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# A Fundamental Problem with Single Measure Event Studies and the Case of Qualified Audit Reports

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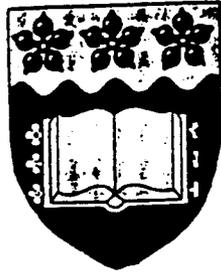
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A FUNDAMENTAL PROBLEM WITH SINGLE  
MEASURE EVENT STUDIES AND THE CASE  
OF QUALIFIED AUDIT REPORTS

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# A FUNDAMENTAL PROBLEM WITH SINGLE MEASURE EVENT STUDIES AND THE CASE OF QUALIFIED AUDIT REPORTS

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## *Abstract:*

*This study draws on the case of event studies of qualified audit reports to illustrate that despite numerous improvements in research design, findings do not converge over time. The conflicting evidence is attributed to the nature of the market for a company's shares, and the fact that past studies rely only on one measure of information content, namely, price change or volume change measures. After construction of a simple micromarket structure of a company's shares by drawing on traditional microeconomics, qualitative comparative statics are used to identify the circumstances in which either the volume or the price change caused by a revision of investor expectations, is relatively reduced. Insights are also provided into the question of post-event volume of trading.*

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## **Introduction**

An event study is a study which attempts to determine the impact of a particular event on financial markets. Such studies compare the observed level of a market activity variable surrounding an event with a counterfactual level. This counterfactual level represents the activity level had the event not taken place. If there is a discrepancy between the two levels, the event is concluded to have affected the market, or the opposite if no discrepancy exists.

In the accounting literature, event studies have been widely used to determine the effects of accounting information on financial markets. Accounting information studied include reported earnings (see Lev [1989] for a recent review), qualified audit reports (Craswell [1985] contains a recent discussion) and accounting method changes (Watts and Zimmerman [1986] contains an extensive review). According to Foster (1986) the "seminal" [p. 389] accounting event study that used share price movements to measure stock market reactions is Ball and Brown [1968], whilst "Beaver (1968) seems to have been the first to suggest using volume reaction to test investors' reactions to the release of information" [Verrechia, 1981, p. 271].

The objective of accounting event studies is to attempt to determine whether a particular item of published information is "useful" [Lev, 1989, p. 153]. The definition used to operationalise this construct is whether the item in question has 'information content'. Beaver (1968) originally suggested that an event has information content "if it leads to a change in investors assessments of the probability distributions of future returns (or prices)...[and]...a change in the decision-makers behaviour" [Beaver, 1968, p. 69]. The seminal studies and those which followed differ fundamentally in their measurement of information content. Whilst Ball and Brown (1968) advocated its measurement through observing "the behaviour of security prices" [p. 160], Beaver [1968] used "the shift in portfolio position reflected in volume" [p. 69]. This study aims to determine the impact

on the results of event studies which use either one or the other measure of information content.

Many reviews of the event studies which followed the seminal studies criticized their research design and methodology, especially whether price or volume movements adequately measure information content, and whether 'information content', the operational definition of usefulness, is adequate. Such reviews include Ball and Foster (1982), Lev and Ohlson (1982) and Lev (1989). It is the aim of this study to contribute to such literature. The conclusions are relevant to the adequacy of both the operational definitions and measures used in event studies.

By providing some theoretical understanding of the nature of the volume measure, this study also addresses criticisms such as Watts and Zimmermans' [1986, p. 64] regarding Beaver's measure of information content:

The problem is the lack of economic theory of volume...consequently, as Beaver recognizes, his volume measure of information is ad hoc

Specifically, this study sets out to determine the circumstances under which an event, despite containing information, may not result in any significant change in the price or volume of shares traded. Thus, the study also contributes towards filling the following gap in event study theory identified by Verrechia [1981, p. 283]:

There are, however, several issues that still need to be pursued. One in particular is whether the degree of volume reaction, looked at in conjunction with the degree of price change, implies anything about the extent to which investors revise their expectations, given new information

In addition, the insights developed are consistent with the empirical observation of persistent abnormal trading volume after the information event has taken place; current theory on trading volume cannot adequately resolve this [Karpoff, 1986, p. 1082]

## The Case of Qualified Audit Reports

The case of qualified audit report event studies indicates that despite continual improvements in research design over time, research design problems, identified and improved upon in subsequent studies, have done little to help resolve the conflicting nature of their results.

