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Summary of Findings

The principal finding is the definite and substantial decline in the real capital-output ratio in manufacturing since the decade 1909-1919. This reversal in direction appears not only in the ratio of total capital to output, but also in the ratio of fixed capital to output and in working capital to output. It is found in most branches of manufacturing, and changes in size structure of establishments or firms cannot provide any explanation of the reversal. These findings seem firmly established despite the many shortcomings of the data.

The explanation must be sought in the altered character of technological innovations broadly defined to include managerial changes. In the earlier decades of this seventy-year period, technological innovations predominantly had the effect of replacing other factor inputs by capital, and in the more recent decades innovations predominantly had the effect of making capital operate more efficiently. Consistent with these trends is our finding that during the period 1880 to 1919, when the capital-output ratio was rising, industries with relatively low ratios in 1880 tended to have larger per cent increases in their ratios than industries with relatively high ratios in 1880; and that in the following decades of a declining capital-output ratio, industries showing larger decreases in the ratio tended to be those which had relatively high ratios in 1919. These tendencies are inferred from the fact that the differences among the capital-output ratios of individual industries, as measured by the coefficient of variation, have become less and less since 1900.

The increased efficiency of capital since 1909-1919, as evidenced by the declining capital-output ratio, contributes to our understanding of the continuous long-term increase in labor productivity or, more pre-

cisely, the reduction in labor per unit of output. From 1900 to 1929 the main cause for the reduction in man-hours per unit of output was the replacement of labor by capital. This is suggested by the continuous increase in capital, total or fixed, per man-hour worked. However, between 1929 and 1948 there was a slight decline in the amount of capital provided for each man-hour worked; nonetheless, man-hours per unit of output continued to decline at a rate comparable to that of 1900 to 1919. An important cause seems to be the increased efficiency of capital.

It must be clear that our objective in this paper is limited primarily to a determination of the trends in the relationship between capital and output; we do not attempt to explain why the trends developed or to project the trends into the future. Before we can explain, it is necessary to know what has to be explained. Our analysis has attempted this necessary preliminary. If long-term projection of capital requirements is to be anything more than a mechanical procedure, it is essential to understand why and how the trends we have been describing came about. How explain first a rising ratio of real capital to real output in most branches of manufacturing and then a declining ratio, which has continued until 1948 or 1951, when our analysis ends? Will the decline continue and what is its limit? Or will the ratio stabilize at the 1948 level? Under what conditions is the ratio likely to rise again, and what are the probabilities of such conditions existing in the foreseeable future? Without this knowledge, the capital-output ratio is a weak link indeed in the chain of long-term projections. This more searching analysis exceeds the scope of this paper.

