

**BURDENSARING IN THE NORTH ATLANTIC ALLIANCE:  
A PRELIMINARY REVIEW OF THE EVIDENCE**

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## PREFACE

The Congress, for some time, has expressed concern that the United States is bearing an excessive share of the NATO defense burden. Since 1981, the Department of Defense (DoD) has been required to report to the Congress on the contributions of our NATO allies and Japan to the defense effort. These reports have assessed--through a variety of quantitative measures and qualitative factors--the relative contributions of each country to the common defense.

This staff working paper is a preliminary response to a request of the ranking minority member of the Senate Committee on Armed Services for a review of the 1984 DoD report. It explains and critiques the measures used by DoD and, in some cases, extends and refines them. In accordance with CBO's mandate to provide objective and impartial analysis, this study makes no recommendations.

R. William Thomas of CBO's National Security Division prepared this paper under the supervision of Robert F. Hale and John D. Mayer, Jr. Nora Slatkin initiated this study before leaving CBO; while acknowledging her many contributions, the author notes that she bears no responsibility for this paper. Patricia H. Johnston, Robert Kornfeld, V. Lane Pierrot, and J. Edward Shephard of CBO contributed to the preparation of the paper.

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## INTRODUCTION AND SUMMARY

For some years, the Congress has been concerned that the European allies were not assuming their proper share of the cost of maintaining adequate defense against aggression. This concern has led the Congress to request, in each of the past four years, that the Department of Defense (DoD) issue a report on the contributions made by the United States and its allies in the defense effort. 1/ The 1984 report noted: "Based on the major quantifiable measures examined for this report, the US appears to be doing somewhat more than its fair share of the NATO and Japan total." 2/ But the report also concluded, and seemed to emphasize, that "the non-US NATO allies appear to be shouldering roughly their fair share of the NATO and Japan defense burden." 3/

The ultimate judgment about the fairness of the U.S. and allied burden is a political one that reflects quantitative data but also many difficult qualitative judgments about the U.S. world role, what might induce our allies to spend more, and other factors. This paper does not attempt to judge the fairness of the current U.S. burden or DoD's qualitative judgments. Rather it reviews the large volume of quantitative data and analysis that DoD supplied the Congress in the 1984 report and reaches several conclusions about that data and analysis:

- o While the DoD provided representative data to measure the defense effort of each nation, the report tended to highlight military indicators that cast the efforts of our NATO allies in a favorable light.
- o DoD included Japan in the report at the direction of the Congress; however, the method of including Japan obscures the issue of NATO burdensharing and affects the quantitative results.
- o When the quantitative results are recalculated excluding Japan and revising and extending the military indicators, they no longer indicate strongly that the allies are shouldering their fair share of the defense burden.

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1. Secretary of Defense Caspar W. Weinberger, "Report on Allied Contributions to the Common Defense" (March 1984).
  2. Ibid., p. 20.
  3. Idem.



- o Estimating values for certain "qualitative" factors frequently cited as additional burdens borne by the allies does not substantially alter the quantitative balance.
- o Over time, the U.S. share of the burden has been increasing, while the allies' share has decreased, relative to their ability to contribute. If recent rates of increase in U.S. and allied defense spending continue, an even greater share of the burden will be assumed by the United States in the future.

The remainder of this paper summarizes the arguments and data contained in the DoD report, critiques that evidence, and shows historical data on burdensharing along with estimates of future trends.

## SUMMARY OF THE DoD 1984 REPORT

### Economic Measures of Burden

DoD measures burdensharing by a variety of economic, military, and political measures. The simplest and most commonly accepted economic measure of the defense burden--namely, the percentage of each nation's gross domestic product (GDP) devoted to defense--indicates that the United States is doing more than its allies. Table 1 shows the defense share of GDP for the NATO nations in 1982. In that year, the U.S. figure was 6.5 percent, higher than every other nation but Greece, and considerably above the non-U.S. NATO average of 3.7 percent of GDP.

Comparison of shares of GDP and defense spending also suggest that the United States is doing more. U.S. defense spending constituted 62 percent of the NATO and Japan total in 1982 (see Table 2). Since the U.S. GDP in 1982 was 44 percent of total GDP for these countries, the DoD report concludes that by this measure, the United States was contributing more than its economically fair share. The NATO allies, by contrast, contributed 34 percent of total defense spending, while their GDPs represented 40 percent of total NATO and Japan GDP. Thus, by this measure, the allies contributed less than their fair share in 1982.

