CYCLICAL ADJUSTMENTS IN WAGES, EMPLOYMENT AND HOURS WORKED IN THE ERIE ECONOMY

James A. Kurre

ECONOMIC RESEARCH INSTITUTE OF ERIE

TECHNICAL REPORT NUMBER 6

April, 1987

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PREFACE

The Purpose of Penn State-Behrend's Economic Research Institute of Erie is to collect, analyze, interpret and disseminate data and information on the Erie regional (County) economy. Research results are published and distributed in two forms: Institute Executive Summaries and Institute Technical Reports. The former are concise summaries of research results intended for general distribution. The latter are detailed technical publications describing the analytical techniques and statistical results underlying the conclusions reported in the Executive Summaries. Copies of Institute Technical Reports are available to the general public at a nominal cost of $5.00 each to cover the cost of duplication and mailing.

The preparation of this technical report was made possible through the support and cooperation of several individuals and groups both within and outside the University. Financial support for the establishment of the Institute was, and continues to be, provided in part by a grant from the Manufacturer's Association of Northwest Pennsylvania. The Institute's Advisory Board and Executive Committee assisted and continue to assist in the evaluation of Institute research proposals and reports. Lois Bird, Regional Labor Market Analyst, Pennsylvania Department of Labor and Industry, continues to provide valuable advice in addition to detailed local labor market data.

The University provides staff salaries as well as research facilities including state of the art computer hardware and software, and library and travel support.

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EXECUTIVE SUMMARY

CYCLICAL ADJUSTMENTS IN WAGES, EMPLOYMENT AND HOURS WORKED IN THE ERIE ECONOMY

James A. Kurre

ECONOMIC RESEARCH INSTITUTE OF ERIE
TECHNICAL REPORT NUMBER 6

APRIL, 1987

Previous work by the Economic Research Institute of Erie has examined the response of the Erie county economy to national business cycles, and has dealt with the timing and severity of Erie's cycles compared with those of the nation. These previous studies have focused on employment changes and ignored other ways that firms could respond to cyclical fluctuations in demand.

When demand for a firm's product falls as the result of a slowdown in the economy, the firm will typically reduce its rate of production. It faces three possible ways to reduce its labor costs during this period: by laying workers off, by reducing the hours worked per week, or by reducing the wage paid. Economic theory is not clear as to which of these responses a firm will choose, and research done in other parts of the country has found that some industries adjust to cyclical fluctuations by altering hours worked per week and/or wage rates, as well as employment.

How this adjustment occurs is important because it implies that looking at the unemployment rate alone as a measure of the region's economic distress is insufficient. If employment stays high but most workers are working very short weeks or for reduced wages, their incomes are significantly lower than usual and the region will be experiencing harder times than the unemployment rate suggests. Of course, it is also possible that hours and wages rise faster than employment during upturns, and that the region's economy is improving at a more rapid pace than the unemployment rate indicates.

The purpose of this Report, then, is to examine the reactions of Erie county firms to cyclical economic slowdowns. The analysis is based on monthly observations on employment, hours worked per week, and earnings per hour since 1960 in Erie county for the aggregate of all manufacturing industries, the durables and nondurables subcategories of manufacturing, and four separate industries. In each case, a trend line is fitted to the series and percentage deviations from the trend line are plotted and analyzed.

The most significant single result of the study is that employment fluctuations <u>are</u> the key adjustment mechanism in the Erie economy for most, but not all industries. Local manufacturers tend to respond to cyclical fluctuations in demand more by hiring and firing than by altering hours worked per week. This implies that a focus on employment statistics is not misplaced, at least for most industries.

This is not to suggest that no adjustments were made in hours worked per week. It was typically the case, however, that adjustments in hours worked tended to reinforce adjustments in employment, rather than offset them. In other words, firms react to a decrease in demand by <u>both</u> cutting hours and laying workers off. However, changes in hours worked tended to precede employment changes somewhat, so the typical reaction of Erie manufacturing firms to an increase in demand seems to be one of first increasing hours worked per week, and then hiring more employees. Likewise, when demand falls hours are cut first, then jobs.

While these patterns were typical, they did not hold in every single case. In the paper and printing industry, fluctuations in hours were about as important as fluctuations in employment. In the food processing industry in the late 60's, hours worked per week increased while employment declined, a clear deviation from the usual pattern. Hours and employment fluctuations did not tend to go hand-in-hand in the rubber and plastics industry, either. These exceptions imply that the relationship between hours and employment changes should be examined on an industry-by-industry basis before using employment statistics as a measure of the situation in individual industries.

Finally, this study found no clear evidence of wage adjustments as a response to cyclical changes in demand. Average hourly earnings showed virtually no evidence of cyclical fluctuations, but rather tended to increase steadily over the study period. This result is, of course, unsurprising given labor resistance to reductions in wages.

An overall conclusion to be drawn from this work is that employment and unemployment statistics are generally trustable as measures of the Erie economy's wellbeing. In some individual industries, it would be wise to also look at hours worked per week, however.

CYCLICAL ADJUSTMENTS IN WAGES, EMPLOYMENT AND HOURS WORKED IN THE ERIE ECONOMY

I. INTRODUCTION

Previous work by the Economic Research Institute of Erie (Weller (1983 and 1985), and Kurre and Weller (1985)) has examined the response of the Erie county economy to national business cycles, and has dealt with the timing and severity of Erie's cycles compared with those of the nation. These previous studies have focused on employment changes and ignored other ways that firms could respond to cyclical fluctuations in demand.

When demand for a firm's product falls as the result of a slowdown in the economy, the firm will typically reduce its rate of production. It faces three possible ways to reduce its labor costs during this period: by laying workers off, by reducing the number of hours worked per week by an average worker, or by reducing the wage paid. Economic theory is not clear as to which of these responses a firm will choose, and research done in other parts of the country has found that some industries adjust to cyclical fluctuations by altering hours worked per week and/or wage rates, as well as employment. (Clark, (1983a) and (1983b).)

Knowing how regional firms react to cyclical fluctuations will assist in understanding the dynamics of the local economy. Moreover, the form which such cyclical adjustments take is important because it implies that looking at the unemployment rate alone as a measure of the region's economic distress may not be sufficient. If employment stays high but most workers are working

very short weeks or for reduced wages, their incomes are significantly lower than usual and the region will be experiencing harder times than the unemployment rate suggests. Of course, it is also possible that hours and wages rise faster than employment during upturns, and that the region's economy is improving at a more rapid pace than the unemployment rate indicates.

The purpose of this Technical Report, then, is to examine the reactions of Erie county firms to cyclical economic fluctuations. The analysis is based on monthly observations on employment, hours worked per week, and earnings per hour since 1960 in Erie county for the aggregate of all manufacturing industries, the durables and nondurables subcategories of manufacturing, and four separate industries. In each case, a trend line is fitted to the series and percentage deviations from the trend line are plotted and analyzed.

II. DATA: SOURCES AND DEFINITIONS

Consistent data series on employment, hours worked and average hourly earnings were available for selected Erie manufacturing industries on a monthly basis, from 1960. The data were collected by the Office of Employment Security (OES) of the Pennsylvania Department of Labor and Industry as part of the establishment survey program of the Bureau of Labor Statistics. The Erie data were made available to ERIE by the Erie Office of the OES.

