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The Smoothing of Reported Corporate earnings through Target Setting: Acceptable Practice or Shareholder Deception?

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Keywords

smoothing, reported, corporate, earnings, through, target, setting, Acceptable, practice, shareholder, deception

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**The Smoothing of Reported Corporate earnings through Target
Setting: Acceptable Practice or Shareholder Deception?**

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The setting of earnings targets is frequently used by corporate managers to reduce the volatility of reported earnings over successive periods. The practice exemplifies the more informal or ad hoc category of income smoothing approaches. This paper investigates the volatility reduction potential of target setting relative to the underlying (but unobservable) income stream. The analysis uses a simulation approach based on a statistical model of accounting measurement that treats periodic earnings reports as successive samples drawn from the underlying earnings generation process. The results indicate substantial reductions in earnings volatility that are remarkably resilient to inaccuracies in targets and increase over reporting periods. But accumulating errors due to misalignment between targets and the firm's expected sustainable earnings capacity may produce explosive volatility when finally reported - to the detriment of shareholders and other long term stakeholders relying on corporate reports.

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INTRODUCTION

The smoothing of a firm's income across successive accounting periods is a persistent and pervasive practice of corporate performance (Newman, 1998). Under accrual accounting principles, some forms of earnings smoothing are acceptable, even required, of managers. A common example is the systematic allocation of asset costs to all relevant periods through the consistent application of time averaging depreciation formulae (Lane and Willett, 1998).

But other, less systematic approaches to smoothing reported corporate earnings may be less acceptable. This second category of income smoothing approaches is characterized by informal or opportunistic adjustments to reported earnings over successive periods rather than the systematic application of time averaging cost and revenue allocation procedures. A prime example is the well-established practice of earnings target setting (Fudenberg and Tirole, 1995; DeFond and Park, 1997). Management pre-sets earnings targets over successive periods, adjusts actual earnings to target and reports the target figures.

Among the managerial benefits of this practice is a potential reduction in the volatility of reported income streams over successive periods in an effect known as 'income smoothing'. Earnings targets are set to dampen down the periodic fluctuations in the underlying earnings stream of the firm as reported in the financial statements. Although income smoothing across successive periods is only one consideration in setting earnings targets, the practice is pervasive and persistent.

Little is known about the effect of target setting on the statistical properties of accounting earnings. Willett (1991b) has shown that systematic, time averaging methods of cost and revenue allocation across periods can produce significant

reductions in the volatility of reported earnings streams. But there is no comparable study of less formal approaches. The gap is significant given the current debate over the rectitude of earnings management practices involved in several high profile corporate collapses. A misalignment between the targets set by management and the longer-term sustainable earnings capacity of the firm may bias performance reporting to the detriment of the longer term interests of shareholders.

The purpose of this paper is to investigate whether the adjustment of periodic corporate earnings streams to pre-set target reduces the volatility of the reported earnings streams relative to the unadjusted earnings streams. We investigate this smoothing effectiveness both with and without final period corrections for any volatility accumulation errors from previous periods. We then examine the influence of three conditioning variables on our results – the number of periods in the time horizon, the accuracy of management’s knowledge about the firm’s (unobservable) long run expected earnings, and the presence of accrual based systematic smoothing in the underlying earnings stream.

Our analytical method is based on the principles of statistical accounting measurement known as Statistical Activity Cost Theory (SACT) due to Willett (1987) and Lane and Willett (1998). This statistical estimation efficiency approach to accounting numbers treats reported earnings figures as sample estimates of indirectly derived accounting concepts such as long-run expected earnings (LREE) rather than as direct measurements of economic concepts. Information content is a function of their reliability as sample estimates of the LREE; where reliability refers to the degree of dispersion (variance) of the sample earnings figures around the LRE. In this sense, statistical estimation efficiency refers to the degree of volatility of successive sample estimates (reported periodic earnings) around the target value - the long run expected earnings per period (LREEP). The lower the dispersion of sample estimates around the target value, the greater is the estimation efficiency.

In SACT terms, the aim of the paper is to investigate the effect of ad hoc target setting on the estimation or inference efficiency of reported income figures where these are treated as successive periodic samplings of the underlying corporate

income/earnings stream rather than as direct measures of objective economic constructs.

Our analysis is organized into five sections. Section two reviews the rationale for using target setting as an income smoothing device and the potential for reporting conflicts between short run volatility reduction behavior and excessive volatility over longer time horizons. Section three explains the general principles of a statistical measurement approach to accounting numbers and briefly reviews the Statistical Activity Cost Theory (SACT) that we use to computer-generate the simulation data in this analysis. Section four presents the simulation results on the smoothing effectiveness of target adjusted earnings relative to both un-smoothed and systematically smoothed benchmarks. The implications of the results for future research agendas are discussed in section five.

S

Earnings Target Setting and Income Smoothing

Opportunistic smoothing through pre-set targets

DeFond and Park (1997) suggested 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. The strategic exercise of these accrual accounting choices is seen as a legitimate, desirable management practice to promote reductions in income stream volatility (Yeo, 2002; Magrath and Weld, 2002). Brugstahler and Dichev (1997) provide supporting evidence of the extensive use of corporate target setting 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).

