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# Defense Spending and the Economy
--
# An Econometric View

by

Jack R. Barnes
Lt Col, USAF

A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE CURRICULUM

REQUIREMENT

Advisor: Dr. Joan Johnson-Freese, PhD

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**ABSTRACT**

TITLE: Defense Spending and the Economy: An Econometric View

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With the perceived reduction of the threat to national interests brought on by the end of the Cold War there has been much talk concerning how to spend "the peace dividend." Most people expect that dividend to be generated by improvements in the economy fueled by reductions in defense expenditure. There have been a myriad of articles written regarding the effects defense spending has on the economy. Many of the authors of these articles disagree with each other on these effects. Empirical analysis shows that while defense spending has slight negative effects on Gross Private Domestic Investment and growth rate of the Gross National Product, the correlations between these economic elements do not meet statistical criteria for significance. Therefore, changes in Gross Private Domestic Investment and Gross National Product are driven by factors other than the relatively small amount dedicated to defense expenditure. Nonetheless, defense spending has been reduced over the past several years and is likely to continue to be reduced in the near future. Whether or not these reductions will bring about improvements in the financial condition of the United States will depend upon the way the "savings" generated from these reductions are used.

## BIOGRAPHICAL SKETCH

Lieutenant Colonel Jack R. Barnes (B.S., Troy State University, M.S., University of Southern California) is a master navigator with more than 1300 hours in fighter aircraft. His assignments include tours in Okinawa, the Republic of the Philippines, Hawaii, the Pentagon, and most recently as a flying training squadron commander at Mather Air Force Base, California. While in the Pentagon, he worked directly with the Base Realignment and Closure Commission and the Office of the Secretary of Defense on Base Realignment and Closure round one. Lieutenant Colonel Barnes is a graduate of the Air Command Staff College class of 1986 and the Air War College class of 1994.

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# CHAPTER I

## INTRODUCTION

> *It is customary in democratic countries to deplore expenditure on armament as conflicting with the requirements of the social services. Their is a tendency to forget that the most important social service that a government can do for its people is to keep them alive and free.*
> J. C. Slesser

Consequent to the end of the Cold War there has been much talk concerning how to spend "the peace dividend." Most people expect that dividend to be generated through reductions in defense spending. With the demise of the monolithic Soviet Union and no other clear and present danger *on* the horizon, it is hard to justify continued large expenditures for national defense. To the majority of the population, there is no perceived need. Further, most Americans do not understand the role that defense expenditure plays in the U.S. economy. Add to that the bleak view of the economy offered by the media and the wasteful picture painted of the defense acquisition process and you have a public demanding defense cutbacks.

Beyond the debate surrounding "need," the economy, and the defense acquisition system, a review of the literature surrounding the effects of defense spending on the economy shows that even the "experts" are split on their opinions. For example, Goran Lindgren

published a study that compared the research of several different economists. His research showed that out of 26 studies conducted on the subject, 2 showed that defense expenditure has a positive effect, 7 neutral or no effect, and 17 negative.[1] The purpose of this paper is to further substantiate the premise that defense spending does not significantly effect the overall economy of the United States. To initiate the examination, a review of literature surrounding this subject will be presented. The conclusion drawn from this review is that the diversity of opinions on the effects of defense expenditure lends credibility to the statement that changes in defense expenditure do not have a causal relationship with the economy as a whole. Then, an empirical analysis will be performed using historical economic data to examine the effects of defense spending on two elements of the economy--Gross National Product (GNP) and Gross Private Domestic Investment (GPDI). The analysis will provide answers to the following three questions, within stated parameters:

1. If defense expenditure is decreased, will GPDI increase?
2. If defense expenditure is decreased, will all elements of GNP other than defense expenditure increase?
3. If GPDI is increased, will there be an increase in GNP elements other than GPDI and defense expenditure?

While the results of the literature review and empirical analysis should demonstrate that the health of the economy is not directly related to defense spending there is an important relationship that does exist. By maintaining a strong defensive

posture, the U.S. economy, and for that matter civilization, has been permitted a continued existence. That is, through our defensive strength, we have survived the Cold War and averted the hot war that could have destroyed civilization as we know it in the U.S..

A defensive spending plan that totally ignores economics can be disastrous. National security strategy must be based upon maintaining well balanced political, economic, social and military powers. An unbalanced approach allowing defensive strength to wither in an effort to strengthen any of the others can lead to a failure of the overall strategy. A case in point is the former U.S.S.R.. Its economy, overburdened by high defense spending that could not be supported, finally collapsed. This means that the amount to be spent on national defense should strike a balance between economics and a rational national defense strategy that protects our national interests at a reasonable level of risk. Attempting to drive defense spending purely by economics or an unrealistic level of risk could lead to disaster on either side of the equation.

## CHAPTER II

## LITERATURE REVIEW

*A wise man learns from his experience; a wiser man learns from the experience of others.*
**Confucius**

There have been a wide variety of articles written on the relationship between defense spending and the economy. Some of these articles attempt to prove or disprove the theories of other economists. Others were written in the mid to late eighties in an attempt to analyze the effects of the Carter/Reagan military buildup. Finally, a number of articles have been written that look back at the effects of the buildup of the 1980s. A common thread that runs through the majority of the articles is that the authors often contradict each other and in some cases contradictions exist within a given article. This lends credibility to the assertion that the effects of defense expenditure on the overall economy of the U.S. are minimal at best. Finally, many studies overlook what should be done with the "savings" produced by reductions in defense spending.

### Conflict within a Study

Twentieth-century Marxists contended that the survival of capitalist economies depended upon defense spending as an outlet for investment of surplus.[1] Thus, in their opinion defense

spending not only had a positive effect on the economy but was necessary to prevent its collapse. Based upon this, a number of economists published studies to disprove the Marxists by showing that defense spending had a negative effect. One such study, performed by Clark Nardinelli and Gary Ackerman, analyzed the relationship between real GNP and real defense expenditures for the years 1905-1973.[2]

The first analysis performed by Nardinelli and Ackerman used actual annual values for GNP and defense expenditure. Their stated results indicated a strong and statistically significant ($r^2$ = 0.33) positive relationship between defense expenditure and the GNP.[3] This favored the assertion of the Marxists.

Nardinelli and Ackerman then discredited this analysis because they claimed the positive correlation between GNP for a given year and past values of GNP violated an assumption for standard linear regression. To correct this error, they ran an analysis to determined the relationship between the percentage change in net GNP and the percentage change in defense spending. The results of this analysis showed that defense expenditure has a small negative effect on GNP. Once again they said the results were statistically significant with an $r^2$ of 0.09.[4]

Using the percentage change method, Nardinelli and Ackerman ran analyses on three subperiods--1905-1916, 1920-1939, and 1946-1973. These subperiods removed the years of World Wars I and II. Two of the subperiods, 1905-1916 and 1946-1973, showed strong statistically significant ($r^2$s of 0.51 and 0.44 respectively)

negative relationships between defense expenditure and GNP. Analysis of the third period indicated no significant relationship.[5]

Nardinelli and Ackerman concluded that since their analysis indicated a negative relationship between defense spending and GNP, it disproved the Marxist assertion that not enough private outlets existed for investment. Thus, defense expenditure was not necessary for the survival of capitalist economies.[6]

This article presented a case where the results within the study contradict themselves. If the first analysis contained a statistical error that caused its results not to fall within a desired margin of error, one must wonder why the results were reported at all. Additionally, they reported statistical significance for three of the four analyses. In Understanding Political Variables, William Buchanan states that for studies of this type, an acceptable level of statistical significance is $p < 0.05$ or 1 chance in 20 that the results are purely due to chance.[7] To achieve this level of significance, $r^2$ would have to be approximately 0.566 or greater. Thus, with the exception of the 1905-1916 subperiod ($r^2 = 0.51$) the statistical significance of the analysis is suspect.

## Conflicting Studies

Steve Chan, in a nonempirical study entitled "The Impact of Defense Spending: A Survey of Evidence and Problems," recognized that most studies have not been consistent or conclusive.[8] He

blames this disparity on the availability and quality of data, biases created by the author's ideology, and sensitivity of the research design to cross-national and over-time variations.[9]

When the effect of defense expenditure on economic growth was determined for African countries, the result was vastly different depending upon which organization's economic data was used. Using U.S. Arms Control and Disarmament Agency data resulted in defense spending having a negative effect four times greater than when data from the Stockholm International Peace Research Institute was used.[10] Additionally, if developing countries are lumped together with developed countries, the data is usually skewed by the data for the developed countries.[11] Further, Chan states:

> "To the extent that the professional status of analysts is affected by the rise and fall in the political popularity of particular movements, policies, or governments (e.g. nuclear freeze, foreign arms sales, countries of one's specialization), they may indeed not be the most objective judges of the wisdom, effectiveness, and importance of these movements, policies, or governments.[12]

This provides the assertion that even what appear to be purely empirical studies can be slanted by the political environment surrounding the study.

Going further to explain the diversity of opinions resulting from econometric studies, Chan stated that the use of aggregate cross-national studies are of limited value. He prefers detailed analysis performed on a country-by-country basis rather than attempting to generalize based upon aggregate cross-national studies.[13] To explain the importance of this distinction, he cited a study by Martin O. Heisler. According to Heisler, "the

proportion of money spent on defense that stays within the domestic economy varies substantially from country to country."[14] For example, while the U.S. might spend 95% of its defense budget domestically, smaller NATO countries may only be able to spend 80% of their defense budget domestically. Therefore, a 3% rise in U.S. defense spending would have a different effect on its overall economy when compared with similar increases for Norway, Belgium, or Denmark.[15]

## The Reagan Years and Beyond

The Defense Budget Project, a Washington, D.C. based independent research organization, sponsored two reports dealing with defense spending and the economy. The first, written by David Gold and Dr. Gordon Adams at the end of the Reagan buildup in July 1987, pointed to the fact that defense spending doubled in the period 1981-1987. It highlighted the fact that this increased spending came with warnings of increased manufacturing bottlenecks and inflation, loss of jobs in non-defense sectors, crowding out of private investment and research and development, and reductions in U.S. productivity, economic growth, and international competitiveness.[16] The authors demonstrated that with the exception of productivity levels and the U.S. trade balance, the warnings for the most part were unwarranted.

The report indicates that most econometric studies attempting to link government spending with inflation are inconclusive.[17] The proof lies in the fact that the inflation rate has dropped

dramatically since 1980 despite high rates of defense expenditure.[18] The authors state that a much broader view of the economy must be taken to explain the causes of inflation. They make a similar conclusion regarding unemployment:

> The rise and fall of employment in the U.S. economy depends far more on broader economic developments -- relative changes in economic sectors, international economic developments, the business cycle -- than they do on changes in the level of defense spending.[19]

With respect to defense expenditure and economic growth and productivity, the authors contend that the results of statistical studies are far from compelling because the mere existence of a correlation does not provide a causal mechanism linking increased defense spending to decreased levels of growth, investment, or productivity. They state:

> It is possible, for example, that the causation runs both ways: the government might use defense spending as a counter-cyclical tool, with a decline in economic activity calling forth higher levels of such spending in an attempt to stimulate the economy.[20]

This, was demonstrated during the 1981-1982 recession when military expansion took up the slack in the economy created by sagging civilian demand.[21]

The authors concluded that since federal spending in general, not just defense spending, is a matter of public choice, it should be scrutinized within the arena of public policy choice. Therefore, "its macroeconomic impact is a less compelling focus of criticism or approval."[22]

Three years later, David Gold authored a second report for the Defense Budget Project entitled "The Impact of Defense Spending on

Investment, Productivity, and Economic Growth." This report appears to have been written in response to the 1987 publication of Paul Kennedy's The Rise and Fall of the Great Nations. Kennedy asserts that as a nation grows richer, it takes on commitments beyond its borders that force it to shift its wealth into defense spending at the expense of productivity. This allows the developing nations previously left in the wake of the great power to catch and eventually overtake the super power economically.[23]

Reiterating the conclusions of his 1987 report, Gold disagrees with Kennedy. Once again, he states that defense spending is too small a part of the overall American economy to be the driving force behind its performance and is not the cause of declining international competitiveness.[24] Gold admits that in the short run, defense spending may have diverted resources, caused some bottlenecks, and contributed to short run inflation. However, he attributes this to short run circumstances such as the Vietnam buildup and states that "on balance over a 40 year period, defense spending has been a relatively neutral feature of the American economic landscape."[25]

## Application of "Savings"

In a Congressional Research Service Report to Congress, Brian W. Cashell used a Data Resources, Inc. (DRI) model to examine the effects of applying defense reductions in two different areas.[26] The savings generated by the reductions were first applied to other non-military spending and then to deficit reductions.

