2005

The smoothing of reported corporate earnings streams through target setting: do managers mislead stakeholders?

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Abstract

The financial demise of several high-profile firms in the UK, US and Australia started with the fairly innocuous practice of smoothing reported earnings and profits to fulfill projected earnings targets. The practice is a widely accepted form of corporate earnings management. Corporate financial performance targets for the next period are pre-set and then the actual earnings stream, if significantly different from the target, is manipulated through accrual accounting choice flexibility to conform to the pre-set earnings target. This study examines whether this form of earnings management does actually reduce the volatility of reported income streams over varying time horizons. Previous work has established that the systematic time-averaging of costs and revenues across periods can effectively smooth unadjusted incomes. Indeed, the practice is a required element of accrual accounting. But the potential for significant earnings stream smoothing through more opportunistic methods such as periodic target setting has not been investigated. Our approach uses an interesting alternative view of accounting numbers that treats each period's reported earnings as sample measurement drawn from the underlying, continuous flow of the firm's activities rather than as a direct measurement of economic earnings for that period. This statistical estimation perspective of accounting measurement treats each period's earnings measurement as a sample estimate of the firm's longer run earning potential. The approach now views earnings volatility as a potential measure of the estimation efficiency of reported earnings. Less volatility means greater estimation efficiency. Our results show that reductions in earnings volatility achieved through adjusting the underlying earnings figures to match target figures before reporting may be more apparent than real. The practice often merely shifts accumulating earnings volatilities into later periods. When finally reported, these accumulated adjustments between actual and target earnings can create explosive volatility. Thus, self-interest motivated managers may q.chieve 'apparent' short-term earnings smoothing that deceive shareholders and those interested in the longer term implications of periodic financial reports.

Disciplines

Business | Social and Behavioral Sciences

Publication Details

McCrae, M. & Hillier, J. (2005). The smoothing of reported corporate earnings streams through target setting: do managers mislead stakeholders?. Seventeenth Asian-Pacific Conference on International Accounting Issues Program & Proceedings CD-ROM: Victoria University of Wellington & California State University.

The Smoothing of Reported Corporate Earnings Streams through Target Setting: Do Managers mislead Stakeholders?

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Abstract

The financial demise of several high-profile firms in the UK, US and Australia started with the fairly innocuous practice of smoothing reported earnings and profits to fulfill projected earnings targets. The practice is a widely accepted form of corporate earnings management. Corporate financial performance targets for the next period are pre-set and then the actual earnings stream, if significantly different from the target, is manipulated through accrual accounting choice flexibility to conform to the pre-set earnings target. This study examines whether this form of earnings management does actually reduce the volatility of reported income streams over varying time horizons. Previous work has established that the systematic time-averaging of costs and revenues across periods can effectively smooth unadjusted incomes. Indeed, the practice is a required element of accrual accounting. But the potential for significant earnings stream smoothing through more opportunistic methods such as periodic target setting has not been investigated. Our approach uses an interesting alternative view of accounting numbers that treats each period's reported earnings as sample measurement drawn from the underlying, continuous flow of the firm's activities rather than as a direct measurement of economic earnings for that period. This statistical estimation perspective of accounting measurement treats each period's earnings measurement as a sample estimate of the firm's longer run earning potential. The approach now views earnings volatility as a potential measure of the estimation efficiency of reported earnings. Less volatility means greater estimation efficiency. Our results show that reductions in earnings volatility achieved through adjusting the underlying earnings figures to match target figures before reporting may be more apparent than real. The practice often merely shifts accumulating earnings volatilities into later periods. When finally reported, these accumulated adjustments between actual and target earnings can create explosive volatility. Thus, self-interest motivated managers may achieve 'apparent' short-term

earnings smoothing that deceive shareholders and those interested in the longer term implications of periodic financial reports.

1. Introduction

The smoothing of reported corporate earnings by managers is a persistent and pervasive practice of corporate performance reporting, along with other types of earnings "management" including pro forma reporting, earnings inflation, large write offs and 'abnormal items' manipulation (Ronan, 2002; Newman, 1998).

Income smoothing may be achieved by either real or artificial means. The latter in clued the artificial volatility reduction of reported income streams through the exercise of discretionary accounting choices by managers under current accrual accounting rules (Bitner and Dolan, 1998).

Despite a well-publicized criticism of earnings management practices by former SEC Chairman A. Levitt, (1998) some practices are considered acceptable, even required of managers. Under accrual accounting principles, required income smoothing practices include systematic time-averaging-of-cost procedures such as depreciation, bad debts provisions and amortization of goodwill and set-up costs. Poitras (2002) emphasizes that corporate wisdom promotes the planned timing of investment, sales, expenditure and financing decisions as necessary strategies for maximization of shareholder value, along with the strategic exercise of accrual accounting decisions to further promote reductions in income stream volatility (Poitras, 2002; Yeo, 2002; Magrath and Weld, 2002).

Many less systematic methods of smoothing earnings numbers may be less acceptable to corporate regulators, the accounting profession and auditors (Levitt, 1998). The deceptive reporting practices in recent, high profile corporate collapses often began merely as accepted corporate practices of 'smoothing' reported earnings rather than intentional deception of stakeholders (Beatty, 2002; Magrath, 2002). Magrath et al (2002) emphasizes the staggering corporate share value losses attributable to abusive earnings management practices and fraudulent accounting schemes such as with Enron, Lucent Technologies, Cendant and Microstrategy. In all four cases, abusive earnings

management practices began as incomesmoothing schemes designed to meet pre-set earnings targets and expectations (Magrath, 2002). Such downward spirals are common (Beatty, 2002). Self interest, economic and industry cycles, poor management and accumulating gaps between reported and actual earnings may pressure management into deceptive earnings management practices to meet expected earnings targets (Dutta, 2002; Jaggi, 2002).

The reaction of the SEC and FASB is to emphasise the need for greater vigilance against the accounting standards manipulation as the most effective tool against future abusive earnings management and fraudulent accounting practices (Jenkins, 2002; SEC, 2003; Magrath and Weld, 2002). But a difficulty is the separation of earnings management practices that fall within accepted corporate practice from those contrary to the intention of accounting and corporate reporting regulation.

Not all earnings management practices are necessarily fraudulent. Discretionary choice under accrual accounting principles creates a spectrum of alternative corporate accounting strategies – from conservative accounting through positive and 'creative' accounting, onto misleading accounting, deliberately deceptive accounting and finally fraudulent accounting practices. Conservative strategies include systematic 'time averaging' forms of cost and revenue allocation. The opportunistic type of discretionary adjustments to periodic reported earnings may be less acceptable. Even discretionary adjustment of corporate periodic earnings to meet pre-set earnings targets through accrual (or other) choices, may, over time, lead to deceptive corporate reporting.

The separation issue highlights the contrast between the direct representation approach to accounting measurement versus the statistical estimation approach. These approaches adopt fundamentally different assumptions about accounting measurement including accounting constructs, measurement processes and the accounting measurement algebra. The 'direct representation' approach emphasizes accounting earnings metrics as direct representations of objective performance constructs. Earnings management

practices are unacceptable because they all bias reported accounting income or earnings away from a 'true and fair view' of corporate performance.

