The shift in the composition of investment factors such as technology and government regulation were important, especially if the origins of changes were traced back to the 1960s. Computer technology, for example, is a technological force that had a significant impact on investment decisions during the 1970s. Increased reliance on automation and information technology enabled firms to improve efficiency and reduce costs. This shift in the composition of investment was also influenced by changes in consumer preferences, as the demand for durable goods and services increased, leading to a shift in investment towards more long-lived assets.

The recessionary period of the 1970s also significantly affected the composition of investment. Short-term changes were observed, such as the shift in investment towards machinery and away from structures during the recession years of 1974-75. However, an important shift in the composition of investment occurred during the 1970s, characterized by a greater emphasis on machinery relative to structures.

A similar but somewhat less pronounced shift is indicated by the estimates from the adjusted sample. When firms that experienced price effects are excluded, the compositional ratio in 1976-79 is nearly 30% higher than in 1970-73. Relative dispersion among the ratios in the adjusted sample is lower in 1976-79 than in 1970-73. Relative dispersion among the ratios in the adjusted sample is lower in 1976-79 than in 1970-73. The recession years of 1974-75 do not appear out of line with a shift in investment composition during the decade, despite economic conditions that were more conducive to disrupt investment patterns. The greater relative dispersion during the recession may reflect the effect of more varied business expectations at this time, but the variability seems confined to the firms excluded from the adjusted sample.

What caused the shift in the composition of investment? Factors such as technology and government regulation were important, especially if the origins of changes were traced back to the 1960s. Computer technology, for example, is an important technological force that had a significant impact on investment decisions during the 1970s. Increased reliance on automation and information technology enabled firms to improve efficiency and reduce costs. This shift in the composition of investment was also influenced by changes in consumer preferences, as the demand for durable goods and services increased, leading to a shift in investment towards more long-lived assets.
Shifting in the Composition of Fixed Investment in the 1970s

by Roger H. Hinderliter

In recent years, a relatively low rate of growth in real business investment has been important to the country's economic performance. Since the last trough in economic activity in 1975, real investment has grown at an average rate of about 6.5 percent a year, compared with about 8 percent a year during the mid-1960s. Concern over investment has diminished somewhat during the 1970s as the business expansions, although real GDP growth also was somewhat slower than in past expansions, some slippage in the share of output devoted to increasing and replacing productive facilities occurred over the past five years. Moreover, increases in employment (about 4 percent a year since 1975) have been stronger than past experience, suggesting a movement toward more labor-intensive operation in the business community.

Viewed from the perspective of the economy as a whole, slow investment has been widely associated with the problem of declining productivity growth. Correspondingly, recent investment performance is related to developments reaching back to the mid-1960s. Concern over investment behavior, which built up in the 1970s and has grown since 1975, now also seems to have been affected by the late-1970s. The allocation of investment between short-lived and long-lived capital facilities is important because the mix of different capital goods materially affects the productive capital processes acquired from a given level of investment. A capital process may be viewed as the combination of short-lived and long-lived facilities that generates output. For example, two machines, each requiring 100 square feet of factory space can produce 20 units of output per year. Many combinations are available (three or four lathes could be placed within 100 square feet of space), but not all processes are equally efficient. Processes are changed through increases in the level of investment, but the over-utilization of one type of capital relative to another (for example, crowding too many lathes into too small a space) is likely to result in less productive processes; incremental capacity would be lower than if the same level of investment were allocated differently. Though recognized in studies of the productivity problem and the Investment Policy Report, compositional changes within the level of investment have been examined less closely than investment growth. In particular, little attention has been focused on the allocation practices of individual firms, where the investment decision is made. Ultimately, changes in investment composition in the economy as a whole rest on capital-budgeting decisions of firms. For the firm, the composition of investment, like the level of the investment, is predictable. A capital choice that reflects the influence of current economic conditions as well as longer-term effects, such as technological change. This Economic Commentary examines the composition of investment, independent of the level of investment, during the 1970s. Data are drawn from a small sample of machinery and equipment firms, of the Federal Reserve Bank of Cleveland (see table 1, footnote a).