TABLE 1 : SURVEY OF EVENT STUDIES OF QUALIFIED AUDIT REPORTS				
AUTHOR(S)	YEAR	COUNTRY	MEASUREMENT	FIND.
Baskin	1972	USA	Price	nonsignif.
Scott	1974	USA	Price	signif
Alderman	1977	USA	Price*	nonsignif
Firth	1978	UK	Price	signif
Alderman	1979	USA	Price*	signif
Ball, Walker & Whittred	1979	Aust.	Price	nonsignif
Banks	1979	USA	Price	nonsignif
Shank, Murdock, & Dillard	1981	USA	Price	signif
Bahjatt	1982	USA	Price	signif
Banks & Kinney	1982	USA	Price	nonsignif
Chow & Rice	1982	USA	Price	signif
Davis	1982	USA	Price	nonsignif
Elliot	1982	USA	Price	nonsignif
Keller & Davidson	1983	USA	Volume	signif
Dodd, Dopuch Holthausen & Leftwich	1984	USA	Price	nonsignif
Shevlin & Whittred	1984	Aust	Price	signif
* Actually used a risk measure B calculated from share price data				

Watts and Zimmerman [1986, p 109] proposed that:

Problems discovered in one study are addressed by a later study. The literature gradually iterates toward more powerful tests, tests that can better discriminate.

However, the findings of event studies of qualified audit reports (which are chronologically surveyed in Table 1 overpage) are inconsistent with this proposition. The sporadic nature of non-significant and significant findings which do not converge over time are not consistent with Watts and Zimmerman's assertion directed at research design issues. This may result from a more fundamental problem in the event study research design and methodology which, as yet, has not been identified.

The results of this study provide an explanation for the anomolous evidence. It will be demonstrated that whether a price movement or volume reaction actually results from an information release is not only dependant on the effects due to changes in investor expectations (that is, whether the item has information content), but also on the relationship between changes in the supply and demand prices and volumes of shares<sup>1</sup>. The results suggest that there are various demand/supply gradient combinations which can act to reduce the observed price or volume movements which can ultimately become insignificant with stockmarket volatility or 'noise'.

In order to demonstrate the circumstances under which an event may occur and cause stock market participants to react with a relatively small observed effect on equilibrium prices or volumes of shares traded, it becomes necessary to construct a model of the market for a company's shares. This model will then become the foundation on which to base a framework for analysis of the effects of an event.

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<sup>1</sup>. Note that this is not referring to the elasticities of supply and demand, but the gradient or slope of a linear relationship

## **A Model of the Micromarket Structure of a Company's Shares**

Event studies rely on detecting movements in the prices and volumes of shares traded which result from a revision of investors' expectations of the value of shares. Since investors include suppliers of shares or shareholders and demanders of shares or potential investors, and their supply and demand decisions affect the equilibrium price and volume of shares traded, a model of the market for a company's shares can be constructed by reverting to the microeconomic supply and demand model of markets. The model's origins can be traced back to the works of the classical Cambridge economist Alfred Marshall (1920).

The model conceptualises a market for a particular item as being composed of the supply and demand for that item, which in turn determine the item's equilibrium price and volume of trade. In the context of a stock market, supply and demand prices are known as ask and bid prices respectively. Thus, for contextual reasons it is appropriate to refer to ask and bid curves, which are analogous to supply and demand curves. Although traditional microeconomic theory hypothesises that 'normal' supply and demand curves are upward and downward sloping respectively, empirically little is known to date about the general nature of the supply and demand curves for a company's shares. This is due to the lack of direct data and the problem of identifiability<sup>2</sup>, although some evidence exists indicating demand curves are normal [Shleifer, 1986]. In addition supportive Australian evidence also exists in the form of empirical evidence indicating that seller and buyer initiated block trades result in decreases or increases in company share prices respectively [Ball and Finn, 1989]. However this evidence is also limited by the identifiability problem. For the purposes of analysis and consistent with the limited available evidence, it will be assumed that both ask (supply) and bid (Demand) curves are linear and normal. Linearity of ask and

