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The Effects of Industry Deregulation on the Stock Market Responses to Earnings Announcements.

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THE EFFECTS OF INDUSTRY DEREGULATION ON THE
STOCK MARKET RESPONSES TO EARNINGS ANNOUNCEMENTS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
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in
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ABSTRACT

Many sectors of the United States economy have experienced deregulation during the 1970s and 1980s. This study examines how deregulation affects the informativeness of accounting earnings of firms in deregulation industries. In this study, the informativeness of accounting earnings is measured by the earnings response coefficient (ERC, the slope coefficient in the regression of abnormal stock returns on unexpected accounting earnings). The effects of deregulation on ERCs are examined by (1) comparing ERCs before deregulation to those after deregulation to determine the changes in the magnitude of ERCs due to deregulation, (2) investigating the time series of ERCs after deregulation to determine the intertemporal variation of ERCs following deregulation, and (3) comparing the change in ERCs in one deregulated industry to that in another deregulated industry to determine the differential effects of deregulation.

Results indicate that changes in the magnitude of ERCs due to deregulation and differences in the changes in the magnitude of ERCs among the three industries examined are found in some cases but only when variables found to be determinants of ERCs in previous studies are not
included in the regression models. In other words, after controlling for the effects of covariates, no evidence is found for a significant impact of industry deregulation on ERCs.
CHAPTER ONE
INTRODUCTION

Many sectors of the United States economy have experienced deregulation during the 1970s and 1980s. This deregulation encompasses diverse industries such as airline, natural gas, and trucking. While the main goal of deregulation is to improve the performance of the affected industries by stimulating competition, deregulation also increases investor uncertainty about future prospects for the firms in the affected industries. A number of studies (e.g., Bundt et al. 1992; Chen and Sanger 1985; Fraser and Kannan 1990) find empirical evidence of increases in systematic risk associated with deregulation. However, Cunningham et al. (1988) find that for airline industry the increase in systematic risk was temporary, and it was followed by a period in which systematic risk fell to a level below or about equal to that in the regulated period.

While a number of prior studies investigate the impact of deregulation on the risk of deregulated firms, this study examines how deregulation affects the informativeness of accounting earnings of firms in deregulated industries. In this study, the informativeness of accounting earnings is measured by the
earnings response coefficient (ERC, the slope coefficient in the regression of abnormal stock returns on unexpected accounting earnings). The ERC is the magnitude of the share price response per unit of unexpected earnings. Earnings numbers of firms with large ERCs are more informative than those of firms with small ERCs because for any given unexpected earnings, relative share price responses of firms with large ERCs will be higher than those of firms with small ERCs. The effects of deregulation on ERCs are examined by: (1) comparing ERCs before deregulation to those after deregulation to determine the changes in the magnitude of ERCs due to deregulation, (2) investigating the time series of ERCs after deregulation to determine the intertemporal variation of ERCs following deregulation, and (3) comparing the change in ERCs in one deregulated industry to that in another deregulated industry to determine the differential effects of deregulation.

To implement these examinations, a sample of firms are obtained from the Value Line Investment Survey. Regression models are developed to test the hypothesized effects of deregulation on ERCs. Variables found to be determinants of ERCs in previous research are included in some of the regression models to control for the effects of these variables on ERCs.
Motivation

Beginning with the seminal work of Ball and Brown (1968), many studies provide evidence of a positive correlation between unexpected earnings and unexpected stock returns. The results of these studies strongly support the hypothesis that accounting earnings numbers contain information relevant for security valuation. However, a simple regression of unexpected returns on unexpected earnings generally explains only a small portion of the variations of unexpected returns around earnings announcement dates. Hagerman et al. (1984) suggest that the low explanatory power indicates that factors other than the magnitude of unexpected earnings affect the stock price responses to earnings announcements, and this study investigates whether deregulation is such a factor. Identification of factors affecting the magnitude of stock price responses to earnings announcements provides insight into whether and how information (e.g. whether the firm is in a regulated industry or not) affects the way accounting numbers are utilized by stock market participants in firm valuation.

This study hypothesizes that deregulation affects both cross-sectional and intertemporal variations of ERCs.

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1See, for example, Brown and Kennelly (1972), Latané and Jones (1977, 1979), Beaver et al. (1979), Rendleman et al. (1982), Hagerman et al. (1984), among others.
Prior studies have found that ERCs are related to various firm-specific factors (e.g., earnings persistence, Kormendi and Lipe 1987) and changes in macroeconomic conditions (e.g., risk-free interest rates, Collins and Kothari 1989). However, the firm-specific factors and the changes in macroeconomic conditions studied affect either the cross-sectional or intertemporal variation of ERCs, but not both. This study adds to this line of literature by suggesting a factor which potentially affects both cross-sectional and intertemporal variations of ERCs.

Moreover, a number of prior studies examine the impact of deregulation on firm systematic risk. This study extends prior research by examining the effects of deregulation in a different area: the informativeness of accounting earnings. Determination of whether deregulation affects the stock price responses to earnings announcements is informative about the effects of deregulation. Many important industries of the U.S. economy were deregulated during the 1970s and 1980s, and it is possible that other industries will be deregulated in the future. Therefore, it is important to understand the impact of deregulation.

Furthermore, this study can also help validate the results of two prior studies. First, Teets (1992) finds that on average, ERCs of electric utilities are significantly less than those of nonregulated firms, and
he suggests that regulation is a determinant of ERCs. However, as acknowledged by Teets (1992, 284), since only one regulated industry is included in his study, it is difficult to determine whether "regulation per se or some other characteristic of [electric] utilities" is responsible for the smaller ERCs. This study represents a more direct test of the hypothesis that regulation is a determinant of ERCs by comparing ERCs before deregulation to those after deregulation. Therefore, it should provide further evidence as to the validity of Teets's assertion.

Secondly, Lang (1991) finds evidence of a decline in the magnitude of the ERCs over time following firms' initial public offerings. Lang (1991, 231) suggests that his model could be applied to other situations, and in particular to events "which substantially increase investor uncertainty about the future prospects of the firm (e.g., industry deregulation ... )." By investigating the time series of ERCs after deregulation, this study should provide insight into the generalizability of Lang's model.

**Historical Background of Regulation Airlines**

Congress adopted the Civil Aeronautics Act in 1938. This Act created the Civil Aeronautics Board (CAB) to regulate interstate air carriers. In order to engage in scheduled airline service, a firm had to first obtain a...
certificate of public convenience and necessity from the CAB. The certificate specified which routes could be served. Applicants of certificates had to show that proposed services were "in the public interest and that they would not harm the incumbent carriers" (Kaplan 1986, 42). The CAB approved a very low percentage of route authority applications by existing airlines to serve new routes or routes served by other carriers (Slovin et al. 1991, 233). In addition, as airlines were required to serve routes listed on their certificates, they could not discontinue routes without CAB approval. Therefore, airlines had little flexibility on what routes they served.

In regulating fares, the CAB's primary concern was on the overall industry profitability rather than on the relationship between fares and costs in particular markets. The CAB used distance as the primary factor in determining fares while the actual cost per passenger mile of providing air service declines with distance. As a result, fares in long-haul markets were above the costs of service while fares in short-haul markets were kept below costs (Kaplan 1986, 43).

Beginning in 1976, the CAB started to reduce its control over airfares and routes, and with public support for deregulation, the Airline Deregulation Act was signed into law in October 1978 (Kaplan 1986, 45). The Act ended
the CAB's authority over routes on December 31, 1981, and its authority over fares on January 1, 1983. The Act also ratified the liberal fare flexibility and route award policies that the CAB had already adopted. For the most part, the CAB's regulation on fares and routes ended sooner than mandated in the Airline Deregulation Act (Kaplan 1986, 47).

With increased fare flexibility, carriers have adopted a variety of pricing strategies. These include restricted discount fares, quantity discounts, and frequent flyer discounts. Prices have become more cost related. Moreover, carriers' route structures are no longer restricted by the CAB. Instead, carriers engage in overall planning of their routes so as to use their resources most efficiently. They emphasize the development of hub-and-spoke operations at major airports.\(^2\) Hub-and-spoke operations allow carriers to combine passengers with different origins and destinations, thus increase loads and reduce operating costs. Hub-and-spoke operations have intensified service competition in most markets nationwide (Slovin et al. 1991, 237). In addition, a number of carriers began to provide interstate air service after deregulation. These

\(^2\)In a hub-and-spoke route network, flights from different origins arrive at an intermediate airport, and passengers will then change airplanes and go on to their final destinations.
included former intrastate carriers and totally new carriers. Deregulation brought freedom in setting prices and establishing routes to airlines. But, it also intensified the competition and increased uncertainty in the operating environments for all carriers.

Natural Gas

The natural gas industry first became subject to federal regulations when Congress passed the Natural Gas Act in 1938. This legislation brought the interstate transmission of natural gas and its sale for resale under the control of the Federal Power Commission. In 1954 the Federal Power Commission's regulatory powers were extended to include prices charged by producers at wellheads by the Supreme Court's ruling in the Phillips Petroleum Company vs. Wisconsin case. However, natural gas sold in intrastate markets remained unregulated because the Natural Gas Act of 1938 and the Supreme Court decision applied only to natural gas sold in interstate markets (Chen and Sanger 1985, 38).

Before 1970, no shortages of natural gas were observed either in the interstate or intrastate markets. However, as the consumption of natural gas increased, prices of natural gas increased. Large price differences arose between the interstate and intrastate markets since natural gas sold within state lines was not subjected to price ceilings set by the Federal Power Commission. As a
result of the natural gas shortages, some industries cut back production and many people lost their jobs. The situation worsened each year. The need for regulatory reform became clear. After more than a year of debate, the Natural Gas Policy Act of 1978 was passed. Under the Act, federal natural gas regulation was extended to gas sold in intrastate markets. Meanwhile, the Act partially deregulated the prices at which producers could sell natural gas to pipelines at wellheads. The majority of new gas (gas from wells drilled after February 19, 1977) were deregulated in January of 1985. One exception was that gas produced from "high cost" sources was deregulated on November 1, 1979. Old gas (gas from wells drilled on or before February 19, 1977) remained regulated indefinitely, but with price ceilings indexed to inflation (Chen and Sanger 1985, 39-40).

Natural gas markets had always been vulnerable to random shocks as a result of changes in weather, level of economic activities or prices of alternative fuels. But, during most of the 1970s, these shocks seldom translated into revenue risks for producers, pipelines and distributors because of price ceilings and excess demands. By eliminating wellhead price ceilings, the Natural Gas Policy Act of 1978 increased the uncertainty faced by producers and pipelines. Wellhead price deregulation changed the way producers sold gas and the way pipelines
bought gas. Prices were determined by market forces and therefore were subject to random shocks. Along with higher uncertainty, deregulation also created new opportunities. Producers could explore and develop resources that would not have been economic under pre-deregulated price ceilings. On the other hand, pipelines could seek out new markets, as they are no longer restricted by inadequate supplies.

**Trucking**

Federal government control was extended to motor carriers in 1935 when the Motor Carrier Act was signed into law. Of the major provisions of the Act, those affecting entry had been most important in shaping the structure of the industry. The burden of proof was on applicants to show that their proposed services were or would be "required by the present or future public convenience and necessity" (Anderson and Huttsell 1989, 16). Therefore, it was difficult for motor carriers to extend their operations. Rates were also strictly controlled by the Interstate Commerce Commission (ICC).

From the beginning, the economic regulation of motor carriers was criticized on the grounds that the industry was inherently competitive (Moore 1986, 17). In 1975, President Gerald Ford called for legislation to reduce trucking regulations, and with changes in the ICC membership, significant regulatory reform began in 1977.
Entry and rate controls became less restrictive. By 1979, the ICC had almost totally deregulated the industry by substantially reinterpreting the law in the direction of reduced regulation (Moore 1986, 21). Recognizing the uncertainty felt by the trucking industry, Congress concluded that the ICC should be given explicit direction for regulation of the trucking industry (Harper 1980, 7). On July 1, 1980, the Motor Carrier Act of 1980 was signed into law.

The Motor Carrier Act of 1980 substantially relaxed entry control in the trucking industry. Its most significant provision was to shift the burden of proof from the applicants to the protestors. In other words, an operating authority will be granted unless the protestors show that the proposed service will be inconsistent with the public convenience and necessity (Harper 1980, 9). In fact, of the 28,414 applications for new or expanded operating rights in 1981, the commission approved 97 percent of them (Felton 1989, 145). In addition, many other operating restrictions were either eliminated or reduced.