When the savings were applied to non-military government spending, non-defense sectors of the economy benefitted at the expense of defense sectors. The resulting changes in the overall economy were relatively small, with a shift in output away from defense-related industries.[27] However, when the savings from defense reductions were used to reduce the deficit, a chain-reaction of events took place which, after an initial contraction of the economy, strengthened the economy and the financial position of the U.S. Government.

It is also important to apply a balanced approach for use of savings generated through defense reductions. Rear Admiral William T. Pendley (USN, Ret.), in an article critical of the recent "Bottom Up Review" performed by the Department of De e, emphasized the importance of rebuilding the domestic foundation of our national security.[28] He states:

> . . . there is the possibility that we will fail to rebuild the domestic foundation of our national security. . . . We must put the primary national security priority on rebuilding our physical infrastructure, improving our education system, revitalizing our economy and mending the social fabric of our nation. These are the key elements of national power and the foundations of national security.[29]

Admiral Pendley's article calls for a balanced approach for use of the savings generated by reductions in defense spending.

## Conclusion

Clearly, there are as many theories available on the effects of defense spending as there are analysts available to offer theories. This makes it difficult for a person to form an opinion

on the results of ongoing and future changes in defense spending. However, with a small investment in time and the use of some simple analytical techniques, an individual can perform his own analysis on the effects of defense spending. The results of this analysis can then be used to help choose between the many theories of the experts. In the following chapter, this type of analysis will be performed.

## CHAPTER III

## EMPIRICAL ANALYSIS

*The fear of the unknown is even more potent than the fear of a known thing which may be weighed and measured and resolutely faced.*
George Fielding Eliot

### Elements Analyzed

Although the national economy is made up of many elements, only two were selected for this study--GNP and GPDI. These elements were selected because of their relevance to economic well being and their ease of understanding by the public.

Statistical data used for this study were obtained from various editions of the Statistical Abstract of the United States, prepared annually by the U.S. Bureau of the Census, Washington, D.C. Data used from other sources will be cited as required. Constant year 1991 dollars are used throughout the analyses.

### Gross National Product

A prime indicator of a nation's economic growth is the rate of growth of the GNP. The U.S. GNP grew from $1.3 trillion in 1946 to $5.7 trillion in 1991 (see Appendix A.1). In fact the GNP has doubled about every 20 years since 1900. The GNP has sustained an average annual growth rate of approximately 3.0% and in the 45-year

period examined, it grew as much as $309.1 billion and declined as much as $115.6 Billion with 7 periods of negative growth. While the U.S. still maintains the highest GNP in the world, the growth rate has been surpassed by a number of nations.[1]

The GNP is made up of four primary elements--Personal Consumption Expenditures, GPDI, Net Exports of Goods and Services, and Government Purchases. This study will determine the extent to which the variability of growth in the GNP correlates to two of these elements--GPDI and that portion of Government Purchases dedicated to National Defense.

## Gross Private Domestic Investment

The share of the GNP dedicated to investment has remained relatively constant at about 13.6% since 1946 (Standard Deviation 1.4%). Change in GPDI has been more volatile than GNP change. Its greatest year of growth was 1984 ($170.3 billion). There have been 18 periods of negative growth since 1946 and GPDI has declined as much as $116 billion (1975). Despite this volatility, GPDI has been growing at an average rate of approximately 4.2%, about .8% higher than the GNP growth rate. One aspect of this study will determine the extent of the correlation between changes in GPDI and changes in defense spending. Additionally, the correlation between GPDI and GNP will be examined.

## National Defense Spending

Spending for national defense has grown at an average rate of 3.0% since 1946. Variation in the rate of growth has been greater than that for GPDI (Standard Deviation 16.4%). The largest positive change was in 1951 ($78 billion) and there have been 17 periods of negative growth. The greatest decline was $75.7 billion in 1947 as part of the drawdown from World War II. Defense spending has averaged an 8.5% share of the GNP since 1946, approximately two thirds that of GPDI. As might be expected, the percentage of GNP devoted to National Defense Spending is highly dependent on the National Security situation. This can be seen in Data Table 1 from 1950 to 1973. As the U.S. passed through the years of the Korean War, the nuclear arms buildup, and the Vietnam War, defense spending averaged 11.8% of GNP. Despite continued growth since that period, the percentage of GNP dedicated to defense has remained fairly steady at between five and six percent of GNP. This includes the years of the Carter/Reagan buildup.

## Method of Analysis

Bivariate regression was used to determine the relationship between GNP, defense spending, and GPDI. Simply stated, bivariate regression predicts the effect that change in an independent variable (X) will have on the dependent variable (Y) and subsequently determines whether or not there is a statistically significant relationship between the two sets of variables.[2] For example, when determining the correlation between changes in

defense spending (X) and changes in the GNP (Y), bivariate regression will also determine the probability that change in defense spending is related to change in GPDI. Then, whether probable or not, the regression will predict the resultant change to GPDI for a given change in defense spending. The results of the analysis are expressed in three outputs--coefficient of determination, slope, and constant. The analysis also tested for the effects of time delays.

## Coefficient of Determination ($r^2$)

The $r^2$ output shows the strength of the relationship between two sets of variables. For example, an $r^2$ of 0.5 for the defense spending to GPDI correlation means that defense spending changes could "account for" 50% of the change in GPDI.[3] This does not mean that changes in defense spending "cause" changes in GPDI. It only shows the probable strength of a relationship. Additionally, $r^2$ can be used to determine the correlation significance. As previously stated, an acceptable level of significance for this study is the probability that less than 5 in 100 sets of variables are related due to chance ($p < .05$).[4] To reiterate, for this study $r^2$ must be .566 or greater to achieve $p < .05$.

## Slope (b)

The slope is expressed as either a positive or negative number. A positive value indicates that as the independent

variable increases, there will be an increase in the dependent variable. A negative value indicates the opposite relationship. The slope also indicates the degree of change predicted by a change in the independent variable. The larger the absolute slope value, the greater the change in the dependent variable for each change in the independent variable.

**Constant (a)**

The constant output, known as the "intercept" or "origin" is used with the slope in the formula $Y_c = a + (b*X)$, where $Y_c$ is the predicted value for Y that will result for a given independent variable (X).* For example, it would provide an answer to the question: based upon historical data, what would be the predicted change in GNP for a $50 billion reduction in defense spending? An example using this formula with a plus or minus $50 billion change in the independent variable will be used in each analysis.

**Effect of Time**

Time phased analysis was used to determine whether a change in the independent variable had an effect on the dependent variable in later years. For example, a change in GPDI may not affect the current year GNP because the additional capacity purchased may not be available until subsequent periods. Each analysis determined the correlation between the independent variable in the current year with changes in the dependent variable in the current year and current year plus one and two years.

## Presentation of Results

Values for the constant, slope, and $R^2$ will be shown for each analysis. The analysis for the current year will then be depicted graphically in a scatter diagram. Presented on the graph will be the individual data points along with a slope line. An example will also be shown to provide a practical application of the analysis. Along with the analysis, any assumptions about or adjustments made to the raw data will be presented.

## Defense Spending's Correlation with Gross Private Domestic Investment

1. If National Defense spending is decreased, will GPDI increase? The analysis yielded the following results (see Appendix B for detail):

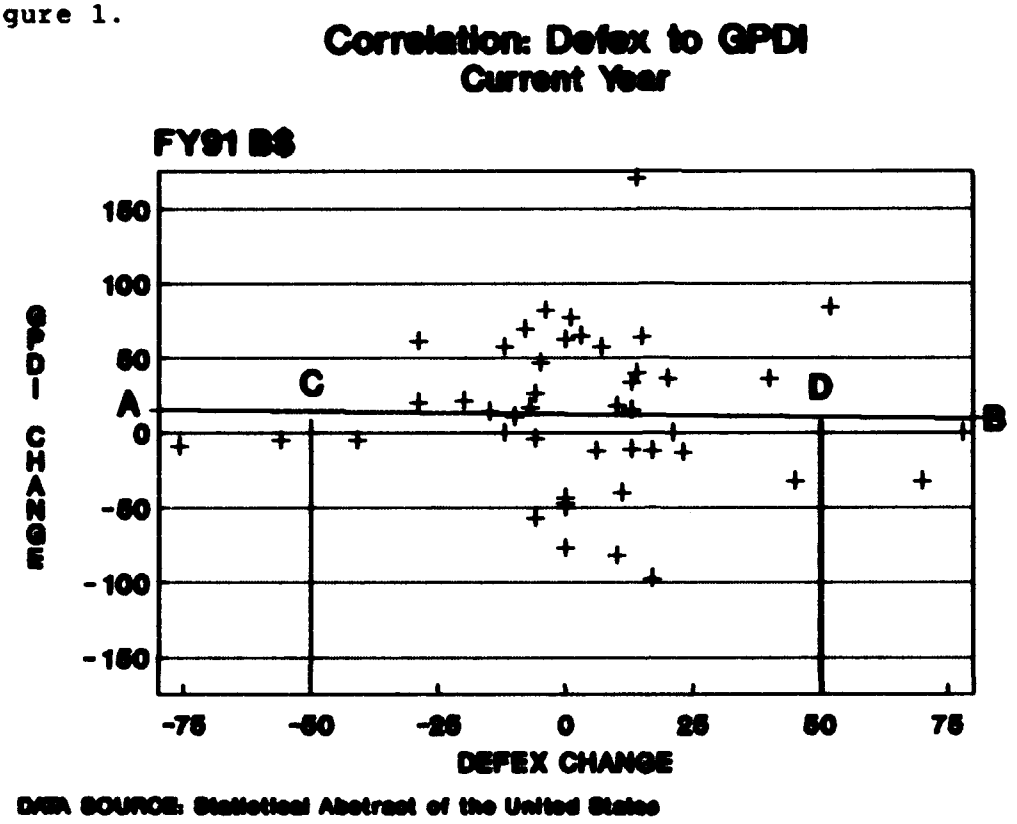
| TIME SEQUENCE | SLOPE (b) | CONSTANT (a) | $r^2$ |
|---|---|---|---|
| Current Year | -0.034 | 12.499 | 0.000 |
| One-year Delay | -0.326 | 14.114 | 0.031 |
| Two-year Delay | -0.119 | 11.872 | 0.004 |

The most important output in this analysis is the low value for the correlation significance ($r^2$). The $r^2$ output for this analysis did not come close to 0.556 and in the first year was less than 0.001. Therefore, there is no statistical correlation between changes in defense spending and changes in GPDI.

The analysis is portrayed graphically for the current year time sequence at Figure 1. If there was a strong correlation between defense spending changes and GPDI changes, the data points

would have been tightly arranged along the slope line (line AB). The low slope value is represented on the graph by the unsystematic

Figure 1.




scattering of the data points well away from the slope line.[6] This also explains the almost horizontal slope line. The negative slope value means that an increase in defense spending relates to a decrease in GPDI. Even if there had been a highly significant correlation, changes in defense spending predict minimal changes in GPDI.

An example using defense spending changes of -$50 billion and +$50 billion is portrayed on the slope line at points C and D

respectively. An increase in defense spending of $50 billion relates to an increase in investment of $10.8 billion in that year (Pt D). A decrease of the same magnitude relates to an increase in GPDI of $14.2 billion. Therefore, over a $100 billion dollar range of change, GPDI changes by only $3.4 billion. However, the low coefficient of determination renders this data unusable for a decision maker.

Answer to question one: There is a small negative relationship between changes in defense spending and changes in Gross Private Domestic Investment. However, there is no statistical significance to the correlation.

