Estimating Financial Fraud Damages with Response Coefficients

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Abstract

Shareholder class action litigation most often deals with allegations that defendants made misrepresentations and/or omissions that caused the stock price to be higher than it otherwise would have been. We show how regression analysis of the response of share prices and investor expectations to news can be exploited in estimating a priori what would have been the effect of the truth had it been told at the time it was covered up. Mindful that there will be statistical error associated with the estimate of such coefficients, their application will nonetheless usually be an improvement over an unadjusted event study under any of the following, frequently encountered, circumstances: (1) it is necessary to isolate the impact of a revelation of the relevant truth on a stock price in the presence of confounding, material news; (2) inflation per share builds up in magnitude over time in response to multiple, sequential misrepresentations; and, (3), it would be useful to put bounds on the proportionate liability of an auditor co-defendant.
# Table of Contents

I. Introduction..........................................................................................................................1

II. Event studies and regression analysis ..................................................................................4
   A. Event study methodology ....................................................................................................5
      1. Step 1: Estimate a market model of share price returns that controls for market movements and news on the event dates .......................................................................5
      2. Step 2: Rule out causation of the impact due to random occurrence............................9
      3. Step 3: Compute the monetary impact of the event-related news on the share price returns .................................................................................................................13
   B. Conditions regarding events that effect event study reliability .........................................15
      1. Confounding information.............................................................................................16
      2. Buildup of inflation per share over the class period ....................................................16
      3. Allocating liability to codefendants .............................................................................21

III. Analyzing price reactions with response coefficients........................................................23
   A. Price effects of financial results in announcements with confounding news ....................23
      1. The nature of financial results announcements............................................................23
      2. Financial results and their impact on stock prices .......................................................24
         a. Earnings response coefficients ...............................................................................25
         b. Analyst forecast revision coefficient .....................................................................27
      3. Using response coefficients to parse price reactions ...................................................28
      4. Successive price effects of misstatements that occurred at different times in the past ...............................................................................................................................31
      5. Bounds on the liability for an individual defendant that is less than aggregate damages ..........................................................................................................................36

IV. What have we learned from research on earnings response coefficients (ERC)? .............39
   A. Estimating the basic ERC equation....................................................................................41
      1. The variables in the basic ERC equation .....................................................................41
         a. Stock price return window .....................................................................................42
         b. Earnings surprises ..................................................................................................44
            i. Expected earnings from time series models ...................................................44
            ii. Analyst forecasts used as market expectations .............................................45
            iii. Deflating the earnings surprise variable ......................................................46
      2. Findings of studies estimating the basic ERC equation...............................................47
   B. Extending the ERC equation with more variables.............................................................48
      1. Including additional firm-specific variables ...............................................................49
         a. Other accounting variables .................................................................................49
            i. Income and cash flow statement variables .....................................................49
            ii. Balance sheet variables ...............................................................................52
         b. Other firm-specific variables .............................................................................53
      2. Including macro variables ..........................................................................................58
   C. Extending the ERC equation with variables capturing revisions in expectations ..........59
1. Including earnings forecast revisions...........................................................................60
2. Including measures for permanency in earnings surprises ........................................60
   a. Breaking a growth trend.........................................................................................61
   b. Transitory and permanent components of earnings...............................................62
D. Dealing with measurement error and data accuracy..........................................................63
   1. How to deal with measurement error in the earnings surprise variable? ................63
   2. Pooled versus firm-specific estimation........................................................................65

V. The academic literature on market expectations and analyst forecast revisions (ARC)....66
   A. Estimating the basic ARC equation ..................................................................................66
   B. Including additional variables in the basic ARC equation.................................................67
   C. ARCs in response to events other than earnings surprises ...........................................68
I. INTRODUCTION

In this paper, we show how statistical analysis of the response of both share prices and investor expectation to new information can be used to improve the estimation of damages in shareholder litigation. Perhaps more controversially, we argue that the standard event study—a statistical shibboleth in securities litigation—is much more limited than is commonly accepted in estimating Rule 10b-5 damages.¹

The iconic status of the event study is due to what it replaced—expert opinion based on unsupported assertions about materiality and loss causation as well as inflation per share estimates drawn from little more than junk science. Such testimony has been thrown out of courtrooms in the post-*Daubert* clean-up of expert evidence. It has been replaced with expert testimony based on the generally agreed-upon notion that a properly performed event study was an appropriate method for estimating damages in shareholder class action litigation. As always, of course, there have been heated disputes among experts over what was meant by proper application of the method. What has been submerged in the debate, though, is that event studies as traditionally used in litigation are often incapable of providing by themselves accurate and unbiased estimates of shareholder damages. At best, the event study is a starting point of the analysis of damages rather than the answer. And in some cases, it may be unnecessary altogether.

As an expository device, the typical example of a shareholder class action claim involves a misstatement that leads investors to over-value the defendant firm’s stock price followed sometime later by a corrective disclosure causing the stock price to fall. An event study measures the magnitude of the price drop associated with the information in the disclosure. This magnitude, then, becomes an estimate of inflation per share—the difference between reported price and the true value—during the time period the stock price was infected with the misstated information. The problem with such a simple example of securities fraud is that it is not all that common in practice. Although often useful to demonstrate various principles involved in analyzing shareholder class actions, the vast majority of shareholder claims are more complex.

¹ The event study methodology is described in Section II below.
For example, the corrective disclosure can be part of a press release that includes material, *timely* information which if negative would have an independent negative impact on the defendant’s stock that would not be compensable. Alternatively, if the timely, confounding information were positive and material then it could mask the magnitude of the price drop that would have occurred had it not accompanied the corrective news. In either case, the event study by itself does not provide a reliable estimate of the value of the misrepresentations that have been corrected by the disclosure.²

A second complication is that most shareholder class action complaints allege a pattern of recurring misrepresentations extending over a number of financial reporting periods. Perhaps the most recognizable example is the prototypical accounting statement fraud that has built up in severity over time. Such a problem can start small with a minor GAAP violation to cover up disappointing performance. But if the market expects continuing growth at a rate that is higher than can be actually attained then attempting to make the firm’s growth rate appear to meet the market’s expectations requires increasingly creative ways to fix the numbers. Eventually, the truth comes out and it is found that the financial statements must be restated extending, sometimes, over several prior fiscal years. But a distinct corrective disclosure is not associated with one and only one past financial statement; rather, the disclosures will often be about the need to restate multiple past financial statements. Consequently, the observed stock price drop is due to information about the entire sequence of financial misstatements that were likely building up in magnitude over time. As such the price reaction does not tell us the effect on the stock price of any single misstatement nor of any combination of prior misstatements other than for the reporting periods specified in the corrective disclosure. As a consequence the event study does not isolate the inflation per share at the earlier times in the class period before the various accounting violations had cumulated to a relatively large magnitude.

A third issue that comes up in shareholder class actions is the apportionment of damages among co-defendants. The Private Securities Litigation Reform Act of 1995 (“PSLRA”)

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² See Frank Partnoy, “*Dura Fraud,*” in 15th Annual ILEP Conference, *Recoveries for Victims of Securities Fraud,* April, 2009, suggesting that the defendant’s decision to “simultaneously disclose information other than information about the allegedly fraudulent conduct at the time of the corrective disclosure” is a conscious strategy aimed at winning a motion to dismiss for failure of plaintiff to plead loss causation adequately.
contained a provision establishing proportionate liability for shareholder class action litigation. Although many such cases have multiple defendants, there is relatively little in the way of well-accepted expert analysis that helps the finder of fact in dividing aggregate damages among the various defendants. The event study may provide some assistance if separate corrective disclosures relate to the misstatements of one and only one co-defendant. This seems to be rarely the case, however. Even if a certain misrepresentation is attributed to one and only one co-defendant, an event study of a corrective disclosure that simultaneously corrects both this misstatement and a material misstatement made by another co-defendant will not be able to allocate the proportion of the observed price drop between the two misstatements.

In what follows, we will focus mainly on the estimation of inflation per share—arguably the most important but not the only step in computing damages in shareholder class actions. To orient the role of inflation per share, note that estimating damages in a shareholder class action builds on a number of elements that relate to plaintiffs’ burden of proof in securities fraud actions. These include the following:

- **Materiality:** testing which of the alleged omissions and/or misrepresentations are material.

- **Loss causation:** estimating the drop in the stock price, if any, that was caused by revelation of the material omissions and misrepresentations.

- **Inflation per share:** estimating the inflation per share on all trading days during the class period so as to determine the magnitude of the reduction in inflation per share between class member purchase and sale dates.

An expert’s evidence on damages typically incorporates findings from each of these steps. In part this is because the same research tool, an event study, sheds light on all three. An additional reason is that findings in each of these areas have a role in the actual computation of damages.

To see this, we start with the proposition that plaintiff suffers an economic loss when he or she buys a security at an inflated price and sells the same security after some or all of the

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inflation has been wrung out of the stock price.\textsuperscript{4} It is important, though, to establish that an alleged omission or misrepresentation is material; if, in the alternative, the truth were not material then its disclosure should neither have had an impact on the share price during the class period nor, therefore, contributed to inflation per share. Assuming, then, that materiality has been established, the measure of economic loss per share is the inflation per share at purchase less inflation per share at sale. This is not necessarily an estimate of damages, however, because plaintiffs also need to establish the loss causation element of damages. This was recently defined by the Supreme Court to be the price decline caused by revelation of “the relevant truth.”\textsuperscript{5} Consequently, it is not an oversimplification to say that a shareholder’s damages are the lesser of the magnitude of economic loss and the magnitude of loss causation.\textsuperscript{6} That being said, the issues described above affect the use of the event study for both inflation per share and loss causation.

In the section that follows, we show how experts have attempted to deal with these problems in the context of relying on an event study of corrective disclosures. Often, there comes a point in the analysis where arbitrary allocations are made. This is followed by a section that shows how statistical analyses from financial economics can be used in each of these circumstances to improve the accuracy of estimated inflation.

\section{II. Event Studies and Regression Analysis}

An event study is an empirical technique used to measure the stock price impact of a specific event, such as a company’s earnings announcement. The technique examines stock price returns—the percentage change in stock prices from one day to the next—to determine how much of the price movement on a particular day is due to the event being examined, and how much is due to changes in conditions affecting the market in general.


Event studies are widely used in litigation to measure the effect of alleged misconduct by examining the share price impact of relevant disclosures.\(^7\) The event study method is commonly used in securities litigation for estimating the share price impact of events because it meets scientific standards. These standards include the following: it provides testable results that may be replicated by other analysts; it is supported by published literature; it produces estimates with a known rate of statistical error; and it has generally been accepted by the scientific community.\(^8\)

**A. Event study methodology**

Although there are multiple ways to perform an event study, among the academically sound methods any differences in measurement of price reaction or determination of statistical significance are usually immaterial. The approach used in this paper, which is also commonly used in the literature, can be described as follows:

**Step 1:** Estimate a market model of share price returns that controls for the effect of market movements and news on the event dates;

**Step 2:** Rule out causation of the impact due to random occurrence.

**Step 3:** Compute the monetary impact of the event-related news on the share price returns;

These steps are described in general terms below.

**1. Step 1: Estimate a market model of share price returns that controls for market movements and news on the event dates**

The first step in performing an event study is to estimate a market model which allows calculating predicted share price returns. The predicted share price returns are the returns expected in the absence of any significant company-specific event. While there are a number of academically-accepted approaches to predicting the returns of a company’s stock, most event studies use a regression analysis called the “market model.” The market model is estimated by regression analysis (described below) and establishes the historical correlation between the


\(^8\) In the United States, the Supreme Court established a standard for expert testimony based on these four factors in 1993 (see *Daubert*, 509 U.S. 579, 589).
company share price returns and market returns to account for market effects. One often uses a period of time prior to the alleged violation in order to estimate predicted share returns. But an equally reasonable alternative is to use a period of time including the violations, and include “indicator” variables (defined below) for each date on which corrective disclosures enter the market. By convention we will label these methods Market Model (1) and Market Model (2) respectively.

Market Model (1) is the following equation:

(1) Predicted company return = \( \alpha + \beta \) (Market index return)

In Market Model (2) the estimated equation can include an indicator variable for each date on which there was new revelation of the relevant truth reaching the market (“event dates”). There is one indicator variable for each event date. Thus, Market Model (2) takes the following form:

(2) Predicted company return = \( \alpha + \beta \) (Market index return) + \( \gamma_1 \) (event date 1) + \( \gamma_2 \) (event date 2) + ... + \( \gamma_N \) (event date N)

In either case, the generic market model predicts the company’s daily share price returns as a constant “\( \alpha \)” plus a quantity which is the coefficient “\( \beta \)” times the market index daily return. The coefficient “\( \beta \)” typically spelled out “beta” has come to have a special place in financial economics. Beta conveys a relationship between the market index and the volatility of a company’s share prices. For example, for a company’s share price to have a beta equal to 0.5 means that if the stock market index were to increase by 10 percent one would expect, everything else held constant, that the company’s share price would increase by 5 percent. Alternatively, a more volatile stock, with a beta equal to 1.5, means that for every 10 percent increase in the stock market index, all else held constant, we would expect the company’s share price to increase by 15 percent.

The “\( \alpha \)” coefficient, also usually spelled out (“alpha”), is an additional factor in the predicted return of an individual stock, though this factor is usually very small and statistically insignificant. Alpha is interpreted as the expected return of the stock when there is no change in
the market index and no event-related news. That is, on days when the index return equals zero and news indicator variables are equal to zero, alpha is the expected return of the stock.

The indicator variables in Market Model (2) each have a “γ” coefficient (“gamma”), and there is one indicator variable for each event date. The gamma coefficients capture the effects of those days’ news, isolating this effect from the effects on the share return due to general market movements.

Often, the values for alpha, beta and, if Market Model (2) is used, the coefficients of the indicator variables are estimated simultaneously using regression analysis on a sample of daily returns. Regression analysis is the most commonly used statistical technique in economics and finance. It is accepted ubiquitously in academic research and is used in litigation in such areas as discrimination, residential property valuation, antitrust and, of course, securities.9

Regression analysis is a statistical method that uses the co-movement between two or more variables to quantify the impact of a change in one variable (e.g., the daily return on the market index) on the other variable (in this case, the daily return on the company’s stock price). One hypothesizes that the returns of the market index and the indicator event date variables will “explain” the changes in the company’s stock price.

In Figure 1 below, the estimation of the alpha and beta coefficients is represented graphically using illustrative, sample data (not actual returns). Each data point on the chart shows the share price return and the market index return on a particular day. The vertical position of the data point measures the company’s daily return and the horizontal position of the data point measures the market index return. The straight line through the data points represents equation (1) from above, Market Model (1). It can be seen that the data points do not all lie exactly on top of the line. The vertical distance between the line and an individual data point is a measure of the statistical error associated with the line on that day—it is the difference between the daily return predicted by the market model and the actual daily return on that day. These errors of the regression are variously called “abnormal returns,” “excess returns” and “market

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adjusted returns” as they are the residual returns unexplained by the market return. We will use these terms interchangeably.