Table 1. Estimates of Investment Composition in the 1970s

<table>
<thead>
<tr>
<th>Period of estimate</th>
<th>Unadjusted sample</th>
<th>Adjusted sample</th>
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<tbody>
<tr>
<td></td>
<td>Average composition</td>
<td>Relative dispersion</td>
</tr>
<tr>
<td>1970-73</td>
<td>3.9</td>
<td>1.12</td>
</tr>
<tr>
<td>1974-75</td>
<td>4.9</td>
<td>1.36</td>
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<tr>
<td>1976-79</td>
<td>5.6</td>
<td>1.16</td>
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A capital process available to a firm combines short-lived and long-lived capital facilities. As an illustration, let

\[ K = K_J + K_L \]

where \( K \) represents a productive capital "unit," and \( K_J \) and \( K_L \) are the long-lived and short-lived components, respectively. Here short-lived and long-lived components combine in the ratio of two-to-one to form one productive capital unit.

Investment changes the capital stock. Investment is the combination of new capital units to replace those that are economically worn out (replacement) and also to add to the capital stock. Increases in employment (for example, the service lives of the short-lived and long-lived components of a capital firm) change the composition of replacement investment will be different from the capital unit being replaced, even if the compositional ratio of the unit is unchanged. If, for example, short-lived capital facilities wear out steadily over five years and long-lived facilities have service lives of ten years, replacement of the capital unit in the example above would require replacement of 1/5 of the short-lived and 1/10 of the long-lived capital.

The composition of investment is reflected in changes in the composition of the capital stock. For example, the composition of replacement investment is reflected in changes in the total level of productive capacity. This means that the lumpiness of investment should be largely smoothed, and a representative estimate of investment changes is the annual change in the ratio of the capital stock to net national product.

Estimates of investment composition (machinery/structures in constant dollars) are presented in table 1. The estimates are calculated from a sample of 1974 machinery and equipment firms that are producers of machinery, equipment, and structures. The sample excludes firms in the general merchandise business that produce only retail merchandise (department stores). The estimates are derived from the Department of Commerce, National Income and Product Accounts, Survey of Current Business (various issues).

A variety of forces lead to changes in the composition of fixed investment. Over the longer term, technological progress plays an important role in determining the service lives of capital facilities. Moreover, advances in the capital budgeting process result in better predictions of the service lives of productive facilities. Finally, changes in capital-goods industries hold constant, in this case, the capital stock, and thus its composition.
Shifts in the Composition of Fixed Investment in the 1970s

by Roger H. Hindusitter

In recent years, a relatively low rate of growth in business investment has been an important ingredient in our economic performance. Since the last trough in economic activity in 1975, real investment has grown at an average rate of about 6.5 percent per year, compared with about 8 percent a year in the mid-1960s. This slower business expansion has been a major factor in the relatively slower growth of real GNP and real investment than past experience, suggesting a movement away from heavy investment to improve productivity that has accompanied economic growth since the mid-1960s. Concern over investment heightening business community worries about the productive capacity of the economy and the potential for overinvestment. Moreover, increases in employment (about 4 percent a year since 1975) have been stronger than past experience, suggesting a movement toward more labor-intensive operations in the business community.

Viewed from the perspective of the economy as a whole, slow investment has been widely associated with the problem of declining productivity growth. Correspondingly, recent investment performance is related to developments reaching back to the mid-1960s. Concern over investment heightening business community worries about the productive capacity of the economy and the potential for overinvestment. Moreover, increases in employment (about 4 percent a year since 1975) have been stronger than past experience, suggesting a movement toward more labor-intensive operations in the business community.

The opinions stated herein are those of the Federal Reserve Bank of Cleveland or of the Board of Governors of the Federal Reserve System.