The Act also relaxed rate regulations. It created a zone within which the ICC might "not investigate, suspend, revise or revoke any rate proposed by a motor carrier ... on the grounds that such rate is unreasonable" (Harper 1980, 19). The zone of rate freedom was 10 percent above
or below the rate in effect one year prior to the proposed change. Furthermore, the Act restricted the activities of motor carrier rate bureaus, and in so doing reduced the effectiveness of these bureaus in controlling rate competition. Perhaps the best indicator of the impact of the regulatory reform on the trucking industry is the loss in the value of operating authorities. The average selling price of the authorities fell from over $350,000 in 1978 to below $20,000 in 1981 (Moore 1986, 30). Regulatory reform in the trucking industry subjects these carriers to a more competitive and uncertain operating environment as the number of carriers increases and as carriers are granted additional operating authorities.

The remainder of the paper is organized as follows. Chapter two discusses literature relevant to the study. Chapter three describes the hypotheses and the methods used. Chapter four provides the empirical findings of the study, and chapter five contains a summary and concluding remarks.
CHAPTER TWO
RELEVANT RESEARCH

This chapter reviews the research literature relevant to this study. Section one reviews research on the associations of accounting earnings and stock returns. Section two reviews research on the effects of deregulation.

Associations of Accounting Earnings and Stock Returns

The relationship between accounting earnings and stock returns has been one of the most researched areas in the recent accounting literature. Ball and Brown (1968) began this line of research by examining the associations between unexpected annual earnings and the 12-month abnormal returns covering the period before the earnings announcements. They find that firms with higher than expected earnings experienced positive abnormal returns and firms with lower than expected earnings experienced negative abnormal returns. Since then, numerous studies have extended Ball and Brown's study. The findings are generally consistent with the notion that the signs as well as the magnitudes of unexpected earnings are positively associated with abnormal returns. However, a simple regression of abnormal returns on unexpected earnings generally explains only a small portion of the...
variations of abnormal returns around earnings announcement dates. For example, Hagerman et al. (1984) regress five-day cumulative abnormal returns around quarterly earnings announcement dates on the proportional changes in the quarterly earnings per share, and the coefficient of determination ($R^2$) is only 5%. These authors suggest that the low explanatory power of the model indicates that factors other than the magnitude of unexpected earnings affect the stock price responses to earnings announcements.

The literature of identifying factors affecting stock price responses to earnings announcements can be divided into two main areas in terms of the theoretical frameworks on which the studies were based: (1) information economics based valuation models and (2) time-series based valuation models (see Cho and Jung 1991b for details).

Information Economics Based Valuation Models

The models developed by Choi (1985), Holthausen and Verrecchia (1988), and Lev (1989) basically use the same form of information system. These models assume that the value (or the price) of a firm is a linear function of future cash flows (or dividends) which are normally distributed with mean $\mu$ and variance $\sigma^2$. Earnings signals are assumed to communicate the true future cash flows (or dividends) perturbed by noise $\epsilon$. The random variable $\epsilon$ is assumed to have a normal distribution with mean zero and
variance $\phi^2$. The reciprocal of the variance, $1/\phi^2$, represents the quality of the earnings signal. Given this simplified setting, the price revision around earnings announcements ($\Delta p$) is given by:

$$\Delta p = \left[ a \sigma^2 / (a^2 \sigma^2 + \phi^2) \right] \times [y - E(y)]$$

where $a > 0$ is a scale factor that converts cash flows (or dividends) to earnings, $y$ is the reported earnings, and $E(y)$ is the expected earnings. Scaling both sides of equation (1) by the price immediately prior to the earnings announcement indicates that the ratio $a \sigma^2 / (a^2 \sigma^2 + \phi^2)$ is the ERC. Differentiating the ERC with respect to $\sigma^2$ (the prior uncertainty with respect to the firm's future cash flows or dividends) and $\phi^2$ (the variance of the noise in the earnings signal) respectively implies that the ERC is positively related to $\sigma^2$ and negatively related to $\phi^2$. The last relationship implies that the ERC is positively related to $1/\phi^2$ (the quality of the earnings signal).

Based on these results, empirical studies hypothesize that ERCs increase with the uncertainty about the firm's future cash flows and with the quality of the firm's reported earnings. Most of these studies examine the effect of a certain event in the informativeness of earnings as measured by ERCs.

**Change in Uncertainty of Future Cash Flows**

Cho and Jung (1991a) investigate the effects of a merger on the information content of earnings
announcements. They report a significant reduction in the information content after the merger for firms whose uncertainty about future earnings prospects is reduced by the merger.

Collins and DeAngelo (1990) examine the stock market reactions to earnings announcements of firms engaged in proxy contests. They argue that a proxy contest increases investor uncertainty about who would manage the firm in the future and hence about the firm's future cash flows. They find that ERCs significantly increase during a proxy contest and suggest that earnings released during a proxy contest are very useful in resolving investor uncertainty about the firm's future cash flows.

**Change in Earnings Quality**

Bandyopadhyay (1994) compares the ERCs of firms using the successful efforts accounting method and those using the full cost method. He argues that earnings quality of successful efforts firms is higher than that of full cost firms. However, the finding of his study is sensitive to time periods. Specifically, ERCs of firms using the successful efforts method, on average, exceed those of firms using the full cost method during 1982-1985 but not during 1986-1990.

Choi and Jeter (1992) examine the effects of qualified audit opinions on ERCs. They hypothesize that ERCs decrease in the post-qualification periods because a
qualified audit opinion has the potential to adversely affect the stock market's perception of the quality of the earnings numbers generated by the firm. The results are consistent with their prediction that ERCs decline subsequent to the issuance of the qualified audit opinions. However, other firm characteristic changes such as the decrease in earnings persistence can also contribute to the observed results.

Collins and Salatka (1993) examine the effects of Statement of Financial Accounting Standards (SFAS) No.52 on firms' earnings quality. They find that ERCs increased following the implementation of SFAS No.52 for those firms whose accounting for foreign currency gains and losses is most affected by the new standard. The results are interpreted to suggest that earnings produced under SFAS No.52 were perceived by stock market participants to be of higher quality than those produced under the old accounting standard.

Rao (1989) examines the intertemporal variation of ERCs following the firms' initial public offerings. She hypothesizes that ERCs increase over time following initial public offerings because of the improvement in the quality of the earnings signals. Consistent with her prediction, ERCs increase as the firms' stocks are seasoned.
Time-Series Based Valuation Models

Collins and Kothari (1989) start with an equity valuation model in which price is modeled as the discounted present value of future expected dividends, and they assume future expected dividends are related to current earning as:

$$E_t(D_{t+k}) = A_{t+k}X_t \quad A_{t+k} > 0 \quad k=1, 2, \ldots \infty$$  \hspace{1cm} (2)

where $E_t(D_{t+k})$ is the expectation at time $t$ of dividends to be received at the end of period $t+k$ and $X_t$ is the firm's reported earnings for period $t$. Then, price is expressed as a function of earnings:

$$P_t = \sum_{k=1}^{\infty} A_t \prod_{j=1}^{k} \left[ \frac{1}{1+E(R_{t+j})} \right] X_t$$  \hspace{1cm} (3)

where $E(R_{t+j})$ is the expected rate of return from the end of period $t+j-1$ to the end of period $t+j$. Therefore, the unexpected return associated with unexpected earnings is derived as:

$$UR_t = \left[ A_t + \sum_{k=1}^{\infty} A_t \prod_{j=1}^{k} \left[ \frac{1}{1+E(R_{t+j})} \right] \right] \frac{UX_t}{P_{t-1}}$$  \hspace{1cm} (4)

where $UX_t = X_t - E_t(X_t)$ is the unexpected earnings in period $t$. Therefore, the ERC is a function of $A_{t+k}$'s and the expected rate of return. Since expected rate of return is a positive function of systematic risk and the risk-free interest rate under the capital asset pricing model, Collins and Kothari (1989) conclude that the ERC is a decreasing function of systematic risk and risk-free interest rate. Furthermore, they argue that $A_{t+k}$'s are
increasing functions of earnings persistence and growth opportunities; therefore, the ERC is positively related to the earnings persistence and growth opportunities.

Lang (1991) models the ERC as a positive function of the level of uncertainty about the time-series process of earnings. He derives the ERC using a model similar to Collins and Kothari (1989) but he assumes that earnings are equal to dividends, and that earnings follow a random walk with drift time series process. Investors are assumed to learn about the unknown drift parameter over time from the observed time series of earnings. As a result, the uncertainty about the firm's value decreases over time as a longer earnings series is available to estimate the unknown drift parameter. Predictions from Lang's model is that the ERC decreases over time following the date the firm begins trading publicly or following events (e.g., industry deregulation) which signal that the information in the past earnings series may not be relevant anymore in predicting future earnings.

Kormendi and Lipe (1987) and Easton and Zmijewski (1989) also use time-series based valuation models to derive determinants of the ERC. The predictions from these studies are that the ERC is a positive function of earnings persistence and a negative function of systematic risk.
Many empirical studies examine the hypothesized relationships between ERCs and the variables identified in these time-series based valuation models. The variables investigated include earnings persistence, systematic risk, risk-free interest rate, growth opportunities, uncertainty about the earnings process, and industry effects.

**Earnings Persistence**

Earnings persistence measures the degree to which current period earnings shocks persist in the future. Earnings persistence is typically measured by estimating an autoregressive integrated moving average (ARIMA) time series earnings process. Studies consistently report that earnings persistence is significantly positively correlated with ERCs (Collins and Kothari 1989; Dhaliwal and Reynolds 1994; Easton and Zmijewski 1989; Kallapur 1994; Kormendi and Lipe 1987; Lipe 1990).

Teets (1992) differs from the previous studies in that he examines regulation as one possible economic determinant of earnings persistence. He finds that the average ERC of regulated electric utilities is significantly less than that of nonregulated firms. With the assumption of a positive relation between the ERC and persistence, he suggests that the result is consistent with the view that earnings persistence is lower for utilities than for nonregulated firms.
Systematic Risk

Collins and Kothari (1989) and Lipe (1990) find evidence of a significant negative correlation between the ERC and systematic risk. However, Easton and Zmijewski (1989), Jeter and Chaney (1992), Ahmed (1994), and Kallapur (1994) do not find the negative correlation to be significant.

Risk-Free Interest Rate

Using yields on long-term U.S. Government bonds as a proxy for the risk-free interest rate, Collins and Kothari (1989) find significantly negative association between ERCs and risk-free interest rates.

Growth Opportunities

Using market-to-book equity ratios as the proxy, Collins and Kothari (1989) find growth opportunities to be positively associated with ERCs. However, Ahmed (1994), using a different proxy (the ratio of stock of research and development expenditures to replacement cost of property, plant, and equipment), find a negative association between ERCs and growth opportunities.

Uncertainty About the Earnings Process

Lang (1991) examines how changes in the level of uncertainty about the time-series process of earnings affect ERCs. He compares ERCs over a 12-quarter period following initial public offerings. The results are consistent with the prediction of his model that ERCs
decrease over time following the date the firm begins trading publicly.

**Industry Effects**

Biddle and Seow (1991) investigate the relationship between industry characteristics and ERCs based on the relationship between these characteristics and earnings persistence or systematic risk. They find significant positive correlation between ERCs and barriers-to-entry and significant negative correlation between ERCs and financial leverage.

**Firm Size**

In addition to the variables mentioned above, firm size is another widely tested variable in the earnings/return correlation literature. Freeman (1987) finds evidence consistent with an inverse relationship between ERCs and firm size. However, Dempsey (1989) finds that the firm size effect disappears with analyst following. In addition, Easton and Zmijewski (1989) and Ahmed (1994) also do not find ERCs to be significantly correlated with firm size.

**Deregulation**

Many sectors of the U.S. economy have experienced considerable deregulation during the late 1970s and 1980s. In 1977, 17 percent of the U.S. gross national product (GNP) was produced by industries which were fully regulated, and by 1988 that total was only 6.6 percent of
GNP (Winston 1993, 1263). Industry deregulation subjects firms to a new operating environment. Some firms are more successful in adjusting to the new environment and in taking advantage of the new opportunities. Others may not be as fortunate and may be made worse off by deregulation. However, Winston (1993, 1284) argues that the overall welfare effect of deregulation on society is significantly positive (his estimate of the gains is about $40 billion annually).

With regard to the effects of deregulation on firm risk, there are two different views. Following the arguments of Peltzman (1976) regarding regulation, one view suggests that deregulation increases the impact of demand and cost shocks on the industry, and thus increases the variability of profits and the risk of the affected firms. On the other hand, Joskow and MacAvoy (1975) assert that regulators are slow to act in response to cost and demand shocks, so that nonregulated firms react to these shocks more quickly; thus, they argue that deregulation reduces rather than increases the risk of the affected firms.