Regression analysis estimates a market model that is the “best” fit to the data points; that is, it calculates the coefficients alpha, beta and, if Market Model (2) is used, gamma such that the sum of squared errors is as small as possible. For this reason the basic regression methodology is sometimes called “ordinary least squares.”

Figure 1

Estimating a Market Model Using Regression Analysis

In Figure 1, the slope of the market model line is the value of the beta coefficient. The slope is the vertical distance that a point on the line would travel if the index return would increase by 1 percent. This distance is represented by the large red bracket to the right of the vertical axis. It tells us the expected amount by which the company’s daily return would change if there was a change in the index return.

The value of alpha is the company’s expected daily return assuming the index return is zero. This is the value of the point on the vertical axis at which the market model line crosses
the vertical axis. This value is shown in Figure 1 by the small red bracket to the left of the vertical axis.10

This picture does not depict indicator variables for event days. But, one can think of the coefficient on an indicator variable that is equal to one on a given day and zero on all other days as the vertical distance between (1) the estimated Daily Company Stock Return on that day (which itself depends on the Daily Index return for that day) and, (2), the actual Daily Company Return on the same day. That is, it is the difference between the predicted return and the actual return which, as we defined, is the excess return. Consequently, for Market Model (2) the value of the indicator variable is a measure of the excess return on an event day.

In performing an event study context with Market Model (1), the estimated market model (equation (1) above) is used to predict the daily returns of the company’s stock price over an event window that includes the day of the corrective disclosure. The event window can be a single day or multiple days. If the event window is more than one day, then a separate prediction for each day can be made with a version of Market Model (1) that has been estimated on daily returns. The prediction is a “conditional expectation.” It is the expected daily return of the company’s stock conditional on a value of the daily market return.

2. Step 2: Rule out causation of the impact due to random occurrence

If, after statistically controlling for general market movements, a company experienced a negative stock price return on the same day that it issued a press release, it is tempting to automatically assume that the observed negative return was caused by the news. Consider, however, that all stocks experience price fluctuations from day to day, and one typically observes price movements even on days with no apparent news relevant to the company. In other words, even in the absence of any new information about a company, actual and predicted returns for the company’s stock almost never exactly coincide except by the rarest of chances. Thus, it has become standard practice to test statistically whether a price movement is just as likely to be random as to be explained by the relevant news.11

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10 Note that empirically, one often observes an alpha close to zero for stocks trading in liquid and efficient markets.

11 It has become common to use the test of statistical significance on a disclosure to be a test of materiality. See, e.g., Tabak and Dunbar. In this paper we focus on estimating inflation per share. In practice the same event study can be used for both purposes. We argue below that the conditions under which the event study provides
This is most often done using the standard t-test. In this context, the t-test provides a
decision rule based on traditional statistical hypothesis testing. It starts with forming a “null”
hypothesis of no effect on stock price from the event. This is equivalent to the statement that the
expected excess return on the event day is zero. The decision rule will be to reject the
hypothesis, and therefore conclude that the event caused the stock price drop, or to fail to reject
the hypothesis, and therefore conclude that the event did not have causal influence on the stock
price. There are two types of incorrect conclusions that we are concerned about in this
framework: incorrectly reject the null hypothesis of no effect (note carefully the double negative
in this description) when the news actually was not material (Type I error); or incorrectly accept
the null hypothesis of no effect when the news actually had an impact (Type II error, which is
defined as one minus the power of the test). Usually, Type I error is the more costly or serious
of the two, and, therefore, decision rules with a low chance of committing a Type I error
predominate. The *de facto* professional standard in economics (and a legal standard in the
United States) is to use a five percent level as the test for statistical significance. Another way
of saying this is that we test whether the what is called a 95 percent confidence interval
\((95 = 100\times [1.00 - 0.05])\) around the estimated parameter includes zero. Consequently, our
decision rule will be if we find that zero excess return lies outside of a 95 percent probability
interval centered around the estimate of the excess return on the event date then we will reject

12 More formally, the hypothesis is that the excess return on the event day was drawn from the probability
distribution of the sample of excess returns used to estimate the parameters of the market model. In the case of
Market Model 1, this sample excludes the days being tested. It is a property of ordinary least squares that the
distribution of the error term, which is the distribution of excess returns in this instance, has zero mean. For the
purposes of statistical testing, it is also assumed that the population of excess returns is normally distributed.

In the case of Market Model 2, the estimation sample includes the days being tested for statistical significance.
But each of these days is represented with its own indicator variable. An indicator variable that equals 1 for a
single day and 0 for all other days causes the values of the daily return of the stock and index on that day to have
no impact on the estimation of any of the other parameters (specifically, \(\alpha\) and \(\beta\)). In other words, it is as if that
day is excluded from sample used to estimate the market model and its only purpose is to be able to estimate
value of the excess return on that day (\(\gamma\)) and the test statistics (described below) associated with the estimate of
the excess return.

13 Sometimes the tolerance levels for the probability of Type I and Type II error are denoted by \(\alpha\) and \(1-\beta\). To
restrict mathematical notation to only that which is essential, we will not be using these symbols for this purpose.

the “no effect” hypothesis and conclude that the news was causally related to the observed excess return.

The next step is to implement the test resulting in an estimate of the confidence interval. If we are using Market Model (1), we start with the excess return of the stock price on the event day and the standard error of the excess return already calculated from the event study above. The standard error is a measure of the volatility of the stock price after controlling for movements in the market index; in other words, it is a measure of the dispersion of the actual returns around the predicted return based on a regression analysis as depicted in Figure (1).

We can use these measures of the excess return and dispersion in the following way. Assume that the excess return is negative, denoted by “−X”. The standard error can then be used to form a bell-shaped probability distribution centered around −X. This is usually called Student’s t-distribution, or t-distribution for short. A graph of the distribution would have excess returns along the horizontal axis. The area under the bell-shaped curve between any two values on the horizontal axis would be the probability of observing an excess return in that range assuming a draw of an excess returns from the same distribution—that is a distribution of returns with mean equal to −X. The point on the horizontal axis that denotes zero excess return would be to the right of −X. It is possible to create an interval of any size centered on −X. Consider, for example, an interval centered on −X that is constructed such that the area under the probability curve between each endpoint of the interval equals 95 percent. This would be our 95 percent confidence interval that would be used in a “two tail” test (the most common in event studies). If the zero point was outside this interval, then using our decision rule we would reject the hypothesis of no effect.

Correspondingly, the same standard error can then be used to form a bell-shaped probability distribution around zero. Then the excess return point −X would be on the part of the horizontal axis to the left of the zero excess return point. If it is far to the left of zero excess return then it will be in the tail of the distribution. That is, if the null hypothesis of zero effect were true then the observed excess return on the event date would have had a low likelihood of occurring.
How low a likelihood? In the two tail test we are interested in whether the observed excess return is in either the positive or negative tail so the likelihood is computed as the area under the curve from $-\infty$ to $-X$ plus the area from $X$ to $\infty$. Assume that the sum of these two areas equals $p$. Then, consistent with zero being outside of the 95 percent confidence interval described above, $p$ is less than 5 percent, the decision value for Type I error. The interpretation of this result is that if we were to conduct this test many times, then the number of times we would make the mistake of rejecting the hypothesis of no effect would converge to $100 \times p$ percent. Assume, for instance, that we calculate a $p$-value of .04, indicating statistical significance based on the 0.05 decision rule given above. Then if the null hypothesis of no effect were actually true every time we did 100 event studies under these conditions we would expect that four times we would make the mistake of concluding that the event had no effect.

The t-distribution for a cumulative excess return extending over more than one day has a mean equal to the cumulative excess return and a measure of dispersion equal to the standard error of the regression times the square root of the number of days over which the return was cumulated. The 95 percent confidence interval would then be constructed from this distribution.

Switching to Market Model (2) above, the t-statistic on the excess return for event day $n$ is the same as the t-statistic on the coefficient $\gamma_n$ that is used to test whether the value of this coefficient is significantly different from zero. Most regression software output will report both the value of the t-statistic and the $p$-value for each estimated regression coefficient. Although this would seem to be a simplification over using Market Model (1), expanding the event window to multiple days and investigating the pattern of returns within the event window is more complicated with Market Model (2). Moreover, selection of the proper days in Model (2)

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16 In making our argument about the shortcomings of the event study technique, we do not need to go into the pros and cons of different ways of performing traditional event studies. All standard event study methods have the problems that will be identified below.
should be limited to those days on which there is an objective \textit{a priori} conviction that news qualifies as either a revelation of the relevant truth or an affirmative misrepresentation.\footnote{See, e.g., Stuebler v. Xcelera, No. 00-11649-RWZ (D. Mass., Apr. 25, 2008) (order precluding expert opinion) in which an expert was prevented from testifying for various reasons including the following: indicator variables in the expert’s model included 130 dates “on which any company news appears” (emphasis in original); and the expert failed to use indicator variables on “relevant event dates” meaning “his theory does not match the facts.”}

3. **Step 3: Compute the monetary impact of the event-related news on the share price returns**

After estimating a market model, the third step of an event study is to calculate the monetary impact of the event-related news on the share price returns (or “excess returns”) on the days of the news. This monetary impact is calculated with the results of either of the market models calculated in Step 1. If Market Model (1) is used, the excess return on an event day can be treated as a percent, though not necessarily a simple percentage as will be explained below. In the same way, if Market Model (2) is used, the estimated coefficient for each indicator variable is used as if it was an excess return expressed as a percent.

In either model, to convert this percentage impact into a monetary impact, one multiplies the stock price on the day before the event-related news by the estimated percentage impact of the news on the event date. The way percentages are calculated in the market model, however, is different from the way they are computed by most people. Financial economists find it easier to work with the excess returns measured in natural logs as they have computation advantages over percentage returns.

Specifically, the daily return is computed as \( \ln(\text{today’s price}/\text{yesterday’s price}) \); where \( \ln(\cdot) \) stands for the natural logarithm of the number inside the brackets. The result is a number that is approximately equal to a percentage change. For small values they are almost the same but the approximation becomes worse the larger the difference between the two prices.

Natural logarithms have desirable properties that simple percentages lack. For example, assume that a three-day pattern of stock prices of $10, $5, and $10 is observed. Obviously, the difference between the day one price and the day three price is $0 ($10 minus $10) which also means that the difference between the day one and the day three price is 0 percent. Note, though, that the simple percent change from day one to day two followed by the simple percent change from day two to day three are -50 percent and 100 percent, respectively. If the two-day percent
changes are cumulated, the result would be 50 percent (-50 percent plus 100 percent). That is, adding together the percent returns implies that the two day return between day one and day three is 50 percent—which would imply that the difference between the day one price and the day three price is 50 percent or $5 (= 0.5×$10) higher than the day one price. But this is clearly incorrect. The reason for this incorrect result is that simple percentages cannot be added to recover cumulative percentages. Natural logarithms do not have this problem. Natural logarithms have the property that \( \ln(\text{day-two-price}/\text{day-one-price}) + \ln(\text{day-three-price}/\text{day-two-price}) = \ln(\text{day-three-price}/\text{day-one-price}) \).

The following formula is used to convert the natural logarithm representation of excess return to a dollar price reaction:

\[
(3) \quad \text{market adjusted price reaction} = (\text{price prior to alleged disclosure}) \times \left( \exp\left[\left(\text{cumulative excess return} + \left(\frac{n \times S^2}{2}\right)\right)\right] - 1 \right)
\]

Where:

- \( \exp[.] \) is the exponentiation function,
- \( S \) is the standard error of the market model regression, and
- \( n \) is the number of days over which the excess return is cumulated.

This formula is based on two features of the mathematics of the estimated return. First, the exponential of the natural logarithm of a number recovers the number: \( \exp[\ln(X)] = X \). Because the daily excess return is represented by \( \ln(\text{today’s price}/\text{yesterday’s price}) \) the exponential of this expression is the quantity today’s price/yesterday’s price. This value is a ratio—if the ratio is greater than (less than) one then today’s price went up (down). When the quantity ((today’s price/yesterday’s price) minus one) is multiplied by yesterday’s price the result is the change in price from yesterday to today.

Second, we note that the quantity \( \ln(\text{today’s price}/\text{yesterday’s price}) \) is normally distributed and this means that the quantity inside the parentheses is lognormally distributed. To convert the (normally distributed) excess return into a price effect, we need to deal with expected value of the (lognormally distributed) ratio of today’s price to yesterday’s price. The normal distribution of the daily excess return has mean equal to zero and variance equal to \( S^2/2 \). The term \( n \times S^2/2 \) in equation (3) is the variance of daily returns cumulated over \( n \) days. To determine
the expected price effect requires an adjustment to the expected excess return involving the variance of the excess return as shown in equation (3).\textsuperscript{18}

This completes the steps to a traditional event study used in securities litigation.

**B. Conditions regarding events that affect event study reliability**

As described above, the event study is a generic research tool. Its specific application in Rule 10b-5 shareholder class action litigation has been most frequent for event days on which the revelations of the relevant truth are disclosed to the market. With certain conditions in place, the event study can be used to establish critical elements of liability, including materiality and loss causation, as well as inflation per share and has been used in the following ways:

*Materiality*—the materiality of the alleged fraud can be tested by determining whether the revelation of the corrected information had a statistically significant impact on the stock price;\textsuperscript{19}

*Loss causation*—Similarly, the loss causation requirement can be determined by the same statistical test—that is, whether disclosure of the concealed information caused a statistically significant price drop;

*Magnitude of loss causation*—The magnitude of the price drop on a corrective disclosure date provides an estimate of loss causation which provides a cap on the estimated inflation per share;

*Magnitude of inflation per share*—Similarly, the magnitude of the price drop can be viewed as a historical experiment of what would have been the impact on the share price were the correct information provided to the market in a timely fashion; inflation per share is another constraint on damages per share.


\textsuperscript{19} It should be stressed that this is an *ex post* measure of materiality of the correct information. Statistical significance on the disclosure date is not sufficient for determining whether the correct information was expected to be material by the defendants at the time of the original omission or would have been material at all times during the class period. Moreover, if the corrective disclosure is not statistically significant then it does not necessarily follow that defendants with knowledge of the omission had a reasonable basis for assuming that it was not material when they made the omission.
For the findings of an event study to be relevant to shareholder class action inflations, however, certain conditions need to be satisfied. Specifically, the reliability of the event study in measuring the full effect of events on a share price is greater under the following circumstances:

1) the events are well-defined;
2) the days and times of day when the news reaches the market are known;
3) the market has not anticipated the news; and
4) it is possible to isolate the effect of the news from market, industry, and other company-specific factors simultaneously affecting the company’s share price.