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<sup>2</sup> The classic exposition of this problem is Working [1927]

bid curves can also be upheld on 'linear approximation' [Archibald et.al., 1967, p. 64] grounds. For an ask curve this assumption implies that there is a positive linear relationship, say  $a$ , between the ask price ( $P$ ) and the volume of shares willing to be supplied at that price ( $Q$ ), per time period (event observation period) thus:

$$P = p_a + aQ \quad (1)$$

where  $p_a$  is the minimum ask price. For a bid curve these assumptions imply a negative linear association, say  $b$ , between the volume of shares demanded ( $Q$ ) for each bid price ( $P$ ) per event observation period as follows:

$$P = p_b - bQ \quad (2)$$

where  $p_b$  is the maximum bid price. The model posits that in equilibrium the 'market price' adjusts until the volume of shares supplied and demanded are equivalent. Thus in equilibrium the ask price is equivalent to the bid price for shares, and the equilibrium volume of trade can be found by equating (1) and (2) and solving for  $Q$  yielding:

$$Q^* = \frac{p_b - p_a}{a + b} \quad (3)$$

where  $Q^*$  is the equilibrium volume of shares traded. Foster [1986, p. 378] puts forward two reasons relevant to explaining why such trade takes place in equilibrium:

- (1) Investors purchasing/selling to co-ordinate their income-earning and income-spending activities
- (2) Investors purchasing/selling to maintain a diversified portfolio.

The equilibrium price for shares can be obtained by substituting  $Q^*$  from (3) into either (1) or (2):

$$P^* = p_a + a \left( \frac{p_b - p_a}{a + b} \right) \quad (4)$$

$P^*$  represents the equilibrium share price or market price at which the 'normal' or equilibrium level of trading volume ( $Q^*$ ) takes place.

Thus, equations (3) and (4) represent the general solutions to the model of the market for a company's shares. They will be used in the next section to construct a framework for analysing the impact on equilibrium share prices and volume of shares traded, of an event which causes askers (suppliers) and bidders (demanders) of shares, to reassess the value of their shares and as a result alter their ask and bid conditions.

### **A Framework for Analysing the Effects of An Event On a Company's Share Price and Volume of Shares Traded**

If an event occurs which causes all stock market participants to change their expectations, this will be reflected in a shift of the ask curve (a change in  $p_a$ ), and /or a shift in the bid curve (a change in  $p_b$ ). The assumptions underlying the following derivations is that only the intercepts ( $p_a$  and  $p_b$ ) change. This does not imply that the gradients ( $a$  and  $b$ ) may not also change but, for initial analysis, intercept change will be focused on determining the effect it has on changes in the market price and volume of trading. This type of analysis for intercept changes could also be adopted to examine the impact of changing gradients.

The partial derivative of  $Q^*$  with respect to  $p_a$  can be used to assess the impact on the equilibrium volume of shares traded of an event which shifts the ask curve, that is:

$$\frac{dQ^*}{dp_a} = -\frac{1}{a+b} \quad (5)$$

Since  $a$  and  $b$  represent the slopes of the ask and bid curves respectively, by increasing or decreasing their values and observing the effect on  $Q^*$  through (5), it is possible to determine whether curves with higher gradients or lower gradients will cause a shift to have a higher or lower observed effect on the equilibrium volume of trade.

Additionally, if (5) is multiplied by the absolute change in the minimum ask price ( $dp_a$ ), the new equation yields the absolute change in the equilibrium volume of shares traded:

$$dQ^*_a = \frac{-dp_a}{a+b} \quad (6)$$

Similarly the absolute shift in the equilibrium volume of shares traded due to a shift in the bid curve ( $dQ^*_b$ ) can be derived as:

$$dQ^*_b = \frac{dp_b}{a+b} \quad (7)$$

Since the model is composed of a system of linear equations, a compound volume of trade differential equation<sup>3</sup> representing the net effect on the equilibrium volume of shares traded due to shifts both in ask and bid curves ( $dQ^*_t$ ), can be derived by adding (6) and (7) :

$$dQ^*_t = \frac{dp_b - dp_a}{a+b} \quad (8)$$

Very similar derivations can be carried out using (4) to derive a compound price differential equation analogous to (8). The compound price differential equation, representing the absolute net change in the share price due to a change in the ask and bid curves which stem from an event causing market participants to change their expectations regarding the value of shares, is:

$$dP^*_t = dp_a + \frac{a}{a+b} (dp_b - dp_a) \quad (9)$$

Equation (9) is remarkably similar in structure and describes the same dependant variable as the capital assets pricing model (which underlies event studies using price

<sup>3</sup> Generally referred to as 'the total differential of a function' [Archibald et al, 1967, p.205], which in the current analysis can alternately be derived as:

$$dQ^*_t = \frac{\delta Q}{\delta a} da + \frac{\delta Q}{\delta b} db + \frac{\delta Q}{\delta p_a} dp_a + \frac{\delta Q}{\delta p_b} dp_b$$

however, one of the assumption of analysis is that the gradients do not change, and thus the first two terms of the above equation are equal to zero and thus the above reduces to equation (8).

measures) originally developed by Sharpe (1964) and Lintner (1965). The equation provides an alternative interpretation of the results of the CAPM in terms of market forces, specifically the relative movements in, and the relationship between changes in bid and ask volumes and changes in bid and ask prices.

