THE RELATIONSHIP OF EXTERNAL FACTORS, INTERNAL FACTORS, AND PRODUCTIVITY IMPROVEMENT PROGRAMS ON PRODUCTIVITY IN TWO APPAREL MANUFACTURING PLANTS

by

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(ABSTRACT)

This study examined three broad areas which related to plant level productivity in two apparel manufacturing plants. First, external factors, specifically unemployment and seasonal cycles, were examined. Second, internal organizational factors involving the size of the organization over time and the absenteeism rate within the company were studied. Finally, after holding constant the effects of the above factors, this study examined the impact of two types of positive incentive programs on employee productivity.

It was hypothesized that there would be a positive relationship between unemployment and plant productivity. Partial support was found in one plant. A relationship between productivity level and seasonal cycles was also hypothesized. Generally, season was related to productivity, although the patterns for these relationships were very plant specific. The hypothesis that there would be a negative relationship between productivity rate and absenteeism rate received support in one plant only.

It was further hypothesized that there would be a negative relationship between productivity level and size of the plant over time. The results for both plants were very different; however neither were in support of the hypothesis in the predicted direction.

To evaluate the impact of the two productivity improvement programs, mean differences (adjusted for covariates and autocorrelation) were compared for three time periods: before, during, and after program implementation. In the Salem plant the time periods before and during the program had significantly higher productivity rates when compared to the period after the program ended. In the Jefferson plant the productivity level was slightly higher during program implementation when compared to the time period before the program. No other significant differences were found.

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I. INTRODUCTION

NATURE OF THE PROBLEM

Productivity decline in the United States is a disturbing trend which effects not only the apparel industry but the nation as well. Decline in productivity has contributed significantly to inflation, unemployment, diminished corporate profits, and it has lowered the value of the American dollar (Shetty, 1982). In addition, the United States, traditionally in a strong position in the international market, is increasingly being challenged by other countries (Stanton, 1983). Consumers are displaying a growing dissatisfaction with product quality and price, and many American products are being underpriced by foreign competitors both in the U.S. and overseas.

There are numerous reasons why the U.S. is having difficulty competing with foreign markets. First, the historical increase of productivity rates in the U.S. has slowed, while the gains of many other industrial nations have been increasing at a rapid rate (English & Marchione, 1983). The National Association of Manufacturers' published statistics which show that between 1973 and 1978, private-sector productivity expanded at an average annual rate of 3.5% in Japan, 4.7% in France, and 5% in West Germany, with the United States averaging only a 0.8% increase (English & Marchione, 1983).

Second, while our national productivity is on a downward trend, labor costs are continuing to rise. American employees have demanded, and usually received, higher wages and benefits in order to maintain or enhance their standard of living. Although the United States leads the industrial world in overall level of labor productivity (Freund, 1981), the rate of increase in productivity in the U.S. has failed to keep pace with the average annual rate of increase in wages and other production expenses (Pinder, 1984).

Finally, although the United States has long been technologically superior to foreign competitors, this too is increasingly being challenged. The number of industries which threaten American businesses continues to grow; and now includes enterprises in which the U.S. has traditionally been the leader, such as steel, textiles, automobiles, footwear, and consumer electronics (Stanton, 1983). *Business Week* (1980), estimates that the decline of competitiveness by American industry in recent years equals 125 billion dollars in production loss, and approximately 2 million lost jobs (Stanton, 1983).

The apparel industry has especially been affected by foreign competition. This industry was hard hit by both the recession in 1981, and a rapid increase in the number of clothing imports. It is only just now beginning to make a comeback. To survive in the business market nearly all apparel and textile companies have invested heavily in automated factories, and have begun to pay more attention to efficiency within the plant (Industry Week, 1984). *Industry Week* (1984) reported annual productivity improvements of 5% or more as common. Some large companies, such as J.P. Stevens, Inc., are diversifying into other lines, such as home-furnishings (Prince, 1983). Other companies are expanding their interests to exporting more of their products. Apparel exports from the U.S. has jumped from $677 million in 1978 to $3.6 billion in 1981 (Industry Week, 1984).

Even with these improvements, however, textile/apparel imports continue to flood the market, making it difficult for U.S. companies to compete. Imports increased by 18% during 1983 (Industry Week, 1984). Government controls have failed to hold back the number of imports, because foreign countries are exporting items which fall into non-regulated categories (American Textile Manufacturers Institute, 1984). The problem is exacerbated by those U.S. manufacturers who have had to move their production processes offshore and then send back the finished goods as imports. As Industry Week (1984) notes, no full recovery for U.S. companies is possible with this "unfair competition" abroad.

It is apparent that the decline in productivity has serious implications for both the nation's quality of life, and the profitability and survival of American industry. To attempt to reverse this alarming trend, two questions must first be considered in this chapter: 1) what do we mean by productivity?, and 2) why is the rate of increase in productivity declining?

Productivity can be defined and measured in a number of ways (Norman & Bahari, 1972). However, the simplest definition is an economic one - "the ratio of physical input to physical output" (English & Marchione, 1983). In managerial terms, it is measured by quantity of output employees accomplish on their job, divided by the amount of time spent on those jobs (for which they are paid wages and benefits) (Pinder, 1984). This output involves more criteria than just the number of units produced; it can involve quality, efficiency, effectiveness, attitudes, and creativity (English & Marchione, 1983).

A number of factors may contribute to a corporation's productivity level. Better work methods, advancement in machine technology, performance measurements, quality control, motivation, good management procedures, and innovative techniques may all influence productivity. Because productivity is a multi-dimensional concept, it is logical that there are many factors responsible for the decline in it's rate of increase. On a national level, government policies, unemployment levels, inflation, and rise in energy costs may all contribute to the problem of declining rates of productivity increases. Within the organization plant facilities, material prices and availability, technology, and human resources are all factors which influence productivity. Although all these elements may in part be responsible for the decline in increases in productivity, Shetty (1983) points out that the efficiency and innovativeness with which managers combine their resources largely determines the rate of productivity improvement.

Management theorists and practitioners are realizing it is the organization's management system and not government policies, labor supply, or availability of resources which is ultimately responsible for productivity improvement (Drucker, 1980; Gerstenberg, 1972; Weil, 1979). Therefore, to better understand the complex nature of productivity, and devise methods to increase it, three broad areas appear conducive to study. These include: 1) environmental factors external to the organization which relate to productivity; 2) organizational factors internal to the organization which relate to productivity; and 3) how programs can be designed in order to increase productivity within an organization.

First, environmental factors related to productivity are those elements not under the direct control of the organization. Some of these factors are related to the national economy, such as unemployment, inflation, and increased energy costs. Other factors deal with societal changes, such as differences in the labor workforce. Environmental elements, like weather conditions and seasonal cycles, may also relate to productivity levels of an organization.

Second, organizational factors related to productivity exist within the firm. Management's philosophy of short-term results, poor training programs, insufficient amount of research and development, and lack of awareness of productivity variables are some of the commonly cited reasons for productivity decline. Other factors which are internal to the organization include the absenteeism rate and change in size of the organization. Both of these could have an effect on productivity level.

The third area involves the design of positive incentive programs to increase an organization's productivity level. Incentive programs such as contests have long been used: (1) to motivate employees involved in sales; (2) to encourage consumers to buy products; and (3) to promote donations to charities (Scott, Markham & Robers, 1985). Companies are now beginning to recognize the value these types of programs have for increasing productivity (Dowling, 1973; Hammer & Hammer, 1976; Bourdon, 1977; Runnion, Johnson & McWhorter, 1978; Robers, 1982; Scott, Markham & Robers, 1985).

Many of these programs are based on positive managerial techniques, such as recognition, rewards, and incentives which are used to systematically reinforce desired behaviors (i.e., improved productivity). Whyte (1972) states that "positive reinforcers generally are more effective than negative reinforcers in the production and maintenance of behavior". Markham & Scott (1985) point out the advantages of using positive approaches for motivating employee behavior: 1) they place a preference on positive rewards; 2) they help direct the desired behavior; and 3) they do not create other negative outcomes associated with punishment.

PURPOSE AND SIGNIFICANCE OF STUDY

This research examines three broad areas which relate to plant level productivity. Two apparel manufacturing plants operated by the same corporation are studied. First, external factors, specifically unemployment and seasonal cycles, are examined. Second, internal organizational factors involving the change in size of the organization over time, and the absenteeism rate within the company are studied. The purpose of examining these areas is to try and better understand the phenomenon of productivity and what factors influence it. Third, this study will examine the effects of two types of positive incentive programs on employee productivity (Scott, Markham & Robers, 1985). The results will have important implications for the effectiveness of positive incentive programs used to increase worker's productivity.

SUMMARY

This chapter has identified the trend toward decreased productivity as serious and threatening at both the national and organizational level. The apparel industry has been particularly effected. Three areas will be examined: 1) external environmental factors related to productivity; 2) internal organizational factors related to productivity; and 3) programs designed to increase productivity. In the next chapter, theory and empirical research will be discussed to determine what effect environmental and organizational factors might have on productivity. Productivity improvement programs will be discussed in detail including: 1) the elements of a productivity improvement program; 2) the theory supporting these elements; and 3) empirical research that has evaluated productivity improvement programs. Chapter Three discusses the methodology employed in the study including the research location, subjects, research design, and method of data collection. The measures of unemployment, seasonal cycles, absenteeism rate, and size of the organization will be described, as well as several "control" variables which were operationalized. The elements of the two productivity improvement plans, along with the program implementation will then be explained. Finally, Chapter 3 will describe the method of analysis. The results of the study including summary statistics, and the hypotheses findings will be presented in Chapter Four. In Chapter Five, a discussion of findings will be presented, and the limitations of the study will be identified. Practical implications of the research for management will be examined along with recommendations for future research.

II. LITERATURE REVIEW

INTRODUCTION

This study will examine productivity from three perspectives: 1) its relationship with environmental factors; 2) its relationship with organizational factors; and 3) the effect positive productivity improvement programs have on an employees' productivity rate. The first two areas (environmental/organizational) are important to study in order to better understand the complex nature of productivity. If productivity is associated with certain environmental and organizational factors, then these elements should be considered when dealing with productivity improvement in an organization. The third area examines productivity improvement programs which use positive methods based on operant conditioning and goal-setting principles. The elements of these types of programs will be discussed including the supporting theory and relevant empirical research.

ENVIRONMENTAL FACTORS AND PRODUCTIVITY

Influences on productivity can be categorized into environmental and organizational factors. Environmental factors deal with those elements which are outside of the company's direct control. Some of these factors are related to the national economy, such as increased governmental regulations. Estimates place government regulations to be responsible for productivity loss which may account for up to two percent of the gross national product (Ross, 1981). Most industries agree that meeting government requirements can effect capital investments, slow down research and development, and prohibit the use of efficient production processes (Ross, 1981). Inflation, rising energy costs, and lack of federally sponsored productivity programs are other factors which may affect an organization's productivity level (Ross, 1981).

Other environmental elements which may influence productivity involves social changes, such as changes in the work force, and different social values and attitudes (i.e., work ethic). A popular belief among managers is that low productivity is due to these factors. However, although the work force composition has changed (i.e., more women, younger workers with less experience, and a shift to service workers), there has been no clear empirical evidence that a decline in the work ethic or a changing labor force is responsible for lower productivity (Ross, 1981).

There is a never-ending debate over the causes of and cures for productivity. Every interest group has their own set of factors which they believe to be responsible for productivity decline. For example, corporations lobby for relaxed government regulations so that more funds can be diverted to capital investment and plant improvements. The unions' position is that corporations export work to foreign countries with low labor rates rather than modernize U.S. plants. Wall Street states that eliminations of "phantom" capital gains, and the "double-tax" on dividends will provide more risk capital to industry (Ross, 1981).

It is obvious that there are a number of external factors which combine to effect a company's productivity level. Although these external factors are beyond the direct control of an organization, they should not be ignored when examining productivity. It is important to understand which factors are associated with productivity. When relationships are found, then managers must consider these correlating variables when analyzing the productivity level within their organization. Two factors appear conducive to study: unemployment rate and seasonal cycles.

The relationship between unemployment rates and plant-level productivity has not been studied, yet logic indicates that there may be a relationship. As the threat of unemployment increases people may tend to work harder and faster thus increasing the organizations productivity level. Research involving productivity and absenteeism has been conducted, and the results have indicated a negative relationship between absenteeism rate and unemployment (Markham, 1985; Leigh, 1985). Therefore, if absenteeism decreases when the unemployment rate rises, it follows that perhaps productivity will increase during this time as well.

The seasonal cycle is another variable which may effect productivity. In their book on quasi-experimental design, Cook and Campbell point out the importance of seasonal trends and the potential threat it could have to the internal validity of a study (Cook & Campbell, 1976). It is possible that there may be systematic variations in productivity levels which coincide with the season. If this is true, then this knowledge could increase the validity and reliability of productivity as a criterion measure for the manager.

Unemployment

The relationship between unemployment and productivity within an organization apparently has not been studied. However, the influence of unemployment on absenteeism has recently been examined. The rationale behind the unemployment/absenteeism relationship is as follows. During poor economic times, unemployment is high, layoffs are frequent, jobs are scarce, and workers currently employed are afraid of losing their jobs. Because of this, employees will make an extra effort, such as reducing their absences, to prevent jeopardizing their employment (Markham, 1985; Leigh, 1985). Similarly, employees may increase their productivity to reduce the chances of their being laid off. Additionally, when the economy is low, management will be concerned with cutting costs and will probably be more attentive to controlling employee behaviors such as absenteeism (Markham, 1985) and productivity.

On the other hand, low unemployment rates may have the opposite effect for various reasons. First, employees may actually work slower, trying to "expand" the limited work in order to make it last longer. Second, fear of layoff could persuade the worker to take time off from his or her job to search for alternative sources of employment (Leigh, 1985). Third, workers may be anxious about layoffs, and this anxiety could effect their job performance. Brenner (1973) found a strong correlation between unemployment and hospital admissions and suicide rate. He felt the threat of unemployment may create emotional stress not only for those people already unemployed, but also for those workers currently employed who are worried about layoffs.

The research has generally found a negative relationship between unemployment and absenteeism (Markham, 1985; Markham & McKee, 1986; Leigh, 1985). Markham (1985) found a significant inverse relationship between absenteeism and unemployment at the organizational level. This result was found even after holding constant the effects of seasons and other economic indicators. Markham (1985) correlated organizational absenteeism data with the national unemployment rate, the state unemployment rate, and the local SMSA unemployment rate. He found the absenteeism rate for the organization to be most closely associated with national unemployment figures.

Markham (1985) cited several important implications of his research results. These include: 1) the perceived ease of finding alternative employment may be an important predictor of absenteeism; 2) the perceived level of unemployment might act as a moderating variable for the relationship between unemployment and satisfaction (i.e., during high unemployment the relationship between absence and satisfaction might not be apparent because absence levels are low); and 3) the worker's perception of the possibility of unemployment may be related to their absence rates.

Markham (1985) believed the results of this study indicated the need for future research, especially at the individual level of analysis. Before determining how workers' perceptions of unemployment is related to their absenteeism rate, corresponding research must be conducted at this level of analysis. Markham warned against interpreting the aggregate unemployment-absenteeism relationship found in this study from the individual "psychological point of view".

Markham and McKee (1986) recently conducted a study examining unemployment, organizational size, and absenteeism. They used data collected from a large textile manufacturer whose plants were spread across the United States. There were 24 plants and data was recorded for over 67 months. A longitudinal analysis was performed to look at the relationship between absence rate and organizational size for each plant. National unemployment rates were used because Markham (1985) had found from a previous study stronger correlations for these plants between absenteeism and the national unemployment rate then with the local unemployment rates. Partial correlations were computed, alternately holding constant unemployment and organizational size. They found that the national unemployment rate accounted for more of the common variance than organizational size, and that unemployment accounted for unique variance above and beyond the contribution of organizational size. They concluded that unemployment appears to be a stronger predictor of absenteeism than organizational size (Markham & McKee, 1986).

A study by Leigh (1985) using a large data base from the University of Michigan's Panel Study of Income Dynamics (PSID) also found absenteeism to be negatively associated with unemployment. Leigh conducted both a micro-analysis of absence behavior and a macro-analysis using absenteeism statistics for a period of 11 years. In the micro-analysis, four empirical variables were used - wages, industry unemployment rate, supplementary income, and injury rate. Two of these variables, unemployment rate and injury rate had significant effects on individuals' absence behavior.

Leigh used two samples in his research study. The first sample controlled for "employer selection bias". This bias, according to Leigh, may occur during times of high unemployment when employers might terminate those workers who are "absent-prone". Therefore, a drop in the absenteeism rate of a particular organization may be due to this factor, and not an actual decrease in absences for those workers still currently employed (Leigh, 1985). The second sample did not control for this possible bias.

The industry unemployment rate was significantly related to absenteeism for both samples. A one standard deviation rise in unemployment was found in the first sample, which resulted in an approximately 11 hour reduction in total absenteeism. The second sample had an approximately 19 hour reduction for the same increase in unemployment. Therefore, the effects of unemployment on absenteeism were greater for the sample which did not control for employer selection bias (Leigh, 1985).

The macro-analysis was used to investigate the relationship between unemployment and absenteeism at the national level. Two aggregate absenteeism statistics were constructed from the Panel Study of Income Dynamics. Both statistics used the mean absence rate due to one's own illness for each year of the sample, however one controlled for "employer selectivity bias" while the other did not.

Eleven years of data were used from the PSID, resulting in 11 observations for each absenteeism measure. For this analysis national unemployment statistics were used. Because of the small sample size, a time series analysis could not be used. Generally, the results found absenteeism rates to follow the cycles of unemployment trends, supporting the hypothesis that when unemployment rises, absenteeism falls (Leigh, 1985). This result also was obtained when "employer selectivity" was controlled for.

In summary, Leigh's research has similar findings to previous research. That is, evidence from a large amount of data suggested that absenteeism is negatively associated with unemployment at both the industry and national levels. Using a longitudinal perspective, one question the above research studies attempted to answer was the extent that absenteeism can be explained by the effects of unemployment. Similarly, this study examines the extent productivity level may be effected by unemployment rates. It is quite possible that a relationship does exist for the same kind of reasons given for the association between absenteeism and unemployment rates. However, following the logic behind the absenteeism studies, this relationship would be a positive one. As unemployment rises, people may tend to work harder and faster, while being absent less frequently. Both these factors would tend to increase productivity in a plant.