Consistent series were available for three two-digit Standard Industrial Classification (SIC) industries (SIC 20, food processing; SIC 25, furniture and fixtures; and SIC 30, rubber and miscellaneous plastics), one combination of two such industries (SICs 26 and 27, paper and printing), and the overall industrial

categories of manufacturing durables, manufacturing nondurables, and all manufacturing. Unfortunately, hours worked and earnings data are not published for nonmanufacturing industries in the Erie area. While employment data are available for a much broader range of industries for Erie, and wage and hours data are available for other manufacturing industries for part of the study period, this report will only deal with industries for which employment, hours worked and wage data are all available for the whole period.

Since the goal of this work is to compare adjustments in all three of those variables, it is desirable that the three series be compatible. While all of the series used in this study come from the same source, they are not perfectly comparable. Although the employment series include salaried workers, the data on hours worked and average hourly earnings cover only production and related workers.

It should also be pointed out that a worker's "average hourly earnings" are not the same as his or her contractual wage rate. Average hourly earnings, as measured here, reflect not only the basic hourly wage rate but also overtime and late-shift premiums as well as incentives based on output. The hourly earnings series reflect gross pay, before any deductions, but do not include the value of fringe benefits provided by the employer. While the term "wage" will be used in this paper for purposes of discussion, it is actually average hourly earnings that will be analyzed.

The data cover the period from January, 1960 through December, 1984--a period which includes a number of business cycles. In previous research (Weller (1983) and (1985)) it was established that the Erie cycle varies somewhat from the national cycle.

Specifically, Erie employment tends to lead the national economy at peaks and lag at troughs, and Erie completely missed the national upturn that occurred in 1980-81. Given these differences from the national cycle, Erie peaks and troughs were used in the analysis rather than national reference dates. Each of the graphs to follow shows the Erie peak and trough dates as vertical reference lines labelled "P" for peak or "T" for trough.

III. ANALYSIS

The purpose of this study is to examine the extent to which Erie industries respond to cyclical fluctuations in demand by adjusting wages, hours worked and/or employment. In order to reduce the seasonal and random fluctuations and to stress cyclical variations in the data, each series was smoothed using a twelve-month moving average.[1]

To allow comparison of changes among them, the three variables had to be converted to similar units; changes of 600 jobs, 2.5 hours per week and $1.25 per hour are impossible to compare directly. This was accomplished by fitting a trend line to each series and then measuring each series' percentage deviations from the trend values. Figures 1, 2, and 3 show the data for manufacturing employment, hours, and wages along with the trend lines that were fitted to each series. As can be seen, linear trend lines were used for the hours worked and employment series. Inspection of the wage series indicated that a nonlinear (quadratic) trend line was more appropriate for those series, however.[2] The percentage deviations of each series' monthly values from these trend values will be the focus of the analysis below.

FIGURE 1
ERIE MANUFACTURING EMPLOYMENT

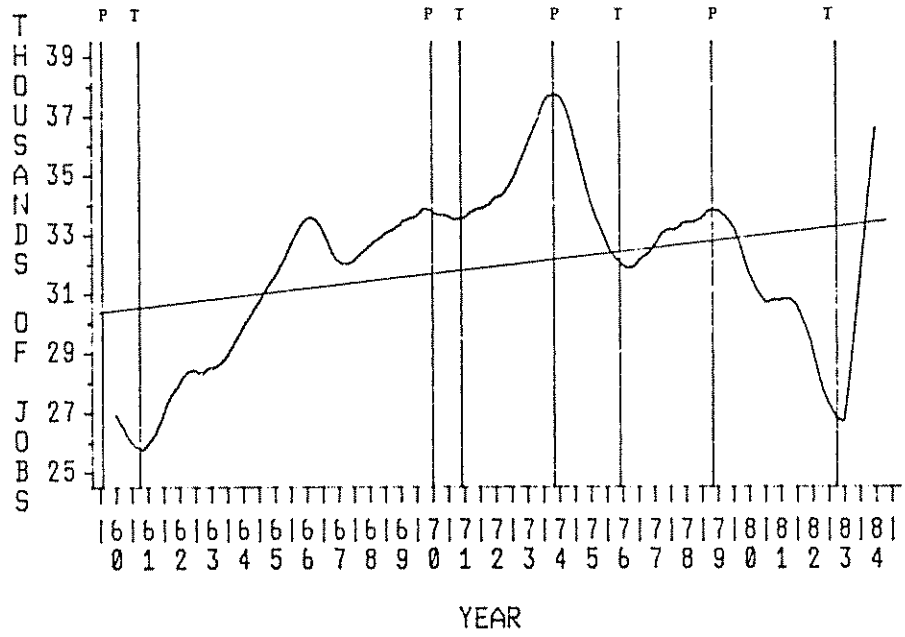


FIGURE 2
ERIE MANUFACTURING HOURS

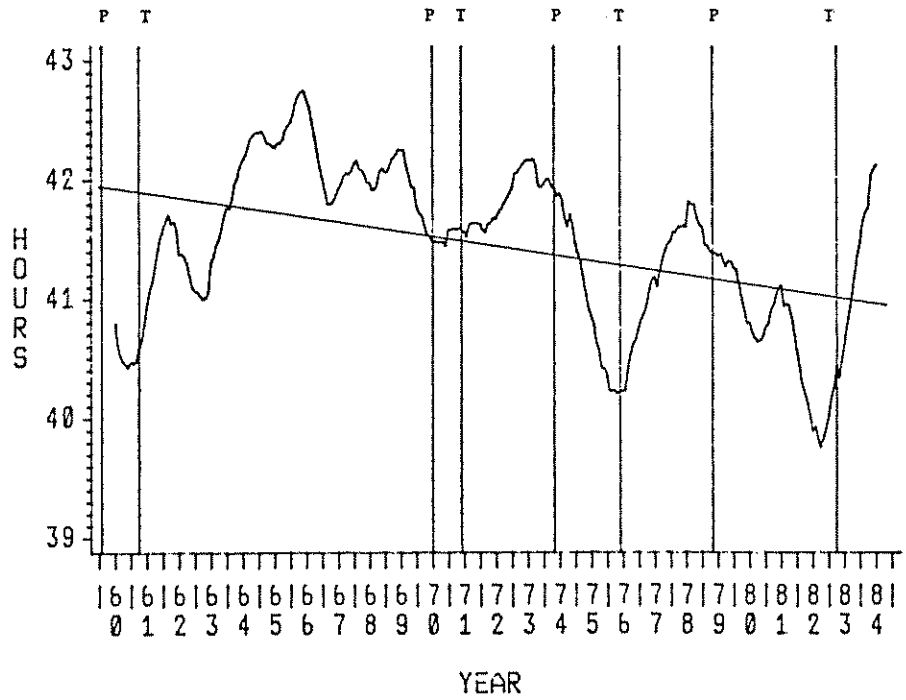
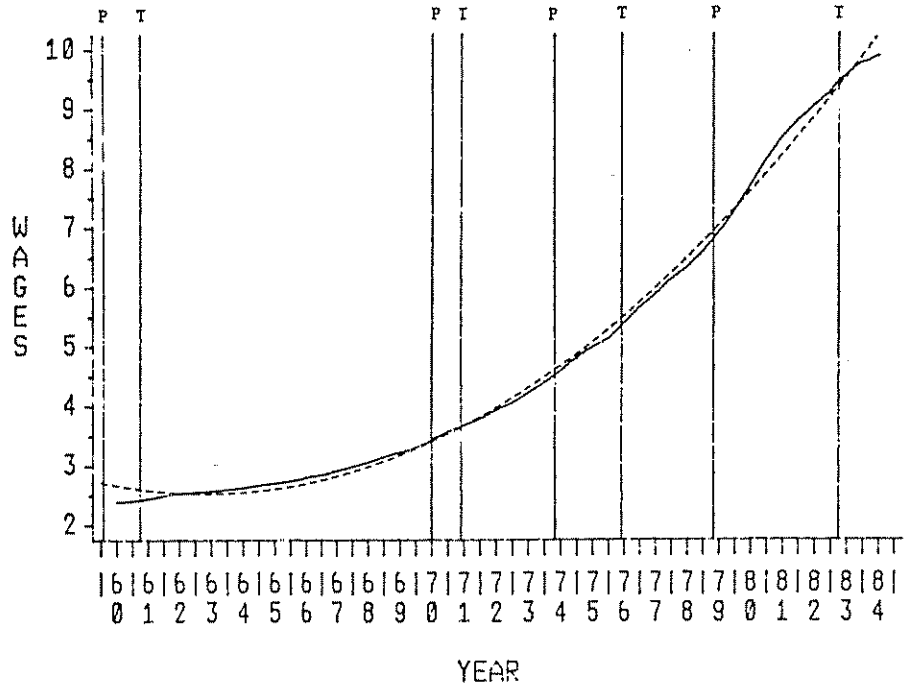