But these more opportunistic methods of smoothing earnings numbers may be less acceptable to corporate regulators, the accounting profession and auditors (Levitt, 1998; Elias, 2002). Beatty (2002) points out that the deceptive reporting practices in many recent, high profile corporate collapses began merely as “ ‘legitimate’ ” corporate practices of smoothing reported earnings to meet pre-set earnings targets rather than intentional deception of stakeholders. Magrath et al (2002) cite staggering losses in corporate share value that were kept hidden from stakeholders

by similar corporate earnings disclosure practices in the corporate bankruptcies of Enron, Lucent Technologies, Cendant, Microstrategy and many other recent high profile corporate collapses. 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).

Despite these failures, recent studies attest to the continued global persistence of accruals management to meet pre-set earnings targets as a pervasive element in corporate earnings management and reporting practice (Peasnell, Pope & Young, 2000b; Mathieu, 2003; see also Murphy & Zimmerman, 1993; Hayn, 1995; Burgstahler & Dichev, 1997; Eddy and Taylor, 1999). Since corporate valuation is determined by the present value of expected future sustainable earnings, target setting is often defended as prudent and necessary both as a relative performance exercise and for identifying the desirable level of reported earnings (Richardson and Wu, 2002).

A common theme in many studies is the coincidence between earnings target setting and the short-run nature of managerial self-interest. De Fond and Parker (1997) suggest that the time frame of managerial self-interest rarely exceed two to three reporting periods. Fudenberg and Tirole (1995) also found that managerial self-interest appears to emphasize reporting satisfactory results for the current and the next period, rather than long-term performance reporting.

Fudenberg and Tirole (1995) also found that present earnings 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 set targets for current year discretionary accruals at least partially in anticipation of future earnings, but they tend only to consider immediate future expected earnings when setting earnings or profit targets. However, Richardson and Waagelein (2002) express a contrary view. They provide evidence that long-term corporate performance considerations and plans can impact on earnings management practices.

If managers emphasize short-term performance horizons, finance theory holds that shareholders typically adopt a longer term view of company sustainable performance. Current models of corporate valuation discount a firm's expected sustainable earnings over a much longer time horizons than manager's self-interest time frames - into perpetuity, or at least, the foreseeable future. In this context, the value of successive periodic earnings reports to external stakeholders becomes a function of the information they convey about the firm's sustainable earnings and dividend capacity over time as well as the income of discrete (but artificial) accounting periods.

In this sense, the shorter-term nature of 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. If opportunistic target setting and achievement practices merely hide reported earnings volatility by accumulating it into later periods then the practice may deceive shareholders and other readers of corporate reports about the sustainable level and behavior of the company's earnings capacity over time. We now investigate these propositions using a statistical measurement theory approach to accounting numbers.

Does target setting produce effective income smoothing?

As early as 1969, Lev asserted that setting periodic earnings targets should enable managers to effectively minimize the volatility of successive earnings estimates (Lev, 1969). An earnings target is set for each period. Any residual difference in actual performance is then adjusted to target levels through discretionary accrual accounting choices. The procedure is repeated over successive periods. The only structural 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 targets that accurately reflects the long run parameter of interest.

Counter-balancing these gains are three sources of error that may, over time, exceed the volatility of the unadjusted earnings figures - (i) differences between actual and target earnings that accumulate over successive periods, (ii) differences between the pre-set periodic targets and the adjusted earnings figures, and (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.

Where these actual-to-target earnings adjustments offset each other over successive periods they are zero sum processes. But the ad hoc nature of setting successive periodic earnings targets is more likely to result in non-zero sum processes where the net adjustments accumulate over successive periods. In such cases, any apparent reduction of volatility relative to unadjusted earnings may not be eliminated, but just shifted into later periods where it keeps accumulating until offset or corrected in a later period.

Managers may delay correction of the accumulating net adjustments for several reporting periods. But, at some stage, they will have to reveal the true state of the firm's actual earnings record and reconcile it with the reported earnings situation. From anecdotal evidence we suspect that delayed correction for the accumulating unadjusted-to-target differences may create explosive volatility in the adjustment period. The correction may then outweigh previous gains in estimation efficiency - to the detriment of shareholders and other stakeholders with longer-term interests in corporate performance.

METHOD

A Statistical Measurement Framework

Investigation of the earnings smoothing dynamics of target setting over time requires an approach to accounting measurement that focuses on the statistical properties of earnings numbers. In this study, we use Statistical Activity Cost Theory (SACT) due to Willett, (1987, 1988) and Lane and Willett, (1993). SACT is an axiomatic measurement approach to the consistent ranking of accounting numbers on quantifiable criteria (Lane and Willett, 1993; Willett, 1987, 1988).

This statistical measurement approach was used by Willett (1987, 1988) to examine the smoothing efficiency of time averaging cost procedures that are common in accrual accounting. Hillier and McCrae (2000) also used the approach to generate

data in a simulation study that compared the earnings smoothing efficiency of alternative depreciation methods.