As previously mentioned, Markham (1985) found the national unemployment rate to be most closely associated with the absenteeism rate for the organization. However, because there has been no research examining the relationship between productivity level and unemployment, the state unemployment rate will be looked at as well. Based on the limited research evidence supporting a negative relationship between absenteeism rate and unemployment, it is tentatively hypothesized that:

H1A: THERE IS A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN AN ORGANIZATIONS' AVERAGE PRODUCTIVITY LEVEL AND THE NATIONAL UNEMPLOYMENT RATE.

H1B: THERE IS A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN AN ORGANIZATIONS' AVERAGE PRODUCTIVITY LEVEL AND THE STATE UNEMPLOYMENT RATE.

Seasonal Cycles

Season is another external factor which may effect productivity. Like unemployment, the relationship between season and productivity rates have not been empirically examined. However, Markham, Dansereau, and Alutto (1983) conducted a study where seasonal patterns in company-specific absenteeism data were found. A higher absenteeism rate prevailed during the period from July to September as compared to the winter months. One possible explanation for this finding is that good weather conditions may affect the willingness or ability of employees to invest time and effort into their jobs (Markham, et al., 1983).

The same may hold true for an employee's productivity level. It is possible that during the summer season employees may be less motivated to work hard because the weather is so good they would rather spend time outdoors. However, alternative scenarios can be thought of. Perhaps during the summer people feel more energetic, less depressed, and more motivated to work then during the winter months.

Persinger (1983) reported that it is common for people to experience "winter blahs" in January and February, followed by "spring irritability" in March and April. After conducting careful operation analyses and time-sampled "behaviorgrams"; he found some major winter-related stimulus patterns which may influence peoples' psychological responses. These stimulus patterns include: 1) a gradual and maintained shift in the ratio of negative to positive stimuli (defined in behavioral terms); 2) stimulus redundancy; and 3) consequences of coerced hypoactivity. In simple terms, this means that first there are more aversive events in winter (i.e., snow storms, car troubles, travel hazards), and second that those events which had previously been rewarding are now less pleasant (i.e. walking outdoors, visiting friends). Furthermore, winter tends to have the same physical properties which are perceived day after day, while one can experience a variety of stimulus (i.e. flowers, birds, rain, sun) in the summertime. Finally, primarily because of the necessity of avoiding the cold, people tend to stay indoors and are less active. According to Persinger (1983) this "coerced hypoactivity" can lead to lowered mood states. Increased irritability is a frequent correlate which can result in "...domestic squabbles, social problems, and conspicuously decreased work productivity" (Persinger, 1983).

The Christmas season also may effect productivity levels. Those workers who are paid on an incentive or piece-rate compensation system may increase their productivity because they wish to earn more money for the holiday season.

On the other hand, the holiday season may negatively affect an employee's productivity. People may be diverted by more home and holiday season activity, and their work performance may consequently suffer. In addition, although there apparently has not been any published research about the relationship between the Christmas season and job performance, it is well known that this period can be a stressful and depressing time for many. A psychologist, George Kimble, has published a table of "life-change events" which quantify types of stress (i.e. death of spouse, marriage, divorce), these events can be positive as well as negative. Christmas is listed on Kimble's scale as a stressful event (Lawrence, 1982). Economic worries may be intensified during this time, as well as feelings of loneliness, and depression. U.S. News and World Report, (1979) stated that many psychiatric hospitals have increased patient loads during the holiday season. It is possible that this holiday stress and worry could transfer to the workplace and effect performance.

Although it is hard to predict the exact way productivity levels might be influenced by the seasons, if an effect is found, this would indicate there is probably predictable variation in the productivity measure. Markham, _et al._ (1978, 1983) reported systematic variation by season in absenteeism which had important implications for the use of absenteeism as a criterion measure in quasi-experimental designs (Cook & Campbell, 1976; Markham _et al._, 1983). If temporal variation is not controlled for in absenteeism field experiments then any differences found may be do to seasonal effects and not the independent variables.

The same may be true for productivity measures. If predictable systematic variation is found in productivity level, then the validity and reliability of productivity as a criterion measure is increased. In fact, Scott, Markham, and Robers (1985) conducted a field experiment in which three separate productivity improvement contests were implemented during a two-year period. Because of this, a natural quasi-experimental design occurred. Seasonal variation was controlled for, and the effect of seasonal fluctuations on the company's productivity accounted for a statistically significant 9.3% of the variance (Scott, _et al._, 1985).

Previous research has found systematic variation by season for both absenteeism (Markham, _et al._, 1983) and productivity (Scott, _et al._, 1985). Based on this empirical research it is hypothesized that:

H2: A RELATIONSHIP WILL BE FOUND BETWEEN AN ORGANIZATION'S PRODUCTIVITY LEVEL AND SYSTEMATIC VARIATION BY SEASON.

Because of the exploratory nature of this research, it is hard to predict the exact fluctuations between seasonal cycles and an organization's productivity level. However, because this study used plants which pay their employees on a piece-rate system, one hypothesis which will be made is that:

H3: DURING THE HOLIDAY SEASON (Season 4 - OCT./NOV./DEC.) THE ORGANIZATION'S PRODUCTIVITY LEVEL WILL SIGNIFICANTLY INCREASE IN COMPARISON TO THE PREVIOUS QUARTER FOR THAT YEAR.

ORGANIZATIONAL FACTORS AND PRODUCTIVITY

These factors can be traced to the individual firm. There are many causes of productivity decline which might be internal to the organization. One frequently cited cause is American management's philosophy of focusing on immediate "bottom-line" financial results (Ross, 1981). Because of this, decisions are made such as delaying plant improvement or research and development projects in order to make the short-term profits of the company look good. Unfortunately, these decisions are often made at the expense of the company's long-term future.

Other internal factors include a lack of awareness and understanding of productivity, and a lack of productivity improvement programs. In a survey of 6000 business managers, the American Management Association found productivity to be a serious problem, although two-thirds of the survey respondents reported no special effort being made to examine the problem (Ross, 1981).

Other reasons for productivity decline which are internal to the company include a lack of goals, poor measurement techniques, and a need for better training. Two other important internal factors which this study will look at from a longitudinal perspective are: 1) the absenteeism rate of an organization; and 2) the change in size of the labor force within that organization.

Most researchers believe there is a negative relationship between absenteeism and productivity; obviously if employees are not at work, productivity will decline. Although common sense indicates the above to be true, there has been little empirical data to support this belief. From the research which has been conducted to date, it appears that the relationship may not be as simple and direct as once thought. Because of the potential complexity of the absenteeism/productivity relationship, and the scarcity of research available, the investigation of this variable appears to be a valuable source of information. If there is a significant negative relationship between absenteeism and productivity, this lends support to the need for policies and programs which both predict and control absenteeism.

Research studying organizational size and productivity from a cross-sectional perspective has found strong positive relationships. In other words, bigger organizations tend to have higher productivity. In this study, the size of an organization over time was looked at. There have been no research studies examining this relationship from a longitudinal aspect. This research was conducted to compare the results of a longitudinal study with the previous cross-sectional studies which have been done, and also to increase the general understanding of productivity within an organization. If a significant positive relationship is found then strategies dealing with productivity must take into account the change of size within an organization.

Absenteeism Rate

As Staw and Oldham (1978) point out, logic would seem to indicate that there is a strong negative relationship between absenteeism and performance. Obviously, if personnel are absent, the work will either 1) not get done; 2) be accomplished by a co-worker; or 3) replacements will be sought. In any of these situations the work will frequently not be completed as quickly or efficiently because of lack of familiarity or practice.

Many researchers support the belief that absenteeism hinders operating effectiveness and efficiency (Metzner & Mann, 1953; Morgan & Herman, 1976; Steers & Rhodes, 1978). Although the absenteeism/performance relationship appears to be straight forward, there has not been much empirical data which supports a simple, direct connection between the two variables (Staw & Oldham, 1978; Moch & Fitzgibbons, 1985). In fact, some researchers see absenteeism as having positive consequences (Staw, 1977; Staw & Oldham, 1978; Hammer, Landau, & Stern, 1981; and Mowday, Porter & Steers, 1982). Absenteeism may relieve dissatisfied employees of job-related stress and boredom, and thereby allow them to be more productive when they return to work. It also is possible that productivity levels may increase for a period of time as workers try to "make up" for their absent co-workers. The relationship between productivity and absenteeism appears complex, apparently with both positive and/or negative consequences (Moch & Fitzgibbons, 1985). This may be a primary reason why research in this area has shown conflicting results.

The little research which has been conducted in relating absenteeism and productivity variables has usually been carried out at the individual level of analysis. For example, Hackman & Lawler (1971) did find generally negative relationships in a large correlational study. However, this type of research analysis may ignore particular organizational factors which could effect the relationship. When Moch & Fitzgibbons (1985) examined the relationship between productivity and absenteeism on the organizational level, they discovered that the effects of absenteeism can vary with certain "macro" or environmental variables. Factors such as the employee's type of job, location within the organization, interdependence of departments, and size of the organization may all be intervening variables in the productivity/absenteeism relationship. Moch & Fitzgibbons (1985) found that absenteeism does not adversely affect operating efficiency under all organizational conditions. They found a negative association between absenteeism and department efficiency only when production processes were not highly automated, and when the absences could not be anticipated in advance. This held true for all departments except packaging, where absenteeism was not associated with lower efficiency at a statistically significant rate. The researchers speculated that this exception could be due to the relatively unskilled nature of the job tasks, which make these employees easier to replace.

In summary, the results Moch & Fitzgibbons (1985) found support the hypothesis that absenteeism negatively effects production. However, they modified the hypothesis by saying that more automation (when possible) may minimize the costs of absenteeism on production efficiency. In addition, those organizations which rely heavily on human resources may want to concentrate on policies and programs which help management more accurately predict future absences.

A study by Scott, et al. (1985) implemented three separate productivity improvement programs (each for a three-month period) in an organization during a span of two years. They took measures of both weekly absenteeism and weekly productivity data at the plant level. No significant correlations were found.

Although Moch & Fitzgibbons (1985) shed some light on moderating variables between absenteeism and productivity from an organizational perspective, it is apparent that research on the productivity/absence relationship is sparse. Understanding the association between productivity and absenteeism seems particularly important in view of the conflicting empirical data, and the almost universal assumption managers make that absenteeism has negative consequences for an organization. As a result, it is hypothesized that:

H4: THERE WILL BE A SIGNIFICANT NEGATIVE RELATIONSHIP BETWEEN THE PRODUCTIVITY RATE AND THE ABSENTEEISM RATE IN THE FOCAL ORGANIZATION.

Organizational Size

Another internal factor to examine is organizational size and its relation to productivity. This relationship can be studied from a cross-sectional or a longitudinal perspective. Cross-sectional research is interested in comparing the size of various organizations at one particular point in time with the corresponding productivity level.

Miller (1978, 1981a, 1981b) has conducted cross-sectional research to investigate how firm size and productivity are interrelated. Miller (1978) compared the average labor productivity of the four largest firms in a particular industry with all other firms in that industry, and found a substantial productivity advantage for the larger firms. Brush (1981) however, refuted Miller's methodology, stating that the higher labor productivity of the four largest firms does not necessarily imply that they have a productivity advantage over all other firms. Brush (1981) examined the labor productivity of the four largest firms with that of the next four largest firms, (instead of the "remainder of the industry"). Although he found a higher productivity rate, the largest industries had less of a productivity advantage over the four firms next in size than for all the industries combined.

In a later study, Miller (1981) divided the "remainder of the industry" into separate size categories. Although he found variations from industry to industry, the overall pattern was consistent. Productivity declined from the largest firms to the smallest. Gupta (1982) also found support for this positive relationship. He reported that "establishment size seems to be the dominant factor in explaining inter-establishment variations in labor productivity in an large majority of industries" (p. 859).

Research using the longitudinal perspective allows one to look at the impact of change in size within one organization as it occurs over time. After an extensive review of relevant research material, no longitudinal research studies investigating the relationship between size of an organization and productivity could be found. The studies which have been conducted have dealt with the relationship between absenteeism and size (Allen, 1982; Markham & McKee, 1986). The study by Allen (1982) examined the relationship between organizational size and absenteeism for a group of English dock workers over a 12 year period. Significant positive relationships were found between two measures of "brief duration absences" and organizational size. However, the final result of the study showed that when holding constant the size of the temporary work force and looking only at permanent employment and "brief absences", the relationships became non-significant. The second study found significant positive relationships between size and absence (Markham & McKee, 1986). However, when controls for unemployment were used, it was apparent that unemployment contributed more to the organization's absence rate than change of size (Markham & McKee, 1986).

The cross-sectional research reviewed lends support for a positive relationship between productivity rate and size. Because this study is the first to examine the relationship between productivity and change in size of an organization from a longitudinal perspective, the hypothesis will be based on the previous limited research of size and productivity from a cross-sectional perspective.

H5: THERE WILL BE A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN ORGANIZATIONAL SIZE OVER TIME AND PRODUCTIVITY RATE.

PRODUCTIVITY IMPROVEMENT PROGRAMS

Productivity improvement involves many factors: better work methods, increased use of technology and innovation, quality control, motivation and the utilization of proven management techniques (English & Marchione, 1983). From a managerial perspective, there are at least two major factors which determine productivity at the individual level: the ability of an employee, and the amount of effort that an employee chooses to expend (Pinder, 1984).

An increasing number of companies are concentrating on this later factor, and they are designing and implementing productivity improvement programs. Many of these programs use motivational theories which attempt to increase the level of effort expended by employees, and consequently their performance. One technique for doing this is through a positive approach which uses rewards and incentives systematically for improved productivity. Two theories become particularly relevant when explaining positive productivity improvement programs: 1) operant conditioning theory, and 2) goal-setting theory.

Operant Conditioning/Reinforcement Theory

Operant conditioning is a science of behavior which rests on the basic assumption that an individual learns mainly by producing changes in his or her environment (Skinner, 1954). It is a process in which characteristics of operant behavior are, over time, modified by the environmental consequences of the behavior. These environmental consequences may be classified into three categories: positive reinforcers, negative reinforcers, and neutral stimuli. Positive reinforcement refers to the situation in which there is a positive contingency between the instrumental response and a reinforcing stimulus. If a subject performs the instrumental response then he or she will be presented with the the reinforcing stimulus; if the subject does not perform the response; the reinforcing stimulus will not be given. Negative reinforcement refers to the situation in which the occurrence of an instrumental response terminates or prevents the delivery of an aversive stimulus. Neutral stimulus do not elicit any type of instrumental response from the subject. The theory states that individuals are more likely to repeat behaviors that are rewarded than behaviors that are punished or ignored.

Another important component in this theory is the contingency or relationship between the behavioral response and the receipt of the reinforcement. For example, monthly salary is a noncontingent reinforcement (generally speaking) because the employee will receive their wages whether or not a particular behavior has occurred. A contingent reinforcement on the other hand, will be given out only if certain behaviors occur. A piece-rate method of compensation would be considered a contingent reward. The person receives money in direct proportion to the level of productivity. Behaviorists argue that contingent rewards yield higher levels of effort and production than noncontingent rewards. They also suggest that motivation is the result of response-reward contingencies (Landy, 1985).

Behavioral research has shown rewards to be more effective if they immediately follow the desired response. If there is a delay in the response time, the reduced effectiveness in behavior change may be due to the fact that the reinforcement might be maintaining behaviors which have occurred <u>after</u> the desired behaviors (Jablonsky & Devries, 1972). An additional factor to consider is the schedule of reinforcement. Reinforcement can be either continuous, whereby the consequence follows the behavior each time, or partial where the consequence follows the behavior some of the time. These schedules can further be broken down into a ratio or time interval basis of reinforcements, and on fixed or variable schedules. Industrial and organizational research on the effects of different schedules of reinforcement (London & Oldham, 1979; Latham & Dossett,1978; and Yukl & Latham, 1975) have provided mixed results in terms of productivity. However, one conclusion appears evident: contingent reinforcement of any type is more effective than noncontingent reinforcement, but there are no reliable differences between or among various contingent schedules when applied to worker productivity.

Goal-Setting Theory

Ryan (1970) reviewed a large amount of literature which postulates that an individual's performance level is closely related to the goals an individual sets or goals the person has accepted from someone else. The principal cognitive process behind goal-setting theory which accounts for job behavior is conscious intention. E.A. Locke has provided a theoretical framework for understanding goal-setting effects, and research has substantiated many of his propositions. In a recent review article by Locke, Shaw, Saari, and Latham (1981), fifteen years of goal-setting research was examined. Landy (1985) summarizes their conclusions:

1. Hard, specific goals will produce higher performance levels than easy goals, vague goals, or no goals at all.
2. "...Goals affect task performance by directing attention and action, mobilizing energy expenditure or effort, prolonging effort over time

(persistence), and motivating the individual to develop relevant strategies for goal attainment" (Locke, et al., 1981, p. 145)

3. Knowledge of results or feedback is also necessary for an individual to perform at high levels. Neither feedback nor a hard goal independently will have the optimum effect on performance.
4. Money and other concrete rewards may have the effect of increasing commitment to an accepted goal.

Goal-setting is important to the topic area because it is not possible to establish incentive programs without at least implicitly establishing goals for some measure or measures of performance. A review by Tolchinsky and King (1980) stated that financial incentives influence the acceptance of goals, the level of effort exerted, and the commitment exhibited to these goals.

Research on Positive Productivity Improvement Programs

One of the earliest and best-known positive reinforcement programs began at Emery Air Freight in the early 1970s (Dowling, 1973). This program was based on operant conditioning principles, and used praise, recognition, and rewards as reinforcements. The program consisted of four basic steps: (1) performance was audited to assess employees behaviors in quantitative terms; (2) specific goals were set for each individual employee; (3) feedback was given on each employee's performance; and (4) reinforcement was administered for the positive aspects of work performance. Through the use of these positive reinforcement techniques, Emery saved an estimated 3 million dollars over a three year period (Dowling, 1973).