FIGURE 3
ERIE MANUFACTURING WAGES



SOLID LINE = WAGE DATA DASHED LINE = QUADRATIC TREND

Table 1 presents descriptive statistics for each series' percentage deviations from trend. The table shows that manufacturing employment varied from 19.82% below its trend value to 17.34% above it. The standard deviation values tell how far the data values were from their trend values, on average, with a higher standard deviation meaning greater fluctuations from trend values. Thus, the 10.18 standard deviation for durables employment shows that employment in this industry category deviated significantly more from its trend values than did employment in the nondurables category. Interpretation of the data in Table 1 will be facilitated if graphs of the data series are considered at the same time. This will be done in the following sections.

A. Analysis By Variable

The first approach to analyzing the data will be to consider a single variable (either employment, hours or wages) at a time, and examine its patterns across industries.

1) Employment

Figure 4 shows percentage deviations in employment from trend for the manufacturing, durables and nondurables categories. Several patterns emerge from this graph. Since durables accounted for nearly three-fourths of all manufacturing employment over the study period, it is unsurprising that the manufacturing series tracks the durables series quite closely. Moreover, nondurables employment tended to follow the same general time patterns as manufacturing, although not as closely.

Table 1

Descriptive Statistics for
Employment, Hours Worked and Wages

EMPLOYMENT

Industry	Percentage Deviations from a Linear Trend: Standard Deviation	Minimum	Maximum
All Manufacturing	8.43	-19.82	17.34
Durables	10.18	-25.09	20.42
25 Furniture & Fixtures	7.43	-11.59	17.77
Nondurables	5.20	-8.17	12.92
20 Food Processing	5.83	-13.11	12.53
26/27 Paper and Printing	2.70	-8.04	4.55
30 Rubber and Plastics	12.83	-23.06	24.17

HOURS WORKED

Industry	Percentage Deviations from a Linear Trend: Standard Deviation	Minimum	Maximum
All Manufacturing	1.46	-3.55	2.87
Durables	1.64	-4.10	3.19
25 Furniture & Fixtures	2.77	-5.12	6.10
Nondurables	1.58	-4.41	3.36
20 Food Processing	3.04	-5.45	10.25
26/27 Paper and Printing	2.67	-8.77	5.32
30 Rubber and Plastics	3.26	-8.84	9.05

AVERAGE HOURLY EARNINGS

Industry	Percentage Deviations from a Quadratic Trend: Standard Deviation	Minimum	Maximum
All Manufacturing	2.84	-10.19	4.02
Durables	2.87	-10.66	4.22
25 Furniture & Fixtures	3.00	-5.91	7.56
Nondurables	3.33	-10.40	4.96
20 Food Processing	3.45	-8.98	5.23
26/27 Paper and Printing	2.97	-9.49	4.05
30 Rubber and Plastics	5.72	-15.39	9.02

FIGURE 4

EMPLOYMENT: MFG, DURABLES, NONDURABLES

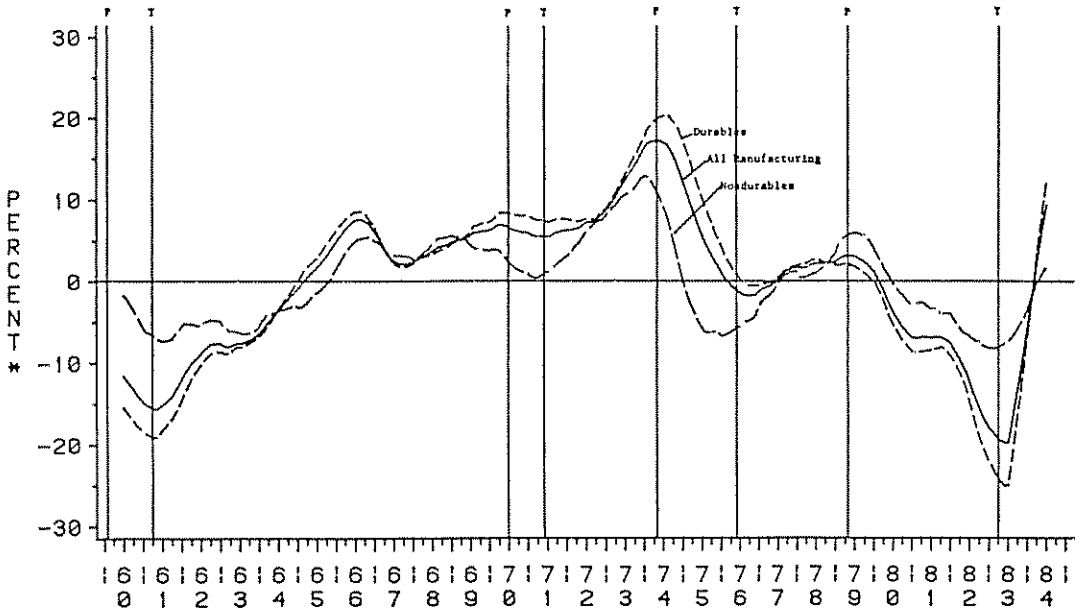
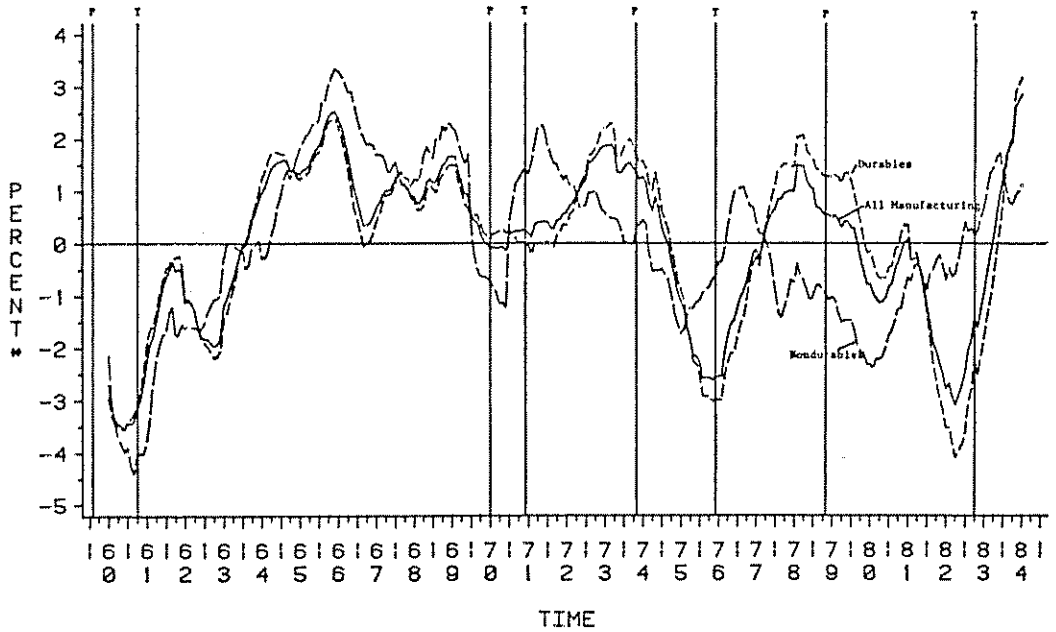


