

Defense Spending and Economic Activity

By Glenn H. Miller, Jr., and Stephen L. Able

Events in southwest Asia in late 1979 and early 1980 have led the United States to reevaluate the urgency and size of its national defense needs. Should such reevaluation lead to a significant military buildup, a substantial impact on economic activity may be expected to result. In contrast to the experience during the Vietnam war buildup of the 1960s, though, a better understanding now exists of the effects of a military buildup on economic activity.

A number of factors contributed to a slow recognition of the expansionary impact on the economy of the Vietnam war buildup. These factors included uncertainty about the U.S. commitment in Vietnam, difficulty in forecasting defense spending, and an incomplete understanding of the manner and timing of a military buildup's effect on economic activity. Furthermore, timely statistics on business activity in the defense production sector were less than readily available and not completely appropriate for analytical purposes. For example, data on manufacturers' orders, inventories, and shipments of defense goods were mixed with data on civilian activity in reports for industries such

as aircraft production. Not until mid-1967 were important data series on defense activity gathered and published in a single report. In addition, budget estimates of future defense spending turned out to be wide of the mark and such errors added to the difficulties of economic analysis and policymaking. The need for accurate, up-to-date forecasts of defense spending soon became evident at that time, but the Vietnam defense spending bulge had largely worked its way through the economy before significant success was achieved in providing such forecasts.

As a result of the attention directed at the problems associated with the Vietnam military buildup, there has been an improvement in the understanding of the defense spending process, in presentation of data, and in analysis and forecasting. To familiarize the reader with this improved understanding, this article first discusses the Federal spending process and its effect on the timing of economic activity. Next, current measures of defense activity and their relationships are presented. The article concludes with a simple empirical analysis of leading and final indicators of defense activity, an analysis which is used to forecast defense goods purchases and to estimate the impact of a military buildup on economic activity. Alternative assumptions about a defense buildup in 1980 and 1981 are made, and simulations

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undertaken to show the estimated increase in economic activity that would be associated with each assumption.

UNDERSTANDING THE SPENDING PROCESS AND ITS EFFECT ON ECONOMIC ACTIVITY

The Federal spending process begins with the President's request to Congress for funds to support his programs. Programs are authorized by Congress and funds are appropriated to the operating agencies who then incur obligations, or commitments—to pay money for wages and salaries, and for the purchase of buildings, equipment, materials, and land. Actual outlays by the Federal government are recorded by the Treasury when payments are made, and these outlays appear in the Federal purchases sector of the GNP accounts when the goods are delivered.

As a result of this spending sequence, there is a lag between obligations and outlays, or expenditures. The lag is shorter for goods purchased from producers' stocks than for goods produced on order or under special contract. In the latter case, the lag occurs because it takes time after orders are received for the private sector to make plans, obtain resources, negotiate subcontracts where necessary, undertake production, and deliver the product. Thus, the employment of resources and the production of goods—those private sector activities that make demands on the economy's capacity to produce—precede delivery to, and payment by, the government. Even though the government is clearly affecting the economy, the data on Federal purchases in the GNP accounts do not reflect that fact. In short, Federal purchases in the GNP accounts are shown on a delivery basis (the endpoint in the government spending process), but the major impact of the spending programs occur earlier in the process, beginning with the letting

of contracts and the placing of orders (the obligation stage).

The fact that changes in government demand for output show up in Federal purchases in the GNP accounts only after a considerable time lag means that "the Federal purchases figures are a misleading clue to the current impact and the timing of the cyclical impact of the Federal government on output."¹ Thus, understanding the Federal expenditure process, and knowing when that process most significantly affects the private sector, are important to an analysis of the direct impact of fiscal action on economic activity. When there is little change in government demand, there is little need for concern about the timing of its impact. But when government demand is changing rapidly and is a particularly dominant force in the economy, understanding the Federal spending process and the timing of its impact on economic activity is especially important for proper interpretation and evaluation of economic developments. Such a situation often is associated with a sharp military buildup because defense outlays usually involve long lags between orders and deliveries.

