

C.2

#53678

INTRA-INDUSTRY STRUCTURAL CHANGE

BY

DAVID WALLACE

STATISTICS STATISTIQUE
CANADA CANADA
JUN 14 1993
LIBRARY
BIBLIOTHÈQUE

Introduction

In the 1980's the watch word for business was change. As the economy went into recession at the beginning of the decade and as government policies liberalized both interprovincial and international trading rules, the pressures to improve productive efficiency were enormous. Through structural change, such as reducing product lines and introducing new production technologies, producers lowered costs. However, is it reasonable to expect establishments of varying size to undergo the same structural changes? The empirical evidence suggests that this is not the case. For example, capacity utilization rates in the manufacturing sector show different levels and trends when aggregated by establishment size (graph 1). Did the drop in capacity utilization experienced by the medium and small establishments in 1989 come as a result of a failure to introduce change and remain competitive or were they more successful innovators and thus expanded capacity at a faster rate than did the large establishments? With this question in mind, research has been started into comparing structural change at the establishment level and preliminary results are presented in this paper.

Establishment Data and Size

To examine the relationship between factor inputs and output,

data on labour and capital along with productivity measures are needed. To produce this data, a longitudinal database has been created by linking at the establishment level the Census of Manufacturers and the Capital and Repair Expenditures Survey for the year 1988. The database was then expanded to cover the years 1985 through 1989 for the set of common establishments, however, some of the data series begin only in 1987. This database combines information on shipments, production, employment, hours worked, wages paid, capital expenditures by asset categories, stocks of fixed assets, and capacity utilization at the establishment level over time.

Given that this is the first time these series have been used at the establishment level, a lot of work has gone into double checking the values, particularly for the small establishments. For example, instances where the respondent consolidates information for a number of establishments must be excluded from the database. As this work has not been finished, the results presented here are preliminary and thus may be subject to revision.

Since this is a starting point for this research, only two industries are looked at - the food and beverage industries and the transportation equipment manufacturers. The major reason for picking these industry groups is that they have the largest number of establishments in the database. In addition, the analysis should show differing results because of the

organization of the two industry groups; major segments of the food and beverage industries are closely regulated and there are no identifiable dependencies existing among the industries or establishments whereas in the transportation equipment manufacturing industries there is a high degree of vertical integration - one industry produces the inputs for another.

In the food and beverage industries, large, medium and small establishments were defined based on the number of production employees; small establishments have less than 50 production employees, medium establishments have between 50 and 199 and large establishments have 200 or more. While these limits are arbitrary, the characteristics of the groupings from the sample support these categories (table 1 a).

A second set of standards were used for the transportation equipment manufacturers because of the different characteristics of these plants. The large establishments account for the top 80% of production, medium establishments produce the next 15% and the small establishments produced the bottom 5%. The characteristics of these groupings are shown in table 1 b.

The data to be presented for the large, medium and small establishments are the mean of the individual responses rather than a sum or weighted average. Any published industry data, production indices or capacity utilization rates for example, are

weighted averages with the weights dependent upon size. Discrepancies should be expected when comparing published industry aggregates with these establishment estimates. This should be kept in mind if comparing industry and establishment indices.

Food and Beverage

The trends followed by the average capacity utilization rates for the small, medium and large establishments are compared in graph 2. To explain the differences in the trends and levels, the relation between actual and capacity production must be examined (graph 3). That small establishments showed the highest growth in both actual and capacity production coincides with other research findings (see feature article in the March 1992 issue of the Canadian Economic Observer) that small establishments were responsible for most of the net new job creation in the overall economy.

The trends in constant dollar capital expenditures imply that the difference in capacity growth rates stems from more aggressive investment behaviour on behalf of the smaller establishments (table 2). However, when looking at the expenditure details, two different strategies emerge. Not only are the large and medium establishments increasing their expenditures on computer assisted process machinery and equipment (graph 4) they are now

consistently devoting a high percentage of their spending on process machinery and equipment to these more advanced assets (graph 5). The result from these spending patterns is that the large and medium establishments are substituting capital for labour (graph 6) and thus reducing their need for production workers (graph 7). However, the investment in high technology coincides only with small increases in labour productivity that occur in 1988 and 1989 (table 3).

Does the low productivity growth signify that high technology has little to offer the food and beverage industries? Not necessarily. Besides increasing labour productivity, technology can decrease the establishment's consumption of other inputs such as energy. Over the whole industry, consumption of fuel and electricity declined every year since 1985.

On the other hand, small establishments displayed virtually no interest in computer assisted process machinery and equipment (graph 4) and yet had the highest growth in capacity production (graph 2). While they too show more reliance upon capital (graph 6), albeit low technology, they also show increased employment of production workers (graph 7). Although the process machinery these establishments purchased is not computer assisted, it does represent an improvement as evidenced by an increase in labour productivity (table 3). Besides the gains in productivity, small establishments were able to increase capacity through growth as

they increased their employment of production workers.

Even though all establishments have shown some increase in their productivity, this has not kept their unit labour costs from rising (graph 8). While the small establishments displayed the highest increase in unit labour costs, this may not be as bad as it looks since the small establishments typically pay the lowest wage rates (see Big is Beautiful Too - Wages and Worker Characteristics in Large and Small Firms in the July 1991 issue of the CEO). The end result may be that the labour cost gap has narrowed between the large and small establishments.

It is interesting that the small establishments made the greatest gains in capacity production using lesser technology. Is this because wage rates for small establishments are low enough that high technology is not necessary to remain cost competitive or is this technology too expensive or too large in scale for use by small establishments? Are the larger establishments ignoring labour productivity for more lucrative returns elsewhere in the production process, e.g., energy efficiency? These questions are beyond the scope of this paper and may be answered in later research.

Transportation Equipment Manufacturers

Again, when capacity utilization for the different establishment

sizes are compared (graph 9) the trends do not coincide. Looking at the capacity and actual production comparison shows the large establishments declining in 1989 while the small and medium establishments continued to grow (graph 10). These trends are not surprising considering recent events in this sector. As new large auto plants came on stream in 1988, the average size increased, pushing up capacity production at a higher rate than actual. However, this growth resulted in over capacity which led to cut backs. On the other hand, as interest rates increased, transportation equipment owners sought to extend the lives of their assets thereby benefitting the medium and small establishments since they are primarily parts manufacturers.

As interest rates climbed and capacity increased, competition among the auto makers intensified. With foreign auto makers already making extensive use of high technology abroad, domestic firms had to follow suit. Moreover, as the foreign firms set up in Canada, the demand for high technology process machinery increased. While the large establishments devoted an increasing share of their expenditures on process machinery and equipment to computer assisted machinery, the shares for the medium and small establishments were greater (graph 11). This is not surprising given the high degree of vertical integration that exists within this industry group. As the large establishments sought to meet the competition, they pressured their suppliers, the medium and small establishments, to cut their costs. As a result, the large

firms would be willing to share their technological developments with their suppliers.

The end result of the investment in technology has been to keep prices down for the total industry (graph 12). Increasing the amount of capital per production worker (graph 13) led to higher labour productivity (table 4), resulting in unit labour costs actually decreasing for the large and medium establishments (graph 14). The need for raising labour productivity stems from the constantly rising labour costs. From the input-output model, the labour income share of inputs was increasing at a growing rate in the years 1986 and 1987; only in 1988 did it decrease.

While the transportation equipment manufacturing industries exhibited structural change in response to market conditions, it is interesting to note its uniformity. Given the dependencies existing in this industry group, the conditions were optimal for the diffusion of technology. As a result, all levels of establishments displayed growth in capacity because of technology.