FIGURE 5

HOURS: MFG, DURABLES, NONDURABLES



MFG=SOLID LINE, DURABLES=SHORT DASHED LINE, NONDURABLES=LONG DASHED LINE
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM LINEAR TREND LINE

The graph shows that fluctuations in employment were more severe for durables than for nondurables. This is visual confirmation of the data in Table 1, which reports that the standard deviation of the durables series is nearly twice that of the nondurables series. The greater variability of the durables industry is unsurprising, since producers and consumers both find it easier to temporarily cut spending on durables (such as automobiles, washing machines, and capital equipment) when a recession comes, than on nondurables (like food and energy.) This difference was especially pronounced in the 1983 recession when nondurables reached a trough 8.2% below its trend, but durables employment fell over 25% below its trend. It will also be noticed that nondurables employment tended to lead all manufacturing and nondurables slightly at cyclical turning points during the late sixties through the mid-seventies.

2) Hours Worked per Week

Figure 5 shows the hours worked series for the same three industry categories. These series tended to fluctuate more frequently but less severely than employment. Notice that the scale on the vertical axis in Figure 5 ranges from -5 to +4, as opposed to the -30 to +30 range of the employment plot in Figure 4. Maximum fluctuations for hours worked were only three to four percent of trend values.

Hours worked tended to move with the business cycle, rising during upturns and falling during downturns, and they tended to lead peaks and troughs in the Erie cycle. However, hours in the durables and nondurables categories did not follow each other as

closely as did their employment patterns. In the early seventies and again in the early eighties, hours worked in the durables industries were moving in the opposite direction from those in the nondurables. Fluctuations in nondurables hours tended to be greater than those in durables in the early part of the study period, but this relationship has reversed itself since the mid-seventies.

3) Wages

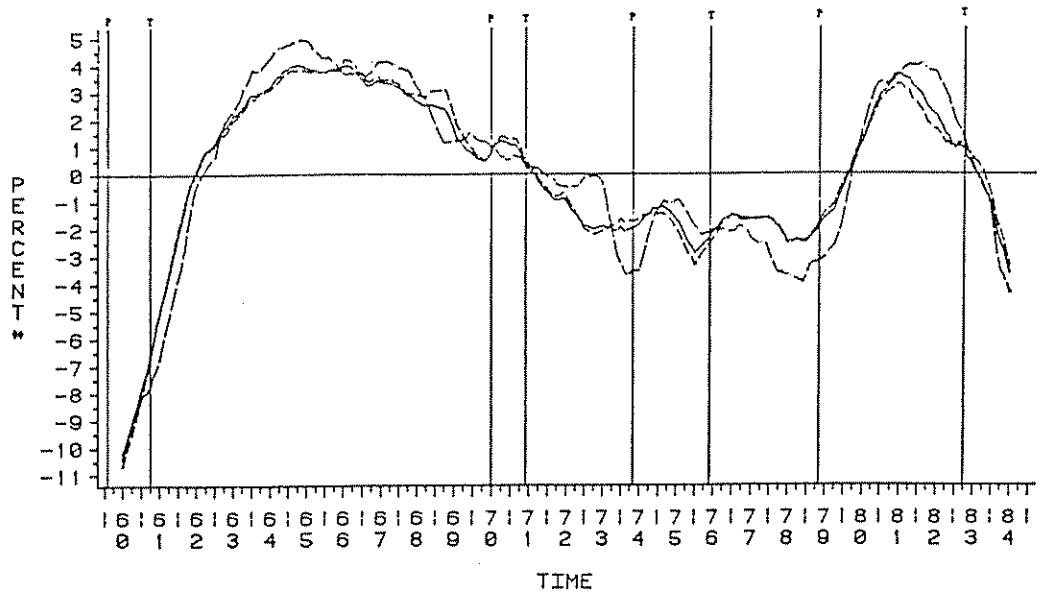
The wage series are presented in Figure 6. These series are the most problematical of the three sets of variables. While wages in both the durables and nondurables categories tended to move together, cyclical patterns are much less apparent overall. If anything, they tend to be slightly countercyclical rather than procyclical.

An examination of wage patterns for four separate industries in Figure 7 shows similar results. In three of the four cases, early values are far below trend values, and the series overall reflect the same patterns as the manufacturing, durables and nondurables categories in Figure 6. Wages in the furniture and fixtures industry, SIC 25, exhibit a quite different pattern, however. The graph shows that this series generally moved in an opposite direction from the others. This is confirmed by statistical analysis of the data, in which the SIC 25 wage series showed a strong negative correlation ($r = -.65$ to $-.82$) with each of the other wage series.[3]

It is not clear that any of the wage series show definite cyclical patterns, either pro- or countercyclical. This implies