When the government places contracts or orders with a private firm, the latter begins to order materials, hire workers, place subcontracts, and perhaps even invest in new plant and equipment. These steps often inspire similar action elsewhere in the economy. As production by the private firm moves ahead, the inventory component of GNP increases, i.e., production on government order appears as private inventory investment in goods in process. Not until the final products are delivered to the government does the Federal sector of the GNP accounts reflect the increase in economic activity. When the goods are

¹ Joseph Scherer, "On Measuring Fiscal Policy," *The Journal of Finance*, December 1965, p. 684.

delivered, the recorded increase in Federal purchases offsets the reduction in private inventories in the GNP accounts—thus leaving no apparent effect on the level of total economic activity at that time.²

Because the Federal spending process works in the above fashion, it is generally agreed that the best indicator of the current impact of defense activity on the economy is not just Federal defense purchases, but rather Federal defense purchases plus the change in private inventories due to changes in the defense goods production sector.

MEASURES OF DEFENSE ACTIVITY

Once it is recognized that the timing of the Federal spending process is important in understanding the impact of a military buildup on economic activity, and that inventory change in the defense goods production sector is a significant part of the total impact, the need for statistical data reflecting these relationships becomes evident. Fortunately, some improved data series have become available since the Vietnam buildup period and can be used to follow current changes in defense activity.

Each month *Business Conditions Digest*, a publication of the U.S. Department of Commerce, includes time series data on a set of defense indicators. These indicators are divided into advance, intermediate, and final measures of defense activity. Among these indicators are the following:

² Murray L. Weidenbaum pioneered in calling attention to this subject. See Murray L. Weidenbaum, "The Federal Government Spending Process," in U.S. Congress, *Subcommittee on Fiscal Policy of the Joint Economic Committee, Federal Expenditures Policy for Economic Growth and Stability—Papers Submitted by Panelists*, 85th Congress, 1st Session, 1957, pp. 493-506; and his "The Economic Impact of the Government Spending Process," *The University of Houston Business Review*, Spring 1961, pp. 7-13.

Advance Indicators

1. Defense Department gross obligations incurred.

This series measures legally binding commitments for payment of funds, as recorded in official accounting records. Included in the series are commitments for compensation of personnel, procurement of equipment, research and development, and construction. Thus it includes both orders for items with long lead times, such as aircraft, and for other commitments with very short lags between obligation and spending, such as personnel compensation.

2. Defense Department military prime contract awards.

Military prime contract awards are orders placed with prime contractors for equipment, supplies, research and development, and construction. Because it excludes some items found in the gross obligations series, such as personnel compensation, the prime contract series is more heavily weighted towards large-scale hardware items with long lags between order and delivery.

3. Manufacturers' new orders, defense products.

The Bureau of the Census collects information on new orders received by manufacturers of defense products. Data come from separate reports covering

only the defense work of large contractors in the following industries: ordnance, communications equipment, aircraft, aircraft parts, and shipbuilding. Although its coverage is somewhat smaller than the prime contract awards series, the manufacturers' new orders series also emphasizes large, long-lead-time items.

Intermediate Indicators

1. Manufacturers' inventories, defense products.

This series records the book value of stocks held by manufacturers, including materials, goods in process, and finished goods. Its industry coverage is the same as the new orders series.

2. Manufacturers' unfilled orders, defense products.

This series measures the value of orders received that have not been completed and shipped. Again, the industry coverage is the same as for the new orders series.

Final Indicators

1. Federal government purchases of goods and services for national defense (GNP accounts).

This most comprehensive measure of defense activity includes personnel compensation, cost of new construction, and value of all other defense purchases. Defense purchases make

up about 65 per cent of total Federal purchases of goods and services, and are recorded when delivery is made to the government.

2. Manufacturers' shipments, defense products.

Shipments represent the value of products shipped, after discounts and allowances and excluding freight charges and excise taxes. For multi-unit companies, interplant transfers are included as shipments. Industry coverage is the same as for new orders; thus manufacturers' new orders, inventories, unfilled orders, and shipments of defense products make up a consistent set of data.