SACT treats reported earnings figures as indirect accounting measurements that provide successive samples of the underlying earnings generation process where the main interest is on the long run average value of that process (Willett, 1991b). These sample estimates make up the transactional database of accounting numbers that summarizes the firm's on-going transaction based activities. Each period's reported earnings figure represents a sample estimate of the firm's long-run expected earnings rather than a direct calculation of an economic construct. These sample estimates are then used to make inferences about the accounting measures of performance over time; for instance long term expected earnings, profitability or cash surplus/deficit.

Under the statistical inference approach to accounting measurement, the information content of accounting numbers relates directly to their statistical efficiency in representing the long-run accounting measure of interest. In the present case, the volatility of the periodic earnings figures can be used as a measure of their efficiency as estimators of the long run expected or average earnings per period of the firm. A decline in this sample variance will reduce uncertainty and increase estimation efficiency. An increase in the volatility of these sample estimates will produce the opposite effect (Brief and Owen, 1970; Gibbins and Willett, 1997; Hillier and McCrae, 2000).

This statistical inference approach provides both a consistent axiomatic foundation for accounting measurement and precise benchmarks for comparing the information content of reported accounting numbers produced under alternative accounting methods. The desirability of systematic or unsystematic methods of earnings smoothing is now ranked by their capacity to increase the statistical efficiency of the sampling estimates. Smoothing practices that reduce the variance of the resulting earnings samples increase their efficiency as sample estimators of long run expected earnings per period. Volatility or variance provides a measure of estimation uncertainty around the parameter of interest (Brief and Owen, 1970; Gibbins and Willett, 1997). 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).

Our analytical framework adopts the SACT approach of Lane and Willett (1993) as formulated 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 earnings function is converted to a computer program allowing simulation experiments over various functional forms and distributions of cost and revenue determining 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. These firm-specific characteristics determine the parameter values of the earnings function that is used to generate sample estimates of earnings for a nominated horizon of reporting periods. The periodic earnings contributions of simulated activities are then accumulated on both an unadjusted earnings and a target adjusted periodic earnings basis.

The simulations

A simulation program yielded sampling estimates per reporting period for target-adjusted earnings, unadjusted earnings and systematically smoothed earnings. Each run contained 100 revenue/cost generating activities spread over the chosen time horizon. Each trial consists of 1000 runs. So, each trial yields 100,000-point sample estimates. Sample estimate variances are then calculated for the three earnings streams as appropriate.

A sample earnings variance reduction ratio (SEVRR) is then calculated for each of the three variance types. The SEVRR computes the ratio of the variances for target-adjusted earnings (numerator) to unadjusted earnings variance or systematically smoothed earnings respectively. This ratio is used as a measure of the absolute smoothing effectiveness of target adjusted earnings relative to unadjusted and systematically smoothed earnings streams.

Conditioning factors.

We also examine the sensitivity of variance reduction results to three conditioning factors. These are: (i) the number of period in time horizon, (ii) the variations in the accuracy of target setting and (iii) the use of systematically smoothed earnings as a benchmark in place of ‘unadjusted’ periodic earnings.

RESULTS

There are four sets of results for the simulation trials. Sets one and two compare the variances of target-adjusted periodic earnings against the variance of the equivalent unadjusted earnings as the benchmark for variance reduction. The first set of results excludes any end-period adjustment for accumulated differences between actual earnings and target earnings over the preceding (0-(T-1)) periods. The second set includes the end period adjustments to offset any accumulated differences. Sets three and four repeat the analysis using the variance of systematically smoothed earnings as the benchmark for estimation efficiency. Set three again excludes any end-period adjustment. Set four includes any adjustment. Set four includes adjustments of accumulated errors.

The results also include two further conditioning factors that may influence the degree of variance change: (i) the number of reporting periods and (ii) the degree of accuracy of management’s knowledge about the firm’s long run expected earnings potential.

The results are presented in seven tables. Tables two through five report the VRR relative to unadjusted earnings and systematically adjusted earnings figures. The variances reflect the spread or distribution of the reported earnings per period around long run expected earnings. Tables six and seven show the differences in these ratios

between two variance reduction benchmarks – unadjusted earnings and systematically smoothed earnings variances.

Robustness of variance ratio results.

Before running the simulation trials we needed to test the uniformity of simulated reduction results over separate trials. Significant differences between trials may create problems for later testing. We ran 10 trials with 100,000 point sample estimates per trial. Each trial has 1000 runs with 100 earnings generating activities per run spread over the horizon. Each run is based on 100 revenue/cost generating activities. We then compared the trials with the highest and lowest VRR values. Uniformity is measured by (i) the absolute difference in VRR between the two trials and (ii) the absolute difference standardized by the average variance reduction value over the ten trials. Table one shows the results. On both measures, the differences in VRR values between trials not significantly different from zero which eliminates differences between trial results as a source of error in results.

Smoothing Effectiveness - Unadjusted Earnings Variance Benchmark

Set 1 - No End Period Correction

The first set of results omits any final period correction of accumulated adjustments between actual earnings and target earnings over previous periods. Table two and Figure two report the variance reduction between target-adjusted earnings and unadjusted earnings per period excluding the end period adjustment for accumulated (target-unadjusted) differences from previous $\{0 - (T-1)\}$ periods. The body of table two gives the VRR values for lengthening time horizons and decreasing accuracy of each period's target relative to the expected long-run earnings value. So, for instance, over a two period horizon and 10 percent target inaccuracy each period, the target-smoothed earnings per period variance is 18.25 percent of the unadjusted earnings variance; 81.75 percent of the benchmark variance is removed by target smoothing.