In circumstances where these criteria are not satisfied, additional information and steps may be needed to isolate the price reaction attributable to the event of interest.

1. Confounding information

Of the above cited conditions for reliability, the fourth condition is the most likely to be violated in practice. A day on which there has been a revelation of the relevant truth is an obvious candidate for analysis—the event is linked to loss causation and measurement of inflation per share—but, as often occurs, this information is contained in a news announcement that also contains information unrelated to the alleged misrepresentations.

For such instances, there are techniques from empirical finance and social science that can be used to help resolve these issues. For example, “content analysis” is now part of the tool kit for determining which among a number of simultaneous news events had effects on the stock price. Content analysis, however, cannot always isolate the price impact of a significant piece of news if it was in the same announcement as other, significant news.

2. Buildup of inflation per share over the class period

Another common problem that arises in application of the event study method is that defendants have made a series of misrepresentations over time with the consequence that inflation per share is changing, usually increasing, through the class period but the revelation of

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the relevant truth is not in a form that each distinct misrepresentation is corrected in an isolated, separate announcement.

This situation is perhaps most apparent in accounting restatement cases. The corrective disclosure is a press release, likely attached to an SEC form 8-K filing, stating the financial statements for the prior, say, two years can no longer be relied upon and will be restated. Let’s assume further that: the restatements will cause downward revisions to reported net income in both years; and the amount and cause of the restatement for each year is material to the market.22 The typical class action will have a class period that commences on the date that the first, erroneous financial statement was released to the market and ends on the date that the restated financials for both years are revealed. The revelation of the corrected financials will be the cumulative, two-year restated amount which, by assumption, will be larger than the first year’s restated amount. The corrective disclosure, then, contains more information than could have been known during the early part of the class period, after the first erroneous financial statement was released but before the second erroneous financial statement was released. Specifically, the announcement that includes quantification of the revisions to net income for both years will inform the market of a larger cumulative impact that could have been known before second year’s, misstated financials were made public.

To give an example, let us assume the following facts concerning, say, E-Z Kredit, Inc. (“E-Z”), a financial services company, concerning its fiscal year earnings announcements:23

**Example 1:**

1) On March 30, 2007, E-Z files a 10-K for the fiscal year ending December 31, 2006 claiming earnings of $1.00 per share.

2) E-Z is silent about FY 2007 financial results until March 30, 2008 when it files a 10-K for the fiscal year ending December 31, 2007 claiming earnings of $1.00 per share for FY 2007.

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22 Materiality in this context implies that the revisions to the financial statements had a material impact on the market’s consensus estimate of the present discounted value of the future free cash flows to be generated by the issuer of the security. This is based on the generally acknowledged thesis that the value of the equity interest of an enterprise is the expected present value of future free cash flow of the operating asset plus net liquid assets. See Richard A. Brealey and Stewart C. Myers, *Principles of Corporate Finance*, 4th ed. (New York: McGraw-Hill, 1991).

23 To keep the example easier to follow, we are assuming, contrary to U.S. regulations, that E-Z was not required to make quarterly financial filings.
3) On May 1, 2008, E-Z issues a press release saying the following:
   a) it is restating its FY 2006 earnings to $0.50 per share (implying that originally reported FY 2006 earnings were overstated by $0.50 per share);
   b) it is restating its FY 2007 earnings to be a loss of $0.50 per share (implying that originally reported FY 2007 earnings were overstated by $1.50 per share); and.
   c) it is taking a substantial writedown of subprime related assets in FY 2008.
4) The stock price responds immediately, dropping a market-adjusted $10.00 per share.

Shortly thereafter, an action is filed under Section 10 of the 1934 Exchange Act on behalf of a class of investors who purchased E-Z securities from March 31, 2007 through April 30, 2008. Defendants include E-Z, its officers and directors, and its auditor.

This example can be used to explore the problems in relying solely on an event study to measure inflation per share for class members. In this instance, an event study will show a $10.00 price drop simultaneously occurring with a revelation of the relevant truth. That is not the same thing however as the full $10.00 drop being caused by the revelation of the relevant truth. If it is shown that the third item in the above disclosure, the writedown of assets for FY 2008, is timely and material then the magnitude of the stock price drop has been increased by a confounding factor unrelated to the fraud. In which case, as described in the prior section, using the event study result of $10.00 per share, without adjustment, would lead to an overestimate of inflation per share. Of course, if the material timely news had been positive rather than negative, then the standard event study result could lead to an underestimate of inflation per share. In either case, the findings of such an event study should be adjusted, if possible, to increase the accuracy of the inflation per share estimates.

There is yet another problem illustrated in this example that relates to the specific topic of this section. For anyone who bought between March 30, 2007, when the erroneous FY 2006 10-K was released and March 30, 2008, when the erroneous FY 2007 10-K was released, the only misinformation in the market is the $0.50 overstatement of FY 2006 earnings; no misrepresentations regarding FY 2007 financials have yet occurred. Consequently, the $10.00
price drop at the end of the class period, by itself, tells us virtually nothing about the inflation in share price for these members of the class. It is extremely unlikely that shares purchased between the filing of the 2006 10-K and the 2007 10-K could be worth a $10.00 damage claim.

This issue is a variant of the confounding information problem when using the event study to measure inflation per share during the class period. Even if the corrective disclosure only contains information about the fraud,\(^{24}\) it may contain too much negative information to measure the magnitude of the price drop that would have been expected from correcting only the first financial statement.

To illustrate, let us suppose in the above example that the court finds that the only misrepresentations were those made about earnings in the 2006 and 2007 10-Ks. We also make the assumption that the experts agree that $8.00 of the $10.00 price drop is due to the corrective disclosures regarding the 2006 and 2007 restatements (leaving $2.00 of the price drop to have been caused by the timely announcement concerning the FY 2008 subprime writedowns). The following table shows what is known at this point about inflation per share:

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Earnings Per Share</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fiscal Year 2006 (1)</td>
</tr>
<tr>
<td>A.</td>
<td>Reported</td>
</tr>
<tr>
<td>B.</td>
<td>Restated</td>
</tr>
<tr>
<td>C.</td>
<td>A−B Overstated</td>
</tr>
<tr>
<td>D.</td>
<td>Inflation per Share Due to Overstatement</td>
</tr>
</tbody>
</table>

The typical approach to dealing with this issue is to use a buildup of the inflation per share over the class period that is proportional to cumulative financial overstatement.\(^{25}\) The following table shows how this is done:

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\(^{24}\) Suppose, in our example, that the writedowns of assets were fraudulently covered up before May 1, 2008 so that every piece of information in press release on that date was a corrective disclosure.

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Fiscal Year 2006</th>
<th>Fiscal Year 2007</th>
<th>Total $(1) + (2)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>A. Reported</td>
<td>$1.00</td>
<td>$1.00</td>
<td></td>
</tr>
<tr>
<td>B. Restated</td>
<td>0.50</td>
<td>(0.50)</td>
<td></td>
</tr>
<tr>
<td>C. A−B</td>
<td>$0.50</td>
<td>$1.50</td>
<td>$2.00</td>
</tr>
<tr>
<td>D. C+prev(C)</td>
<td>0.50</td>
<td>2.00</td>
<td>n/a</td>
</tr>
<tr>
<td>E. C+sum(C)</td>
<td>25%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Buildup of Inflation**

| F. E×$8.00     | Pro Rata Method | $2.00             | $8.00            | $8.00            |
|----------------|-----------------|--------------------|------------------|

If the earnings have been overstated for a large number of years, then calculation of the cumulative overstatement proceeds as follows: the cumulative overstatement of the first year is just the first year’s overstatement; the cumulative overstatement of the second year is the sum of the first year overstatement and the overstatement of the second year; the cumulative overstatement of the third year is the sum of the cumulative overstatement of the second year (calculated in the prior step) and the overstatement of the third year; etc. The cumulative overstatement of the last year is always 100 percent of the total overstatement.

Table 2 computes the cumulative overstatement for Example 1 in row D. The next step is to compute the percentage of each year’s cumulative overstatement to the total overstatement. In Example 1, the year 1 overstatement of $0.50 is 25 percent of the total overstatement of $2.00. The pro rata allocation approach would therefore assign 25 percent of the price drop to the first year’s overstatement. This amounts to $2.00 per share (0.25 × $8.00 per share). Under this allocation, purchasers who bought E-Z shares during the period March 31, 2007 through March 30, 2008 and retained these shares through the end of the class period would have...

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estimated economic loss (reduction inflation between purchase and sale) of $2.00 per share. Alternatively, class members who purchased after March 30, 2008 and held to the end of the class period would have estimated economic loss of $8.00 per share.

One of the key assumptions in the buildup approach presented here is that one can estimate the fraction of the observed $10.00 per share that is due to the accounting misrepresentations before building up the inflation per share over the class period. As will be shown below this assumption is likely problematic.

On a related point, the pro rata allocation approach may cause a distortion in the buildup because it does not take into account that the observed price drop is based on market expectations that would have been different in the counterfactual world. For example, market expectations for 2007 earnings would have been lower had the true 2006 earnings been reported. This has an effect on the buildup because in the counterfactual world, the 25 percent of cumulative overstatement will have had a different, often larger, than pro rata effect on inflation per share.

3. Allocating liability to codefendants

It is often the case that different sets of codefendants—such as officers versus outside auditors—are alleged to be responsible for different misrepresentations that are, nonetheless, revealed altogether in corrective disclosures. This again is a species of confounding information. Consider that each misrepresentation is associated with a set of codefendants. Some misrepresentation may be associated with two codefendants; a second misrepresentation with one codefendant; etc. Were there a series of corrective disclosures and each was associated with one and only one of the misrepresentations, then there might be some hope that an event study would be able to assign an inflation per share to each misrepresentation. Then each codefendant would have an upper bound on their liability from the dollar drops associated with the corrective disclosures only for the misrepresentations for which they had some legal responsibility. Instead, corrective disclosures usually reveal the truth about a number of alleged misrepresentations creating the problem that analysis of event study results is of limited value in helping to determine proportionate liability.
To give an example, let us change our example somewhat and assume the following facts concerning one of E-Z’s backers, Asset Backed Lending, Inc. (“ABL”), whose net income is the same as E-Z but, unlike E-Z, files quarterly as well as annual financial statements:

**Example 2:**

1) On March 30, 2007, ABL files a 10-K for the fiscal year ending December 31, 2006 claiming earnings of $1.00 per share.

2) During 2007, ABL issues three 10-Qs as follows:
   a) On May 15, the Q1 2007 10-Q states earnings per share for Q1 2007 are $0.20 per share;
   b) On August 15, the Q2 2007 10-Q states earnings per share for Q1 2007 are $0.30 per share;
   c) On November 15, the Q3 2007 10-Q states earning per share for Q1 2007 are $0.30 per share.

3) On March 30, 2008, ABL files a 10-K for the fiscal year ending December 31, 2007 claiming earnings of $1.00 per share for FY 2007 and $0.20 per share for Q4 2007.

4) On May 1, 2008, ABL issues a press release saying:
   a) it is restating its FY 2006 earnings to $0.50 per share (implying that originally reported FY 2006 earnings were overstated by $0.50 per share);
   b) it is restating its FY 2007 earnings to be a loss of $0.50 per share (implying that originally reported FY 2007 earnings were overstated by $1.50 per share); and.
   c) it is taking a substantial writedown of subprime related assets in FY 2008.

5) The stock price responds immediately, dropping a market adjusted $10.00 per share.

Consider the defense of the auditor co-defendant that the only times it made any representations to the market was by certifying its audit of the financial statements in the two 10-Ks. Neither the quarterly earnings announcements nor the 2008 writedown announcement involved any statements made by the auditors. As a result, any inflation or loss causation attributable to the 10-Qs or the 2008 writedowns would not contribute to damages against the auditor. Alternatively, a portion of the inflation per share and loss causation from the
misstatements in the 10-Ks would be jointly attributable to the auditor and other codefendants involved in their preparation and dissemination. But the event study by itself cannot distinguish which part of the $10.00 price drop is due to correction of misstatements in 10-Ks versus misstatements in the 10-Qs and revelations about the subprime writedowns.

III. ANALYZING PRICE REACTIONS WITH RESPONSE COEFFICIENTS

In what follows we extend our examples to demonstrate how response coefficients can be used to improve the accuracy of inflation estimates. These applications draw from forty years of studies of the impact on stock prices of financial announcements published in the finance literature.\(^{26}\) The specific topics covered include the following:

How a response coefficient can be used to separate the stock price impact of an announcement concerning the financial results of a company from the impact of other announcements made simultaneously: This application of response coefficients intends to separate the portion of a price reaction attributable to quantified financial results from the portion attributable to, either quantitative or qualitative, confounding news.

The construction of a hypothetical price path, or “true value,” over the class period based on the counterfactual that no misrepresentations were made:\(^{27}\) This is particularly relevant if each of several misstatements occurred at different points in time.

Calculating bounds on damages for particular defendants when different parties share the liability for an alleged misconduct: The hypothetical price paths can be based on party-specific response coefficients and will therefore allow calculating a cap on inflation per share over the class period for a given party.

A. Price effects of financial results in announcements with confounding news

1. The nature of financial results announcements

Quarterly, and especially the fourth quarter’s, announcements that inform investors about its financial results often contain the most eagerly-awaited information a company releases over

\(^{26}\) The literature review of response coefficients is presented in Section IV below.

\(^{27}\) Oftentimes we will call these hypothetical prices the “but-for prices” or simply the “but-for world” if we refer to the assumption of no misrepresentations and the resulting price path conjunctively.
the course of a year. For well-followed companies, security analysts will have published their expectations well in advance of such announcements and discussed the different factors that support their estimates. In some cases, analysts share their views about the implications that financial results in excess or below expectations would have on their valuation of the company. The anticipation of financial results by the wider investor community has also been documented; academic research has found that stock prices exhibit significantly higher volatility in the days before the announcements of financial results.

Announcements of financial results are rarely limited to financial statement data. Because they are crucial for the valuation of a stock by investors, financial results are generally a platform for more wide-ranging communications by management to investors. For example, in earnings calls with security analysts, management might make an earnings forecast for subsequent periods, discuss their understanding of the company’s growth opportunities, or respond to analysts’ questions on a range of subjects beyond the reported financials. Academic research has shown that concurrent, ancillary information, such as management forecasts, has significant stock price impacts.