To arrive at the apparently contradictory conclusion that the NATO allies are doing their fair share, the DoD introduced a measure of the ability to pay, which is termed the prosperity index. This measure adjusts each nation's total GDP according to its relative prosperity (as measured by per capita GDP). Thus, relatively more prosperous nations, such as the United States and Germany, would be expected to contribute more to defense,





TABLE 1. PERCENTAGE OF GDP SPENT FOR DEFENSE IN 1982

Country	Percent
Belgium	3.4
Canada	2.1
Denmark	2.5
France	4.2
Germany	3.4
Greece	7.0
Italy	2.6
Luxembourg	1.3
The Netherlands	3.2
Norway	3.0
Portugal	3.4
Turkey	5.2
United Kingdom	5.1
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Non-U.S. NATO Average <u>a/</u>	3.7
United States	6.5

SOURCE: Adapted by the Congressional Budget Office from Secretary of Defense Caspar W. Weinberger, "Report on Allied Contributions to the Common Defense" (March 1984), p. 29.

a. Weighted average based on size of GDP (expressed in U.S. dollars).

relative to the size of their economy, than poorer nations such as Portugal and Turkey. According to this standard, the U.S. share would increase to 52 percent in 1982, while the non-U.S. NATO allies' share would be reduced to 34 percent.

When DoD compares shares of defense spending to shares according to the prosperity index, the results suggest that the United States is still doing about 20 percent more than its fair share. But now the non-U.S. NATO



TABLE 2. DoD'S SUMMARY MEASURES OF ABILITY TO CONTRIBUTE AND OF CONTRIBUTION

Indicators of Ability to Contribute (percent of total)

	GDP Share	Population Share	Prosperity Index Share
United States	44	33	52
Non-U.S. NATO	40	50	34
Japan	16	17	14

Indicators of Contribution (percent of total)

	Defense Spending Share	Total Defense Manpower Share	Ground Forces ADEs <sup>a</sup> / Share	Tactical Aircraft Share
United States	62	39	39	41
Non-U.S. NATO	34	58	57	55
Japan	4	3	4	4

Ratios of Contribution to Ability to Contribute

	Defense Spending Share/ Prosperity Share	Defense Manpower Share/ Population Share	Ground Forces Share/ Prosperity Share	Tactical Aircraft Share/ Prosperity Share
United States	1.20	1.18	0.75	0.79
Non-U.S. NATO	1.00	1.16	1.68	1.63
Japan	0.26	0.16	0.30	0.26

SOURCE: Adapted by the Congressional Budget Office from Secretary of Defense Caspar W. Weinberger, "Report on Allied Contributions to the Common Defense" (March 1984).

a. Armored Division Equivalents. 4



allies' defense spending share (34 percent) exactly matches their prosperity share. It should be noted, as will be discussed more fully below, that Japan is included in all these computations, and its very low defense spending but substantial GDP and prosperity affects the results for all countries.

Although both the GDP share and prosperity index measures appear in the report, DoD stressed the use of the prosperity index in its quantitative analysis. By doing so, it set a lower standard for the allied contribution and thus tended to favor the allies in its presentation of results.

### Military Measures of Burden

In addition to the comparison of total defense spending, the DoD report compares U.S. and allied efforts on a variety of military measures, which tend to suggest the non-U.S. NATO allies are doing their share or more. One measure is military manpower, which is related to each country's population. The U.S. share of total manpower (counting both active forces, reserves, and civilian employees) is 39 percent, while our NATO allies' contribute 58 percent (see Table 2). The U.S. share of population is 33 percent compared to 50 percent for the allies.

Comparisons of ground forces and aircraft shares also buttress the proposition that the allies are doing their fair share or more. Ground forces are measured by Armored Division Equivalents (ADEs), a methodology used by some Army analysts to equate differing units by assigning scores to weapons based on judgments about their capabilities. The standard U.S. active armored division is given a value of 1.00; other U.S. and allied divisions' values depend on their size and the quantity and quality of equipment. Interestingly, DoD concludes that the NATO allies' contributions to the total ADEs exceed their share of the prosperity index by 68 percent, while the United States is substantially below its fair share of 1.00 by this measure (see Table 2). But, it should be noted, as will be discussed later, that the ADE measure ignores many elements of combat capability.