The results indicate that managers can give the appearance of large reductions in the variance of corporate earnings streams by reporting target earnings rather than unadjusted earnings per period, even where periodic earnings targets set by management are relatively inaccurate estimators of long run earnings. Over a four

period horizon, target-adjusted earnings remove over 60 per cent of the variance for unadjusted earnings (Table 2).

The size of this variance reduction is relatively immune to reasonable levels of target inaccuracy in terms of management's ability to infer the firm's sustainable earning capability. Accurate target estimation of long run earnings 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 LRE still removes 95% of unadjusted earnings variance over a two period horizon (Table 2). 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 also influences the size of variance reduction at each level of target accuracy. Variance reductions increase as the time horizon expands, although at a decreasing rate. Over two, four and 10 period horizons the variance of target adjusted earnings decreases to 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 fairly long 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.

Set 2 - With End Period Correction

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. The second set of results includes this final period correction. Table three reports the variance reduction ratio that includes an end period correction for the accumulated differences between unadjusted and target earnings levels. The reversal of results between tables 2 and 3 is dramatic. For a two period horizon and 10 percent target inaccuracy the variance has now increased by

153.18 percent relative to the benchmark variance as opposed to the 8 percent decrease in Table 1.

These initial results confirm our suspicion that opportunistic smoothing may merely shift accumulated errors between target and actual earnings into later periods rather than eliminate it. This possibility now introduces a contrary influence. Time horizon expansion may increase volatility reduction but it may also increase the size of the terminal period correction per period when reconciling the targeted and earnings estimates over the T period time horizon. The end period correction, when reported, may exceed the estimation efficiencies of the previous $[0-(T-1)]$ periods.

Table 3 shows that inclusion of end period error corrections creates estimation variance inefficiencies over all time horizons and all degrees of target accuracy - relative to the variance of the unadjusted sample earnings estimates. The inclusion of end period corrections causes reversals of volatility reduction into excess volatility. Even when targets accurately reflect LRE, target volatility still exceeds unadjusted earnings variance.

Lengthening the time horizon

This excess volatility grows dramatically over the number of periods in a time horizon. Even with small target errors, the 13.8 per cent increase in estimation variance for two periods rises to 22.6 per cent over four periods (Tables 3). More periods imply both additional (target-actual) adjustments to offset, and the increasing likelihood that targets will deviate from the evolving LREEPP; thus introducing another source of error. So the horizon end correction becomes progressively larger due to increasing target error and accumulated adjustments error (unadjusted to target) 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).

Increased Target Error

The excess volatility may be intensified by the likelihood of target estimation errors due to a manager's lack of knowledge about future cost and revenue parameter values, future activity levels and expectations about LREEPP values. Managers' targets are likely to over- or under- shooting LREEPP; especially where short-term considerations are their main focus. 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. As error increases so does the resultant excess volatility. Table three shows that a target inaccuracy of five percent over a six period horizon results increases benchmark variance by 154.28 percent. At 20 percent target inaccuracy this inefficiency is 4.2553 times the unadjusted earnings variance.

A conjunction of increasing target error and time horizon periods compounds both effects (Table3 and Figure 3) and 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. Over 10 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 LREE. They hide the cumulative error introduced by target error and adjustment error. The sixth and tenth periods respectively would see a dramatic adjustment in reported earnings as managers offset these cumulative target errors.

Of course, managers may minimize offset effects by backing it out gradually over time. 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.

Sets 3 and 4 - Systematic Smoothing Bench-mark

Corporate earnings streams contain a degree of systematic, time averaging in cost and revenue streams; that is, the systematic allocation of costs and revenues to successive periods according to a deterministic model. Accrual accounting principles mandate these systematic smoothing methods for the calculation of periodic earnings estimates Willett, (1991) and Hillier and McCrae, (1999) show that cost and revenue allocations through such time averaging techniques as depreciation, amortization, debt and goodwill provisions increase estimation efficiency of unadjusted earnings streams over a wide range of conditions, including time horizons, allocation methods and managers' knowledge states. So comparing ad hoc smoothing techniques against a systematically smoothed earnings benchmark is arguably more appropriate than an unadjusted earnings volatility benchmark.

Establishing the relative estimating efficiencies of the two alternative methods is also a worthwhile exercise from the perspectives of managers, shareholders, regulators and other stakeholders. The comparison permits a relative ranking of measurement efficiency of two systems on unambiguous, consistent and quantifiable measurement criteria.

Set 3 - No End Period Correction

The results in this set compare the variance of target-adjusted earnings with that of systematically smoothed earnings streams **excluding** any end period correction. The results are reported in Table 4 and Figure 4. The body of Table four is the same as for Table two, except that the benchmark is now the variance of systematically smoothed earnings.