2. Financial results and their impact on stock prices

Research concerned with the stock price movements in reaction to financial results has been a subject of academic research for at least half a century. The hypothesis that earnings announcements contain information that can move a stock price is based, in part, on a model that

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32 We discuss this literature in Section IV.
equates the value of equity to the expected present discounted value of the future stream of cash flows.\textsuperscript{33} In the case of a stock, all free cash flow, ultimately, accrues to the equity holder in the form of distributions such as stock buy backs and dividends.\textsuperscript{34} The argument is that were the price higher (lower) than the sum of discounted future distributions, an investor buying the stock would expect to make an economic loss (profit) in the long run. As a consequence, reduced (increased) demand would decrease (increase) the stock price towards the equilibrium where it equals the sum of expected discounted future dividends.

Expected distributions to equity holders depend on expected cash flow which, in turn, should bear a relationship, in the long run, to expected earnings of a company.\textsuperscript{35} Therefore, according to this model of stock price formation, in an efficient market, stock price is an unbiased estimate of the value of the stock based on all public information of future earnings. It is therefore not surprising that the stock price generally reacts very little or not at all when a company announces earnings in line with the current market expectations. Alternatively, stock prices have been found to react significantly to unexpected earnings numbers, i.e., to earnings surprises. The reason is that investors adjust their expectations of future earnings in the direction of the surprise.

\textbf{a. Earnings response coefficients}

Academic explorations have summarized the quantitative relationship between earnings surprises and stock price estimating an earnings response coefficient (“ERC”).\textsuperscript{36} For an intuitive explanation, consider the effect of an earning surprise on a stock price return. Suppose, for


\textsuperscript{34} Ibid.


In the short run, cash flows and accounting earnings can diverge. The reasons are that there are differences between a) the timing of cash flows and the sales activity that initiates them and b) the cash outlay of long-lasting assets and the sales activities that use these assets as an input.

example, that there is a negative earnings per share surprise that is -10 percent of the stock price. Such an announcement will often cause a swift stock price drop. In the instant case, let us suppose that the observed stock price effect is -30 percent. The price response coefficient in this case is equal to 3; it is the change in return divided by the change in the earnings surprise to price ratio. In this instance, it would be -30 percent divided by -10 percent.

To generalize the factor by which an earnings (per share) surprise transforms into a price change can be represented as:\textsuperscript{37}

\[
\text{Market-adjusted price reaction due to earnings surprise} = \text{ERC (times) earnings surprise per share}
\]

The research on the magnitude of the price change in response to earnings surprises has developed a more rigorous representation to facilitate statistical estimates:

An earnings surprise, is defined as \( \hat{e}_t - E(e_t) \)

where:

\( \hat{e}_t \) is the earnings per share announced on day \( t \);
\( E(e_t) \) is the market’s expectations of earnings per share on day \( t \) (usually represented as consensus analysts’ forecasts).

The market adjusted stock price return (excess return), \( AR_t \), in response to this earnings news is assumed to be predicted the following expression:

\[
AR_t = a + b \left\{ \frac{\hat{e} - E(e_t)}{p_{t-1}} \right\}
\]

where:

\( p_{t-1} \) is the prior day’s share price;
\( b \) is the estimated earnings response coefficient;
\( a \) is an estimated constant term.

\textsuperscript{37} Note that depending on the estimation technique used to measure the ERC this formula needs to be adjusted.
As a matter of experience, it is likely that the earnings response coefficient is not constant if there are multiple earnings surprises that are the result of disclosures of false accounting. For a growth stock, the first announcement could be expected to have a disproportionately larger effect than subsequent announcements. That is, the earnings response coefficient for initial announcements would likely be larger than it is for follow-on announcements. This is because the initial price reaction would include a component that reassesses upward the risk of ensuing bad news. If that risk materializes in a subsequent earnings surprise that an investigation is related to the same violative conduct as the first disclosure, then losses caused by the conduct are the sum of the two excess returns.

b. Analyst forecast revision coefficient

We have discussed above that a stock price changes when investors change their expectations of future earnings, or, as we might also say, revise their earnings forecasts. Current academic research has converged to using securities analyst forecasts as an approximation for market expectations. We will discuss the reasons for this in Section IV. The factor by which analyst forecasts are revised due to an earnings surprise is called the analyst forecast revision coefficient, or ARC. The basic relationship between forecast revisions and earnings surprise can be thought of as:

\[ \text{Analyst forecast revision due to earnings surprise} = \text{ARC} \times \text{earnings surprise per share} \]

Academic researchers have quantified these response coefficients for various samples of firms, industries and time periods. These calculations are based on historical data using regression analysis. Because this statistical technique uses many historical observations to estimate the response coefficients, it will calculate response coefficients that are not influenced by the possible confounding news in the single historical announcements used. Large sample results produce unbiased estimates of response coefficients. In more casual terms, we could say that the effects of the confounding news in the announcements used in the estimation cancel out.

We discuss how to calculate or select the appropriate ERC and ARC for a company in our review of the academic literature on ERCs and ARCs in Sections IV and V, respectively.
We will now turn to examples which demonstrate how these response coefficients can be used to analyze price reactions.

3. Using response coefficients to parse price reactions

The importance of financial results and the fact that they are often announced simultaneously with other company specific news is the motivation for our first example using response coefficients. Before we can address all the complexities present in Example 1 of the previous section, we demonstrate the application of response coefficients in simplified situations. Consider the following case of a corrective disclosure of a misrepresentation announced simultaneously with a timely (i.e., nonfraudulent) earnings disappointment:

**Example 3**

1) On March 4, 2008, amid market speculations that Acme Bank and Fidelity ("Acme") will have to write down subprime related assets in 2008, Acme announced that it would not take any writedowns (when in fact management already knew they were inevitable).

2) On March 30, 2008, Acme announces that its 2007 earnings are $1.50 below the market’s expectation (timely announcement) and that it would have to write down its subprime related assets substantially (correction of misrepresentation).

3) An event study shows that Acme’s stock price declined by a market adjusted $10.00 on March 30, 2008.

Clearly, the price reaction on March 30, 2008, includes the combined effect that investors attribute to both the writedowns of subprime related assets and the disappointing earnings announcement. As a consequence, the event study on March 30, 2008, does not by itself allow one to determine the price decline exclusively due to the disclosure of the misrepresentation.

Instead we can make use of the academic research on price reactions in response to earnings announcements which provides us with a technique to calculate the price reaction due to the $1.50 earnings disappointment. The technique uses the concept of an earnings response coefficient, or ERC, as introduced above.

Let’s assume that either through a regression analysis or from the professional literature, we can infer that Acme has an ERC of 5 over the relevant time period. This implies that for every cent of an earnings surprise its stock price reacts by five cents.
Using an ERC of 5 in our example gives the following result:

**Table 3**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Total Price Change on March 30, 2008 Disclosure</td>
<td>$ (10.00)</td>
</tr>
<tr>
<td>B</td>
<td>Earnings Surprise announced on March 30, 2008</td>
<td>$ (1.50)</td>
</tr>
<tr>
<td>C</td>
<td>Earnings Response Coefficient</td>
<td>5.00</td>
</tr>
</tbody>
</table>

*Inflation Due to Misstatement made on March 4, 2008*

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>A − B × C ERC Method</td>
<td>$ (2.50)</td>
</tr>
<tr>
<td>E</td>
<td>Unadjusted Event Study Method</td>
<td>$ ?</td>
</tr>
</tbody>
</table>

To parse the fraction of a price reaction due to an earnings surprise is not the only application of response coefficients. The technique can also be applied to calculate inflation in a stock price when the earnings themselves are misrepresented or overstated and later corrected in a disclosure of the correct numbers.

This, in fact, may be the most relevant use of ERC’s in securities litigation. While not all restatements result in litigation, restatements are in fact quite common and therefore an important application of response coefficients: The July 2006 report on financial restatements issued by the U.S. Government Accountability Office finds that 6.8 percent of all companies listed on major exchanges restated at least one financial statement in 2005.\(^3\)\(^8\) This is the motivation for our next example which again is a simplified version of our Example 1 in the previous section. Example 4 below deals with disclosure of overstated financial results simultaneously with confounding news:

**Example 4:**

1) On May 1, 2008, Big Investment Group (BIG) issues a press release informing investors that its 2007 earnings announced on March 30, 2008, had been overstated by $1.50, and that it will take substantial writedowns on its subprime related assets in 2008 (the writedowns are considered as timely information).

2) An event study on May 1, 2008, shows a price reaction of $10.00.

\(^3\)\(^8\) The report is available here: http://www.gao.gov/new.items/d06678.pdf.
This, of course, is the mirror image of Example 3; and, similar to Example 3, the event study will not provide us with enough information to calculate inflation due to the overstated 2007 earnings. However, we can calculate the expected movement of the price on February 28, 2008 due to the earnings announcement alone by applying the ERC. Assume that BIG has an ERC of 5:

Table 4

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Total Price Change on May 4, 2008 Disclosure</td>
<td>$ (10.00)</td>
</tr>
<tr>
<td>B. Earnings Misstatement on February 28, 2008</td>
<td>$ (1.50)</td>
</tr>
<tr>
<td>C. Earnings Response Coefficient</td>
<td>5.00</td>
</tr>
<tr>
<td>D. B×C ERC Method</td>
<td>$ (7.50)</td>
</tr>
<tr>
<td>E. Unadjusted Event Study Method</td>
<td>$ ?</td>
</tr>
</tbody>
</table>

Inflation Due to Earnings Overstatement made on March 30, 2008

Examples 3 and 4 show how an ERC can separate the impact of an earnings surprise from the impact of news announced simultaneously with the financial results. Four comments are in order.

First, if the timely news were positive rather than negative, then the predicted price using the ERC would be expected to be greater than the actual change in price. The difference between the predicted and the actual would be an estimate of the effect of the positive news alone on the stock price.

Second, the examples above could also have been based on response coefficients other than the ERC. As we will see in Chapter IV, the academic literature has studied many different response coefficients. For instance, in young industries with considerable set-up costs, earnings are not likely to be considered a meaningful measure of performance as big initial investments imply that all competitors have negative earnings. In fact, it might even be the case that companies with the bigger loss are expected to grow faster in the future as they might invest faster and therefore build a client base sooner. In such a case, revenues may be a more reliable accounting measure for the performance of a company. Similarly, in some markets cost-cutting
is the only viable survival strategy of companies. For those markets, cost response coefficients might be the most appropriate response coefficients to use.

Third, along these lines, in the examples above it would have been theoretically possible to use a “writedown response coefficient” to parse the stock price rather than an earnings response coefficient. But this could create a situation where the sum of the expected price declines from the earnings response coefficient and the writedown response coefficient would be less than or greater from the observed stock price decline of $10. Such a result would not be surprising because of the presence of statistical error in both of the earnings and writedown response coefficients as well as the event study itself. In such circumstances, the inflation per share estimate from using the earnings response coefficient would be different from the inflation per share estimate from using the writedown response coefficient. This would mean that the analyst would have to find a way to reconcile the three different statistical estimates. One approach would be to select one or the other inflation estimate, based on test statistics that would show which of the two response coefficients gives the lowest expected error. If the results of the event study show a price drop in excess of the price drop based on the selected response coefficient, then this would give a way to parse the price drop into two unique components using the approaches shown in Tables 3 and 4 above. In the alternative, there are sophisticated statistical techniques that can be used to combine various estimates into a single estimate based on the statistical errors in each of the separate estimates. These methods, however, are beyond the scope of this paper.

Fourth, market expectations are the single most important factor to understand the stock price reaction to an earnings announcement. We have discussed that investors will adjust their expectations of future cash flows from holding a given stock if earnings announcements are not in line with their expectations. In the next subsection we will use this fact to extend the situations to which we can apply response coefficients.

4. **Successive price effects of misstatements that occurred at different times in the past**

In this section we address the situation of several misstatements made at different points in time. Although our technique is applicable to many different kinds of misstatements, the most obvious application is to announcements revealing financial statement restatements involving
several periods. This is not a small fraction of all the restatements announced. Professors Palmrose, Richardson and Scholz show that almost one third of all firms restating financial statements restate multiple years.\textsuperscript{39}

To demonstrate our method we now address Example 1 from above. We repeat the sequence of events in the example for convenience:

**Example 5:**

1) On March 30, 2007, E-Z files a 10-K for the fiscal year ending December 31, 2006 claiming earnings of $1.00 per share.

2) E-Z is silent about FY 2007 financial results until March 30, 2008 when it files a 10-K for the fiscal year ending December 31, 2007 claiming earnings of $1.00 per share for FY 2007.

3) On May 1, 2008, E-Z issues a press release saying the following:
   a) it is restating its FY 2006 earnings to $0.50 per share (implying that originally reported FY 2006 earnings were overstated by ($0.50 per share);
   b) it is restating its FY 2007 earnings to be a loss of $0.50 per share (implying that originally reported FY 2007 earnings were overstated by $1.50 per share); and.
   c) it is taking a substantial writedown of subprime related assets in FY 2008.

4) The stock price responds immediately, dropping a market adjusted $10.00 per share.

As discussed previously, it is important to separate the effects of the different news items announced on May 1, 2008. The reason is that the subprime related asset writedowns are or could be argued to be timely events which did not inflate the stock price in the period from March 30, 2007 to May 1, 2008. In the prior incarnation of Example 5, it was assumed that the price impact corrective disclosure concerning the restatement alone was $8.00 per share.\textsuperscript{40} But now we have a method of estimating the price reaction based on the ERC rather than simply assuming the price reaction.

\textsuperscript{40} See Example 1 in Section II.
Let us assume that we have estimated an ERC of 4 for E-Z. Naïve application of the ERC implies that E-Z’s stock price would have dropped $2.00 (= 4 x $0.50) on March 30, 2007, and another $6.00 (= 4 x $1.50) on March 30, 2008. But this is likely to be wrong because it neglects that the market often adjusts its expectations regarding future earnings if it experiences an earnings surprise. Had E-Z announced lower 2006 earnings on March 30, 2007, investors would have expected lower earnings in 2007 and the earnings surprise would have been smaller than $1.50 on March 30, 2008.

We have discussed above that we can use an ARC to measure by how much analyst expectations, which are our best approximation of the market’s expectations, change when the market experiences an earnings surprise. Let’s say, that we have measured an ARC of 0.8 for E-Z. Consequently, the counterfactual world would have had the following cause and effect dynamic:

First, were the market to have learned on March 30, 2007, that (correct) earnings were $0.50 lower than expectations for 2006, it would have reacted with a price decrease of $2.00 (ERC of 4 times $0.50 lower earnings for 2006);

Simultaneously, the market would have adjusted its expectations for the 2007 earnings downward by $0.40 (ARC of 0.8 times $0.50 lower earnings in 2006);

As a result, were E-Z to have announced the lower, correct earnings on March 30, 2008, the market’s expectations would have already been lower by $0.40 from the actual world expectations;

So the market would only have experienced $1.10 earnings surprise (= $1.50 - $0.40) on March 30, 2008;

This would have resulted in an additional price decrease of $4.40 (ERC of 4 times $1.10 lower than expected earnings for 2007).