The aim of the following analysis is to demonstrate that it is possible, even though investors may in fact change their expectations because of information contained within an event, and subsequently alter their ask and bid conditions (implying the event has information content), for the effect on prices of shares and the volume of shares traded to be small or reduced because of the relative gradients of the ask and bid curves. This may lead a researcher to invalidly to conclude the event has no information content. Equations (8) and (9) represent the framework used for the subsequent analysis identifying these gradients.

### Results of Analysis

It is readily apparent from (8) and (9) that if  $dp_a$  is equal to  $dp_b$  (the shift in the ask schedule due to an event is identical to the shift in the bid schedule), then there will be no change in the equilibrium level of trading volume, and the impact on price will be equivalent to the shift in the ask schedule  $dp_a$ . However, such movements would be improbable coincidences. Even if movements are in consistent directions (that is, all investors interpret the information as either 'good' or 'bad' news and revise their expectations up or down respectively), it is improbable the two movements will be of identical magnitude as individual differences amongst investors will operate to preclude such a reaction. As explained by Verrechia [1981, p. 274]:

expectations and risk tolerances do not necessarily interact in a fashion such that when all investors shift their expectation in a homogeneous fashion, prices shift to offset relative changes in demand

Given that the relative shifts in ask and bid curves are not identical in nature, the study of comparative statics necessarily identified not only the nature of gradients of ask and bid curves resulting in a lower observed price or volume effect, but also the nature of their relative shifts producing these effects.

TABLE 2

Comparative Statics of the Compound Price Differential Equation : Sensitivity Analysis of Price Changes to Different Gradients of Ask and Bid Curves

Magnitude of gradient of ask or bid Curves	Magnitude of Change in Price if		
	$ dp_b  >  dp_a $	$ dp_b  =  dp_a $	$ dp_b  <  dp_a $
Higher <i>a</i>	higher	lower	lower
Higher <i>b</i>	lower	lower	higher
Lower <i>a</i>	lower	lower	higher
Lower <i>b</i>	higher	lower	lower

TABLE 3

Comparative Statics of Compound Price Differential Equation : Sensitivity analysis of Change in Volume to Different Gradients of Ask and Bid Curves

Magnitude of gradient of ask or bid Curves	Magnitude of Change in Volume of Trade
Higher <i>a</i>	lower
Higher <i>b</i>	lower
Lower <i>a</i>	higher
Lower <i>b</i>	higher

The results, the qualitative comparative statics are presented in tables 2 and 3 above. The analysis and tables only present the results of the study of circumstances in which ask and bid curve shifts are in consistent directions. This implies that all investors interpret a given event as 'good' news thus decreasing ask and increasing bid prices, or the opposite for 'bad' news but that there is never a non-consensus regarding the nature of the news contained within the event.

Table 2 presents the relative changes in the market prices of shares, and Table 3 presents the relative changes in the equilibrium volume of shares traded, due to shifts in ask and bid curves under differing magnitudes of the gradients of these curves.

### **Implications of Analysis and Results**

Prior to discussing the implications of findings a caveat is in order. The preceding analysis and the conclusions drawn there from are subject to the validity of the model, analytical framework and analytical assumptions used, most of which have been explicitly stated throughout the study. In addition, the hypothetical scenarios depicted in the results, on which the conclusions are based, are subject to their empirical existence.

The results indicate that it is possible under certain ask/bid scenarios and changes, for either the observed movement in the equilibrium prices of shares or volume of shares traded to be relatively lower. Tables 4 and 5 clearly identify these scenarios. For example, if the ask curve has a higher gradient and the bid curve has a lower gradient and the shifts in the curves are as in Table 4, then, as illustrated in scenario 3 in Table 4, the probability of finding that the event has significant information content is reduced if the price measure of information content is used. This result arises because the relative movement in the market price is reduced by the nature of bid and ask curves.