The comparative results are remarkably similar as shown in Table five which shows the difference in variance reduction between the two benchmarks. Table five combines

Tables two and four. Tables five (and Table seven) compare that variance of target-adjusted earnings against an unadjusted earnings variance benchmark, with the same ratio against the systematically smoothed earnings variance benchmark. Negative cell numbers indicate that variance reductions (increases) of target-adjusted earnings against the unadjusted earnings variance benchmark variance are greater (smaller) than for the systematically smoothed earnings variance benchmark. Positive cell numbers indicate the reverse situation.

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 5). The comparison suggests that the sample earnings estimation efficiency gains from targeting are not greatly affected by the choice of benchmark earnings streams. 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 long run expected earnings at reasonable levels of target accuracy (up to 10% difference). In these cases, the starting benchmark variance is somewhat immaterial.

Set 4 - With End Period Correction

Set four results include end period corrections for any accumulated variance in previous periods. The variance reduction ratio values between target adjusted and systematically smoothed earnings are given in Table 6.

The body of table six shows the ratio values over lengthening time horizons and varying target accuracy levels. Figure six gives a visual representation of the results. The general pattern of results is similar to the unadjusted earnings benchmark case. The inclusion of the end period correction now creates statistically significant excess volatility (at the 5 percent confidence interval) rather than volatility reduction. The volatility increase is observed at all levels of target accuracy and across all time horizons. The strength and similarity of this outcome over the two volatility benchmarks implies that adjustment to target does not reduce the inherent volatility relative to unadjusted earnings estimates. The differences just accumulate over successive periods until correction in some 'final' period of the horizon (Tables 6).

But the pattern is intensified for the systematically smoothed benchmark case. Increases in excess volatility over identical horizons and target accuracy are significantly greater than for the unadjusted earnings benchmark. Table 7 compares the variance reductions under the two benchmarks (Table three with Table six). Negative cell numbers again indicate that variance increases for of target-adjusted against smoothed earnings are greater than for the unadjusted earnings variance benchmark. Positive cell numbers indicate the reverse situation.

The differences are highly significant at the 5 per cent confidence interval. Even a two period time horizon with relatively accurate targets (110% of LREEPP) gives a 20% absolute difference in SEVRR.

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 less accurate target levels (160% to 180% of LREEPP) and longer time horizons (8 to 10 periods) the differences become increasingly larger. For these longer horizons, the excess volatility against the systematically smoothed earnings benchmark from 24 percent to 80 percent larger than the excess volatility against the unadjusted earnings benchmark (Table 7).

Results Summary

To summarise, when reported periodic earnings are treated as sample estimates of long run expected earnings per period, managers can apparently use earnings targets to reduce the volatility of unadjusted earnings estimates. This variance reduction can be both dramatic and fairly robust to target error of up to 10-5 percent. The reduction increases with additional reporting periods. However, the volatility reduction may be more apparent than real since it assumes either (i) that successive target adjustments are offsetting or (ii) that managers can hide the implied correction needed to offset accumulating differences over successive periods. When managers are forced to disclose an end period correction, the smoothing results are dramatically reversed. Earnings estimates are now more volatile. This excess volatility is sensitive both to target error and to lengthening time horizons.

A broadly similar pattern emerges when the benchmark for volatility reduction is changed to the variance of systematically smoothed earnings. As long as the end period correction is excluded, the volatilities of reported earnings estimates appear to reduce substantially. The reductions have low sensitivity to target error, up to 10-15 percent of LREEP. Volatility reduction increases with time. The inclusion of end period corrections for accumulated (target-actual earnings) errors also results in excess volatility.

But here the similarities end. The comparison between the two benchmarks in Table seven illustrates the dramatic change. Excess volatilities are significantly larger than for the unadjusted earnings benchmark at all time horizons and target inaccuracy levels. They are also more sensitive to target error size and time horizon length. The result is significant since, under accrual accounting principles, systematically smoothed earnings and profit streams are required procedures in corporate financial performance estimation and reporting. Earnings estimation on accrual accounting principles appears particularly susceptible to the adverse effects of ad hoc or opportunistic methods of smoothing income streams.

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 performance indicators.

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.

The results show that managers can substantially lower the variances of successive reported earnings figures (relative to unadjusted figures) if they set earnings targets, adjust actual earnings to these targets and ignore any accumulating errors. 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 continually set targets that differ substantially from the expected sustainable earnings (e.g. over 20 per cent error), then the estimation variance quickly exceeds the variance of unadjusted estimates in a non-linear fashion. This excess is magnified when LRE follows a growth (decline) rather than a constant path over successive reporting periods. Such large or persistent levels of target inaccuracy may motivate managers to redress the imbalance, since at significant levels of error, the speed of volatility increase relates to error size. Errors can quickly accumulate out of control.

In a recent study, Ioannidis, Peel and Reel (2003) also propose the potential non-linearity of corporate target ratio adjustment to error size. Drawing on the time series properties of financial ratios work by Tippet (1990), Tippet and Whittington (1995) and Whittington and Tippet, (1999), they suggest that the rate of adjustment of ratios to their optimal value is an increasing function of deviation from target. Within a range of small error, managers may refrain from target adjustment, but outside a certain error range they may become increasingly concerned with the size of potential error adjustments and take more dramatic and speedier remedial action as discrepancies grow larger (p. 701).

The inclusion of a terminal period correction for any accumulated errors creates a different situation. 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 expected LREEPP become less accurate and as target setting errors increase relative to the expected LREEPP.