The statistical estimation approach treats reported accounting numbers as highly aggregated, artificial accounting constructs that indirectly reflect corporate economic performance through derived measurements that constitute indirect, periodic samplings of the underlying transaction processes. Income smoothing acceptability relates to whether or not they produce more efficient (less volatile) sample estimates of long run earnings, income or profit. Estimation efficiency refers to the degree of volatility of successive sample estimates (reported periodic earnings) around the long-run expected parameter value.

We investigate opportunistic or ad hoc income smoothing from a statistical efficiency perspective. The purpose is to identify. the statistical efficiency effects of adjusting periodic earnings to pre-set targets. Accounting 'earnings' are treated as highly aggregated sample estimates of the underlying transaction processes. The investigation covers four specific issues: (i) does the ad hoc adjustment of earnings figures to meet pre-set targets improve the sample estimation efficiency relative to unadjusted earnings figures? (ii) Does the terminal period reversal of accumulated ad hoc adjustments offset any efficiency in pre-reversal periods? (iii) Does the number of periods in the time horizon affect the estimation efficiency of target setting? (iv) Does the accuracy of target setting affect smoothing efficiency?[1] The benchmarks for our comparisons are the volatility of unadjusted earnings per period.

The various classes of income smoothing raise a significant issue for regulators, stakeholders and accountants – the impact of earnings management practices on the validity of reported numbers and the separation of acceptable from unacceptable practices. Unfortunately, traditional 'valuation' based accounting measurement theory is hampered in dealing with these issue. Accounting numbers are treated as direct representations of economic value based on primary measurement processes. Earnings management practices are

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[1] These questions are put in the null for statistical testing purposes, of course.

undesirable when they 'bias' accounting numbers away from a 'true and fair' representation of the changes in economic value. Unfortunately this 'economic valuation' based approach is extensively criticized for a lack of (i) an axiomatic framework and (ii) precise, consistent and unambiguous criteria for assessing the information content of accounting numbers reported in financial statements (Mattessich, 1964; Cambers, 1966b; Mozes, 1998, Chambers, 1998).

We circumvent these problems by using a 'transactions' based, statistical measurement theory approach that does provide a consistent axiomatic measurement foundation and precise benchmarks for comparing the information content of reported accounting numbers. Statistical measurement theory treats accounting numbers as derived calculations that provide highly aggregated and summarized sample estimates of a firm's transactions based activities that are the direct database of accounting numbers. The information content of accounting numbers relates to their statistical efficiency as sample estimates of these underlying transaction processes that represent the productive activity of the firm.

The desirability of systematic or unsystematic methods of earnings smoothing is ranked by their capacity to increase their statistical efficiency as sample estimators of a parameter of interest. Volatility or variance provides a measure of estimation uncertainty around the parameter of interest – such as the long-run expected earnings per period (LREEPP) (Brief and Owen, 1970; Gibbins and Willett, 1997; Hillier and McCrae, 2000). The smoothing of reported periodic income through such time averaging cost methods as depreciation does appear to reduce sample estimation volatility over a wide range of knowledge and time horizons (Lane and Willett, 1998; Hillier and McCrae, 1999). But less systematic methods, such as 'opportunistic' or 'ad hoc' smoothing of earnings to pre-set targets, may behave differently.

The concern in this paper is to investigate the effect of target setting on the estimation efficiency reported income figures where these are treated as successive periodic samplings of the underlying corporate income/earnings stream rather than direct measures of objective economic constructs.

The analysis is organized into six sections. The potential impacts of opportunistic smoothing through target setting on the statistical properties of reported earnings figures are outlined in section two, including the potential conflict between short run volatility reduction behavior and excessive volatility over longer time horizons. Section three defines the scope of our investigation and its limits. The statistical framework is described in section four. The simulation analysis of the potential variance efficiencies due to opportunistic target setting is based on Statistical Activity Cost Theory (SACT) due to Willett, Lane and Gibbins (Gibbins and Willett, 1997; Lane and Willett, 1998). Section five presents the simulation results on the smoothing effectiveness of target relative to both unsmoothed and systematically smoothed benchmarks. The implications of the results for future research agendas are discussed in section six.

2. LITERATURE REVIEW

Opportunistic smoothing through pre-set targets

Managers may smooth income streams because they perceive beneficial advantage in doing so. DeFond and Park (1997) suggest that the management practice of using discretionary accounting choices to smooth reported earnings around some pre-determined target is accepted as 'conventional wisdom' in managerial performance reporting. Brugstahler and Dichev (1997) provide extensive evidence of the use of target setting behavior to maintain consistent increases in earnings and to maintain positive earnings (see also Weisbach, 1988; Warner et al, 1988; Murphy and Zimmerman, 1993; Hayn, 1995). Managers' benefits may be directly connected to report earnings time series that maintain the value of the firm. Since value of the firm is determined by the present value of expected future sustainable earnings, target setting is necessary both as a relative performance exercise and for identifying the desirable level of reported earnings over time (Richardson and Wu, 2002).

Income smoothing by self-interested managers may also reflect the relative importance of past, present and future earnings. Murphy and

Zimmerman (1993) suggest that 'information decay' may mean that managers give more weight to future earnings than current earnings which, in turn, receive more weight than past earnings performance. Target setting is the outcome of relative performance evaluation between past, present and expected future earnings, in which the latter dominate Fudenberg and Tirole, 1995).

From this perspective, target setting reflects manager's concerns with expected future profits when making discretionary choices. A concern motivated by monetary and non-monetary implications of missing financial targets or of poor reported performance (Merchant, 1989; Murphy and Zimmerman, 1993). Managers may inflate earnings in periods of poor performance by increasing current year's income discretionary accruals by shifting future earnings into the current period. In good years, managers set reported earnings targets below actual and then use discretionary accruals to achieve that target by shifting earnings into future periods through increasing future accruals.

These studies emphasize the short-run nature of managerial self-interest.. The time frame of managerial self-interest may rarely exceed two to three reporting periods (De Fond and Parker, 1997). Fudenberg and Tirole (1995) also found that present targets are predominantly set on manager's expectations of next period's earnings. Manager's self-interest appears to emphasize reporting satisfactory results for the current and the next period, rather than long-term performance reporting. Managers may choose current year discretionary accruals at least partially in anticipation of future earnings, but they tend only to consider immediate future expected future earnings when setting targets.

If managers emphasize short-term performance horizons, shareholders typically adopt a long-range view of company performance. Current models of market valuation discount a firm's expected earnings over a much longer time horizon than manager's self-interest time frames. Shareholders are more concerned with the expected future sustainable earning into perpetuity, or at least, the foreseeable future. Reported results for successive periods are

primarily valued for their ability to provide a reflection of the expected longer term or sustainable earnings and dividend capacity. While managers often appeal to the need to protect shareholder's interests to justify their earnings

Management behavior, the short-termism engendered by managerial self-interest may conflict with shareholder's interests which span a much longer time horizon in relation to a firm's intrinsic, sustainable earnings capacity.

Does targeting Setting produce effective smoothing?

Intuitively, target setting should enable managers to effectively minimize the volatility of periodic earnings estimates. An earnings target is set for each period. Actual performance is then adjusted to target levels through discretionary accrual accounting choices (Lev, 1969). The procedure is then repeated over successive periods. The only limit to variance reduction is the capacity of managers to find sufficient accrual choices to achieve the necessary earnings adjustments and their ability to set target that accurately reflects the long run parameter of interest – such as LREEPP.

