The assumption that technology and the nature of products remain unchanged is not entirely realistic however. In fact, the advancement in military tecnhology and changes in the nature of products during the past 15 years were unprecedented in history. From the viewpoint of individual products, technological progress will improve the quality of product and/or the methods of production. An improvement in production methods may shorten the length of time required for the production of a given product. In other words it may shorten the structural lags between new orders and shipments of the product in question. However, a more apparent result of technological progress is the introduction of new products. As new products are introduced, the product mix changes.[2] This is evident in that the proportion of defense procurement devoted to missiles and electronic equipment, which have high technology content, has been increasing since the early 1950's.

A change in product mix undoubtedly will alter the nature of structural lags between new orders and shipments of defense products. Because of this, the assumption that the nature of structural lags remains unchanged throughout the sample period will have to be relaxed. In other words, instead of assuming the fixed values of α's as in equation (1), we assume that α's are a function of product mix. That is to say, the nature of structural lags as indicated by α's changes with a change in product mix.

There is no precise measurement of how product mix changes. However, as noted above, the growing importance of missiles and electronic equipment may be a good indicator and is used as proxy for changes in product mix. This variable is quantified by taking the ratio of the obligations on missiles and electronic equipment to the obligations on the total defense procurement. This ratio ranges from a low of .07 to a high of .43 over the sample period.

On the assumption that the nature of structural lags is a function of product mix P_t, we write:

$$\alpha_{1t}=\alpha_{10}+\alpha_{11}P_{t-1} \tag{2}$$

$$\alpha_{2t}=\alpha_{20}+\alpha_{21}P_{t-2} \tag{3}$$

$$\alpha_{3t}=\alpha_{30}+\alpha_{31}P_{t-3} \tag{4}$$

$$\cdots\cdots\cdots$$

$$\alpha_{8t}=\alpha_{80}+\alpha_{81}P_{t-8} \tag{8}$$

Substituting equation (2) through (8) in equation (1), we obtained:

$$\begin{aligned}S_t=\alpha_0&+(\alpha_{10}+\alpha_{11}P_{t-1})O_{t-1}+(\alpha_{20}+\alpha_{21}P_{t-2})O_{t-2}+\\&(\alpha_{30}+\alpha_{31}P_{t-3})O_{t-3}+\cdots+\\&(\alpha_{80}+\alpha_{81}P_{t-8})O_{t-8}+\alpha_9R_t+U_t\end{aligned} \tag{9}$$

Rewriting (9), we have:

$$\begin{aligned}S_t=\alpha_0&+\alpha_{10}O_{t-1}+\alpha_{20}O_{t-2}+\cdots+\alpha_{80}O_{t-8}+\alpha_{11}(PO)_{t-1}+\\&\alpha_{21}(PO)_{t-2}+\cdots+\alpha_{81}(PO)_{t-8}+\alpha_9R_t+U_t\end{aligned} \tag{10}$$

[2] This study is concerned with the relationship of new orders to shipments of defense products in aggregate term. The order-shipment relationships of individual products are not within the scope of this investigation.