Conclusion

As we have seen, structural change was widespread throughout the two manufacturing industries examined here. Not only did the changes vary across industries, differences existed within

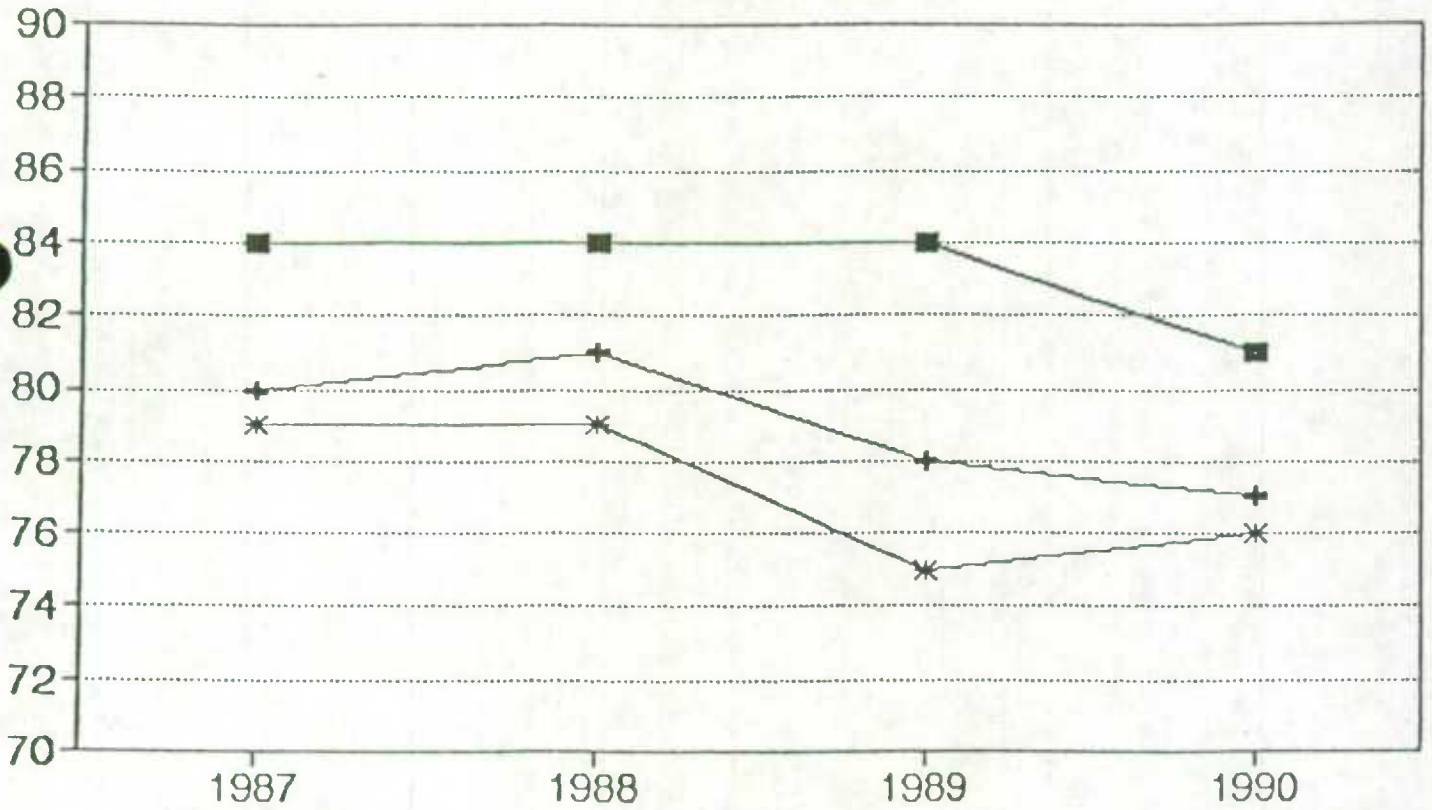
industries.

In both industry groups there was a decline in the capacity of the large establishments. In the food and beverage industries the smaller establishments appeared to have been more successful innovators and thus showed more growth than the large establishments. In the transportation equipment manufacturing industries the large establishments were the biggest innovators yet were victims of their own success as the decline was a result of over expansion. While all establishments used capital to increase productivity, the use of advanced technology was no guarantee of success.

As to the questions raised in this paper regarding gains from investment outside of labour productivity, there is information on the database to explore these issues - this may be done at a later date.

Graph 1

CAPACITY UTILIZATION RATES BY SIZE



—■— TOP THIRD —+— MIDDLE THIRD —*— BOTTOM THIRD

Table 1(a)

Food & Beverage Industries

SIZE CATEGORY	# of Est.	% of Est.	# of Emp.	% of Emp.	Fixed Assets	% of Fixed Assets	Value of Man. Prod.	% of Man. Prod.
Large	130	12	52,880	51	3,532	40	12,358	42
Medium	367	32	37,887	37	3,060	34	11,989	41
Small	633	56	11,997	12	2,285	26	4,852	17

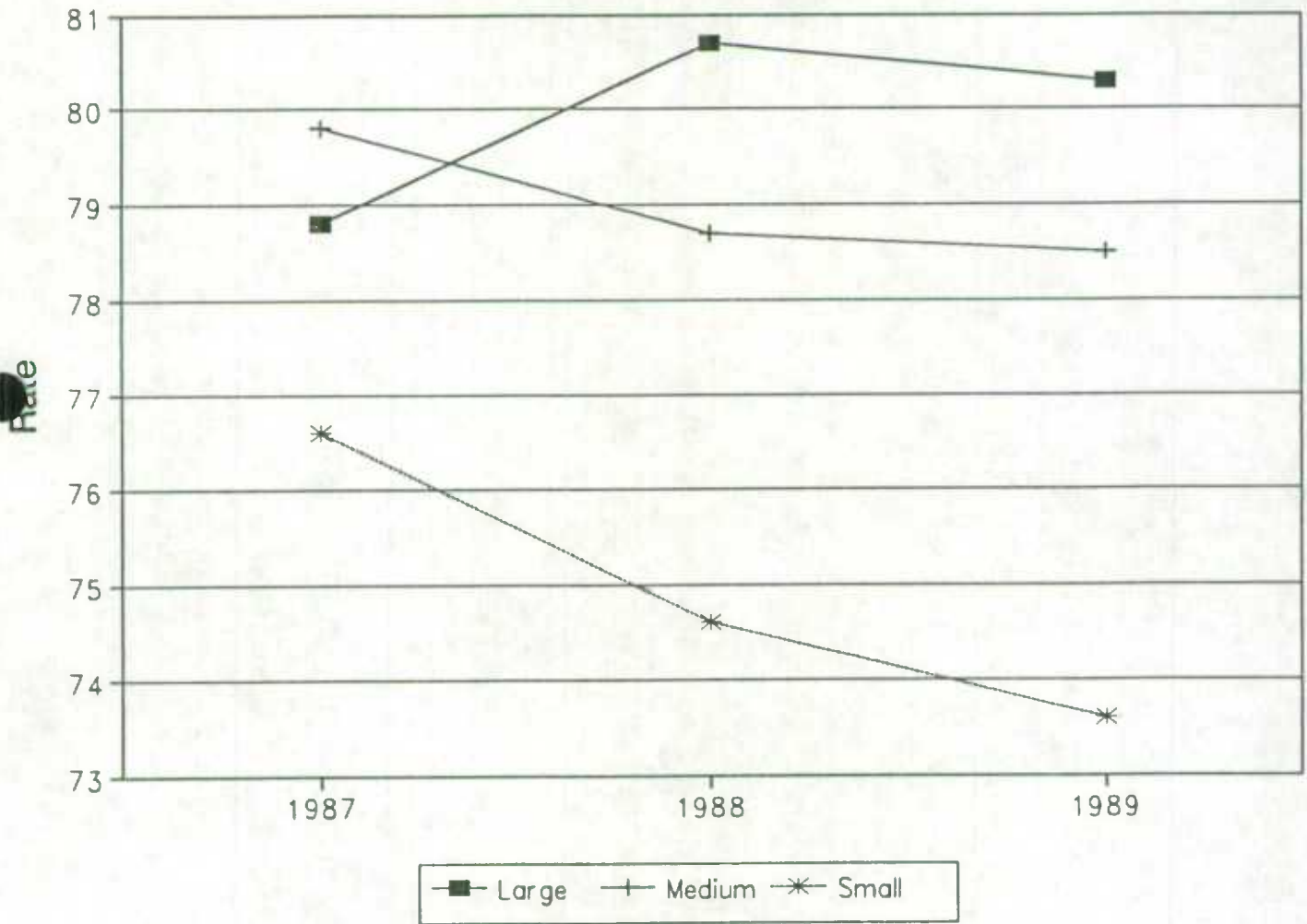
Table 1(b)