Counter-balancing these gains are three sources of error that may, over time, exceed the volatility of the unadjusted earnings figures - (i) adjustments between actual and target earnings that accumulate over successive periods. Where these represent offsetting shifts of income from one period to another they are zero sum processes. For non-zero sum processes, the accumulated adjustments will require reversal at some stage. (ii) Differences between the pre-set periodic targets and the adjusted earnings figures, (iii) Differences between periodic targets and the long-run parameter of interest due to inaccurate forecasting of the LREEPP. The first item is the major source of error or correction. The latter two factors represent sources of residual volatility in smoothed estimates over the short run.

Actual-to-target adjustments that offset each other in successive periods result in zero sum processes over time. Lack of offset leads to accumulating adjustment situations. In accumulating cases, unadjusted earnings volatility is not eliminated, only accumulated until offset in a later period. Delayed

correction merely accumulates unadjusted-target differences over successive periods.

The implied correction is unavoidable, since managers will be forced to reveal the true state of the firm's actual earnings record at some stage and reconcile them with the reported earnings situation. We suspect that sustained delays in correcting the accumulating unadjusted-to-target differences may create explosive volatility in the adjustment period that outweighs previous gains in estimation efficiency; to the detriment of shareholders and other stakeholders with long term interests.

3. SCOPE OF INVESTIGATION

The study focuses on the volatility reduction potential of opportunistic income adjustments by managers to achieve pre-set earnings targets [2]. The aim is to see whether the smoothing potential of these practices, is effective in a statistical sense, relative to both unadjusted and systematically smoothed earnings numbers. We investigate target setting smoothing efficiency both with and without final period reversing corrections of the opportunistic adjustments made in previous periods. We then examine the influence of increases in both time horizons and target inaccuracy on baseline results. The criterion for effective smoothing is the usual quadratic loss function. The (unobservable) parameter of interest is taken as the firm's long run earnings performance. Each period's reported profit represents a sampling point of its evolution

As mentioned, apparent reduction in short-term sampling variance may be negated by delayed, but accumulating error corrections. To offset the potentially negative effects this accumulation, managers may make progressively rather than abruptly offset the errors. From a statistical measurement perspective, progressive

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[2] This 'opportunistic' apportionment of activity cost contrasts with the investigation of Hillier and McCrae (1999) into the more restricted case of a systematic apportionment of costs across periods.

offsetting is merely a variation on the end period corrections strategy - although it may have disclosure implications.

We use simulation analysis to quantify the reduction in reported earnings volatility under opportunistic smoothing relative to unadjusted earnings series. The smoothing results are conditional on the accuracy of manager's expectations about long run earnings as reflected in the setting of periodic targets and the number of periods in the time horizon. We also undertook a subsidiary analysis of other potential conditioning factors such as the number of activities that generate earnings over successive periods.

4. STATISTICAL MEASUREMENT FRAMEWORK

Traditional Accounting Measurement framework

Under the traditional 'valuation' based view of accounting numbers, all earnings management practices reduce the information value of reported earnings to external stakeholders. Accounting numbers are taken as direct measurements of a firm's periodic economic performance (Chambers, 1966b; Edwards and Bell, 1961; FASB, 1980: 1984: 1985). Managers distort reported earnings figures through accounting choices so that they no longer represent the 'real' performance of the firm over one or successive periods. Thus, ' earnings management' biases measurement, distorts 'true and fair' disclosure, reduces the desirable informational characteristics of direct accounting measures. 'reliability', comparability, and 'relevance' of reported earnings figures and disadvantages stakeholders who must rely on corporate financial reports to reflect the firm's actual (but unobservable) performance (Edwards and Bell, 1961; Chambers, 1966b, 1998).

Under this view, the function of accounting regulation is to restrict managers' accounting opportunities for misrepresentation while leaving them enough flexibility in reporting choices to allow for substantive differences in operational and market environments between firms and industries. Earnings measurement systems are then ranked on their 'representational' ability as direct measures of the economic performance of the firm in terms of changes in

economic value (lack of bias). But measurement theorists criticize this approach for its lack of consistency and robustness in both measurement concepts and ranking of alternative accounting practices (Ijiri, 1967; 1975; Tippett, 1978).

A Statistical View of Accounting Numbers

Statistical activity cost theory (SACT) is an axiomatic measurement approach to the consistent ranking of accounting numbers on quantifiable criteria that overcomes these difficulties (Willett, 1987, 1988). Under this approach, some types of earnings management may, in fact, improve the statistical properties of accounting numbers where these are taken as sample estimates of the parameter of interest (Gibbins and Willett, 1997; Gonedes, 1972).

Some work has been done on the statistical impact of systematic smoothing on reported accounting earnings. Willett (1987, 1988) defined the necessary conditions for a reduction in earnings volatility (in a statistical sense) through discretionary accrual accounting choice. They used a stochastic form of accounting measurement theory known as statistical activity cost theory (SACT) to examine the smoothing efficiency of time averaging cost procedures that are common in accrual accounting.

Hillier and McCrae (1999) also used a SACT framework to analysis the earnings smoothing efficiency of alternative depreciation methods when systematically applied to gross earnings figures over successive reporting periods. They found that the systematic application of such time averaging procedures as depreciation appeared to be an efficient and effective means of reducing the volatility of earnings time series around the long run parameter of interest (LREEPP). These results were remarkably robust over several conditioning factors such as the degree of manager's ability to predict the firm's long run earning potential, the number of reporting periods in the time horizon and alternative distributions used to generate the simulated cost and revenue streams over time.

However, their study is limited to the systematic application of time averaging cost procedures. That is, the analyzed situations where each method is systematically, or mechanically, applied in each period and the expected target is simply taken to be the long run average of the earnings stream of interest. Our paper generalizes the analysis to the case where managers set and pursue a particular earnings target and then use accrual accounting choices in a non-systematic or ad hoc fashion to achieve the set target as best they can in each period. This approach we call ad hoc or opportunistic smoothing to reflect the ad hoc use of discretionary accrual accounting choices to achieve the set target in each period.

The SACT Framework

Our analytical framework adopts the SACT of Lane and Willett (1993) as specified in Hillier and McCrae (1999). The SACT accounting earnings function treats accounting numbers as arising from transactions that create activities over the reporting period with characteristic starting, finishing and duration times, and characteristic costs and revenues distributions. All these characteristics are stochastic in the sense that, over time, they derive from random variable probability distributions unique to that firm or industry both in terms of form of distribution and unique moments (Willett 1987, 1989)

The SACT earnings functions treat accounting numbers as generated by these separable activities. The earnings function consists of: (i) An algorithm determining the periodic earnings contribution of an activity depending on the state of the activity and manager's guess about its useful life (see further McCrae and Hillier 1999).

(ii) Arguments that reflect states of expectational accuracy. These variables represent managers' guesses about asset acquisition dates and values, useful lives, durations and disposal values.

The earnings function is converted to a computer program allowing simulation experiments over various functional forms and distributions of variables. The basic transactional unit is the 'activity'. Cost and revenue observations for each activity are sampled from specified distributions for each

variable. The sampling distributions for number, starting times, durations, costs and revenues of activities can be chosen to represent the unique firm or industry production characteristics. Sampling and distribution procedures follow that of McCrae and Hillier, 1999. The periodic earnings contributions of simulated activities are accumulated on both an unadjusted earnings and a target adjusted periodic earnings basis.

Conditioning factors.