## Defense Spending's Correlation with Gross National Product

2. If defense spending is decreased, will all other elements of GNP increase?

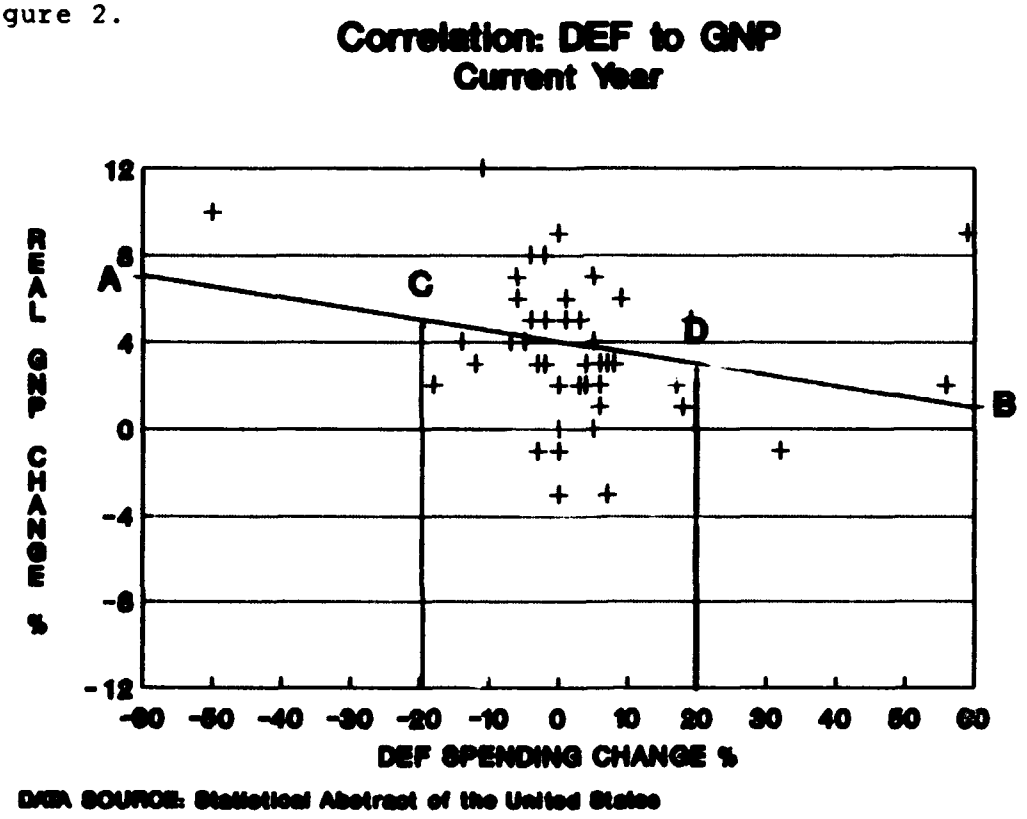
To perform this analysis, changes in GNP were adjusted by removing changes that occurred in defense spending for the current year. A change in defense spending would cause direct change in the GNP in the amount of the defense spending change. Therefore, that amount was removed from the amount of total GNP change. The regression was then performed using the percentage change in defense expenditure and GNP.

The analysis yielded the following results (see Appendix C for detail):

| TIME SEQUENCE | SLOPE (b) | CONSTANT (a) | $r^2$ |
|---|---|---|---|
| Same Year | -0.045 | 0.037 | 0.052 |
| One-year Delay | -0.031 | 0.035 | 0.027 |
| Two-year Delay | 0.034 | 0.000 | 0.015 |

Once again, the correlation significance ($r^2$) is well below the stated parameter of 0.556 and decreases in each year of the time sequencing.

Figure 2.



The data points in Figure 2. are once again scattered and most are well away from the slope line. Because the slope value is negative, decreases in defense spending indicate an increase in other elements of the GNP. The example using the $50 billion defense increase (equates to a 20% change in 1991) indicates a 3.0% increase in non-defense GNP. The $50 billion defense decrease yields a 4.4% increase. If there was a high coefficient of determination, this example would represent a significant increase in GNP (1.0% higher growth rate than the 3.4% averaged for the period studied). Using the non-defense GNP for 1991 ($5.068 trillion), growth of 1.0% equals a $50 billion growth increase. Again, the low coefficient of determination makes this data unusable for a decision maker.

Answer to question two: There is a negative relationship between changes in defense spending and Gross National Product. However, there is no statistical significance to the correlation.

## Gross Private Domestic Investment's Correlation with Gross National Product

3. If GPDI is increased, will those elements of GNP other than GPDI and defense spending increase?

To perform this analysis, changes in GNP were adjusted by removing changes that occurred in GPDI and defense spending in the current year. Like defense spending, a change in GPDI would cause direct change in GNP in the amount of the GPDI change. Therefore, that amount was removed. Since the objective was to determine if

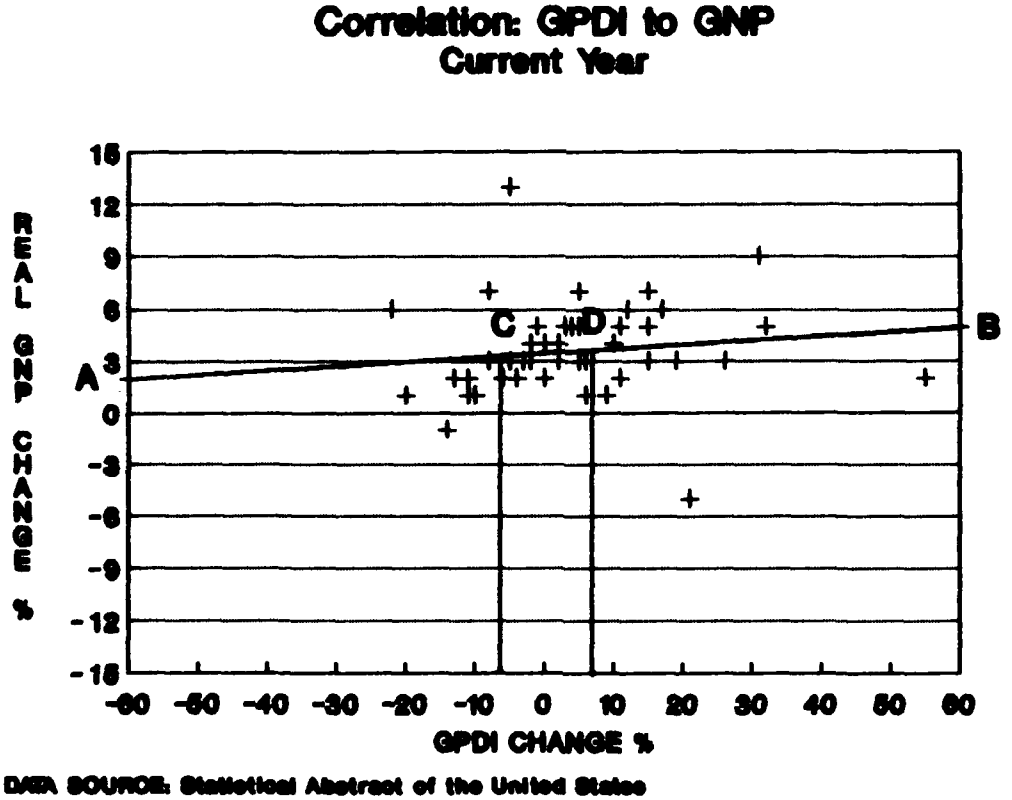
a relationship exists between changes in GPDI and non-defense changes in the GNP, changes in defense spending were also removed. Again, percentage changes in GPDI and GNP were used.

The analysis yielded the following results (see Appendix D for detail):

| TIME SEQUENCE | SLOPE (b) | CONSTANT (a) | $r^2$ |
|---|---|---|---|
| Same Year | 0.024 | 0.035 | 0.016 |
| One-year Delay | 0.010 | 0.034 | 0.004 |
| Two-year Delay | -0.014 | 0.037 | 0.011 |

Once again, the correlation significance ($r^2$) is well below the stated parameter of 0.556.

Figure 3.



There are several data points which group tightly along the length of the slope line in Figure 3. However, too many are scattered well away from the line for this to be a significant correlation. Although the slope is positive in the current year and for a one year delay, it becomes negative after a 2-year delay. A $50 billion GPDI increase indicates an increase of 3.7% in GNP while an equal decrease yields a 3.4% increase. Again, the low coefficient of determination renders this data unusable for a decision maker.

Answer to question three: There is a small positive relationship between Gross Private Domestic Investment and Gross National Product. However, there is no statistical significance to the correlation.

## CHAPTER IV

## ANALYSIS OF RESULTS

***The central problem is not collecting and transmitting information, but synthesizing for the decision maker.***
**Richard Burt**

The analyses showed that a negative relationship exists between changes in defense spending and both GPDI and GNP. Additionally, the analysis demonstrated a small positive relationship between GPDI and GNP. However, in each analysis, it was demonstrated that there was no statistically significant relationship. Factors other than defense expenditures determine the amount dedicated to GPDI and growth in GNP.

This lack of statistical significance can be further substantiated by examining two 20 year subperiods which showed dramatic changes in average defense burden. In the period 1950 to 1970, defense spending averaged 11.4% of GNP. In the next 20 year period, the percentage of GNP dedicated to defense averaged only 5.6%, a drop of more than 50%. If the results of the analysis in Chapter III had been statically significant, you would expect this change in defense burden to be associated with a rise in both GPDI and the GNP.

Changes in the amount of GNP dedicated to investment for the same periods were not as dramatic. Investment's share of the GNP

for the first period was 13%. This increased to 14.4% for the period 1971-1991. An increase of only 11% as opposed to the 50% decrease in defense spending share.

Despite the results of the second analysis (although not statistically significant) which predicted increased GNP growth for decreases in defense expenditure (negative relationship), an examination of the two subperiods implies a positive relationship. For the period 1950 to 1970, the GNP grew at an average rate of 4.2%. This growth rate, associated with the 50% drop in defense burden, dropped to 2.9% for the second 20-year period. This decreased growth rate occurred despite the 11% share increase in GPDI. This is contrary to the results of analysis three in chapter III which predicted increases in GNP for increases in GPDI share (again not statistically significant).

Thus, a long term substantial drop in defense burden could be associated with a relatively small increase in GPDI. Also, the long term drop in defense burden coupled with a small increase in investment could be associated with a substantial decrease in the average growth rate in gross national product. A result contrary to the latter two analyses in Chapter III.

The first analysis in Chapter III and the above simple analysis agrees with the assertion by Gold that "defense spending is not an important determinant of investment."[1] Likewise, the second analysis in Chapter III (defense expenditure to GNP) coupled with the above periodic analysis implies that defense spending plays a minor role in the overall generation of economic growth.

The raw data demonstrate that decreases in defense spending were not adequately offset by other sectors of the economy, despite an average increase on the investment side of the equation.

What all this means for the decision maker is that looking to reductions in defense spending as the sole way of boosting the overall economy is myopic at best. Historical reductions in defense expenditure have not led to increased growth rate despite increases in private investment. Additionally, the results of empirical analysis on historical data could not establish a statistically significant relationship between defense expenditure and other elements of the economy. Therefore, the decision maker must examine other areas if a serious attempt is to be made at increasing the overall economic well-being of the nation.

## CHAPTER V

## CONCLUSION

*If a nation values anything more than freedom, it will lose that freedom; and the irony of it is that if it is comfort or money that it values more, it will lose that, too.*
**Somerset Maugham**

The stated purpose of this paper was to further substantiate that changes in defense spending do not have a substantial effect on the overall economy of the U.S. The analyses demonstrated that since 1946 there has been no statistically significant correlation between defense spending changes and changes in Gross Private Domestic Investment or Gross National Product. Therefore, changes in these two elements result from factors not related to defense spending changes. Additionally, it was demonstrated that there is an extremely low probability that GPDI is one of the outside factors related to GNP changes.

This does not mean that defense expenditures can not or should not be reduced. The pertinent questions in this regard is how much should be reduced, what within defense should be reduced, and what should be done with the "savings" from a reduction.

