Interpreting the production function in economic terms

What can be said about economic sense of this statistically derived production function? It is perhaps useful at the outset to consider the relative importance of the various factors in explaining changes in output.

(1) The increase in the potential labor input and the associated capital (capital-labor ratio held constant), accounts for between one-quarter and one-third of the change in potential output.
(2) The change in the ratio of the capital stock to the potential labor input accounts for between one-eighth and one-sixth of the change in potential output.
(3) The variation in the age of the capital stock accounts for between 2 and 4 percent of the change in potential output.
(4) The many factors represented by the time trend, as a proxy, account for between one-half and two-thirds of the total annual increase in potential output.
(5) The other changes in output were determined by changes in the mix or composition of demand as between industries with different rates of productivity and by variations in the ratio of actual man-hours to potential man-hours.

To students of the production function, certain economic implications of the present formulation will be readily apparent. The coefficient for the potential labor input (*Lp*) is given at unity. Since this term carries with it by implication an associated stock of capital with a fixed ratio to the potential labor input and a fixed average age of the capital stock, this coefficient of unity implies constant returns to scale. The work of Douglas, Tintner and Solow (38) reached the conclusion that there might be some evidence of a tendency toward decreasing returns to scale, at least in manufacturing. This study suggests that if any such tendency prevailed in the economy as a whole over the last half century, then it must have been quite small and was covered up during this period by the overriding effect of technological improvement which would tend to offset any tendency to diminishing returns (39). Experiments, which varied arbitrarily the coefficient of *Lp* above and below 1, gave no indication whatsoever of improvement of fit to the data.

The cyclical term in the final equation $\left(0.9104 \log \frac{La}{Lp} - 3.39\left[\log \frac{La}{Lp}\right]^2\right)$ seems reasonable in light of both theory and other empirical research. Its parabolic shape (due to the squared term) implies that at low rates of operation of the economy $\left(60 \text{ to } 90 \text{ percent for } \frac{La}{Lp}\right)$ an increase in inputs will yield a more than proportionate increase in output (*Oa*), i.e., there will be a cyclical rise in productivity. As operations approach full employment $\left(100 \text{ on the } \frac{La}{Lp} \text{ scale}\right)$, the cyclical change in productivity dies out and increases in inputs yield equivalent increases in output.

When demand pushes operations to exceptional high rates, as happened during World War II, output increases do not keep pace with rising inputs—all other variables held constant. This is consistent with the fact that at these high rates of operation it is necessary to bring into use less efficient resources; older, standby plant and equipment are put back into use, and less efficient labor is employed. Furthermore, with labor markets exceptionally tight (unemployment fell below 1 percent at the peak of war production), there is a tendency