We examine the effects of three conditioning factors on smoothing realizations. These are (i) number of period in time horizon, (ii) variations in the accuracy of target setting and (iii) The impact of using systematically smoothed income streams as a sample variance reduction benchmark rather than 'unadjusted' periodic earnings.

A sample earnings variance reduction ratio (SEVRR) is calculated as a measure of absolute smoothing effectiveness. The SEVRR computes the ratio of the variances for target adjusted earnings (numerator) to unadjusted earnings variance or systematically smoothed earnings respectively.

Tests

We test the hypothesis that the smoothing effectiveness is greater than or equal to a hypothetical value h, this being 0 for absolute smoothing effectiveness and 1 for no reduction relative to the denominator variance. Results are presented on (i) the overall smoothing effectiveness of target setting by managers and on (ii) the influence of (i) time horizon length (ii) target accuracy and (iii) previous systematic smoothing of unadjusted earnings streams. 'Time horizon' refers to the number of periods over which earnings are opportunistically smoothed. 'Target accuracy' refers to the accuracy of managers' cost, revenue and activity level expectations when estimating LREEPP. 'Systematic smoothing' refers to the prior application of time averaging cost procedures such as depreciation to the earnings streams

Although the underlying distributions are not strictly normal they are quite close to normality, which validates the use of a one sided 0.01 significance level F test as a criterion for comparing SEVRRs (Hillier, 1995). This implies that if

(1/SEVRR)h > F(0.99), we reject the hypothesis and conclude that smoothing effectiveness is less than h (i.e. smoothing is effective relative to h) (Hillier and McCrae 1999). Since the observed SEVRRs are estimates, we adopt a conservative 0.05 confidence level of significant difference.

5. RESULTS

This section presents the results of the simulation trials for four scenarios. First, a comparison of the variance of target adjusted periodic earnings with unadjusted earnings that excludes any final period off-set of accumulated differences over the preceding (0-(T-1)) periods. Second, a similar comparison but including end period offset of accumulated (Target-Unadjusted) differences from pervious periods. Third, a comparison of target adjusted variance with the variance of systematically smoothed periodic earnings rather than unadjusted earnings. The comparison again excludes any final period correction of accumulated differences between target and smoothed earnings figures. The fourth scenario includes any correction.

We first briefly examine the robustness of simulated variance ratios by comparing results for two simulation trials. Each trial yields 100,000 point sample estimates from 1000 separate sampling runs (per time horizon). Each run is based on 100 revenue/cost generating activities.

Table one indicates remarkable robustness in similar SEVRR calculations between trials over time horizons that include from two to ten separate reporting periods.

Maximum variance differences between trials which occur for a time horzon of two periods is less than 7% absolute difference and less than 6% of average variance value. For a four period horizon the differences falls to to less than 3 per cent in most cases.

General Smoothing Effectiveness

Results on the overall change to sample volatility through target adjustments first exclude and then include any final period correction to offset accumulated adjustments.

(i) No Compensating Correction for Target Adjustments

The first scenario omits final period correction of accumulated adjustments. Results are stated as Sample Earnings Variance Reduction Ratio (SEVRR) values for target smoothed versus unsmoothed earnings (Table 2 and Figure 2).

Managers can give the appearance of substantial reduction in the variance of corporate earnings streams by reporting target earnings rather than unadjusted earnings per period, even where periodic earnings targets are relatively inaccurate estimators of LREEPP. Over a four period horizon target earnings seems to remove over 60 per cent of unadjusted earnings variance (Table 2)

. Accurate target estimation of LREEPP by managers apparently removes most of the earnings variance from a wide range of T period time horizons. A target error of five percent relative to LREEPP still removes 95% of unadjusted earnings variance over a two period horizon (Table 2).

The size of this variance reduction is relatively immune to reasonable levels of target inaccuracy. Even 20 per cent target inaccuracy still results in a 74 per cent reduction in unadjusted earnings variance for a two period horizon However, target levels in excess of 25% estimation error of LREEPP start to exponentially erode estimating efficiencies (Table 2, Figure 2).

The number of periods in a time horizon influences the size of variance reduction. Expanding period numbers are associated with higher variance reductions, although at a decreasing rate. Over two, four and 10 period horizons the variance of target adjusted earnings are only under 18, 11 and 8 per cent of unadjusted earnings variances respectively (Table 2, Figure 2).

These results suggest that managers can apparently smooth reported earnings streams by reporting pre-set target levels in successive periods over a wide range of time horizons and target accuracies, relative to the parameter of estimation interest. But these increases in statistical estimation efficiencies may be more apparent than real.

(ii) Including Terminal Period Compensating Corrections

Where the actual-to-target adjustments accumulate over T periods, an earnings correction must be reported in period T to offset the accumulated

target adjustments in the previous [0-(T-1)] periods. We now report on simulation scenarios that include this final period correction. In the previous results we added the caveat of 'apparent' increase in estimation efficiency, since opportunistic smoothing may merely shift accumulated errors between target and actual earnings into the Tth period.

This possibility introduces a contrary influence in accumulating errors scenario. Apparent smoothing effectiveness per period for [0-(T-1)] still increases with the number of periods in the smoothing horizon. But, adding more periods also increases the size of the terminal period correction when reconciling the targeted and earnings estimates over the T period time horizon. The final T period correction, when reported, may exceed the estimation efficiencies of the previous 0-(T-1) periods. (Table 3.Figure 3).

Simulation scenarios that include this T period correction are characterized by estimation variance <u>inefficiencies</u> over all time horizons and degrees of target accuracy relative to the actual sample earnings estimates (Table 3). Terminal period corrections induce <u>excess volatility</u> in target adjusted earnings relative to the variance of unadjusted earnings as sample estimates of LREEPP. Even when targets accurately reflect the LREEPP, target volatility exceeds unadjusted earnings variance. The excess grows dramatically with expanding time horizons and target inaccuracy. Even with zero target error, the 13.8 per cent increase in estimation variance for two periods rises to 22.6 per cent over four periods (Tables 3).

Target Inaccuracy and LREEPP Estimation Inaccuracies

At least two factors contribute to the observed increased volatility of target earnings over unadjusted earnings streams. First, terminal period corrections produce a terminal period volatility blow out that usually exceeds the apparent variance efficiencies of the previous [0-(T-1) smoothed periods. Excess volatility is due to Type A and Type B target error. Type A error arises from estimation errors implied by a manager's lack of knowledge about future cost and revenue parameter values, future activity levels and expectations

about LREEPP values. Type 2 errors refer to induced estimation inaccuracy in previous targets relative to the LREEPP. The changing value of LREEPP as it evolves time may increase inaccuracies levels in previous target estimates.

In reality, managers will be subject to two types of error in setting targets around the evolving LREEPP, especially if this metric is not their main parameter of interest. Even if managers are accurate in predicting the actual LREEPP, the fact that this metric evolves over time, as more sample observations are available to calculate it means that a constant target will not always hit the LREEPP. This we call Type B target error. Managers are also likely to be subject to error in terms of over- or under- shooting LREEPP in their estimates.

The consequence is that when final period corrections are included (scenario 2), the excess volatility is extremely sensitive to the degree of target error relative to the long run parameter (LREEPP). As error increases so does the resultant excess volatility (adjustment volatility – actual volatility).

Increasing number of periods in Time horizon.