Other studies have developed programs using combinations of goal-setting, feedback, and reinforcement to improve job performance. These studies have been used in a wide variety of organizational settings, and with diverse work groups such as: grocery store clerks (Komaki, Waddell, & Pearce, 1977), mountain beaver trappers (Latham & Dossett, 1978), truck drivers (Latham & Baldes, 1975; Runnion, Johnson, & McWhorter, 1978), telephone service crews (Kim & Hamner, 1976), salespeople (Miller, 1977), managers, (Bourdon, 1977), and others (Hammer & Hammer, 1976; Andrasik, 1979).

Runnion, Johnson, and McWhorter (1978) investigated the effectiveness of these reinforcement principles at the shipping division of a company. They attempted to reduce the turnaround time of truck shipments at delivery sites in order to increase the overall amount of material transported. Letters were sent to each plant manager which gave the time for his or her particular plant, as well as the actual "turnaround times" of those plants which met the company goal of 45 minutes. In addition, the drivers were given prompting letters to explain the project, and to inform them of ways to reduce turnaround time. Various rewards (i.e., certificates and photographs) were given to the drivers, dockworkers, and forklift operators at plants that met the company goal.

The average turnaround times during baseline, weekly feedback, biweekly feedback, and monthly feedback were 67, 39.1, 37.2, and 38.3 minutes, respectively. The feedback component could be responsible for the reduced turnaround time, or it may have been due to the rewards given to the workers. In any event, the program did prove to be effective in increasing the amount of material shipped.

Incentives and rewards have been used frequently in the area of retail and industrial sales. For example, Miller (1977) made salesmen's annual bonuses contingent upon sales performance. To avoid the potential problem of salesmen losing interest in the program because of the extensive delay between performance and reward, Miller instituted a point system that would allow each worker to earn points for performance throughout the year. This accumulation of points would determine the size of the bonus at the end of the year.

The results of the program showed an increase of sales volume for three different commodities over a seven month period (117.1%, 63%, 40.1%). Industry-wide increases over the entire thirteen month period also occurred (47.9%, 42.5%, and 34.3%) for the same three products (Miller, 1977). This study appears to be successful, but as Elliot, et al., (1979) points out the study used only a control and treatment phase in the experiment (AB design). If the study had used a control and treatment phase, and then dropped the treatment and implemented the control phase once again (ABA design), it would be possible to say with more certainty whether the program was actually responsible for the increases.

Another study designed to improve sales volume attempted to increase target behaviors which were likely to achieve this goal. Komacki, Waddell, and Pierce (1977) used conditioning principles to alter work behaviors of two clerks. The researchers operationally defined the desired behaviors as: (1) being in the store; (2) assisting customers, (i.e., approaching customers as they entered the store, asking if they need help while smiling); and (3) keeping the shelves stocked to 60% capacity. At least one of the clerks had to behave in the desired manner at least 90% of the time (when it was possible to do this), and the reinforcement used was time-off with pay. The clerks' progress was charted on a bulletin board. The program was effective in increasing behaviors from the baseline period for all three criteria. Baseline means of 53%, 35%, and 57% increased to 86%, 87%, and 86% for being in the store, assisting customers, and stocking shelves respectively.

Several studies have been conducted in the apparel industry which are particularly relevant. One type of productivity program was developed for the Maid Bess Corporation by Vice-President, Richard W. Robers. The company uses a piece-rate compensation system which pays each employee by the number of units produced, therefore the more units produced the larger the weekly earnings. Robers designed a system which gave a weekly bonus in addition to the employees' regular pay check (Robers, 1982). The bonus was determined individually as a percentage of the worker's earnings for each particular week. As earnings increased, a higher bonus was paid, thus rewarding those employees who were more productive. The bonus percentage was set up on a progressive scale ranging from 6 to 10 percent, allowing the more productive employee to move up into higher bonus brackets. For example, an employee earning $3.75 an hour received a 7% bonus (or $0.26 extra each hour), while an employee earning $5.00 received a 9.5% bonus (or $0.48 extra each hour). The bonus each worker received was printed as a separate amount on the weekly payroll stub, which served as a constant reminder that productivity is rewarded. This productivity bonus system resulted in an 8% increase in plant productivity, and a 19% increase in employee earnings (Robers, 1982).

Scott, Markham, and Robers (1985) reported a contest used at Maid Bess to improve productivity above and beyond the above listed program. Employees were formed into six groups based on their past performance, (i.e. highest paid in one group, next highest paid in the next group etc.). The single employee in each group who increased their performance the most over a three month period received a reward (money or a trip).

Productivity was measured by the number of units each employee produced compared to the standard rate used by the company. To determine who won the reward, each employee's average quarterly earnings were compared with their average earnings for the quarter prior to the contest period. The plant's productivity was measured on a weekly basis as the average productivity of all employees. In addition to the productivity measure, an attendance criteria was required. To be eligible for the contest, workers could miss no more than two days during a contest period.

Three separate contests each lasting three months were implemented during a two year period. Because this created a natural quasi-experimental design, seasonal variation was controlled for (Markham, et al., 1983). The findings indicated that the productivity contests for employees had a significant effect on plant productivity (Scott, et al., 1985). On the average productivity increased 3.79 (from 83.53% to 87.32%) percentage points during contest periods.

Two other studies were conducted in the apparel industry. Emmert (1978) used behavioral management to increase the number of spliced small yardage bobbins and rewound bobbins from an average of 246 "splices and bobbins" to 300 per operator per day (the goal established by industrial engineering standards). A graph was publicly posted on a daily basis which showed the relationship between the goal (300) and the average number of splices and bobbins per operator per crew, and also showed the percentage of work efficiency for each of the four crews. At the end of three weeks each worker was given individual feedback and an explanation of the worker's performance graph. The supervisors were encouraged to give praise for improvement.

This particular program was not particularly successful. Average baseline production was 245 units, group feedback led to a 2.7% increase (253 units), and individual feedback led to a 7.0% increase (266 units). No control procedures were used, so it can not be determined whether the change in quantity of output was actually due to the program or not.

A field study conducted by McCarthy (1978) concerned a problem of quality control. Workers in a textile yarn factory occasionally would push a bobbin only part of the way down on a spindle before starting to spin yarn. This behavior resulted in "high bobbins" with outcomes such as tangled yarn, waste, inefficiency, and work hours lost untangling yarn. A program was implemented to try and reduce the number of high bobbins. Goals were set to gradually reduce the number of high bobbins allowed each day. A chart was publicly posted and the supervisors praised the workers who attained the goal that was in effect. The program resulted in a decrease in high bobbins, but the number of high bobbins never reached zero (the final goal). During an eleven day reversal, the frequency of high bobbins started to increase, but the frequency declined again when the feedback and praise were restored (Elliot & Geller, 1980).

Because much of the above research literature lends support for the success of productivity improvement programs using positive reinforcement techniques, it is hypothesized that:

H6: BOTH FORMAL RECOGNITION AND FINANCIAL INCENTIVE PRODUCTIVITY IMPROVEMENT PROGRAMS WILL SIGNIFICANTLY INCREASE PRODUCTIVITY WHEN COMPARED TO THE BASELINE DATA FOR EACH PLANT.

SUMMARY

This chapter has presented a review of research literature which relates to the relationship between four variables and organizational productivity. Two factors external to the organization have been discussed, the national unemployment rate and seasonal cycles. It is thought that unemployment will have a positive relationship with productivity, and that there will be systematic variation in productivity by season. Two factors internal to the organization have also been looked at, absenteeism rate and change in organizational size. The relationship between absenteeism and productivity is thought to be negative, and it is postulated there will not be a relationship between change in size and productivity.

Additionally, research literature relating to the elements of positive productivity improvement programs were examined, as well as supporting empirical evidence for the use of these programs. It was hypothesized that these programs will be successful in improving the organizations productivity level.

The next chapter will discuss the methodology employed in the study including the research location, subjects, and method of data collection. The measures of unemployment, seasonal cycles, absenteeism rate, and size of the organization also will be discussed. Finally, the methods of analysis will be described.

III. METHODS

INTRODUCTION

This chapter will describe the organization where the study was conducted and the characteristics of the population studied. In addition, it will discuss research design, the method of data collection, the measures used in the study, and the analytical techniques conducted to test the research questions.

RESEARCH LOCATION AND POPULATION

The research locations were two garment factories located in the Virginia/North Carolina area, both part of the Maid Bess Corporation. Maid Bess specialized in sewing uniforms and women's clothing. The Maid Bess Corporation had a total of six geographically dispersed plants with sizes ranging from 150 to 450 employees. A total of 1850 employees worked for the corporation. The plants were similar in terms of the workforce, manufacturing technology, and employment policies. The chairman and the vice-president of industrial relations had frequent contact with each plant, however each plant was operated independently and there was virtually no communication between plants.

Approximately 75% of the employees were paid on a piece-rate basis. Although employees are guaranteed the minimum wage, average earnings range from \$4.50 to \$5.25 an hour, with some workers earning up to \$9.00 an hour. Most of the employees were women (96%) and their average education was the 11th grade. Generally, the women worked as sewing operators, and the men worked as material "cutters". Job applicants were screened for psychomotor skills and received up to 14 weeks of training.

During the year 1984-85, Maid Bess Corporation experienced an absenteeism rate ranging from 4% to 7%, depending on the particular plant location. These percentages are relatively low for the industry. There were similar attendance control policies at each of the plants, and employees were not paid when they are absent. Employees could be terminated for excessive absenteeism. Absenteeism was also tied to the paid vacation program, where the fewer days an employee was absent, the higher the amount paid during vacations. Turnover rates ranged from 30% per year to 120%. The industry average was 65%. Employees were not represented by a union.

RESEARCH DESIGN

This study consisted of two major components. The first involved examining longitudinally the relationships between four external/internal factors and the productivity rate of two apparel plants. The relationships were looked at from both a within-plant and between-plant perspective. The second major part of this study was concerned with evaluating two different productivity improvement programs which were installed in each of the plants.

As stated previously, productivity is a complex, multi-dimensional variable. Because of this, determining what can be attributed to high or low productivity becomes especially difficult. During the course of this research it became apparent that there were other specific events affecting productivity level besides those which were studied. These variables were specific to the two apparel plants. In order to determine whether the four external/internal variables where in fact related to productivity and also whether the productivity programs did indeed improve productivity level, these other variables had to be operationalized and controlled for. This control was also necessary if any between-plant comparison was to be made. These "control variables" will be detailed later in this section.

Measures

The following is a description of the dependent variable, productivity rate, and each external/internal factor used as independent variables.

Plant Average Productivity Rate

The productivity rate for each plant was calculated on a weekly basis. This rate represents the average hourly wage employees received during a certain week, and it is directly related to the productivity level within the plants. Because the company uses a piece-rate compensation system, each employee is paid by the number of units produced. Therefore, the more products manufactured the larger the weekly earnings. The calculations were taken directly from the company payroll. The monthly productivity plant average was also used for some analyses.

Unemployment

National unemployment data were taken from the U.S. Bureau of Labor Statistics (BLS) (1981-1986). These data were seasonally adjusted and applied to all civilian workers. State unemployment data were taken from the U.S. Bureau of Labor Statistics and the Labor Market Trends publication issued by the Virginia Employment Commission. These data were not seasonally adjusted and applied to all civilian workers. Both national and state data were reported on a monthly basis.

Initially, another measure of unemployment was also included in this study. An index of help-wanted ads had been used in a previous study by Markham (1985) who, as previously mentioned, investigated the affects of unemployment on absenteeism. Markham stated that a workers' anticipation of unemployment rates in future months may affect their decisions about the risks of being absent now. This index was used as a measure of the perceived future risk of being unemployed. It was thought that this same measure could provide further information for this study. The help-wanted ads index was based on the volume of help-wanted advertising in major U.S. newspapers, and the data were obtained from the monthly Survey of Current Business (U.S. Department of Commerce).

Seasons

Season is defined as Winter - 1 (January through March), Spring - 2 (April through June), Summer - 3 (July through September), and Fall - 4 (October through December). This categorization was also used by Dansereau et al. (1978), and Markham (1985).

Absenteeism Rate

The measure of absenteeism in this study was computed by dividing the daily number of absent workers by the total number on the organizational payroll for that day (Vacations, Clock-Outs, and Layoffs not included). In order to correspond with the weekly productivity data the daily absenteeism rates for a particular week were added and an average figure calculated. A monthly absenteeism average was also used for some analyses. Percent absent was calculated by multiplying the number of people absent on a particular day by 100 and dividing by the total number of people active on the payroll. Days in which absences were greater than 50% were excluded from the data. These absences were assumed to be unavoidable due to poor weather and were categorized as "snow days" in accordance with Maid Bess company policy.

Organizational Size

This measure was calculated by taking the number of people on the company payroll for a particular day. This does not include people who were on vacation, clock-outs, or layoffs. These figures were then converted into a weekly and monthly average to correspond with the productivity, absenteeism, and unemployment data.

Measures Not Specific to Literature Review

These events were found to be specific to each apparel plant. They were important to measure and control in order to determine what effect the external/internal factors and the productivity programs had on the productivity level in each of the plants.

Labor Engineering Time Motion Studies

Time motion studies are conducted within the Maid Bess Corporation every few years. These studies assess the workers' job efficiency levels. It is well known within the industry that after each engineering study, productivity typically drops for a period of time as workers learn new machine techniques and different work habits etc. This is, however, only a temporary decline at which point productivity rises and hopefully will exceed the previous rate (i.e. before the engineering study).

One such time motion study was performed at each plant during the six year period this thesis examined. The studies were performed for approximately the same length of time, but during different years for each plant. Salem began the study in January, 1981, and ended in February, 1986, - a period of 13 months. Jefferson's study began in April, 1983, and lasted until

July, 1984, - a period of 15 months. Because productivity is closely related with these time motion studies it became important to try and operationalize this variable and control for its effects. This was done through the use of a "surrogate" variable - the number of work hours performed by the labor engineering consultants brought into the plant. At each plant two consultants were hired for a 40 hour work week for a period of 13-15 months. These work hours were added into the data base during the proper time periods for each plant. The variable could then be measured, and its effects controlled for.

Plant Manager Changes

There is a major difference in the turnover of plant managers between the two plants. Salem has had the same plant manager for the entire time period this thesis covered (5 1/2 years). Jefferson, however, has had 6 different plant managers during the same time period. The following is a list of Jefferson plant managers and the corresponding time periods the person was plant manager.

1. Plant Manager 1: 1978 - March 1981 (2 months covered in thesis data).
2. Plant Manager 2: April 1981 - August 1982 (17 months).
3. Plant Manager 3: September 1982 - May 1983 (9 months).
4. Plant Manager 4: June 1983 - August 1983 (3 months).
5. Plant Manager 5: September 1983 - January 1984 (5 months).
6. Plant Manager 6: February 1984 - Current (20 months covered in thesis)

Plant manager changes was operationalized by creating a variable corresponding to the time period a particular manager worked at the plant. Each week or month (depending on the data set used) had a "plant manager" variable of 1-6 depending on which manager was employed at the time.

Uniform Style Changes

The problem of uniform style changes occurred only at the Salem plant. According to the plant manager, there was a period of 6-8 months in 1984 when a certain style was being made which was very different from the rest. He thought that it was possible this new "Christopher Norris" style could effect negatively the productivity level in the plant. This style change occurred in June or July of 1984 and lasted for approximately 6-8 months. The style did not circulate through the entire plant until 1-2 months after it was implemented (August-September).

Productivity Improvement Programs

A major part of this study was concerned with installing productivity improvement programs in two of the plants. Based on the literature and the feasibility of program implementation, the following programs were used.

Formal Recognition Program

This program utilized formal recognition to reward employees for increased productivity. The program was installed in the Salem plant with the assistance of the Balfour Corporation, a company that specializes in designing and delivery recognition programs in industry. A central theme was utilized, and posters, recognition cards, and prizes were given out. At the end of each quarter during the contest year, employees were to receive a personal recognition card with their attendance and productivity improvement recorded on it. At the end of the year, employees were eligible for the grand prize of a customized gold necklace or gold pen knife. To receive this prize the employee had to:

1. Have no more than two absences a year or one absence a quarter.
2. Be among the top 25% of employees in terms of production for all workers.
3. Have no warning for quality problems.
4. By the end of the contest period have increased earnings by at least $.50 from the former base rate average.

Financial Incentive Program

This program was installed in the Jefferson plant and utilized financial incentives to reward increased productivity. At the end of the year employees were eligible to receive a $50.00 cash bonus. The stipulations for winning this bonus were the same as those used for the productivity recognition program. The employee had to:

1. Have no more than two absences a year or one absence a quarter.
2. Be among the top 25% of employees in terms of production for all workers.
3. Have no warning for quality problems.
4. By the end of the contest period have increased earnings by at least $.50 from the former base rate average.

Although this program was announced and supervisors were directed to provide information about the program, individual employees were not formally recognized for their productivity during the course of the program.

Each of the programs were conducted at the same time, from July, 1984 through June, 1985. The fact that the experiments lasted for a full year is important because seasonal variation can be controlled. (Cook & Campbell, 1976; Markham, et al., 1983). Additionally, this time period will provide a test of the programs endurance.

Data Analysis

Time-Series Analyses

A within-plant comparison was used, with each plant acting as its own control. Five and a half years of data were available (1981 through 1986). Because multiple observations over time were used, there was a potential problem of auto-correlation. This means that each data point may not be independent of the other, and; therefore, each error would be correlated with the error immediately before it. If results from a simple regression were used, there would be an overestimation of the "fit" of the model (i.e. the R-square would be inflated), and one would not reject the null hypothesis when it actually is false (type II error). To avoid this problem, the relationship between the error terms must be looked at and the information used to re-estimate the equation (Ostrom, 1978). This is done through time-series analysis.

One of the major advantages of a time-series analysis over other forms of quasi-experimental analysis, is that it does not make an assumption of independence of errors. Most statisticians recommend having at least 50 observations; this amount is necessary in order to estimate the structure of the correlated error in the series (Cook & Campbell, 1979).

Durbin-Watson statistics were calculated to determine the extent of auto-correlational problems. The value of D-W is close to 2 if the errors are uncorrelated. If residuals were found to be correlated, than the regression model was modified, and a lagged regression model based on the Cochrane-Orcutt method was conducted.