The following table summarizes the methodology:

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41 The real world of securities litigation is rarely as tidy as this example. To see an example based on ARC and time-varying ERC see Report of Frederick C. Dunbar, Dorajay Pty Ltd. v. Aristocrat Leisure Ltd. (Mar. 19, 2007), (Federal Court of Australia, N.S.W. District Registry N362 of 2004) and Reply Report of Frederick C. Dunbar, Dorajay Pty Ltd. v. Aristocrat Leisure Ltd. (Sep. 18, 2007), (Federal Court of Australia, N.S.W. District Registry N362 of 2004).
Table 5

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>$ (0.50)</td>
<td>$ (1.50)</td>
</tr>
<tr>
<td>B</td>
<td>Earnings Response Coefficient</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>C</td>
<td>Analyst Revision Coefficient</td>
<td>0.80</td>
<td>0.80</td>
</tr>
<tr>
<td>D</td>
<td>A − C × prev(A) Hypothetical Earnings Surprise</td>
<td>(0.50)</td>
<td>(1.10)</td>
</tr>
</tbody>
</table>

Buildup of Inflation

<table>
<thead>
<tr>
<th></th>
<th>E × B + prev(E) ERC Method</th>
<th>$ (2.00)</th>
<th>$ (6.40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Pro Rata Method</td>
<td>$ (1.60)</td>
<td>$ (6.40)</td>
</tr>
</tbody>
</table>

Row F of Table 5 shows, for comparison purposes, how a pro rata buildup would have performed had a hypothetical event study isolated the impact of the restatement disclosure to be the same as was estimated from applying the ERC and ARC to build up the inflation (i.e., $6.40). As can be seen, the pro rata buildup has a lower inflation per share in the early part of the class period than the inflation per share estimated using the ERC and ARC.

In this example, there is no ambiguity concerning the inflation per share attributable to the incorrectly stated financials because the estimate is less than the amount of the market adjusted price drop and the difference between the estimated inflation per share and the price drop can be attributed to timely news. But suppose the example was changed so that the only news was the financial restatement. There is no guarantee that the market adjusted price drop would be equal to the inflation per share estimated using the ERC and ARC. Similar to the prior example, statistical error will cause the estimates based on ERC/ARC buildup to vary from the estimate based on an unadjusted event study. The analyst will then have to decide how to employ the estimates in computing damages based on a number of factors including the following:

Loss causation. If the ERC/ARC method were considered the best evidence on inflation per share and if the inflation per share were greater than the market adjusted price drop, then damages would be capped by the inflation adjusted price drop because this would reflect the loss causation constraint on damages;
**A priori versus ex post damages.** If the ERC/ARC estimates are based on data prior to the corrective disclosure then they represent an *a priori* estimate of the inflation per share due to the incorrect financials. Alternatively, the market adjusted price drop represents an *ex post* measure of the (cumulative) inflation per share. Although securities fraud litigation has not addressed this issue, there is a general presumption in the law and economics literature that the *a priori* measure of damages satisfies more closely the goal of optimal deterrence.\(^{42}\)

**Statistical error.** Weighing the statistical confidence in the two different estimates may also reveal a clear preference for one over the other. If there is a preference for the unadjusted event study in estimating the cumulative inflation per share at the time of the final restatement then the analyst would have to develop an alternative approach, though likely employing the ERC/ARC estimates, to the buildup of inflation over the class period.

It is worth mentioning that the buildup of inflation per share does not readily translate into loss causation. For an ARC greater than zero, the lingering effect on a long-ago misstatement on today’s price is lower than the inflation per share at the time of the misstatement. Whether this has an indirect effect on reducing damages per share during the early part of the class period based on a loss causation argument is a question that has not been addressed by the courts. Moreover, it is a legal policy issue rather than an economics question. The economics of the damages estimate is clear; an economic loss in the magnitude estimated in the ERC/ARC framework has been suffered by the class members. But the loss causation cap imposed by *Dura* will sometimes prevent recovery of full economic losses. This being said, if the courts would reduce the damages for the early part of the class period based on a loss causation argument this would have the perverse effect of rewarding those defendants who delay in restating their financials. Such a policy would likely increase the social costs of securities aftermarket fraud.

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5. **Bounds on the liability for an individual defendant that is less than aggregate damages**

We now address the case in which different sets of co-defendants are jointly responsible for alleged misrepresentations. For misrepresentations in financial statements, for example, auditors are oftentimes named as co-defendants along side officers, directors and the issuing firm. As described above, except in unusual circumstances, the event study of the corrective announcements could not be used to apportion damages among defendants.

Even though the auditor is a co-defendant, there may be a number of misrepresentation in which the auditor did not participate. Usually, the only statements made by the auditors that are actionable are in 10-Ks. Misrepresentations made by other co-defendants, such as 10-Q’s and other news releases not associated with the audited financials, could result in inflation per share apart from that caused by misrepresentations in the 10-Ks. This makes the case of an auditor co-defendant a potentially noteworthy example of the problem of apportioning inflation per share. Specifically, a consequential measure of the portion of the inflation that *can not be attributed to the auditor* is the price reaction to the alleged misrepresentations in which the auditor had no participation, i.e., had they exclusively been incorporated into unaudited financial statements. Regarding the distinction between responsibilities of auditor and management the Statement of Auditing Standards holds that the financial statements are management’s responsibility, whereas it is the auditor’s responsibility to express an opinion on the financial statements.43

While an event study can not provide such a measure, response coefficients do allow for the estimation of inflation in audited versus unaudited financial statements. The reason is that the academic literature has found the response coefficients as measured on audited quarters (fourth quarters) to differ from response coefficients measured on unaudited quarters (first to

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43 See AU 110.03, Source: SAS No. 1, section 110; SAS No. 78; SAS No. 82. See also Regulation S-X (17 CFR Part 210) on the certification of income statements: “If, as a result of the examination and the conclusion reached, the accountant is not in a position to express an affirmative opinion as to the fairness of the presentation of earnings year by year, the registration statement is defective because the certificate does not meet the requirements of Rule 20-2 of Regulation S-X. If the accountant is not satisfied with the results of his examination he should not issue an affirmative opinion.” See Certification of Income Statements, Exchange Act Release No. 33-4458, 27 Fed. Reg. 2312 (March 10, 1962).
third quarters).\footnote{See, e.g., Bradford Cornell and Wayne R. Landsman, “Security Price Response to Quarterly Earnings Announcements and Analysts’ Forecast Revisions,” The Accounting Review, 63, no. 4 (1989): 680-92. Also, see our discussion of the fourth quarter effect in Section IV. We discuss papers that have found other variables responsible for the fourth quarter effect, such as firm size and seasonality of returns. These additional explanations can be excluded by an estimation of the response coefficients that controls for these effects.} Below, we exploit this finding statistically to estimate the effect of an audit opinion on misstated financials.

In summary, for the purpose of estimating a cap on the auditor's liability, we consider the effect of the alleged misstatements on the share price as a result of having these misstatements certified by the auditor as opposed to having them in announcements of uncertified financials. To estimate this incremental effect, we estimate the difference between: a) the inflation in the stock price entering as a result of the overstatements announced in audited financials; and b) the inflation that would have entered the stock had these misstatements occurred in unaudited financial statements.

We now provide an example for this method by adapting the previous example to a situation involving restatement of several financial statements with management as well as outside auditor as co-defendants.

**Example 6:**

On May 4, 2008, BIG issues a press release informing investors that the 2007 earnings announced on February 28, 2008 and the 2006 earnings announced on February 23, 2007 had been overstated by $0.40 and $0.80, respectively. BIG further informs investors that its CEO is leaving the company immediately and that it has lost a patent infringement lawsuit. Both management as well as auditors are named in a class action complaint filed a few weeks later.

An estimation of the ERC on Company BIG’s and its peers’ data show that the ERC estimated on the first three quarters of each fiscal year used is significantly different from the ERC estimated on the fourth quarter of each fiscal year used. A careful review using other variables suggested in the academic literature shows that the entire difference can be attributed to the fact that the fourth quarter earnings are audited. The ERC for audited quarters is 7, while the ERC for unaudited quarters is 3.
A similar effect is found for the ARC. The ARC for audited quarters is 0.8, while the ARC for unaudited quarters is 0.3. These response coefficients can now be used to calculate two distinct inflation series: a) The inflation in the stock price that is due to alleged misrepresentations that were made in audited financial statements ("Inflation A"); and b) the inflation that would have been in the stock price had the alleged misrepresentations been made in unaudited financial statements ("Inflation B"). Each inflation series can be calculated as shown in Table 6.

### Table 6

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>$ (0.40)</td>
<td>$ (0.80)</td>
</tr>
</tbody>
</table>

#### 1) Audited Financial Statements

| B. Earnings Response Coefficient | 7.00 | 7.00 |
| C. Analyst Revision Coefficient  | 0.80 | 0.80 |
| D. A−C×prev(A) Hypothetical Earnings Surprise | (0.40) | (0.48) |
| E. D×B Hypothetical Price Change Due to Misstatement | $ (2.80) | $ (3.36) |
| F. E+prev(F) Inflation A | $ (2.80) | $ (6.16) |

#### 2) Unaudited Financial Statements

| G. Earnings Response Coefficient | 3.00 | 3.00 |
| H. Analyst Revision Coefficient  | 0.30 | 0.30 |
| I. A−H×prev(A) Hypothetical Earnings Surprise | (0.40) | (0.68) |
| J. I×G Hypothetical Price Change Due to Misstatement | $ (1.20) | $ (2.04) |
| K. J+prev(K) Inflation B | $ (1.20) | $ (3.24) |
| L. F−K Difference Between Inflation A and B | $ (1.60) | $ (2.92) |

Inflation A is the total inflation in the stock price. Inflation B is the inflation that cannot be attributed to the auditor, which implies that the difference between Inflation A and Inflation B is the inflation for which both the auditor and other co-defendants are liable. As such, it is also cap on the auditor’s liability.

As an aside, it is also likely that the complaint in this matter would allege that the statements made in the quarterly 10-Q filings contained omissions and/or misrepresentations. If
so and if the misstatements were to be material, then there would be a within-fiscal-year, quarterly buildup of inflation. Oftentimes, this quarterly buildup can be estimated using the same ERC and ARC coefficients as are used for the fiscal year misstatements. If the auditors did not speak in the quarterly filings, then the relevant inflation per share for co-defendants including the auditor is the inflation based only on fiscal year misstatements. In other words, the auditor’s liability would exclude within-fiscal-year quarterly increments; but the auditors’ liability would include the fiscal year increment at the time of announcement of fiscal year audited results (which, obviously, would incorporate the sum of four quarters worth of misstatements).

IV. WHAT HAVE WE LEARNED FROM RESEARCH ON EARNINGS RESPONSE COEFFICIENTS (ERC)?

There is a prolific academic literature on the estimation of response coefficients. The scope of the published research is quite broad and covers many, if not most, of the situations that an expert would encounter in estimating financial fraud inflations. The methodologies and conclusions found in many of these articles can certainly be challenged, but they nonetheless point to standards in the estimation of response coefficients. The estimation techniques are usually multiple regression analysis, described above, and its more sophisticated variants. As such, estimated response coefficients will have a known rate of error. All three of these factors—general acceptance, methodological standards, and known rate of error—should lead to the admissibility under Daubert of the professional application of response coefficients in litigation.

This section presents a review of the literature so that the analyst can be aware of the sources of information on various methodological issues that can be confronted in the estimation of response coefficients. This should give some notion of both the scope and constraints of using response coefficients.

Response coefficients, at base, are attempts to understand how accounting information affects stock prices. Two academic papers are widely considered to represent the start of modern capital markets-based accounting research, the first being by Professors Ball and Brown, who studied whether the announcement of unexpected earnings affect stock prices, and the second by Professor Beaver, who studied the information content of earnings announcement and
established that both trading volume as well as return volatility increase at the time of earnings announcements.\textsuperscript{45}

At the time of these developments, academics generally were modeling the stock price of a company as the discounted expected dividend payments investors can expect from holding the stock.\textsuperscript{46} However, capital-markets-based accounting research mainly focused on earnings as opposed to dividends. This is supported by the “irrelevance proposition” of Professors Merton H. Miller and Franco Modigliani, which states that in well-functioning markets the value of a firm will not depend on its financing decisions or its dividend policy.\textsuperscript{47} Consequently, investors will be indifferent between dividend payouts and reinvestments and only base their valuation of the stock on earnings. Of course, the theoretical concept of earnings, used in the Modigliani-Miller proposition could be a far cry from GAAP earnings. This measurement problem is one of the central issues in accounting research and is one of the reasons there has been so much study of the relationship between reported earnings and firm value.

Earnings are, or should be, an important information item in financial statements.\textsuperscript{48} In most economic models, profits are assumed to be the signal directing the optimal allocation of capital. In valuation theory, as well as valuation models used in practice, expected cash flows, a metric that should be related to earnings, is one of the main input variables. Accordingly, security analysts express their beliefs about future outcomes of many securities in the form of expected earnings.

Most academic studies accept the hypothesis that capital markets are efficient and that stock prices include all available information. This hypothesis implies that the value of expected earnings is already incorporated in the stock price and that only the unexpected part of an earnings announcement, the earnings surprise, will have an effect on the stock price.


Ball and Brown used simple, non-parametric methods to assess whether earnings surprises were associated with unexpected stock returns; their research, therefore, did not result in parameters, such as an ERC, that could be used to determine inflation per share from an earnings misstatement. Subsequent studies, addressing the same question as well as the question of the magnitude of the association, refined their method. It became popular to use a linear, statistical model, usually Equation (4) above, to capture the relationship between unexpected returns and earnings surprises. Over the last forty years this type of model has been used to estimate ERCs on many different samples and using many different versions of the earnings surprise and the unexpected returns variables. It has also been widely used as a benchmark model against which to compare more sophisticated approaches including additional variables and more complicated functional forms.

These enhancements to the simple model will improve the estimation of inflation per share depending on the facts of the case and the availability of data. We will start with reviewing the studies that estimate an ERC using the basic equation above and follow with a review of academic papers that study extended versions of the basic equation.

A. Estimating the basic ERC equation

1. The variables in the basic ERC equation

A researcher who intends to estimate an ERC using the basic equation presented above has to make several decisions on how to use the available data:

Over which time period to measure the price change that is attributed to an earnings announcement;

How to measure the price change attributed to the earnings surprise; and

How to measure unexpected earnings.