Transportation Equipment Manufacturers

SIZE CATEGORY	# of Est.	% of Est.	# of Emp.	% of Emp.	Fixed Assets	% of Fixed Assets
Large	17	8	51,287	57	5,733	66
Medium	59	27	24,083	27	2,265	26
Small	143	65	14,462	16	675	8

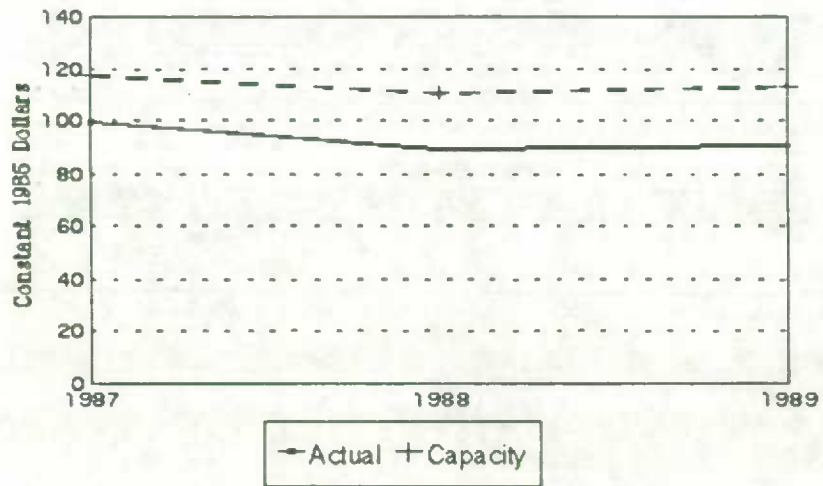
Graph 2

Food and Beverage Industry Capacity Utilization Rate

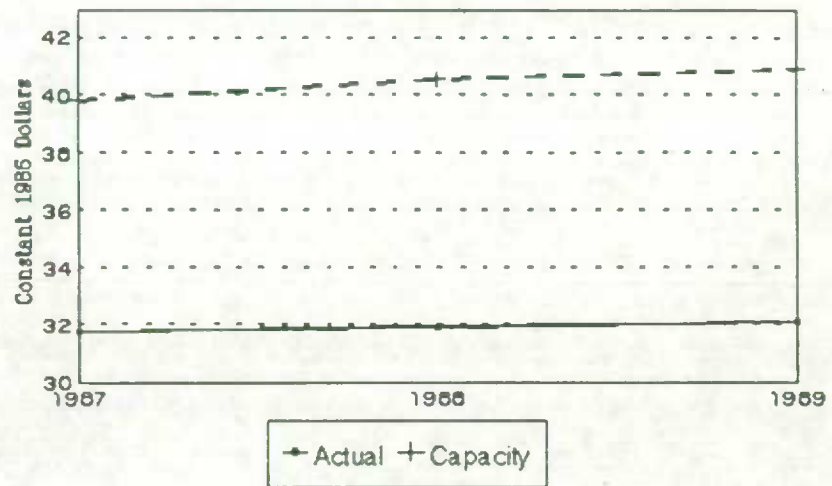


Graph 3

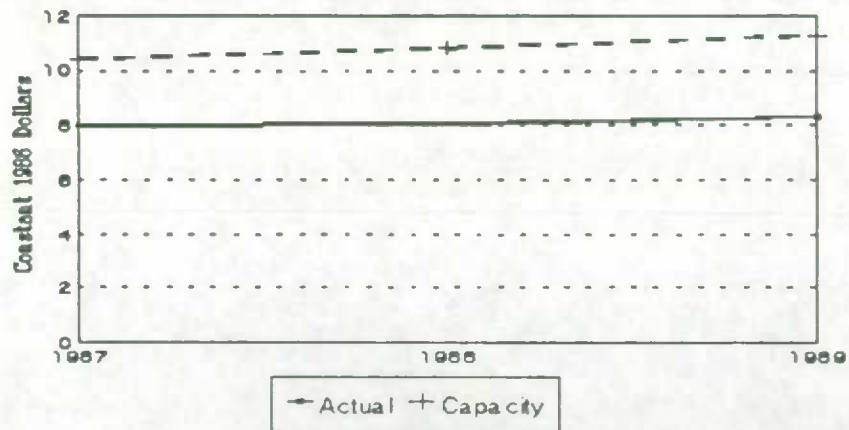
Large Establishments



Medium Establishments



Small Establishments



Food and Beverage Industries
Actual vs Capacity Production

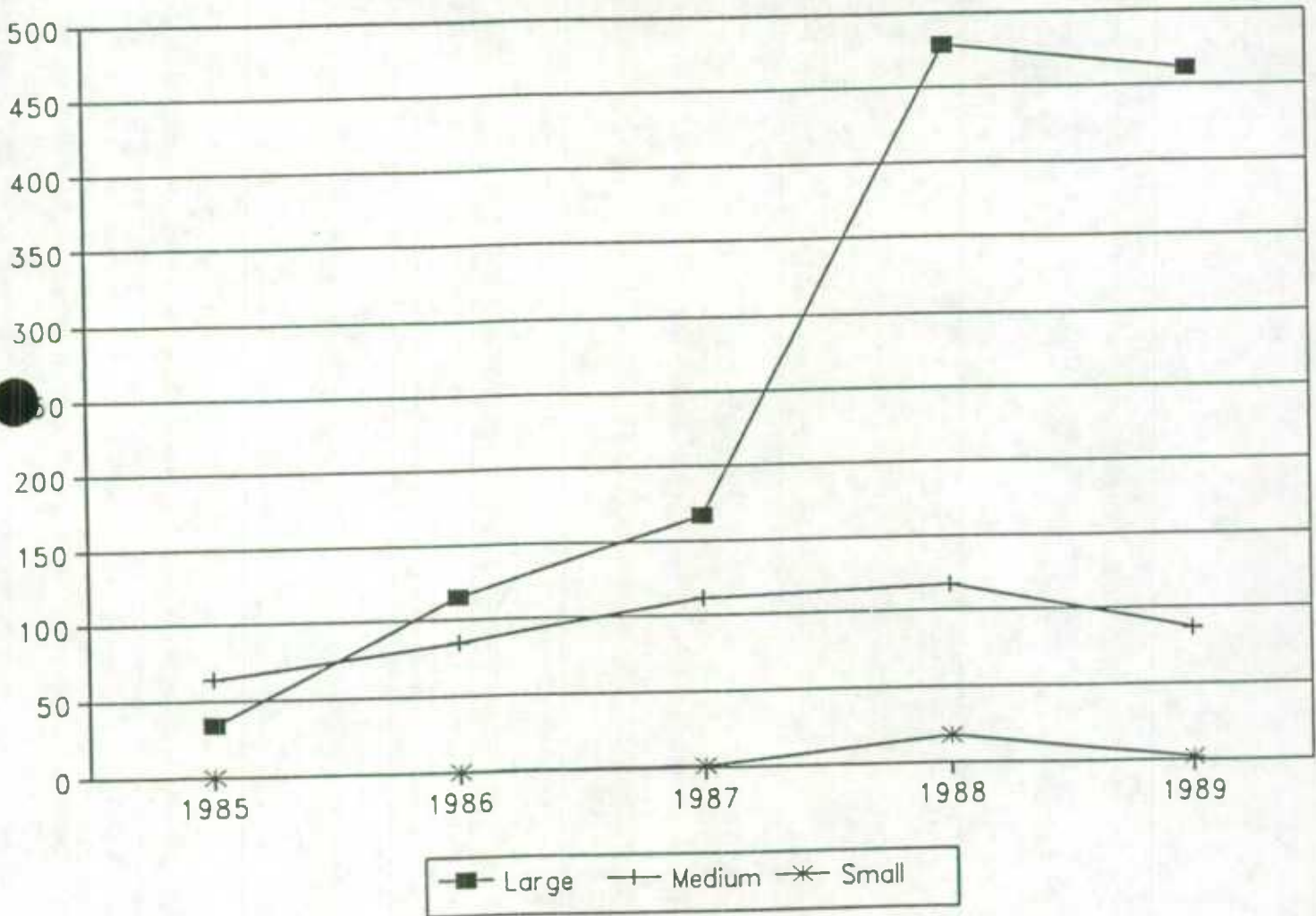
Table 2

Food and Beverage Industries
Total Capital Expenditures Index

	Large	Medium	Small
1985	84.1	87.3	116.1
1986	82.8	86.1	90.2
1987	100.00	100.00	100.00
1988	100.2	126.1	133.1
1989	99.8	127.3	135.8