FIGURE 6

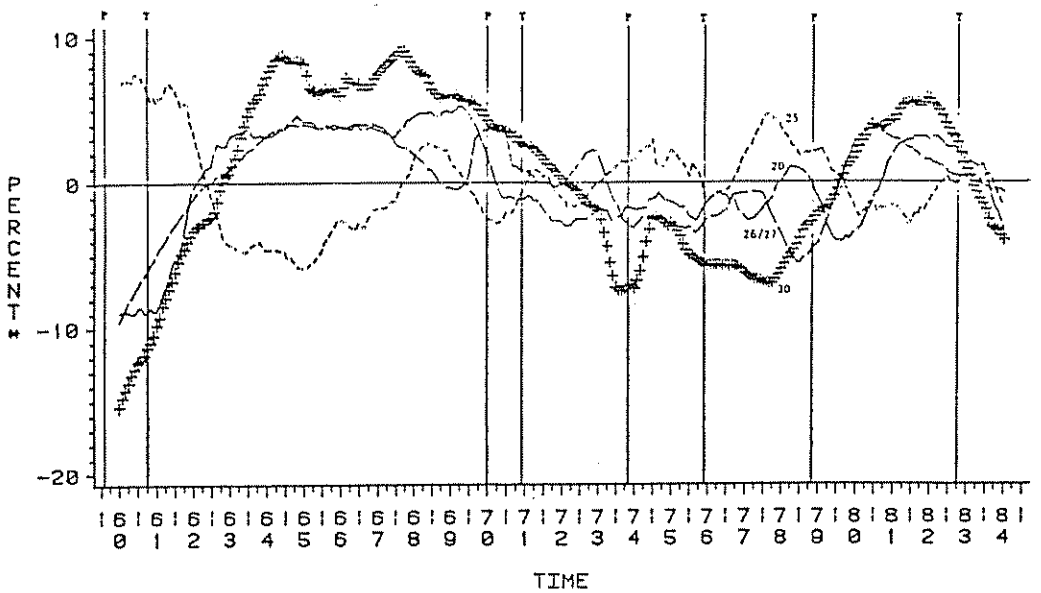
WAGES: MFG, DURABLES, NONDURABLES



MFG=SOLID LINE, DURABLES=SHORT DASHED LINE, NONDURABLES=LONG DASHED LINE
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM QUADRATIC TREND LINE

FIGURE 7

WAGES: SICS 20, 25, 26 & 27, 30



*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM QUADRATIC TREND LINE

that Erie manufacturers do not typically adjust wage levels in response to cyclical changes in demand. It is unsurprising that wage levels are not reduced during recessions, given labor resistance to wage cuts. However, the data do not show a tendency for wages to be increased more rapidly during cyclical upturns, either.

These results are similar to the findings in a major study by Clark, Gertler, and Whiteman (1986). Their examination of three manufacturing industries in eleven metro areas over the 1972-1980 period resulted in the conclusion that "...there were no significant deviations from the trend in response to phases of business conditions.... Short-run (wage) adjustment does not exist in the local labor market...." (p. 84) Thus, Erie manufacturers seem to follow "typical" patterns in their lack of cyclical wage adjustment.

B. Analysis By Industry

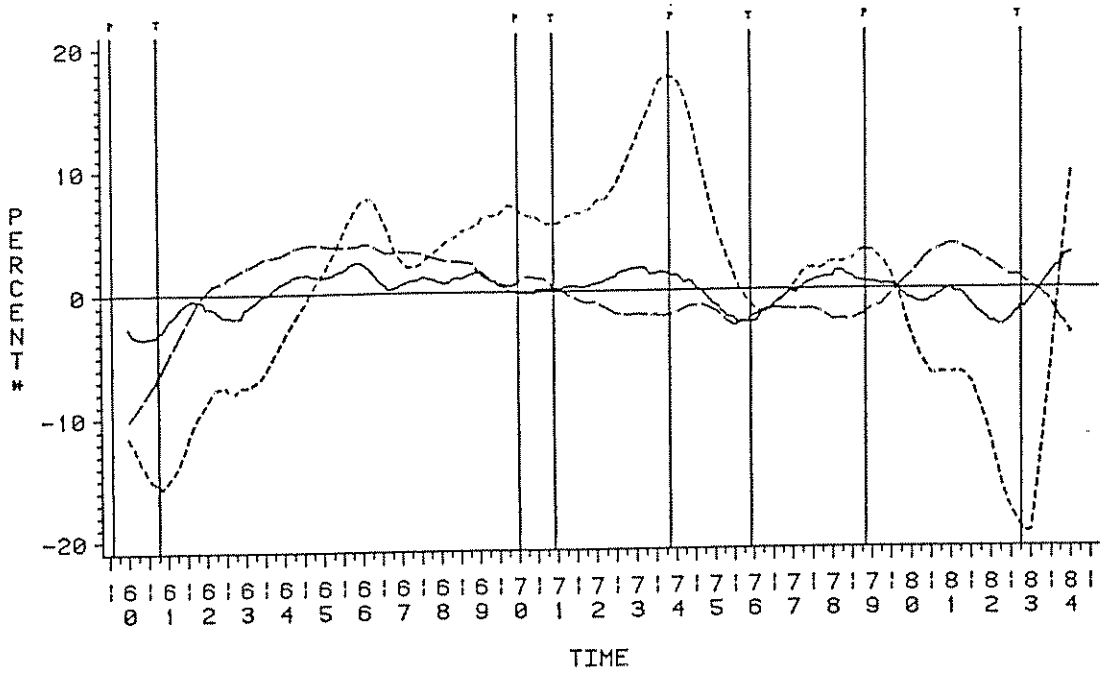
A different approach to the analysis is to consider how the three variables interact for an individual industry or industrial category.

1) All Manufacturing

Figure 8 presents data on all three variables for manufacturing industries overall. It is readily apparent that manufacturers in the Erie area adjusted to cyclical changes in demand primarily through hiring and firing, rather than wage or hour adjustments. While the hours worked series does show evidence of cyclicality, the variable fluctuated by a maximum of only 3.6%

FIGURE 8

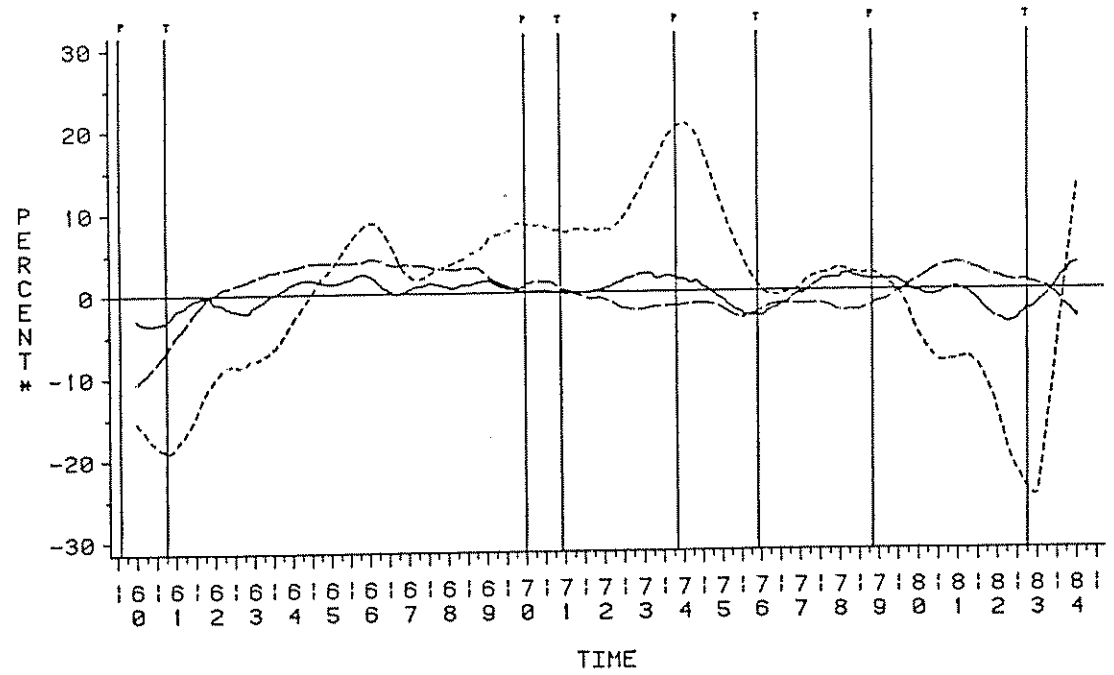
MANUFACTURING: WAGES, HOURS AND EMPT.