Excess volatility also increases with periods (Table/Figure 3). Increasing periods mean more target adjustments to offset and increasing likelihood that targets will deviate from the evolving LREEPP. So the horizon end correction becomes progressively larger due to increasing target error and accumulated adjustments error over time. As mentioned, over a two-period horizon, excess volatility is 13% over actual earnings. But at ten periods, the volatility has increased by 1.621 times the volatility of the unadjusted earnings.

The increased volatility is actually spread over all periods. But target setting delays the effects and cumulates them into the last period of the time horizon. For instance, Table 3 shows that over a 5 period horizon, the reported target incomes in the first four periods will give financial statement readers the impression of stable earnings around a persistent longer term earnings potential. But this is more than offset in period 5 by the sudden dramatic adjustment to income as managers offset the cumulative adjustments and target error in previous periods. The longer this apparently stable target based income stream is reported the

worse will be the accumulated but delayed adjustment in the last period of the time horizon (Table 3).

Increasing Target Error and Period numbers in Time Horizons.

A conjunction of increasing target error and time horizon periods compounds both effects (Table/Figure 3) leads to a significant increase in relative variance ratios at larger numbers of periods. A target error of 20% per period over 6 periods increases the REVR to 4.26 times the actual earnings variance. Over10 periods, the same REVR value increased to 4.34 times actual earnings variance Over these multi-period time horizons, financial statement readers would observe a smoothed reported income with less volatility than the actual (but unobservable) earnings figures over 5 and 9 periods respectively. But these reported targets are deceptive as an estimate of LREEPP. They hide the cumulative error introduced by target error and adjustment error. The sixth and tenth periods respectively would see a truly dramatic adjustment in reported earnings as managers wash out the volatility consequences of these cumulative target errors.

Of course, managers may minimize effects of cumulative error size by backing it out sequentially at more than one point. Banks and other firms often show such dramatic accrual adjustments (bad debts, abnormal items, write downs etc) during economic downturns. During down turns and recessions, the market expects poor results and is less likely to be surprised or condemn poor performance. These negative expectations give managers the opportunity to periodically compensate for prior upward earnings adjustments without hurting their own self-interest too much. This wipes the earnings slate clean and another period of target setting can commence.

Comparison with Systematic Smoothing

As previously mentioned, an alternative form of income smoothing is to systematically apportion revenues and costs to successive periods according to a deterministic model. Realism increases with the introduction of systematically smoothed earnings as the estimation efficiency bench-mark since, under accrual

accounting, all corporate earnings streams will contain a degree of systematic, time-averaging in cost and revenue streams.

Cost and revenue allocations through time averaging techniques (eg. Depreciation) increase the estimating efficiency of unadjusted earnings streams over a wide range of conditions, including time horizons, deterministic methods and managers' knowledge states (Willett, 1991; Hillier and McCrae, 1999). Systematically smoothed earnings streams are a more realistic benchmark than unadjusted earnings for at least two reasons. First, systematic smoothing methods represent a feasible, relevant and comparable smoothing alternative to opportunistic smoothing. Establishing the relative estimating efficiencies of the two alternative methods is a worthwhile exercise, from the perspectives of managers, shareholders, regulators and other stakeholders. Such a comparison enables us to establish a relative ranking of measurement efficiency of two systems on unambiguous, consistent and quantifiable measurement criteria.

Second, opportunistic smoothing methods may be used in conjunction with systematic smoothing. Indeed, simultaneous use is the more common and realistic situation, since managers commonly apply systematic smoothing methods as a matter of course in calculating period earnings (e.g. depreciation and other expense and revenue provisions, amortization and progressive write-offs).

(i) Systematic Smoothing Variance Benchmark with no End Period Corrections

In scenarios with no terminal correction for target adjustments in previous smoothed periods, the results are similar to those using actual earnings variance as the benchmark for the SEVRR comparisons Table 6 compares Table2 results to Table 4). The results indicate that the estimation efficiency improvements against systematically smoothed volatility benchmarks are only 1 to 3 per cent less than for the non-smoothed benchmarks (Table 6. The general conclusion is that the sample earnings estimation efficiency gains from targeting are comparable whatever the benchmark variance that is used in the comparison. A not unreasonable result since the maximum potential efficiency gains is a reduction of earnings variance to zero in the case of absolute target accuracy or to extremely low levels of variance about the LREEPP at reasonable levels of target

accuracy (up to 10% difference). In these cases, the starting benchmark variance is somewhat immaterial (Table 6).

(ii) Systematic Smoothing Variance Benchmark including End Period Corrections

The same broad pattern emerges as for target to unadjusted scenario that includes end period correction. Excess volatility is observed at all levels of target accuracy and across all time horizons.. Which again implies that the underlying volatility is not really decreased by adjustment to target figures but accumulates in successive periods until correction in some 'final' period of the horizon (Tables 5/Figure 5). But where income streams have been systematically smoothed, the increases in excess volatility induced by target setting are substantially greater than for the 'unadjusted earnings' case (Tables 3 and 5 and Table 7). Table 7 compares the SEVRRs for target adjusted to unadjusted earnings with those for target adjusted to smoothed earnings (scenarios 2 and 4). Even a 2 period time horizon with relatively accurate targets (110% of LREEPP) gives a 20% absolute difference in SEVRR (Table 7). The difference is less dramatic in standardized error terms (absolute difference/ average SEVRR) at about 6% (Table 7).

Excess volatility the smoothed earnings case (scenario 4) increases more than monotonically with expanding time horizons and increased inaccuracy of targets relative to LREEPP. At more inaccurate target levels (160% to 180% of LREEPP) and longer time horizons (8 to 10 periods) the differences become increasingly larger. The excess volatility induced in systematically smoothed earnings streams becomes from 24 percent to 80 percent larger than for unsmoothed earnings streams (Table 7)..

These results raise concern for corporate, accounting and audit regulators and for stakeholders since accrual accounting is the mandatory form of corporate accounting. Accrual accounting streams are dominated by time-averaging of costs and revenues. Yet such systematically smoothed income streams appear to be more susceptible to excess volatility shocks than cash-based accounting results.

6. DISCUSSION

Our approach to the measurement accuracy of periodic reported earnings figures differs from the traditional 'valuation' based measurement approach adopted by accounting standard setters and regulators. Under SACT, periodic accounting performance numbers are not seen as direct, representations of the underlying production processes of the firm, but rather as sample estimates of a firm's economic transactions over successive accounting periods based on indirect or derived accounting concepts that only indirectly represent the results of those transactions. Each reported figure is a sample estimate of the parameter of interest over the reporting horizon – for instance, sustainable earnings. Alternative methods of opportunistic or 'ad hoc' income smoothing through alternative accrual accounting choices are then ranked by their ability to reduce sample estimation variance in representing the earnings parameter of interest.

Our results show that managers can substantially lower the variances of successive reported earnings figures (relative to unadjusted figures) if they set earnings targets, then adjust actual earnings to target through offsetting shifts of income between periods. This variance reduction increases with the number of periods. The results are even fairly robust against inaccuracies in managers' target setting accuracy relative to the long run parameter of interest – up to 15 per cent inaccuracy. However, if managers set targets that differ substantially from the expected LREEPP (e.g. over 20 per cent error), then the estimation variance quickly exceeds the variance of unadjusted estimates. The effect is magnified when LREEPP follows a growth (decline) rather than a constant path over successive reporting periods.