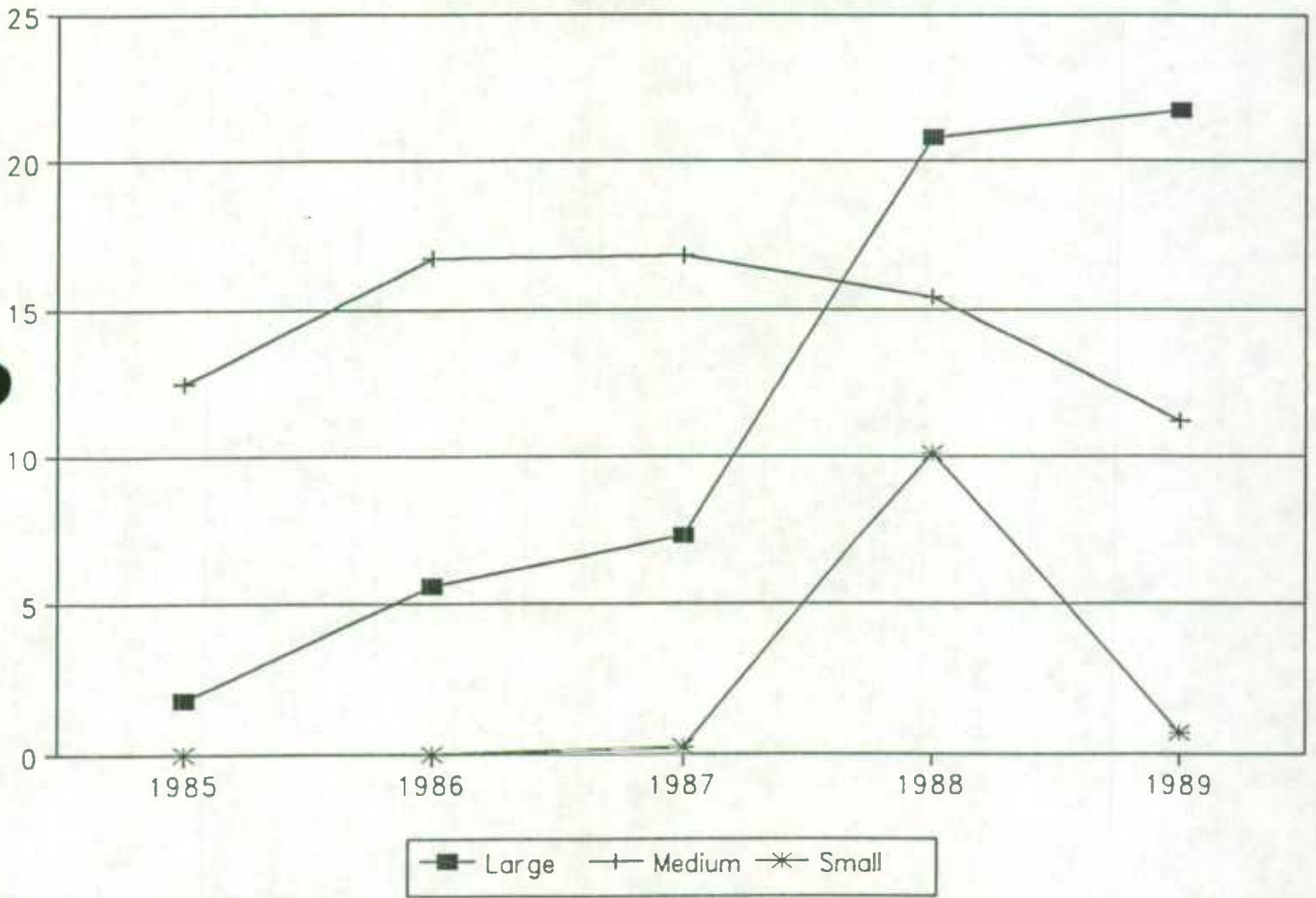
Graph 4

Food and Beverage Industry Computer Assisted Process M&E Spending



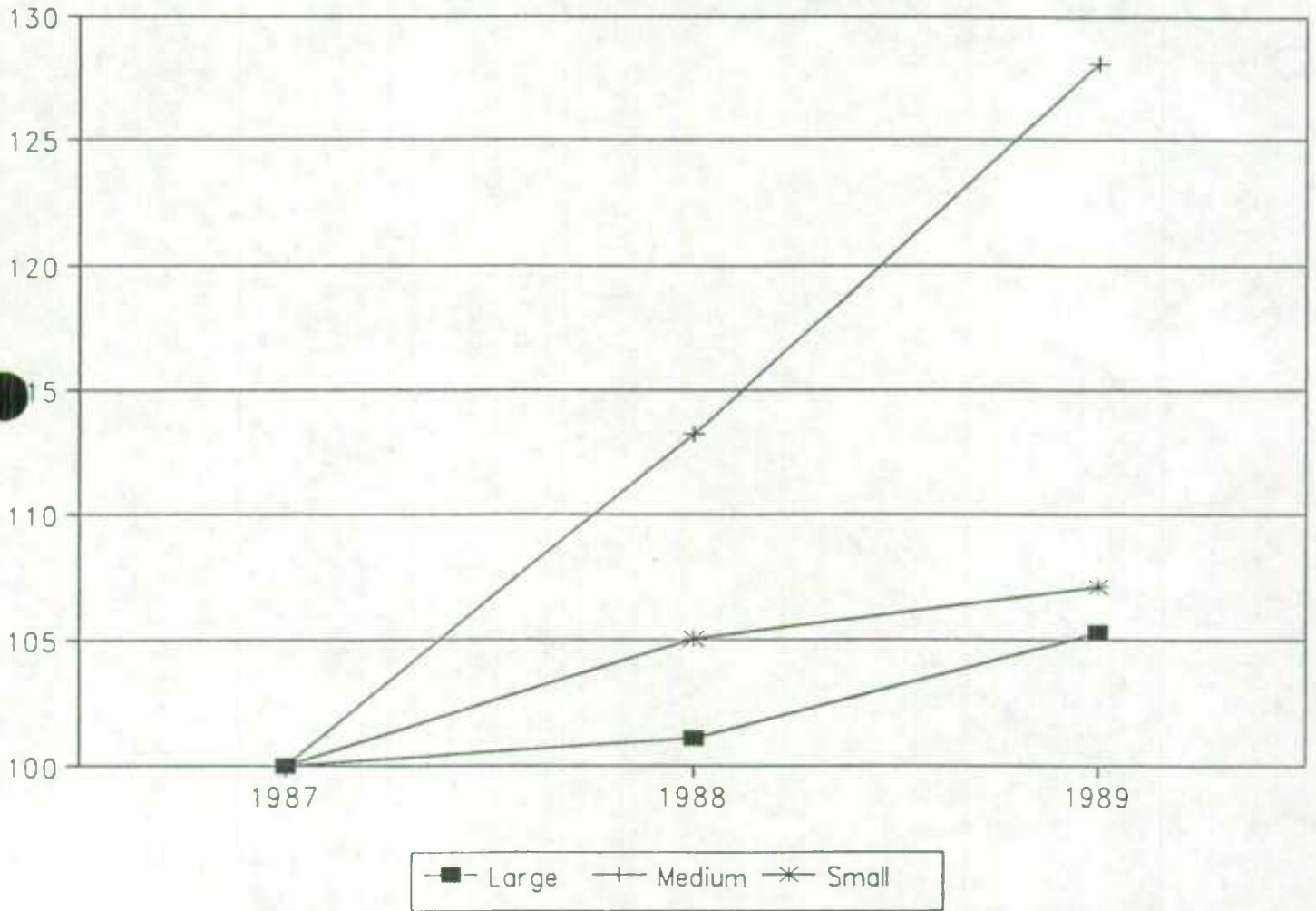
Graph 5

Food and Beverage Industry Computer Assisted Process M&E Share



Graph 6

Food and Beverage Industry
Capital-Labour Ratio Index, 1987=100



Graph 7