SOLID LINE=HOURS LONG DASH=WAGES SHORT DASH=EMPLOYMENT
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM TREND LINE.

FIGURE 9

DURABLES: WAGES, HOURS AND EMPT.



SOLID LINE=HOURS LONG DASH=WAGES SHORT DASH=EMPLOYMENT
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM TREND LINE.

from its trend value. Employment in manufacturing, on the other hand, varied from 17% above trend in 1974 to 20% below trend in 1983.

Changes in hours and employment tended to reinforce each other, having a positive correlation of .71. It can also be seen that hours worked appear to lead changes in employment at the turning points. In other words, firms tended to begin cutting average hours worked before they slowed hiring at the peaks, and began increasing hours before rehiring at troughs. As might be expected from the above analysis, the wage series does not show the cyclical pattern evident in the other two variables.

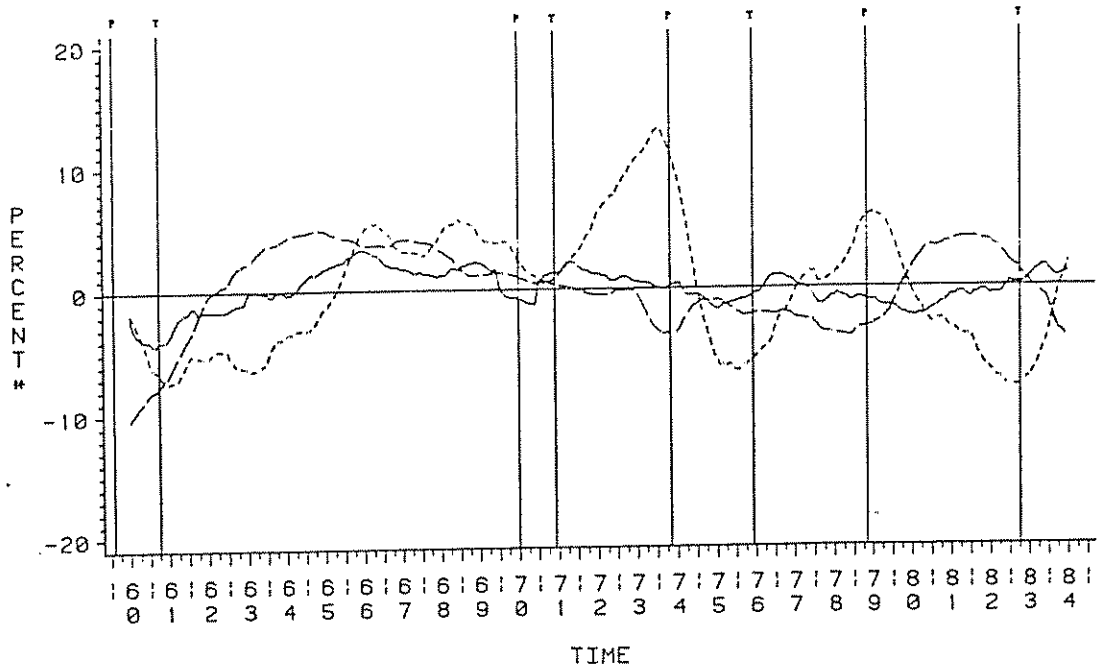
2) Durables

The patterns shown for durables in Figure 9 are very similar to those for all manufacturing. However, the fluctuations for all three variables were more severe for durables than for manufacturing overall, as might have been expected. Employment varied from 20% above trend to 25% below trend, and hours varied from 4.1% below trend to 3.2% above. Again, hours and employment fluctuations tended to reinforce each other, displaying a correlation of .68. Hours worked tended to lead employment changes for the durables industries also.

3) Nondurables

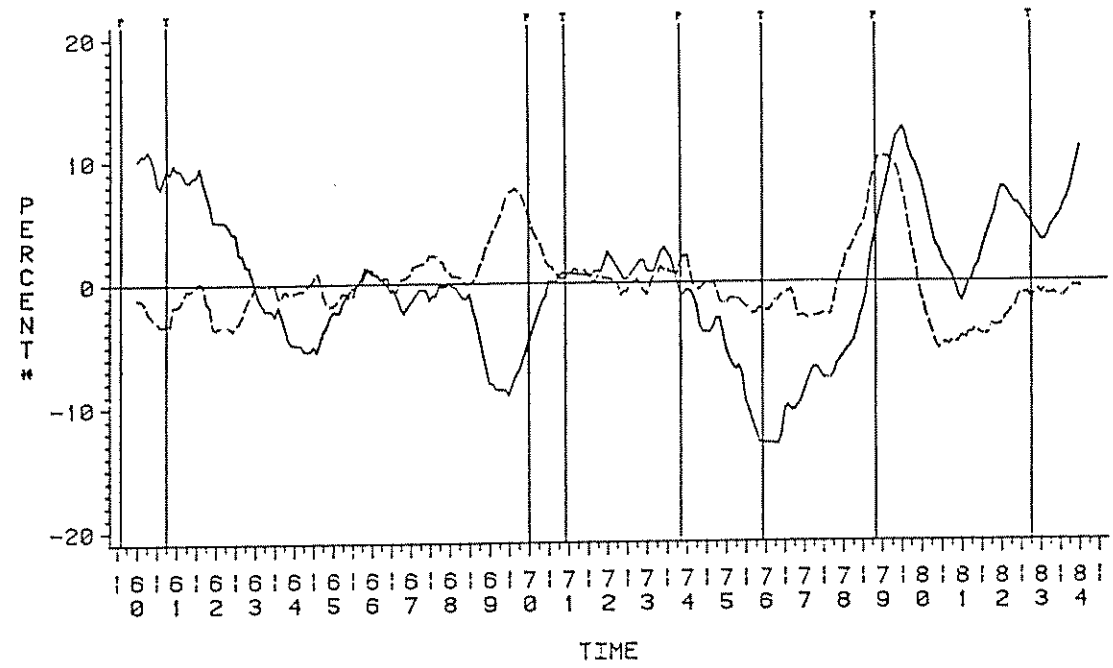
Figure 10 shows the patterns for nondurables. Again, employment fluctuations overshadow the other two variables. The correlation between hours and employment for nondurables is not as strong as for durables; the correlation coefficient has a value of

FIGURE 10
NONDURABLES: WAGES, HOURS AND EMPT.



SOLID LINE=HOURS LONG DASH=WAGES SHORT DASH=EMPLOYMENT
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM TREND LINE

FIGURE 11
EMPLOYMENT AND HOURS WORKED: SIC 20



EMPLOYMENT=SOLID LINE, HOURS WORKED=DASHED LINE
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM LINEAR TREND LINE

.44. Fluctuations in hours worked were less than in wages or employment. The standard deviations were 1.58 for hours, 3.33 for wages and 5.20 for employment. As mentioned above, it is unclear that the wage patterns represent cyclical adjustments, however.