Plant Comparison Analyses

Preliminary analyses were conducted to determine whether the plants were significantly different in terms of productivity rate, percent absent, and plant size. These analyses were important to conduct in order to decide if subsequent analyses should be performed using combined plant or separated plant data.

The General Linear Model (GLM) procedure was used to test interactions for "season * plant" and for "year * plant" . Regression models were performed with the above three factors used separately as dependent variables. Either a "main effect" or or an "interaction" were found. A main effect is a difference among means for levels of a factor (i.e. productivity rate) collapsed over the other factors. An interaction occurs when the nature of the effect for one factor (i.e. productivity) is not the same under all conditions or under all levels of another factor (i.e. season or year) (McCall, 1980). If the regression model showed a significant interaction, than the factors were graphed to determine where the interaction existed.

Regression and Correlational Analyses

To test the relationship between productivity and unemployment, absenteeism rate and organizational size, regression and correlational procedures were used. Regression models determined the proportion of variance of productivity accounted for by the independent variables. Stepwise regression was used to allow the estimation of the independent contributions of each of the independent variables while the "control" variables (i.e. season, labor efficiency programs etc.) were held constant. Correlational methods were used to examine the relationship between productivity and the independent variables. These variables were also lagged by 1 week intervals to determine if there were any significant differences in size and direction of the relationships. To test the effects of cyclical season patterns, the above statistical tests were used as well as the Duncan's Multiple Range Test to examine differences in means.

Program Analyses

To assess the effects of the productivity improvement programs, a within-plant comparison was used for analysis, with each plant acting as it's own control. As many researchers have noted there may exist cyclical variations in the measure of a particular variable, as has been found with absenteeism (Cook & Campbell, 1976; Dansereau, et al., 1978; Markham, et al., 1982; Markham & Scott, 1985). The results of the experimental year will be compared to the three and a half year period before the program and the one year period after the program ended. An ANCOVA analyses was conducted for each plant. Those variables which were significant in accounting for a unique proportion of variance in productivity rate were held constant as covariates. A post-hoc Duncan's Multiple Range Test was next performed to determine mean differences in payrate for before, during, and after the program.

IV. RESULTS

INTRODUCTION

This chapter presents the findings of the study. First, a description of the research location will be reported along with summary descriptive statistics of the independent and dependent variables within each plant. These variables will then be compared between plants. Second, the measures not related to the literature review will be discussed in terms of how they affected productivity in the plants. Finally, the findings relevant to each hypothesis will be examined.

RESEARCH LOCATION

The research locations studied were two apparel manufacturing plants - Salem and Jefferson, both part of the Maid Bess Corporation. The plants were located in the Virginia/North Carolina area, approximately 120 miles apart. Although managed independently, they are similar in terms of the workforce (96% women - 11th grade education), manufacturing technology, and employment policies.

SUMMARY STATISTICS

Plant Size

The size of both plants varied during the five and a half years examined. As shown in Table 1, the Salem plant averaged 370 people with a range between 329 and 412. The Jefferson plant averaged 333 people with a minimum of 279 to a maximum of 392. Table 1 presents a breakdown by year of size mean and standard deviation for each plant, as well as for the entire time period studied. This table shows more variation in the Jefferson plant.

Insert Table 1 about here

Plant Absenteeism

Absenteeism during the time period studied averaged 6.35% in the Salem plant and 5.80% in the Jefferson plant. Table 2 gives the average percent absent and standard deviation by year for each plant. The overall summary statistics for both percent absent and number of people absent in each plant are also given.

Table 1

Summary Statistics For Size - Mean and Standard Deviation
Weekly Data

	SALEM $\bar{x}$	SALEM s	JEFFERSON $\bar{x}$	JEFFERSON s
1981	356	4.06	344	19.59
1982	363	6.77	316	19.88
1983	377	10.27	340	28.37
1984	386	15.55	326	26.79
1985	361	17.08	323	23.58
1986	385	17.06	362	16.64

SALEM		JEFFERSON	
Total Time Period		Total Time Period	
$\bar{x}$	s	$\bar{x}$	s
370.44	17.09	332.7	27.01
Minimum	Maximum	Minimum	Maximum
329.40	412.60	278.60	392.40
(n=276 weeks)		(n=272 weeks)	

Insert Table 2 about here

Unemployment Rate

Unemployment was measured both nationally and state-wide, and applies to civilian workers only. The national data is seasonally adjusted, while the state-wide data is not. Table 3 presents the average yearly rate of unemployment for both sets of data.

Insert Table 3 about here

Productivity Rate

Productivity data were taken directly from the company payroll for a period of 269 weeks - from January 1981 through September 1986. These data represent the productivity rate for each plant calculated on a weekly basis. The rate is the average hourly wage employees receive during a specific week. Productivity rate means and standard deviations both by year and for the entire period are given in Table 4. Overall, during the five year six month period, Salem averaged $3.93 per hour with a minimum of $2.99 and a maximum of $4.70. Jefferson averaged $4.06 per hour with the rate ranging from $2.88 to $4.93. These pay ranges include all

Table 2

Summary Statistics For Absence - Mean and Standard Deviation
Weekly Data

	SALEM		JEFFERSON	
	$\bar{x}$	s	$\bar{x}$	s
1981	6.71%	1.42	9.37%	3.11
1982	5.91%	1.95	7.54%	4.29
1983	5.82%	1.47	4.69%	2.39
1984	5.90%	1.54	4.20%	2.13
1985	6.80%	2.15	4.17%	4.96
1986	7.65%	1.58	4.45%	2.04
Total Period	$\bar{x}$	s	$\bar{x}$	s
Percent Absent	6.35%	1.80	5.80%	3.96
	Minimum	Maximum	Minimum	Maximum
	0	17.90%	1.11%	36.95%
	$\bar{x}$	s	$\bar{x}$	s
Number Absent	23.57	6.89	19.31	3.96
	Minimum	Maximum	Minimum	Maximum
	0	67.40	4	106.50
	(n=276 weeks)		(n=272 weeks)	

Table 3

Average Yearly National and State Unemployment Rate

	1981	1982	1983	1984	1985	1986
National	7.60%	9.71%	9.58%	7.51%	7.20%	7.06%
(Seasonally Adjusted)						
State	6.12%	7.69%	6.08%	5.05%	5.61%	5.46%
(Not Seasonally Adjusted)						

employees who meet the basic "standard rate" required by the company. It does not include employees in training.

Insert Table 4 about here

PLANT COMPARISONS

As stated in the Methods section, regression analyses were used to test for interactions between plant and season and plant and year. These were conducted to determine if separated or combined plant data should be used for subsequent analyses. Productivity rate, percent absent, and plant size were all used as dependent variables in independent regression models to test for the before-mentioned interactions. When the variables of season, plant, and season*plant were entered into the regression model significant interactions were found for all three dependent variables.

With productivity rate as the dependent variable, the overall model showed a R square of .407 ($p<.0001$). As Table 5A presents the interaction of year * plant for productivity yielded a significant F of 30.25 ($p<.0001$). The interactions are depicted in Figure 1 with a graph of productivity rate by year for both plants.

Table 4

Summary Statistics For Average Hourly Payrate
Mean and Standard Deviation - Weekly Data

	SALEM		JEFFERSON	
	$\bar{x}$	s	$\bar{x}$	s
1981	\$3.99	.15	\$4.10	.20
1982	\$4.02	.20	\$4.24	.45
1983	\$4.08	.14	\$3.74	.45
1984	\$4.22	.23	\$4.13	.34
1985	\$3.77	.39	\$4.24	.23
1986	\$3.37	.12	\$3.91	.20
	$\bar{x}$	s	$\bar{x}$	s
Total Period	\$3.93	.35	\$4.06	.38
	Minimum \$2.99	Maximum \$4.70	Minimum \$2.88	Maximum \$4.93
	(n=269 weeks)		(n=269 weeks)	

Insert Figure 1 about here

The results of the regression model with percent absent as the dependent variable is given in Table 5B. The R square was .239 ($p<.0001$) and the interaction year * plant shows a F of 16.19 ($p<.0001$). The graph of percent absent by year for Salem and Jefferson is shown in Figure 2.

Insert Figure 2 about here

The regression model was also significant when size was looked at as the dependent variable. The R square was .601 ($p<.0001$) and the F value for the year * plant variable was 19.99 ($p<.0001$) (see Table 5C). Figure 3 depicts the graph for this dependent variable.

Insert Figure 3 about here

Insert Tables 5A,B, and C about here

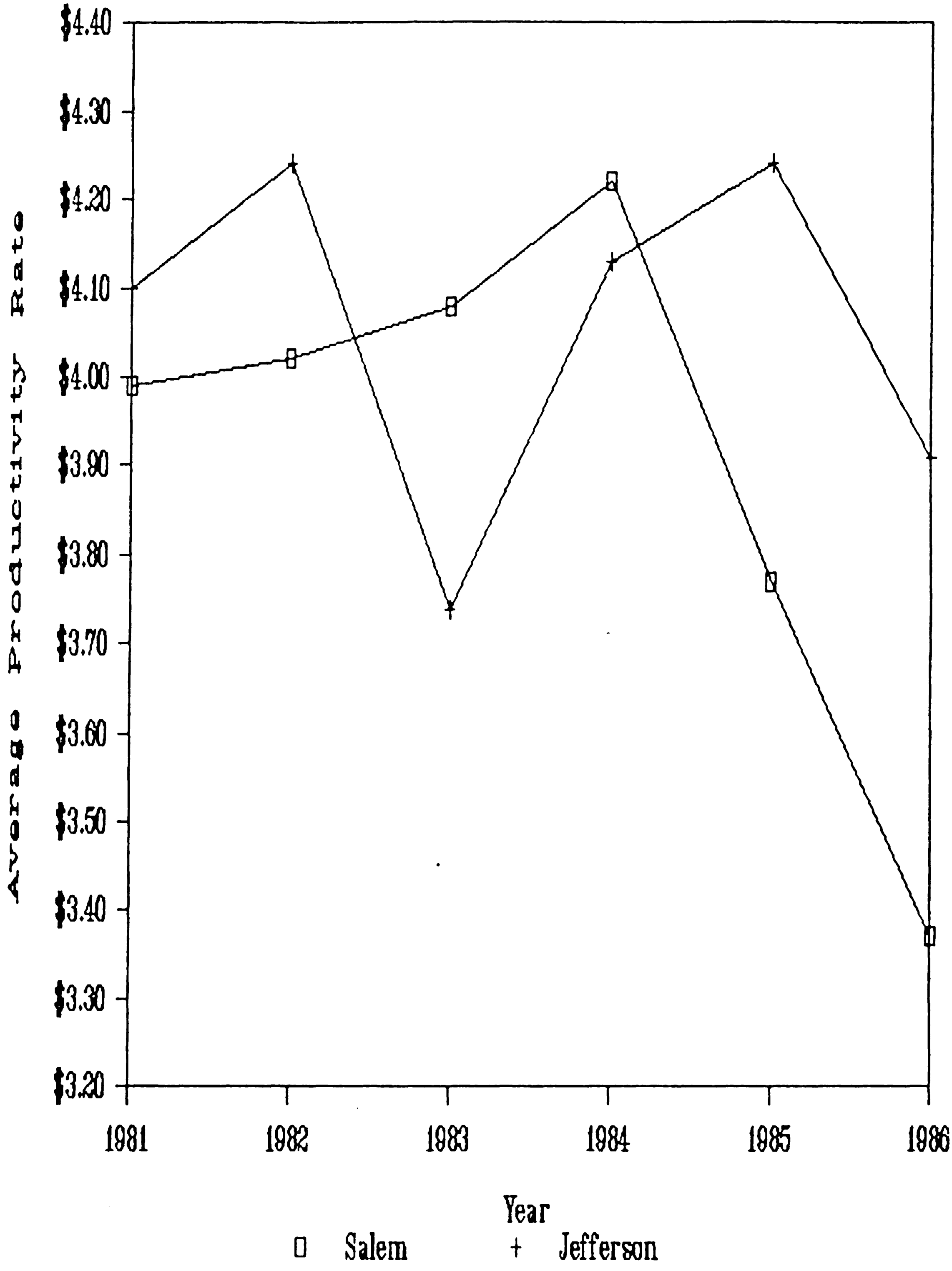

FIGURE 1

Average Hourly Productivity Rate By Year:
Salem and Jefferson Plants

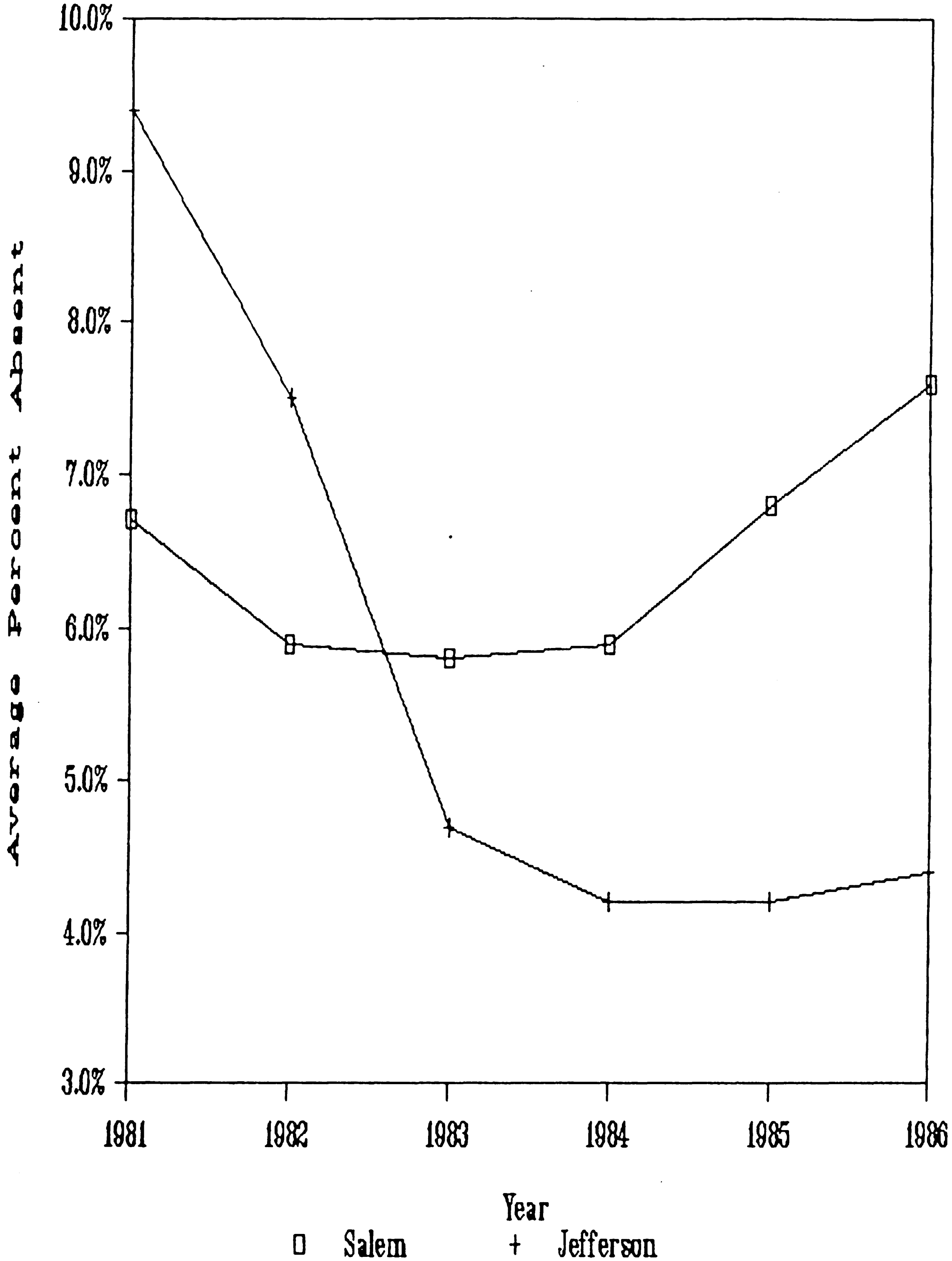

FIGURE 2

Average Percent Absent By Year:
Salem and Jefferson Plants

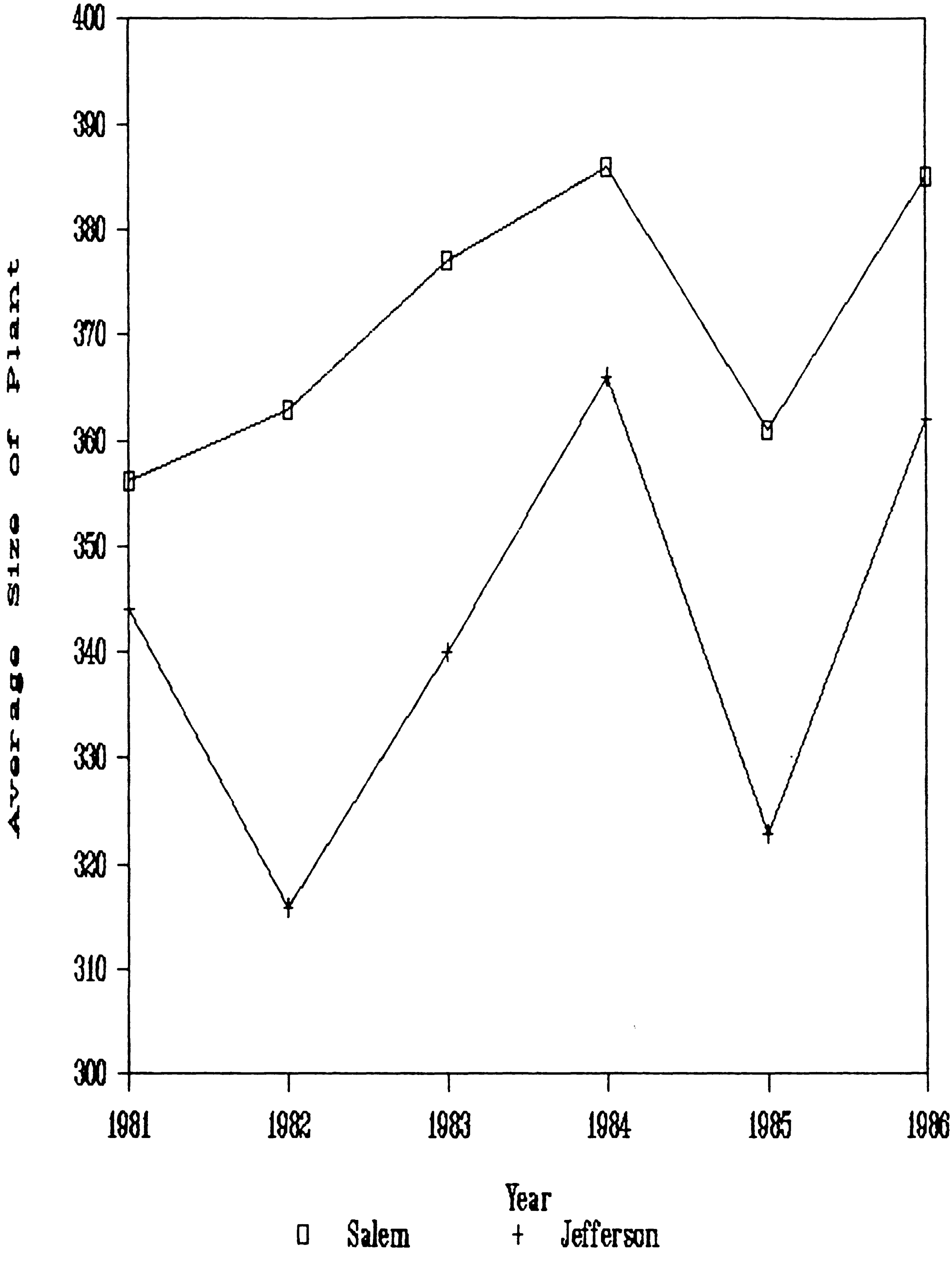

FIGURE 3

Average Plant Size By Year:
Salem and Jefferson Plants

Table 5A

Regression - Productivity Rate As The Dependent Variable
Year, Plant, Year * Plant As The Model