The situation is very different when a terminal period correction of any accumulated errors is included. Estimation efficiency relative to unadjusted earnings is reduced over all time horizons (even just 2 periods), all expectation states about LREEPP and all target error levels. This inefficiency gets worse as

more periods are added, as managers' forecasts of LREEPP become less accurate as target setting errors increase relative to the expected LREEPP.

The results create substantial implications for future governance, accountability and fiduciary regulation of accounting earnings reporting. Our results clearly show that managers can use financial reports to present apparently stable income streams by shifting the volatility into subsequent reporting periods. The real underlying volatility can be kept hidden by simply delaying the inevitable correction until forced into revelation through some regulatory or circumstantial factor. At this point, shareholders and other external stakeholders suddenly discover the sum of all the accumulated earnings volatility from previous periods.

We have limited discussion of opportunistic or 'add hoc' earnings smoothing techniques to pre-setting targets because of its wide acceptance and use as an established part of earnings management and 'good' corporate governance. Our concern is with the effect of income smoothing techniques on the statistical properties of reported earnings numbers. But the results are so decisive as to suggest that corporate regulators, accounting standard setters and those charged with overseeing good corporate governance and protecting corporate stakeholders might do worse than considering the implications of a statistical estimation approach to accounting numbers and the insights it offers.

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Tables and Figures 1-7

Tables 1

The body of the table gives the SEVRR *r*esults for two simulation runs of target adjusted variances versus unadjusted earnings variances for a scenario with end period corrections. The accuracy of the simulations is measured by (i) the absolute difference in average SEVRRs between the two trials and (ii) the absolute difference standardized by the average SEVRR value.

Tables 2-5

The body of each table shows the sample variance of the target-adjusted earnings relative to the variance of the unadjusted periodic earnings or the systematically smoothed earnings. The variances reflect the distribution of these sample estimates - where these periodic earnings are taken as sample estimates of the long-run expected earnings per period (LREEPP) All variances refer to distribution as estimates around the expected value of the this parameter.

The variances are expressed as a ratio – the sample estimate variance reduction ratios (SEVRR) which are reported in each table. The ratios are drawn from simulation trials. Each trial has 1000 runs with 100 earnings generating activities per run spread over the horizon.

(i) Tables 2 and 3

Tables 2 and 3 show the earnings variance of the target-adjusted earnings relative to the variance of unadjusted earnings per period expressed as a SEVR Ratio. Table 2 **excludes** the end period adjustment for accumulated (target-unadjusted) differences from previous {0 – (T-1)} periods in the time horizon. Table 3 **includes** this correction in the end period. In both cases,

(ii) Tables 4 and 5

Tables 4 and 5 are similar to tables 2 and 3 except the benchmark variance is the systematically smoothed periodic earnings stream in place of the unadjusted earnings. The figures in the body of the tables is the ratio of the target adjusted to smoothed variances (SEVRR).

Figures 1-7 are multi-column graphical representations of the associated tables.

Tables 6 and 7.

The tables compare the amount of volatility reduction achieved by reporting target adjusted periodic earnings relative to unadjusted earnings with reductions relative to systematically smoothed periodic earnings. The body of the tables show the differences in the levels of absolute sample variance reduction in terms of the absolute variance of the underlying benchmark earnings. Negative cell numbers indicate that variance reductions achieved by Target adjusted earnings relative to the Unadjusted Earnings benchmark variance are greater than for the Systematically Smoothed variance benchmark. That is, the ratio of the variance of Target adjusted earnings relative to the variance of Unadjusted Earnings is smaller than the ratio of the Target Adjusted earnings variance relative to Systematically Smoothed earnings variance. Positive cell numbers indicate the reverse situation. Negative cell numbers that the ratio of the variance of Target adjusted earnings relative to the variance of Unadjusted
Earnings is smaller (volatility reduction is greater) than the ratio of the Target Adjusted earnings variance relative to Systematically Smoothed earnings variance.

Table 1 SEVRR Simulation trial Accuracy: Target Adjusted/Unadjusted Earnings Absolute and Standardised Variance Difference With End Period Correction										
Trial	**Periods**									
	2	**Diff**	**4**	**Diff.**	**6**	**Diff.**	**8**	**Diff.**	**10**	**Diff.**
1	1.1		1.238		1.432		1.492		1.604	
2	1.176	0.076	1.215	0.023	1.407	0.025	1.438	0.055	1.639	0.0345
Average	**1.138**	**0.066**	**1.226**	**0.019**	**1.42**	**0.017**	**1.465**	**0.037**	**1.621**	**0.021283**

Figure 1
SEVRR Simulation Accuracy: Target Adjusted/Unadjusted Earnings - 2 Trials, Increasing Periods
With End Period Correction

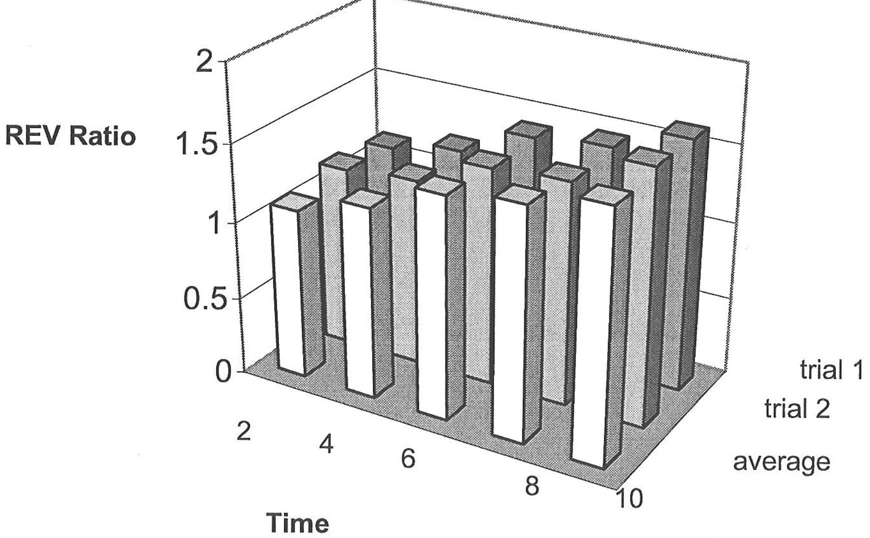

Table 2
SEVRR Ratio: Target Adjusted/Unadjusted Earnings
Increasing Periods, Decreasing Accuracy
Without End Period correction

Periods	**%LREPP**						
in Horizon	**100%**	**105%**	**110%**	**115%**	**120%**	**140%**	**160%**
2	0.0000	0.0492	0.1825	0.4608	0.7313	3.0781	7.2705
4	0.0000	0.0376	0.1428	0.3381	0.5919	2.4072	5.3816
6	0.0000	0.0291	0.1127	0.2569	0.453	1.8277	4.115
8	0.0000	0.0227	0.0863	0.2021	0.3509	1.4289	3.1988
10	0.0000	0.0178	0.0738	0.1685	0.2969	1.2004	2.6877

Figure 2
SEVRR: Target Adjusted/Unadjusted Earnings
Expanded horizons,, Decreased Accuracy
Without Correction at End of Time Horizon