Using the set of data on defense products orders, inventories, and shipments as an illustration, the following process may be expected to occur. New orders would be the first indicator to reflect an increase in defense programs. As a leading indicator of activity in the defense production sector, a change in this series alerts the analyst that Government action is, or very soon will be, influencing overall economic activity. Next, production activity moves into the intermediate stage of the process. As production proceeds, pressures on capacity mount, backlogs of unfilled orders increase, and the ratio of unfilled orders to shipments rises. Later, as production catches up with commitments, backlogs rise less rapidly and the ratio of unfilled orders to shipments levels off. But even as new orders stop increasing and unfilled orders grow more slowly, a sizeable amount of output may remain in the defense products pipeline. Thus inventories may continue to rise

rapidly after the other series level off or grow less rapidly. In this set of indicators, the final stage of the process is represented by the shipments series, whose lagging behavior has already been discussed.

The 1970s did not produce a military buildup of the size and sharpness of those associated with the Korean war in the 1950s and the Vietnam war in the 1960s. Therefore dramatic changes in—and a demonstration of the relationships between—advance, intermediate, and final measures of defense activity are not readily evident in the data. However, the relationships are still present. Federal defense purchases appear to have lagged both obligations and prime contract awards by about a year at the series troughs in the early 1970s (Chart 1). The intermediate indicators (inventories and unfilled orders) appear to lag behind the turnaround in new orders by about half a year at the trough in the early 1970s, and shipments seem to lag new orders at that turning point by nearly a year (Chart 2). The availability of these and other related data on a timely and readily accessible basis will certainly aid analysts and policymakers should the nation face another period of sharp military buildup.

FORECASTING DEFENSE PURCHASES AND INVENTORY CHANGE

One successful effort to develop accurate and timely forecasts of defense spending as shown in the GNP accounts was conducted by Harvey Galper and Edward Gramlich in 1968.³ They used some of the leading indicator series of defense activity along with other variables in a regression analysis to provide quarterly forecasts of defense purchases. Their model

³ Harvey Galper and Edward Gramlich, "A Technique for Forecasting Defense Expenditures," *The Review of Economics and Statistics*, Vol. 50, No. 2, May 1968, pp. 1-13.

gave quite accurate quarterly predictions for 1966, a critical and difficult year for defense spending forecasts. They also made assumptions about the relationship between production and contract awards in order to derive estimates of private inventory accumulation consistent with their defense spending forecasts, which could then be combined to shed some light on the total impact of defense activity on the economy.

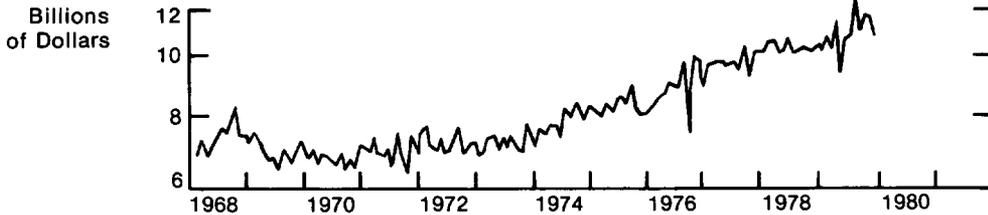
For this article, a version of the Galper-Gramlich model was constructed to provide some quantitative information on the expected impact of defense spending in 1980 and 1981. First, a simplified version of their model relating contract awards to defense spending was estimated over the period from 1968 through 1979. Next, the model was expanded to include a regression equation relating contract awards to defense-related inventory investment, making use of the expanded and improved data described in the preceding section.

In the model, the defense spending variable used as a dependent variable is total Federal purchases of goods and services for national defense, less personnel compensation. While data are unavailable for the defense-related portion of inventory investment as given in the GNP accounts, data do exist for manufacturing inventories of defense products. The latter data series was therefore used as the dependent variable in the model's inventory equation. The only independent variables included in the forecasting equations are current and past values of military prime contract awards. Despite significant differences in coverage from the dependent variables, contract awards worked well as an explanatory variable in both equations.