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A capital process available to a firm combines short-lived and long-lived capital facilities. As an illustration, let \( K = K_1 + K_2 \), where \( K_1 \) represents a productive capital unit with very short lives, and \( K_2 \) are the long-lived, component, respectively. Here, short-lived and long-lived components combine in the ratio of two-to-one to form one productive capital unit.

Investment changes the capital stock. Investment is the allocation of new capital to replace those that are economically worn out (replacement) and also to add to the existing capital stock. The ratio of the service lives of the short-lived and long-lived components of the capital stock indicates the extent of replacement investment in the period indicated. Relative dispersion is measured by the coefficient of variation (standard deviation divided by the average), and indicates the relative riskiness of individual returns.


The investment tax credit, until 1978, experienced a decline in the average level of capital investment. The investment tax credit, until 1978, experienced a decline in the average level of capital investment. The investment tax credit, until 1978, experienced a decline in the average level of capital investment. The investment tax credit, until 1978, experienced a decline in the average level of capital investment. The investment tax credit, until 1978, experienced a decline in the average level of capital investment.

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In recent years, a relatively low rate of growth in gross investment has been important to its economic performance. Since the last trough in economic activity in 1975, real investment has grown at an average rate of about 6.5 percent a year, compared with about 8 percent a year in the mid-1960s, a period of unusually rapid business expansions. Although real GNP growth also was somewhat slower than in past expansions, some slippage in the share of output devoted to increasing and replacing productive facilities occurred over the past five years. Moreover, increases in employment (about 4 percent a year since 1975) have been stronger than past experience, suggesting a movement toward more labor-intensive operation in the business community.

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The outstanding feature of the estimates in table 1 is the clear shift in investment composition toward short-lived capital facilities during the 1970s. Measured by the geometric mean of the individual ratios, composition in 1976-79 included 12.2 units (1972 dollars) where machinery in the existing capital stock and thus the rental price of capital, which is a broader concept than the price of machinery included was small and restricted to three industry groupings (and therefore not representative of the economy as a whole), this evidence is consistent with broader tendencies noted elsewhere. The shift was not associated with growing dissimilarities, implying that does not seem to have been the result of the sum of changes in technology or other long-run determinants of investment composition. It is possible, for example, that much of the investment effort in the late-1970s was directed at improving energy efficiency rather than capacity or labor productivity. Longer-term implications are difficult to identify and depend on a high degree on whether the economic conditions of the 1970s continue into the 1980s.

Caused the shift in the composition of investment? Factors such as technology and government regulation no doubt were important, especially if the origins of changes are traced back to the 1960s. Computer technology is an obvious technological force in the period that is likely to increase machinery relative to structures. Pollution regulations appeared in the late 1960s, probably with similar effect. While these developments may have exerted continuing influence on investment composition, and help explain why a firm's machinery/structures ratio would be higher in the 1970s than earlier, it is less clear that they would account for sharp changes during the 1970s. Economic conditions in the 1970s, however, were volatile. The economy experienced the worst business recession since the 1930s. Recurring energy price shocks after 1973 added to economic uncertainty. Inflation was a persistent problem throughout the 1970s, and in the latter part of the decade inflationary pressures intensified.

Inflation stems from many sources and is not represented by proportional increases in all individual prices. Some prices rise faster than others, and relative prices as well as the level of inflation may vary from period to period. Even if the overall rate of inflation were correctly anticipated by firms, changes in relative prices might still have contributed to the greater dissimilarities among firms in the period that is likely to increase machinery relative to structures. For a technical analysis of these effects on investment composition, see Feldstein, Green, and Sabin (August 1978), pp. 345-50.