A number of studies have examined empirically the impact of deregulation on the risk of the deregulated firms. Bundt et al. (1992) examine the effects of the Depository Institutions Deregulation and Monetary Control Act of 1980 on the market risk of the U.S. banking
industry. The estimated average change in systematic risk associated with deregulation for the portfolio of 27 bank holding companies is positive and significant. Furthermore, nonsystematic risk is also found to have increased after deregulation.

Chen and Sanger (1985) examine the impact of the deregulation of the U.S. natural gas industry provided by the Natural Gas Policy Act of 1978. They find significant increases in the systematic risks of natural gas producers, distributors, and firms in some natural gas related industries (bituminous coal mining and machinery industries) around the time of passage of the Act. In addition, Fraser and Kannan (1990) and Pettway et al. (1988) also find empirical evidence of increases in systematic risk associated with deregulation.

On the other hand, Cunningham et al. (1988) analyze the impact of deregulation of the U.S. airlines industry in 1978, and find that systematic risk of airlines increased in the period (of about one year) immediately after deregulation. But the increase was temporary, and it was followed by a period in which systematic risk fell to a level below or about equal to that in the regulated period.

Summary

Chapter two discusses research relevant to this study. Research on the associations of accounting
earnings and stock returns is reviewed. Studies identifying factors affecting stock price responses to earnings announcements and the two theoretical frameworks on which these studies are based are discussed. The two theoretical frameworks are the information economics based valuation models developed by Choi (1985), Holthausen and Verrecchia (1988), and Lev (1989) and the time-series based valuation models developed by Collins and Kothari (1989), Easton and Zmijewski (1989), Kormendi and Lipe (1987), and Lang (1989). Many empirical studies examine the hypothesized relationships between ERCs and variables identified in these models. The findings of these studies are generally consistent with the predictions that ERCs are positively related to the uncertainty about future cash flows and earnings persistence and negatively related to the quality of the earnings signal. However, empirical evidence of the effects of other variables (including systematic risk, risk-free interest rate, growth opportunities, uncertainty about the earnings process, barriers-to-entry, financial leverage, and firm size) on ERCs is either mixed or sparse. The chapter concludes with a review of the research on the effects of deregulation. A number of studies find empirical evidence of increases in systematic risk associated with deregulation. However, Cunningham et al. (1988) find that for the airline industry the increase in systematic risk
was temporary, and it was followed by a period in which systematic risk fell to a level below or about equal to that in the regulated period.
CHAPTER THREE
RESEARCH METHOD

This chapter discusses the research methodology used in this study. Section one discusses the research hypotheses. Data sources are described in section two. The final section describes the statistical procedures used to test the research hypotheses.

Research Hypotheses
Hypothesis One

Peltzman (1976) argues that the presence of regulation reduces the impact of demand and cost shocks on the industry. His argument is that if costs rise, regulators will allow the firm to increase prices so that profits are not affected, and on the other hand, if costs fall, regulators will ask the firm to reduce prices so that the firm does not earn too much profit. The results are that earnings of regulated firms will not fluctuate too much, and thus the level of uncertainty of regulated firms' future earnings or cash flows is relatively low. However, with the deregulation of the industry, protection given by the regulators ceases to exist. Some firms may be able to take advantage of the opportunity created by deregulation. Others may not be able to adjust to the new environment quickly. Thus, deregulation increases the
level of uncertainty of the deregulated firms' future earnings or of the firms' future cash flows.

The theoretical models of Choi (1985), Holthausen and Verrecchia (1988), and Lev (1989) suggest that stock price responses to value-relevant information are a function of: (1) the uncertainty in the firms' value-relevant cash flows and (2) the variance of the noise in the information signal. In particular, as related to this study, the implications of these models are that ERCs are positively related to uncertainty associated with the future cash flows and negatively related to the variance of the noise in the earnings signals. As suggested by Jeter and Chaney (1992, 841), intuitively, these relationships are expected because information from earnings announcements could resolve more uncertainty for firms with greater uncertainty, and the stock market participants will rely less on earnings signals if the signals are perceived to be noisier and thus less dependable. Deregulation leads to a higher level of uncertainty, but deregulation is not expected to lead to noisier earnings signals. Therefore, larger ERCs are expected after deregulation. In addition, Teets (1992) finds that the ERCs of electric utilities are significantly less than those of nonregulated firms. This result suggests that ERCs of regulated firms are smaller than those of nonregulated firms and that ERCs should thus be larger after deregulation.
On the other hand, deregulation substantially reduces industry barriers to entry, and Biddle and Seow (1991) provide evidence that ERCs are positively correlated with these same barriers. Moreover, results of prior research suggest that the risk of firms experiencing deregulation could increase. Collins and Kothari (1989) and Lipe (1990) find that ERCs vary negatively with the systematic risk of the firms (though, Easton and Zmijewski 1989, among others find the relationship to be insignificant). These results suggest that ERCs could decline after deregulation. However, the results in Teets (1992) suggest that these two factors (barriers to entry and firm risk) are not dominant factors. Teets finds that the ERCs of electric utilities are significantly less than those of nonregulated firms but one would probably expect that the barriers to entry are higher in the electric utility industry than those in nonregulated industries. Moreover, Teets finds that electric utilities have lower systematic risk than nonregulated firms, but the ERCs of electric utilities are significantly less than those of nonregulated firms. Therefore, it is expected that the uncertainty factor will dominate, and that larger ERCs are expected after deregulation. These arguments lead to the following hypothesis (stated in alternative form):

$$H_1: \text{Earnings response coefficients are larger after deregulation than before deregulation.}$$
Hypothesis Two

Lang (1991) suggests that the magnitude of the stock price responses to earnings is a function of the degree of uncertainty about the time series parameters of earnings. He presents a model in which future earnings are estimated by investors from the observed time series of earnings. The implication of his model is that when investors are less certain about the time series parameters of earnings, ERCs will be relatively larger. Over time, as the uncertainty is resolved, ERCs will decrease toward a positive lower bound. Lang (1991) provides empirical evidence that ERCs decrease over time, following the date firms begin trading publicly.

Deregulation subjects firms to a relatively new operating environment. Earnings numbers before deregulation will not necessarily reflect what can be expected following deregulation. Thus, after deregulation, as in the case of initial public offerings, uncertainty about the future prospects for the firm will be relatively high. As a longer series of earnings numbers after deregulation becomes available, uncertainty decreases and the magnitude of the stock price responses to earnings decreases.

Rao (1989) also examines the intertemporal variation of ERCs following initial public offerings, but she uses annual earnings announcements and investigates annual ERCs.
(i.e., slope coefficients from regressions of annual stock returns on annual unexpected earnings). Rao's results differ from those of Lang (1991). Specifically, Rao finds that as firms' stocks are seasoned, the annual ERCs increase. Rao's basic premise is that the quality of the earnings signals improve over time following initial public offerings. However, these results are not expected in this study for three reasons. First, this study considers quarterly earnings announcements (as does Lang), and as suggested by Lang (1991, 230), perhaps the pattern of decreasing ERCs is most pronounced over the first several quarters following events that substantially increase the uncertainty level. Thus, it will be difficult to detect this pattern using annual earnings announcements. Second, this study examines stock market responses to earnings announcements over only a two-day period, whereas Rao examines stock market responses over a 12-month period. Third, as suggested previously, deregulation is not expected to change the quality of the earnings signals. As a result, it is expected that the uncertainty factor will dominate, and that the magnitude of the stock price responses to earnings will decrease over time following deregulation. This leads to the following hypothesis (stated in alternative form):

\[ H_0: \text{ Following deregulation, earnings response coefficients decrease over time.} \]
Hypothesis Three

This study examines deregulation in three industries: airline, natural gas, and trucking. The scope and extent of deregulation vary for these three industries. The Airline Deregulation Act of 1978 essentially eliminated all economic regulations on airlines. The Act ended the CAB's authority over routes on December 31, 1981, and its authority over airfares on January 1, 1983. The Motor Carrier Act of 1980 substantially relaxed entry and rate regulations in the trucking industry. However, the Act fell short of the kind of deregulation prescribed in the Airline Deregulation Act of 1978. Specifically, the Motor Carrier Act of 1980 did not eliminate entry and rate regulations; it just substantially relaxed them. Finally, the Natural Gas Policy Act of 1978 only partially deregulated the price of natural gas charged by producers.

The increase in the uncertainty about a firm's future cash flows due to deregulation should depend on the scope and extent of deregulation. Intuitively, the full-scale deregulation in the airline industry should lead to a larger increase in uncertainty than the substantial relaxation of regulations in the trucking industry. The latter, in turn, should lead to a larger increase in uncertainty than the gradual and partial deregulation in the natural gas industry. However, factors other than the scope and extent of deregulation can also affect the
magnitude of the increases in the uncertainty induced by deregulation. One such factor is the ability of deregulated firms to cope with the changes in their operating environment. For example, in the natural gas industry long term contracts between producers and pipelines are quite common. Bound by contracts signed in the pre-deregulation era, these producers and pipelines cannot respond quickly to changes in the operating environment induced by deregulation. Furthermore, relatively limited mobility of the operating assets of these firms can also hinder the adjustments to the new operating environment. On the other hand, airlines can adjust the prices they charge and the routes they serve relatively easily. Therefore, it is unclear what the order of the magnitude of the increases in uncertainty and thus the order of the magnitude of the increase in ERCs is. This issue is examined empirically by testing the following hypothesis (stated in alternative form):

$$H_0: \text{The increases in the earnings response coefficients due to deregulation of firms in the airline, natural gas, and trucking industries are not the same.}$$

*Sample Selection*

This study attempts to determine the impact of deregulation on ERCs. Three industries (airline, natural gas, and trucking) that were deregulated in the late 1970s and early 1980s are examined. The laws that deregulated
these industries are the Airline Deregulation Act of 1978, the Natural Gas Policy Act of 1978, and the Motor Carrier Act of 1980. As the Natural Gas Policy Act deregulated only the prices at which producers could sell natural gas to pipelines at wellheads, only firms engaged in the exploration, production or transmission of natural gas are examined in this study. In other words, firms engaged primarily in petroleum exploration and production or in natural gas distribution are excluded from this study.

Firms included in the study must meet the following criteria: (1) the firm must be in the airline, natural gas exploration, production or transmission, or trucking industries; (2) the firm must be followed by the Value Line Investment Survey (Value Line) and must have Value Line's actual and forecast quarterly earnings per share; (3) earnings announcement dates of the firm must be available from the Wall Street Journal Index or the Standard and Poor's Compustat; (4) the firm must have daily return data on the Center for Research in Security Prices (CRSP) daily return tapes; (5) the firm must have at least 32 usable observations over the study's testing periods\(^3\); and (6) the firm must not have its earnings announcement dates and the immediately preceding trading dates coincide with the dates of deregulation. This last

\(^3\)The testing periods used in the study are discussed in detail later in the chapter.
criterion is included to ensure that earnings announcements can be classified as those in pre- or post-deregulation periods.

Value Line, Standard and Poor's Register of Corporations, Directors and Executives, and Moody's Industrial Manual are consulted to determine a firm's membership in a certain industry. Earnings announcement dates are taken primarily from the Wall Street Journal Index. For those which are not available from the Wall Street Journal Index, Compustat are used. Return data are taken from the CRSP daily return tapes.

Value Line's most recent forecasts of quarterly earnings per share are used as a proxy for the market's earnings expectation. Earnings forecasts are adjusted for any stock splits and stock dividends that occurred between the earnings forecast dates and the earnings announcement dates. The choice of Value Line analysts' forecasts as the proxy for the market's expectation of earnings is supported by the evidence reported by Leftwich and Zmijewski (1994) and Philbrick and Ricks (1991). Leftwich and Zmijewski find that Value Line forecast errors are more highly correlated with the 3-day abnormal returns around earnings announcements than are the seasonal random walk forecast errors and the random walk forecast errors. Meanwhile, Philbrick and Ricks compare the associations of seven forecast error metrics (using combinations of Value
Line and Institutional Brokers Estimate System (IBES) forecasts and Value Line, IBES, and Compustat actual earnings) with the 3-day abnormal returns around earnings announcements. They find that the strongest associations are obtained with the use of Value Line actual earnings and either Value Line or IBES forecast data.