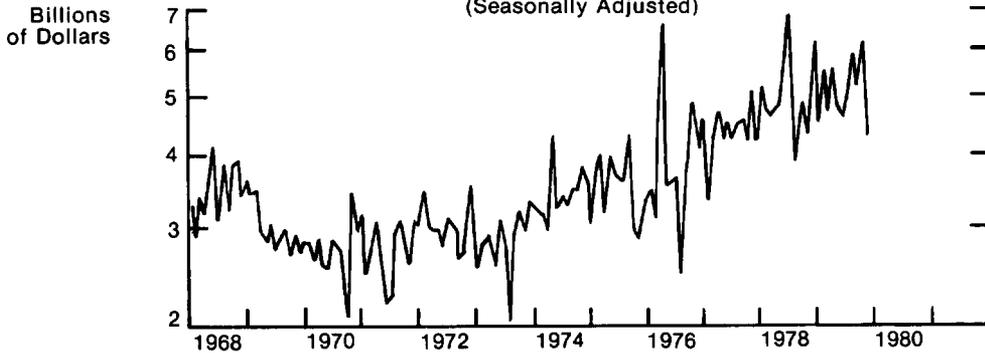
The basic equations contained in the model are as follows:

$$(1) DG = a_1 + \sum_{i=0}^n b_{1i} \cdot DCA_{-i}$$

Chart 1
DEFENSE DEPARTMENT GROSS OBLIGATIONS INCURRED
 (Seasonally Adjusted)



DEFENSE DEPARTMENT MILITARY PRIME CONTRACT AWARDS
 (Seasonally Adjusted)



FEDERAL GOVERNMENT PURCHASES OF GOODS AND SERVICES FOR NATIONAL DEFENSE
 (Seasonally Adjusted Annual Rate)

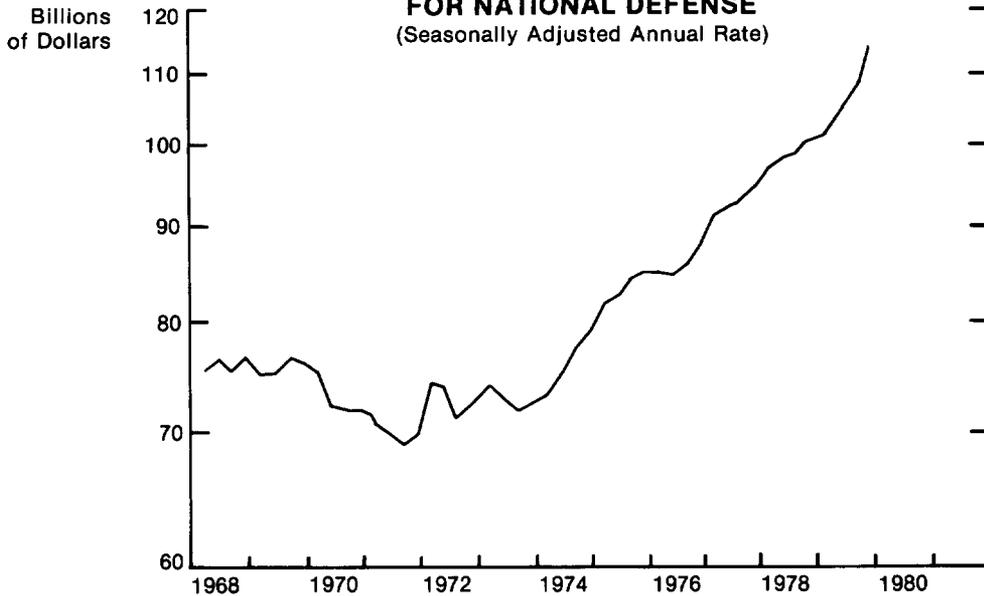
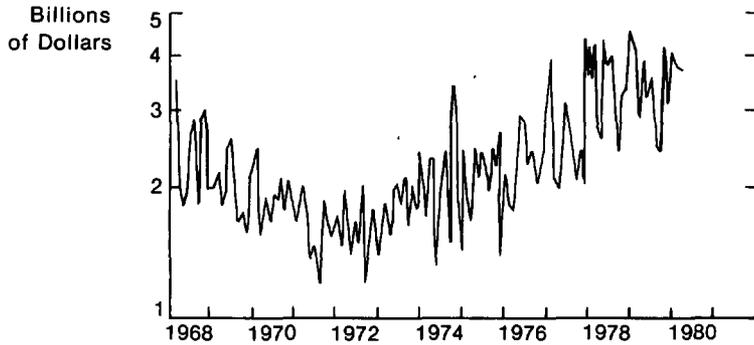
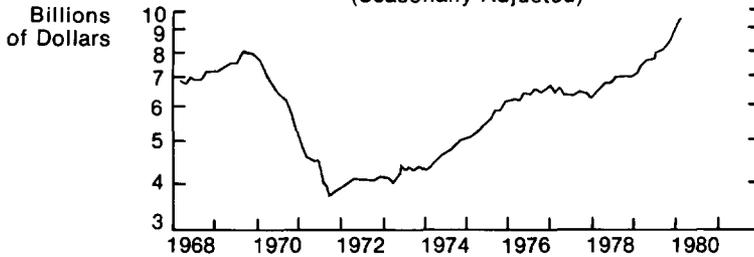