Tactical aircraft measures used in the DoD report also bear out the conclusion that the NATO allies are doing their share or more. The measure used in the report counts only fighter and attack aircraft in each nation's air force; as will be discussed later, the count excludes naval air assets, helicopters, and strategic aircraft. But, by this measure, the allied contribution exceeds their share of the prosperity index by 63 percent, while the U.S. share falls below its prosperity index share by 21 percent (see Table 2).



## Qualitative Factors

The DoD also notes that certain costs associated with the defense effort of the allies are not included in the NATO definition of defense spending. These include the value of real estate provided free of charge for the stationing of foreign forces, the economic burden imposed by conscription on the population, and other contributions (chiefly by the government of the Federal Republic of Germany) to further political purposes related to the maintenance of stability in Europe.

Finally, the report noted political actions that should be considered. For example, it emphasized such actions as the NATO Long Term Defense Plan and allied solidarity in moving forward with the deployment of intermediate range nuclear forces, despite Soviet threats and considerable domestic political opposition.

## CRITIQUE OF THE DoD REPORT

### Economic Measures Affected by Inclusion of Japan

Including Japan in all the calculations, as the 1984 DoD report does, makes it appear that the non-U.S. NATO allies are doing roughly their fair share whereas a comparison excluding Japan would not. Japan, of course, is not a member of NATO. While legislation required that the DoD discuss Japanese defense spending, it might be useful to show the figures without Japan so as not to confuse the discussion of NATO burdensharing.

Japan has the second largest economy in the free world but spends relatively little on defense (1 percent of its GDP). Including Japan in the comparison increases total GDP by 19 percent but increases defense spending by only 4 percent. As a result, including Japan makes all the other nations' relative contributions appear higher. Doing the calculation without Japan emphasizes the difference (see Table 3). Using the report's method, which includes Japan, the non-U.S. allies have the same share of defense spending as they do of the prosperity index; that is, their ratio is 1.00. This leads to the "roughly fair" conclusion. With Japan excluded, the non-U.S. NATO allies are spending only about 89 percent of their "fair share" of the NATO total by DoD's measure.

### Problems with Military Measures

The military measures in the DoD report tend to present the allies in a favorable light. One measure that made the allies look very strong was





TABLE 3. SEPARATING OUT JAPAN ALTERS CONCLUSIONS IN FAVOR OF UNITED STATES

	DoD Approach Including Japan			DoD Approach Excluding Japan	
	United States	Non-U.S. NATO	Japan	United States	Non-U.S. NATO
Defense Spending Share/Prosperity Index	1.20	1.00	0.26	1.07	0.89
Defense Spending Share/GDP Share	1.43	0.85	0.22	1.24	0.74

SOURCE: Congressional Budget Office.

armored division equivalents. While superior to simple counts of divisions, the armored division equivalent measure is still only a measure of firepower; it does not take into account important aspects of military capability such as training, readiness, ability to sustain forces in a long war, and capability to move forces. This probably makes the United States appear less capable. For example, although all NATO countries have deficiencies in wartime sustainability, relative to their objectives, the U.S. days of supply are generally conceded to be significantly higher than those of the allies. In addition, the United States has a much greater ability to move forces over long distances.

The measure of tactical air forces used in the report also tends to favor the allies. The DoD reported that U.S. tactical aircraft constituted 41 percent of the NATO and Japan total, while the NATO allies provided 55 percent. But the report includes only Air Force tactical aircraft. It does not include tactical fighter or attack aircraft in Navy or Marine Corps squadrons, nor does it count attack helicopters in the Army. If such assets were included for the United States and the allies, CBO estimates that the U.S. share of total tactical aircraft would rise to 51 percent and the NATO allies' contribution would decline to 45 percent.



As the DoD report notes, there are also important qualitative differences among allied air forces. Forty-two percent of U.S. aircraft were assessed to be "modern" forces while only 14 percent of aircraft of the allies met that description.

Moreover, the report notes naval contributions but does not emphasize them. The comparison of naval tonnage in the report shows that U.S. forces represent 55 percent of total principal surface combatants compared to 39 percent for the NATO allies.

Finally, no comparisons were made for strategic systems in the report even though these forces do play a key role in NATO defenses. Based on deliverable warheads, the U.S. strategic systems represent 97 percent of the NATO total. British and French strategic nuclear assets constitute the remaining 3 percent.