We discuss these variables in the following subsections.

a. **Stock price return window**

The length of the window over which abnormal stock price returns are cumulated and attributed to an earnings announcement can have a major effect on the estimated stock price effect and the extent to which the estimate is contaminated by confounding factors. If a chosen window is too narrow, the stock price changes will understate the impact earnings surprises have. If stock price changes are measured over a window that is too long, the stock price changes might be convoluted by other information that has entered the market during this time. Unfortunately, standard practice has to contend with making sense of the fact that over time researchers have used many window lengths.\(^{52}\) Fortunately, there is an explanation for this history with the result that a relatively short window, i.e., three days or less, is the most supportable.\(^{53}\)

In earlier studies, the main reason for long return windows was data constraints. Specifically, analyst forecasts, which are a popular approximation of market expectations, were only available once a month by providers such as I/B/E/S.\(^{54}\) As a consequence, a longer time window was necessary to incorporate the impact of events prior to an announcement into the return variable because analyst expectations would have incorporated this extraneous


\(^{53}\) There are also studies that do not presume a causal connection between accounting information and price changes. These studies are called association studies and have the objective to test whether accounting measures such as earnings capture changes in the information set that is reflected in security returns over a given period. Such an approach requires longer return windows and is not subject to our discussion. See, e.g., S. P. Kothari, “Capital markets research in accounting,” *Journal of Accounting and Economics*, 31 (2001): 105-231.

information. Over time, I/B/E/S and other providers of analyst forecasts have updated considerably their services and now provide daily analyst forecasts. This allows an accurate determination of analyst forecasts on the day of the earnings announcement (or the day immediately prior to it).

For causal analysis, academics have converged to using shorter event windows when estimating ERCs, usually one to three days. A narrow window allows the analyst to conclude that the cause of the price change is the information contained in the announcement rather than information coming into the market on days outside the window.

While some early studies have analyzed the percentage change in raw stock price as a result of an earnings announcement, most studies have focused on some measure of unexpected price returns. There are several methods of how to calculate unexpected returns over the window chosen as the event window. The most prominent method is to use the abnormal returns calculated from a market model as the unexpected returns. These market adjusted returns would be estimated as described above using, for examples, Market Models (1) or (2). The cumulated returns over the event window chosen are the returns that are attributed to the earnings announcement.

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58 There are papers making a technical distinction between abnormal and unexpected returns. We will use the term unexpected returns as an umbrella term for abnormal and size-adjusted returns.

59 In market model (2) above, cumulated returns would require a change in the regression specification. For example, an estimate of $\lambda$ for a two-day return window would require the dependent (left-hand side) variable in the market model that would be two-day returns rather than the daily return; similarly the market index return (right-hand side variable) would be over two days rather than daily. In certain circumstance, adjustments would have to be made to the test statistics of such an equation to correct for serial correlation in the error terms.
b. Earnings surprises

As shown in Equation (4) above, an earnings surprise is defined as announced earnings minus expected earnings. A researcher who wants to create an earnings surprise variable has to decide how to measure expected earnings. This is somewhat challenging as expected earnings cannot be observed.

The approaches to approximate the market’s expectations of future earnings taken in the academic literature can be separated into two groups. First, academics have studied the time series properties of earnings and used these models to estimate market expectations of future earnings. Second, and preferably, academics have used analyst forecasts of earnings to approximate the market’s expectations of future earnings.

i. Expected earnings from time series models

There is a substantial literature on the time series properties of annual earnings numbers. Similarly, quarterly earnings have been forecasted with sophisticated time series analysis. Brown provides a more detailed summary of time series models for earnings forecasting.

In the ERC context, a study of alternative time series models has found that simple models did as well as more involved ones despite of the fact that the latter had higher forecast accuracy. One of the co-authors, an expert for the In re Tyco shareholder class action

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60 Of theoretical interest was the question of whether, like stock prices, earnings could be treated as a random walk. See, e.g., Ray Ball and Ross Watts, “Some Time Series Properties of Accounting Income,” *Journal of Finance*, 27, no. (1972): 663-681. Some later studies found evidence of weak mean reversion which has been explained by the non-sustainability of above-normal profitability, accounting conservatism, liquidation option of non-profitable firms, and the increased use of special items in accounting. See discussion in Kothari (2001) and the citations provided therein.


litigation, subsequently described how this approach could be used for building up inflation per share over the class period.\textsuperscript{64}

\textbf{ii. Analyst forecasts used as market expectations}

Research has shown the following: security analyst forecasts\textsuperscript{65} are more accurate than time series model predictions of earnings;\textsuperscript{66} and earnings surprises created from analyst forecasts are more strongly associated with abnormal market returns than earnings surprises created from time series forecasts.\textsuperscript{67} The higher correlation between analyst forecast based earnings surprises and abnormal stock returns implies that analyst forecasts are a superior approximation of the markets expectations than time series models. The reasons for the better performance of analyst forecasts over time series forecasts are: a) analysts incorporate more information than just the straight earnings numbers from past quarters, e.g., they are in a better position to distinguish between permanent and transitory earnings; and b) analysts incorporate information that becomes available after the last earnings announcements.\textsuperscript{68}

Over the past two decades, analyst forecasts became available electronically from sources such as I/B/E/S, Value Line, Standard and Poor’s Earnings Forecasts, and Zacks Investment Research.\textsuperscript{69}


\textsuperscript{65} Analyst forecasts are from sell-side analysts as the buy-side analyst forecasts are usually not publicly available.


\textsuperscript{68} See Fried and Givoly (1982) and Brown (1993).

\textsuperscript{69} See Brown (1993) for a summary of the literature.
Initial efforts to compare the forecast accuracy of the four sources of analyst data named above found that Value Line and I/B/E/S provide comparable forecast data. In their study, the authors emphasize the importance of using the appropriate reported earnings number. More recent research, though, finds that I/B/E/S earnings forecasts outperform Value Line forecasts in terms of accuracy and as proxies for market expectations. The conflicting conclusions can be reconciled by improvements that I/B/E/S made to its data reporting.

The expert needs to be aware that analysts have increasingly relied on modified definitions of GAAP numbers—so-called Street numbers which may reflect variations such as “operating” or “pro forma” earnings. There has been an increase in the frequency and magnitude of cases where GAAP and Street earnings differ. As analysts forecast Street earnings, the reported earnings number has to be adjusted to represent the Street’s definition because otherwise a measurement error is introduced into the ERC estimation.

It is common in the literature to use either the mean or median analyst forecast across brokerage firms with the median generally being somewhat preferred as it is less prone to outliers and to have a smaller bias.

iii. Deflating the earnings surprise variable

Once the earnings surprise has been calculated, it is often deflated or normalized. While some different deflators are used in the literature, the stock price at the beginning of the window, as in Equation (4) above, has been the most commonly used deflator and has been argued to be the econometrically correct deflator to use.

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74 See Kothari (2001) for a discussion on analyst forecast bias.
In studies with short return windows, the stock price used to normalize the earnings surprise is often lagged by a few days. The reason is that many companies exhibit anomalous stock returns around earnings announcement dates.\textsuperscript{76}

2. Findings of studies estimating the basic ERC equation

To assess the reasonableness of the estimates found by the analyst, it is worthwhile to review what has been found in the academic literature.

One finding is that the correlation between earnings surprises and stock returns in large sample such as those used in the academic literature is not very high. Researchers who estimated the basic ERC equation usually estimate a regressions whose R-squared is in the range of 2 to 10 percent, which means that only 2 to 10 percent of the variance of the unexpected stock returns measured around earnings announcements can be explained by earnings surprises.\textsuperscript{77} To put this in context, though, market models will typically have similar levels of R-squared. Although litigating attorneys often perceive a low R-squared as a significant problem this usually reflects a misunderstanding of the importance of the R-squared statistic.\textsuperscript{78} Without the R-squared from another model specification estimated on the same sample, the R-squared is not very meaningful as it critically depends on the properties of the analyzed data. Of more importance is the test statistic on the estimated ERC.

One of the reasons for the relatively low R-squared is that accounting earnings are likely not the metric that contains all information that is relevant to investors regarding a specific firm. Researchers have therefore included additional variables into the basic ERC equation and


extended their research to the impact of variables other than earnings. We discuss this research in Section B.

The second and third findings are the following: ERCs estimated in academic research are oftentimes lower than predicted by economic theory; the estimated ERCs seem to vary over time and cross-sectionally and therefore depended on the sample used.\textsuperscript{79} This may imply the basic ERC equation is a “first-order approximation” to the true relationship between earnings surprise and share price. To reconcile it with the prevalent models of stock price formation in the finance literature, certain assumptions have to be made that may not do justice to second-order and indirect effects. Researchers have therefore attempted to estimate more general ERC equations that are derived from theoretical models. We discuss this research in Section C.

Another reason for these findings may be that earnings could be measured with an error and therefore bias the estimates of ERCs. Researchers have therefore tried to understand how estimation techniques could be changed to correct for potential biases. We discuss this research in Section D.

**B. Extending the ERC equation with more variables**

Adjusting the ERC relationship should be done cautiously if the estimation sample includes data only from the subject firm or from judiciously chosen peers. If such a sample is available, then the estimation process will be simplified because each observation can be treated as a historical experiment. But circumstances can differ between the observed price reactions and the counterfactual price reactions that are to be predicted. Controlling for these differences will require more complicated specifications or estimation techniques. As the sample size expands to include observations that become even less comparable, the need for additional controls in the estimation process increases.

Among the ways to control for the differing conditions impacting the individual observations is to include more variables in the regression equation. We can split the studies that include additional variables into the basic ERC equation into research including additional firm-

specific variables and research including macro variables. We will first address research including additional firm-specific variables.

1. Including additional firm-specific variables

One large subcategory of research includes tests of different accounting variables in ERC regressions. Some of these studies include additional variables in a way that measures their impact on the ERC. Other studies calculate separate response coefficients for these additional variables without quantifying the impact on the ERC, i.e., the variables are included to improve the overall fit of the model and to avoid omitted variable bias.

a. Other accounting variables

There are numerous studies that add different accounting variables to the basic ERC equation to measure their incremental information content beyond that provided by earnings by testing the statistical significance of the estimated coefficients.80

i. Income and cash flow statement variables

A firm’s success will ultimately depend on its ability to generate cash in excess of its disbursements. So it is an obvious question whether cash flows are a superior metric for firm performance and could therefore better explain stock returns. Indeed, in financial fraud litigation, this implies a common defense against allegations of misstated GAAP income: such misstatements do not matter if expected cash flows are unaffected. However, because cash flows might not be concurrent with economic activity of the firm they might not be representative for firm performance over short time periods. To resolve these timing and matching problems, firms can use accruals to alter the timing of cash flows recognition in earnings. Professor Dechow studies whether accruals improve earnings as an explanatory variable of stock returns and finds that indeed stock returns are more strongly associated with earnings than cash flows over periods

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up to a year. She also finds that long-term operating accruals play a less important role than short-term working capital accruals.

As is well-known by securities lawyers, management has some discretion over the recognition of accruals, which suggests that they can be misused for earnings management. This is the motivation for Professors Kerstein and Rai to study working capital accruals. They argue that the market is likely to perceive large working capital accruals in combination with small earnings changes as earnings management. Consistent with this hypothesis they find that ERCs are approximately 20 percent lower when working capital accruals are large in combination with small earnings increases.

Other studies have focussed on the main components of cash flows, revenues and expenses, and have estimated revenue response coefficients (“RRC”) as well as expense response coefficients (“EXRC”), sometimes as additional parameters in the basic ERC equation. This issue will be important in those cases where the more important financial misstatement is of a financial statement item other than earnings. Professors Swaminathan and Weintrop find a significant and positive RRC and a significant and negative EXRC in a regression of unexpected

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83 See Gerald A. Feltham and Jinhan Pae, “Analysis of the Impact of Accounting Accruals on Earnings Uncertainty and Response Coefficients,” *Journal of Accounting Auditing & Finance*, 15, no. 3 (2000): 199-220, for a theoretical model of management’s ability to influence information received by investors through its choice of accruals. They predict that the ERC depends both on the persistence of earnings as well as the informativeness of reported earnings, both of which are a function of management’s choice of accrual management.


85 In an as of yet unpublished study, Mark Bagnoli, Sanjay Kallapur, and Susan G. Watts, “Top Line and Bottom Line Forecasts: A Comparison of Internet Firms During and After the Bubble,” Krannert Graduate School of Management, Purdue University Working Paper (June 2001), study the relative information content of revenue and earnings for internet firms during and after the bubble. They find that stock prices of firms reporting losses respond to revenue, but not earnings, surprises both during and after the bubble. For firms reporting profits, stock prices respond to earnings and revenue surprises during the bubble and only to earnings surprises after the bubble.
returns on unexpected revenues and expenses as independent variables. Moreover, they find that unexpected revenues have information content beyond unexpected earnings. Other studies confirm these results but point out that investors react significantly more strongly to a dollar of revenue surprise than to a dollar of cost savings.

One potentially interesting specification for an expert studying inflation might be how meeting or missing the expected revenues affects the ERC. One study finds evidence that the unexpected returns to meeting or beating (not meeting) earnings forecasts is accentuated when revenue forecasts are also met.

One of the most common events associated with securities litigation is a large, unexpected write-off. Professors Elliott and Hanna show that the percentage of firms reporting large negative special items has increased significantly over time. They study firms that

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87 In an as of yet unpublished study, Zhaoyang Gu, Prem C. Jain, and Sundaresh Ramnath, “In-Sync or Out-of-Sync? The Joint Information in Revenues and Expenses,” Working Paper (April 26, 2006) SSRN-id579381, argue that revenue and expenses should only be used jointly as they find that the joint “in-sync” or “out-of-sync” movement of revenues and costs is the variable that provides more information than revenues by itself.


90 Write-offs are part of special items which appears as a separate line in the income statements. Although the special items line must be included in earnings from continuing operations, the separate line allows investors to easily identify “earnings before special items.” Special items are defined as either unusual or infrequent transactions. See, e.g., John A. Elliott, and J. Douglas Hanna, “Repeated Accounting Write-Offs and the Information Content of Earnings,” *Journal of Accounting Research*, 34 suppl. (1996): 135-155.
announce multiple write-offs that are not further apart than a year (the paper tests various definitions). They find that the ERC is higher for earnings before special items than earnings after special items, which is consistent with the hypothesis that special items are less relevant to estimate future firm performance than earnings before special items. They further find that the ERC for earnings before special items declines significantly when companies announce write-offs. The response coefficient of special items is positive and significant (write-offs are entered as negative numbers), but declines with the number of consecutive write-offs. A companion piece finds differences in the response coefficients of different types of write-offs. While inventory write-offs and unspecified or multi-asset write-offs result in negative stock price reactions, restructuring charges are followed by positive stock returns.91

ii. Balance sheet variables

Often, an earnings surprise triggering a shareholder class action will have implications for net equity and, perhaps, other items on the balance sheet. Professors Easton and Harris argue that not only the changes in income represented by the earnings surprise, but also changes in the book value of a firm, should matter for the change in the value of a firm as represented by stock price returns. They argue that changes in the book value are best approximated by the level of earnings and they therefore suggest including earnings deflated by the stock price at the beginning of the period into the ERC equation as an approximation of the changes in book value. Their empirical results find significant coefficients for earnings levels.93 Other research has made similar explorations into the use of book value relationships.94

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91 Jennifer J. Francis, Douglas Hanna, and Linda Vincent, “Causes and Effects of Discretionary Asset Write-Offs,” *Journal of Accounting Research*, 34 suppl.(1996): 117-134. They also find a significant response coefficient on overall write-offs, but their ERC in the same estimation is insignificant. Possible reasons are that they do not use analyst forecasts as an approximation of market expectations.