	DF	SS	F	P	R-square
Model	11	30.308	32.84	.0001	.407
Error	526	44.135			
Source					
Year	5	15.036	35.84	.0001	
Plant	1	2.580	30.75	.0001	
Year*Plt	5	12.692	30.25	.0001	

Table 5B

Regression - Percent Absent As The Dependent Variable
Year, Plant, Year * Plant As The Model

	DF	SS	F	P	R-square
Model	11	1246.122	15.39	.0001	.239
Error	536	3946.122			
Source					
Year	5	608.221	16.52	.0001	
Plant	1	42.015	5.71	.017	
Year*Plt	5	595.886	16.19	.0001	

Table 5C

Regression - Size of Plant As The Dependent Variable
Year, Plant, Year * Plant As The Model

	DF	SS	F	P	R-square
Model	11	283690.21	73.26	.0001	.601
Error	536	188677.82			
Source					
Year	5	55087.96	31.30	.0001	
Plan	1	193418.68	549.47	.0001	
Year*Plt	5	35183.57	19.99	.0001	

The interactions involving the factor season * plant were also examined. Results of the regression models using season, plant, and season * plant for all three dependent variables (productivity rate, percent absent, and plant size) are given in Tables 6A,B, and C, respectively.

Insert Tables 6A,B,C about here

Figures 4, 5, and 6 depict the graphs of these interactions for productivity rate, percent absent, and size, respectively.

Insert Figures 4,5,6 about here

As can be seen from the above analyses the interactions are significant for all three dependent variables at both time periods (year and season). Therefore, further statistical analyses must be done using separated plant data.

MEASURES NOT RELATED TO LITERATURE REVIEW

In order to correctly assess the relationships between productivity level and unemployment, organizational size, and percent absent, the effects of certain variables need to be controlled. In this study four control

Table 6A

Regression - Productivity Rate As The Dependent Variable
Season, Plant, Season * Plant As The Model

	DF	SS	F	P	R-square
Model	7	5.940	6.88	.0001	.087
Error	506	62.436			
Source					
Season	3	2.776	7.50	.0001	
Plant	1	1.674	13.56	.0003	
Season*Plant	3	1.488	4.02	.0076	

Table 6B

Regression - Percent Absent As The Dependent Variable
Season, Plant, Season * Plant As The Model

	DF	SS	F	P	R-square
Model	7	655.43	11.14	.0001	.126
Error	540	4536.810			
Source					
Season	3	439.976	17.46	.0001	
Plant	1	41.545	4.94	.026	
Season*Plant	3	173.914	6.90	.0001	

Table 6C

Regression - Size of Plant As The Dependent Variable
Season, Plant, Season * Plant As The Model

	DF	SS	F	P	R-square
Model	7	211143.59	62.35	.0001	.447
Error	540	261224.44			
Source					
Season	3	8948.48	31.30	.0004	
Plant	1	194383.19	401.83	.0001	
Season*Plant	3	35183.57	5.38	.0012	

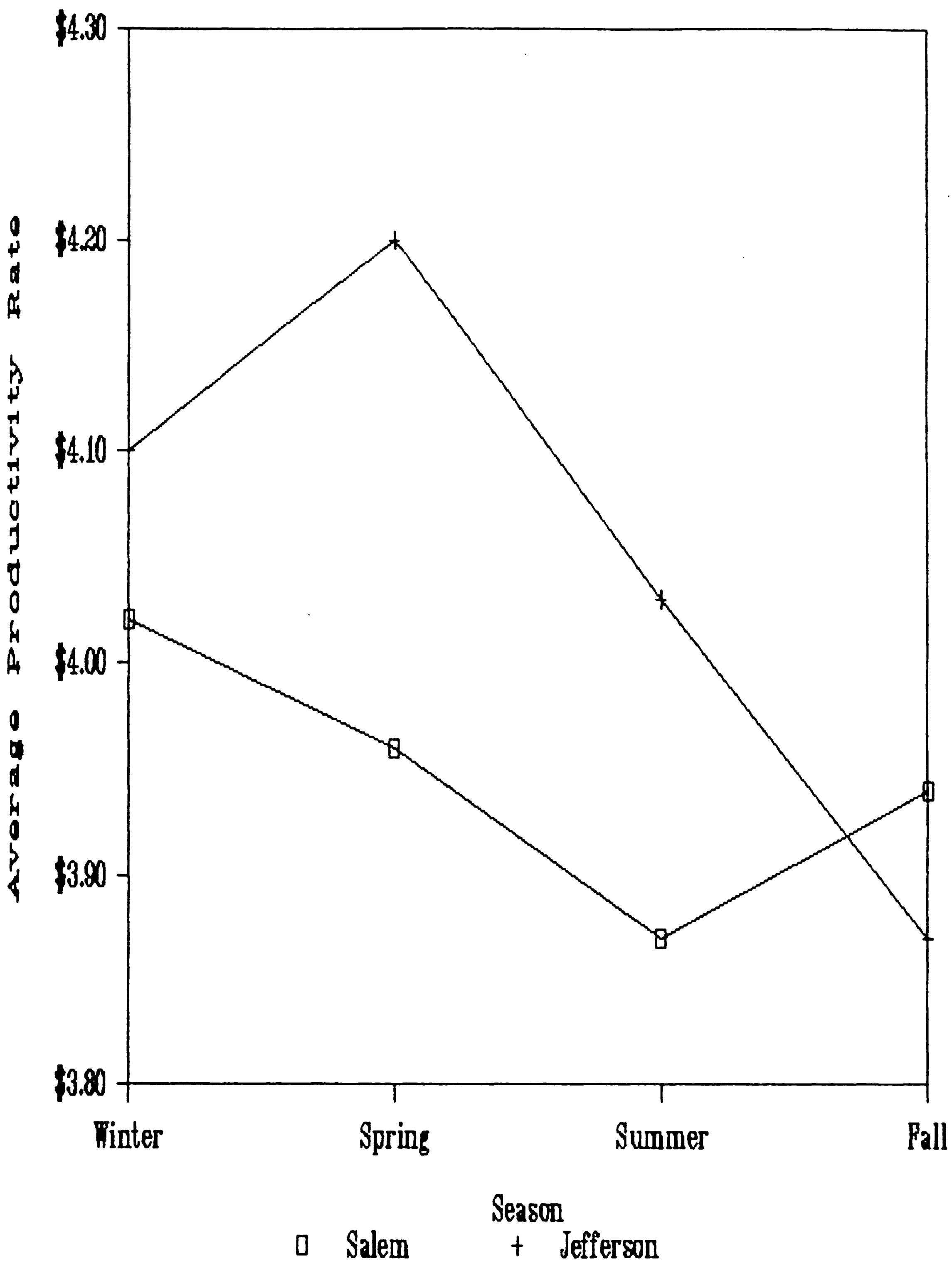

FIGURE 4

Average Hourly Productivity Rate By Season:
Salem and Jefferson Plants

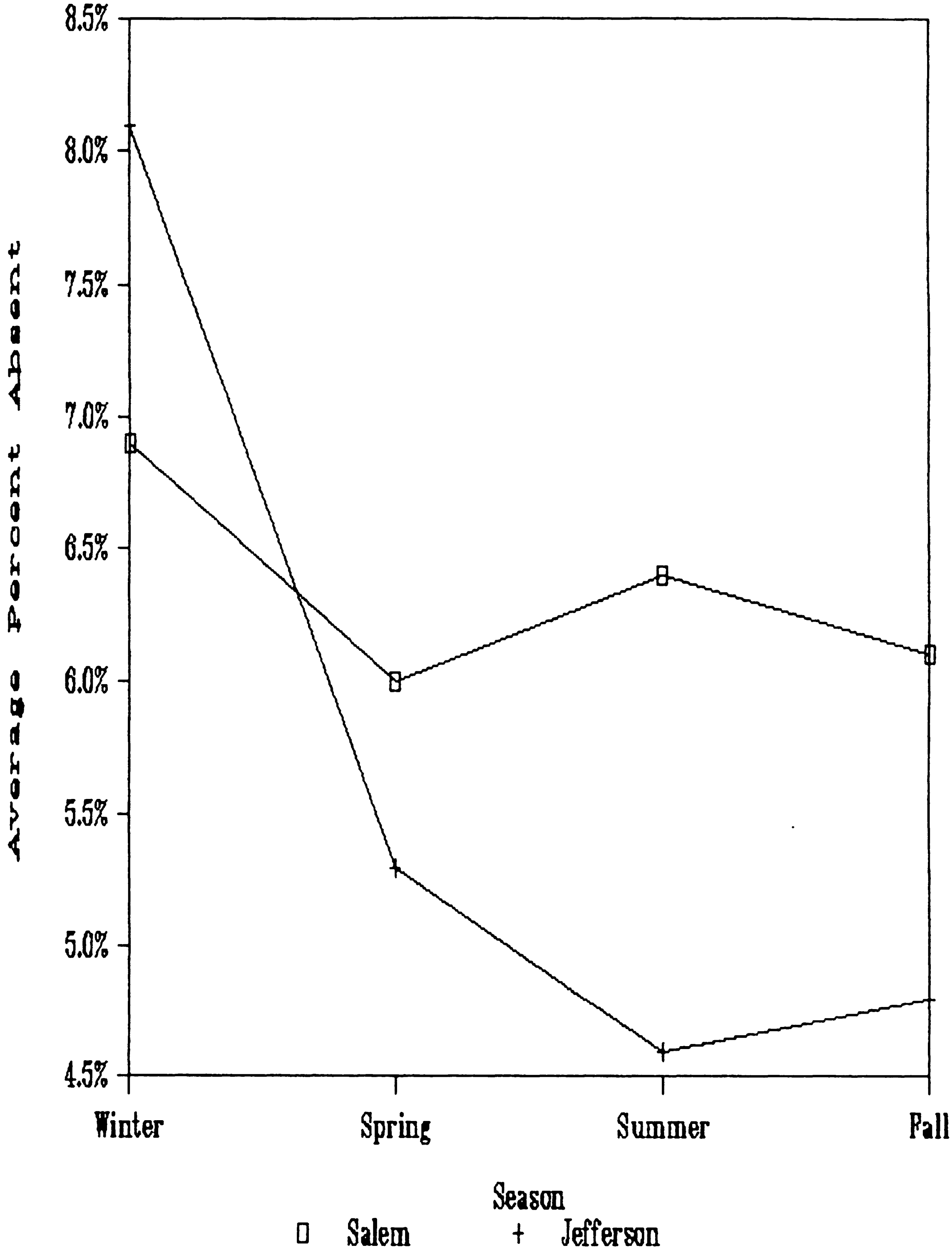

FIGURE 5

Average Percent Absent By Season:
Salem and Jefferson Plants

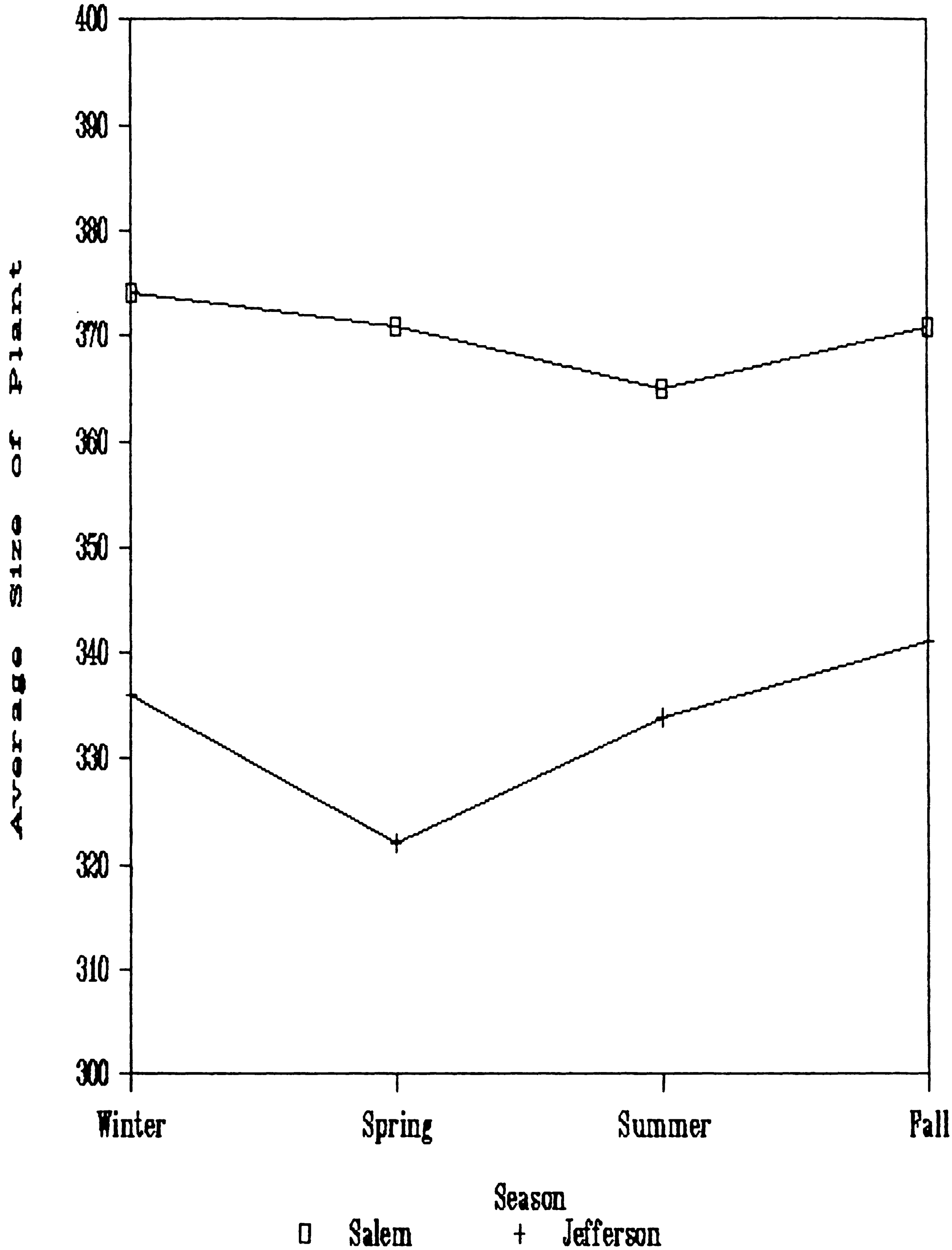

FIGURE 6

Average Plant Size By Season:
Salem and Jefferson Plants

variables have been determined: (1) season, (2) time-motion studies, (3) plant manager changes, and (4) uniform style changes.

Season

As previously stated in the literature review, seasonal cycles have been found to be related to differences in both absenteeism (Cook & Campbell, 1976; Markham, et al., 1983) and productivity (Persinger, 1983; Scott, et al., 1985). As Cook & Campbell (1976) point out, if temporal variation is not controlled for in field experiments then any differences found may be due to seasonal effects and not the independent variables.

When season was entered into the model, with productivity rate as the dependent variable, the results yielded a R-square of .028 ($p<.063$) for the Salem plant and a R-square of .088 ($p<.0001$) for the Jefferson plant. The Durbin Watson D statistic was .162 for Salem and .139 for Jefferson, both were significant. The results are shown in "step 0" of the stepwise regression given in Table 8. In this study, season is used both as a control variable and as an independent variable in the hypotheses section; therefore a detailed explanation of the season/productivity relationship will be given later.

Labor Engineering Time-Motion Studies

As stated in the methods section a labor engineering time-motion study was performed at each plant once during the five and a half years studied.

The "surrogate" variable of consulting hours was used to identify this time period. These studies do decrease the level of productivity in a plant for a period of time, and their effects must be controlled. Table 7 shows the results of a Duncan's Multiple Range Test for the variable payrate. Both plants have a lower average payrate during the time-motion study time period.

Insert Table 7 about here

When the variable consulting hours was added to the regression model after season, the R-square for the Salem plant increases by .131 ($p<.0001$) to an overall model R-square of .158 ($p<.0001$). The Jefferson plant showed an increase in R-square of .072 ($p<.0001$) to an overall model R-square of .161 ($p<.0001$). The Durbin Watson "D" statistic was a significant .186 for Salem and a significant .130 for Jefferson. The components of the stepwise regression model along with their corresponding degrees of freedom, sums of squares, F value, and D statistic are shown in Tables 8 and 9.