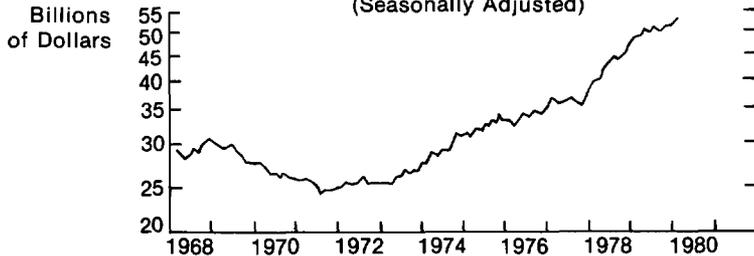
Chart 2
MANUFACTURERS' NEW ORDERS, DEFENSE PRODUCTS
 (Seasonally Adjusted)



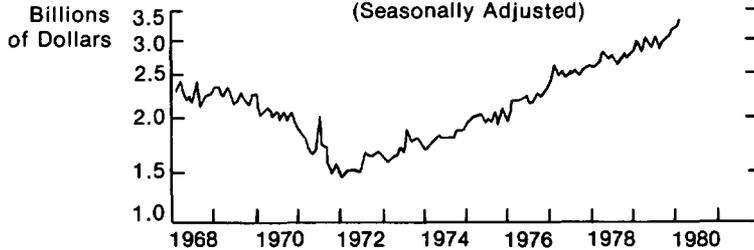
MANUFACTURERS' INVENTORIES, DEFENSE PRODUCTS
 (Seasonally Adjusted)



MANUFACTURERS' UNFILLED ORDERS, DEFENSE PRODUCTS
 (Seasonally Adjusted)



MANUFACTURERS' SHIPMENTS, DEFENSE PRODUCTS
 (Seasonally Adjusted)



and

$$(2) DII = a_2 + \sum_{i=0}^n b_2 \cdot DCA_{-i}$$

where

- DG = national defense goods purchases,
- DII = investment in manufacturers' inventories for defense products,
- DCA = military prime contract awards, and
- a₁ and a₂ = constant terms representing the differences in coverage.

The econometric estimates of equations (1) and (2) appear in the Appendix. These estimates indicate that a substantial lag exists between a change in contract awards and subsequent changes in defense goods purchases and inventory investment. The nature of the lagged relationships may be seen in Table 1, which presents the quarter-by-quarter response of defense goods purchases and defense-related inventory investment to a one-quarter-only

increase of \$10 billion in contract awards.

The impact on defense goods purchases of a change in contract awards is completed after 11 quarters (Table 1, column 2). Only 25 per cent of the defense goods purchases induced by a change in contract awards is completed during the year of that change. As mentioned earlier, though, using defense purchases as the measure of defense-related economic activity is misleading because a step-up in private production and inventories precedes the increase in the delivery of finished goods that is recorded as Federal defense purchases. Including the rise in private defense goods sector activity provides a better indicator of the total economic impact of an increase in defense activity, and an estimate of inventory investment by defense producers furnishes that information. The timing of the relationship is important: column 3 of Table 1 shows the impact on inventory investment of a change in

Table 1
CHANGE IN DEFENSE GOODS PURCHASES AND INVENTORY INVESTMENT,
IN RESPONSE TO A SINGLE QUARTER \$10 BILLION INCREASE IN
MILITARY PRIME CONTRACT AWARDS