#### Qualitative Contribution of the Allies

The DoD noted that certain costs borne by the European allies--such as land use by foreign forces and conscription--are not recorded in their defense expenditures. Estimates suggest, however, that--when these costs can be quantified--they would not alter the basic thrust of the numbers.

The nation bearing the highest burden of these excluded costs is probably the Federal Republic of Germany (FRG). Official FRG defense spending in 1982 was 54.234 billion marks (\$22.35 billion U.S. dollars). This represented 3.4 percent of the FRG Gross Domestic Product (GDP). Germany drafts its enlisted forces. CBO estimates that, if the FRG shifted to a volunteer force, it would incur an additional expense of \$1.6 billion in higher pay and benefits.<sup>4/</sup> This would raise its total defense contribution to 3.6 percent of its GDP. A second, unrecorded cost is the value of real estate occupied by foreign military facilities. The FRG Ministry of Defense has estimated the annual rental value of this real estate at over 2 billion marks (\$1 billion U.S. dollars). In addition, the FRG government spends 1.1 billion marks (\$450 million U.S. dollars) a year for the support of foreign military forces in West Berlin.

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4. CBO estimated the cost by assuming that, without conscription, the FRG would have to pay its forces wages 9 percent higher than the average German manufacturing wage. This is the same ratio which prevails in the United States.



When added to official FRG defense expenditures, these contributions raise the FRG defense effort to 3.9 percent of GDP, as compared to the 6.5 percent of its GDP which the United States spends for defense. Thus the "unrecorded" factors raise FRG spending by 14 percent but still leave the FRG well below the U.S. level. One should also note that costs such as military assistance and the value of land used as bases are not included in U.S. defense expenditures either.

Although CBO did not have data to perform this calculation for all NATO countries, the fact that most foreign forces in Europe are in Germany suggests that these factors would weigh heavier on it than any of the other allied countries. Thus the qualitative factors discussed by DoD, at least those that can be quantified, do not appear of sufficient magnitude to reverse the conclusion that the United States contributes more to NATO than do its allies.

#### The Effects of Non-NATO Spending

The DoD report notes one factor that would cast the effort of the allies in a more favorable light but does not make numerical estimates. The United States devotes a substantial amount of its defense spending to capabilities that might not be related directly to the defense of Europe. These could include U.S. strategic nuclear forces and those U.S. forces stationed in the Pacific and Southwest Asia. There is no precise way to measure the proportion of the U.S. defense budget directly related to NATO, but estimates by the Department of Defense have suggested that only about 60 percent of its budget is spent for forces directly committed to NATO. <sup>5/</sup> Eliminating non-NATO spending from the U.S. and NATO totals, and similarly eliminating out-of-area spending by the allies, could alter the conclusions substantially in favor of the allies.

But many might argue against eliminating non-NATO spending; indeed the Department of Defense always uses total U.S. defense spending in its assessment of burdensharing. This may be reasonable since U.S. forces not directly committed to NATO could play an important part in the overall defense. Strategic nuclear forces, for example, play a key role in strategic deterrence. Forces stationed or devoted to areas other than NATO might

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5. U.S. Department of Defense, "United States Expenditures in Support of NATO (U)," SECRET (June 1984).



protect vital NATO interests, such as oil in the Persian Gulf, and could require that potential adversaries devote some of their defense budget to non-NATO areas rather than focusing solely on Europe.

#### PAST AND FUTURE TRENDS IN BURDENSARING

Even if the United States today is paying a disproportionate share of NATO costs, it might be argued that this has always been true and so is "appropriate." Historical analysis suggests, however, that the United States has been bearing an increasing share of the NATO defense burden.

Table 4 and Figure 1 show the economic measures of burdensharing at five-year intervals, starting in 1955. Using the ratio of defense spending share to GDP share, the U.S. burden has risen from a value of 0.98 in 1955, indicative of relatively even burdensharing, to the 1982 value of 1.25.