Insert Tables 8 and 9 about here

Table 7

Duncan's Multiple Range Test For Average Productivity Rate
Comparison Between
Labor Efficiency Study Time Period And All Other Times

Duncan Grouping		Mean	N	Time Period*
SALEM	A	$4.016	199	0
	B	$3.735	58	1
JEFFERSON	A	$4.120	196	0
	B	$3.898	62	1

* 0 = All Other Time Periods
1 = Labor Efficiency Evaluation Time Period

** Means with the same letter are not significantly different

Table 8

Salem Control Variables: Stepwise Regression
Productivity Rate as the Dependent Variable
Season/Consulting Hours/Uniform Style as the Model

	DF	SS	F	P	R-Square	R-Square Change
SALEM Step 0 - Season						
Model	3	.798	2.462	.062	.028	-
Error	253	27.353				
Step 1 - Season&Cons.						
Model	4	4.474	11.900	.0001	.158	.131***
Error	252	23.678				
Step 2 - Season&Cons. & CNorris1						
Model	5	5.348	11.770	.0001	.189	.031**
Error	251	22.803				

*** p<.0001

Table 9

Jefferson Control Variables: Stepwise Regression
Productivity Rate as the Dependent Variable
Season/Consulting/Plant Manager As The Model - Jefferson

	DF	SS	F	P	R-Square	R-Square Change
JEFFERSON						
Step 0 - Season						
Model	3	3.411	8.210	.0001	.088	-
Error	254	35.160				
Step 1 - Season&Cons.						
Model	4	6.194	12.100	.0001	.161	.072***
Error	253	32.376				
Step 2 - Season&Cons. & Plant Mgr.						
Model	9	16.603	20.830	.0001	.430	.269***
Error	254	35.160				

*** $p<.0001$

Plant Manager Changes

As discussed in the Methods section there is a major difference between the two plants in terms of plant manager turnover. The Salem plant has had the same plant manager for the entire five year six month period studied. The Jefferson plant however, has had 6 different plant managers during this same time period. It is quite possible that a new plant manager could have an effect on the workers and their productivity level. If this is so, then plant manager changes should be controlled for.

The following analyses were done only for the Jefferson plant. The plant manager variable was first entered alone into the regression model, and the results were a R-square of .400 ($p<.0001$). Table 10 presents the sums of squares, and degrees of freedom associated with the model. The Durbin Watson D statistic was a significant .225.

Insert Table 10 about here

Plant manager was then entered into a stepwise regression model to control for seasonal effects and consulting hours. The R-square increased from a .164 ($p<.0001$) (season & chours model) to .430 ($p<.0001$), a change of .276 ($p<.0001$). The plant manager variable contributed a significant amount of variance to the model with a F value of 23.50 ($p<.0001$). Table 9 includes the results of the above model. These findings indicate the

Table 10

Regression - Productivity Rate As The Dependent Variable
Plant Manager As The Model

	DF	SS	F	P	R-Square
JEFFERSON					
Plant Mgr.					
Model	5	15.435	33.62	.0001	.400
Error	252	23.135			

turnover of Plant Managers is a significant factor to consider when accounting for the variance of productivity, and it should be controlled for in future regression models.

A Duncan's Multiple Range Test was also performed on productivity means between plant managers. The results of this test are shown in Table 11. Plant Manager 5 has a significantly lower average productivity level (3.33), than all other plant managers. Plant Manager 2 has a significantly higher productivity level (4.27) than plant managers 3,4, and 5. Caution should be used in interpreting the results of this test however, because the cell sizes are dramatically different (n = 9 - 119). Duncan's test uses the harmonic mean when determining significance between unequal cell sizes.

Insert Table 11 about here

Average productivity rate was plotted by week for each plant manager separately. This was done to compare the pattern of productivity change between plant managers. It was thought that productivity may decrease at the beginning of a new plant managers employment. This could occur for a variety of reasons; including the plant manager learning the companies systems and policies (and perhaps changing them), and also the employees reacting to change. Upon examination of the plots, (plant manager 1 was omitted because employment had not begun during the time

Table 11

Duncan's Multiple Range Test For Average Productivity Rate
Jefferson Plant - Comparisons Between Plant Managers

Duncan Grouping	Mean	N	Plant Manager	Date
A	$ 4.279	63	2	(0581 - 0982)
A	$ 4.136	119	6	(0284 - 0986)
B A	$ 4.121	9	1	(0181 - 0481)
B C	$ 4.013	11	4	(0683 - 0883)
C	$ 3.859	36	3	(0982 - 0583)
D	$ 3.328	19	5	(0983 - 0284)

* Means with the same letter are not significantly different

the data was collected) 4 out of 5 plots depicted a decrease in productivity during the beginning months of employment (see Figures 7-11).

Although there appears to be a pattern, interpretation must be made with caution. The plant managers were employed for very different periods of time (12 - 104 weeks), so it becomes difficult to directly compare them. Furthermore, the time-motion study was being conducted during the total time period that both plant managers 4 and 5 were employed; and as stated earlier, these studies do decrease productivity for a period of time.

Uniform Style Changes

Salem is the only plant which had a significant style change during the time period covered. The "Christopher Norris" style was manufactured from June/July 1984 to approximately January/February 1985. The Salem plant manager felt that the introduction of this new style may have significantly decreased productivity. Therefore this time period was separated out and analysed.

Two versions of the same concept were operationalized. These two time periods were: (1) June, July, August, September (CNorris1); and (2) August, September, October, November (CNorris2). These time periods were selected because they were thought to best represent when the productivity changes might occur. Only the beginning months were looked at because it is during this time that the workers are getting used to the new style change. The second time period was added because the plant manager said it took 1-2 months before the style circulated through the entire plant. This lag is reflected in the variable "CNorris2".

Table 12 presents the results of the two regression models. When the first time period was entered into the model (CNorris1) the results yielded a significant R-square = .028 ($p<.01$). When the second time period (CNorris2) was entered into the model there were no significant findings.

Insert Table 12 about here

Another regression was conducted with CNorris1 entered into a step-wise regression, controlling for season and for consulting hours. The overall R-Square increased from .158 ($p<0001$) to .189 ($p<.0001$). The F value of CNorris1 was significant (9.63, $p<.01$). Table 8 includes the results of this model.

A Duncan's Multiple Range Test was conducted for both CNorris1 and CNorris2 time periods. As with the regression analyses significant findings were found only for the CNorris1 time period. The payrate means during the CNorris1 four month period was significantly <u>higher</u> (not lower, as expected) than during the other months. This finding is misleading however, because the test compared the CNorris1 four month period with all other months over the five year six month period. In addition the

Table 12

Regression - Productivity Rate As The Dependent Variable
CNorris1 Time Period and CNorris2 Time Period as The Source

	DF	SS	F	P	R-square
SALEM					
CNorris1					
Model	1	.789	7.36	.007	.028
Error	255	27.362			
CNorris2					
Model	1	.098	.89	.346	.003
Error	255	28.054			

cell sizes are extremely unequal (17 vs. 240). Therefore, a more accurate picture results from looking at means of the months which occurred directly before and after the "CNorris" style was implemented. These means are listed in Table 13, and the results of a Duncan's test are shown. The months of August and September were significantly lower then the 6 months before the introduction of the new style. They were not significantly lower then the 3 months after the implementation of the Norris style.

Insert Table 13 about here

RESULTS OF HYPOTHESIS TESTING

Hypothesis 1A

H1A: THERE IS A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN PLANT PRODUCTIVITY LEVEL AND THE NATIONAL UNEMPLOYMENT RATE.

Correlations between national unemployment rate and productivity rate for Salem and Jefferson plants are presented in Table 14. The Pearson correlation between unemployment and productivity for the Salem plant was .28 ($p<.05$), and -.21 (ns) for the Jefferson plant. Thus, the hypothesis was supported in the Salem plant but not the Jefferson plant.

Table 13

CNorris1 Time Period - Productivity Monthly Means and Duncan's Test for Months Before and After Style Change

Monthly Productivity Means - 1984

February	$ 4.45		August	$3.84	(CNorris1)
March	$ 4.40		September	$4.01	(CNorris1)
April	$ 4.37		October	$4.09	
May	$ 4.27		November	$4.19	
June	$ 4.52	(CNorris1)	December	$4.08	
July	$ 4.23	(CNorris1)			

Duncan's Mulitple Range Test

Duncan Grouping			Mean	N	Months	(CNorris)
	A		$ 4.425	2	Feb. March	Before CN
B	A		$ 4.370	2	June July	During CN
B	A		$ 4.310	2	April May	Before CN
B		C	$ 4.120	3	Oct. Nov. Dec.	After CN
		C	$ 3.930	2	August Sept.	During CN

* Means with the same letter are not significantly different

Insert Table 14 about here

Initially the variables of season, help-wanted ads, and unemployment rates were all entered in the regression model. However, an investigation of the VIF (variance inflation factor) diagnostic statistic showed a problem of multicollinearity between unemployment rates and help-wanted ads. Because these two measures essentially measure the same thing, the help-wanted ad index was dropped. The unemployment rate variable was kept because it is a more conventional and acceptable measure of unemployment.

The variable season was entered first into all of the regression models in order to control for its effects. When both season and national unemployment were entered into the model the R-square was .142 ($p<.064$) for the Salem plant and a significant .220 ($p<.01$) for the Jefferson plant. Therefore, when national unemployment was added to the model there was an increase in the R-square of .101 ($p<.05$) for the Salem and an increase of .105 for Jefferson (see Table 15). Inspection of the model shows that national unemployment accounts for a significant portion of the variance in the Salem plant although the overall model is not quite significant at the .05 alpha level ($p<.064$). The Jefferson plant results indicate that although the overall model is significant at the .01 alpha level ($p<.006$), season is adding the significant portion of the variance, not unemployment rate. When a stepwise regression model was next performed controlling for both season and consulting hours, in neither plant did

Table 14

Correlations Between Productivity Rate and National/State Unemployment Rate

	Salem	Jefferson
National Unemployment (Season Adjusted)	.28*	-.21
State Unemployment (Not Season Adjusted)	.17	-.50***

*$p < .05$
**$p < .01$
***$p < .001$

n = 62 months for National Unemployment
n = 65 months for State Unemployment

national unemployment achieve a high enough significance level to be entered into the model (entrance requirement set at $p < .05$).

Insert Table 15 about here

Hypothesis 1B

H1B: THERE IS A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN PLANT PRODUCTIVITY LEVEL AND THE STATE UNEMPLOYMENT LEVEL.

As shown in Table 14, the Pearson correlation was not significant in the Salem plant and was negatively significant in the Jefferson plant $r = -.50$ ($p < .001$). When state unemployment was entered into the regression model after controlling for season, the R-square was not significant in either case (see Table 16).

Insert Table 16 about here

Table 15

Regression - Comparison of Models:
Season And Season With National Unemployment

	DF	SS	F	P	R-square	R-Square Change
SALEM						
Season						
Model	3	.267	.877	.460	.041	-
Error	62	6.300				
Season and Nat. Unemp.						
Model	3	.739	2.360	.064	.142	.101*
Error	57	4.464				
JEFFERSON						
Season						
Model	3	1.060	2.708	.052	.116	-
Error	62	8.087				
Season and Nat. Unemp.						
Model	4	1.930	4.031	.006	.220	.105
Error	57	4.464				

Table 16

Regression - Productivity Rate As The Dependent Variable
And Season/State Unemployment As The Source

	DF	SS	F	P	R-square
SALEM					
Source					
Model	4	.264	.667	.617	.043
Error	60	27.353			
JEFFERSON					
Source					
Model	4	1.091	2.055	.098	.120
Error	60	35.083			

Hypothesis 2

H2: A RELATIONSHIP WILL BE FOUND BETWEEN PRODUCTIVITY LEVEL IN AN ORGANIZATION AND SEASONAL VARIATION.

The Duncan's Multiple Range Test was performed to determine whether there were significant differences in the average payrate between seasons. Season is defined as: Season 1 - Winter (January through March), Season 2 - Spring (April through June), Season 3 - Summer (July through September, and Season 4 - Fall (October through December). As Table 17A indicates, in the Salem plant Season 1 (winter) had a significantly higher payrate average then Season 3 (summer). No other significant differences were found. Table 17B presents Duncans' test for the Jefferson plant. Season 4 (fall) was found to be significantly lower than all other seasons; and Season 3 (summer) had a significantly lower payrate than Season 2 (spring).

Insert Tables 17A,B, about here

Another Duncan's Test was conducted to compare productivity rate across months. In the Salem plant the months of January, February, March, and April showed significantly higher productivity rates then the other months.

Table 17A

Duncan's Multiple Range Test For Average Productivity Rate
Salem Plant - Comparisons Across Season

Duncan Grouping		Mean	N	Season
	A	$ 4.023	71	1 - Winter
B	A	$ 3.964	74	2 - Spring
B	A	$ 3.938	53	4 - Fall
B		$ 3.868	59	3 - Summer

Table 17B

Duncan's Multiple Range Test For Average Productivity Rate
Jefferson Plant - Comparisons Across Season

Duncan Grouping			Mean	N	Season
	A		$ 4.120	74	2 - Spring
B	A		$ 4.104	71	1 - Winter
B			$ 4.029	59	3 - Summer
		C	$ 3.873	53	4 - Fall

* Means with the same letter are not significantly different

As Table 18A presents, this corresponds to the results found in the seasonal comparison with the exception of the additional month - April being added to the group. Also the months of August and September displayed significantly lower rates then the Jan-April group.

Table 18B gives the results of the Duncan's Test across months in the Jefferson plant. The month of December is significantly lower than all other months of the year. April is significantly higher than October, November, December, January, and July; June is significantly higher than July, November, and December.

Insert Tables 18A,B about here

Pearson correlations were performed to examine the relationship between each of the four seasons and productivity rate. The results for both the Salem and Jefferson plants are found in Table 19. The correlation between Spring and productivity is positive with $r = .22$ ($p<.001$) for Jefferson, and no significant results were found for Salem. Summer shows a negative correlation with productivity rate, $r = -.14$ ($p<.05$) for Salem, and no significant results for Jefferson. Fall has a negative correlation with significant results found only in Jefferson, $r = -.25$ ($p<.001$). Finally, Winter and productivity have a positive correlation with a significant relationship in Salem, $r = .13$ ($p<.05$), and no significant relationship in Jefferson.

Table 18A

Duncan's Multiple Range Test For Average Productivity Rate
Salem Plant - Comparisons Across Months

Duncan Grouping	Mean	N	Month	
A	$ 4.038	25	4	April
A	$ 4.019	25	3	May
A	$ 4.018	20	1	January
A	$ 4.011	24	2	February
B A	$ 3.971	26	6	June
B A	$ 3.971	14	12	December
B A	$ 3.962	11	11	November
B A	$ 3.903	10	10	October
B A	$ 3.885	24	5	May
B A	$ 3.865	20	7	July
B	$ 3.754	23	9	September
B	$ 3.752	27	8	August

Table 18B

Duncan's Multiple Range Test For Average Productivity Rate
Jefferson Plant - Comparisons Across Months

Duncan Grouping	Mean	N	Month	
A	$ 4.262	25	4	April
B A	$ 4.222	26	6	June
B A C	$ 4.177	24	5	May
B A C	$ 4.153	25	3	March
B A C	$ 4.104	24	2	Febraury
B A C	$ 4.081	23	9	September
B A C	$ 4.036	27	8	August
B C	$ 3.996	20	1	January
B C	$ 3.980	20	10	October
C	$ 3.957	20	7	July
C	$ 3.945	20	11	November
D	$ 3.631	15	12	December

* Means with the same letter are not significantly different

Insert Table 19 about here

The significant findings in the Salem plant indicate that as Summer progresses (July through Sept.) the productivity rate decreases, and that as Winter (January through March) advances productivity increases. The results which were significant in the Jefferson plant suggest that as Spring continues (April through June), productivity goes up and that as Fall progresses (October through December) productivity goes down.

To investigate further the hypothesis that there is variation in productivity levels which are associated with seasonal cycles, season was entered into a regression model. As discussed previously, and shown in Table 20, the overall model was not significant in Salem with a R-square of .028 ($p<.062$), but was significant in Jefferson, with a R-square of .090 ($p<.0001$).

Insert Table 20 about here

The plants were compared to determine if there were any common seasonal patterns. Although no strong similarities resulted, several tentative conclusions can be made. First, during the summer months (July, August, September) both plants exhibited a lower productivity rate then at other

Table 19

Correlations Between Productivity Rate And Season

	Salem	Jefferson
Spring	.021	.218***
Summer	-.140*	-.054
Fall	-.023	-.254***
Winter	.131*	.060

*p<.05
**p<.01
***p<.001

n = 257 weeks

Note: Winter = January through March
Spring = April through June
Summer = July through September
Fall = October through December

Table 20

Regression - Productivity Rate As The Dependent Variable
Season As The Source

	DF	SS	F	P	R-square
SALEM					
Source					
Model	3	.798	2.462	.063	.028
Error	253	27.353			
JEFFERSON					
Source					
Model	3	3.466	8.333	.0001	.090
Error	253	35.083			

times of the year. This was true especially for the Salem plant. In Jefferson summer was lower than Spring (April, May, June), but fall (Oct. Nov. Dec.) remained the lowest season during the year. The holiday season appears have lower productivity rates, especially significant in the Jefferson plant, where December stood out as significantly lower then all other times.

<u>Hypothesis 3</u>

H3: DURING THE HOLIDAY SEASON (FALL - OCT.,NOV.,DEC. - 4TH SEASON) THE ORGANIZATION'S PRODUCTIVITY LEVEL WILL INCREASE SIGNIFICANTLY IN COMPARISON TO THE PREVIOUS QUARTER (SUMMER - JULY, AUGUST, SEPT.).

When a Duncan's was performed on the total five year time period, fall was not significantly higher then summer in either plant. In fact, in the Jefferson plant fall was significantly lower than all other seasons (see Tables 17A and 17B).

