. In the cases of Norway and Sweden—our best rough approximations of peace system nations—linkages were far fewer, and those that emerged were comparatively weak. More specifically, the direct paths from population and technology to defense were weak for Norway and Sweden, but strong and significant for Germany and Great Britain (1870-1914). Thus on the one hand, these direct paths, however weak, tend to reinforce the basic proposition that population growth and technological advancement exert a strong influence in the direction of defense activities and war-prone arrangements. On the other hand, the fact that the linkages exist in the Swedish and Norwegian cases (together with other Swedish and Norwegian military phenomena) suggest that defense activities are not in themselves necessarily incompatible with rough first approximation peace systems.

As compared with Major Power patterns, a notable aspect of Scandinavian military expenditures has been their generally level or even downward trends—with increases in times of general war (and some aberrations for Norway and Denmark, the occupied countries, during and after World War II). These considerations suggest a Scandinavian disposition to adjust military expenditures in terms of fairly realistic appraisals of external threat. The tendency to bring military budgets down after the termination of war contrasts rather sharply with a frequent tendency, revealed by some of our ongoing research, for Major

Powers either to lower their post-war budgets only part way, thus establishing a new plateau well above pre-war levels, or to bring their budgets quite far down immediately after a war, but then to begin increasing them again after a year or two.

Among Major Powers prior to 1914 (and for some of them on up to World War II) there was a strong tendency to expand their national interests by territorial expansion or colonial domination and maintenance as well as through commerce and other forms of overseas activity and investment. In the case of pre-World War I Germany, the leadership decided also that a strong navy was necessary to protect an expanding commerce; in the British case, the Admiralty insisted that the commercial "lifeline" made continuing British naval supremacy mandatory. Since World War II the tendency for some of the Major Powers has been to press overseas trade, aid, and other investment, and also to establish overseas military bases and surveillance. Again, the Scandinavian pattern stands in sharp contrast: Norway, Sweden, and Denmark have developed and maintained vigorous world trade with a minimum of territorial expansion or colonial domination and with virtually no military or colonial domination and with virtually no military or naval protection or surveillance. Holland has been somewhat closer to the Major Power model.

In these terms it appears that during the nineteenth and early twentieth centuries the Scandinavian countries, with uneven success, found ways of satisfying with some degree of adequacy the demands for resources generated by their populations and by the requirements of their respective technologies without much reliance on territorial acquisition or military protection. Admittedly, a part of their success can be attributed to the forebearance (or the "peace-keeping" of other deterrent or equilibrium-maintenance activities) of some of the Major Powers. On the other hand (at least in some instances) their successes stemmed in large part from their determination and ingenuity.

With respect to Norway and Sweden, the combination of relatively low population levels with relatively high levels of technology (knowledge and skills) may have facilitated the task: by wise determination of technological emphasis and judicious use of domestic resources it was possible to supply the populace with basic goods and, especially in the Swedish case, to obtain gratifying returns on investment without the establishment of far-flung spheres of economic and political interest requiring surveillance and defense. Elsewhere, in reporting on the Major Powers prior to World War I, we have referred to the "satisfied" as those empires (like the British and French) that were able to expand their colonies and spheres of interest for decades at a time without serious constraint or other interference by a more powerful rival, and to the "dissatisfied" as those (such as Germany prior to both World Wars and Japan prior to Pearl Harbor) as those which, while expanding, nevertheless found their ambitions and activities blocked by real or perceived opponents. Here, in reporting on the Scandinavian states, we have evidence of countries having established and maintained quite distinguishable patterns of relative non-violent behavior—although not, in the Norwegian and Danish cases, without having paid considerable penalties.

JONATHAN WILKENFELD

10. Models for the Analysis of Foreign Conflict Behavior of States

ABSTRACT

This study investigates the extent to which a state's level of foreign conflict behavior is a function of prior or present levels of domestic conflict. The basic hypothesis is that a relationship between conflict behavior in the two spheres does exist, and that it takes various forms depending upon (1) the type of state under consideration, (2) the type of conflict behavior involved, and (3) the type of temporal relationship.

A series of Markov models are developed to cope with various types of lag situations. These models impose one and two year lags between the occurrence of prior and subsequent levels of foreign conflict behavior, as well as zero, one, and two year lags between levels of domestic and foreign conflict behavior. Six years of data for 74 states are arrayed in matrices, based on the probabilities associated with transitions from one level of foreign conflict in a given year to another level in the following year.

The findings indicate that among polyarchic states there is an overriding tendency to pursue a policy of foreign conflict behavior which matches their previous foreign conflict level. While a similar tendency is noted among the centrist states, they are to a certain extent better-equipped to change levels of foreign conflict behavior from year to year. The personalist states indicate only a few cases in which there is a tendency to perpetuate levels of foreign conflict from year to year.

For the polyarchic states, there are only rare instances in which the level of domestic conflict appears to play a significant role in the determination of a level of foreign conflict. The centrist states appear to be slightly more influenced by domestic conflict levels, particularly when a one-year lag is involved between domestic and subsequent foreign conflict. The personalist states indicate in a few instances a substantial impact of domestic conflict levels on subsequent levels of foreign conflict.   ∎

Peace, War, and Numbers

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