TABLE 4. HISTORICAL TRENDS IN BURDENSARING

	1955	1960	1965	1970	1975	1980	1982
<b>Defense Share/GDP Share</b>							
United States	0.98	1.06	1.09	1.24	1.19	1.21	1.25 <u>a/</u>
Non-U.S. NATO	1.02	0.94	0.91	0.77	0.82	0.74	0.68 <u>a/</u>
<b>Defense Share/Prosperity Index</b>							
United States	0.77	0.86	0.89	1.05	1.02	1.09	1.14 <u>a/</u>
Non-U.S. NATO	1.53	1.25	1.19	0.93	0.98	0.85	0.79 <u>a/</u>

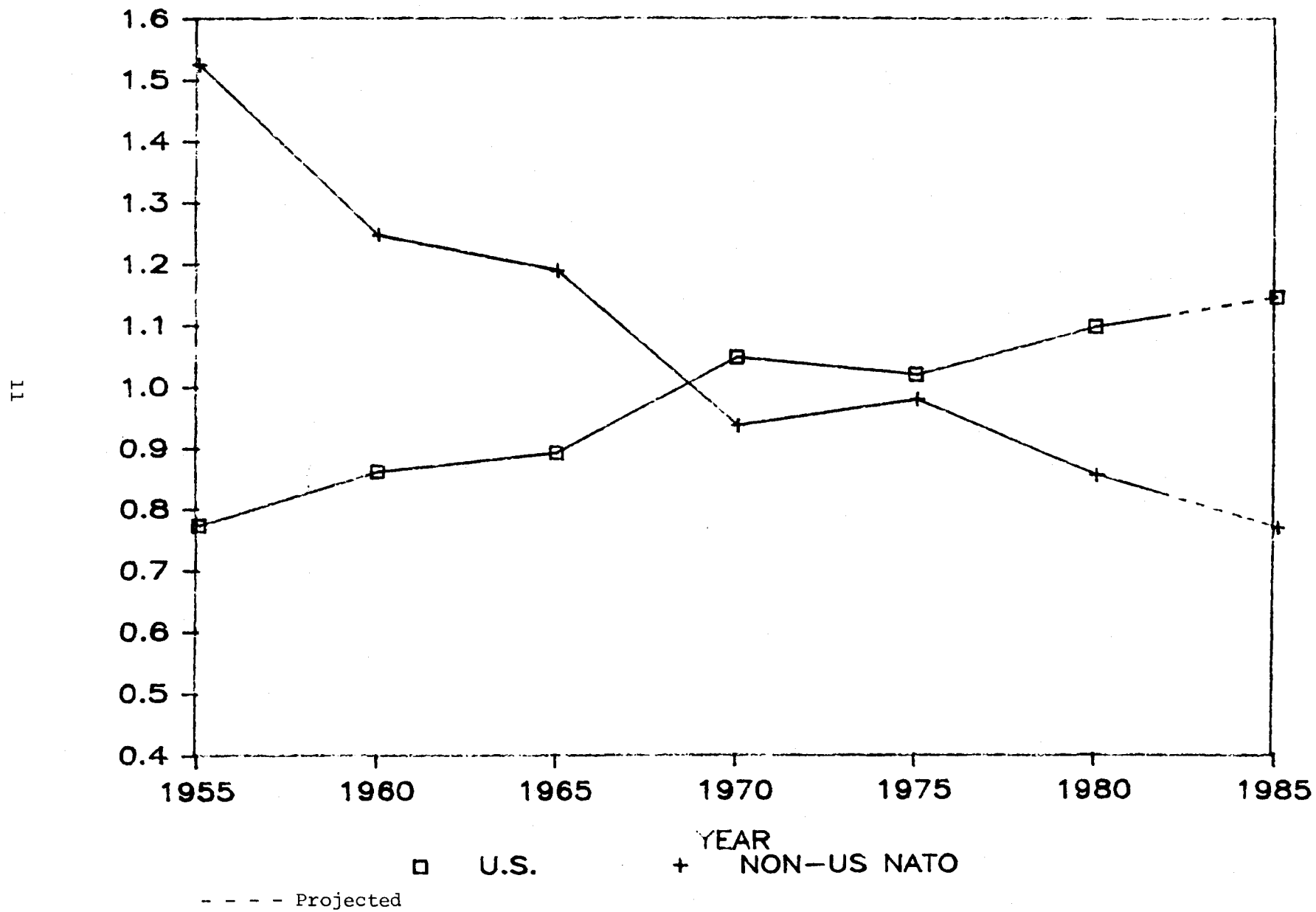
SOURCE: Congressional Budget Office.