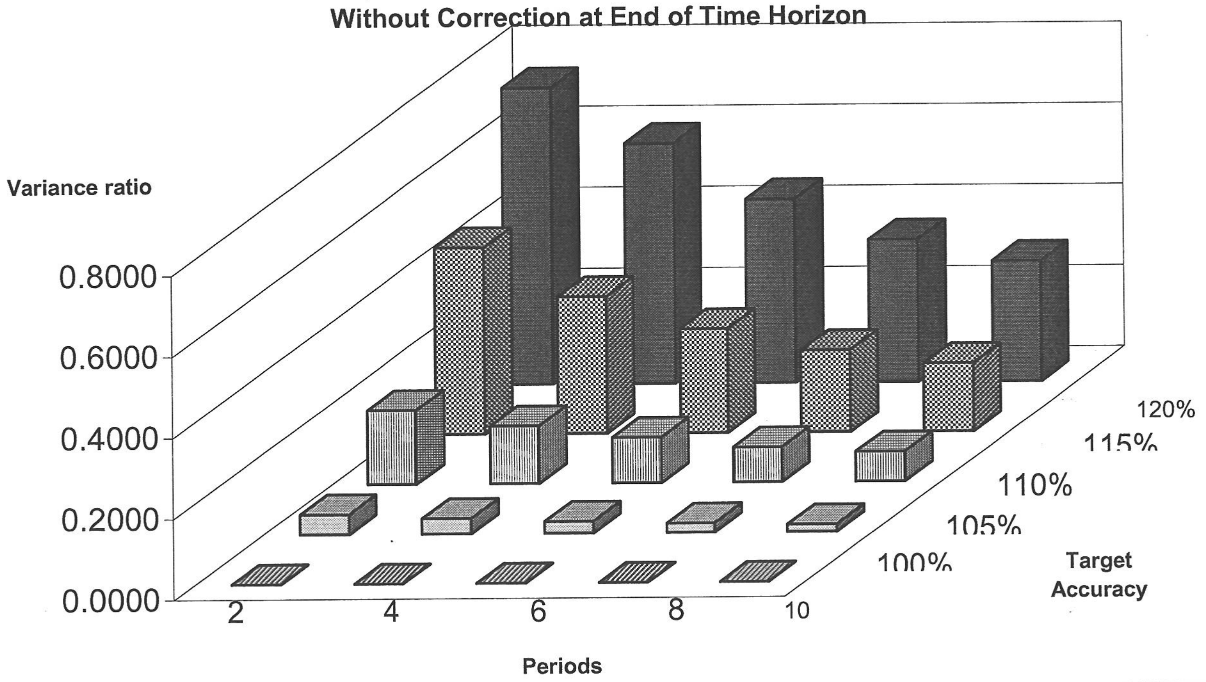

Table 3 SEVRR:Target Adjusted/Unadjusted Earnings Increasing Periods, Decreasing Accuracy With End Period Correction							
Periods	**% LREPP**						
in Horizon	**100%**	**105%**	**110%**	**115%**	**120%**	**140%**	**160%**
2	1.0966	1.1603	1.5318	2.1056	2.5059	7.443	15.4091
4	1.3099	1.4172	1.7737	2.7183	3.5999	10.818	22.5547
6	1.4054	1.5428	2.0027	2.9088	4.2553	12.2354	26.2543
8	1.5629	1.6424	2.0741	3.1043	4.1009	12.9996	27.1467
10	1.6704	1.9322	2.3435	3.3628	4.342	13.8242	28.7542

Figure 3
SEVRR: Target Adjusted/ Unadjusted Earnings
Increase Periods, Decrease Accuracy
With Correction at End of Time Horizon

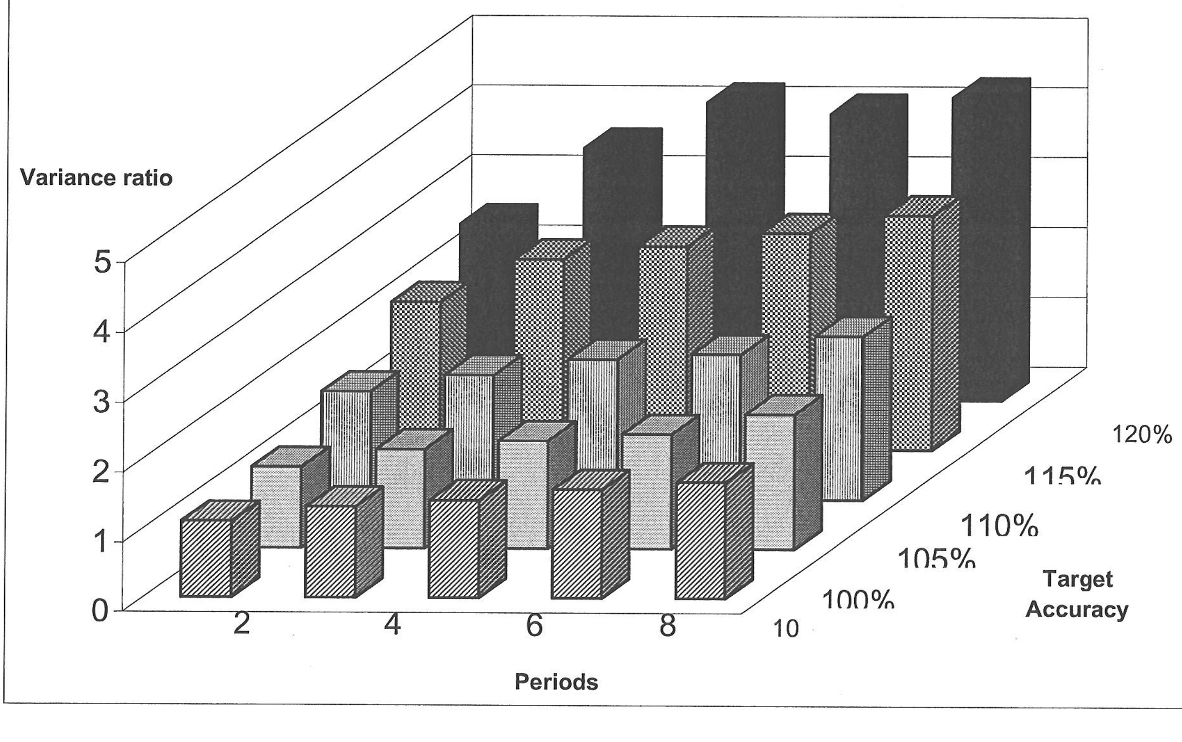

Table 4
SEVRR Ratio:Target Adjusted/Smoothed Earnings
Increasing Periods, Decreasing Accuracy
Without End Period correction
RVP Expectation State

Periods	**%LREPP**						
In Horizon	**1.0000**	**1.05%**	**1.10%**	**1.15%**	**120%**	**140%**	**160%**
2	0.0000	0.0527	0.1947	0.4634	0.7771	3.3455	8.0054
4	0.0000	0.0472	0.1831	0.4292	0.7493	2.9428	7.0521
6	0.0000	0.0419	0.1687	0.3766	0.6682	2.7627	6.1062
8	0.0000	0.036	0.1377	0.3249	0.5542	2.2742	5.22
10	0.0000	0.0309	0.1335	0.3055	0.5522	2.2585	4.7592

Figure4
Earnings Variance Ratio: Target/Smoothed
RVP Expectation State
Increase Periods, Decrease Accuracy
Without Correction at End of Time Horizon