**Statistical Procedures**

**Regression Model**

The following regression model (denoted as the full model) is estimated for firms in the sample to test the hypothesized effects of deregulation on ERCs:

\[
\text{CAR}_{iq} = a_0 + a_1 D_{iq} + a_2 U_{Ei,q} + a_3 U_{Ei,q} * D_{iq} + a_4 U_{Ei,q} * D_{iq} * \left( \frac{1}{T_{iq}} \right) + a_5 RVL_{iq} + a_6 U_{Ei,q} * \text{PER}_{iq} + a_7 U_{Ei,q} * \text{INT}_{iq} + a_8 U_{Ei,q} * \text{BETA}_{iq} + \epsilon_{iq}
\]  

(5)

where

- \( \text{CAR}_{iq} \) = cumulative abnormal returns over day 0 and day -1 relative to the earnings announcement date of firm \( i \) in quarter \( q \).
- \( D_{iq} = 1 \) if quarter \( q \) is in the post-deregulation period.
- \( = 0 \) if quarter \( q \) is in the pre-deregulation period.
- \( U_{Ei,q} = \) (Value Line's actual earnings per share minus Value Line's most recent earnings per share forecast) divided by share price two days before earnings announcement date of firm \( i \) in quarter \( q \).
- \( T_{iq} = 1 \) if quarter \( q \) is in the pre-deregulation period.
- \( = \) the number of quarters since deregulation for quarters in the post-deregulation period.
- \( RVL_{iq} = \) cumulative abnormal return from the most recent Value Line's earnings forecast date through 2 days prior to the earnings announcement date of firm \( i \) in quarter \( q \).
- \( \text{PER}_{iq} = \) earnings persistence for firm \( i \) in quarter \( q \), measured as the time-series parameter in the Foster (1977) model.
BETA_{iq} = \text{beta estimated from the market model for firm } i \text{ in quarter } q.

INT_{iq} = \text{yield of long term U.S. Government bonds in the month of the earnings announcement of firm } i \text{ in quarter } q.

U_{iq} = \text{random disturbance term.}

\text{CAR}_{iq} \text{ is computed as:}

\begin{equation}
\text{CAR}_{iq} = \sum_{j=-1}^{0} (R_{iqj} - ER_{iqj})
\end{equation}

where \( R_{iqj} \) is the actual daily return of firm \( i \) on day \( j \) and \( ER_{iqj} \) is the expected return of firm \( i \) on day \( j \). Expected returns are estimated using the market model:

\begin{equation}
R_{it} = \alpha_i + \beta_i \cdot R_{mt} + e_t
\end{equation}

where

\begin{align*}
R_{it} & = \text{return of firm } i \text{ on day } t; \\
R_{mt} & = \text{return of the CRSP equally-weighted market portfolio on day } t; \\
e_t & = \text{random disturbance term.}
\end{align*}

The market model is estimated using a 200-day trading period prior to the day before each quarterly earnings announcement, excluding the day prior to and the day of any quarterly earnings announcements of the firm. \( ER_{iqj} \) is then calculated as \( \alpha_i + \beta_i \cdot R_{mj} \) where \( \alpha_i \) and \( \beta_i \) are parameters estimated from the above regression, and \( R_{mj} \) is the actual return of the CRSP equally-weighted market portfolio on day \( j \). A second method of estimating expected returns is also used. In this method, the expected return is the equally-weighted return on the market value portfolio of which the firm is a member. Market value portfolios are constructed by the CRSP every year according to the firm's
market capitalization at previous year-end. There are ten portfolios each containing approximately the same number of firms. This second method is intended to control for the widely documented firm size effect (Kothari and Wasley 1989). Since the tenor of the results of the study is not sensitive to the estimation method of expected returns, only results using the market model method are reported.

Unexpected earnings ($UE_q$), defined as Value Line's actual earnings minus Value Line's most recent earnings forecasts, are deflated by stock price. The theoretical models of Choi (1985), Holthausen and Verrecchia (1988), and Lev (1989) suggest that unexpected earnings should be deflated by stock price. Furthermore, Christie (1987) also argues that stock price is the correct deflator if the dependent variable is stock return.

The term $1/T_{q}$ is included in the regression to model for the hypothesized pattern of ERCs (i.e., decreasing over time) after deregulation. This functional form is also used by Lang (1991). An alternative way, discussed later in the chapter, of modelling the hypothesized intertemporal variation of ERCs following deregulation is also used.

Value Line's earnings forecasts are used as a proxy for the market's expectation of earnings immediately before earnings announcements. However, Value Line's earnings forecasts are made before actual announcement
In order to mitigate the measurement error in expected earnings arising from stale forecasts, \( RVL_{it} \) is included in the regression model (see Easton and Zmijewski 1989 for the rationale in including this variable).

A number of variables, which have been documented to be determinants of ERCs, are included in the regression model to control for the effects of these variables.\(^4\) Collins and Kothari (1989), Easton and Zmijewski (1989), among others have documented that ERCs are positively related to earnings persistence. In this study, earnings persistence \( \text{PER}_{it} \) is measured as the time-series parameter in the Foster (1977) model. For each firm-quarter in the sample, earnings persistence is estimated using the six most recent actual quarterly earnings and all the available Value Line's quarterly earnings forecasts. Collins and Kothari (1989) find a negative correlation between the ERC and the risk-free interest rate. As in Collins and Kothari (1989), the yields of long term U.S. Government bonds are used as a proxy for the risk-free interest rate \( \text{INT}_{it} \). The evidence of the

\(^4\)Over the periods investigated in this study, Value Line's earnings forecasts were made, on average, 18 trading days prior to the earnings announcement dates for the sample firms.

\(^5\)Regression models with an additional control variable, financial leverage, which is defined as long-term debt divided by market value of equity, are also employed. The results are qualitatively similar to those estimated without this variable.
effects of beta on ERCs is mixed. Collins and Kothari (1989) and Lipe (1990) find evidence of a significant negative association between ERCs and beta. However, Easton and Zmijewski (1989) and Ahmed (1994) do not find the negative correlation to be consistently significant. Beta ($BETA_{jq}$) is the parameter estimate of the slope coefficient in the market model (see equation 7).

All control variables (i.e., earnings persistence, interest rate, and beta) enter the model interactively with unexpected earnings so that the coefficients ($a_6$, $a_7$, $a_8$) represent the average change in ERCs per unit change in these variables. Multicollinearity is a potential data problem since interaction terms are included in the regression models. To mitigate the multicollinearity problem, the following alternative model specification (denoted as the mean adjusted model) is also used:

$$CAR_{iq} = a_0 + a_1 D_{iq} + a_2 UE_{iq} + a_3 \text{RVL}_{iq} + a_4 \text{PER}_{iq} + a_5 \text{INT}_{iq} + a_6 \text{BETA}_{iq} + \epsilon_{iq}$$

This approach is consistent with Freeman and Tse (1992, 203), Teoh and Wong (1993, 355), and Bandyopadhyay (1994, 667).

$$\text{It can be noted from the results presented in next chapter that this model specification greatly mitigates the multicollinearity problem.}$$

$$\text{First differencing instead of mean adjusting of the control variables is also employed. The results are qualitatively similar to those of the mean adjusted models.}$$
where $\text{MPER}_i$, $\text{MINT}_i$, and $\text{MBETA}_i$ are the means of earnings persistence, interest rate, and beta respectively of firm $i$ over the sample period. Definitions of all other terms in this model are the same as those in equation (5). In this model specification the coefficients $a_6$, $a_7$, and $a_8$ represent the average change in ERCs per unit deviation from the firm-specific means of these control variables. Furthermore, in order to determine the effects of these control variables on the findings of the study, regression models without these control variables are also employed. In other words, the following regression model (denoted as the reduced model) is also estimated for firms in the sample:

$$
\text{CAR}_{iq} = a_0 + a_1 D_{iq} + a_2 \text{UE}_{iq} + a_3 \text{UE}_{iq} \times D_{iq} + a_4 \text{UE}_{iq} \times E_{iq} \times (1/T_{iq}) + a_5 \text{RVL}_{iq} + U_{iq}
$$

(9)

Definitions of all the terms in this model are the same as those in equation (5).

In addition to using a reciprocal function to model the intertemporal variation of ERCs after deregulation, a dummy variable ($E_{iq}$) with a value of one for the first ten quarters in the post-deregulation period and a value of zero otherwise is also employed. Therefore, the following regression and its corresponding mean adjusted and reduced models are also estimated:

$$
\text{CAR}_{iq} = a_0 + a_1 D_{iq} + a_2 \text{UE}_{iq} + a_3 \text{UE}_{iq} \times D_{iq} + a_4 \text{UE}_{iq} \times E_{iq} + a_5 \text{RVL}_{iq} + a_6 \text{UE}_{iq} \times \text{PER}_{iq}
$$

$$
+ a_7 \text{UE}_{iq} \times \text{INT}_{iq} + a_8 \text{UE}_{iq} \times \text{Beta}_{iq} + U_{iq}
$$

(10)
Definitions of all terms except $E_{i,q}$ in this model are the same as those in equation (5). This model specification represents a more general test for the evidence of decreasing ERCs over time without the restriction of a reciprocal functional form.

In the regression models represented by equations (5), (7), or (8), the ERC before deregulation ($D_{i,q}=0$) is $a_2$ and the ERC after deregulation ($D_{i,q}=1$) is $a_2+a_3+a_4(1/T_{i,q})$ after controlling for the covariates. For the alternative specification models where $E_{i,q}$ is used, the ERC after deregulation is $a_2+a_3+a_4$ for the first ten quarters and is $a_2+a_3$ for the next ten quarters after controlling for the covariates. Positive values of $a_2+a_4$ are consistent under both model specifications with the prediction that ERCs after deregulation are greater than ERCs before deregulation. Positive values of $a_4$ are consistent with the prediction that ERCs decline over time following deregulation, after controlling for the covariates.

The research hypotheses in this study are tested using both pooled time-series cross-sectional regressions and firm-specific time-series regressions. When pooled time-series cross-sectional regressions are used, hypothesis one is tested by determining whether the parameter estimate of $a_2+a_4$ is significantly positive. Hypothesis two is tested by determining whether the parameter estimate of $a_4$ is significantly positive.
Finally, hypothesis three is tested by comparing the parameter estimate of $a_1^+a_4$ in one industry with that in another industry.

When firm-specific time-series regressions are estimated separately for each firm in the sample, the significance of the parameter estimates of $a_3+a_4$'s and $a_4$'s is tested on an aggregate basis by using the following $z$-statistic:

$$z = \frac{1}{\sqrt{n}} \sum_{i=1}^{n} \frac{t_i}{\sqrt{k_i / (k_i-2)}}$$

(11)

where

- $t_i$ = the $t$-statistic for firm $i$ associated with the estimate of the parameter
- $k_i$ = the degree of freedom in firm $i$'s regression
- $n$ = the number of firms in the sample.

Under the Central Limit Theorem and under the null hypothesis that the parameter equals zero, the distribution of the $z$-statistic is standard normal (see Christie 1990 for a detailed discussion of the test). In using this test, it is assumed that the parameter estimates are independent across the firms in the sample.

To investigate cross-sectional dependence, pairwise correlations of the residuals from the firm-specific regressions are estimated since cross-sectional correlation of the residuals across equations is a necessary condition for cross-sectional correlation of the parameter estimates (Theil 1971). The mean correlation

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coefficients are positive and at most 0.05 for all the samples and model specifications investigated in this study. Thus, no strong evidence of cross-sectional dependence is found.

Hypothesis one is tested by determining whether the z-statistic calculated by aggregating the parameter estimates of $a_i + a_4$ is significantly positive. Similarly, hypothesis two is tested by determining whether the corresponding z-statistic calculated for $a_i$ is significantly positive. Finally, hypothesis three is tested by comparing the z-statistic of the parameter estimates of $a_i + a_4$ of one industry with the corresponding z-statistic of another industry.

Estimation Period

When available, 40 time series observations (20 observations each for the pre- and post-deregulation periods) are used in the analysis. To be retained in the sample, firms must have at least 32 usable observations. The decision to use this number of observations in the time series is arbitrary. This choice of the length of the time series represents a compromise. On one hand, the time series has to be long enough to permit a reliable test of the research hypotheses. On the other hand, as the time series becomes longer, the assumption of intertemporal stability of the parameters becomes less reasonable.
As mentioned previously, the Airline Deregulation Act of 1978, the Natural Gas Policy Act of 1978, and the Motor Carrier Act of 1980 are the laws which deregulated these industries. However, the date the stock market incorporated the effects of deregulation may not be the date the acts were signed into law or the date the acts became effective. Furthermore, there could be a period of transition to deregulation. A transition period is a period over which the industry is not in the pre-deregulation era nor in the post-deregulation era. The determinations of deregulation dates and transition periods are done subjectively after reviewing legislative history and prior studies of deregulation in these three industries.