Food and Beverage Industry Production Workers

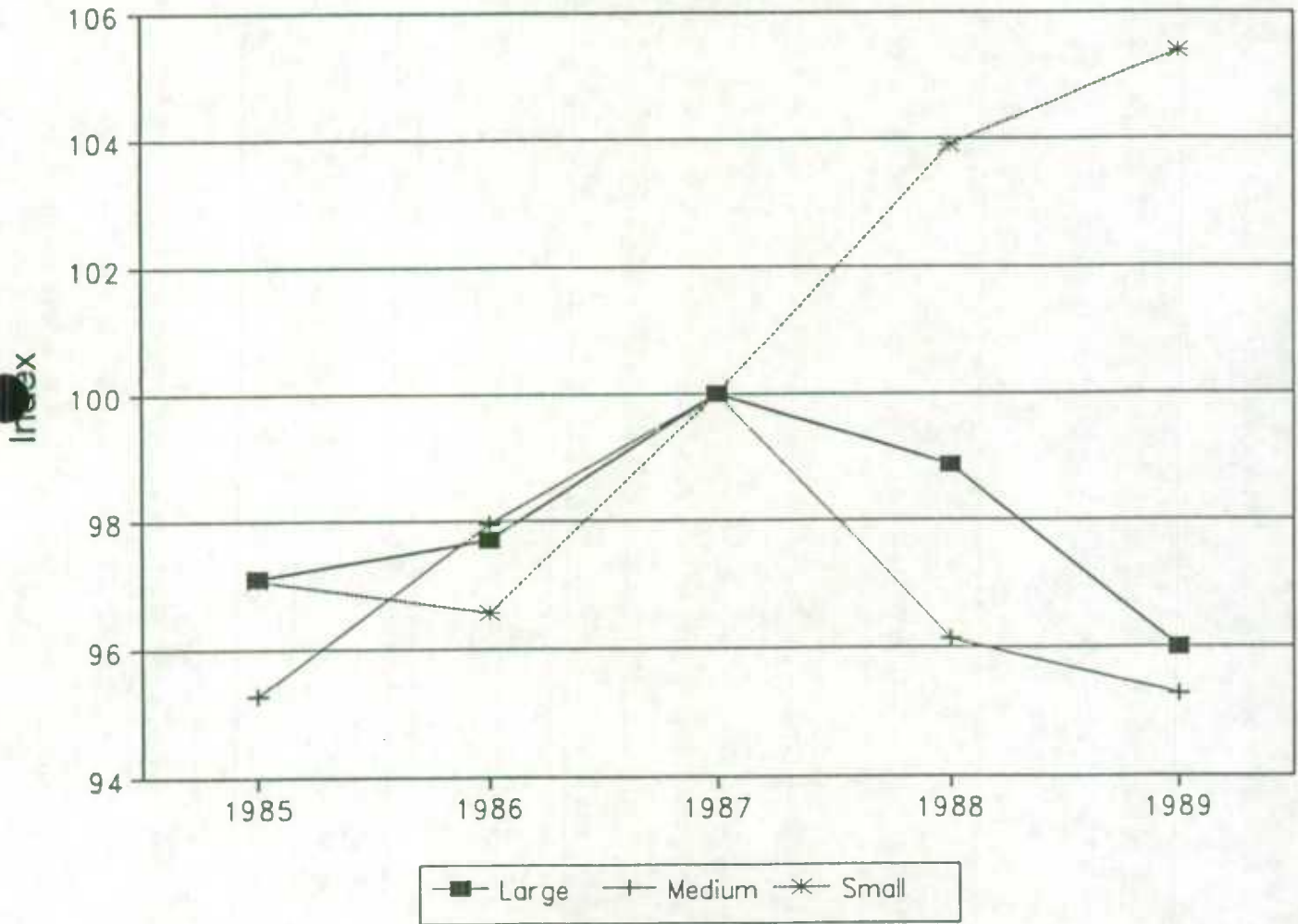


Table 3

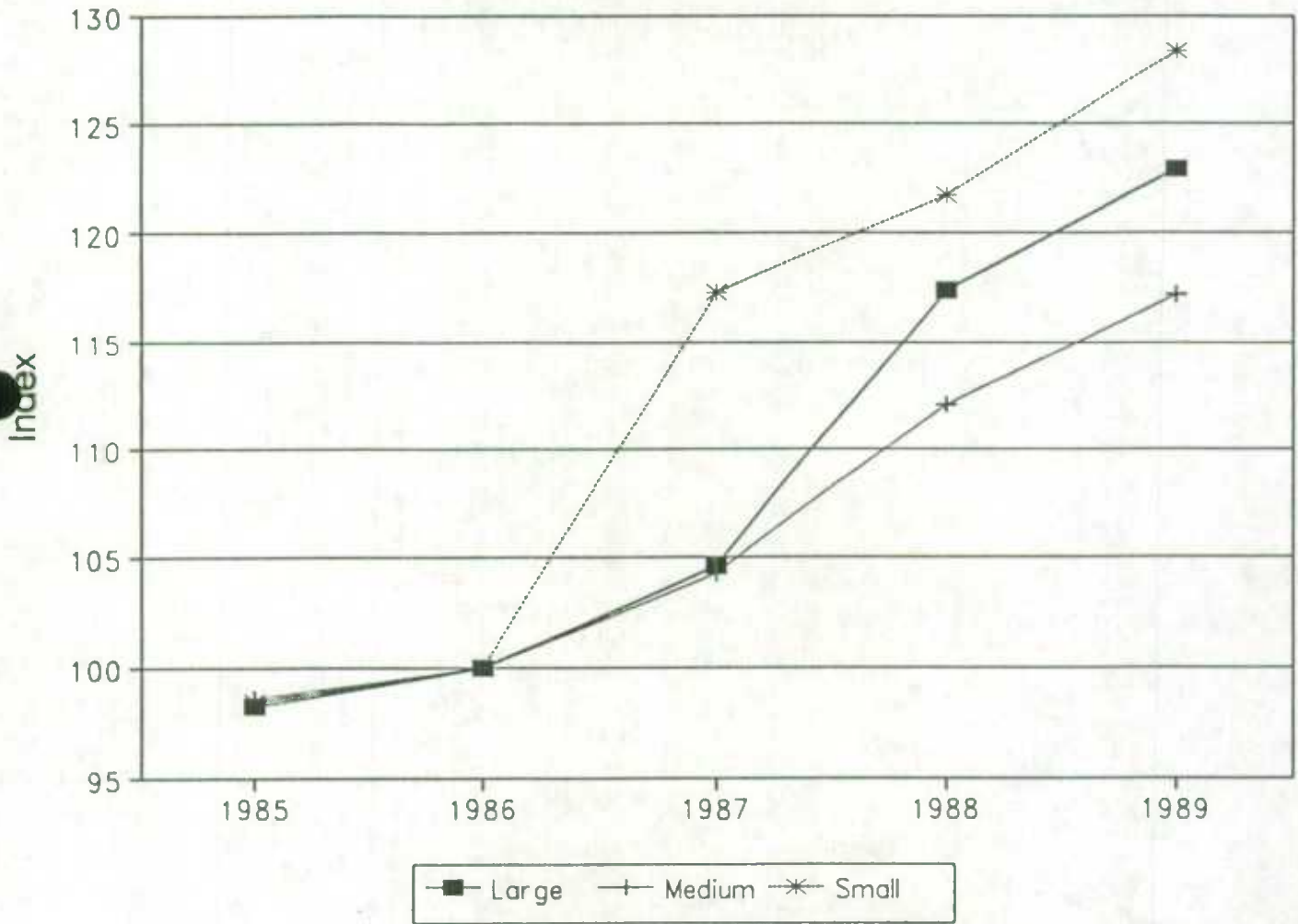
Food and Beverage Industries

Labour Productivity Index

	Large	Medium	Small
1985	100.75	106.45	94.76
1986	100.00	100.00	100.00
1987	99.75	99.68	98.56
1988	96.20	105.60	97.70
1989	102.00	103.70	99.92

