For example, the general industrial machinery and vehicles sector experienced near-parallel growth of domestic production (for both domestic and foreign markets) and the domestic market between 1969 and 1979. Production of specialized industry machinery and information-processing equipment expanded slightly faster than their domestic market growth over that period, while production of electrical equipment slightly lagged its domestic market growth. These variations are nevertheless quite small compared to the growth of the PDE market and the domestic producers' share of that market. Only when the dollar's appreciation is included, does domestic production consistently and substantially lag domestic market growth. Indeed, production more nearly paralleled the growth of domestic producers' share of the domestic market. In other words, domestic producers were to correct for the dollar's appreciation damaged the growth of domestic producers' share of the domestic market. While domestic capital-goods producers are to benefit from trade, the trade patterns are not encouraging for the years ahead. Domestic producers most likely will continue to lose their competitive position in the world market. Even if the dollar declines, market losses in earlier years are unlikely to be reversed easily. Regaining domestic market share may be particularly difficult, as auto and steel producers have already discovered. As concerns about quality of product and reliability of service are resolved, price competition intensifies, and many imports still have the same labor-cost advantages over domestically produced capital goods that have troubled domestic steel and auto producers. Once domestic capital-goods buyers perceive the threshold problems of finding reliable trading partners, trade between the partners could quickly expand.

Concluding Remarks
While the capital-goods industry is still rightfully seen as one of the strongest industries in the United States, recent trends in capital formation raise concern about its potential for future growth. 

ECONOMIC COMMENTARY

Capital formation in the United States has undergone dramatic changes since the 1960s, particularly for domestic capital-goods producers. Two of many (often related) trends are the overall slowdown in capital formation and the shift in the mix of capital goods being formed. A third major trend, only recently gaining prominence, is the expanding penetration of imported capital goods into domestic capital-goods markets.

Capit Formation Slowdown
Despite some concern that the nation is deindustrializing, our stock of capital has not actually been shrinking. However, the overall growth of capital stock has slowed during the recession and the post-1975 slowdown. In the early 1980s, the post-1975 slowdown seems to have ended, and capital formation is rising more rapidly than in the late 1970s. This growth may return to earlier rates of capital formation.

Federal Reserve Bank of Cleveland
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Robert H. Schnorbus
Economist, Economic Commentary, June 15, 1985

Major Trends in Capital Formation
by Robert H. Schnorbus

1. To avoid distortions associated with different phases of the business cycle, growth rates were calculated with the aid of Data Resources, Inc. forecast for 1985, real PDE growth during this period would show a slowing (4.7 percent) from previous periods. See Review of the U.S. Economy, Data Resources, Inc., May 1985.
rate, that is, the rate at which the existing capital stock was written off for depreciation purposes.

Equipment investment as a share of total investment fell from a low of 55 percent in 1962 to roughly 70 percent in 1978. This indicates that the need to modify existing capital stock was rising during the 1970s. As a result, some of the stimuli to the equipment market have been burdened with excessive capacity.

As a result, during the current economic downturn, capacity has been strained for many high-tech capital goods, while most traditional capital goods have been burdened with excessive capacity. The shift in the mix of investment within the PDE market reflects a dramatic change in the control of large-scale enterprises and in the production process itself (i.e., from human labor to robots). The sharp decline in the real cost of computers during the 1970s made the technological advances that were once too expensive to consider profitable and commercially accessible. As a result, the need to modify existing capital stock was rising during the 1970s. As a result, some of the stimuli to the equipment market have been burdened with excessive capacity.

Imports and Equipment Spending

Traditional capital-goods producers have much bigger worries than losing their share of PDE spending: they have been steadily losing larger and larger shares of their own domestic market to foreign producers. Surprisingly, high-tech producers have also experienced some share erosion in recent years.

The loss of market share to foreign producers is not as yet as great as it was before because the capital-goods industry historically had been viewed as one of America's strong manufacturing sectors. The long-standing competitive advantages of domestic PDE producers over foreign producers were shaped by the fact that much of America's industrial leadership in such areas as research, innovation, and quality of the work force is not nearly as strong as in other sectors. The gap between the size of the domestic and foreign market has been steadily narrowing, the trend thus far is not expected to continue.

The difference between domestic producers' share of the domestic market and their total production represents the size of the foreign goods exports, as distinct from their production for use in their own market. The relationship between the domestic machinery and total domestic machinery production determines the trade surplus generated by these capital-goods producers.