The airline industry was deregulated when the Airlines Deregulation Act was passed on October 24, 1978. However, the CAB had already started toward a more flexible regulatory regime before the passage of the Act. Debate on regulatory reform stemmed from the poor profit performance of airlines coupled with substantial fare increases in the early 1970s. Questions about the CAB's regulatory policies were growing. In July 1975, a special CAB task-force report recommended legislative reform. Meanwhile, a report by the Senate Aviation Committee concluded that increased competition was warranted. Thereafter, the CAB began to adopt a more liberal
regulatory policies. The first significant step to
deregulation was the approval of the advance booking
charters on October 7, 1976 (Kaplan 1986, 44). Unlike
earlier charters, which usually required membership in
specific clubs or other restrictions, the advance booking
charters required only advance-purchase and minimum-stay
requirements. Recognizing the increased threat of
competition from charters, scheduled carriers such as
American Airlines applied for authority to offer
substantial discount fares. The CAB routinely approved
these requests of discount fares (Kaplan 1986, 44). At
the same time, the CAB also took steps to give airlines
greater discretion to determine the routes they served
(Kaplan 1986, 45). These more liberal regulatory policies
were eventually ratified by the passage of the Airline
Deregulation Act in October 1978. The Act instructed the
CAB to place reliance on competition in the regulation of
airlines and ended the CAB's authority over routes on
December 31, 1981, and the CAB's authority over fares on
January 1, 1983. However, for the most part, the CAB's
regulation on fares and routes ended sooner than mandated
by the Act (Kaplan 1986, 47). To increase the pricing
flexibility, the CAB, on May 14, 1980, allowed airlines to
raise their fares ranging from 30% up to an unlimited
amount, depending on the length of the routes involved.
This essentially ended the CAB's regulation on airfares.
(Kaplan 1986, 47). The end to route regulation came even sooner. Under the provisions of the Airline Deregulation Act, airlines could enter one market each year without formal CAB approval. In addition, the burden of proof in route cases were shifted from the potential entrant to the incumbent. In summary, the first significant step to airline deregulation was taken on October 7, 1976 and the CAB's regulation on airfares and routes essentially ended on May 14, 1980. Therefore, the period before October 7, 1976 is considered as the regulated period while the period after May 14, 1980 is considered as the deregulated period. The period in between these two dates is considered as the transition period.

The Motor Carrier Act of 1980 was passed on July 1, 1980. While some loosening of trucking regulation can be traced back to 1975, major regulatory reform began in 1977 after Daniel O'Neal was appointed as the Chairman of the ICC (Kahn 1979, 5). A major step toward deregulation was taken when the ICC revised the procedures for applying for motor carrier operating authority on December 9, 1977 (Kahn 1979, 7). The revised procedures made it much easier to obtain the necessary authority to engage in motor carrier operations. Thereafter, the ICC continued to loosen its controls on the operations of trucking firms. By 1979 the ICC had almost totally deregulated the industry by substantially reinterpreting the law in the
direction of reduced regulation (Moore 1986, 21). The Motor Carrier Act of 1980 basically ratified the liberal regulatory policies of the ICC and provided an explicit direction for the deregulation efforts in the trucking industry (Harper 1980, 7). The ICC began implementing the law immediately after the Act was signed (Moore 1986, 21). Therefore, the period before December 9, 1977 is considered as the regulated period while the period after July 1, 1980 is considered as the deregulated period. The period in between these two dates is considered as the transition period.

The Natural Gas Policy Act was passed into law on November 10, 1978. Unlike the cases of airline and trucking deregulation, there was no loosening up of regulation in the natural gas industry before the passage of the deregulation law. Although the law was debated for over a year, the passage of the law was never assured until very close to the time that it was finally passed. Thus, the period before November 10, 1978 is considered as the regulated period. Under the provisions of the Natural Gas Policy Act, the prices of the majority of the gas deregulated by the Act became decontrolled on January 1, 1985. In the interim, the price ceilings were indexed to inflation. Therefore, the period after January 1, 1985 is considered as the deregulated period, and the period
between November 10, 1978 and January 1, 1985 is considered as the transition period.

Summary

Chapter three discusses the research methods used to answer the research question: How does deregulation affect ERCs? Three research hypotheses are developed: (1) ERCs are larger after deregulation than before deregulation; (2) ERCs decline over time following deregulation; and (3) the increases in ERCs due to deregulation of firms in the three industries examined are not the same. Sample firms are obtained from the Value Line Investment Survey. Regression models are then developed to test the research hypotheses. Both pooled time-series cross-sectional and firm-specific time-series regression models are used. Variables found to be determinants of ERCs in previous research are included in some of the regression models to control for the effects of these variables on ERCs.
CHAPTER FOUR
RESULTS

This chapter reports the analyses and results of the study. The first section presents the sample selection. The second section reports the results of the tests of research hypotheses.

Sample Selection

As indicated in chapter three, firms included in this study must meet the following criteria: (1) the firm must be in the airline, natural gas exploration, production or transmission, or trucking industries; (2) the firm must be followed by the Value Line and must have Value Line's actual and forecast quarterly earnings per share; (3) earnings announcement dates of the firm must be available from the Wall Street Journal Index or the Standard and Poor's Compustat; (4) the firm must have daily return data on the CRSP daily return tapes; (5) the firm must have at least 32 usable observations over the study's testing periods; and (6) the firm must not have its earnings announcement dates and the immediately preceding trading dates coincide with the dates of deregulation. Application of these selection criteria resulted in a sample of 35 firms listed in table 1. Nine of the sample
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<tr>
<td>Enron</td>
<td>293561</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Equitable Resource</td>
<td>294549</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Helmerich &amp; Payne</td>
<td>423452</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Kerr-McGee</td>
<td>492386</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>KN Energy</td>
<td>482620</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Louisiana Land &amp; Expl.</td>
<td>546268</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Mesa</td>
<td>590655</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Panhandle Eastern</td>
<td>698462</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Tenneco</td>
<td>880370</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Texas Eastern</td>
<td>882387</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Transco Energy</td>
<td>893532</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Arkansas Best</td>
<td>040789</td>
<td>Trucking</td>
</tr>
<tr>
<td>CLC of America</td>
<td>125615</td>
<td>Trucking</td>
</tr>
<tr>
<td>Consolidated Freight</td>
<td>209237</td>
<td>Trucking</td>
</tr>
<tr>
<td>Flexi-Van</td>
<td>339376</td>
<td>Trucking</td>
</tr>
<tr>
<td>Leaseway Transp.</td>
<td>522066</td>
<td>Trucking</td>
</tr>
<tr>
<td>Overnite Transp.</td>
<td>690326</td>
<td>Trucking</td>
</tr>
<tr>
<td>Ryder Systems</td>
<td>783549</td>
<td>Trucking</td>
</tr>
<tr>
<td>Transway International</td>
<td>894015</td>
<td>Trucking</td>
</tr>
<tr>
<td>Xtra</td>
<td>984138</td>
<td>Trucking</td>
</tr>
<tr>
<td>Yellow Freight</td>
<td>985509</td>
<td>Trucking</td>
</tr>
</tbody>
</table>
firms are airlines, sixteen are natural gas firms, and the remaining ten are trucking firms.

Table 2 reports the pre- and post-deregulation sample means of the variables used in the regression models for the full sample and samples disaggregated by industry. It can be noted that no significant differences emerged between the pre- and post-deregulation periods in abnormal returns around earnings announcement dates or abnormal returns from earnings forecast dates through two days prior to the earnings announcement dates for any of the samples. Unexpected earnings are negative for both the full sample and samples disaggregated by industry in both pre- and post-deregulation periods. This is consistent with extant empirical evidence (e.g., Lys and Sohn 1990; O'Brien 1988) that financial analysts in general are, on average, optimistic in their earnings forecasts. For natural gas firms unexpected earnings become significantly more negative in the post-deregulation period. However, this is due to the fact that the magnitude of unexpected earnings are relatively very small prior to deregulation for these firms. In spite of the evidence of optimism, Value Line analysts' forecasts are used as the proxy for the market's earnings expectation because of the strong

9Recalled that unexpected earnings are defined as actual earnings minus forecast earnings scaled by stock price.
Table 2
Sample Means of Variables Used in the Regressions

<table>
<thead>
<tr>
<th></th>
<th>Pre-deregulation mean</th>
<th>Post-deregulation mean</th>
<th>T*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abnormal returns around earnings announcements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>0.00146</td>
<td>-0.00184</td>
<td>1.47</td>
</tr>
<tr>
<td>Airline</td>
<td>0.00028</td>
<td>-0.00407</td>
<td>0.79</td>
</tr>
<tr>
<td>Natural gas</td>
<td>-0.00018</td>
<td>-0.00450</td>
<td>1.66</td>
</tr>
<tr>
<td>Trucking</td>
<td>0.00549</td>
<td>0.00428</td>
<td>0.26</td>
</tr>
<tr>
<td><strong>Unexpected earnings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>-0.00342</td>
<td>-0.00411</td>
<td>0.27</td>
</tr>
<tr>
<td>Airline</td>
<td>-0.00712</td>
<td>-0.00596</td>
<td>-0.13</td>
</tr>
<tr>
<td>Natural gas</td>
<td>-0.00054</td>
<td>-0.00315</td>
<td>2.74b</td>
</tr>
<tr>
<td>Trucking</td>
<td>-0.00479</td>
<td>-0.00401</td>
<td>-0.18</td>
</tr>
<tr>
<td><strong>RVL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>-0.00264</td>
<td>0.00128</td>
<td>-0.89</td>
</tr>
<tr>
<td>Airline</td>
<td>0.00857</td>
<td>0.00864</td>
<td>-0.01</td>
</tr>
<tr>
<td>Natural gas</td>
<td>-0.00829</td>
<td>0.00146</td>
<td>-1.60</td>
</tr>
<tr>
<td>Trucking</td>
<td>-0.00383</td>
<td>-0.00539</td>
<td>0.18</td>
</tr>
<tr>
<td><strong>Earnings persistence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>0.16937</td>
<td>0.17461</td>
<td>-0.20</td>
</tr>
<tr>
<td>Airline</td>
<td>0.26038</td>
<td>0.14546</td>
<td>2.59b</td>
</tr>
<tr>
<td>Natural gas</td>
<td>0.11663</td>
<td>0.17489</td>
<td>-1.50</td>
</tr>
<tr>
<td>Trucking</td>
<td>0.17180</td>
<td>0.19953</td>
<td>-0.54</td>
</tr>
<tr>
<td><strong>Interest rate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>0.07818</td>
<td>0.10851</td>
<td>-38.60b</td>
</tr>
<tr>
<td>Airline</td>
<td>0.07345</td>
<td>0.12334</td>
<td>-46.40b</td>
</tr>
<tr>
<td>Natural gas</td>
<td>0.08090</td>
<td>0.09098</td>
<td>-15.03b</td>
</tr>
<tr>
<td>Trucking</td>
<td>0.07811</td>
<td>0.12331</td>
<td>-54.73b</td>
</tr>
<tr>
<td><strong>Beta</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full sample</td>
<td>1.27581</td>
<td>1.10350</td>
<td>6.13b</td>
</tr>
<tr>
<td>Airline</td>
<td>1.69516</td>
<td>1.50013</td>
<td>5.65b</td>
</tr>
<tr>
<td>Natural gas</td>
<td>0.99262</td>
<td>0.96424</td>
<td>0.80</td>
</tr>
<tr>
<td>Trucking</td>
<td>1.35744</td>
<td>0.97846</td>
<td>6.70b</td>
</tr>
</tbody>
</table>

* T-statistic for testing equality of means between the pre- and post-deregulation periods.

** Significant at p < 0.05.

***Cumulative abnormal return from the earnings forecast date through two days prior to the earnings announcement date.
association between stock market responses to earnings and forecast errors based on Value Line analysts' forecasts reported in Leftwich and Zmijewski (1994) and Philbrick and Ricks (1991). Furthermore, the accuracy characteristics of Value Line analysts' forecasts are similar to those of other databases such as IBES and the Standard Poor's Earnings Forecaster (Philbrick and Ricks 1991).

Earnings persistence declined significantly from the pre-deregulation to the post-deregulation period for airlines, but not for natural gas or trucking firms. Interest rates increased significantly from the pre-deregulation to the post-deregulation period for all sample firms. This reflects that interest rates in the 1980s were generally higher than those in the 1970s. A number of studies (e.g., Bundt et al. 1992; Chen and Sanger 1985) find that deregulation increases the beta values of deregulated firms. However, in this study sample firms in airline and trucking industries experienced a significant reduction in beta from the pre-deregulation to the post-deregulation period, while natural gas firms did not experience a significant change in beta. One possible reason for the differences in the findings of this study from those of the two aforementioned studies is that there is a transition period between pre- and post-deregulation periods in this
study. Furthermore, the findings in this study are consistent with those in Cunningham et al. (1988) who find that beta increased for the period immediately after the passage of the Airline Deregulation Act in 1978, but beta fell to a level below or about equal to that in the regulated period two years after the Act was passed.