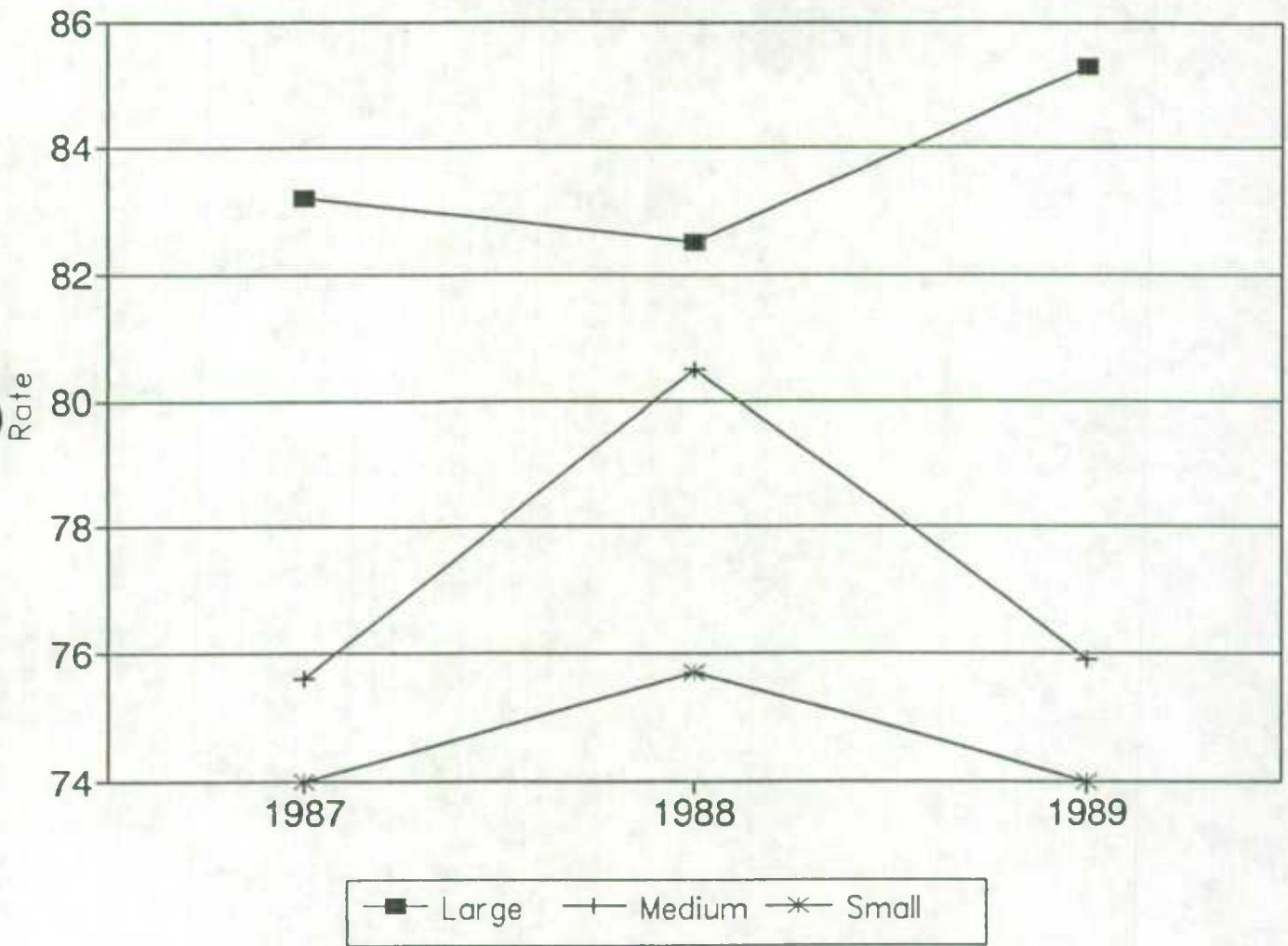
Graph 8

Food and Beverage Industry Unit Labour Cost

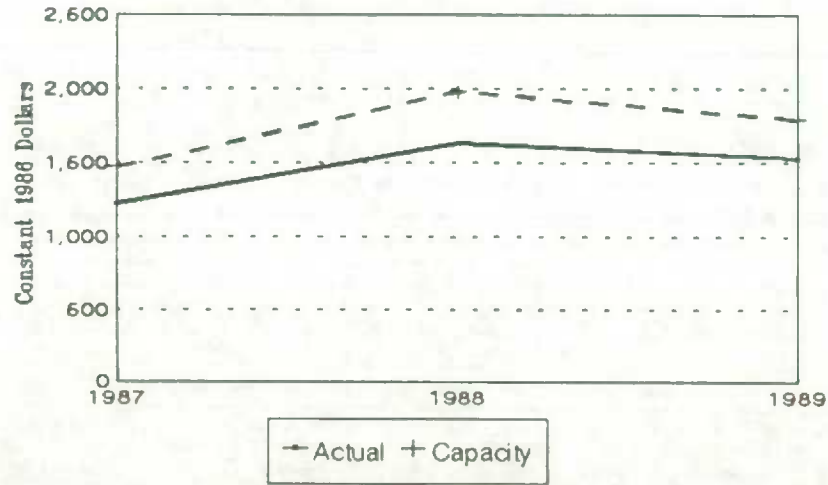


Graph 9

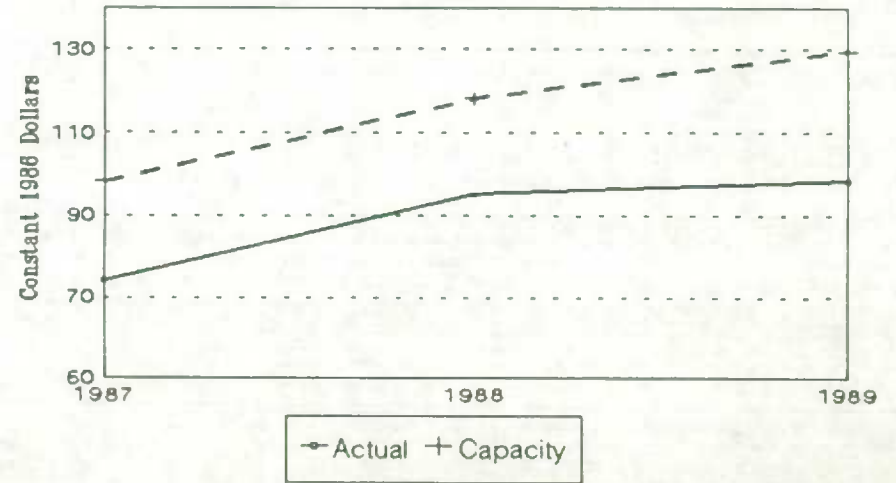
Transportation Equipment Manufacturing Capacity Utilization Rate