The relationship between the domestic industry and its world market is not accidental. Domestic producers have been able to maintain their share of the domestic market by creating new markets, by helping others to develop their domestic markets, and by helping others to develop their domestic markets.

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Table 1: Market Growth of PDE with Trade Adjustments

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The difference between domestic producers' share of the domestic market and their total production represents the size of the foreign goods exports, as distinct from their production for use in their own market. The relationship between the domestic machinery and total domestic machinery production determines the trade surplus generated by these capital-goods producers.

4. Average service life of newly purchased PDE fell from 8.2 years between 1960 and 1977 to an average of 11.9 years. Since then, the rising share of office machines, which has an average service life of eight years, has further reduced the average life of total PDE.
5. A notable exception to this statement among the computer industry is the software component, which currently appears to have excess capacity. The problem might be temporary difficulty in getting software programmers. The industry's problem and need for retraining, however, rather than a shortage of programmers, may have reduced the excess of the capacity in the industry. See Randall Smith, "Computer Industry Called Ripe for Mergers," Wall Street Journal, June 30, 1980.
The Shift in PDE Spending
Demand has not been changing uniformly across all types of capital goods during the current expansion. As recently as 1970, traditional capital equipment, including vehicles, general industrial machinery, and specialized industry machinery, held about 65 percent of the domestic PDE market (see box).

By 1984, their market share had fallen to 42 percent. Indeed, by 1984 the "high-tech" capital goods, identified most closely with information processing (including computers) and electrical equipment, had supplanted traditional capital goods to become 60 percent of the total PDE market.

Imports and Equipment Spending
Traditionally, domestic producers have bigger worries than losing their share of PDE spending; they have been steadily losing larger and larger shares of their own domestic market to foreign producers. Surprisingly, high-tech producers have also experienced significant share erosion in recent years.

The loss of market share to foreign producers is particularly noted because the capital goods industry historically had been viewed as one of America's strongest sectors. The long-standing competitive advantages of domestic PDE producers over foreign producers were shaped by the unique knowledge base--developed through research and innovation--in such areas as advanced data processing and quality of the work force.

Net share losses of domestic producers' market share peaked in 1974, and began a sharp decline after 1980, as the share of the domestic market fell from 80 percent in 1970 to 76 percent in 1984. Penetration varied among sectors in 1984, ranging from 14 percent in vehicles to 39 percent in electrical equipment, but still represented substantial gains in each sector over 1970 import shares.

The explanation for the recent deterioration in net trade of capital goods is the sharp appreciation of the dollar since mid-1980, which, relative to foreign currencies, has made all domestic goods more expensive in the world market and imports cheaper. During the 1970s, the dollar was generally depreciating. Many exchange-market analysts predicted that the current dollar is overvalued and expect this depreciation to return in the future. If that is the case, domestic producers can help offset some of the competitive advantage currently being enjoyed by foreign producers.

Some of the stimulus to the equipment market may have ended in the 1980s with the sharp decline in inflation. However, falling short-term interest rates relative to long-term rates, new tax incentives (i.e., accelerated depreciation), and the need to modernize labor-intensive, foreign against foreign competition has contributed to a rise in PDE's share of total capital spending during the current economic expansion.

As a result, during the current economic expansion, capacity has been strained for many high-tech capital goods, while most traditional capital goods have been burdened with excessive capacity.

The shift in the mix of investment within the PDE market reflects a dramatic change in the control of large-scale enterprises and in the production mix itself (i.e., a shift from human labor to robots). The sharp decline in the real cost of computers during the 1970s made the technological advances that they represent commercially accessible. As a result,

8. See Irving B. Kravis, Robert E. Lipsey, and Dennis M. Bushe, "Prices and Market Shares in Domestic Capital-Goods Industries," in International Machinery Trade; December issues, Tables 5, 6, and 7; and Table 6; Bureau of the Census, Highlights of U.S. Merchandise Trade, December issues, Tables 5 and 6.

9. The size of the world PDE market, usually defined as the sum of all countries' exports, is not a useful indicator of the size of the world market. The world PDE market includes the large and growing export efforts of countries that have been losing their share of the world market because of depressed domestic markets and the collapse of their capital goods exports, as distinct from the domestic market in any given year. The different patterns of behavior in the domestic market and total domestic production reflect the trade surplus generated by these capital goods-producers. The difference between domestic producers of domestic and their total production repre-

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These variations are nevertheless quite small compared to the growth of the PDE market and the domestic producers' share of that market. Only when economic conditions and policies are included, does domestic production consistently and substantially lag domestic market growth. Indeed, production more nearly paralleled the growth of domestic producers' share of the domestic market. In other words, domestic producers were to some extent successful in offsetting losses in their domestic market with gains in their export market. Even so, the dollar's appreciation damaged their world competitiveness in terms of both imports and exports.