### How Much and What

The question regarding the amount of a reduction and what should be reduced can only be answered in the context of strategy

development. Strategy is the development of a plan that matches resources to objectives. For the military, this must begin with a national security strategy with stated national security objectives. When clear national security objectives have been presented, a national military strategy can be developed which supports the accomplishment of those objectives by matching resources to task. At present, the only available national security strategy was written by the Bush administration.

In the absence of a national security strategy written by the current administration, the then Secretary of Defense Les Aspin directed the accomplishment of a "Bottom Up Review" (BUR). The report that resulted from the BUR provided a framework for shaping U.S. military forces to achieve stated "Review" objectives. The military services built a budget required to support the trimmed down force called for by the BUR. It was soon learned that the budget required to support the "Review" strategy would not stay within given fiscal guidelines. Shortly after the shortfall was presented in the media, Secretary Aspin announced his resignation as Secretary of Defense.

If the "Bottom Up Review" is in fact a strategic roadmap for our future military, agreed to by the President, the fiscal resources required to support that strategy should be made available. This is the cost that the military has determined is required to buy security for the United States at an acceptable risk level. Going below that funding level increases the risk level and threatens National Security. If the BUR is not the

roadmap for the future, then it is high time a cogent National Security Strategy was published upon which the military could build its force requirements.

## Application of Savings--A Balanced Approach

The budget developed to support the "Bottom Up Review" resulted in significant cuts in defense spending. The application of these "savings" will determine whether or not reductions in our military will contribute to improvements in the economy and the American way of life. There are a number of ways to apply such savings. A primary consideration is deficit reduction. However, a balanced approach which considers all the elements of national power must be used.

As mentioned in the introduction, for National Security Strategy to succeed there must be a balance between political, economic, social, and military powers. Allowing any single power to wither at the expense of the others could eventually lead to an overall failure of the strategy as a whole. However, the fact remains that the military forces of the Cold War and their associated costs are no longer required and have already been substantially reduced. While this means that absolute military power is decreasing, as evidenced by the numbers of bases closed, weapon systems retired and forces reduced, U.S. military power relative to the current world threat environment remains strong. A failure to recognize an emerging change in the world threat level

is the primary danger in reducing the military to the levels indicated in the BUR.

This balance must be achieved through the right mix of deficit reduction on the one hand and the selection of the correct non-military spending programs on the other. This balance will provide the stimulus to strengthen our economy while as Admiral Pendley states, ". . . making an investment that will prepare the United States for the uncertainties of the next century."[1] The success of our uniformed and elected officials in achieving this balance may well determine the continued viability of the United States on the world scene.

APPENDIX A.1
DATA TABLE 1

| | YEAR | GNP CY$B | GNP 91$B | DEF CY$B | DEF 91$B | DEF %GNP | GPDI CY$B | GPDI 91$B | GPDI %GNP |
|---|---|---|---|---|---|---|---|---|---|
| | 1946 | 210.7 | 1,277.7 | 18.8 | 151.4 | 11.8% | 28.1 | 170.0 | 13.3% |
| 1 | 1947 | 234.3 | 1,314.4 | 11.4 | 75.7 | 5.8% | 31.5 | 161.5 | 12.3% |
| 2 | 1948 | 259.4 | 1,305.2 | 11.6 | 88.3 | 6.8% | 43.1 | 195.6 | 15.0% |
| 3 | 1949 | 258.1 | 1,323.6 | 13.6 | 88.3 | 6.7% | 33.0 | 153.0 | 11.6% |
| 4 | 1950 | 284.8 | 1,485.3 | 14.1 | 140.6 | 9.5% | 54.1 | 237.3 | 16.0% |
| 5 | 1951 | 329.0 | 1,586.2 | 33.9 | 218.6 | 13.8% | 56.3 | 237.3 | 15.0% |
| 6 | 1952 | 347.0 | 1,647.8 | 46.4 | 288.2 | 17.5% | 49.9 | 205.6 | 12.5% |
| 7 | 1953 | 365.4 | 1,709.5 | 49.3 | 309.3 | 18.1% | 50.3 | 205.6 | 12.0% |
| 8 | 1954 | 363.1 | 1,687.0 | 41.2 | 253.1 | 15.0% | 48.9 | 200.4 | 11.9% |
| 9 | 1955 | 398.0 | 1,835.6 | 38.6 | 224.5 | 12.2% | 67.4 | 261.6 | 14.2% |
| 10 | 1956 | 419.2 | 1,872.9 | 40.4 | 218.6 | 11.7% | 67.4 | 257.4 | 13.7% |
| 11 | 1957 | 442.5 | 1,905.6 | 44.3 | 224.5 | 11.8% | 66.6 | 245.0 | 12.9% |
| 12 | 1958 | 447.3 | 1,863.6 | 45.9 | 224.5 | 12.0% | 60.9 | 195.1 | 10.5% |
| 13 | 1959 | 482.7 | 2,003.7 | 46.2 | 224.5 | 11.2% | 72.7 | 257.4 | 12.8% |
| 14 | 1960 | 507.0 | 2,053.4 | 44.0 | 212.7 | 10.4% | 76.0 | 257.7 | 12.5% |
| 15 | 1961 | 520.1 | 2,091.3 | 47.8 | 225.3 | 10.8% | 71.7 | 247.0 | 11.8% |
| 16 | 1962 | 560.3 | 2,230.1 | 51.6 | 245.3 | 11.0% | 83.0 | 282.8 | 12.7% |
| 17 | 1963 | 589.2 | 2,314.3 | 50.8 | 235.3 | 10.2% | 86.9 | 293.5 | 12.7% |
| 18 | 1964 | 628.7 | 2,432.1 | 49.9 | 220.3 | 9.1% | 92.9 | 307.8 | 12.7% |
| 19 | 1965 | 691.0 | 2,600.4 | 49.0 | 215.3 | 8.3% | 114.0 | 354.3 | 13.6% |
| 20 | 1966 | 747.6 | 2,764.5 | 60.6 | 255.3 | 9.2% | 120.8 | 390.1 | 14.1% |
| 21 | 1967 | 789.7 | 2,831.9 | 72.4 | 300.4 | 10.6% | 114.3 | 357.9 | 12.6% |
| 22 | 1968 | 864.2 | 2,974.9 | 78.3 | 310.4 | 10.4% | 126.0 | 375.8 | 12.6% |
| 23 | 1969 | 930.3 | 3,054.9 | 78.4 | 290.3 | 9.5% | 139.0 | 397.3 | 13.0% |
| 24 | 1970 | 993.0 | 3,129.9 | 74.0 | 249.6 | 8.0% | 144.0 | 392.5 | 12.5% |
| 25 | 1971 | 1,055.5 | 3,193.3 | 71.6 | 220.3 | 6.9% | 153.2 | 412.2 | 12.9% |
| 26 | 1972 | 1,155.2 | 3,418.1 | 74.4 | 212.5 | 6.2% | 178.3 | 481.3 | 14.1% |
| 27 | 1973 | 1,326.0 | 3,614.1 | 73.0 | 200.8 | 5.6% | 230.0 | 538.1 | 14.9% |
| 28 | 1974 | 1,434.0 | 3,591.0 | 77.0 | 195.0 | 5.4% | 229.0 | 481.3 | 13.4% |
| 29 | 1975 | 1,549.0 | 3,752.2 | 83.0 | 205.5 | 5.5% | 206.0 | 441.8 | 11.8% |
| 30 | 1976 | 1,718.0 | 3,936.0 | 86.0 | 201.7 | 5.1% | 258.0 | 523.7 | 13.3% |
| 31 | 1977 | 1,918.0 | 4,119.8 | 93.0 | 203.0 | 4.9% | 324.0 | 601.0 | 14.6% |
| 32 | 1978 | 2,164.0 | 4,337.0 | 100.0 | 205.5 | 4.7% | 387.0 | 665.5 | 15.3% |
| 33 | 1979 | 2,418.0 | 4,444.2 | 112.0 | 212.8 | 4.8% | 423.0 | 722.3 | 16.3% |
| 34 | 1980 | 2,633.0 | 4,437.3 | 131.0 | 223.1 | 5.0% | 402.0 | 640.3 | 14.4% |
| 35 | 1981 | 2,938.0 | 4,523.6 | 154.0 | 236.9 | 5.2% | 472.0 | 680.2 | 15.0% |
| 36 | 1982 | 3,149.6 | 4,408.0 | 193.8 | 254.2 | 5.8% | 503.4 | 583.2 | 13.2% |
| 37 | 1983 | 3,405.0 | 4,565.4 | 214.4 | 269.1 | 5.9% | 546.7 | 646.8 | 14.2% |
| 38 | 1984 | 3,777.2 | 4,874.4 | 233.1 | 282.9 | 5.8% | 718.9 | 817.1 | 16.8% |
| 39 | 1985 | 4,038.7 | 5,038.7 | 258.6 | 305.9 | 6.1% | 714.5 | 804.2 | 16.0% |
| 40 | 1986 | 4,268.6 | 5,176.6 | 276.7 | 323.2 | 6.2% | 717.6 | 792.3 | 15.3% |
| 41 | 1987 | 4,539.9 | 5,353.4 | 292.1 | 335.8 | 6.3% | 749.3 | 807.4 | 15.1% |
| 42 | 1988 | 4,900.4 | 5,592.9 | 295.6 | 330.1 | 5.9% | 793.6 | 833.3 | 14.9% |
| 43 | 1989 | 5,244.0 | 5,733.5 | 300.0 | 323.2 | 5.6% | 837.6 | 850.5 | 14.8% |
| 44 | 1990 | 5,548.8 | 5,756.4 | 313.4 | 323.2 | 5.6% | 802.6 | 803.1 | 14.0% |
| 45 | 1991 | 5,714.3 | 5,714.3 | 323.5 | 323.2 | 5.7% | 726.7 | 726.6 | 12.7% |
| MEAN | | 1,686.0 | 3,193.0 | 105.8 | 236.5 | 8.5% | 266.8 | 445.5 | 13.6% |
| STD DEV | | 1,642.6 | 1,415.8 | 93.1 | 61.8 | 3.4% | 261.5 | 223.9 | 1.4% |