Our results have direct implications for future regulation of accounting earnings reporting. They show that such ad hoc practices as setting periodic earnings targets and then using accounting choices to artificially attain those targets can give the illusion of stable income streams by shifting the earnings volatility into subsequent reporting periods. The real underlying volatility is kept hidden by simply delaying the correction of the accumulating target to actual earnings errors until some regulatory or circumstantial factor forces disclosure. At this point, shareholders and other external stakeholders suddenly discover the accumulated earnings volatility from previous periods.

Several national corporate and accounting regulators 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 as Vinciguerra, & O'Reilly-Allen (2004) emphasise, the difficulty is the separation of earnings management practices that fall within accepted corporate practice from those that are considered 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.

We have limited discussion of opportunistic or 'add hoc' earnings smoothing techniques to pre-setting targets because of its wide acceptance 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 need to consider the implications of a statistical estimation approach to accounting numbers for detection of deceptive reporting practices in relation to performance indicators. For instance, knowing that income smoothing is a widely used corporate reporting practice is one thing, being able to tell when such manipulation of periodic results has occurred is quite another. There is still relative little work on the statistical properties of accounting earnings time series that might assist in identifying such situations.

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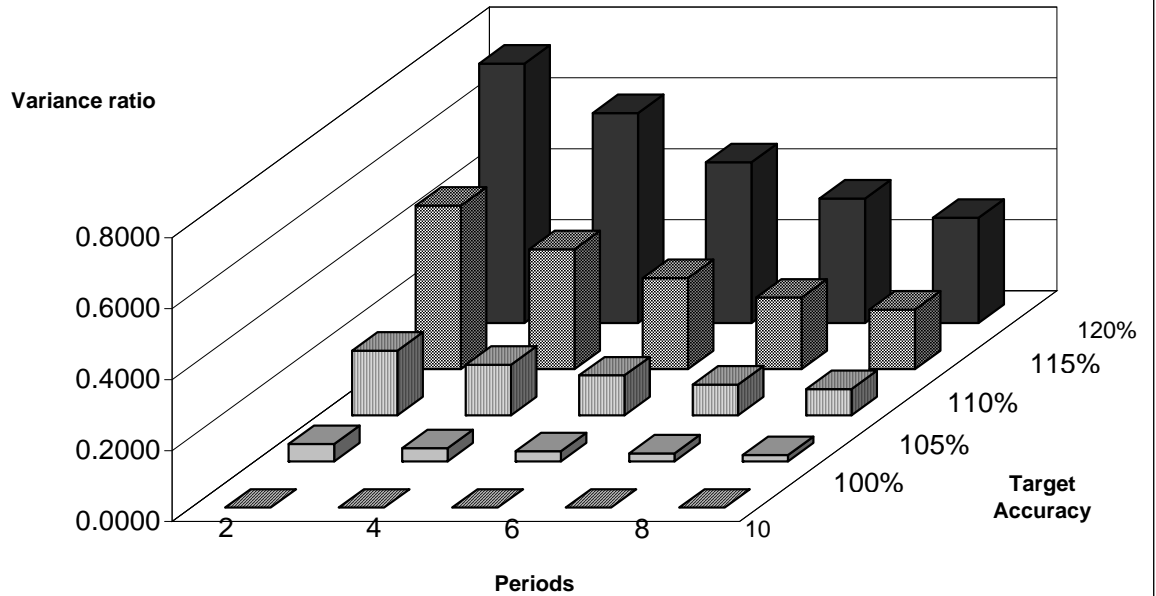
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Table 1 Variance ratio trial accuracy: Target adjusted/unadjusted Earnings variance differences for two extreme values in a ten trial series (with end period correction)										
Extreme	Periods									
Trials	2 Pds		4Pds		6Pds		8Pds		10Pds	
	Var	VarDiff	Var	VarDiff	Var	VarDiff	Var	VarDiff	Var	VarDiff.
4	1.1		1.238		1.432		1.492		1.604	
8	1.176	0.076	1.215	0.023	1.407	0.025	1.438	0.055	1.639	0.034
Average		0.066*		0.019*		0.017*		0.037*		0.0212*
* represent average difference over ten trials										

Table 2
Variance Reduction Ratios: Target Adjusted/Unadjusted Earnings
Increasing time horizons, Decreasing target accuracy for LREEP
(without end period correction)

Periods in Horizon	Target Accuracy in Estimating LREEP						
	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
Variance Reduction Ratios: Target Adjusted/Unadjusted Earnings
Increasing time horizons, Decreasing target accuracy for LREEP
(without end period correction)



<p align="center">Table 3 Variance Reduction Ratio: Target Adjusted/Unadjusted Earnings Increasing time horizons, Decreasing target accuracy for LREPP (with end period correction)</p>							
Periods in Horizon	% LREPP						
	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

