expenditure stage. In fact, expenditure and delivery of shipment usually signals the end of the impacts of a given defense procurement. Because of this, it is not the sales or the expenditure, but the letting of new orders that should be investigated to measure the impacts of defense procurement on economic activity.

A study of the nature of structural lags between new orders and shipments will not directly reveal the impacts of defense procurements on economic activity. But on the assumption that the placement of new orders signal the beginning and shipments signal the end of the impacts of defense procurements, a study of the nature of structural lags does indicate the duration of such impacts. On the one hand, this knowledge is useful for model building in econometrics. On the other, it will be useful for the timing of fiscal and monetary policies to coincide with or offset any changes in defense procurement.

The Nature of Orders-Shipments Relationship

Defense products, as defined by the Bureau of Census,[1] include communication equipment, complete aircraft, aircraft parts, and ordnance. These products vary in characteristics. The length of time required for the production of some of these products may be quite short. However, for products such as complete aircraft and missiles, 2 years or so may be elapsed before an order results in shipments.

From a technical viewpoint, it can be assumed that new orders placed during a given period, O_t, will not result in shipments during the same period. It is also assumed that a proportion, α_{t+1}, of O_t results in shipments in $(t+1)$; and a proportion, α_{t+2}, of O_t results in shipments in $(t+2)$, etc. As a first approximation, we assume that all or nearly all of the new orders placed during t, O_t, are filled within a period of 2 years (eight quarters). This order-shipment relationship can be restated as that the current shipments, S_t, are derived from new orders placed during the preceding eight quarters, O_{t-1}, O_{t-2}, . . . O_{t-8}.

The length of time required for an order to be filled can be said to depend on (1) state of technology, (2) the nature of product, and (3) the extent of capacity utilization. Technological condition and the nature of product can be regarded as long run factors which affect the nature of structural lags or the order-shipment relationship through α's. The rate of capacity utilization, on the other hand, may be regarded as a shortrun factor the effect of which on the order-shipment relationship may be assumed to be additive. That is, the fuller the capacity is utilized, the smaller the size of S_t will be, and vice versa.

On the assumption that technology and the nature of products remain constant over the sample period, we postulate that:

$$S_t=\alpha_o+\alpha_1 O_{t+1}+\alpha_2 O_{t-2}+\ldots+\alpha_8 O_{t-8}+\alpha_9 R_t+U_t$$

Where α's represent the proportions of new orders placed during each of the periods $t-1$, $t-2$, . . . , $t-8$, that result in current shipment, S_t. α_0 is introduced to take care of systematic deviations from the hypothesis and α_9 shows the effect of the rate of capacity utilization R_t on S_t. U_t is introduced to account for any random disturbances.

[1] See Bureau of Census publication: "Manufacturers' Shipments, Inventories, and Orders: 1947-63 Revised."