## APPENDIX A.2
## DATA TABLE 2

| | YEAR | GNP 91$B | CHANGE | CHANGE % | DEF 91$B | CHANGE | CHANGE % | GPDI 91$B | CHANGE | CHANGE % |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1946 | 1,277.7 | | | 151.4 | | | 170.0 | | |
| 1 | 1947 | 1,314.4 | 36.8 | 2.9% | 75.7 | -75.7 | -50.0% | 161.5 | -8.5 | -5.0% |
| 2 | 1948 | 1,305.2 | -9.2 | -.7% | 88.3 | 12.6 | 16.7% | 195.6 | 34.0 | 21.1% |
| 3 | 1949 | 1,323.6 | 18.4 | 1.4% | 88.3 | .0 | .0% | 153.0 | -42.5 | -21.7% |
| 4 | 1950 | 1,485.3 | 161.6 | 12.2% | 140.6 | 52.3 | 59.2% | 237.3 | 84.2 | 55.0% |
| 5 | 1951 | 1,586.2 | 100.9 | 6.8% | 218.6 | 78.0 | 55.5% | 237.3 | .0 | .0% |
| 6 | 1952 | 1,647.8 | 61.7 | 3.9% | 288.2 | 69.6 | 31.8% | 205.6 | -31.6 | -13.3% |
| 7 | 1953 | 1,709.5 | 61.7 | 3.7% | 309.3 | 21.1 | 7.3% | 205.6 | .0 | .0% |
| 8 | 1954 | 1,687.0 | -22.4 | -1.3% | 253.1 | -56.2 | -18.2% | 200.4 | -5.3 | -2.6% |
| 9 | 1955 | 1,835.6 | 148.5 | 8.8% | 224.5 | -28.6 | -11.3% | 261.6 | 61.2 | 30.5% |
| 10 | 1956 | 1,872.9 | 37.4 | 2.0% | 218.6 | -5.9 | -2.6% | 257.4 | -4.2 | -1.6% |
| 11 | 1957 | 1,905.6 | 32.7 | 1.7% | 224.5 | 5.9 | 2.7% | 245.0 | -12.5 | -4.8% |
| 12 | 1958 | 1,863.6 | -42.0 | -2.2% | 224.5 | .0 | .0% | 195.1 | -49.8 | -20.3% |
| 13 | 1959 | 2,003.7 | 140.1 | 7.5% | 224.5 | .0 | .0% | 257.4 | 62.3 | 31.9% |
| 14 | 1960 | 2,053.4 | 49.7 | 2.5% | 212.7 | -11.8 | -5.3% | 257.7 | .3 | .1% |
| 15 | 1961 | 2,091.3 | 37.9 | 1.8% | 225.3 | 12.6 | 5.9% | 247.0 | -10.7 | -4.2% |
| 16 | 1962 | 2,230.1 | 138.9 | 6.6% | 245.3 | 20.0 | 8.9% | 282.8 | 35.8 | 14.5% |
| 17 | 1963 | 2,314.3 | 84.2 | 3.8% | 235.3 | -10.0 | -4.1% | 293.5 | 10.7 | 3.8% |
| 18 | 1964 | 2,432.1 | 117.8 | 5.1% | 220.3 | -15.0 | -6.4% | 307.8 | 14.3 | 4.9% |
| 19 | 1965 | 2,600.4 | 168.3 | 6.9% | 215.3 | -5.0 | -2.3% | 354.3 | 46.5 | 15.1% |
| 20 | 1966 | 2,764.5 | 164.1 | 6.3% | 255.3 | 40.0 | 18.6% | 390.1 | 35.8 | 10.1% |
| 21 | 1967 | 2,831.9 | 67.3 | 2.4% | 300.4 | 45.1 | 17.6% | 357.9 | -32.2 | -8.3% |
| 22 | 1968 | 2,974.9 | 143.1 | 5.1% | 310.4 | 10.0 | 3.3% | 375.8 | 17.9 | 5.0% |
| 23 | 1969 | 3,054.9 | 79.9 | 2.7% | 290.3 | -20.0 | -6.5% | 397.3 | 21.5 | 5.7% |
| 24 | 1970 | 3,129.9 | 75.0 | 2.5% | 249.6 | -40.7 | -14.0% | 392.5 | -4.8 | -1.2% |
| 25 | 1971 | 3,193.3 | 63.4 | 2.0% | 220.3 | -29.3 | -11.8% | 412.2 | 19.7 | 5.0% |
| 26 | 1972 | 3,418.1 | 224.8 | 7.0% | 212.5 | -7.8 | -3.5% | 481.3 | 69.1 | 16.8% |
| 27 | 1973 | 3,614.1 | 196.0 | 5.7% | 200.8 | -11.6 | -5.5% | 538.1 | 56.8 | 11.8% |
| 28 | 1974 | 3,591.0 | -23.1 | -.6% | 195.0 | -5.8 | -2.9% | 481.3 | -56.8 | -10.6% |
| 29 | 1975 | 3,752.2 | 161.2 | 4.5% | 205.5 | 10.5 | 5.4% | 441.8 | -39.6 | -8.2% |
| 30 | 1976 | 3,936.0 | 183.8 | 4.9% | 201.7 | -3.8 | -1.9% | 523.7 | 81.9 | 18.5% |
| 31 | 1977 | 4,119.8 | 183.8 | 4.7% | 203.0 | 1.3 | .6% | 601.0 | 77.3 | 14.8% |
| 32 | 1978 | 4,337.0 | 217.2 | 5.3% | 205.5 | 2.6 | 1.3% | 665.5 | 64.6 | 10.7% |
| 33 | 1979 | 4,444.2 | 107.2 | 2.5% | 212.8 | 7.2 | 3.5% | 722.3 | 56.7 | 8.5% |
| 34 | 1980 | 4,437.3 | -7.0 | -.2% | 223.1 | 10.4 | 4.9% | 640.3 | -81.9 | -11.3% |
| 35 | 1981 | 4,523.6 | 86.3 | 1.9% | 236.9 | 13.8 | 6.2% | 680.2 | 39.9 | 6.2% |
| 36 | 1982 | 4,408.0 | -115.6 | -2.6% | 254.2 | 17.3 | 7.3% | 583.2 | -97.0 | -14.3% |
| 37 | 1983 | 4,565.4 | 157.3 | 3.6% | 269.1 | 15.0 | 5.9% | 646.8 | 63.6 | 10.9% |
| 38 | 1984 | 4,874.4 | 309.1 | 6.8% | 282.9 | 13.8 | 5.1% | 817.1 | 170.3 | 26.3% |
| 39 | 1985 | 5,038.7 | 164.3 | 3.4% | 305.9 | 23.0 | 8.1% | 804.2 | -12.9 | -1.6% |
| 40 | 1986 | 5,176.6 | 137.8 | 2.7% | 323.2 | 17.3 | 5.6% | 792.3 | -11.9 | -1.5% |
| 41 | 1987 | 5,353.4 | 176.8 | 3.4% | 335.8 | 12.7 | 3.9% | 807.4 | 15.1 | 1.9% |
| 42 | 1988 | 5,592.9 | 239.5 | 4.5% | 330.1 | -5.8 | -1.7% | 833.3 | 25.9 | 3.2% |
| 43 | 1989 | 5,733.5 | 140.6 | 2.5% | 323.2 | -6.9 | -2.1% | 850.5 | 17.2 | 2.1% |
| 44 | 1990 | 5,756.4 | 22.9 | .4% | 323.2 | .0 | .0% | 803.1 | -47.4 | -5.6% |
| 45 | 1991 | 5,714.3 | -42.1 | -.7% | 323.2 | .0 | .0% | 726.6 | -76.5 | -9.5% |
| MEAN | | 3,193.0 | 98.6 | 3.4% | 236.5 | 3.8 | 3.0% | 445.5 | 12.4 | 4.2% |
| STD DEV | | 1,415.8 | 86.2 | 3.0% | 61.8 | 27.3 | 16.4% | 223.9 | 50.6 | 14.3% |

## APPENDIX B.1
### Correlation: Defense Expenditure with GPDI (Raw Data)

| | YEAR | DEF 91$B | DEF CHANGE | GPDI 91$B | GPDI CHANGE |
|---|---|---|---|---|---|
| | 1946 | 151.4 | | 170.0 | |
| 1 | 1947 | 75.7 | -75.7 | 161.5 | -8.5 |
| 2 | 1948 | 88.3 | 12.6 | 195.6 | 34.0 |
| 3 | 1949 | 88.3 | .0 | 153.0 | -42.5 |
| 4 | 1950 | 140.6 | 52.3 | 237.3 | 84.2 |
| 5 | 1951 | 218.6 | 78.0 | 237.3 | .0 |
| 6 | 1952 | 288.2 | 69.6 | 205.6 | -31.6 |
| 7 | 1953 | 309.3 | 21.1 | 205.6 | .0 |
| 8 | 1954 | 253.1 | -56.2 | 200.4 | -5.3 |
| 9 | 1955 | 224.5 | -28.6 | 261.6 | 61.2 |
| 10 | 1956 | 218.6 | -5.9 | 257.4 | -4.2 |
| 11 | 1957 | 224.5 | 5.9 | 245.0 | -12.5 |
| 12 | 1958 | 224.5 | .0 | 195.1 | -49.8 |
| 13 | 1959 | 224.5 | .0 | 257.4 | 62.3 |
| 14 | 1960 | 212.7 | -11.8 | 257.7 | .3 |
| 15 | 1961 | 225.3 | 12.6 | 247.0 | -10.7 |
| 16 | 1962 | 245.3 | 20.0 | 282.8 | 35.8 |
| 17 | 1963 | 235.3 | -10.0 | 293.5 | 10.7 |
| 18 | 1964 | 220.3 | -15.0 | 307.8 | 14.3 |
| 19 | 1965 | 215.3 | -5.0 | 354.3 | 46.5 |
| 20 | 1966 | 255.3 | 40.0 | 390.1 | 35.8 |
| 21 | 1967 | 300.4 | 45.1 | 357.9 | -32.2 |
| 22 | 1968 | 310.4 | 10.0 | 375.8 | 17.9 |
| 23 | 1969 | 290.3 | -20.0 | 397.3 | 21.5 |
| 24 | 1970 | 249.6 | -40.7 | 392.5 | -4.8 |
| 25 | 1971 | 220.3 | -29.3 | 412.2 | 19.7 |
| 26 | 1972 | 212.5 | -7.8 | 481.3 | 69.1 |
| 27 | 1973 | 200.8 | -11.6 | 538.1 | 56.8 |
| 28 | 1974 | 195.0 | -5.8 | 481.3 | -56.8 |
| 29 | 1975 | 205.5 | 10.5 | 441.8 | -39.6 |
| 30 | 1976 | 201.7 | -3.8 | 523.7 | 81.9 |
| 31 | 1977 | 203.0 | 1.3 | 601.0 | 77.3 |
| 32 | 1978 | 205.5 | 2.6 | 665.5 | 64.6 |
| 33 | 1979 | 212.8 | 7.2 | 722.3 | 56.7 |
| 34 | 1980 | 223.1 | 10.4 | 640.3 | -81.9 |
| 35 | 1981 | 236.9 | 13.8 | 680.2 | 39.9 |
| 36 | 1982 | 254.2 | 17.3 | 583.2 | -97.0 |
| 37 | 1983 | 269.1 | 15.0 | 646.8 | 63.6 |
| 38 | 1984 | 282.9 | 13.8 | 817.1 | 170.3 |
| 39 | 1985 | 305.9 | 23.0 | 804.2 | -12.9 |
| 40 | 1986 | 323.2 | 17.3 | 792.3 | -11.9 |
| 41 | 1987 | 335.8 | 12.7 | 807.4 | 15.1 |
| 42 | 1988 | 330.1 | -5.8 | 833.3 | 25.9 |
| 43 | 1989 | 323.2 | -6.9 | 850.5 | 17.2 |
| 44 | 1990 | 323.2 | .0 | 803.1 | -47.4 |
| 45 | 1991 | 323.2 | .0 | 726.6 | -76.5 |

## APPENDIX B.2
## Correlation: Defense Expenditure with GPDI (Same Year)

| | | DEF CHANGE X | GPDI CHANGE Y |
|---|---|---|---|
| 1 | 1947 | -75.7 | -8.5 |
| 2 | 1948 | 12.6 | 34.0 |
| 3 | 1949 | .0 | -42.5 |
| 4 | 1950 | 52.3 | 84.2 |
| 5 | 1951 | 78.0 | .0 |
| 6 | 1952 | 69.6 | -31.6 |
| 7 | 1953 | 21.1 | .0 |
| 8 | 1954 | -56.2 | -5.3 |
| 9 | 1955 | -28.6 | 61.2 |
| 10 | 1956 | -5.9 | -4.2 |
| 11 | 1957 | 5.9 | -12.5 |
| 12 | 1958 | .0 | -49.8 |
| 13 | 1959 | .0 | 62.3 |
| 14 | 1960 | -11.8 | .3 |
| 15 | 1961 | 12.6 | -10.7 |
| 16 | 1962 | 20.0 | 35.8 |
| 17 | 1963 | -10.0 | 10.7 |
| 18 | 1964 | -15.0 | 14.3 |
| 19 | 1965 | -5.0 | 46.5 |
| 20 | 1966 | 40.0 | 35.8 |
| 21 | 1967 | 45.1 | -32.2 |
| 22 | 1968 | 10.0 | 17.9 |
| 23 | 1969 | -20.0 | 21.5 |
| 24 | 1970 | -40.7 | -4.8 |
| 25 | 1971 | -29.3 | 19.7 |
| 26 | 1972 | -7.8 | 69.1 |
| 27 | 1973 | -11.6 | 56.8 |
| 28 | 1974 | -5.8 | -56.8 |
| 29 | 1975 | 10.5 | -39.6 |
| 30 | 1976 | -3.8 | 81.9 |
| 31 | 1977 | 1.3 | 77.3 |
| 32 | 1978 | 2.6 | 64.6 |
| 33 | 1979 | 7.2 | 56.7 |
| 34 | 1980 | 10.4 | -81.9 |
| 35 | 1981 | 13.8 | 39.9 |
| 36 | 1982 | 17.3 | -97.0 |
| 37 | 1983 | 15.0 | 63.6 |
| 38 | 1984 | 13.8 | 170.3 |
| 39 | 1985 | 23.0 | -12.9 |
| 40 | 1986 | 17.3 | -11.9 |
| 41 | 1987 | 12.7 | 15.1 |
| 42 | 1988 | -5.8 | 25.9 |
| 43 | 1989 | -6.9 | 17.2 |
| 44 | 1990 | .0 | -47.4 |
| 45 | 1991 | .0 | -76.5 |