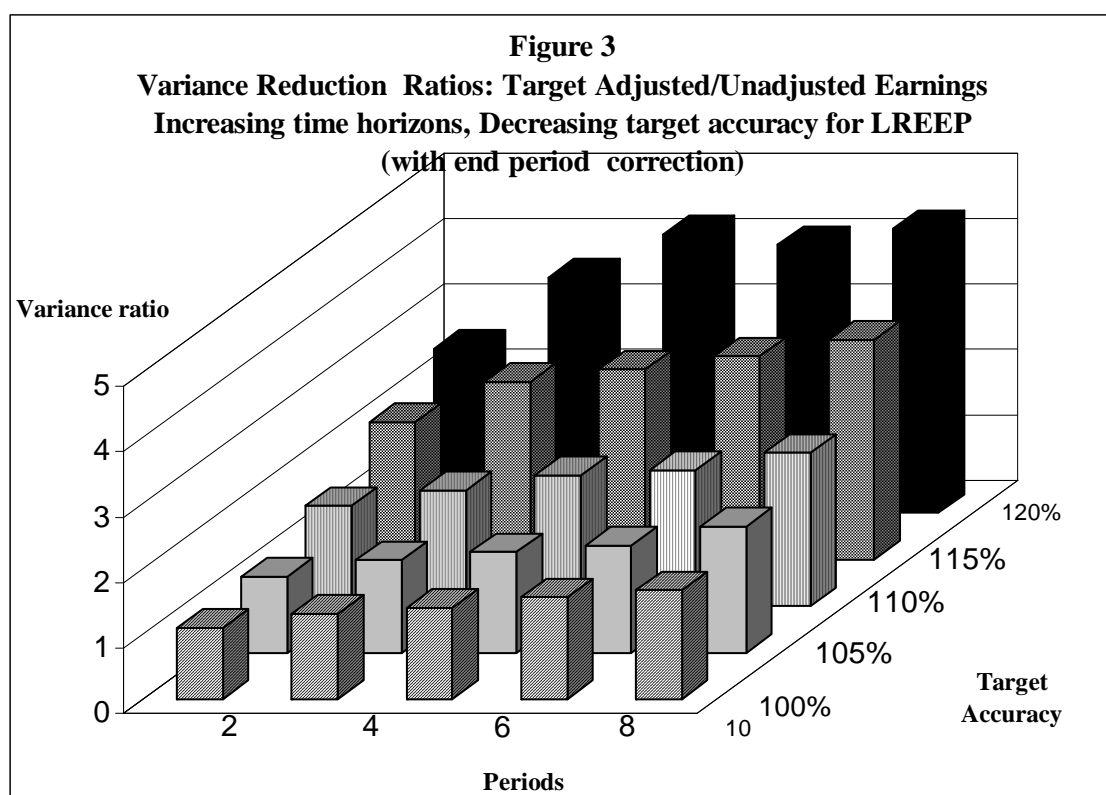


Table 4 Variance Reduction Ratio:Target Adjusted/Smoothed Earnings RVP Expectation State Increasing periods, decreasing target accuracy for LREPP (without end period correction)							
Periods In Horizon	%LREPP						
	1.0000	1.05%	1.10%	1.15%	120%	140%	160%
2	0.0000	0.0527	0.1947	0.4634	0.7771	3.3455	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