<u>Hypothesis 4</u>

H4: THERE WILL BE A SIGNIFICANT NEGATIVE RELATIONSHIP BETWEEN THE PRODUCTIVITY RATE AND THE ABSENTEEISM RATE IN THE FOCAL ORGANIZATION.

Table 21 presents the Pearson correlations between percent absent and productivity rate. In the Salem plant, r = -.34 (p<.001) and in Jefferson, r = .16 (p<.01). Therefore, the hypothesis was supported only at Salem.

Insert Tables 21

Further correlations between productivity level and percent absent were looked at by "lagging" the variables in one week intervals. Thus, it could be seen whether the relationship changed when looking at both productivity rate and percent absent lagged for 1,2,3, and 4 week periods. No major differences were found in either plant. The correlations between the lagged variables did not change in direction or significance level in the Salem plant. In the Jefferson plant the lagged variables all remained significant in the same direction. The only change was in the significance level which became slightly higher for most of the variables when lagged for 2,3, and 4 periods (from p<.01 to p<.001).

When the variables season and percent absent were enter into the regression, the overall model in both plants were significant. The R-square was .158 in the Salem plant (p<.0001), and .101 in the Jefferson plant (p<.0001). The R-square change was .130 (p<.0001) in Salem and .011 (p<.05) in Jefferson (see Table 22).

Table 21

Correlations Between Productivity Rate And Percent Absent

	Salem	Jefferson
Percent Absent	-.34***	.16**

**p<.01
***p<.001

n = 257 weeks for Salem
n = 253 weeks for Jefferson

Insert Table 22

In support of the relationships found with the Pearson correlations, the F value was negatively significant in the Salem plant and positively significant in the Jefferson plant. Again, the hypothesis is supported only for the Salem plant.

A stepwise regression was next performed entering the control variables. In the Salem plant, the stepwise model forced in season and consulting hours (time motion study) first. The other control variable - style change and the independent variable - percent absent, were allowed to enter the model if it met the .05 probability level. The results are given in Table 23. In the first step of the model percent absent was entered after season and consulting hours, and the R-square increased by .083 ($p<.0001$) therefore a significant proportion of variance was accounted for by this variable. The second step of the model added the style change variable (CNorris1), and the R-square increased by .026 ($p<.01$). The bottom of Table 23 gives the individual components of the entire model. Percent absent accounts for a significant amount of variance even when all three control variables are entered into the model. Thus, the hypothesis is supported in the Salem plant.

Table 22

Regression - Comparison of Models:

Season And Season/Percent Absent

	DF	SS	F	P	R-Square	R-square Change	Durbin-Watson
SALEM							
Season							
Model	3	.798	2.462	.062	.028	-	-
Error	253	27.353					
Season - Percent Abs							
Model	4	4.450	11.830	.0001	.158	.130***	.328
Error	252	23.701					236 obs.
JEFFERSON							
Season							
Model	3	3.466	8.333	.0001	.090	-	-
Error	253	35.083					
Season and Percent Abs							
Model	4	3.865	7.005	.0001	.101	.011*	.158
Error	248	34.205					229 obs.

**p<.001
***p<.0001

Insert Table 23 about here

In the Jefferson plant the hypothesis is not supported. When a stepwise regression was conducted controlling for season and consulting hours, percent absent did not reach the .05 significance level required to be entered into the model.

Hypothesis 5

H5: THERE WILL BE A SIGNIFICANT POSITIVE RELATIONSHIP BETWEEN CHANGE IN ORGANIZATIONAL SIZE AND PRODUCTIVITY RATE.

Table 24 shows the Pearson correlations between productivity rate and plant size. The hypothesis is not supported in either plant. There is not a significant relationship in the Salem plant, and there is a significant, but negative relationship in the Jefferson plant, $r = -.60$ ($p < .0001$).

Insert Table 24 about here

Table 23

Salem Plant:
Stepwise Regression - Productivity Rate As The Dependent Variable
Season / Consulting Hours / Style Change / Percent Absent As The Model

	DF	SS	F	P	R-Square	R-Square Change
SALEM						
Step 0 - (Season&Cons)						
Model	4	4.474	11.90	.0001	.158	-
Error	252	23.678				
Step 1 - (Season&Cons) (& % Absent)						
Model	5	6.822	16.06	.0001	.242	.083***
Error	251	21.330				
Step 2 - (Season&Cons) (& CNorris1) (& % Absent)						
Model	6	7.562	15.30	.0001	.269	.026**
Error	250	20.589				
Variables (Step 2)						
Winter	1	1.565	19.01	.0001		
Spring	1	.228	2.77	.097		
Fall	1	.223	2.71	.101		
CHours	1	2.013	24.45	.0001		
CNorris1	1	.740	8.99	.003		
PctAbsnt	1	2.231	26.88	.0001		

**p<.001
***p<.0001

Table 24

Correlations Between Productivity Rate And Plant Size

	Salem	Jefferson
Plant Size	-.006	-.603***

***p<.0001

n = 257 weeks for Salem
n = 253 weeks for Jefferson

Further correlations were looked at using size and productivity lagged for four periods. There were no significant changes; Salem still showed no significant findings, and Jefferson remained significant at the $p<.0001$ alpha level.

The variables season and plant size were entered into a regression model. Plant size did not account for any significant amount of variance in the Salem plant. Furthermore, as Table 25 presents neither the season nor the season/size overall models had a significant R-square. The Jefferson plant did show plant size do be significantly contributing to the amount of variance accounted for (see Table 25). The R-square for the season/size model was .394 ($p<.0001$) with an increase of .304 ($p<.0001$). over just the season model.

Insert Table 25 about here

Stepwise regression models including the control variables were conducted for each plant. In the Salem plant, as with percent absent, both season and consulting hours were forced into the model first. Next, both the control variable - style change and the independent variable - plant size were allowed to "float" into the model if significance level reached .05. In the Salem plant, style change (CNorris1) was entered in the first step of the model, R-square was .190 ($p<.0001$). Percent Absent was entered

Table 25

Regression - Comparison of Models:
Season And Season/Plant Size

	DF	SS	F	P	R-Square	R-Square Change	Durbin-Watson
SALEM							
Season							
Model	3	.798	2.462	.062	.028	-	-
Error	253	27.353					
Season - Size							
Model	4	.829	1.912	.108	.029	.001	.163***
Error	252	27.322					236 obs.
JEFFERSON							
Season							
Model	3	3.466	8.333	.0001	.090	-	-
Error	253	35.083					
Season and Size							
Model	4	14.985	40.245	.0001	.394	.304***	.237***
Error	248	23.084					229 obs.

**p<.001
***p<.0001

in step two of the model after the three control variables. The R-square increased by .030 (p<.01), with the total R-square at .220 (p<.0001). Table 26 presents the results of this model.

Insert Table 26 about here

In the Jefferson plant two stepwise regression models were performed. The first controlled for both season and consulting hours. After these variables were forced into the model, plant size was entered. The R-square increased from .154 (p<.0001)to .430 (p<.0001), a change of .276 (p<.0001). The next model forced in season, consulting hours, and plant manager, with plant size being entered last. The R-square again increased from .430 (p<.0001) to .628 (p<.0001), for a change of .198 (p<.0001). Table 27 gives the results of both models.

Insert Table 27 about here

In conclusion, although the first regression model (season & percent absent) did not show significant findings for the Salem plant, the stepwise regressions after controlling for season, labor efficiency study, and style change <u>did</u> show plant size to add a significant amount of variance to the model. In the Jefferson plant, size appeared to add a large amount

Table 26

Salem Plant:
Stepwise Regression - Productivity Rate As The Dependent Variable
Season / Consulting Hours / Style Change / Plant Size As The Model

	DF	SS	F	P	R-Square	R-Square Change
SALEM						
Step 0 - (Season&Cons)						
Model	4	4.474	11.90	.0001	.158	-
Error	252	23.678				
Step 1 - (Season&Cons) (& CNorris1)						
Model	5	5.348	11.77	.0001	.190	.031**
Error	251	22.803				
Step 2 - (Season&Cons) (& CNorris1) (& Plant Size)						
Model	6	6.187	11.74	.0001	.220	.030**
Error	250	21.964				
Variables (Step 2)						
Winter	1	1.905	21.68	.0001		
Spring	1	.627	7.14	.008		
Fall	1	.694	7.91	.005		
CHours	1	3.673	41.81	.0001		
CNorris1	1	1.305	14.86	.0001		
TotAct (Size)	1	.839	9.55	.002		

**p<.01

Table 27

Jefferson Plant:
Stepwise Regression - Productivity Rate As The Dependent Variable
Season / Consulting Hours / Plant Mgr. / Plant Size As The Model

	DF	SS	F	P	R-Square	R-Square Change
JEFFERSON						
Step 0 - (Season&Cons)						
Model	4	5.880	11.36	.0001	.154	-
Error	249	32.213				
Step 1 - (Season&Cons) (& Plant Mgr.)						
Model	9	16.603	20.83	.0001	.430	.276***
Error	248	21.968				
Step 2 - (Season&Cons) (& Plant Mgr) (& Plant Size)						
Model	10	23.939	41.10	.0001	.623	.199***
Error	243	14.153				
Variables (Step 2)						
Winter	1	.113	1.94	.165		
Spring	1	.012	.20	.652		
Fall	1	.0003	.00	.945		
CHours	1	.928	15.93	.0001		
Pmgr1	1	.780	13.40	.0003		
Pmgr2	1	1.514	25.99	.0001		
Pmgr3	1	.012	.20	.656		
Pmgr5	1	.852	14.63	.0002		
Pmgr6	1	.766	13.14	.0004		
TotAct (Size)	1	7.539	129.44	.0001		

**p<.001
***p<.0001

of variance, even when accounting for all of the control factors. Size seems to be an important factor, especially in the Jefferson plant. However, based on the Pearson correlations the relationship is negative, not positive as hypothesized.

Final stepwise regressions were performed in each plant. These were conducted with all the control variables forced into the model first, and the remaining two independent variables (percent absent and plant size) entered into the model if their probabilities exceeded .05. In the Salem plant, both of the independent variables contributed a significant amount of the variance. As shown in Table 28, step 1, percent absent increased the R-square from .190 (season, consulting hours, style change) to .269, a change of .080 ($p<.0001$). In step 2, plant size was added into the model, and the R-square increased significantly by .013 ($p<.05$), to R=.282.

Insert Table 28 about here

The same type of stepwise model was conducted for the Jefferson plant. The control variables (season, time-motion studies, plant manager) was forced into the model first. Then both percent absent and plant size were allowed to enter the model if they achieved the .05 significance level. In this plant once all the control variables were added, only plant size accounted for a significant proportion of the variance. The addition of

Table 28

Salem Plant:
Stepwise Regression - Productivity Rate As The Dependent Variable
All Significant Variables Entered Into Model

	DF	SS	F	P	R-square	R-Square Change
SALEM						
Step 0 - (Season&Cons) (& CNorris1)						
Model	5	5.348	11.77	.0001	.190	-
Error	251	22.803				
Step 1 - (Season&Cons) (& CNorris1) (& % Absent)						
Model	6	7.562	15.30	.0001	.269	.079***
Error	250	20.589				
Step 2 - (Season&Cons) (& CNorris1) (& % Absent) (& Plant Size)						
Model	7	7.954	14.01	.0001	.282	.014*
Error	249	20.197				
Variables (Step 2)						
Winter	1	1.870	23.06	.0001		
Spring	1	.337	4.15	.042		
Fall	1	.374	4.62	.032		
CHours	1	2.336	28.80	.0001		
CNorris1	1	.999	12.32	.0005		
Percent Absent	1	1.767	21.78	.0001		
TotAct (Size)	1	.392	4.83	.029		

*p<.05
**p<.01
***p<.001

plant size increased the model R-square from .430 to .623 a significant change of .199 ($p<.0001$); percent absent was not entered into the model. The results of this regression are the same as those found in Table 27.

In conclusion, the plants show quite different results. While percent absent appears to be adding more variance than plant size in the Salem plant, just the opposite is true in Jefferson.

Hypothesis 6

H6: BOTH FORMAL RECOGNITION AND FINANCIAL INCENTIVE PRODUCTIVITY PROGRAMS WILL SIGNIFICANTLY INCREASE PRODUCTIVITY WHEN COMPARED TO THE BASELINE DATA FOR EACH PLANT.

Regression anaylsis using the program variable (before, during, and after) as the regressor and productivity rate as the dependent variable was first conducted to determine the Durbin-Watson "D" statistic. In both plants the "D" statistic was significant, thus indicating autocorrelation (Salem "D" = .522, Jefferson "D" = .402, ($p<.001$)). Therefore, all of the following analyses must be interpreted with caution, as the R-square will be overestimated.

An analysis of covariance was conducted to determine the effects of the programs on productivity. The three time periods compared were before implementation of the program (Jan 1981 - June 1984), during program implementation (July 1984 - June 1985), and after the program ended (July 1985 - July 1986). Table 29 contains the results of an analysis of covariance for each plant. In the Salem plant all of the covariates, season, time-motion study, style change, percent absent and size were significant at the .001 alpha level or less. The program variable was significant, $F=145.78$, $df=2,247$, $p<.0001$, R-square=.671, ($p<.0001$).

Insert Table 29 about here

A Duncan's post-hoc test was performed to determine where the mean differences occurred for the three time periods. These means are not adjusted for the covariates or autocorrelation, so interpretation must be made with caution. As presented in Table 30, the mean differences were not in the hypothesized direction. No significant differences were found before and during the program, but both were significantly higher than after the program.

Insert Table 30 about here

In the Jefferson plant the following covariates were significant at the .0001 alpha level, season, time-motion studies, plant manager turnover,

Table 29

Analysis of Covariance
Results Of Program Effects On Productivity

	DF	SS	F	P	R-square	Durbin - Watson
SALEM						
Model	9	18.888	55.96	.0001	.671	.522***
Error	247	9.263				(n=232)
SOURCE						
Season	3	.798	7.10	.0001		
CHours	1	3.675	98.00	.0001		
Style Ch.	1	.874	23.32	.0001		
% Absent	1	2.214	59.03	.0001		
Plant Size	1	.392	10.45	.001		
Program	2	10.934	145.78	.0001		
JEFFERSON						
Model	12	24.193	34.96	.0001	.635	.402***
Error	241	13.899				(n=232)
SOURCE						
Season	3	3.188	18.43	.0001		
CHours	1	2.692	46.67	.0001		
Plant Mgr.	5	10.519	36.48	.0001		
Plant Size	1	7.539	130.73	.0001		
Program	2	.255	2.21	.112		

***p<.0001

Table 30

Duncan's Multiple Range Test
Results Of Program Effects On Productivity
(Not Adjusted For Confounding Variables)

	Duncan Grouping	Mean	N	Program
SALEM	A	$ 4.086	157	1 - Before
	A	$ 4.071	49	2 - During
	B	$ 3.428	51	3 - After
JEFFERSON	A	$ 4.323	49	2 - During
	B	$ 4.027	155	1 - Before
	B	$ 3.956	50	3 - After

* Means with the same letter are not significantly different

and plant size. Percent absent was not a a significant covariate. The program variable was not significant, F=2.19, df=2,240, (p<.114), even though the entire model was significant, R-square=.635, (p<.0001) (see Table 31). A Duncan's post-hoc test was conducted to determine if mean differences (unadjusted) occurred for the three time periods. The average productivity rate during the program was significantly higher than both before and after program implementation (see Table 30). The hypothesis was supported; however, these results must be interpreted with caution because in the analysis of covariance program was not significant.

PROGRAM EVALUATION - EFFECTS OF 1ST ORDER AUTOCORRELATION REMOVED

As stated previously, tests of the null hypothesis require that certain assumptions be made in order for the results of the data analyses to be meaningfully interpreted. As Cook and Campbell (1979) state, an important assumption of multiple regression techniques and analysis of variance is that there be uncorrelated errors. Because this study used multiple observations over time, there was a problem of autocorrelation (as shown by the Durbin- Watson "D" statistic). Therefore, the R-square was overestimated in the previous regression models. To avoid this problem, the first order autocorrelation was obtained for the full model in each plant. It was then removed from all the continuous variables in the model: percent absent, plant size, and productivity rate. A final analysis of covariance was performed using these new variables (with autocorrelation removed) in the model.

As shown in Table 31, after the 1st order autocorrelation effects were removed the R-squares in both plants dropped dramatically but were still significant. In the Salem plant there was a decrease in the R-square from .671 to .218, with the model still significant ($F=7.36$, $df=9,238$, $p<.0001$). The Durbin Watson was 2.12, indicating there was no longer a problem of autocorrelation. After the effects of autocorrelation were removed, three of the covariates were no longer significant: season ($F=2.01$, $p<.11$), style change ($F=2.66$, $p<.10$), and size ($F=1.14$, $p<.28$). The program variable was significant, $F=19.69$, $df=2,238$, $p<.0001$.

In the Jefferson plant there was a decrease in the R-square from .635 to .245, with the model still significant ($F=6.22$, $df=12,230$, $p<.0001$). The Durbin Watson was 1.77, indicating there was no longer a problem of autocorrelation. As Table 31 presents, after the effects of autocorrelation were removed, all the covariates remained significant at the .05 alpha level or less. The program variable was not significant, $F=2.42$, $df=2,230$, $p<.09$.

Insert Table 31 about here

A Least Squares Means Test was performed to determine where the mean differences occurred for the three time periods. These means were adjusted for both the covariates and autocorrelation. Although this test

Table 31

Analysis of Covariance With
1st Order Autocorrelation Effects Removed:
Results Of Program Effects On Productivity

	DF	SS	F	P	R-square	Durbin - Watson
SALEM						
Model	9	1.086	7.36	.0001	.218	2.12
Error	238	3.900				(n=228)
SOURCE						
Season	3	.099	2.01	.113		
CHours	1	.201	12.29	.0005		
Style Ch.	1	.044	2.66	.104		
AutoAbsnt.	1	.078	4.76	.030		
Autosize	1	.019	1.14	.286		
Program	2	.645	19.69	.0001		
JEFFERSON						
Model	12	1.280	6.22	.0001	.245	1.767
Error	230	3.944				(n=223)
SOURCE						
Season	3	.282	5.49	.001		
CHours	1	.064	3.72	.055		
Plant Mgr.	5	.712	8.31	.0001		
Autosize	1	.138	8.08	.005		
Program	2	.083	2.42	.091		

***p<.0001

is valuable for determining the significance of mean differences, the actual LS Mean values are hard to interpret because of the adjustment procedure.