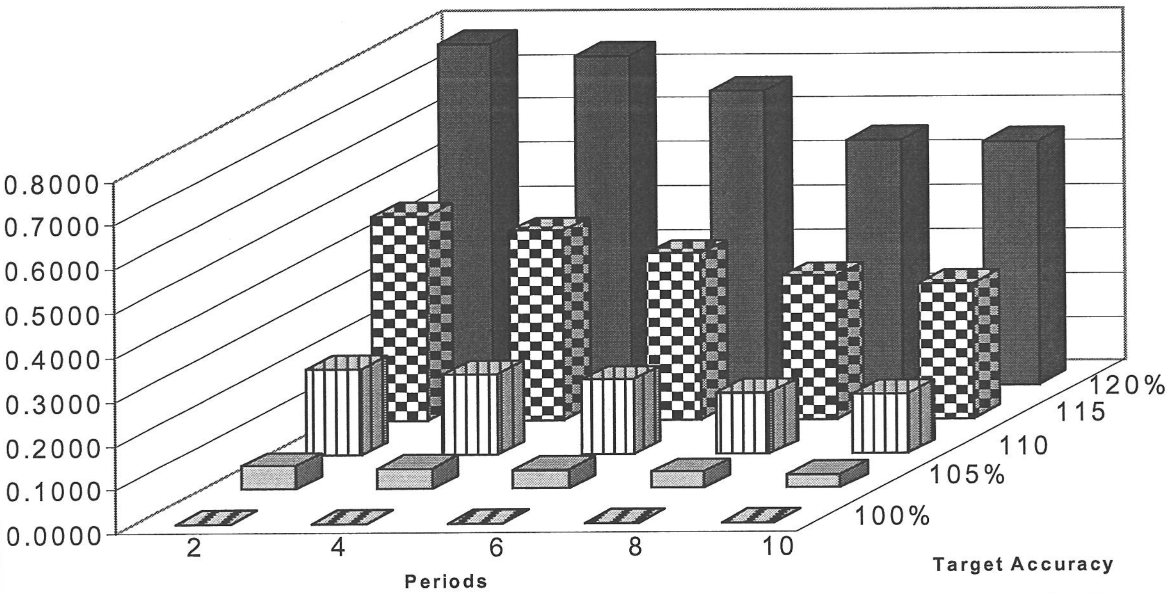

Table 5 SEVRR: Target Adjusted/Smoothed Earnings Increasing Periods, Decreasing Accuracy With End Period Correction							
Periods	**% LREEPP**						
in Horizon	**100%**	**105%**	**110%**	**115%**	**120%**	**140%**	**160%**
2	1.2218	1.45961	1.7335	2.3532	2.7583	8.136	17.0249
4	2.0635	2.1864	2.6768	3.5861	4.9836	13.6009	29.6903
6	2.692	2.7342	3.5579	4.8001	6.9906	18.7432	39.4236
8	3.4248	3.8112	4.3289	6.1528	7.6123	21.65	45.4348
10	4.1286	4.5753	5.3157	7.2462	9.5029	27.6624	51.9673

Figure 5
SEVRR: Target/Smoothed
Increase Periods, Decrease Accuracy
With Correction at End of Time Horizon

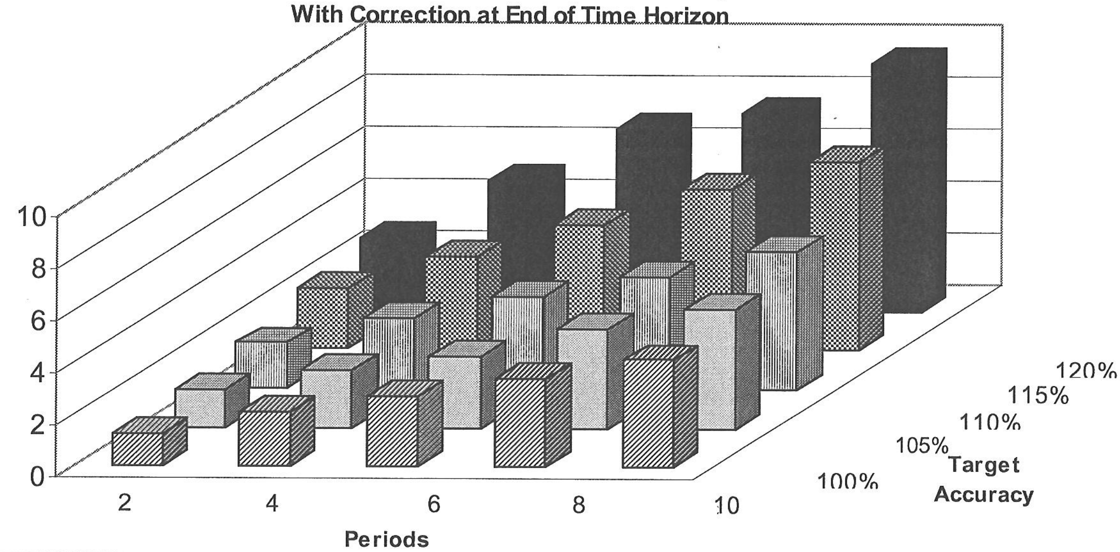

Table 6
Difference in SEVR Ratios for two Benchmarks - Unadjusted v. Smoothed
(Table 2 versus Table 4)
Target Adjusted/Unadjusted Ratios versus Target-Adjusted/Smoothed Earnings Ratios
Without End Period Corrections

	%LREEPP									
	1.00%		1.10%		120%		140%		160%	
Periods	abs. Diff	stdd diff	abs. Diff	stdd diff	abs. Diff	stdd diff	abs. Diff	stdd diff	abs. Diff	stdd diff
2	-0.0035	-0.0343	-0.0122	-0.0323	-0.0458	-0.0304	-0.2674	-0.0416	-0.7349	-0.0481
4	-0.0096	-0.1132	-0.0403	-0.1237	-0.1574	-0.1174	-0.5356	-0.1001	-1.6705	-0.1344
6	-0.0128	-0.1803	-0.056	-0.199	-0.2152	-0.1919	-0.935	-0.2037	-1.9912	-0.1948
8	-0.0133	-0.2266	-0.0514	-0.2295	-0.2033	-0.2246	-0.8453	-0.2283	-2.0212	-0.2401
10	-0.0131	-0.269	-0.0597	-0.288	-0.2553	-0.3007	-1.0581	-0.3059	-2.0715	-0.2782

Table 7
Difference in SEVR Ratios for two Benchmarks - Unadjusted v. Smoothed
(TABLE 3 V. table 5)
Target Adjusted/Unadjusted Ratios versus Target-Adjusted/Smoothed Earnings Ratios
With End Period Corrections

Periods	%LREEPP									
	1.00%		1.10%		120%		140%		160%	
	abs. Diff	stdd diff	abs. Diff	stdd diff	abs. Diff	stdd diff	abs. Diff	stdd diff	abs. Diff	s
2	-0.1252	-0.05	-0.2	-0.06	-0.25	-0.048	-0.693	-0.04448	-1.6158	-0.10486
4	-0.7536	-0.22	-0.9	-0.2	-1.38	-0.161	-2.783	-0.11397	-7.1356	-0.31637
6	-1.2866	-0.31	-1.56	-0.28	-2.74	-0.243	-6.508	-0.21007	-13.1693	-0.2354
8	-1.8619	-0.37	-2.25	-0.35	-3.51	-0.3	-8.65	-0.24965	-18.2881	-0.67368
10	-2.4582	-0.42	-2.97	-0.39	-5.16	-0.373	-13.84	-0.33356	-23.2131	-0.80729