Slope (b) = -.034
Constant (a) = 12.499
R squared = .000

$50 billion defense increase predicts INV change of:
($B) 10.8

$50 billion defense decrease predicts INV change of:
($B) 14.2

## APPENDIX B.3
## Correlation: Defense Expenditure with GPDI (One Year Delay)

| | | DEF CHANGE X | GPDI CHANGE Y |
|---|---|---|---|
| 1 | 1947 | -75.7 | 34.0 |
| 2 | 1948 | 12.6 | -42.5 |
| 3 | 1949 | .0 | 84.2 |
| 4 | 1950 | 52.3 | .0 |
| 5 | 1951 | 78.0 | -31.6 |
| 6 | 1952 | 69.6 | .0 |
| 7 | 1953 | 21.1 | -5.3 |
| 8 | 1954 | -56.2 | 61.2 |
| 9 | 1955 | -28.6 | -4.2 |
| 10 | 1956 | -5.9 | -12.5 |
| 11 | 1957 | 5.9 | -49.8 |
| 12 | 1958 | .0 | 62.3 |
| 13 | 1959 | .0 | .3 |
| 14 | 1960 | -11.8 | -10.7 |
| 15 | 1961 | 12.6 | 35.8 |
| 16 | 1962 | 20.0 | 10.7 |
| 17 | 1963 | -10.0 | 14.3 |
| 18 | 1964 | -15.0 | 46.5 |
| 19 | 1965 | -5.0 | 35.8 |
| 20 | 1966 | 40.0 | -32.2 |
| 21 | 1967 | 45.1 | 17.9 |
| 22 | 1968 | 10.0 | 21.5 |
| 23 | 1969 | -20.0 | -4.8 |
| 24 | 1970 | -40.7 | 19.7 |
| 25 | 1971 | -29.3 | 69.1 |
| 26 | 1972 | -7.8 | 56.8 |
| 27 | 1973 | -11.6 | -56.8 |
| 28 | 1974 | -5.8 | -39.6 |
| 29 | 1975 | 10.5 | 81.9 |
| 30 | 1976 | -3.8 | 77.3 |
| 31 | 1977 | 1.3 | 64.6 |
| 32 | 1978 | 2.6 | 56.7 |
| 33 | 1979 | 7.2 | -81.9 |
| 34 | 1980 | 10.4 | 39.9 |
| 35 | 1981 | 13.8 | -97.0 |
| 36 | 1982 | 17.3 | 63.6 |
| 37 | 1983 | 15.0 | 170.3 |
| 38 | 1984 | 13.8 | -12.9 |
| 39 | 1985 | 23.0 | -11.9 |
| 40 | 1986 | 17.3 | 15.1 |
| 41 | 1987 | 12.7 | 25.9 |
| 42 | 1988 | -5.8 | 17.2 |
| 43 | 1989 | -6.9 | -47.4 |
| 44 | 1990 | .0 | -76.5 |

Slope (b) = -.326
Constant (a) = 14.114
R squared = .031

$50 billion defense increase predicts INV change of:
($B) -2.2

$50 billion defense decrease predicts INV change of:
($B) 30.4

## APPENDIX B.4
## Correlation: Defense Expenditure with GPDI (Two Year Delay)

| | | DEF CHANGE X | GPDI CHANGE Y |
|---|---|---|---|
| 1 | 1947 | -75.7 | -42.5 |
| 2 | 1948 | 12.6 | 84.2 |
| 3 | 1949 | .0 | .0 |
| 4 | 1950 | 52.3 | -31.6 |
| 5 | 1951 | 78.0 | .0 |
| 6 | 1952 | 69.6 | -5.3 |
| 7 | 1953 | 21.1 | 61.2 |
| 8 | 1954 | -56.2 | -4.2 |
| 9 | 1955 | -28.6 | -12.5 |
| 10 | 1956 | -5.9 | -49.8 |
| 11 | 1957 | 5.9 | 62.3 |
| 12 | 1958 | .0 | .3 |
| 13 | 1959 | .0 | -10.7 |
| 14 | 1960 | -11.8 | 35.8 |
| 15 | 1961 | 12.6 | 10.7 |
| 16 | 1962 | 20.0 | 14.3 |
| 17 | 1963 | -10.0 | 46.5 |
| 18 | 1964 | -15.0 | 35.8 |
| 19 | 1965 | -5.0 | -32.2 |
| 20 | 1966 | 40.0 | 17.9 |
| 21 | 1967 | 45.1 | 21.5 |
| 22 | 1968 | 10.0 | -4.8 |
| 23 | 1969 | -20.0 | 19.7 |
| 24 | 1970 | -40.7 | 69.1 |
| 25 | 1971 | -29.3 | 56.8 |
| 26 | 1972 | -7.8 | -56.8 |
| 27 | 1973 | -11.6 | -39.6 |
| 28 | 1974 | -5.8 | 81.9 |
| 29 | 1975 | 10.5 | 77.3 |
| 30 | 1976 | -3.8 | 64.6 |
| 31 | 1977 | 1.3 | 56.7 |
| 32 | 1978 | 2.6 | -81.9 |
| 33 | 1979 | 7.2 | 39.9 |
| 34 | 1980 | 10.4 | -97.0 |
| 35 | 1981 | 13.8 | 63.6 |
| 36 | 1982 | 17.3 | 170.3 |
| 37 | 1983 | 15.0 | -12.9 |
| 38 | 1984 | 13.8 | -11.9 |
| 39 | 1985 | 23.0 | 15.1 |
| 40 | 1986 | 17.3 | 25.9 |
| 41 | 1987 | 12.7 | 17.2 |
| 42 | 1988 | -5.8 | -47.4 |
| 43 | 1989 | -6.9 | -76.5 |

Slope (b) = .119
Constant (a) = 11.872
R squared = .004

$50 billion defense increase predicts INV change of:
($B) 17.8

$50 billion defense decrease predicts INV change of:
($B) 5.9

## APPENDIX C.1
## Correlation: Defense Expenditure with GNP (Raw Data)

| | YEAR | GNP 91$B | Real GNP (GNP-DEF) | % Change Real GNP | DEF 91$B | % DEF CHANGE |
|---|---|---|---|---|---|---|
| | 1946 | 1,277.7 | 1,126.3 | | 151.4 | |
| 1 | 1947 | 1,314.4 | 1,238.7 | 10.0% | 75.7 | ( 50.0%) |
| 2 | 1948 | 1,305.2 | 1,216.9 | ( 1.8%) | 88.3 | 16.7% |
| 3 | 1949 | 1,323.6 | 1,235.3 | 1.5% | 88.3 | .0% |
| 4 | 1950 | 1,485.3 | 1,344.7 | 8.9% | 140.6 | 59.2% |
| 5 | 1951 | 1,586.2 | 1,367.5 | 1.7% | 218.6 | 55.5% |
| 6 | 1952 | 1,647.8 | 1,359.6 | ( .6%) | 288.2 | 31.8% |
| 7 | 1953 | 1,709.5 | 1,400.2 | 3.0% | 309.3 | 7.3% |
| 8 | 1954 | 1,687.0 | 1,434.0 | 2.4% | 253.1 | ( 18.2%) |
| 9 | 1955 | 1,835.6 | 1,611.1 | 12.4% | 224.5 | ( 11.3%) |
| 10 | 1956 | 1,872.9 | 1,654.4 | 2.7% | 218.6 | ( 2.6%) |
| 11 | 1957 | 1,905.6 | 1,681.2 | 1.6% | 224.5 | 2.7% |
| 12 | 1958 | 1,863.6 | 1,639.1 | ( 2.5%) | 224.5 | .0% |
| 13 | 1959 | 2,003.7 | 1,779.3 | 8.5% | 224.5 | .0% |
| 14 | 1960 | 2,053.4 | 1,840.8 | 3.5% | 212.7 | ( 5.3%) |
| 15 | 1961 | 2,091.3 | 1,866.0 | 1.4% | 225.3 | 5.9% |
| 16 | 1962 | 2,230.1 | 1,984.8 | 6.4% | 245.3 | 8.9% |
| 17 | 1963 | 2,314.3 | 2,079.0 | 4.7% | 235.3 | ( 4.1%) |
| 18 | 1964 | 2,432.1 | 2,211.9 | 6.4% | 220.3 | ( 6.4%) |
| 19 | 1965 | 2,600.4 | 2,385.2 | 7.8% | 215.3 | ( 2.3%) |
| 20 | 1966 | 2,764.5 | 2,509.2 | 5.2% | 255.3 | 18.6% |
| 21 | 1967 | 2,831.9 | 2,531.5 | .9% | 300.4 | 17.6% |
| 22 | 1968 | 2,974.9 | 2,664.6 | 5.3% | 310.4 | 3.3% |
| 23 | 1969 | 3,054.9 | 2,764.5 | 3.8% | 290.3 | ( 6.5%) |
| 24 | 1970 | 3,129.9 | 2,880.3 | 4.2% | 249.6 | ( 14.0%) |
| 25 | 1971 | 3,193.3 | 2,973.1 | 3.2% | 220.3 | ( 11.8%) |
| 26 | 1972 | 3,418.1 | 3,205.7 | 7.8% | 212.5 | ( 3.5%) |
| 27 | 1973 | 3,614.1 | 3,413.3 | 6.5% | 200.8 | ( 5.5%) |
| 28 | 1974 | 3,591.0 | 3,396.0 | ( .5%) | 195.0 | ( 2.9%) |
| 29 | 1975 | 3,752.2 | 3,546.7 | 4.4% | 205.5 | 5.4% |
| 30 | 1976 | 3,936.0 | 3,734.3 | 5.3% | 201.7 | ( 1.9%) |
| 31 | 1977 | 4,119.8 | 3,916.9 | 4.9% | 203.0 | .6% |
| 32 | 1978 | 4,337.0 | 4,131.5 | 5.5% | 205.5 | 1.3% |
| 33 | 1979 | 4,444.2 | 4,231.5 | 2.4% | 212.8 | 3.5% |
| 34 | 1980 | 4,437.3 | 4,214.2 | ( .4%) | 223.1 | 4.9% |
| 35 | 1981 | 4,523.6 | 4,286.7 | 1.7% | 236.9 | 6.2% |
| 36 | 1982 | 4,408.0 | 4,153.9 | ( 3.1%) | 254.2 | 7.3% |
| 37 | 1983 | 4,565.4 | 4,296.3 | 3.4% | 269.1 | 5.9% |
| 38 | 1984 | 4,874.4 | 4,591.5 | 6.9% | 282.9 | 5.1% |
| 39 | 1985 | 5,038.7 | 4,732.8 | 3.1% | 305.9 | 8.1% |
| 40 | 1986 | 5,176.6 | 4,853.4 | 2.5% | 323.2 | 5.6% |
| 41 | 1987 | 5,353.4 | 5,017.6 | 3.4% | 335.8 | 3.9% |
| 42 | 1988 | 5,592.9 | 5,262.8 | 4.9% | 330.1 | ( 1.7%) |
| 43 | 1989 | 5,733.5 | 5,410.3 | 2.8% | 323.2 | ( 2.1%) |
| 44 | 1990 | 5,756.4 | 5,433.3 | .4% | 323.2 | .0% |
| 45 | 1991 | 5,714.3 | 5,391.1 | ( .8%) | 323.2 | .0% |