4) Food Processing, SIC 20

For this industry as well as the other individual industries, only employment and hours patterns are examined due to the lack of cyclical fluctuations in the wage series.

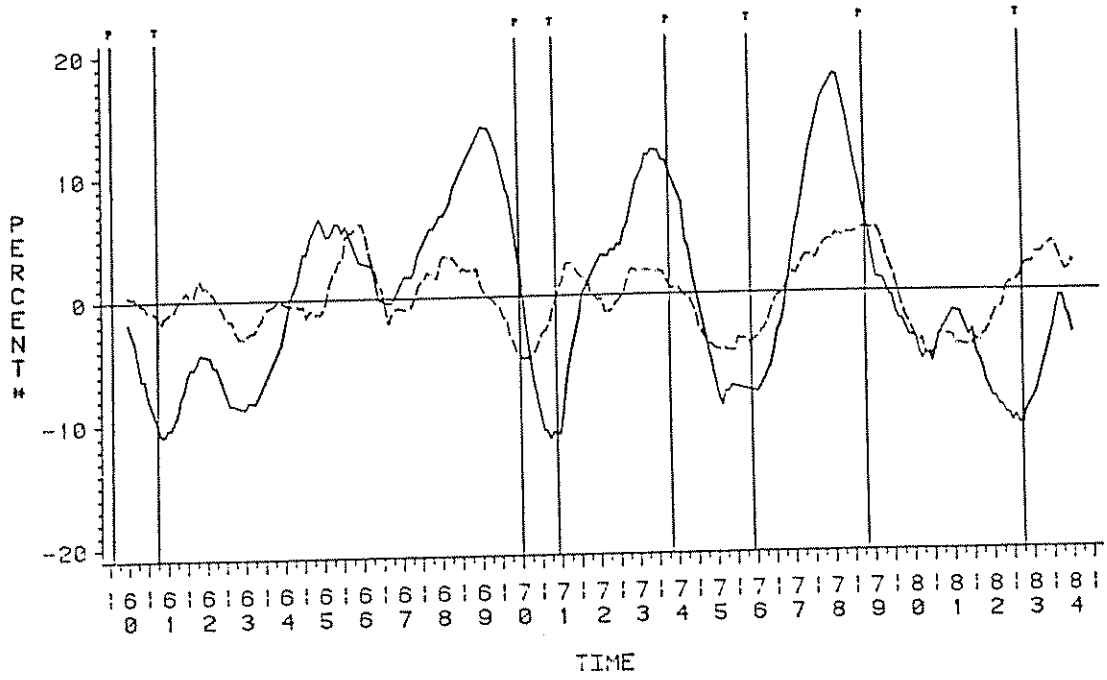
Figure 11 shows that hours and employment tended to move in opposite directions in the food processing industry until the early seventies, contrary to the general relationship seen thus far for these two series. The pattern for the period for 1969-71 is especially striking, since the two variables are virtually mirror images of each other. During this period, food processing firms apparently reduced employment but increased hours worked for those that remained employed. Such a policy might save employers the value of fringe benefits associated with extra workers, although it would result in overtime premiums when hours per week were greater than forty, as they were for the industry during this time.

Since the mid-seventies, hours and employment in this industry have tended to move in the same direction during cycles, although hours tended to lead the employment series.

5) Furniture and Fixtures, SIC 25

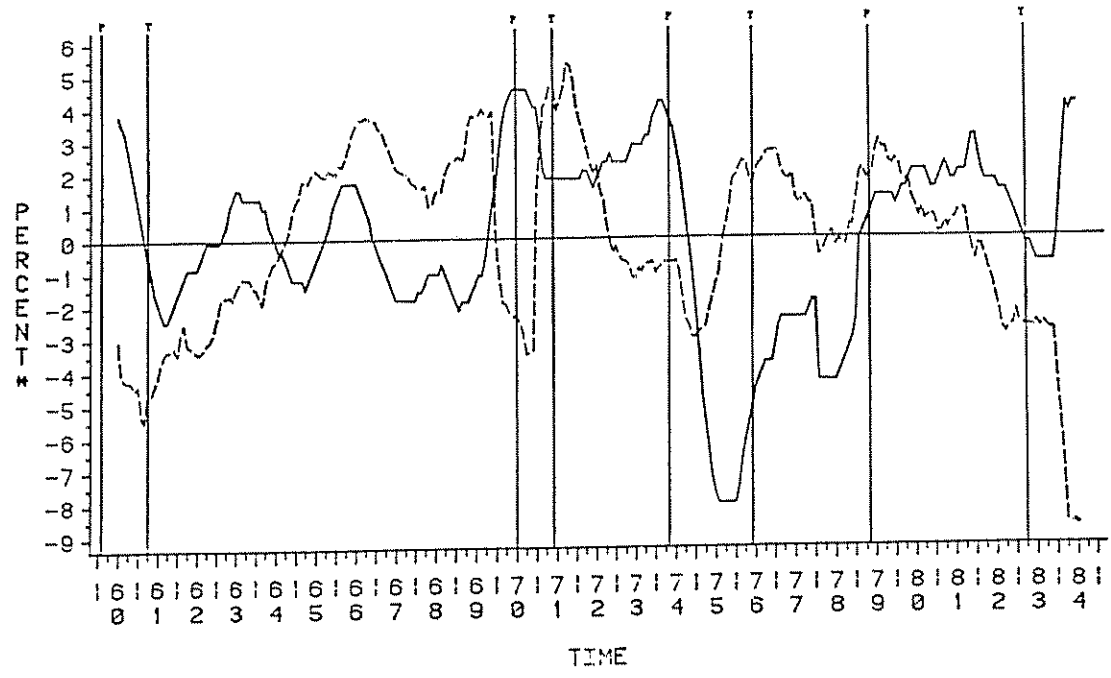
Hours and employment patterns in the furniture and fixtures industry are shown in Figure 12. The typical patterns appear here again. Hours worked and employment tend to fluctuate together;

FIGURE 12
EMPLOYMENT & HOURS: SIC 25



EMPLOYMENT=SOLID LINE, HOURS WORKED=DASHED LINE
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM LINEAR TREND LINE

FIGURE 13
EMPLOYMENT & HOURS: SICS 26–27



EMPLOYMENT=SOLID LINE, HOURS WORKED=DASHED LINE
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM LINEAR TREND LINE

their correlation coefficient was .53. Employment variations played the major role in this industry, also. The standard deviation of the employment series was 7.43 compared with 2.77 for the hours series. One remarkable aspect of the employment pattern in the furniture industry is that it tended to lead the Erie economy at peaks, although trough timing appears to be coincident with the cycle in employment. Perhaps this series could be useful in forecasting local recessions.

6) Paper and Printing, SICs 26 and 27

The paper and printing industry, shown in Figure 13, presents an exception to the general pattern in which employment fluctuations play the dominant role. In this industry, hours worked varied about as much as employment. This is not due to greater than average variability in the hours variable; its standard deviation was 2.67, comparable with that of the other detailed industries examined. Rather, the paper and printing industry exhibits a very stable employment pattern. Table 1 shows that this industry has the lowest standard deviation in employment of all industries considered, and the smallest minimum and maximum deviations from trend values. This confirms earlier work on employment data which found printing and publishing to be one of Erie's most stable industries, considering both manufacturing and nonmanufacturing industries. (Kurre and Weller, (1986))

The typical pattern of hours and employment varying together is not evident in this industry either. There was, in fact, a slight negative correlation (-.17) between them.