- a. These ratios were computed using purchasing power parities, not exchange rates. Consequently, they differ from the values shown for 1982 in Table 3. Japan was not included in the calculations.





FIGURE 1. DEFENSE SHARE/PROSPERITY INDEX (Using purchasing power parities)





If one selects instead the prosperity index measure as more appropriate, as DoD appears to do, the results are considerably more dramatic. Since the European NATO allies were considerably poorer in the 1950s than they are today, relative to the U.S. standard of living, quantitative comparison shows that they contributed 53 percent more than their prosperity index share in 1955, while the United States paid only 77 percent of its share. The allies' share has declined steadily since then. By 1982, the allies contributed 79 percent of their share, while the United States exceeded its share by 14 percent.

### Projections of Future Trends

One of the goals of the NATO Long Term Defense Plan was that the NATO countries would increase their defense spending, after adjusting for inflation, by 3 percent annually. Table 5 shows the results achieved through 1983. Only two countries have met the goal every year--the United States and Luxembourg. On average, the non-U.S. NATO allies increased their spending by 2.7 percent per year, while U.S. spending rose by 5.4 percent per year (both figures adjusted for inflation).

In 1984, results should be better; CBO estimates that at least seven and perhaps as many as ten NATO countries will meet the 3 percent real growth commitment. This is due mainly to lower rates of inflation as most countries have not accelerated the growth of nominal defense expenditures.

CBO calculates that, based on the 1980-1983 trends for which firm data are available, by 1989 the ratio of defense spending share to GDP share will be 1.28 for the United States, while the allies' ratio will decline to 0.63. It could be argued that this comparison overstates the likely increase in U.S. defense spending. Even if U.S. defense budget authority in fiscal year 1986 was held to the fiscal year 1985 real level, however, and allowed to grow at 3 percent a year in 1987-1990 after adjustment for inflation, the relative U.S. burden would still increase. Moreover, under these assumptions U.S. outlays for defense would rise at an average rate of 3.3 percent a year over the 1985-1990 period, after adjustment for inflation. Since outlays are the typical measure used to assess compliance with the Long Term Defense Plan, the United States would meet the 3 percent target.



TABLE 5. REAL INCREASE IN DEFENSE SPENDING (Percentage change from previous year after adjusting for inflation)

	1980	1981	1982	1983	Average 1980-1983	Forecast 1984
Belgium	1.9	0.9	-3.3	-2.5	-0.8	1.1
Canada	5.1	3.1	4.9	-0.2	3.2	10.4
Denmark	0.7	0.6	-0.3	3.7	1.2	4.6
France	3.7	3.7	0.9	1.8	2.5	-2.0
Germany	2.3	3.2	-0.8	1.1	1.4	1.5
Greece	-9.4	22.8	0.1	-8.2	0.5	8.7
Italy	4.9	-0.5	3.2	1.9	2.3	5.7
Luxembourg	16.3	4.8	3.9	5.7	7.6	1.5
The Netherlands	-2.1	3.3	2.1	-0.1	0.8	0.3
Norway	1.8	2.7	4.1	5.7	3.6	0.1
Portugal	6.0	0.9	0.5	1.6	2.2	-9.5
Turkey	2.0	1.8	4.6	-2.6	1.4	5.5
United Kingdom	2.8	1.4	6.4	9.7	5.0	5.5
United States	4.9	4.7	7.6	4.5	5.4	12.1
Non-U.S. NATO Average	2.6	2.8	2.3	3.0	2.7	2.7
Total NATO	4.0	4.0	5.7	4.0	4.4	9.0

SOURCES: 1980-1982 data: Secretary of Defense Casper W. Weinberger, "Report on Allied Contributions to The Common Defense," (March 1984), p. 49.

1983 data: Based on NATO estimates of defense spending and national rates of inflation.

1984 forecasts: Based on NATO forecasts for defense spending and CBO projections of inflation in each nation. The projections were based on incomplete data for 1984 on overall price increases and do not reflect defense-specific prices.