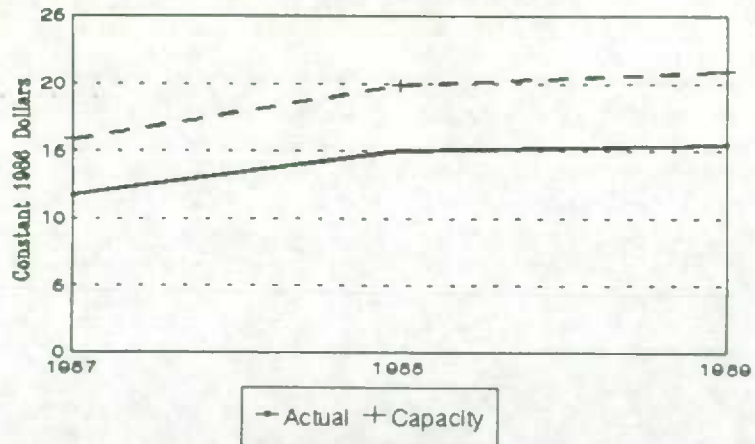
Large Establishments



Medium Establishments



Small Establishments

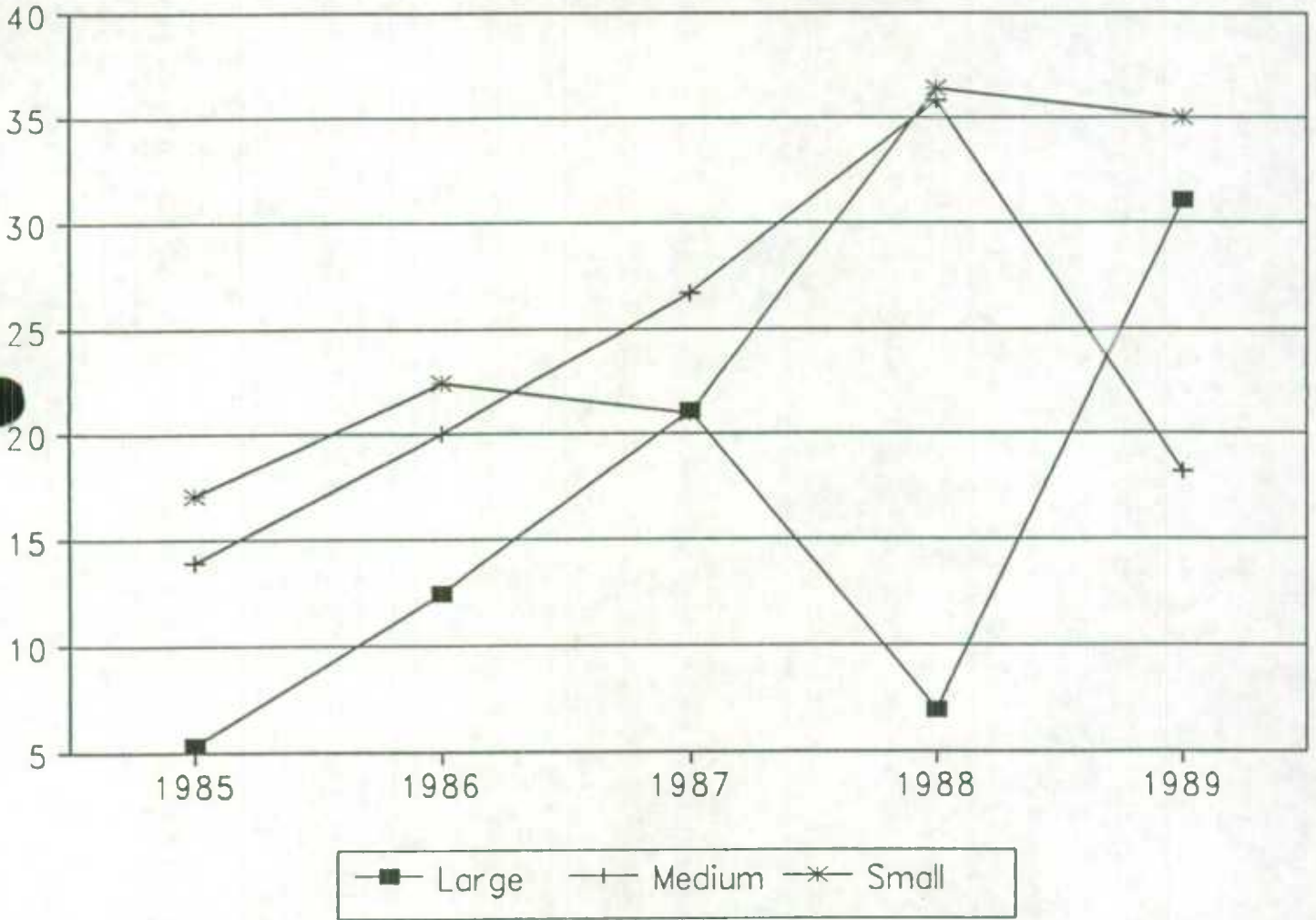


Transportation Equipment Manufacturers

Actual vs Capacity Production

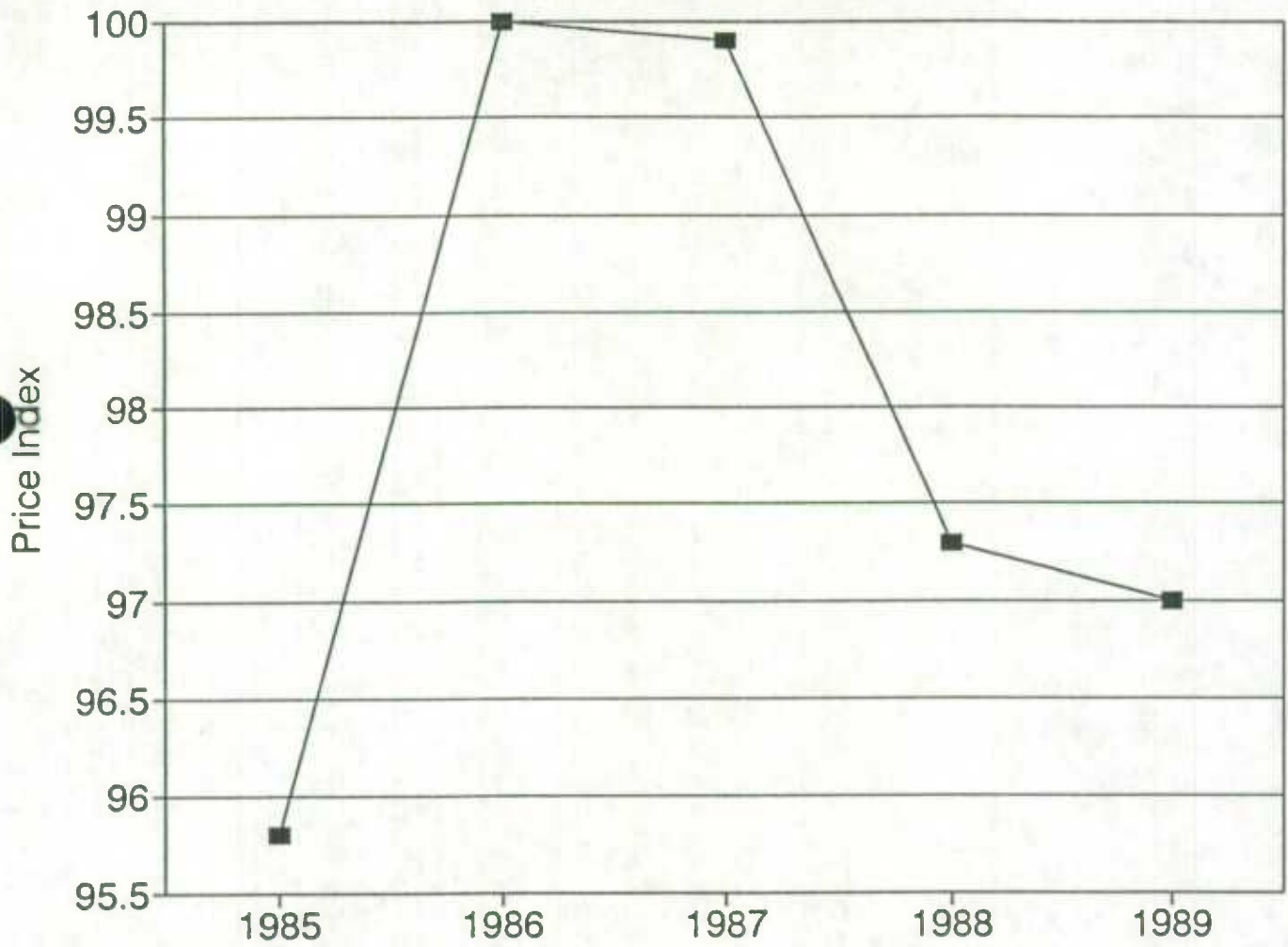
Graph 11

Transportation Equipment Manufacturing Computer Assisted Process M&E Share