92 Another study that has found a positive response coefficient for write-offs is Srinivasan Ragothaman and Bruce O. Bublitz, “An Empirical Analysis of the Impact of Asset Writedown Disclosures on Stockholder Wealth,” *Quarterly Journal of Business and Economics*, 35, no. 3 (1996): 32-47. Their estimation equation however is different in that it contains sales and cost forecast errors as well as forecast errors of other expenses.

93 See Peter D. Easton and Trevor S. Harris, “Earnings as an Explanatory Variable for Returns,” *Journal of Accounting Research*, 29, no. 1 (1991):19-36. Ali and Zarowin (1992) point out that as Easton and Harris (1991) use change in earnings as an approximation for unexpected earnings, the more transitory the previous period’s earnings are, the greater is the measurement error in the earnings change variable as a proxy for unexpected earnings. They argue that earnings levels act as an additional proxy for unexpected earnings when the previous period’s earnings are not purely permanent and does therefore increase the ERC (being the sum of the coefficients on all the approximations for unexpected earnings). See Ashiq Ali and Paul Zarowin, “The Role of
These models have been extended by including additional variables,\(^9\) including the magnitude of book and market value\(^6\) and the important issue of capitalizing versus expensing research and development.\(^7\)

b. Other firm-specific variables

If the sample becomes larger and goes beyond the subject firm and its peers then the analyst should be aware that certain firm characteristics may affect the size of the ERC. These characteristics include the following: where the stock is traded,\(^8\) firm size,\(^9\) funding sources

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\(^{94}\) Following the model in James A. Ohlson, “Earnings, book values, and dividends in equity valuation,” *Contemporary Accounting Research*, 11 (1995): 661-87, in which the price of a stock is a linear function of both earnings and book value, Daniel W. Collins, Edward L. Maydew, and Ira S. Weiss, “Changes in the value-relevance of earnings and book values over the past forty years,” *Journal of Accounting & Economics*, Vol. 24 (1997): 39-67 use a regression of yearly prices on earnings and book values with almost 120,000 observations over 40 years from 1953-1993 that: a) combined value relevance of earnings and book values have not declined over this period, b) earnings’ value relevance has declined but was replaced by increasing value-relevance of book values; and c) the reason is that more one-time items and negative earnings are reported along with changes in firm size.

\(^{95}\) See Peter D. Easton and Jinhan Pae, “Accounting Conservatism and the Relation Between Returns and Accounting Data,” *Review of Accounting Studies*, 9 (2004): 495-521. They argue that accounting rules are inherently conservative and that value relevant items such as future payoffs from positive net present value projects are not recognized. This implies that the balance sheet understates book value due to both the current as well as past application of conservative accounting rules. They suggest including the change in operating assets and change in cash investments to compensate for accounting conservatism and find that these variables have explanatory power for annual returns.


\(^{97}\) See Baruch Lev and Theodore Sougiannis, “The capitalization, amortization, and value-relevance of R&D,” *Journal of Accounting and Economics*, 21 (1996): 107-138. They show that corrections to reported earnings and book values for research and development (“R&D”) capitalization were strongly associated with stock returns, and R&D capitalization therefore yields value-relevant information. They also show that R&D capital is not fully incorporated into the company’s stock price immediately, as it is associated with future stock returns. Lev and Sougiannis posit two possible explanations for this: (1) There is a systemic mispricing of R&D capital; (2) This represents the compensation for an extra-market risk premium for R&D.

\(^{98}\) Edward B. Grant, “Market Implications of Differential Amounts of Interim Information,” *Journal of Accounting Research*, 18, no. 1 (1980): 255-268 finds that these security price reactions were higher for over-the-counter (“OTC”) firms as compared to firms listed on New York Stock Exchange (“NYSE”). He interpreted this to be a result of OTC firms having systematically less interim information available than NYSE firms, and therefore the earnings announcements of OTC firms contained relatively more information than those of NYSE firms. Mark Lang, “Time-Varying Stock Price Response to Earnings Induced by Uncertainty About the Time-Series Process of Earnings,” *Journal of Accounting Research*, 29, no. 2 (1991): 229-257 finds that the less market participants know about the earnings process of a firm, the higher its ERC.
(internal versus external), managerial ownership, systematic risk, default risk and leverage, seasonality, and firm-specific standard deviation in analysts’ forecasts. Below we highlight additional findings that are of particular significance to securities fraud litigation.


100 Chul W. Park and Morton Pincus, “Internal versus External Equity Funding Sources and Earnings Response Coefficients,” *Review of Quantitative Finance and Accounting*, 16 (2001): 33-52, test whether the lower financing costs of firms relying relatively more on internal funding translate into higher ERCs due to their reduced cost of capital lowering the discount rates. They find empirical support for this hypothesis and also show that the effect is more extreme for high growth firms.

101 Terry D. Warfield, John J. Wild, Kenneth L. Wild, “Managerial ownership, accounting choices, and informativeness of earnings,” *Journal of Accounting and Economics*, 20 (1995): 61-91 found that the informative value of earnings announcements for stock returns is systemically related to managerial ownership, with the ERC increasing by more than 400 percent for corporations with higher managerial ownership.


103 Dan S. Dhaliwal and Stanley S. Reynolds, “The Effect of the Default Risk of Debt on the Earnings Response Coefficient,” *The Accounting Review*, 69, no. 2 (1994): 412-419 claim that default risk is an additional proxy for the discount rate, which is necessary because it is unlikely that the correct discount rate is fully captured by systematic risk. But see Bruce K. Billings, “Revisiting the Relation between the Default Risk of Debt and the Earnings Response Coefficient,” *The Accounting Review*, 74, no. 4 (1999): 509-522, who argues that part of the reason for the negative relationship between default risk and ERC in Dhaliwal and Reynolds (1994) is because their default risk proxies also reflect expected earnings growth. In Dan S. Dhaliwal, Kyung J. Lee and Neil L. Fargher, “The association between unexpected earnings and abnormal security returns in the presence of financial leverage,” *Contemporary Accounting Research*, 8, no. 1 (1991): 20-41, though, the authors measure the default risk of a firm as its leverage and find that all equity firms have higher ERCs than leveraged firms and that low-leverage firms have higher ERCs than high-leverage firms. But see Yeo Hwan Kim, Roger J. Willett, and Jee In Jang, “Default Risk as a Factor affecting the Earnings Response Coefficient,” QUT School of Accountancy Working Paper (January 30, 2002), SSRN-id300350, who argue this would suggest that issuance (redemption) of debt would decrease (increase) the ERC, but such a finding could not be confirmed empirically.

104 Gerald L. Salamon and Thomas L. Stober, “Cross-Quarter Differences in Stock Price Responses to Earnings Announcements: Fourth-Quarter and Seasonality Influences,” *Contemporary Accounting Research*, 11, no. 1-II (1994): 297-330 find that firms with seasonal sales have higher ERCs in peak sales quarters than in non-peak quarters. This is consistent with a greater resolution of uncertainty about seasonal firms’ prospects in their peak sales quarters than in other quarters.

105 See Eugene A. Imhoff and Gerald J. Lobo, “The Effect of Ex Ante Earnings Uncertainty on Earnings Response Coefficients,” *The Accounting Review*, 67, No. 2 (1992): 427-439, who argue that the greater the noise in a firm’s earnings number, the less responsive the stock price will be to an earnings surprise. Standard deviation of analyst forecasts is deflated by stock price two days prior to the earnings announcement. For an analysis of the impact of dispersion of analyst forecasts on returns, see Cheolbeom Park, “Stock Return Predictability and the Dispersion in Earnings Forecasts,” *Journal of Business*, 78, no. 6 (2005): 2351-2375. But see See James S. Linck, Thomas J. Lopez and Lynn Rees, “The valuation consequences of voluntary accounting changes,” *Review of Quantitative Financial Accounting*, 28 (2007): 327-352, who show that voluntary accounting changes which could enhance noise in earnings announcements have not been found to significantly increase a firm’s ERC.
Of special relevance when there is an auditor codefendant, the question of how the market response to an earnings surprise is related to the quality of the reported earnings numbers has been dealt with by a number of authors.\textsuperscript{106} Professors Teoh and Wong test whether auditor quality differs, in terms of generating more or less credible earnings reports for investors, by looking at the difference in ERC between companies with Big 8 and non-Big 8 auditors.\textsuperscript{107} They find that Big 8 (now Big 4) clients have statistically significantly larger ERCs than non-Big 8 clients. Professors Francis and Ke take a different approach to the same question, looking at market perception of auditor independence before and after the disclosure of auditor fees paid by firms was mandated in 2001 by the SEC.\textsuperscript{108} They find that ERCs were significantly lower after the mandated disclosure for firms paying high levels of nonaudit fees to their auditor. They interpret this to mean that the market’s perception of the independence of a company’s auditor affects its perception of the quality of that company’s earnings numbers.

In light of these findings it is not surprising that ERCs would decrease after restatements which could decrease the investors’ perception of the reliability of a company’s financial statements. It will often be observed in securities litigation that the first corrective disclosure of an accounting problem will have a larger impact than subsequent statements. The first mention of a need for a restatement may signal to the market more bad news is coming. Presumably, in those unusual instances where there is no further bad news, the stock price will have excess

\textsuperscript{106} See Robert W. Holthausen and Robert E. Verrecchia, “The Effect of Sequential Information Releases on the Variance of Price Changes in an Intertemporal Multi-Asset Market,” \textit{Journal of Accounting Research}, 26, no. 1 (1988): 82-106, for a theoretical model of how credibility, i.e., the quality of information affects security returns in reaction to the release of the information. See also Mark DeFond, Mingyi Hung, and Robert Trezevant, “Investor protection and the information content of annual earnings announcements: International evidence,” \textit{Journal of Accounting and Economics}, 43 (2007): 37-67 use a sample of earnings announcements in 26 countries to find support for their hypotheses that in countries with higher quality earnings and stronger enforcement of insider trading laws the market response to earnings announcements is greater, while more frequent interim financial reporting lessens the response. Additionally, they observe that, on average, earnings announcements are more informative and are incorporated into prices faster in countries with stronger investor protection institutions.


positive returns. Experts dealing with these situations will be confronted with time-varying ERCs that may have to be adjusted to be applicable to estimating the counterfactual, true value.

Academic research is broadly consistent with these observations. Professor Wilson, for example, studied the ERCs of the companies that restated over the period from January 1997 to June 2002.\textsuperscript{109} The ERC is smaller for the three quarters announced after the restatement compared to the quarter immediately before the restatement. She also finds that the nature of the restatement matters with respect to its impact on subsequent ERCs. Revenue recognition errors and restatement announcements that resulted in large stock price declines affect the number of subsequent ERCs that are smaller than the ERC in the quarter before the restatement. In an as of yet unpublished study, Professors Cheng, Crabtree and Smith test whether options backdating allegations decrease the ERC of a company.\textsuperscript{110} They find that ERCs are lower after options backdating allegations become public and interpret this finding as evidence that the market’s perception of a company’s financial information credibility is changed by options backdating.

Another event that gives rise to securities litigation is the issuance of a qualified audit opinion. Professors Choi and Jeter study the impact of qualified audit opinions on ERCs.\textsuperscript{111} Their results are that ERCs drop by 56 to 70 percent after a qualified opinion and the authors offer loss of credibility in financial statements as a possible explanation.

A number of studies have found that the timeliness of an earnings announcement is informative for reported earnings. As securities litigators well know, managements that miss their own expected earnings report dates have, on average, negative earnings surprises—and the later the announcement, the more negative the surprise.\textsuperscript{112} Professors Bagnoli, Kross, and Watts estimate that the average earnings surprise is more negative by approximately one cent for each day of delay.\textsuperscript{113} The study also finds that returns cumulated over the expected report date and the


\textsuperscript{112} Expected report dates can be obtained, e.g., from First Call Thompson Reuters.

next trading day are significantly negative and prices drop further if the report continues to be delayed. (The vast majority of analysts, however, do not revise their forecasts after the missed reporting date.) These findings have implications for ERC estimation if delayed announcements are included in the data; without adequate controls, an estimated ERC may be biased downwards as smaller price reactions to earnings surprises will be measured.  

A number of papers discuss the ERC of the first three quarters in comparison to the ERC of the fourth quarter. As mentioned above, these findings are of special importance to cases where there is an auditor co-defendant; the fourth quarter is different from the first three in a fiscal year because it contains audited financial statements. Accounting research has also found that the fourth quarter is more likely to contain write-offs than the first three and that management tends to delay the disclosure of bad non-earnings news until the fiscal year-end.  

Professors Cornell and Landsman find that the fourth quarter ERC is significantly larger than the ERC of the first three quarters. The authors attribute this to the fact that only the fourth quarter results are audited and might contain corrections of earnings previously reported in prior quarters.
Finally, there is a question of how market inefficiency affects the estimates of ERC. Professors Aboody, Hughes, and Liu provide evidence that standard value-relevance regressions, such as the market response to earnings announcements, are materially affected by market inefficiencies. Related to this research is an attempt to examine the influence of institutional investors on earnings management by looking at R&D spending for firms that could avoid missing earnings expectations for a quarter by cutting R&D. In general, high institutional ownership reduces the likelihood of this type of earnings management, implying that institutional investors serve a monitoring role in reducing these short-term earnings target pressures. The exception to this is the case in which the institutions have high portfolio turnover and engage in momentum trading. In extension of these findings, Professors Hotchkiss and Strickland observe that returns following negative earnings surprises decrease as the proportion of momentum ownership to total institutional ownership increases. Similarly, they also find that these returns decrease as the proportion of aggressive growth investors increases, and increases as the proportion of value investors increases.

2. Including macro variables

The analyst should also be aware that an ERC estimate under one set of macroeconomic conditions may not provide the best prediction of stock price reaction when those conditions are no longer present. Professors Conrad, Cornell and Landsman show that the price response to negative earnings surprises increases as the market level rises, supporting the hypothesis that the market responds most strongly to bad news in good times. In related research, Professor

Versus Fourth-Quarter Earnings,” *Journal of Accounting Research*, 26 suppl. (1988): 87-90, points out that under Mendenhall and Nichols’ (1988) argument they should also have tested a “good news management” hypothesis as it is to be expected that managements might also recognize positive news as early as possible which would result in a bigger fourth quarter ERC for good news. Stephen J. Dempsey, “Interim Earnings Management and the Fourth Quarter Good News Effect,” *Journal of Business Finance & Accounting*, 21, no. 6 (1994): 889-908, confirms this hypothesis.