(Billions of Dollars)

Quarter Following Change in Contract Awards	Single Quarter Change in DG	Single Quarter Change in DII	Single Quarter Change in DG + DII
0	.27	.24	.51
1	.50	.36	.86
2	.70	.38	1.08
3	.85	.33	1.18
4	.96	.23	1.19
5	1.02	.10	1.12
6	1.04	-.05	.99
7	1.01	-.19	.82
8	.92	-.29	.63
9	.78	-.35	.43
10	.58	-.33	.25
11	.32	-.22	.10
12	0	0	0

contract awards to be positive in the periods immediately following that change—as production is begun and work-in-progress inventories accumulate—and negative thereafter, as inventory stocks are depleted upon the shipment of finished goods.

Adding estimated defense inventory investment to defense goods purchases results in an improved estimate of the total impact of increased defense activity on output growth. Thus, the impact on economic activity of the change in contract awards is shown in column 4 of Table 1 as the sum of defense purchases and inventory investment (columns 2 and 3). The response of this measure of total economic activity is more rapid than is that of purchases, with 40 per cent of the total impact occurring within the year of the change in contract awards.

The model presented in equations (1) and (2) has so far been used to support the notion that a substantial amount of time passes between a decision to increase defense spending and the actual increase in the Federal purchases measure. In addition, the model supports the view that a shorter period of time passes before these decisions are reflected in increased economic activity, measured as the sum of defense purchases and inventory accumulation. The model may also be used to forecast future defense-related economic activity.

To forecast defense goods purchases and inventories using the model presented in equations (1) and (2), it is necessary to project the level of contract awards over the period for which the forecast is to be made. Three alternative assumptions were used to project the growth of military prime contract awards during 1980 and 1981, in each case assuming contracts increased at a constant rate through the period.

1. Contract awards were assumed to increase at about the rate of

increase that occurred, year-over-year, in the 1976 to 1978 period—about 12 per cent.

2. A slightly more rapid military buildup was assumed, about a 20 per cent year-over-year increase in contracts.
3. Rapid military buildup about the same as that which occurred in the Vietnam war buildup was assumed—a 30 per cent year-over-year increase.

The quarterly forecasts for 1980 and 1981 of defense goods purchases, inventory investment, and total defense-related economic activity resulting from the three alternative contract awards projections are presented in Table 2. Despite the differences in projected contract awards, the forecasts are quite similar—especially in the earlier quarters of the period. This is because much of the total defense goods purchases of 1980 and 1981 results from contracts awarded prior to 1980. The nature of the lag relationships shown in column 1 of Table 1 is such that changes in contract awards do not produce substantial differences in defense goods purchases for several quarters. By the fourth quarter of 1981, however, the level of defense goods purchases—and of GNP—is about \$3 billion higher if contracts were awarded at the rapid military buildup rate than if the 1976 to 1978 rate of increase were maintained. Because the levels of defense goods purchases are much greater than those of inventory investment, total defense-related activity (purchases plus investment, shown at the bottom of Table 2) does not show much change in the earlier quarters of the period. Over the full period of 1980 and 1981, however, the inclusion of inventory growth makes a significant contribution to the rise in total

Table 2
FORECASTS OF DEFENSE GOODS PURCHASES AND INVENTORY INVESTMENT,
QUARTERLY FOR VARIOUS ASSUMED INCREASES* IN
MILITARY PRIME CONTRACT AWARDS
(Seasonally Adjusted Annual Rates)

Quarter	Defense Goods Purchases, Billions of Dollars		
	Twelve Per Cent Increase in Contract Awards	Twenty Per Cent Increase in Contract Awards	Thirty Per Cent Increase in Contract Awards
1980:1	\$62.68	\$62.69	\$62.71
:2	63.40	63.46	63.54
:3	63.98	64.10	64.30
:4	64.41	64.64	65.02
1981:1	64.99	65.39	66.03
:2	65.58	66.20	67.19
:3	66.73	67.62	69.07
:4	67.81	69.03	71.03
1980	63.62	63.72	63.89
1981	66.28	67.06	68.33

