Summary

This study measures the productivity of U.S. food manufacturing to explore its input-output relationships during 1975-97. The gross output (the value of shipments net of changes in inventories) of the food manufacturing sector grew 1.88 percent yearly, reaching an annual average of $353 billion in 1995-97. The net output (gross output minus the cost of material inputs and purchased services), which shows the industry's contribution to the Nation's gross domestic product (GDP), increased 3.58 percent yearly. In 1995-97, the annual average net output was $135 billion (about 38 percent of the gross output), with the 62-percent difference accounted for by expenditures on material inputs.

Annual employment growth in the food manufacturing sector averaged just 0.12 percent between 1975 and 1997. However, new capital expenditures, measured at 1982 prices, show a yearly increase from $6.3 billion in 1975-79 to $8.8 billion in 1995-97, a growth rate of 2.39 percent. Similarly, capital services costs increased 1.41 percent annually from $9 billion in 1975-79 to $11.2 billion in 1995-97. Slow growth in employment, coupled with the increase of capital expenditures, is evidence that capital is substituting for labor by providing each employee with more and better capital to work with.

To measure the productivity of the U.S. food manufacturing sector, this study calculates multifactor and labor productivity indexes. The multifactor productivity index measures the rate of output growth in excess of growth due simply to increases in combined factor inputs. The labor productivity index measures the rate of growth in output per labor-hour devoted to the production of that output.

Two approaches are applied to measure the multifactor and labor productivity indexes of U.S. food manufacturing. The gross-output approach specifies gross output as a function of capital, labor, energy, and all intermediate material inputs. Alternatively, the net-output approach specifies net output as a function of labor and capital inputs only. The two approaches produce substantially different productivity measurements, mainly because material costs constitute more than 60 percent of the food manufacturing sector's gross output. The ratios for some food manufacturing industries, like meat products and fats and oils, reached 74 and 79 percent, respectively, in 1995-97. Consequently, including or excluding material inputs as a component in a production function will substantially affect the results of measured productivity indexes.

For interpreting food manufacturing productivity, the gross-output productivity indexes should be used to assess technology changes over time because this model includes as many factor inputs as available data sources allow, and the potential change effects from unmeasured inputs can be avoided. The gross-output multifactor productivity index for food manufacturing grew 0.19 percent per year between 1975 and 1997. This slow growth rate is consistent with the Bureau of Labor Statistics (BLS) estimate of 0.45 percent using different data. Both estimates of productivity indexes are low when compared with the BLS estimate of 1.25 percent per year for the whole manufacturing sector over the same period of time. The reason for the lower productivity growth in food manufacturing is not fully understood, but low investment in research and development (R&D) could be one reason. The economic implications of slow growth in food manufacturing productivity are threefold.

First, instead of productivity growth, the expansion of combined factor inputs provided significant impetus to food manufacturing output. U.S. food manufacturing gross output grew 1.88 percent yearly during 1975-97. During this period, the combined capital, labor, energy, and material inputs grew at an average rate of 1.69 percent yearly, with material inputs growing fastest at 2.25 percent. Food manufacturing is materials-intensive, and a 3.6-percent decline in real producer prices of crude food and feedstuffs fueled the expansion of input utilization.

Second, the productivity growth of food manufacturing contributed little to price declines in recent years. The real producer price of processed foods declined an average 2.13 percent per year over the period 1975-97. Researchers have hypothesized that advances in food manufacturing productivity would explain the decline in real prices of processed foods. According to this study, however, it was a decrease in the prices of crude food and feedstuffs that drove down the prices of processed foods paid by consumers.

Third, heightened merger and acquisition activity in recent years has had little effect on changes in food manufacturing productivity. According to *Mergerstat Review*, which tracked purchases valued at $1 million or higher and transfers of ownership involving at least 10 percent of a company's equity, the pace of merger and acquisition activity in food processing increased steadily from 60 transactions in 1991 to 157 in 1998. On the basis of slow growth in the multifactor productivity index, it appears that recent heightened merger and acquisition activity has had little effect on food manufacturing productivity.

In evaluating the contribution of food manufacturing to the growth of the Nation's GDP, productivity indexes from the net-output approach should be used, because net output is defined the same as gross-product-originating (value-added) GDP. Both the net output and labor productivity indexes exhibit a steady increase, implying that the contribution of food manufacturing to the Nation's GDP has increased over time. This study also evaluates the effects of a 10-percent increase in both capital and labor inputs and finds that food manufacturing's net output would increase by $4.3 billion. In addition, a 10-percent increase in capital input alone would increase the sector's capital intensity, and consequently its labor productivity, by $1.43 per worker-hour. A 10-percent increase in labor input alone would reduce the sector's capital intensity and reduce its labor productivity by $1.58 per worker-hour.