Simultaneously, the probability of a volume measure change is increased through the

gradient possessed by the ask curve, however, the nature of the bid curve would act to reduce this.

TABLE 4

Relative Price and Volume Changes Under Different Ask/Bid Gradient States if  $|dp_b| < |dp_a|$

State of Nature	Effect on Price Change due to gradient of		Effect on Volume Change due to gradient of		Measure with Highest Probability of Significant Change
	Ask Curve	Bid Curve	Ask Curve	Bid Curve	
(I) higher <i>a</i>	higher <i>b</i>	lower	higher	lower	Price
(II) higher <i>a</i>	lower <i>b</i>	lower	lower	higher	Volume
(III) lower <i>a</i>	higher <i>b</i>	higher	higher	lower	Price
(IV) lower <i>a</i>	lower <i>b</i>	higher	lower	higher	Volume

TABLE 5

Relative Price and Volume Changes Under Different Ask/Bid Gradient States if  $|dp_b| > |dp_a|$

State of Nature	Effect on Price Change due to gradient of		Effect on Volume Change due to gradient of		Measure with Highest Probability of Significant Change
	Ask Curve	Bid Curve	Ask Curve	Bid Curve	
(V) higher <i>a</i>	higher <i>b</i>	higher	lower	lower	Price
(VI) higher <i>a</i>	lower <i>b</i>	higher	higher	lower	Price
(VII) lower <i>a</i>	higher <i>b</i>	lower	lower	higher	Volume
(VIII) lower <i>a</i>	lower <i>b</i>	lower	higher	higher	Volume

It should also be noted that the preceding analysis suggests that any change in trading volume is persistent or permanent even after the event date, because the market settles to a new equilibrium position. This is consistent with the previously identified empirical experience which to date theory has been unable to adequately explain.

The research design implications of these findings are that an information content measure based *either* on price *or* volume of shares traded is invalid as the reaction of the stock market to the event may be less concentrated in the measure used and possibly more concentrated in the alternative measure (as illustrated in Tables 4 and 5). Thus there is a lower probability of validly determining whether an event has significant information content if a single measure of information content is used. To increase the probability of validly determining the information content of an event a dual measure could be used in which information content is found for each company in a sample if there is a significant price movement and/or volume change, alternately a new methodology which directly tests for abnormal shifts in ask and bid curves would greatly increase this probability<sup>4</sup>.

This limitation of single measure event study research designs may explain the conflicting nature of evidence concerning the information content of certain events such as the release of qualified audit reports, since all previous studies only considered one measure in detecting information content. This may have resulted in the differing nature of ask and bid conditions of shares of companies sampled, reducing the effect on the measure studied and ultimately concealing it in stock market volatility or noise and resulting in conflicting nonsignificant findings. Analysis of the alternative measure, in addition to the one monitored in each study, would have increased the probability of validly detecting whether qualified audit reports contain information.

Implications for the validity of using 'information content' as an operational definition for 'usefulness' also stem from the findings. It is near impossible to determine the degree of

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<sup>4</sup> The author is currently working on such a methodology. The additional strength of such a methodology is that it could greatly eliminate or incorporate the gradient effect in determining whether an event has information content, whereas a dual measure would not overcome this problem but merely reduce the probability of bias from it.

usefulness of different information events, or more generally the degree of impact of an event on the stock market using the information content operational definition. This implies the fallacy of statements such as :

If a revision in stock prices provides evidence on earnings usefulness, then obviously larger revisions imply greater usefulness [Lev, 1989, p. 156]

Since the degree of response of variables is also a function of the nature of ask and bid conditions, the observed movement in the measures used do not unambiguously indicate the degree of response to particular events. Thus, comparisons of the relative information content of events on different samples (which may contain different ask/bid conditions and investors with heterogeneous interpretations of events) using either one or other measure are invalid. Additionally, even if the nature of ask/bid conditions across companies sampled were known, and a dual measure were used, comparisons of the relative information content and usefulness of events also face the problem of requiring price/volume tradeoffs.

### **Conclusion**

In summary, the basic implications of the analysis is simply that to consider the degree of reaction to an event of either volume changes alone or price movements alone, will decrease the probability of validly determining the impact of that event on the stockmarket. In addition, the degree of the impact on these measures is not solely a function of the changes provoked by the occurrence of the event, but is also related to the nature of the stockmarket.

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