Johnson finds that ERCs are larger in expansions than in recessions and larger in credit crunch periods than in reliquification periods.122

C. Extending the ERC equation with variables capturing revisions in expectations

There is enormous variation in the impact that earnings restatements will have on investor expectations. Some restatements are not material and others can cause a major stock price crash. One way to attempt to deal with whether the alleged financial fraud is negligible, very serious or somewhere in between is to return to first principles to derive an a stock price reaction relationship that is more accurate than Equation (4) in a wider variety of circumstances. As mentioned above, the most widely accepted stock valuation theory is that the company’s equilibrium stock price equals the present value of expected future cash flows accruing to the investor possessing the stock.123 It follows from this model that depending on how a specific earnings surprise affects the expectations of future income, the ERC will vary across announcements, firms, or other parameters.

Academics have addressed this issue in three different ways: Studies that include forecast revisions into the basic ERC equation, studies that attempt to use a measure for the permanency of earnings surprises, and studies which alter the functional form of the basic ERC equation.


123 See Williams (1938) and Miller and Modigliani (1961), along with the literature based on these seminal papers.
1. Including earnings forecast revisions

Using the discounted dividend model as a starting point, Easton and Zmijewski argue that the magnitude of price reactions in response to earnings announcements will depend on the revisions of both expected dividends as well as the expected rate of return at which expected dividends are discounted. They are among the first to show empirically that ERCs are positively correlated with higher revisions in expected earnings and negatively correlated with higher rates of return. Although their findings are of interest, the applicability of their methodology to shareholder class actions is likely to be too complicated given data availability.

Cornell and Landsman make the same point using a more practical methodology. They include the analyst forecast revisions for the next quarter and the next fiscal year into their ERC regression and find significant coefficients for all three variables. As mentioned above, they find that the fourth quarter plays a special role which they attribute to the fact that forth quarters are audited. This specification will not be an improvement on all samples constructed by experts because it can be the case that the analyst forecast revision variable is statistically insignificant.

In the same vein, Professors Liu and Thomas estimate an ERC model including several forward lags of analyst forecast revisions that have become available through I/B/E/S. They find that these additional terms have significant explanatory power and improve the fit of the overall regression significantly.

2. Including measures for permanency in earnings surprises

An interesting way of viewing the causal issue in the materiality and magnitude of a corrective disclosure is whether an earnings surprise is expected to be permanent. Only if an

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124 See also Dan Gode and James Ohlson, “Accounting-Based Valuation with Changing Interest Rates,” *Review of Accounting Studies*, 9 (2004): 419-41, who allow for stochastic interest rates and find that the ERC decreases as the beginning-of-period (lagged) rate increases.

125 They use a random coefficient regression model that jointly estimates several regression equations to show the correlations. The revision parameters are estimated in two different ways: The first one uses analyst forecast revisions in response to an earnings surprise, the second one uses the Foster model. The Foster model relates the increases in analyst expectations of a given quarter over the same quarter in the previous year to the increase in the subsequent quarter over the respective quarter of the previous year (Foster, 1977).

earnings surprise has a permanent component will it prompt the market to adjust expectations of future income and therefore have an impact on the stock price. The two major ways of capturing the permanency effect includes breaking a high growth trend (perhaps signalling a fundamental change in the firm) and breaking the earnings surprise into transitory and persistent earnings components.

a. Breaking a growth trend

It has been known for a long time that growth firms are more likely to have a shareholder class action filed against them than other firms. This is attributed, in part, to the volatility of their share price. Such a description is overly general, however, because volatility usually refers to a high value for beta. A more refined observation is that growth firms have high ERCs, at least for the first earnings surprise—an element of idiosyncratic risk rather than the systematic risk measured by beta.

A large number of studies have shown that stock returns and earnings growth are positively correlated with ERC. In particular, Professors Skinner and Sloan find that growth stocks exhibit an asymmetrically large ERC to negative earnings surprises which explains the return differential between growth and value stocks. These results are consistent with a well-

127 All academic papers have to make an assumption of how the earnings of a company affect the cash flows, i.e., the dividends, paid to its shareholders. Different processes have been discussed and used in the literature, see, e.g., Roger Kormendi and Robert Lipe, “Earnings Innovations, Earnings Persistence, and Stock Returns,” *Journal of Business*, 60, no. 3 (1987): 323-345, and Collins and Kothari (1989).


known finding that the present value of revisions in expected future earnings are correlated with stock returns.\textsuperscript{130}

\textbf{b. Transitory and permanent components of earnings}

Another relevant consideration in financial fraud litigation is which component(s) of earnings needed to be restated. With regard to their impacts on investor expectations of future cash flows, not all components are created equal. Professors Ramakrishnan and Thomas argue that unexpected earnings need to be disaggregated into three different components, permanent, transitory and price-irrelevant unexpected earnings, and an ERC needs to be estimated for each component of unexpected earnings.\textsuperscript{131} Other academics use a permanent versus transitory paradigm to classify earnings revisions.\textsuperscript{132}

It has also been argued that big earnings surprises are more likely to be due to transitory unexpected earnings implying that the ERC measured on a sample of big earnings surprises should be smaller than an ERC measured on a sample of small earnings surprises.\textsuperscript{133} The empirical support found for this argument—along with studies on measurement error, sample

\begin{itemize}
  \item See Robert N. Freeman, and Senyo Y. Tse, “A Nonlinear Model of Security Price Responses to Unexpected Earnings,” \textit{Journal of Accounting Research}, 30, no. 2 (1992): 185-209. The authors argue that because persistent earnings have a higher valuation impact than transitory earnings, investors are expected to place greater emphasis on forecasting the persistent earnings and are therefore expected to forecast persistent earnings with higher accuracy. This argument implies that big earnings surprises are more likely to be due to transitory earnings and because transitory earnings have a smaller valuation impact than persistent earnings this results in a smaller ERC coefficient for big earnings surprises (non-linearity of stock returns to earnings surprise relationship). They find that there is evidence of nonlinearity in their empirical results and that their non-linear model has higher explanatory power than the basic ERC equation. See also C. S. Agnes Cheng, William S. Hopwood and James C. McKeown, “Non-Linearity and Specification Problems in Unexpected Earnings Response Regression Model,” \textit{The Accounting Review}, 67, no. 3 (1992): 579-598. For a contradictory finding see Zhi-Xing Lin and Michael Shih, “Does the Stock Market See a Zero or Small Positive Earnings Surprise as a Red Flag?” NUS Business School, National University of Singapore Working Paper (August 2006).
\end{itemize}
selection and ERCs on losses—were among the reasons for a more recent focus of the literature on so-called “non-linear” ERC equations.  

D. Dealing with measurement error and data accuracy

Academics have studied how to improve the quality of the data used in ERC regressions and how to reduce measurement errors. Of particular interest is experimentation with the inherently unobservable market expectations of earnings.

1. How to deal with measurement error in the earnings surprise variable?

Among studies that have investigated whether changes in data used to create the earnings surprise variable could improve an ERC estimation are those that focus on whether Street or GAAP numbers are more relevant to the investors.  


137 Also, Lawrence D. Brown and Kumar Sivakumar, “Comparing the Value Relevance of Two Operating Income Measures,” Review of Accounting Studies, 8 (2003): 561-572, find that Street earnings contain more information than a measure of operating income created from GAAP statements.
Other studies have argued that this conclusion is driven by extreme tail observations for which Street numbers greatly exceed GAAP numbers and should be cautiously interpreted.138

These findings will only be of practical value if the analyst is using a data set where all observations are drawn from the same industry. Typically, the approach used by analysts to construct Street numbers will vary from industry to industry depending on what they view to be the most informative about underlying economic performance. Using Street numbers from different industries in the same sample would lead to apples versus oranges comparisons.

Academics have also attempted to improve the approximation of market expectations of earnings beyond analyst forecasts. One example is the so-called “whisper forecasts.”139 Professors Bagnoli, Beneish, and Watts describe whisper forecasts as unofficial forecasts of earnings reported in the press and investor’s web sites such as fool.com and techstocks.com.140 On a small sample of firms they find that whisper forecasts tend to be more accurate than First Call forecasts and a better approximation of market expectations of earnings contain additional information to analyst forecasts.141


Finally, several papers have suggested improving the estimation techniques to avoid biases from a possible measurement error in the earnings surprise variable.\textsuperscript{142} Care should be taken in using these techniques, however, to confirm that the results are robust.

2. \textbf{Pooled versus firm-specific estimation}

One question that the expert will need to address is whether ERC estimates are accurate when measured across different companies. Professors Teets and Wasley find that short-window ERCs estimated from pooled time-series cross-sectional regressions are systematically smaller than corresponding averages of firm-specific coefficients estimated from time-series regressions.\textsuperscript{143} The reason is that firms with higher earnings stability tend to have higher ERCs, but have less of an effect on the coefficient estimate when pooled with firms that have higher volatility in returns. This explanation does not preclude using peers in the sample, however, because peers are likely to have similar volatility characteristics to the subject firm. The authors suggest using firm-specific estimation instead of pooled estimation when a negative relation between firm-specific ERCs and unexpected earnings variances might exist.


V. THE ACADEMIC LITERATURE ON MARKET EXPECTATIONS AND ANALYST FORECAST REVISIONS (ARC)

The literature on analysts’ forecasts revisions is significant, though less voluminous than the ERC literature. One issue that is the same for both ERC and ARC estimation is how to construct the earnings surprise variable, and will not be repeated in this section.

A. Estimating the basic ARC equation

The dependent variable, the analyst forecast revisions, are calculated as the difference between the analyst forecast of earnings for a specific period immediately prior to an earnings announcement and the analyst forecast of earnings for the same period immediately after the earnings announcement. As it takes the analysts a few days to update their forecasts after an earnings announcement, academics usually use the forecasts a week after the announcement. This delay used to be much bigger as forecasts were only available monthly. Again, researchers will normalize both variables with the stock price prior to the earnings announcement (see Section IV for a discussion).

The original estimation dates back to 1979 with the work of Professors Brown and Rozeff. More recently, Professors Jin, Lee, and Huh estimate the ARCs of quarterly earnings surprises on the one- and two-quarter ahead earnings forecasts.

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144 Zhang (2008) examines the factors which influence how quickly analysts update their forecasts following earnings announcements. (Yuan Zhang, “Analyst responsiveness and the post-earnings-announcement drift”, Journal of Accounting and Economics, 46 (2008) 201-215.) She analyzed a sample of earnings announcements from 1996-2002 and found that between 26-53 percent of analysts revised their forecast either the day of the announcement or the following day. She finds that analysts are more likely to update their forecasts following earnings announcements when firms are larger, conference calls or managerial guidance is available to analysts, announcements are for fourth fiscal quarters, more resources and support are available (in the form of larger brokerage houses), and a high level of competition exists between the analysts. Additionally she finds that analysts are more likely to update their forecasts quickly for high technology or growth industries.


The behavioral foundation of the basic ARC equation for their model is a form of learning called adaptive expectations. They use the estimated ARCs to measure the predictive value of quarterly earnings announcements on annual earnings forecasts. First, consistent with prior research, they find that as additional quarterly announcements are made available the error of analysts’ annual earnings forecasts decreases. Additionally they hypothesize that the revision coefficients should be positively related to the quality of information contained in the earnings announcements, leading to larger revision coefficients. They show empirically that larger revision coefficients are indeed positively related to the accuracy of annual earnings forecasts.

B. Including additional variables in the basic ARC equation

Academic research has tested adding a number of other variables to earnings surprise in efforts to improve the accuracy of the basic ARC equation. These have included the following: dividend information,\(^{147}\) revenue surprises,\(^{148}\) whether revenues and costs move in the same direction (“in-sync” versus “out-of-sync”),\(^{149}\) research and development expenses,\(^{150}\) restructuring charges,\(^{151}\) and whether firms meet market earnings expectations.\(^{152}\)

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148 See Narasimhan Jegadeesh and Joshua Livnat, “Revenue surprises and stock returns,” *Journal of Accounting and Economics*, 41 (2006): 147-171, who find earnings surprises have a more significant impact on forecast revisions than revenue surprises; however, all the ARCs on revenue surprises are significant and positive. Moreover, analysts seem to expect revenue and earnings surprises to have amore persistent effect for value firms than for growth firms.


150 See Li-Chin Jennifer Ho, Chao-Shin Liu, and Thomas F. Schaefer, “Analysts’ forecast revisions and firms’ research and development expenses,” *Review of Quantitative Finance and Accounting*, 28, no. 3 (April 2007): 307-326, who find a positive and significant association between the level of research and development expenses and the magnitude of analysts’ forecast revisions following quarterly announcements.


Often, securities litigation will be triggered by stock price drops on pre-announcement surprises. Professor Miller analyzes the combined effect of preannouncement surprises and subsequent earnings announcement surprises on analysts forecast revisions. He finds that when both surprises were of the same sign (either positive or negative) analysts made larger revisions to their one-year ahead earnings forecasts than when both surprises were of opposite signs.

One question that might arise in sample construction is whether to use the data from defendant firms’ earnings announcements during the class period. On point is a study by Professors Ettredge, Shane and Smith. They match a sample of firms that announced after an earnings announcement, that they had overstated the earnings, with a control sample of firms. They estimate separate ARCs for each both samples. Their results show that analysts draw different conclusions from the sample that had reported earnings containing (unknown) overstatement errors than from the sample that had accurately reported earnings. This may imply that analysts identify some of the overstatement, at least on average. It might be worthwhile for experts to check whether there is a different estimated ARC for the defendant firm during the class period than for either the defendant firm before the class period or for peers.

C. ARCs in response to events other than earnings surprises

Often, the allegations of financial fraud will relate to misstatements other than quarterly earnings announcements. Academics have also estimated ARC in response to variables other than such earnings surprises. We discuss two examples in this section, noting the list is not complete.

Professors Baginski and Hassell calculate an ARC for a measure of management earnings forecast news issued prior to analyst revisions and for a measure derived from the security market price reaction to that news. Results indicate that security price reactions to management forecasts are useful in predicting subsequent analyst forecast revisions.

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Professors Lacina and Karim examine financial analysts’ reactions to management earnings forecasts. The findings show that analysts react less to management forecasts of improved earnings expectations than to management forecasts of bad earnings. But, consistent with the fraud on the market theory, results show that the stock market and analysts are unable to distinguish management forecasts of improved earnings expectations that come true from management forecasts of improved earning expectations that do not come true.

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