7) Rubber and Plastics, SIC 30

The rubber and plastics industry, shown in Figure 14, goes to the other extreme in terms of employment stability. It is the least stable of the industries examined in this study, although previous work indicates that other regional industries demonstrate even greater instability. It also exhibits the greatest instability in hours worked, with a standard deviation of 3.26 in Table 1.

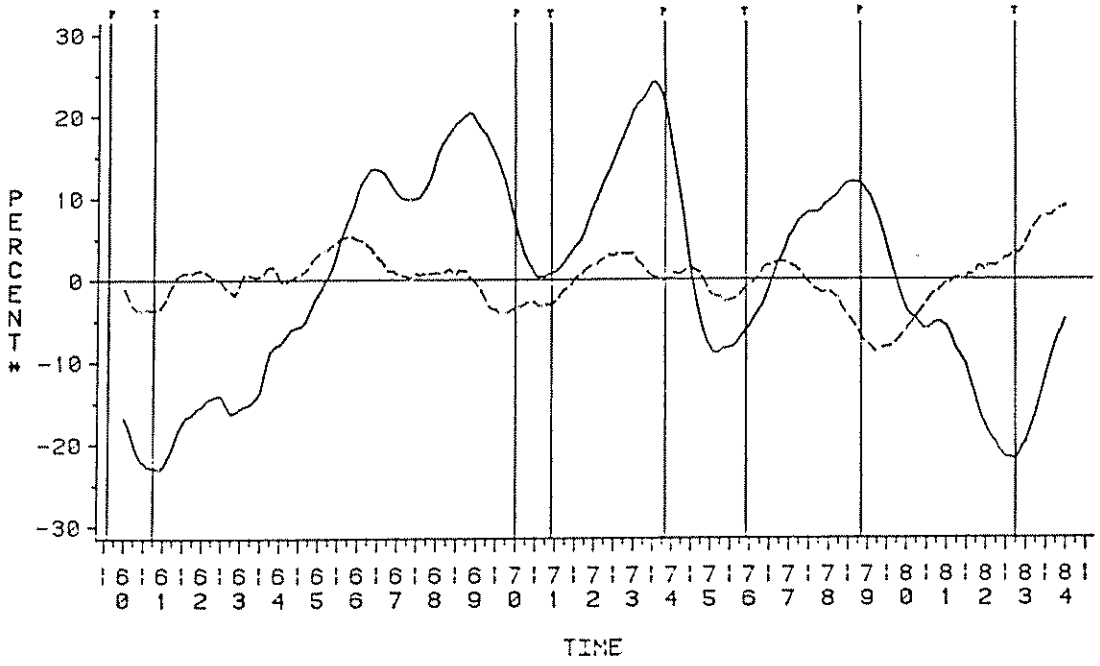
These two variables do not reinforce each other, however, in the rubber and plastics industry. Figure 14 does not show a clear pattern of similar upturns and downturns, and the correlation coefficient of the two variables is -.04. This suggests that while hours worked vary more in this industry than any of the others examined, cyclical factors are not the primary determinant of their fluctuations.

IV. CONCLUSIONS

The most important single result that arises from this study is that Erie manufacturers tend to respond to cyclical fluctuations in demand by hiring and firing, rather than by altering hours worked per week. Only one case was uncovered in which fluctuations in hours were of the same magnitude as fluctuations in employment.

It was typically the case that hours and employment fluctuations tended to move in the same direction. This implies that firms react to decreasing demand both by cutting hours and by laying workers off. Since changes in hours worked tended to lead employment changes, the typical reaction of Erie manufacturing firms to an increase in demand seems to be one of first increasing

FIGURE 14
EMPLOYMENT & HOURS: SIC 30



EMPLOYMENT=SOLID LINE, HOURS WORKED=DASHED LINE
*PERCENTAGE DEVIATIONS OF SMOOTHED SERIES (12-MONTH MA) FROM LINEAR TREND LINE

hours worked per week, and then hiring more employees. When demand falls; hours are cut first, then jobs.

While these patterns were typical, they did not hold in every single case. In the paper and printing industry, fluctuations in hours were about as important as fluctuations in employment. In the food processing industry in the late 60's, hours worked per week increased while employment declined, a clear deviation from the usual pattern. Hours and employment fluctuations did not tend to go hand-in-hand in the rubber and plastics industry, either. These exceptions imply that the relationship between hours and employment changes should be examined on an industry-by-industry basis before using employment statistics as a measure of the situation in individual industries.

Finally, this study found no clear evidence of wage adjustments as a response to cyclical changes in demand. Average hourly earnings showed virtually no evidence of cyclical fluctuations, but rather tended to increase steadily over the study period. This result is, of course, unsurprising given labor resistance to reductions in wages.

More generally, if the patterns discussed above also hold true for the nonmanufacturing industries that were not examined in this study, then the typical focus on employment and unemployment series is not misplaced. In other words, employment and unemployment statistics will be good indicators of the Erie economy's wellbeing. If the goal is to draw conclusions about conditions in some individual industries, however, it would be wise to also look at average hours worked per week in the industry.

ENDNOTES

[1] A twelve-month moving average smooths the spikes and valleys that occur in the data due to seasonal and random effects, by averaging the values over the period of a year. In other words, the data for January 1960 to December 1960 were averaged, and the result was considered the value for the middle of the period (July 1960). The same was done for February 1960 to January 1961, resulting in a value for August 1960, and so on. This process resulted in the loss of six data points at the beginning of each series, and five at the end. However, the pattern of cyclical fluctuations is highlighted by this process, and analysis of these cyclical patterns is the goal of the report.

[2] Linear, quadratic and cubic trend lines were fitted to each of the employment, hours and earnings series. For the employment series, quadratic trend lines tended to fit significantly better than linear trends, although cubic trends improved the fit only marginally. The percentage deviations from all three trend lines tended to be highly correlated, however, so the simplest (linear) trend fits were used. For the wage series, the quadratic trends fitted the data very closely, with an R^2 usually over .99, and the deviations from the quadratic (and cubic) fits showed quite different patterns from the linear fit's deviations. Because of this, the quadratic fits were used for the wage series.

Unfortunately, the hours series were not as nicely behaved as the employment and wage series. Increasing the degree of the polynomial tended to consistently increase the goodness of fit for these series. Of course, fitting a polynomial of high enough degree would allow a virtually perfect fit, but would completely miss the point of allowing measurement of deviations from trend. Given this, and the fact that the deviations from all three trend lines tended to vary together, it was decided to use the simplest--linear--trend lines for the hours variables.

[3] The correlation coefficient, as used in this study, measures the extent to which two series move together through time. The coefficient is usually designated by "r", and varies from -1 to +1. A correlation coefficient of +1 indicates a perfect correlation between the two series; each time one variable increases, so does the other. A correlation coefficient of -1 also indicates a perfect correlation, but in this case it indicates an inverse correlation; every time one variable increases, the other decreases. A value of zero indicates no relationship between the two series.

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