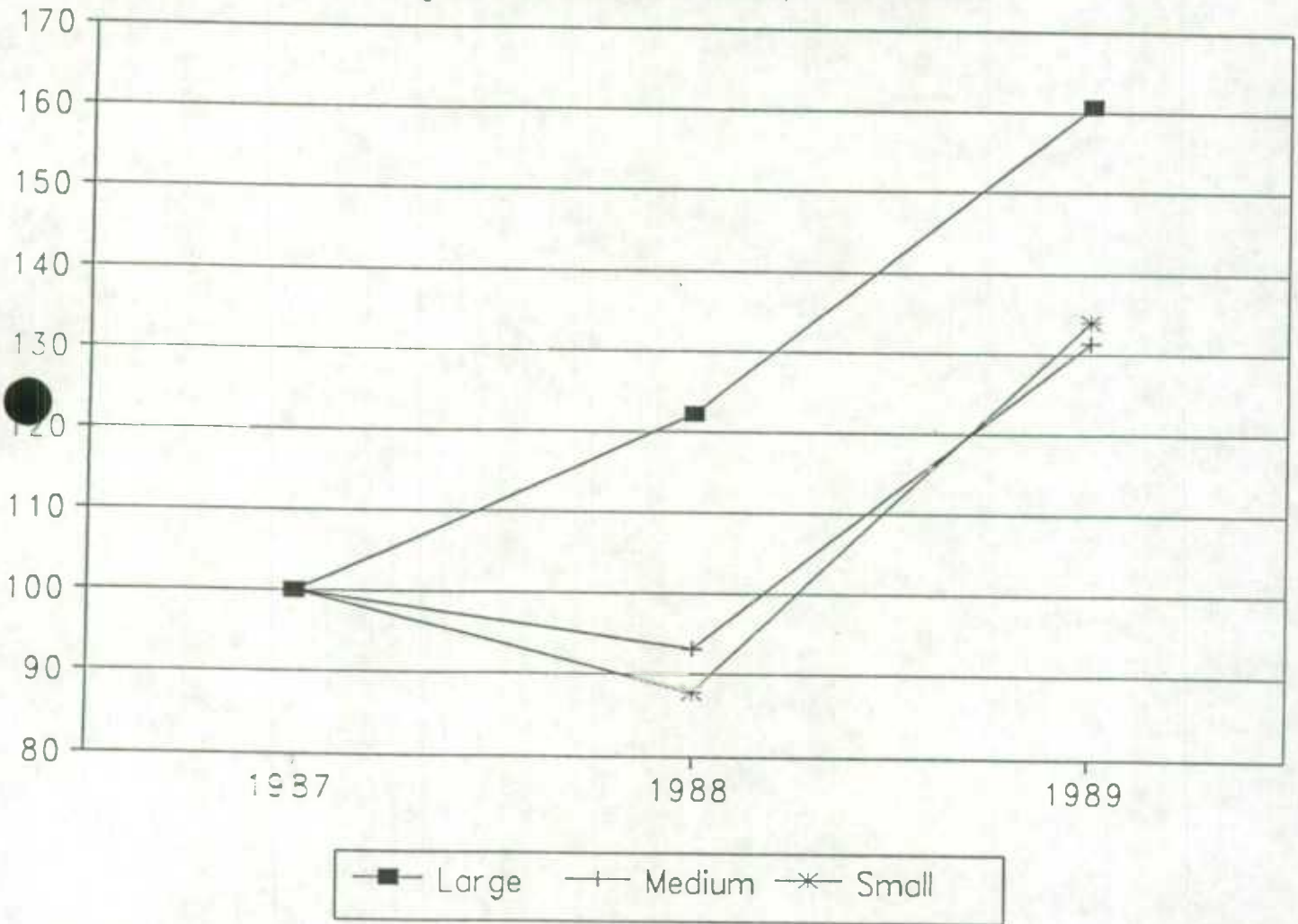
Graph 12

Transportation Equipment Manufacturing
Industry Selling Price



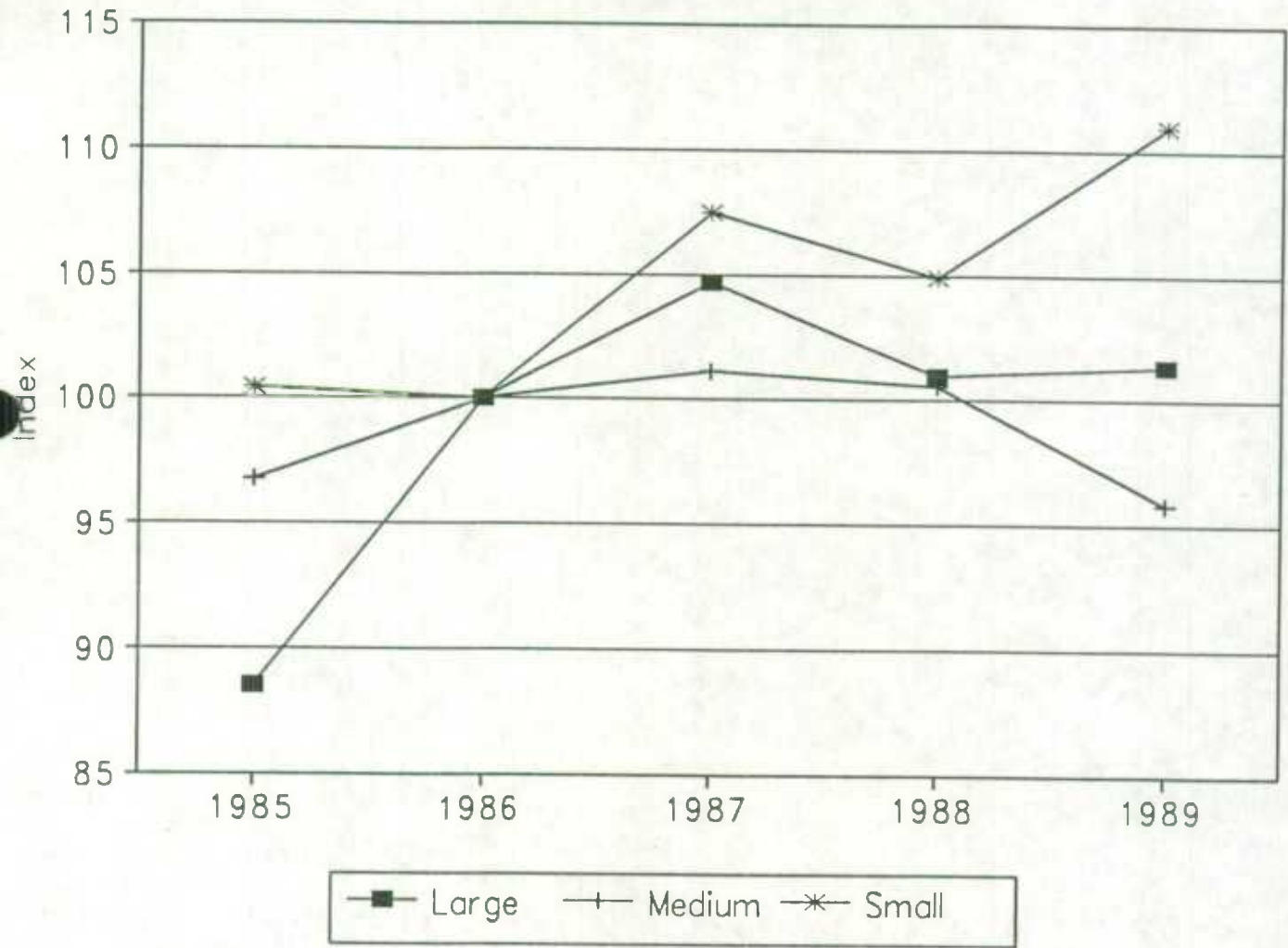
Graph 13

Transportation Equipment Manufacturing
Capital-Labour Ratio Index, 1987=100



Graph 14

Transportation Equipment Manufacturing Unit Labour Cost



005

STATISTICS CANADA LIBRARY
BIBLIOTHÈQUE STATISTIQUE CANADA



1010142460