## APPENDIX A. THE PROSPERITY INDEX AND AN ALTERNATIVE APPROACH TO COMPUTING IT

The Department of Defense (DoD) adopted the prosperity index approach as its preferred measure of ability to contribute and used it extensively in the quantitative part of its analysis of allied burdensharing. 1/ Prosperity indexes reflect not only a country's total gross national product but also its per capita wealth. The prosperity index concept has as its theoretical foundation the idea of using a progressive tax to pay for a public good--collective security. As analysts have noted, there is no logical way to measure the benefits to individual countries of NATO's security, nor is it possible to deny the benefits to one nation while providing them to others. 2/ Assessing ability to contribute as if it were a tax levied at a rate which increases with per capita income level has appeal, since it mirrors the policies adopted by most NATO nations for their own domestic tax structures.

### Computing the DoD Prosperity Index

DoD computes the prosperity index in several steps (as shown in Table A-1):

- (1) Each nation's GDP is converted to U.S. dollars at market exchange rates, and expressed as a share of the NATO and Japan total.
- (2) Per capita GDP of each nation is expressed as a percentage of the most wealthy nation (Norway, in 1982). 3/

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1. Secretary of Defense Caspar W. Weinberger, "Allied Contributions to the Common Defense" (March 1984).
  2. Gavin Kennedy reviews these arguments in Burden Sharing in NATO (Holmes & Meier, New York, 1979).
  3. Actually, this step is unnecessary, since the normalization in step (4) could just as well be applied to the raw products of total and per capita GDP. It may be useful in motivating and explaining the computational process.





TABLE A-1. COMPUTATION OF PROSPERITY INDEX

	(1)	(2)	(3)	(4)
	Percent GDP Share	Per Capita GDP (Percent of Highest Nation)	(1) x (2)	Prosperity Index (Percent Allocation of Column (3))
Belgium	1.23	63.0	77.24	0.96
Canada	4.21	86.6	364.25	4.53
Denmark	0.82	80.7	65.83	0.82
France	7.81	73.0	570.32	7.09
Federal Republic of Germany	9.55	78.5	750.01	9.33
Greece	0.55	28.2	15.38	0.19
Italy	5.03	44.9	225.82	2.81
Luxembourg	0.05	66.3	3.17	0.04
The Netherlands	1.99	70.5	140.25	1.74
Norway	0.81	100.0	81.28	1.01
Portugal	0.34	17.3	5.94	0.07
Turkey	0.76	8.2	6.24	0.08
United Kingdom	6.83	61.8	421.98	5.25
United States	43.77	95.5	4,181.32	51.99
Japan	<u>16.25</u>	<u>69.8</u>	<u>1,133.78</u>	<u>14.10</u>
Non-U.S. NATO	39.9	57.3	2,727.70	33.91
Non-U.S. NATO plus Japan	56.23	60.4	3,861.48	48.01
Total NATO	83.75	72.4	6,909.02	85.90
Total NATO plus Japan	100.00	72.0	8,042.80	100.00

SOURCE: Reproduced from Secretary of Defense Caspar W. Weinberger, "Report on Allied Contributions to the Common Defense" (March 1984), p. 22.



- (3) The resultant percentages are multiplied by each nation's GDP share and
- (4) The products computed in step (3) are normalized to add to 100 percent.

Note that countries with higher than average per capita GDP have higher prosperity index shares than GDP shares, while the poorer countries receive lower shares using the prosperity index. Overall, the United States' share, using the prosperity index, is 52 percent (compared to a GDP percent of 44); the non-U.S. NATO allies collective share is 34 percent (versus a GDP share of 40), and Japan is assigned a share of 14 percent (versus 16 percent).

#### Alternative Method for Computing the Prosperity Index

The text notes the effects on burdensharing of using the prosperity index. The major problem with the DoD method is the use of exchange rates to express each nation's total and per capita GDP in U.S. dollars. The use of exchange rates in international comparisons of economic activity and prosperity has been extensively criticized. <sup>4/</sup> Exchange rate movements today are driven more by international capital flows than by changes in the prices of tradeable goods. Exchange rates also may not reflect price trends for nontradeable goods and services, which make up the bulk of domestic consumption.

Fortunately, there is a superior procedure: actually comparing the prices of representative market baskets of goods across countries and computing a composite price index which directly compares two or more countries' currencies in terms of purchasing power. The resulting measure is called a purchasing power parity (PPP). The United Nations has sponsored work to compute such PPPs for both developed and developing countries. <sup>5/</sup>

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4. M. Gilbert and I.B. Kravis, An International Comparison of National Products and the Purchasing Power of Currencies (OECD, Paris, 1954).
  5. I. Kravis and others, A System of International Comparisons of Gross Product and Purchasing Power (John Hopkins Press, Baltimore, 1975).