**Results of the Tests of Hypotheses**

This section presents the results of the analyses of the research hypotheses. Both pooled time-series cross-sectional and firm-specific time-series regressions are employed.\(^\text{10}\)

Hypothesis one examines the changes in the magnitude of ERCs due to deregulation while hypothesis two examines the intertemporal variation of ERCs following deregulation. Table 3 presents the results of the analysis for the full sample. It can be noted from panel A of table 3 that the maximum condition index is 31 for the full model pooled regression. Belsley et al. (1980) suggest that condition indexes in excess of 30 indicate multicollinearity problems. On the other hand, the maximum condition indexes of the mean adjusted and reduced model pooled regressions are eleven and four respectively,

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\(^{10}\)The null hypothesis that the residuals are homoskedastic is tested using the procedure developed by White (1980). The null is reject only when pooled regressions are estimated for the natural gas sample. In these cases t-statistics are calculated using White's (1980) heteroskedasticity consistent covariance matrix.
Table 3  
Results of various pooled and firm-specific regressions for the full sample. (A reciprocal function is used to model the intertemporal variation of ERCS following deregulation.)

<table>
<thead>
<tr>
<th>Panel A: Pooled</th>
<th>Maximum condition index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a$_3$ + a$_4$</td>
</tr>
<tr>
<td>Full$^{e}$</td>
<td>-0.148 (0.351)</td>
</tr>
<tr>
<td>Mean adjusted$^{d}$</td>
<td>-0.281 (0.103)</td>
</tr>
<tr>
<td>Reduced$^{e}$</td>
<td>-0.235 (0.061)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Firm-specific</th>
<th>Number of regressions with condition indexes &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a$_3$ + a$_4$</td>
</tr>
<tr>
<td>Full$^{e}$</td>
<td>0.608 (0.543)</td>
</tr>
<tr>
<td>Mean adjusted$^{d}$</td>
<td>0.608 (0.543)</td>
</tr>
<tr>
<td>Reduced$^{e}$</td>
<td>-0.076 (0.947)</td>
</tr>
</tbody>
</table>

$^{a}$Parameter estimates (p-values in parentheses).  
$^{b}$Z-statistics (p-values in parentheses).  
$^{c}$Full model: CAR$_{it}$ = $a_0 + a_1D_{it} + a_2UE_{it} + a_3UE_{it}^3 + a_4UE_{it}^2*D_{it} + a_5UE_{it}^3*D_{it}*(1/T_{it}) + a_6RVL_{it} + a_7UE_{it}^4*PER_{it} + a_8UE_{it}^2*INT_{it} + a_9UE_{it}^2*BETA_{it} + U_{it}$.  
$^{d}$Mean adjusted model: CAR$_{it}$ = $a_0 + a_1D_{it} + a_2UE_{it} + a_3UE_{it}^2*D_{it} + a_4UE_{it}^3*D_{it}*(1/T_{it}) + a_5RVL_{it} + a_6UE_{it}^4*PER_{it} - MPER_{it} + a_7UE_{it}^2*(INT_{it} - MINT_{it}) + a_8UE_{it}^2*(BETA_{it} - MBETA_{it}) + U_{it}$.  
$^{e}$Reduced model: CAR$_{it}$ = $a_0 + a_1D_{it} + a_2UE_{it} + a_3UE_{it}^2*D_{it} + a_4UE_{it}^3*D_{it}*(1/T_{it}) + a_5RVL_{it} + U_{it}$.
well below the threshold of 30. Results in panel A of table 3 indicate that for the full sample the change in ERCs due to deregulation ($a_3 + a_4$) is not significantly different from zero for any of the three pooled regression model specifications. The coefficient to test the intertemporal variation of ERCs following deregulation ($a_4$) is also not significantly different from zero for any of the three pooled regression model specifications.

Panel B of table 3 presents the results of firm-specific regressions. Full, mean adjusted, and reduced model regressions are estimated for each sample firm. The maximum condition indexes are in excess of 30 for all 35 firm-specific regressions for the full model while they are in excess of 30 for only seven firm-specific regressions for the mean adjusted model, and none is in excess of 30 for the reduced model. The t-statistics of parameter estimates for each sample firm are then aggregated to form a z-statistic according to equation (11) described in chapter three. It can be noted that the z-statistics calculated from the full model firm-specific regressions are the same as those calculated from the mean adjusted model firm-specific regressions. This can be explained by the way the mean adjusted model is structured. The only difference between the full and the mean adjusted models is the way the control variables are included in the regressions. For the full model control
variables enter the regression as the raw data interacted with the unexpected earnings. For the mean adjusted model control variables enter the regression as the deviations from their respective firm-specific means interacted with the unexpected earnings. Since these firm-specific means are constant across observations when firm-specific regressions are estimated, parameter estimates and their standard errors from the full and the mean adjusted models are the same except for $a_7$, the coefficient of the unexpected earnings variable. Therefore, the $z$-statistics aggregated for $a_3+a_4$ and $a_4$ from these two models are the same. However, since these firm-specific means are not constant across observations when pooled regressions are estimated, parameter estimates from the full and the mean adjusted model pooled regressions are not the same.

Results in panel B of table 3 indicate that the change in ERCs due to deregulation ($a_3+a_4$) and the coefficient to test the intertemporal variation of ERCs following deregulation ($a_4$) are again not significantly different from zero for any of the three model specifications. In summary, for the full sample both the change in ERCs due to deregulation and the intertemporal variation of ERCs following deregulation are found to be insignificant.

Table 4 presents the results of pooled regressions for samples disaggregated by industry. It can be noted
Table 4

Results of various pooled regressions for samples disaggregated by industry. (A reciprocal function is used to model the intertemporal variation of ERCs following deregulation.)

<table>
<thead>
<tr>
<th>Panel A: Airline</th>
<th>Parameter estimates</th>
<th>Maximum condition index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a_3 + a_4^t$</td>
<td>$a_4^t$</td>
</tr>
<tr>
<td><strong>Full</strong></td>
<td>-0.439</td>
<td>-0.290</td>
</tr>
<tr>
<td></td>
<td>(0.104)</td>
<td>(0.233)</td>
</tr>
<tr>
<td><strong>Mean adjusted</strong></td>
<td>-0.524</td>
<td>-0.344</td>
</tr>
<tr>
<td></td>
<td>(0.057)</td>
<td>(0.163)</td>
</tr>
<tr>
<td><strong>Reduced</strong></td>
<td>-0.363</td>
<td>-0.140</td>
</tr>
<tr>
<td></td>
<td>(0.073)</td>
<td>(0.531)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Natural gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Mean adjusted</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Reduced</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C: Trucking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Mean adjusted</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Reduced</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

$^a$Parameter estimates (p-values in parentheses).

$^b$Full model: $CAR^t_q = a_0 + a_1 D^t_{iq} + a_2 UE^t_{iq} + a_3 UE^t_{iq} * D^t_{iq} * (1/T^t_{iq}) + a_5 RVL^t_{iq} + a_6 (UE^t_{iq} * PER^t_{iq} + a_7 UE^t_{iq} * INT^t_{iq} + a_8 UE^t_{iq} * BETA^t_{iq} + U^t_{iq})$.

$^c$Mean adjusted model: $CAR^t_q = a_0 + a_1 D^t_{iq} + a_2 UE^t_{iq} + a_3 UE^t_{iq} * D^t_{iq} + a_5 RVL^t_{iq} + a_6 (UE^t_{iq} * (PER^t_{iq} - MPER^t_{iq}) + a_7 UE^t_{iq} * (INT^t_{iq} - MINT^t_{iq})) + a_8 UE^t_{iq} * (BETA^t_{iq} - MBETA^t_{iq}) + U^t_{iq}$.

$^d$Reduced model: $CAR^t_q = a_0 + a_1 D^t_{iq} + a_2 UE^t_{iq} + a_3 UE^t_{iq} * D^t_{iq} + a_5 RVL^t_{iq} + U^t_{iq}$.

$^e$These p-values are determined using White's (1980) heteroskedasticity-consistent covariance matrix since the null hypothesis that the errors are homoskedastic is rejected at the 0.05 level (the chi-square statistics are 61.3, 57.5, and 24.8 for the full, the mean adjusted, and the reduced models respectively).
that the maximum condition indexes are in excess of 30 for all three industry samples for the full model pooled regressions while they are not in excess of 30 for either the mean adjusted or the reduced model. The change in ERCs due to deregulation \((a_3+a_4)\) is not significantly different from zero for any of the three model specifications for any of the three industries except for the reduced model of the natural gas industry. When the reduced model is estimated for firms in the natural gas industry, \(a_3+a_4\) is significantly negative which means that, contrary to expectations, ERCs are smaller after deregulation for natural gas firms. However, \(a_3+a_4\) is not significantly different from zero for either the full or the mean adjusted model. In other words, the significant reduction in the magnitude of ERCs is not found when control variables are included in the models. As to \(a_4\), it is again not significantly different from zero for any of the three model specifications for any of the three industries.

Table 5 presents the results of firm-specific regressions for samples disaggregated by industry. Neither the change in ERCs due to deregulation \((a_3+a_4)\) nor the coefficient to test the intertemporal variation of ERCs following deregulation \((a_4)\) is significantly different from zero for any of the three model specifications for any of the three industries. In summary, after
Table 5

Results of various firm-specific regressions for samples disaggregated by industry. (A reciprocal function is used to model the intertemporal variation of ERCs following deregulation.)

<table>
<thead>
<tr>
<th>Panel A: Airlines</th>
<th>( a_3 + a_4 )</th>
<th>( a_4 )</th>
<th>Number of regressions with condition indexes &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full</strong></td>
<td>0.237</td>
<td>0.540</td>
<td>9</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.813)</td>
<td>(0.589)</td>
<td></td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>0.237</td>
<td>0.540</td>
<td>1</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.813)</td>
<td>(0.589)</td>
<td></td>
</tr>
<tr>
<td>Reduced</td>
<td>-0.636</td>
<td>-0.232</td>
<td>0</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.525)</td>
<td>(0.816)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Natural gas</th>
<th>( a_3 + a_4 )</th>
<th>( a_4 )</th>
<th>Number of regressions with condition indexes &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full</strong></td>
<td>0.619</td>
<td>1.412</td>
<td>16</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.541)</td>
<td>(0.158)</td>
<td></td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>0.619</td>
<td>1.412</td>
<td>4</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.541)</td>
<td>(0.158)</td>
<td></td>
</tr>
<tr>
<td>Reduced</td>
<td>0.052</td>
<td>1.169</td>
<td>0</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.959)</td>
<td>(0.242)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C: Trucking</th>
<th>( a_3 + a_4 )</th>
<th>( a_4 )</th>
<th>Number of regressions with condition indexes &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full</strong></td>
<td>0.130</td>
<td>1.180</td>
<td>10</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.897)</td>
<td>(0.238)</td>
<td></td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>0.130</td>
<td>1.180</td>
<td>2</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.897)</td>
<td>(0.238)</td>
<td></td>
</tr>
<tr>
<td>Reduced</td>
<td>0.396</td>
<td>0.700</td>
<td>0</td>
</tr>
<tr>
<td>( Z )-statistics</td>
<td>(0.692)</td>
<td>(0.484)</td>
<td></td>
</tr>
</tbody>
</table>

\({}^aZ\)-statistics (p-values in parentheses).
\(^b\)Full model: \( CAR_{it} = a_0 + a_{D_{it}} + a_{UE_{it}} + a_{UE_{it} \times D_{it}} + a_{UE_{it} \times D_{it} \times (1/T_{it})} + a_{RVL_{it}} + a_{UE_{it} \times \text{PER}_{it}} + a_{UE_{it} \times \text{INT}_{it}} + a_{UE_{it} \times \text{BETA}_{it}} + U_{it} \).
\(^c\)Mean adjusted model: \( CAR_{it} = a_0 + a_{D_{it}} + a_{UE_{it}} + a_{UE_{it} \times D_{it}} + a_{UE_{it} \times D_{it} \times (1/T_{it})} + a_{RVL_{it}} + a_{UE_{it} \times \text{PER}_{it}} + a_{UE_{it} \times \text{INT}_{it} - \text{MINT}_{it}} + a_{UE_{it} \times (\text{BETA}_{it} - \text{MBETA}_{it})} + U_{it} \).
\(^d\)Reduced model: \( CAR_{it} = a_0 + a_{D_{it}} + a_{UE_{it}} + a_{UE_{it} \times D_{it}} + a_{UE_{it} \times D_{it} \times (1/T_{it})} + a_{RVL_{it}} + U_{it} \).
controlling for the effects of covariates, no evidence is found for a change in the magnitude of ERCs due to deregulation or for an intertemporal variation of ERCs following deregulation for the three industries investigated in this study.