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Inflation was a persistent problem throughout the 1970s. This was true, however, throughout the decade, and the relative price change in real machinery is the relative price of machinery in the 1970s. A similar but somewhat less pronounced shift in the composition of investment occurred during the early 1970s. This is consistent with the macro evidence on investment behavior. For a firm's investment decision, the price level change in an inflationary environment is not represented by proportional increases in all individual prices. Some prices rise faster than others, and relative prices as well as the level of inflation may vary from period to period. Even if the overall rate of inflation were correctly anticipated by firms, changes in relative prices might still have contributed to the greater dissimilarities among firms in the period that is likely to increase machinery relative to structures. For a technical analysis of these effects on investment composition, see Feldstein, Green, and Sabin (August 1978), pp. 345-50.

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Inflation stems from many sources and is compounded by price indexes that reflect the composition of an economy. If inflation is higher in some sectors than in others, the relative price of machinery versus structures may be changing. Since the shift in composition toward machinery is associated with a larger proportion of investment, even if the relative price of machinery versus structures were unchanged, a firm substituting labor for capital might find it more profitable to expand its machinery component. Incoming workers would require, in the absence of expanding investment, a larger proportion of investment going to machinery. Rapidly increasing energy prices may well have contributed to this shift and its composition through adjustments in a firm's demand for factors of production. A firm's decision is the increase in costs from acquiring and conserving on energy would probably require, in the absence of expanding investment allowances by inflation may have been the worst business recession since the 1980s. This was true, however, throughout the decade, and the relative price change in machinery versus structures was smaller in 1970-73 than in 1976-79. To the firm, of course, the important consideration in an investment decision is the increase in costs from acquisition of capital facilities. This is measured by the rental price of capital, which is a broader concept than a price index which included speculative activity, interest rates, and the firm's financial structure. Although rental prices may have moved similarly to price indexes in the 1970s, this is uncertain. The impairement of depreciation allowances by inflation may have been greater for structures than machinery, especially in 1976-79.

Of course, relative price effects alter the demand for capital and (the level of investment) is unaffected by relative price changes associated with inflation. A direct incentive to realize investment still could arise if the relative price of machinery versus structures changes. Judging only from price indexes (implicit deflators) of capital goods, the price of structures rose faster than the price of machinery in the 1970s. This was true, however, throughout the decade, and the relative price change in machinery versus structures was smaller in 1970-73 than in 1976-79. To the firm, of course, the important consideration in an investment decision is the increase in costs from acquisition of capital facilities. This is measured by the rental price of capital, which is a broader concept than a price index which included speculative activity, interest rates, and the firm's financial structure. Although rental prices may have moved similarly to price indexes in the 1970s, this is uncertain. The impairement of depreciation allowances by inflation may have been greater for structures than machinery, especially in 1976-79.

The rate of inflation in 1976-79 was, on simple measures, more variable as well as higher than in the early 1970s. Greater uncertainty about prices in the post-recession period followed increases in uncertainty already generated by the recession, which was causing firms to re-examine many aspects of the way they conducted business. As unearned disbursements, rising, or does it seem to have been the result of some changes in technology or other long-run determinants of machinery composition? It might have well be part of the inflationary environment and uncertain economic conditions of the decade. Apart from the level of investment, the shift in composition suggests that capital processes were forced to a short-run effect could exist, and, if the variability of inflation increases with the rate of inflation, the studies show, expectational errors may be reinforcing during periods of high inflation rates.4

In conclusion, a pronounced shift in investment toward short-lived machinery occurred during the 1970s. Although the sample of firms examined was small and restricted to three industry groupings (and therefore not representative of the economy as a whole), this evidence is consistent with broader tendencies noted elsewhere.5 The shift was not associated with growing dissimilarities of capital equipment. The findings are consistent with the macro evidence on inflation.6

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3. This is consistent with the macro evidence on investment and employment growth cited above. Once again, depreciation is an important channel through which the rental price of (real) capital is increased during inflation, as are corporate tax rates and the firm's financial structure. For a technical analysis of these effects on capital, see M. Feldstein, J. Green, and E. Sheeshkin, "Inflation, Aggregate Demand, and Economic Efficiency," 'International Economic Review' (April 1979, part 2), pp. 553-70.