Quarter	Defense Goods Inventory Investment, Billions of Dollars		
	Twelve Per Cent Increase in Contract Awards	Twenty Per Cent Increase in Contract Awards	Thirty Per Cent Increase in Contract Awards
1980:1	.81	.83	.86
:2	.57	.67	.78
:3	.49	.71	.95
:4	.64	1.02	1.46
1981:1	.82	1.41	2.10
:2	1.19	2.01	2.99
:3	1.27	2.32	3.61
:4	1.54	2.82	4.43
1980	.63	.81	1.02
1981	1.21	2.14	3.28

Quarter	Billions of Dollars		
	Twelve Per Cent Increase in Contract Awards	Twenty Per Cent Increase in Contract Awards	Thirty Per Cent Increase in Contract Awards
1980:1	63.49	63.52	63.57
:2	63.97	64.13	64.32
:3	64.47	64.81	65.25
:4	65.05	65.66	66.48
1981:1	65.81	66.80	68.13
:2	66.77	68.21	70.18
:3	68.00	69.94	72.68
:4	69.35	71.85	75.46
1980	64.25	64.53	64.91
1981	67.48	69.20	71.62

NOTE: Increases at a constant rate through the period.

activity, especially in the case of a rapid military buildup.

The annual data in Table 2 emphasize how locked in total defense-related economic activity is for 1980. Defense purchases plus inventory investment for 1980 as a whole would be less than \$1 billion greater if contract awards grew at a 30 per cent rate than if they grew at a 12 per cent rate. The difference in 1981 is larger—\$4 billion more of defense-related economic activity is associated with a 30 per cent rise in contract awards than with a 12 per cent increase. Decisions now being made about defense spending that result in contract awards during the current year are likely to have relatively little impact before 1981.

SUMMARY

Improvements have been made since the

mid-1960s in understanding the defense spending process, in the availability of data on defense activity, and in the analysis and forecasting of the economic impact of a military buildup. Data series on advance, intermediate, and final measures of defense activity are readily available and can be used in conjunction with the recognition of the timing of impact of defense activity on the economy.

Because increased defense activity shows up first in the private inventories of defense goods producers, adding that inventory investment to defense goods purchases gives a fairly good measure of the degree and the timing of changes in economic activity attributable to defense program changes. The simulation analysis presented in this article suggests that even a relatively large increase in defense activity would have little effect on economic activity in 1980, and only a modest impact in 1981.

Appendix

$$\text{Equation (1) } DG = 7.23 + \sum_{i=0}^{11} b_i * DCA_i$$

(2.9)

$$b_0 = .027 \quad b_6 = .104$$

(2.8) (10.8)

$$b_1 = .050 \quad b_7 = .101$$

(3.6) (6.7)

$$b_2 = .070 \quad b_8 = .092$$

(4.9) (4.8)

$$b_3 = .085 \quad b_9 = .078$$

(7.2) (3.8)

$$b_4 = .096 \quad b_{10} = .058$$

(12.7) (3.1)

$$b_5 = .102 \quad b_{11} = .032$$

(18.2) (2.6)

DG = Defense goods purchases.
(Federal purchases of goods and services for national defense less personnel compensation)

DCA = Military prime contract awards.

$$\bar{R}^2 = .904$$

n = 37

$$\text{Equation (2) } DII = -1.14 + \sum_{i=0}^{11} b_i * DCA_i$$

(.4)

$$b_0 = .024 \quad b_6 = -.005$$

(3.5) (-.9)

$$b_1 = .036 \quad b_7 = -.019$$

(3.6) (-1.9)

$$b_2 = .038 \quad b_8 = -.029$$

(3.8) (-2.3)

$$b_3 = .033 \quad b_9 = -.035$$

(4.1) (-2.5)

$$b_4 = .023 \quad b_{10} = -.033$$

(4.6) (2.6)

$$b_5 = .010 \quad b_{11} = -.022$$

(3.2) (-2.7)

DII = Manufacturers' inventory investment, defense products.

$$\bar{R}^2 = .368$$

n = 37

NOTE: The relationships were estimated by means of the Almon polynomial lag regression technique.