It can be noted from the results presented so far that the coefficient to test the intertemporal variation of ERCs following deregulation \( (a_4) \) is not significant in any of the regression models examined. As indicated in chapter three an alternative specification where a dummy variable which equals one for the first ten quarters in the post-deregulation period and equals zero otherwise is also used to test the change in ERCs after deregulation. In this model specification, a step function, instead of a reciprocal function used previously, is used to model the intertemporal variation of ERCs following deregulation. Table 6 presents the results of the analysis for the full sample. It can be noted that \( a_4 \) is again not significantly different from zero for any of the three model specifications for either pooled or firm-specific regressions. On the other hand, the change in ERCs due to deregulation \( (a_3+a_4) \) is significantly negative when the reduced model pooled regression is estimated. However, this significant reduction in the magnitude of ERCs is again not found when control variables are included in the regression models. Furthermore, \( a_3+a_4 \) is not significantly
Table 6

Results of various pooled and firm-specific regressions for the full sample. (A step function is used to model the intertemporal variation of ERCs following deregulation.)

Panel A: Pooled

<table>
<thead>
<tr>
<th></th>
<th>Maximum condition index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a_3 + a_4$</td>
</tr>
<tr>
<td>Full</td>
<td>-0.105</td>
</tr>
<tr>
<td></td>
<td>(0.513)</td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>-0.221</td>
</tr>
<tr>
<td></td>
<td>(0.191)</td>
</tr>
<tr>
<td>Reduced</td>
<td>-0.212</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
</tr>
</tbody>
</table>

Panel B: Firm-specific

<table>
<thead>
<tr>
<th></th>
<th>Number of regressions with condition indexes &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a_3 + a_4$</td>
</tr>
<tr>
<td>Full</td>
<td>-0.644</td>
</tr>
<tr>
<td></td>
<td>(0.520)</td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>-0.644</td>
</tr>
<tr>
<td></td>
<td>(0.520)</td>
</tr>
<tr>
<td>Reduced</td>
<td>-0.525</td>
</tr>
<tr>
<td></td>
<td>(0.600)</td>
</tr>
</tbody>
</table>

Parameter estimates (p-values in parentheses).
Z-statistics (p-values in parentheses).

Full model: $\text{CAR}_{ij} = a_0 + a_1 D_{ij} + a_2 U_{ij} + a_3 U_{ij} * D_{ij} + a_4 U_{ij} * E_{ij} + a_5 R{V}_{ij}$
$+ a_6 U_{ij} * \text{PER}_{ij} + a_7 U_{ij} * \text{INT}_{ij} + a_8 U_{ij} * \text{BETA}_{ij} + U_{ij}$.

Mean adjusted model: $\text{CAR}_{ij} = a_0 + a_1 D_{ij} + a_2 U_{ij} + a_3 U_{ij} * D_{ij}$
$+ a_4 U_{ij} * D_{ij} * E_{ij} + a_5 R{V}_{ij} + a_6 U_{ij} * (\text{PER}_{ij} - \text{MPER}_{ij}) + a_7 U_{ij} * (\text{INT}_{ij} - \text{MINT}_{ij})$
$+ a_8 U_{ij} * (\text{BETA}_{ij} - \text{MBETA}_{ij}) + U_{ij}$.

Reduced model: $\text{CAR}_{ij} = a_0 + a_1 D_{ij} + a_2 U_{ij} + a_3 U_{ij} * D_{ij} + a_4 U_{ij} * D_{ij} * E_{ij}$
$+ a_5 R{V}_{ij} + U_{ij}$.
different from zero for any of the three firm-specific regression models.

The results of pooled regressions for samples disaggregated by industry are presented in table 7. It can be noted that \( a_i \) is again not significantly different from zero for any of the three model specifications for any of the three industries. On the other hand, \( a_j + a_k \) is significantly negative when reduced model pooled regressions are estimated for both the airline sample and the natural gas sample. However, \( a_j + a_k \) is not significantly different from zero for either the full or the mean adjusted model. For the trucking sample, \( a_j + a_k \) is not significant for any of the three model specifications. The results of firm-specific regressions for individual industry samples are presented in table 8. Neither \( a_j + a_k \) nor \( a_i \) is significantly different from zero for any of the three model specifications for any of the three industry samples. In summary, after controlling for the effects of covariates, no evidence is found for a change in the magnitude of ERCs due to deregulation or for an intertemporal variation of ERCs following deregulation.

Hypothesis three examines the differential effects of deregulation on ERCs for the three industries investigated. The changes in the magnitude of ERCs due to deregulation are compared pairwise among the three industries. Table 9 presents the results of the analysis.
Table 7

Results of various pooled regressions for samples disaggregated by industry. (A step function is used to model the intertemporal variation of ERCs following deregulation.)

<table>
<thead>
<tr>
<th>Panel A: Airline</th>
<th>Maximum condition index</th>
<th>( a_3 + a_4 )</th>
<th>( a_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>-0.202</td>
<td>-0.059</td>
<td>47</td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>-0.211</td>
<td>-0.058</td>
<td>15</td>
</tr>
<tr>
<td>Reduced</td>
<td>-0.215</td>
<td>-0.089</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Natural gas</th>
<th>Maximum condition index</th>
<th>( a_3 + a_4 )</th>
<th>( a_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>-0.036</td>
<td>0.676</td>
<td>33</td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>-0.223</td>
<td>0.638</td>
<td>8</td>
</tr>
<tr>
<td>Reduced</td>
<td>-0.675</td>
<td>0.283</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C: Trucking</th>
<th>Maximum condition index</th>
<th>( a_3 + a_4 )</th>
<th>( a_4 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full</td>
<td>-0.491</td>
<td>-0.009</td>
<td>48</td>
</tr>
<tr>
<td>Mean adjusted</td>
<td>-0.700</td>
<td>0.002</td>
<td>15</td>
</tr>
<tr>
<td>Reduced</td>
<td>0.013</td>
<td>0.023</td>
<td>6</td>
</tr>
</tbody>
</table>

| Parameter estimates (p-values in parentheses). |
| Full model : \( CAR_{iq} = a_0 + a_1 D_{iq} + a_2 UE_{iq} + a_3 UE_{iq} * D_{iq} + a_4 UE_{iq} * D_{iq} + a_5 RVL_{iq} + a_6 UE_{iq} * PER_{iq} + a_7 UE_{iq} * INT_{iq} + a_8 UE_{iq} * BETA_{iq} + U_{iq} \) |
| Mean adjusted model : \( CAR_{iq} = a_0 + a_1 D_{iq} + a_2 UE_{iq} + a_3 UE_{iq} * D_{iq} + a_4 UE_{iq} * D_{iq} + a_5 RVL_{iq} + a_6 UE_{iq} * (PER_{iq} - MPER_{iq}) + a_7 UE_{iq} * (INT_{iq} - MINT_{iq}) + a_8 UE_{iq} * (BETA_{iq} - MBETA_{iq}) + U_{iq} \) |
| Reduced model : \( CAR_{iq} = a_0 + a_1 D_{iq} + a_2 UE_{iq} + a_3 UE_{iq} * D_{iq} + a_4 UE_{iq} * D_{iq} + a_5 RVL_{iq} + U_{iq} \) |

These p-values are determined using White's (1980) heteroskedasticity-consistent covariance matrix since the null hypothesis that the errors are homoskedastic is rejected at the 0.05 level (the chi-square statistics are 62.2, 56.3, and 27.9 for the full, the mean adjusted, and the reduced models, respectively).
Table 8

Results of various firm-specific regressions for samples disaggregated by industry. (A step function is used to model the intertemporal variation of ERCS following deregulation.)

<table>
<thead>
<tr>
<th>Panel</th>
<th>Industry</th>
<th>( a_3 + a_4' )</th>
<th>( a_4' )</th>
<th>Number of regressions with condition indexes &gt; 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Airlines</td>
<td>Full(^b)</td>
<td>-0.209 ( (0.834) )</td>
<td>-0.993 ( (0.321) )</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Mean adjusted(^c)</td>
<td>-0.209 ( (0.834) )</td>
<td>-0.993 ( (0.321) )</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Reduced(^d)</td>
<td>-0.393 ( (0.694) )</td>
<td>-1.413 ( (0.158) )</td>
<td>0</td>
</tr>
<tr>
<td>Panel B: Natural gas</td>
<td>Full(^b)</td>
<td>-0.661 ( (0.509) )</td>
<td>1.822 ( (0.068) )</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Mean adjusted(^c)</td>
<td>-0.661 ( (0.509) )</td>
<td>1.822 ( (0.068) )</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reduced(^d)</td>
<td>-0.263 ( (0.793) )</td>
<td>1.795 ( (0.073) )</td>
<td>1</td>
</tr>
<tr>
<td>Panel C: Trucking</td>
<td>Full(^b)</td>
<td>-0.171 ( (0.864) )</td>
<td>-1.041 ( (0.298) )</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Mean adjusted(^c)</td>
<td>-0.171 ( (0.864) )</td>
<td>-1.041 ( (0.298) )</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reduced(^d)</td>
<td>-0.276 ( (0.783) )</td>
<td>-0.731 ( (0.465) )</td>
<td>0</td>
</tr>
</tbody>
</table>

\(^a\)Z-statistics (p-values in parentheses).
\(^b\)Full model: \( CAR_{it} = a_0 + a_1 D_{it} + a_2 U_{it} + a_3 D_{it} U_{it} + a_4 U_{it} E_{it} + a_5 RVL_{it} + a_6 U_{it} \times PER_{it} + a_7 U_{it} \times INT_{it} + a_8 U_{it} \times \beta_{it} + u_{it} \)
\(^c\)Mean adjusted model: \( CAR_{it} = a_0 + a_1 D_{it} + a_2 U_{it} + a_3 D_{it} U_{it} + a_4 U_{it} \times PER_{it} + a_5 U_{it} \times INT_{it} + a_6 U_{it} \times \beta_{it} + a_7 RVL_{it} + u_{it} \)
\(^d\)Reduced model: \( CAR_{it} = a_0 + a_1 D_{it} + a_2 U_{it} + a_3 D_{it} U_{it} + a_4 U_{it} E_{it} + a_5 RVL_{it} + u_{it} \)

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when a reciprocal function is used to model the intertemporal variation of ERCs following deregulation. Panel A provides the results of comparing parameter estimates from pooled regressions. One of the comparisons shows a significant difference in the changes in ERCs due to deregulation between two industries. This is the case where there is a significant decrease in ERCs for the natural gas sample and an essentially no change in ERCs for the trucking sample. However, this significant difference in the changes in ERCs due to deregulation is not found when control variables are included in the regression model. Panel B provides the results of comparing the z-statistics of parameter estimates aggregated from firm-specific regressions. None of the comparisons of the z-statistics shows significant differences in the changes in ERCs due to deregulation among the three industries.

Table 10 presents the results of the analysis when a step function is used to model the intertemporal variation of ERCs following deregulation. Similar to the results presented in table 9, a significant difference in the changes in ERCs due to deregulation is found between natural gas and trucking sample firms but again only when reduced model pooled regressions are estimated. In summary, from the results presented in tables 9 and 10 it can be concluded that after controlling for the effects of

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Table 9

Results of pairwise comparisons of the changes in ERCs due to deregulation ($a_2 + a_3$ in the regressions) among the three industries.* (A reciprocal function is used to model the intertemporal variation of ERCs following deregulation.)

Panel A: Comparisons of parameter estimates from pooled regressions (p-values in parentheses).

<table>
<thead>
<tr>
<th></th>
<th>Air-Gas</th>
<th>Air-Truck</th>
<th>Gas-Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full$^b$</td>
<td>-0.073</td>
<td>0.053</td>
<td>0.126</td>
</tr>
<tr>
<td></td>
<td>(0.909)</td>
<td>(0.921)</td>
<td>(0.866)</td>
</tr>
<tr>
<td>Mean adjusted$^c$</td>
<td>-0.081</td>
<td>0.158</td>
<td>0.239</td>
</tr>
<tr>
<td></td>
<td>(0.904)</td>
<td>(0.773)</td>
<td>(0.758)</td>
</tr>
<tr>
<td>Reduced$^d$</td>
<td>0.790</td>
<td>-0.427</td>
<td>-1.217</td>
</tr>
<tr>
<td></td>
<td>(0.095)</td>
<td>(0.172)</td>
<td>(0.013)</td>
</tr>
</tbody>
</table>

Panel B: Comparisons of z-statistics of parameter estimates aggregated from firm-specific regressions (p-values in parentheses).