## APPENDIX C.2
## Correlation: Defense Expenditure with GNP (Same Year)

| | | DEF CHANGE X | GNP CHANGE Y |
|---|---|---|---|
| | 1946 | | |
| 1 | 1947 | ( 50.0%) | 10.0% |
| 2 | 1948 | 16.7% | ( 1.8%) |
| 3 | 1949 | .0% | 1.5% |
| 4 | 1950 | 59.2% | 8.9% |
| 5 | 1951 | 55.5% | 1.7% |
| 6 | 1952 | 31.8% | ( .6%) |
| 7 | 1953 | 7.3% | 3.0% |
| 8 | 1954 | ( 18.2%) | 2.4% |
| 9 | 1955 | ( 11.3%) | 12.4% |
| 10 | 1956 | ( 2.6%) | 2.7% |
| 11 | 1957 | 2.7% | 1.6% |
| 12 | 1958 | .0% | ( 2.5%) |
| 13 | 1959 | .0% | 8.5% |
| 14 | 1960 | ( 5.3%) | 3.5% |
| 15 | 1961 | 5.9% | 1.4% |
| 16 | 1962 | 8.9% | 6.4% |
| 17 | 1963 | ( 4.1%) | 4.7% |
| 18 | 1964 | ( 6.4%) | 6.4% |
| 19 | 1965 | ( 2.3%) | 7.8% |
| 20 | 1966 | 18.6% | 5.2% |
| 21 | 1967 | 17.6% | .9% |
| 22 | 1968 | 3.3% | 5.3% |
| 23 | 1969 | ( 6.5%) | 3.8% |
| 24 | 1970 | ( 14.0%) | 4.2% |
| 25 | 1971 | ( 11.8%) | 3.2% |
| 26 | 1972 | ( 3.5%) | 7.8% |
| 27 | 1973 | ( 5.5%) | 6.5% |
| 28 | 1974 | ( 2.9%) | ( .5%) |
| 29 | 1975 | 5.4% | 4.4% |
| 30 | 1976 | ( 1.9%) | 5.3% |
| 31 | 1977 | .6% | 4.9% |
| 32 | 1978 | 1.3% | 5.5% |
| 33 | 1979 | 3.5% | 2.4% |
| 34 | 1980 | 4.9% | ( .4%) |
| 35 | 1981 | 6.2% | 1.7% |
| 36 | 1982 | 7.3% | ( 3.1%) |
| 37 | 1983 | 5.9% | 3.4% |
| 38 | 1984 | 5.1% | 6.9% |
| 39 | 1985 | 8.1% | 3.1% |
| 40 | 1986 | 5.6% | 2.5% |
| 41 | 1987 | 3.9% | 3.4% |
| 42 | 1988 | ( 1.7%) | 4.9% |
| 43 | 1989 | ( 2.1%) | 2.8% |
| 44 | 1990 | .0% | .4% |
| 45 | 1991 | .0% | ( .8%) |

Slope (b) = -.045
Constant (a) = .037
R squared = .052

$50 billion defense increase predicts Real GNP% change of:
(91$B) 3.0%

$50 billion defense decrease predicts Real GNP% change of:
(91$B) 4.4%

## APPENDIX C.3
## Correlation: Defense Expenditure with GNP (One Year Delay)

| | | DEF CHANGE X | GNP CHANGE Y |
|---|---|---|---|
| | 1946 | | |
| 1 | 1947 | ( 50.0%) | ( 1.8%) |
| 2 | 1948 | 16.7% | 1.5% |
| 3 | 1949 | .0% | 8.9% |
| 4 | 1950 | 59.2% | 1.7% |
| 5 | 1951 | 55.5% | ( .6%) |
| 6 | 1952 | 31.8% | 3.0% |
| 7 | 1953 | 7.3% | 2.4% |
| 8 | 1954 | ( 18.2%) | 12.4% |
| 9 | 1955 | ( 11.3%) | 2.7% |
| 10 | 1956 | ( 2.6%) | 1.6% |
| 11 | 1957 | 2.7% | ( 2.5%) |
| 12 | 1958 | .0% | 8.5% |
| 13 | 1959 | .0% | 3.5% |
| 14 | 1960 | ( 5.3%) | 1.4% |
| 15 | 1961 | 5.9% | 6.4% |
| 16 | 1962 | 8.9% | 4.7% |
| 17 | 1963 | ( 4.1%) | 6.4% |
| 18 | 1964 | ( 6.4%) | 7.8% |
| 19 | 1965 | ( 2.3%) | 5.2% |
| 20 | 1966 | 18.6% | .9% |
| 21 | 1967 | 17.6% | 5.3% |
| 22 | 1968 | 3.3% | 3.8% |
| 23 | 1969 | ( 6.5%) | 4.2% |
| 24 | 1970 | ( 14.0%) | 3.2% |
| 25 | 1971 | ( 11.8%) | 7.8% |
| 26 | 1972 | ( 3.5%) | 6.5% |
| 27 | 1973 | ( 5.5%) | ( .5%) |
| 28 | 1974 | ( 2.9%) | 4.4% |
| 29 | 1975 | 5.4% | 5.3% |
| 30 | 1976 | ( 1.9%) | 4.9% |
| 31 | 1977 | .6% | 5.5% |
| 32 | 1978 | 1.3% | 2.4% |
| 33 | 1979 | 3.5% | ( .4%) |
| 34 | 1980 | 4.9% | 1.7% |
| 35 | 1981 | 6.2% | ( 3.1%) |
| 36 | 1982 | 7.3% | 3.4% |
| 37 | 1983 | 5.9% | 6.9% |
| 38 | 1984 | 5.1% | 3.1% |
| 39 | 1985 | 8.1% | 2.5% |
| 40 | 1986 | 5.6% | 3.4% |
| 41 | 1987 | 3.9% | 4.9% |
| 42 | 1988 | ( 1.7%) | 2.8% |
| 43 | 1989 | ( 2.1%) | .4% |
| 44 | 1990 | .0% | ( .8%) |

Slope (b) = -.031
Constant (a) = .035
R squared = .027

$50 billion defense increase predicts Real GNP% change of:
(91$B) 3.1%

$50 billion defense decrease predicts Real GNP% change of:
(91$B) 4.0%

## APPENDIX C.4
## Correlation: Defense Expenditure with GNP (Two Year Delay)

| | | DEF CHANGE X | GNP CHANGE Y |
|---|---|---|---|
| | 1946 | | |
| 1 | 1947 | ( 50.0%) | 1.5% |
| 2 | 1948 | 16.7% | 8.9% |
| 3 | 1949 | .0% | 1.7% |
| 4 | 1950 | 59.2% | ( .6%) |
| 5 | 1951 | 55.5% | 3.0% |
| 6 | 1952 | 31.8% | 2.4% |
| 7 | 1953 | 7.3% | 12.4% |
| 8 | 1954 | ( 18.2%) | 2.7% |
| 9 | 1955 | ( 11.3%) | 1.6% |
| 10 | 1956 | ( 2.6%) | ( 2.5%) |
| 11 | 1957 | 2.7% | 8.5% |
| 12 | 1958 | .0% | 3.5% |
| 13 | 1959 | .0% | 1.4% |
| 14 | 1960 | ( 5.3%) | 6.4% |
| 15 | 1961 | 5.9% | 4.7% |
| 16 | 1962 | 8.9% | 6.4% |
| 17 | 1963 | ( 4.1%) | 7.8% |
| 18 | 1964 | ( 6.4%) | 5.2% |
| 19 | 1965 | ( 2.3%) | .9% |
| 20 | 1966 | 18.6% | 5.3% |
| 21 | 1967 | 17.6% | 3.8% |
| 22 | 1968 | 3.3% | 4.2% |
| 23 | 1969 | ( 6.5%) | 3.2% |
| 24 | 1970 | ( 14.0%) | 7.8% |
| 25 | 1971 | ( 11.8%) | 6.5% |
| 26 | 1972 | ( 3.5%) | ( .5%) |
| 27 | 1973 | ( 5.5%) | 4.4% |
| 28 | 1974 | ( 2.9%) | 5.3% |
| 29 | 1975 | 5.4% | 4.9% |
| 30 | 1976 | ( 1.9%) | 5.5% |
| 31 | 1977 | .6% | 2.4% |
| 32 | 1978 | 1.3% | ( .4%) |
| 33 | 1979 | 3.5% | 1.7% |
| 34 | 1980 | 4.9% | ( 3.1%) |
| 35 | 1981 | 6.2% | 3.4% |
| 36 | 1982 | 7.3% | 6.9% |
| 37 | 1983 | 5.9% | 3.1% |
| 38 | 1984 | 5.1% | 2.5% |
| 39 | 1985 | 8.1% | 3.4% |
| 40 | 1986 | 5.6% | 4.9% |
| 41 | 1987 | 3.9% | 2.8% |
| 42 | 1988 | ( 1.7%) | .4% |
| 43 | 1989 | ( 2.1%) | ( .8%) |

Slope (b) = .034
Constant (a) = .000
R squared = .015

$50 billion defense increase predicts Real GNP% change of:
(91$B) .5%

$50 billion defense decrease predicts Real GNP% change of:
(91$B) ( .5%)