In the Salem plant, as shown in Table 32, there was not a significant difference in productivity before and during the program. However, there was a significant drop in productivity when comparing time periods before and during the program with after the program.

In the Jefferson plant there was a marginally significant ($p<.059$) increase in productivity during the program when compared to the time period before the program. No other significant differences were found. However, this result must be interpreted with caution because in the ANCOVA model the program variable did not account for a significant amount of variance ($p<.09$).

Insert Table 32 about here

SUMMARY

This chapter has highlighted the major findings of the study. Population characteristics and summary statistics were presented, as well as the results of testing the hypotheses. In summary, these results indicated

Table 32

Least Squares Means Test
Results Of Program Effects On Productivity
(Adjusted For All Confounding Variables Including Autocorrelation)

	LS Means (Productivity Rate)	Standard Error (LS Means)	Prob > T H0:LSMeans(I)= LSMeans(J)		
SALEM			Program		
Program			1	2	3
1 - Before	$.892	.012	-	.255	.0001
2 - During	$.859	.023	.255	-	.0001
3 - After	$.731	.021	.0001	.0001	-
JEFFERSON			Program		
Program			1	2	3
1 - Before	$.776	.020	-	.059	.270
2 - During	$.885	.046	.059	-	.124
3 - After	$.840	.046	.270	.124	-

that no hypothesis was completely supported in both plants, although several hypotheses were supported in either the Jefferson or Salem plant.

In the Salem plant, Hypothesis 2, 4, and 6 were at least partially supported. Season was marginally significant ($p<.06$) when entered into a regression model with productivity as the dependent variable. The winter season yielded a significantly higher productivity average when compared to the summer season. There was a significant negative correlation between percent absent and productivity, and this relationship was still significant even after controlling for the effects of other variables. The results of the program analysis indicated that the variable program was significant in an ANCOVA model with productivity as the dependent variable. There was a significant drop in productivity when comparing time periods before and during the program with after the program.

In the Jefferson plant, only Hypothesis 2 was supported. Season was significant when entered into an ANOVA model with productivity as the dependent variable. Productivity during Fall was found to be significantly lower when compared to all other seasons. Plant size was found to be significant in a regression model, although the relationship was negative (not positive as hypothesized). This relationship was maintained even after the effects of other variables were controlled. Plant manager turnover, although not related to the research hypotheses, accounted for a large amount of the variance in productivity level at the Jefferson plant.

The next chapter will provide an indepth discussion of these findings including their interpretation and implications. The chapter will also identify the limitations of this research and discuss recommendations for future research.

V. DISCUSSION, LIMITATIONS, RECOMMENDATIONS

INTRODUCTION

The purpose of this chapter is to discuss the findings of the research. This will include a summary of the study, interpretation of the results, and discussion of their implications. Finally, the limitations of the study will be examined and recommendations for future research will be presented.

SUMMARY OF STUDY

This research consisted of two parts: (1) an exploration of the relationships of two external and two internal factors with plant-level productivity; and (2) an evaluation of the effectiveness of two types of productivity improvement programs after holding constant the control variables in part one. In the first part, two external factors, specifically unemployment and seasonal cycles, were examined. Next, two internal organizational factors, the size of the plant over time, and the absenteeism rate within the company, were analyzed. During the course of the study three other factors were identified which had significant effects on the productivity level within one or both plants. These were: 1) time-motion studies, 2) the turnover of plant managers, and 3) the style change of uniforms manufactured in the plant. In order to determine the effects of the internal/external factors and the effects of the productivity programs on productivity, the contribution of these "control variables" had to be held constant.

The second part of this study examined the effects of implementing two types of positive incentive programs: 1) Personal Recognition; and 2) Financial Incentives, after the above factors were accounted for. These programs were based on the concept that productivity is related (at least in part) to the amount of effort an employee chooses to expend (Pinder, 1984). In order to increase this effort, and consequently performance, programs based on motivational principles were designed. If program effects were found, this would lead to the support for the use of one or both types of programs in the apparel industry.

DISCUSSION OF RESEARCH FINDINGS

The results of the study will be discussed in terms of each hypothesis.

H1A/B: There is a significant positive relationship between plant productivity level and the national/state unemployment rate.

This hypothesis was based on the notion that during times of high unemployment layoffs are frequent, work is scarce, and workers currently employed are afraid of losing their jobs. Thus, employees may increase their productivity to reduce the chances of being laid off. Additionally, management will probably be more attentive and aware of the productivity rate within the organization.

This hypothesis received partial support in only the Salem plant. A small positive relationship between national unemployment rate and productivity was found ($r=.28$, $p<.05$). In the Jefferson plant a moderate negative relationship was found between state unemployment rate and productivity ($r=-.50$, $p<.001$). Because these Pearson correlations could have been due to the effects of other variables, regression analysis holding these variables constant was performed. These results indicated that both state and national unemployment were not related to plant-level productivity. Therefore, when the control variables were accounted for, the hypotheses were not supported.

There are several reasons why these findings may have occurred. First, it is possible that in these two specific plants the national unemployment rate was not a sensitive measure. The Jefferson plant is located in a very rural area with little potential for other employment, thus the amount of work available may be different than that indicated by the national and state unemployment rates. A more accurate measure of unemployment for these two plants may be to examine the workers' perceptions of job availability in their relevant labor market area.

Second, this hypothesis was based on the rationale behind the unemployment/absenteeism relationship. It is quite possible that this theory does not apply in the same way for productivity rate. The rate at which people work may not be as "visible" a behavior to management as absenteeism. Unlike excessive absenteeism, employees may not necessarily perceive a decrease in their productivity as jeopardizing their employment.

H2: A relationship will be found between productivity level in an organization and seasonal cyclicality.

One question this study attempted to answer was if there were systematic variations in productivity which related to seasonal cyclicality. The importance of season as a contributing factor was found in previous research which examined both absenteeism (Markham et al., 1983) and productivity (Scott et al., 1985).

The results from regression analyses using winter, spring, summer, and fall as the independent variables, and productivity rate as the dependent variable, yielded a significant R-square in Jefferson, and a marginally significant R-square in the Salem plant. These results should be interpreted with caution however, as the Durbin-Watson D statistic was significant in both plants. As there is a problem of autocorrelation, the R-square will be lower.

Generally, although season was related to productivity, the patterns for these relationships were very plant specific. For instance, the relationships between productivity and summer, and productivity and winter were significant at Salem and not at Jefferson. While, in Jefferson unlike Salem, productivity was significantly related to spring and fall.

Productivity mean differences also differed seasonally, and were plant specific. In the Salem plant, summer had a significantly lower productivity average then winter. One interpretation of these results follows from an explanation offered by Markham, et al., (1983). This study found a higher absenteeism rate during the summer months when compared to the winter months. The researchers suggested that good weather conditions may effect the willingness or ability of employees to invest time and effort into their jobs. This same rationale can be applied to productivity, where during the summer months employees who are not absent may be less motivated to perform as quickly and efficiently as in the winter.

In Jefferson, the summer months showed an average productivity rate which was significantly lower than the springtime months. The "good weather" explanation that was offered for the Salem plant could apply to this plant as well. Another significant finding at Jefferson was that fall had the lowest average productivity rate when compared to all the other seasons. This finding relates directly to the third hypothesis and will be discussed next.

H3: During the Holiday Season (Fall - Oct., Nov., Dec.) the organization's productivity level will increase in comparison to the previous quarter (Summer - July, August, Sept.).

This hypothesis was not supported in either plant. In Salem there was not a significant difference. In the Jefferson plant, a significant difference was found although not in the anticipated direction; the holiday season (fall) had the lowest productivity average of the whole year. When the holiday season was further examined by month, December had the significantly lowest productivity when compared to all the months of the year. The above results indicate that in the Jefferson plant productivity is negatively affected by the Holiday season. It is possible that people may be diverted by more home and holiday responsibilities, and their work performance may suffer. It is also possible however, that other variables are accounting for this decrease, and the holidays are not the important factor.

H4: There will be a significant negative relationship between the productivity rate and the absenteeism rate in the focal organization.

This hypothesis was supported in the Salem plant only. The Pearson correlations were significant in both plants; positive for Salem ($r=-.34$, $p<.001$) and negative for Jefferson ($r=.16$, $p<.01$). Because these Pearson correlations could have been significant due to the effects of the control variables (season, time-motion studies, etc.), regression analysis holding these variables constant was performed. These results indicated that in the Jefferson plant, percent absent was not a significant factor once the effects of the control variables were removed. In the Salem plant, percent absent did contribute a unique amount to the regression model, even after all the control variables were entered into the equation.

In conclusion, the results found in the Salem plant support previous research which found that absenteeism hinders operating effectiveness and efficiency (Metzner & Mann, 1953; Morgan & Herman, 1976; Steers & Rhodes, 1978). If employees are absent, the work will either not get done, or be accomplished by a co-worker or replacement. Therefore, the work will frequently not be completed as quickly or efficiently because of lack of familiarity or practice.

However, the equivocal results between plants also lends support to research which asserts that there are other intervening variables in the absenteeism/performance relationship. As Moch & Fitzgibbons (1985) stated the effects of absenteeism may vary depending on other organizational factors. The lack of strong significant results for absenteeism in the Jefferson plant and the strong significant results found in the Salem plant support the notion that the absenteeism/productivity relationship is not affected similarly under all organizational conditions. Therefore, in the Salem plant, percent absent did account for a unique proportion of variance above and beyond the other variables. While, in the Jefferson plant, there are other variables (eg., size - which will be discussed next), which had stronger effects on productivity.

H5: There will be a significant positive relationship between change in organizational size and productivity rate.

Again, the results for both plants were very different; however, neither were in support of the hypothesis. Based on both correlation and regression analysis, there was a significant _negative_ relationship in the Jefferson plant. The correlation was $r = -.63$ ($p<.0001$), and the regression model, holding the control variable's effects constant, still showed plant size to contribute significant unique variance to productivity (R-square change = .198, $p<.0001$).

The hypothesis predicting a significant positive relationship was based on the previous limited research of size and productivity from a cross-sectional perspective. This means that size was compared between organizations at one particular point in time. The result found in the Jefferson plant however, indicates that longitudinal research which studies the impact of change in size within one plant is affected quite differently.

The negative relation between size of the organization over time and productivity could be explained by the correlation between turnover rates and size. In the apparel industry, turnover rates are frequently high, and many of the people who leave tend to be the slower and less experienced workers. When size is relatively lower, this means that many of the "less productive" workers have quit, while the the more tenured employee with a corresponding higher average productivity rate are still with the organization. Therefore, when size is relatively higher, the average productivity rate which is reflected includes those less experienced, slower workers.

In the Salem plant there was not a significant correlation. In regression analysis with only the effects of season removed, plant size was not significant. However, when all three control variables (season, labor efficiency, style change) were entered into the model, plant size became a significant contributing factor (R-square change = .03, $p<.01$). Therefore, plant size may not <u>itself</u> be correlated with productivity, but instead be correlated with other variables in a way which suppressed it's significance when entered alone into the model. The lack of significant results in Salem, and the significant results found in the Jefferson plant, could also be explained by the relatively higher variability in size in the Jefferson plant.

H6: Both formal recognition and financial incentive productivity improvement programs will significantly increase productivity when compared to the baseline data for each plant.

Three time periods were compared; before program implementation, during program implementation, and after the program ended. Both plants had significant "D" statistics indicating a problem with autocorrelation. A final analysis was performed with the first order autocorrelation effects removed. Once this was done, the Durbin Watson "D" statistic in both plants showed there was no longer a problem of autocorrelation. In both plants the R-square was dramatically reduced, but both models remained significant at the .0001 alpha level.

With the effects of autocorrelation removed, in the Salem plant three of the covariates F values dropped, and were no longer significant (season, style change, size). The covariates time-motion studies and percent absent remained significant. The program variable was significant at the .0001 alpha level.

Mean differences (adjusted for covariates and autocorrelation) were compared for the three time periods of the program variable. There was no change in productivity rate during the program time period when compared to the time period before the program was implemented. However both these time periods did have a significantly <u>higher</u> productivity rate when compared to the time period after the program ended.

One explanation for this result is that other variables may have negatively effected productivity during the program time period, and therefore, implementation of the program kept the productivity rate stable instead of decreasing it, as it would have without the program. Productivity rate dropped after the program ended, possibly because the program incentives for increased productivity were no longer available.

In the Jefferson plant all the covariates remained significant in the ANCOVA model. The program variable was not significant, although it was marginal ($p < .09$). When mean differences (adjusted for covariates and autocorrelation) were compared for the three time periods, the productivity level was slightly higher (marginal significance, $p < .059$) during the program when compared to the time period before the program. There was not a significant difference when compared to the period after the program. No other differences were found.

The above results for the Jefferson plant should be interpreted with caution, because the program variable was not significant in the ANCOVA model. Also the one significant mean difference which was found in the LS Means Test was of marginal significance.

In the Jefferson plant, a test for mean differences did show productivity to be significantly higher when compared to the time period before the program. Although this result supports the hypothesis, it should be interpreted with caution because the program variable was not significant once all the covariates were entered into the ANCOVA model. The implication of this is that in implementing a productivity improvement program, managers should not simply attribute any effects found to the program, but rather, must consider the effects of the above variables as possible confounding factors.

In summary, the program accounts for more variance in productivity in the Salem plant then in Jefferson (although Jefferson is borderline significant ($p<.09$). One explanation for the differences in plant findings is the effect of the type of program. Formal recognition was implemented in the Salem plant, and a Financial Incentive program was implemented in the Jefferson plant. Previous research conducted by Markham & Scott (1985) has shown the recognition program to be especially effective in reducing absenteeism in the Maid Bess Corporation. This program may also be more effective in improving productivity rate.

Another explanation is that the effectiveness of the program may be very plant specific, depending on what other factors are contributing to productivity. In the Jefferson plant for example, plant manager turnover, appears to be accounting for a large amount of the variance in productivity level. Therefore, changes in plant managers may be a very important factor to consider when analyzing the productivity level in a plant.

RESEARCH IMPLICATIONS

One of the most consequential and surprising results of this study were the major differences found between the plants. This is especially astonishing, when one considers that this study examined two plants operated by the same company, in the same industry, in relatively the same area of the country. It may be that plants are as <u>individually different</u> as people! This has great implications from both an academic and practical viewpoint. Academically, it is possible that in order to study and understand the multi-dimensional nature of productivity, a "taxonomy" of productivity must be developed. That is, certain variables related to productivity must be identified in plants or industries, and not only the direct but indirect effects should be examined. Specifically, the interactions between factors may be important in understanding the nature of productivity. Practically, plant managers must be aware that the identification of variables which affect productivity may be quite plant specific, and they should attempt to determine which factors are of importance within their own plant. If a productivity improvement program has been implemented, the true effects of this program cannot be evaluated until these variables are identified and their effects on productivity removed.

LIMITATIONS OF STUDY

A limitation of this study is that the program results may be difficult to generalize to other organizations. However, the research methods and considerations are generally applicable. The study focused on only two plants within the same company in the garment industry. The variables examined here may only be important in this industry, company, plant, area of the country, etc. In addition, this sample was limited to mostly female workers, and to employees on a piece-rate compensation system. Organizations using other types of wage systems with both male and female workers may find productivity influenced quite differently.

There were statistical limitations in this study as well. First, much of the data was autocorrelated, which means some models could have an overestimated amount of variance accounted for. Thus, it is possible that once the effects of autocorrelation are removed, the R-square may drop and in fact, not be significantly different from zero.

Second, a problem of range restriction may have occurred as well. When a variable involved in a correlation is restricted (less variability), the correlation will tend to be smaller than a similar correlation based on a unrestricted sample. In this study, some of the variables, including percent absent, size, and unemployment, may have been restricted, thus attenuating the r value. This may explain, in part, why the correlation between size and productivity reached significance in the Jefferson plant (more variation in size) and not in the Salem plant.

A note must be made on the implementation of the formal recognition program. Unfortunately, this program was not carried out as initially planned. Originally, individual recognition cards stating an employee's progress in productivity improvement and attendance status were to be given out each quarter. This "positive recognition" was an important element of the program, as it was to serve as a feedback mechanism, and incentive to "keep up the good work". Unfortunately, quarterly personalized progress cards were not given out. Instead, general reminder cards were distributed only during the fourth quarter (May, 1985). This change in the design of the program may have had a major impact on the effects of the formal recognition productivity program

RECOMMENDATIONS FOR FUTURE RESEARCH

The significant research findings of several hypotheses tested indicates the need to take a new look at some of these research questions. For example, this study did not find any strong significant results between national/state unemployment rate and productivity, and there may in fact not be a relationship. However, another possibility is that other unemployment measures could be used. For example, local SMSA rates may be more valid indicators because they may more accurately reflect employment opportunities in that particular area. Another unemployment measure which may be useful to consider is the specific plant worker's perceptions of the ease in finding alternative employment.

More research needs to be conducted investigating the relationship between absenteeism and productivity. It has generally been accepted that employee absenteeism leads to decreased production efficiency, however, a simple negative relationship may not always be the case. The results of this study indicate that when studying absenteeism from a plant-level perspective, there may be certain intervening organizational variables which moderate it's effect on productivity. Moch and Fitzgibbons (1985) point out that the effects of absenteeism will vary with a variety of "macro" variables. These could include: employee's type of job, automation in the plant, absence policies, etc. More studies investigating these concepts need to be conducted.

The strong effect of plant manager turnover in the Jefferson plant indicates the need for more research in this area. It would be of valuable practical significance to determine if changes in plant managers effects productivity in other plants and in other types of organizations.

The results of this study have indicated the complex nature of productivity. More research is needed to examine other variables which may relate to productivity, as well as to investigate further the ones identified in this study. It would be interesting to examine the other four plants operated by the Maid Bess Corporation using productivity as a dependent measure. Thus, one could determine if the variables which were selected in this study would be associated with productivity in other plant settings, and if relationships are found, then one could compare and contrast these relationships.

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