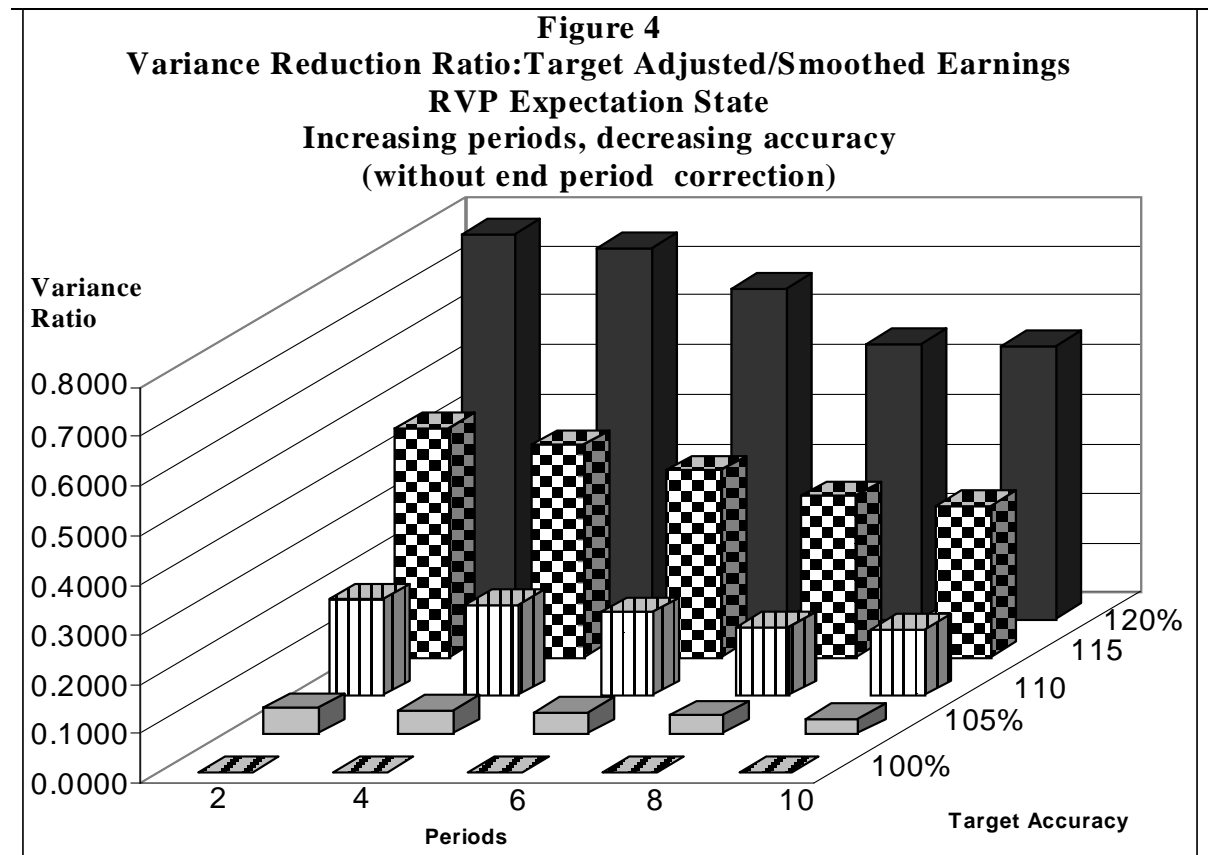


Table 5 Difference in Variance Reduction Ratios for two Benchmarks - Unadjusted & Smoothed Earnings (Table 2 v. Table 4) Target Adjusted/Unadjusted Ratios versus Target-Adjusted/Smoothed Earnings Ratios (without end period correction)				
%LREEPP				
1.00%	1.10%	120%	140%	160%
Average Difference	Average Difference	Average Difference	Average Difference	Average Difference
-0.0035	-0.0122	-0.0458	-0.2674	-0.7349
-0.0096	-0.0403	-0.1574	-0.5356	-1.6705
-0.0128	-0.056	-0.2152	-0.935	-1.9912
-0.0133	-0.0514	-0.2033	-0.8453	-2.0212
-0.0131	-0.0597	-0.2553	-1.0581	-2.0715

Table 6

Variance Reduction Ratio: Target Adjusted/Smoothed Earnings

Increasing Periods, Decreasing target Accuracy for LREEP
(with end period correction)

Periods in Horizon	% LREEPP						
	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 6

Variance Reduction Ratio: Target Adjusted/Smoothed Earnings

Increasing periods, Decreasing target Accuracy for LREEP

(with end period correction)

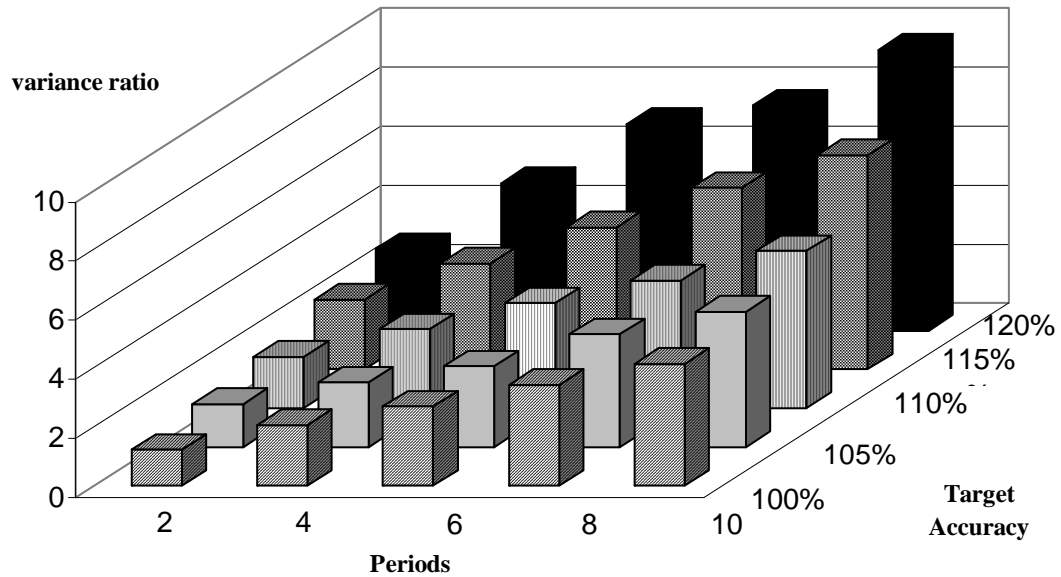


Table 7 Difference in Variance Reduction Ratios for two Benchmarks - Unadjusted & Smoothed Earnings (Table 3 v. Table 6) Target Adjusted/Unadjusted Ratios versus Target-Adjusted/Smoothed Earnings Ratios (with end period correction)					
Periods	%LREEPP				
	1.00%	1.10%	120%	140%	160%
	Average Difference	Average Difference	Average Difference	Average Difference	Average Difference
2	-0.1252	-0.2	-0.25	-0.693	-1.6158
4	-0.7536	-0.9	-1.38	-2.783	-7.1356
6	-1.2866	-1.56	-2.74	-6.508	-13.1693
8	-1.8619	-2.25	-3.51	-8.65	-18.2881
10	-2.4582	-2.97	-5.16	-13.84	-23.2131