## APPENDIX D.1
## Correlation: GPDI with GNP (Raw Data)

| | YEAR | GNP 91$B | GNP-INV-DEF | % Change | GPDI 91$B | GPDI % CHANGE | DEF |
|---|---|---|---|---|---|---|---|
| | 1946 | 1,277.7 | 956.2 | | 170.0 | | 151.4 |
| 1 | 1947 | 1,314.4 | 1,077.2 | 12.6% | 161.5 | ( 5.0%) | 75.7 |
| 2 | 1948 | 1,305.2 | 1,021.4 | ( 5.2%) | 195.6 | 21.1% | 88.3 |
| 3 | 1949 | 1,323.6 | 1,082.3 | 6.0% | 153.0 | ( 21.7%) | 88.3 |
| 4 | 1950 | 1,485.3 | 1,107.4 | 2.3% | 237.3 | 55.0% | 140.6 |
| 5 | 1951 | 1,586.2 | 1,130.3 | 2.1% | 237.3 | .0% | 218.6 |
| 6 | 1952 | 1,647.8 | 1,154.0 | 2.1% | 205.6 | ( 13.3%) | 288.2 |
| 7 | 1953 | 1,709.5 | 1,194.5 | 3.5% | 205.6 | .0% | 309.3 |
| 8 | 1954 | 1,687.0 | 1,233.6 | 3.3% | 200.4 | ( 2.6%) | 253.1 |
| 9 | 1955 | 1,835.6 | 1,349.5 | 9.4% | 261.6 | 30.5% | 224.5 |
| 10 | 1956 | 1,872.9 | 1,397.0 | 3.5% | 257.4 | ( 1.6%) | 218.6 |
| 11 | 1957 | 1,905.6 | 1,436.2 | 2.8% | 245.0 | ( 4.8%) | 224.5 |
| 12 | 1958 | 1,863.6 | 1,444.0 | .5% | 195.1 | ( 20.3%) | 224.5 |
| 13 | 1959 | 2,003.7 | 1,521.8 | 5.4% | 257.4 | 31.9% | 224.5 |
| 14 | 1960 | 2,053.4 | 1,583.1 | 4.0% | 257.7 | .1% | 212.7 |
| 15 | 1961 | 2,091.3 | 1,619.1 | 2.3% | 247.0 | ( 4.2%) | 225.3 |
| 16 | 1962 | 2,230.1 | 1,702.1 | 5.1% | 282.8 | 14.5% | 245.3 |
| 17 | 1963 | 2,314.3 | 1,785.5 | 4.9% | 293.5 | 3.8% | 235.3 |
| 18 | 1964 | 2,432.1 | 1,904.0 | 6.6% | 307.8 | 4.9% | 220.3 |
| 19 | 1965 | 2,600.4 | 2,030.8 | 6.7% | 354.3 | 15.1% | 215.3 |
| 20 | 1966 | 2,764.5 | 2,119.1 | 4.3% | 390.1 | 10.1% | 255.3 |
| 21 | 1967 | 2,831.9 | 2,173.6 | 2.6% | 357.9 | ( 8.3%) | 300.4 |
| 22 | 1968 | 2,974.9 | 2,288.7 | 5.3% | 375.8 | 5.0% | 310.4 |
| 23 | 1969 | 3,054.9 | 2,367.2 | 3.4% | 397.3 | 5.7% | 290.3 |
| 24 | 1970 | 3,129.9 | 2,487.8 | 5.1% | 392.5 | ( 1.2%) | 249.6 |
| 25 | 1971 | 3,193.3 | 2,560.8 | 2.9% | 412.2 | 5.0% | 220.3 |
| 26 | 1972 | 3,418.1 | 2,724.3 | 6.4% | 481.3 | 16.8% | 212.5 |
| 27 | 1973 | 3,614.1 | 2,875.2 | 5.5% | 538.1 | 11.8% | 200.8 |
| 28 | 1974 | 3,591.0 | 2,914.7 | 1.4% | 481.3 | ( 10.6%) | 195.0 |
| 29 | 1975 | 3,752.2 | 3,105.0 | 6.5% | 441.8 | ( 8.2%) | 205.5 |
| 30 | 1976 | 3,936.0 | 3,210.7 | 3.4% | 523.7 | 18.5% | 201.7 |
| 31 | 1977 | 4,119.8 | 3,315.9 | 3.3% | 601.0 | 14.8% | 203.0 |
| 32 | 1978 | 4,337.0 | 3,466.0 | 4.5% | 665.5 | 10.7% | 205.5 |
| 33 | 1979 | 4,444.2 | 3,509.2 | 1.2% | 722.3 | 8.5% | 212.8 |
| 34 | 1980 | 4,437.3 | 3,573.8 | 1.8% | 640.3 | ( 11.3%) | 223.1 |
| 35 | 1981 | 4,523.6 | 3,606.5 | .9% | 680.2 | 6.2% | 236.9 |
| 36 | 1982 | 4,408.0 | 3,570.7 | ( 1.0%) | 583.2 | ( 14.3%) | 254.2 |
| 37 | 1983 | 4,565.4 | 3,649.5 | 2.2% | 646.8 | 10.9% | 269.1 |
| 38 | 1984 | 4,874.4 | 3,774.4 | 3.4% | 817.1 | 26.3% | 282.9 |
| 39 | 1985 | 5,038.7 | 3,928.6 | 4.1% | 804.2 | ( 1.6%) | 305.9 |
| 40 | 1986 | 5,176.6 | 4,061.1 | 3.4% | 792.3 | ( 1.5%) | 323.2 |
| 41 | 1987 | 5,353.4 | 4,210.2 | 3.7% | 807.4 | 1.9% | 335.8 |
| 42 | 1988 | 5,592.9 | 4,429.5 | 5.2% | 833.3 | 3.2% | 330.1 |
| 43 | 1989 | 5,733.5 | 4,559.8 | 2.9% | 850.5 | 2.1% | 323.2 |
| 44 | 1990 | 5,756.4 | 4,630.1 | 1.5% | 803.1 | ( 5.6%) | 323.2 |
| 45 | 1991 | 5,714.3 | 4,664.6 | .7% | 726.6 | ( 9.5%) | 323.2 |

## APPENDIX D.2
### Correlation: GPDI with GNP (Same Year)

| | YEAR | INV % Change X | Real GNP % Change Y |
|---|---|---|---|
| | 1946 | | |
| 1 | 1947 | ( 5.0%) | 12.6% |
| 2 | 1948 | 21.1% | ( 5.2%) |
| 3 | 1949 | ( 21.7%) | 6.0% |
| 4 | 1950 | 55.0% | 2.3% |
| 5 | 1951 | .0% | 2.1% |
| 6 | 1952 | ( 13.3%) | 2.1% |
| 7 | 1953 | .0% | 3.5% |
| 8 | 1954 | ( 2.6%) | 3.3% |
| 9 | 1955 | 30.5% | 9.4% |
| 10 | 1956 | ( 1.6%) | 3.5% |
| 11 | 1957 | ( 4.8%) | 2.8% |
| 12 | 1958 | ( 20.3%) | .5% |
| 13 | 1959 | 31.9% | 5.4% |
| 14 | 1960 | .1% | 4.0% |
| 15 | 1961 | ( 4.2%) | 2.3% |
| 16 | 1962 | 14.5% | 5.1% |
| 17 | 1963 | 3.8% | 4.9% |
| 18 | 1964 | 4.9% | 6.6% |
| 19 | 1965 | 15.1% | 6.7% |
| 20 | 1966 | 10.1% | 4.3% |
| 21 | 1967 | ( 8.3%) | 2.6% |
| 22 | 1968 | 5.0% | 5.3% |
| 23 | 1969 | 5.7% | 3.4% |
| 24 | 1970 | ( 1.2%) | 5.1% |
| 25 | 1971 | 5.0% | 2.9% |
| 26 | 1972 | 16.8% | 6.4% |
| 27 | 1973 | 11.8% | 5.5% |
| 28 | 1974 | ( 10.6%) | 1.4% |
| 29 | 1975 | ( 8.2%) | 6.5% |
| 30 | 1976 | 18.5% | 3.4% |
| 31 | 1977 | 14.8% | 3.3% |
| 32 | 1978 | 10.7% | 4.5% |
| 33 | 1979 | 8.5% | 1.2% |
| 34 | 1980 | ( 11.3%) | 1.8% |
| 35 | 1981 | 6.2% | .9% |
| 36 | 1982 | ( 14.3%) | ( 1.0%) |
| 37 | 1983 | 10.9% | 2.2% |
| 38 | 1984 | 26.3% | 3.4% |
| 39 | 1985 | ( 1.6%) | 4.1% |
| 40 | 1986 | ( 1.5%) | 3.4% |
| 41 | 1987 | 1.9% | 3.7% |
| 42 | 1988 | 3.2% | 5.2% |
| 43 | 1989 | 2.1% | 2.9% |
| 44 | 1990 | ( 5.6%) | 1.5% |
| 45 | 199[illegible] | ( 9.5%) | .7% |

Slope (b) = .024
Constant (a) = .035
R squared = .016

$50 billion investment increase predicts %GNP change of:
(91B$) 3.7%

$50 billion investment decrease predicts %GNP change of:
(91B$) 3.4%

## APPENDIX D.3
## Correlation: GPDI with GNP (One Year Delay)

| | YEAR | INV % Change X | Real GNP % Change Y |
|---|---|---|---|
| 1 | 1947 | ( 5.0%) | ( 5.2%) |
| 2 | 1948 | 21.1% | 6.0% |
| 3 | 1949 | ( 21.7%) | 2.3% |
| 4 | 1950 | 55.0% | 2.1% |
| 5 | 1951 | .0% | 2.1% |
| 6 | 1952 | ( 13.3%) | 3.5% |
| 7 | 1953 | .0% | 3.3% |
| 8 | 1954 | ( 2.6%) | 9.4% |
| 9 | 1955 | 30.5% | 3.5% |
| 10 | 1956 | ( 1.6%) | 2.8% |
| 11 | 1957 | ( 4.8%) | .5% |
| 12 | 1958 | ( 20.3%) | 5.4% |
| 13 | 1959 | 31.9% | 4.0% |
| 14 | 1960 | .1% | 2.3% |
| 15 | 1961 | ( 4.2%) | 5.1% |
| 16 | 1962 | 14.5% | 4.9% |
| 17 | 1963 | 3.8% | 6.6% |
| 18 | 1964 | 4.9% | 6.7% |
| 19 | 1965 | 15.1% | 4.3% |
| 20 | 1966 | 10.1% | 2.6% |
| 21 | 1967 | ( 8.3%) | 5.3% |
| 22 | 1968 | 5.0% | 3.4% |
| 23 | 1969 | 5.7% | 5.1% |
| 24 | 1970 | ( 1.2%) | 2.9% |
| 25 | 1971 | 5.0% | 6.4% |
| 26 | 1972 | 16.8% | 5.5% |
| 27 | 1973 | 11.8% | 1.4% |
| 28 | 1974 | ( 10.6%) | 6.5% |
| 29 | 1975 | ( 8.2%) | 3.4% |
| 30 | 1976 | 18.5% | 3.3% |
| 31 | 1977 | 14.8% | 4.5% |
| 32 | 1978 | 10.7% | 1.2% |
| 33 | 1979 | 8.5% | 1.8% |
| 34 | 1980 | ( 11.3%) | .9% |
| 35 | 1981 | 6.2% | ( 1.0%) |
| 36 | 1982 | ( 14.3%) | 2.2% |
| 37 | 1983 | 10.9% | 3.4% |
| 38 | 1984 | 26.3% | 4.1% |
| 39 | 1985 | ( 1.6%) | 3.4% |
| 40 | 1986 | ( 1.5%) | 3.7% |
| 41 | 1987 | 1.9% | 5.2% |
| 42 | 1988 | 3.2% | 2.9% |
| 43 | 1989 | 2.1% | 1.5% |
| 44 | 1990 | ( 5.6%) | .7% |

Slope (b) = .010
Constant (a) = .034
R squared = .004

$50 billion investment increase predicts %GNP change of:
(91B$) 3.4%

$50 billion investment decrease predicts %GNP change of:
(91B$) 3.3%

## APPENDIX D.4
### Correlation: GPDI with GNP (Two Year Delay)

| | YEAR | INV % Change X | Real GNP % Change Y |
|---|---|---|---|
| 1 | 1947 | ( 5.0%) | 6.0% |
| 2 | 1948 | 21.1% | 2.3% |
| 3 | 1949 | ( 21.7%) | 2.1% |
| 4 | 1950 | 55.0% | 2.1% |
| 5 | 1951 | .0% | 3.5% |
| 6 | 1952 | ( 13.3%) | 3.3% |
| 7 | 1953 | .0% | 9.4% |
| 8 | 1954 | ( 2.6%) | 3.5% |
| 9 | 1955 | 30.5% | 2.8% |
| 10 | 1956 | ( 1.6%) | .5% |
| 11 | 1957 | ( 4.8%) | 5.4% |
| 12 | 1958 | ( 20.3%) | 4.0% |
| 13 | 1959 | 31.9% | 2.3% |
| 14 | 1960 | .1% | 5.1% |
| 15 | 1961 | ( 4.2%) | 4.9% |
| 16 | 1962 | 14.5% | 6.6% |
| 17 | 1963 | 3.8% | 6.7% |
| 18 | 1964 | 4.9% | 4.3% |
| 19 | 1965 | 15.1% | 2.6% |
| 20 | 1966 | 10.1% | 5.3% |
| 21 | 1967 | ( 8.3%) | 3.4% |
| 22 | 1968 | 5.0% | 5.1% |
| 23 | 1969 | 5.7% | 2.9% |
| 24 | 1970 | ( 1.2%) | 6.4% |
| 25 | 1971 | 5.0% | 5.5% |
| 26 | 1972 | 16.8% | 1.4% |
| 27 | 1973 | 11.8% | 6.5% |
| 28 | 1974 | ( 10.6%) | 3.4% |
| 29 | 1975 | ( 8.2%) | 3.3% |
| 30 | 1976 | 18.5% | 4.5% |
| 31 | 1977 | 14.8% | 1.2% |
| 32 | 1978 | 10.7% | 1.8% |
| 33 | 1979 | 8.5% | .9% |
| 34 | 1980 | ( 11.3%) | ( 1.0%) |
| 35 | 1981 | 6.2% | 2.2% |
| 36 | 1982 | ( 14.3%) | 3.4% |
| 37 | 1983 | 10.9% | 4.1% |
| 38 | 1984 | 26.3% | 3.4% |
| 39 | 1985 | ( 1.6%) | 3.7% |
| 40 | 1986 | ( 1.5%) | 5.2% |
| 41 | 1987 | 1.9% | 2.9% |
| 42 | 1988 | 3.2% | 1.5% |
| 43 | 1989 | 2.1% | .7% |

Slope (b) = -.014
Constant (a) = .037
R squared = .011

$50 billion investment increase predicts %GNP change of:
(91B$) 3.6%

$50 billion investment decrease predicts %GNP change of:
(91B$) 3.8%

## NOTES

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