More recently, Heston and Summers extended these results to nations not included in the original sample. 6/

Table A-2 shows just how misleading exchange rate comparisons can be. It presents data on 1980 per capita income for the NATO nations and Japan, computed using exchange rates and using PPPs. Since the U.S. dollar was relatively weak in 1980, the use of exchange rates suggests that seven of our NATO allies have higher per capita incomes than ourselves. Using purchasing power parities, the United States was still the richest nation in terms of what the dollar would buy. In 1980 exchange rate comparisons overstated the per capita income of the richer European nations by 30 to 40 percent. (Today, because of the appreciation of the dollar, this is no longer true.) Conversely, the use of exchange rates understates the per capita income of the poorer NATO members, such as Portugal and Turkey. Thus it exaggerated the income disparities among the richer and poorer NATO countries.

#### Historical Measures of Burdensharing: Alternative Approaches

CBO computed the ratios of defense spending share to GDP share and defense spending share to prosperity index share using the measures of total and per capita GDP computed by Heston and Summers. To express NATO defense expenditures in constant (purchasing power) dollars, specialized indexes for government expenditures, also developed by Heston and Summers, were used. The results appear in Table A-3. Using the defense share-to-GDP share approach, the U.S. contribution to NATO burdensharing increased from 98 percent of its GDP share in 1955 to 125 percent of its share in 1982. Meanwhile, over the same period, the NATO allies' contribution declined from 102 percent of their share to 68 percent of their share. 7/

Using the prosperity index share approach, the results are even more dramatic. Since the NATO allies were relatively poorer in 1955 than they are today, when compared to the United States, their defense spending was over 150 percent of their prosperity index share at that time. By 1982,

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6. Alan Heston and Robert Summers, "Improved International Comparisons of Real Product and Its Composition: 1950-1980," Review of Income and Wealth, June 1984, pp. 207-219.
  7. These computations exclude Japan.



TABLE A-2. 1980 PER CAPITA GROSS DOMESTIC PRODUCT  
(as a percentage of U.S.)

	Using Exchange Rates (1)	Using Purchasing Power Parities (2)	Percent Deviation (3)
Belgium	106.5	77.8	+36.9
Canada	94.0	93.0	+01.1
Denmark	114.2	83.4	+36.9
France	106.9	82.6	+29.4
F.R. Germany	117.3	86.1	+36.1
Greece	37.3	48.8	-23.5
Italy	60.8	57.6	+5.7
Luxembourg	106.3	82.0	+29.6
Netherlands	104.4	72.4	+44.2
Norway	123.8	84.4	+46.7
Portugal	21.4	38.2	-44.1
Turkey	11.1	25.6	-56.6
United Kingdom	83.2	61.7	+33.4
U.S.	100.0	100.0	N/A
Japan	75.4	74.1	+01.8

SOURCES: (1) Secretary of Defense Caspar W. Weinberger, "Report on Allied Contributions to the Common Defense" (March 1984).

(2) Alan Heston and Robert Summers, "Improved International Comparisons of Real Product and Its Composition: 1950-1980," Review of Income and Wealth, June 1984, pp. 207-219.

(3) Col (1) - Col (2) as a percentage of Col (2).

the value of their defense spending had declined to 83 percent of their fair share, as measured by the prosperity index.

These results suggest that DoD, when it makes international comparisons of burdensharing, should consider using the best methodology available, purchasing power parities. The trends analysis also may suggest that the use of the prosperity index has interesting implications for assessing the issue of whether the U.S. burden in NATO is increasing.





TABLE A-3. HISTORIC BURDENSARING MEASURES

	1955	1960	1965	1970	1975	1980	1982 a/
Defense Share/GDP Share							
United States	0.98	1.06	1.09	1.24	1.19	1.21	1.25
Non-U.S. NATO	1.02	0.94	0.91	0.77	0.82	0.74	0.68
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Defense Share/Prosperity Index							
United States	0.77	0.86	0.89	1.05	1.02	1.09	1.11
Non-U.S. NATO	1.53	1.25	1.19	0.93	0.98	0.85	0.83

SOURCE: Congressional Budget Office.

- a. These ratios were computed using purchasing power parities, not exchange rates. Consequently they differ from the values shown for 1982 in Table 3. Japan was not included in the calculations.