<table>
<thead>
<tr>
<th></th>
<th>Air-Gas</th>
<th>Air-Truck</th>
<th>Gas-Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full$^b$</td>
<td>-0.382</td>
<td>0.107</td>
<td>0.489</td>
</tr>
<tr>
<td></td>
<td>(0.787)</td>
<td>(0.939)</td>
<td>(0.729)</td>
</tr>
<tr>
<td>Mean adjusted$^c$</td>
<td>-0.382</td>
<td>0.107</td>
<td>0.489</td>
</tr>
<tr>
<td></td>
<td>(0.787)</td>
<td>(0.939)</td>
<td>(0.729)</td>
</tr>
<tr>
<td>Reduced$^d$</td>
<td>-0.688</td>
<td>-1.032</td>
<td>-0.344</td>
</tr>
<tr>
<td></td>
<td>(0.627)</td>
<td>(0.465)</td>
<td>(0.808)</td>
</tr>
</tbody>
</table>

*The three industries are: Air = airline; Gas = natural gas; Truck = trucking.

$^b$Full model: CAR$^q_i = a_0 + a_1D_i + a_2UE_q + a_3UE_q*D_i + a_4UE_q*D_i*(1/T_q)
+a_5RVL_q + a_6UE_q*PER_q + a_7UE_q*INT_q + a_8UE_q*BETA_q + U_{iq}.$

$^c$Mean adjusted model: CAR$^q_i = a_0 + a_1D_i + a_2UE_q + a_3UE_q*D_i
+a_4UE_q*D_i*(1/T_q) + a_5RVL_q + a_6UE_q*PER_q + a_7UE_q*(INT_q - MINT_q)
+a_8UE_q*(BETA_q - MBETA_q) + U_{iq}.$

$^d$Reduced model: CAR$^q_i = a_0 + a_1D_i + a_2UE_q + a_3UE_q*D_i + a_4UE_q*D_i*(1/T_q)
+a_5RVL_q + U_{iq}.$

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Table 10

Results of pairwise comparisons of the changes in ERCs due to deregulation ($a_3+a_4$ in the regressions) among three industries.* (A step function is used to model the intertemporal variation of ERCs following deregulation.)

Panel A: Comparisons of parameter estimates from pooled regressions (p-values in parentheses).

<table>
<thead>
<tr>
<th></th>
<th>Air-Gas</th>
<th>Air-Truck</th>
<th>Gas-Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full(^b)</td>
<td>-0.166</td>
<td>0.289</td>
<td>0.455</td>
</tr>
<tr>
<td></td>
<td>(0.711)</td>
<td>(0.596)</td>
<td>(0.433)</td>
</tr>
<tr>
<td>Mean adjusted(^c)</td>
<td>0.012</td>
<td>0.489</td>
<td>0.477</td>
</tr>
<tr>
<td></td>
<td>(0.979)</td>
<td>(0.364)</td>
<td>(0.411)</td>
</tr>
<tr>
<td>Reduced(^d)</td>
<td>0.460</td>
<td>-0.228</td>
<td>-0.688</td>
</tr>
<tr>
<td></td>
<td>(0.088)</td>
<td>(0.138)</td>
<td>(0.014)</td>
</tr>
</tbody>
</table>

Panel B: Comparisons of z-statistics of parameter estimates aggregated from firm-specific regressions (p-values in parentheses).

<table>
<thead>
<tr>
<th></th>
<th>Air-Gas</th>
<th>Air-Truck</th>
<th>Gas-Truck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full(^b)</td>
<td>0.452</td>
<td>-0.038</td>
<td>-0.490</td>
</tr>
<tr>
<td></td>
<td>(0.749)</td>
<td>(0.978)</td>
<td>(0.729)</td>
</tr>
<tr>
<td>Mean Adjusted(^c)</td>
<td>0.452</td>
<td>-0.038</td>
<td>-0.490</td>
</tr>
<tr>
<td></td>
<td>(0.749)</td>
<td>(0.978)</td>
<td>(0.729)</td>
</tr>
<tr>
<td>Reduced(^d)</td>
<td>-0.130</td>
<td>-0.117</td>
<td>0.013</td>
</tr>
<tr>
<td></td>
<td>(0.927)</td>
<td>(0.934)</td>
<td>(0.993)</td>
</tr>
</tbody>
</table>

*The three industries are: Air = airline; Gas = natural gas; Truck = trucking.

\(^b\)Full model: \( CAR_{iq} = a_0 + a_1 D_{iq} + a_2 U_{E_{iq}} + a_3 U_{E_{iq}} D_{iq} + a_4 U_{E_{iq}} E_{iq} + a_5 R_{VL_{iq}} + a_6 U_{E_{iq}} \times \text{PER}_{iq} + a_7 U_{E_{iq}} \times \text{INT}_{iq} + a_8 U_{E_{iq}} \times \text{BETA}_{iq} + U_{iq} \).

\(^c\)Mean adjusted model: \( CAR_{iq} = a_0 + a_1 D_{iq} + a_2 U_{E_{iq}} + a_3 U_{E_{iq}} D_{iq} + a_4 U_{E_{iq}} E_{iq} + a_5 R_{VL_{iq}} + a_6 U_{E_{iq}} \times (\text{PER}_{iq} - \text{MPER}_{iq}) + a_7 U_{E_{iq}} \times (\text{INT}_{iq} - \text{MINT}_{iq}) + a_8 U_{E_{iq}} \times (\text{BETA}_{iq} - \text{MBETA}_{iq}) + U_{iq} \).

\(^d\)Reduced model: \( CAR_{iq} = a_0 + a_1 D_{iq} + a_2 U_{E_{iq}} + a_3 U_{E_{iq}} D_{iq} + a_4 U_{E_{iq}} E_{iq} + a_5 R_{VL_{iq}} + U_{iq} \).
covariates, no evidence of a differential effect of deregulation on ERCs is found among the three industries examined in this study.

Summary

This chapter reports the results of the study. The first section discusses the results of the sample selection. The sample consists of 35 firms. Nine of them are airlines, sixteen are natural gas firms, and the remaining ten are trucking firms. The second section presents the results of the tests of research hypotheses. Reductions in the magnitude of ERCs due to deregulation are found in the airline and natural gas industries but only when reduced model pooled regressions are estimated. No evidence of an intertemporal variation of ERCs following deregulation is found. Significant differences in the changes in ERCs among the three industries examined are found only when reduced model pooled regressions are estimated. Therefore, the overall conclusion is that after controlling for the effects of covariates, no evidence is found for a significant impact of deregulation on ERCs.\footnote{The influence diagnostics procedures suggested by Belsley et al. (1980) are used to identify influential observations in various pooled regression models. Approximately one percent of the observations are identified as outliers. Pooled regression models are estimated after deleting these observations. The overall conclusion of the study is not altered.}
This chapter contains a summary of the study and the conclusions reached. Section one provides a brief overview of the study. The second section discusses the expected findings of the study. Results of the study are presented in section three. Section four contains the conclusions. The chapter closes with discussions of the limitations of the study and suggestions for future research.

Overview of the Study

Many sectors of the United States economy have experienced deregulation during the 1970s and 1980s. This study examines how deregulation affects the informativeness of accounting earnings of firms in deregulation industries. In this study, the informativeness of accounting earnings is measured by the ERCs. The effects of deregulation on ERCs are examined by: (1) comparing ERCs before deregulation to those after deregulation to determine the changes in the magnitude of ERCs due to deregulation, (2) investigating the time series of ERCs after deregulation to determine the intertemporal variation of ERCs following deregulation, and (3) comparing the change in ERCs in one deregulated
industry to that in another deregulated industry to determine the differential effects of deregulation.

Three industries (airline, natural gas, and trucking) that were deregulated in the late 1970s and early 1980s are examined. Sample firms in these industries are obtained from the Value Line Investment Survey. Regression models are estimated to test the hypothesized effects of deregulation on ERCs. Variables found to be determinants of ERCs in previous research are included in some of the regression models to control for the effects of these variables on ERCs.

Expectations

As applied to the context of this study, the theoretical models of Choi (1985), Holthausen and Verrecchia (1988), and Lev (1989) suggest that ERCs are positively related to the uncertainty associated with the future cash flows and negatively related to the variance of the noise in the earnings signals. Based on the arguments of Peltzman (1976), deregulation is expected to lead to a higher level of uncertainty, but deregulation is not expected to lead to noisier earnings signals. Therefore, larger ERCs are expected after deregulation.

Lang (1991) suggests that the magnitude of the stock price responses to earnings is a positive function of the degree of uncertainty about the time series parameters of earnings. Deregulation subjects firms to a relatively new
environment. Earnings numbers before deregulation will not necessarily reflect what can be expected following deregulation. Thus, after deregulation, uncertainty about the future prospects for the firm will be relatively high. As a longer series of earnings numbers after deregulation becomes available, uncertainty decreases and the magnitude of the stock price responses to earnings decreases. Therefore, ERCs are expected to decline over time following deregulation.

The increase in the uncertainty about a firm's future cash flows due to deregulation should depend on the scope and extent of deregulation. However, other factors (e.g., the ability of deregulated firms to cope with the changes in their operating environment) can also affect the magnitude of the increase in the uncertainty induced by deregulation. Therefore, no expectation is formed as to the order of the magnitude of the increase in ERCs of the three industries examined in this study.

Results

Hypothesis one examines the changes in the magnitude of ERCs due to deregulation. Contrary to expectations, reductions in the magnitude of ERCs are found in the airline and natural gas industries when reduced model pooled regressions are estimated. However, after controlling for the effects of covariates, no evidence of a change in the magnitude of ERCs due to deregulation is
found. Hypothesis two examines the intertemporal variation of ERCs following deregulation. No evidence of an intertemporal variation of ERCs following deregulation is found. Hypothesis three examines the differential effects of deregulation on ERCs for the three industries investigated in this study. Significant differences in the changes in ERCs among the three industries are found only when reduced model pooled regressions are estimated. Therefore, after controlling for the effects of covariates, no evidence of a differential effect of deregulation on ERCs is found.

Conclusions

After controlling for the effects of covariates, no evidence is found for a significant impact of deregulation on ERCs. This result is surprising given the expected increase in uncertainty associated with the future cash flows induced by deregulation and the positive correlation between ERCs and uncertainty in the models developed by Choi (1985), Holthausen and Verrecchia (1989), and Lev (1989). However, there could be offsetting factors. First, in the aforementioned models, ERCs are decreasing functions of the noise in the earnings signals, and deregulation may have increased this noise. Second, deregulation reduces industry barriers to entry and Biddle and Seow (1991) find evidence consistent with a positive correlation between ERCs and these same barriers.
Furthermore, factors other than those included in this study could affect the magnitude of ERCs and could (at least partially) be responsible for the reported results.

**Limitations**

Certain limitations of the study must be recognized. First, evidence regarding the impact of (or in this case the lack thereof) deregulation on ERCs must be handled carefully. In order to determine the "true" impact of deregulation, one will have to know what would have happened without deregulation, and that is impossible. Second, even though deregulation dates are determined after reviewing legislative history and prior studies, the determination process is inherently subjective. Third, by including only firms followed by the Value Line, this study focuses on large and widely held firms. Therefore, the findings of this study may not be generalizable to other firms. Finally, multicollinearity is a concern in interpreting the results of the study especially those of the full model regressions--though, it should not a problem for the mean adjusted or the reduced model pooled regressions.

**Suggestions for Future Research**

There are several suggestions for related future research. First, the regression models used in this study contain only a few variables that could have affected the stock market responses to earnings announcements. Models
controlling for other firm characteristics or macroeconomic variables could be constructed to investigate the impact of deregulation. Second, a reciprocal and a step function are used in this study to model the intertemporal variation of ERCs following deregulation, other model specifications could certainly be used. Third, this study examines the impact of deregulation on ERCs on an industry level. Future research could investigate the impact of deregulation on a firm level. Individual firms may be affected by deregulation differently. If these effects are offsetting then they could be masked in an industry level study.
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Born in Hong Kong, Wing Wah Poon graduated from Hong Kong Baptist College in 1985 with a major in mathematics. He received his master of arts degree in mathematics from the University of California, Davis, in 1988, and his master of science degree in accounting from California State University, Sacramento, in 1991. Mr. Poon then entered the doctoral program at Louisiana State University. He completed the program and received his doctoral degree in 1996, with a major in accounting and a minor in finance. His areas of interest include capital market based accounting research and accounting choice.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Wing Wah Poon

Major Field: Accounting

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