Although exports of domestically produced capital goods continue to rise, relative to domestic production, the PDE producers have been declining as evidenced by their declining share of the world market. Domestic producers may be particularly difficult, as auto and steel producers have already discovered. As concerns about quality and reliability of imported, price competition intensifies, and many imports still have the same labor-cost advantages over domestically produced capital goods that have troubled domestic steel and auto producers. Once domestic capital-goods buyers have come to accept the threshold problems of finding reliable trading partners, trade between the partners could quickly expand.

Concluding Remarks

While the capital-goods industry is still rightfully seen as one of the strongest industries in the United States, recent trends in capital formation raise concern about its potential for future growth. The capital formation trends discussed above have been detrimental to domestic capital-goods producers. In some cases, as the slowdown in capital formation, the trend should not be considered irreversible—although some overbuilding of structures may have occurred in recent years and may take a few years to be absorbed. The 1982-84 boom in information-processing equipment is an encouraging sign for producers of equipment. However, part of that strength was linked to an expansionary phase of the business cycle and presumably will weaken as the economy itself loses steam, as appears to be happening in late 1984 and early 1985.

The overall growth of the equipment market and its changing composition are part of the economic environment in which domestic capital-goods producers must operate, but over which they have little direct control. The gradual decline in international competitiveness, on which they might have some influence, has been a far more worrisome trend. If the capital-goods industry is to remain strong in an increasingly global market, domestic producers must be aggressive in capturing their share of the world market and in finding new ways to expand their share of the world market.

The gradual decline in international competitiveness of domestic producers seems to have been dependent on their quality of product and reliability of delivery. While domestic capital-goods producers have the same labor-cost advantages as foreign competitors, which they have little direct control. If the slowdown in the growth of capital-goods producers, and labor costs increase, the trend could be costly. Capital-goods producers have not been able to take full advantage of that better performance because of rising imports, which will be discussed later.

The slowdown in the growth of capital goods perhaps has two sources—one reflects the long-term threats to the future of the domestic capital-goods industry.

Capital formation Slowdown

Despite some concern that the nation is deindustrializing, our stock of capital has not actually been shrinking. However, the overall growth of capital stock has slowed during the recession of 1973-75 and the depression in economic activity in 1981-82. The annual capital formation rate during this period has been much lower than the long-term average.

The slowdown in capital formation during the 1980s will depend, in large part, on how long the current recession continues. If the slowdown continues through 1985, the comparison for the 1979-84 period may understate the growing strength in the steady-state ratio of net capital stock to gross domestic product of 0.73 in 1962 to 0.82 in 1985.

Net capital stock was expanding rapidly in the 1960s (6.0 percent between 1962 and 1971), but has slowed nearly a third in the 1970s and early 1980s, as growth in gross domestic product slowed from 4.5 percent during the 1960s to 3.8 percent in the 1970s and early 1980s. The rising ratio, could, therefore, imply that the economy has not been growing fast enough to sustain earlier rates of capital formation.

The industrialization issue is, therefore, overemphasized. Although the manufacturing sector is not growing as fast as other sectors of the economy, its absolute size (including output, capital stock and, until recently, employment) is expanding. Continuation of the slowing trend in capital formation during the 1980s will depend, in large part, on how long the current recession continues.

ECONOMIC COMMENTARY

Major Trends in Capital Formation

by Robert H. Schnorbus

Robert H. Schnorbus is an economist at the Federal Reserve Bank of Cleveland. The author would like to thank Roger H. Hinderliter for his thoughtful comments.

1. To avoid distortions associated with different phases of the business cycle, growth rates were calculated for the period 1979-84, excluding the sluggish capital-goods growth period during 1979-80.

2. These growth rates represent the long-term growth rate of net capital formation. See for the 1970s, 1969 and 1979.

3. For the period, 1979-84, the end year was the latest data available and was the second year of a exceptionally robust economic expansion. If the current expansion continues through 1985, the comparison for the 1979-84 period may understate the strength in the steady-state ratio of net capital stock to gross domestic product of 0.73 in 1962 to 0.82 in 1985.

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Another important source of the capital-goods slowdown has been the shift from structures to relatively short-lives producers' durable equipment. This shift, in effect, decreased the growth rate of capital formation by increasing its average depreciation.