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Mean reversion in profitability for non-listed firms

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Mean Reversion in Profitability for Non-listed Firms*

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Abstract

The presence of mean reversion in profitability at the firm level is important for valuation and prediction of growth and earnings. We investigate the mean reversion in accounting profitability for Norwegian non-listed firms for the period 1988-2006. We find a mean reversion rate of about 0.44. This is higher than found in other studies. We also find that small firms have a higher mean reversion rate than large firms. Previously, price-to-book ratios have been used to investigate changes in profitability over time for listed firms. We examine bankruptcy risk as an alternative variable for unlisted firms. We find that bankruptcy risk may help explain changes in profitability, but the results are not as strong as found in previous work.

JEL Codes: G10, G30

Keywords: Non-listed firms, profitability, mean reversion

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1 Introduction

In economics it is generally assumed that profitability is mean reverting. The justification for mean reversion is that competitive forces will cause a correction of especially high or low profitability over time. Firms with high profitability will meet strong competition from new entrants and from existing firms copying their business models. This will lead to a downwards pressure on profitability in the next period. Similarly, firms with low profitability may take actions to improve their situation. They may also close down, either voluntarily or through bankruptcy, or be taken over by other firms. This will contribute to an improvement for the remaining firms. Firms with low profitability that survive the next period may therefore be expected to improve their profitability.

Mean reversion in profitability may be studied at the firm, industry, or country level. Depending on the level of analysis, the speed of mean reversion is therefore of interest to policy makers and others concerned with competition. We are concerned with mean reversion in profitability at the firm level. Expected future profitability, or earnings, enters most valuation models. Mean reversion is therefore important for valuation and decision making at the firm level. We use a large sample of financial reports for Norwegian non-listed firms for the time period 1988-2006. Non-listed firms have no market values and no available analysts' earnings forecasts. Thus, earnings projections for these firms are crucial for firm valuation. Our results should therefore be of particular interest to private equity investors and other analysts of non-listed firms.

Our paper is related to the large body of literature on the relation between financial statements and capital markets. A comprehensive survey of this literature is provided by Kothari (2001). Studies that deal with prediction of accounting-based firm performance mostly look at other performance measures than profitability, such as earnings, cash flow, or sales. In addition to firm valuation, the main research questions are whether markets are efficient and whether information in accounting reports is useful to market participants. Early contributions to the literature are Beaver (1970) and Ball and Brown (1968) who use event studies to investigate market reactions to earnings announcements. Models of the time-series properties of earnings and cash flows serve an important role as input in many types of analysis. Estimates of expected earnings is needed to isolate surprise components of earnings from anticipated components, and managers' accounting procedure choices are evaluated against estimates of "normal" earnings. Besides, many studies test for market efficiency by using the time-series properties of earnings

to predict security returns.

Studies of the time series behavior of earnings largely conclude that the annual accounting income follow a random walk or a process similar to a submartingale (a random walk with drift), see for example Ball and Watts (1972).[1] Over time, the time series models have been challenged by the widespread availability of analysts forecasts. Studies of earnings predictability that focus on the difference in accuracy between security analysts forecasts and the forecasts produced by time series models largely conclude that long-term growth rate forecasts provided by security analysts outperforms those made by other models.[2]

As noted by Kothari (2001), the random walk property of annual earnings is puzzling and not predicted by economic theory. In contrast, economic theory do suggest that both profitability and earnings should be mean reverting.[3] Early studies that document mean reversion in the time series of earnings include Lipe and Kormendi (1994) and Ramakrishnan and Thomas (1992). Our work is based on the cross-sectional estimation approach introduced to this literature by Fama and French (2000). Fama and French argue that much of the literature presented about predictability of earnings (and to a lesser degree profitability) is difficult to judge for three reasons. First, formal tests are seldom provided. Second, if tests are provided, they are often applied to time series of individual firms. Third, cross section regressions of changes in profitability and earnings seldom correct for correlation among firms. Fama and French (2000) perform an estimate of mean reversion of profitability along the lines of Fama and MacBeth (1973). They perform yearly regressions of mean reversion rates and base their inference on the average of the yearly estimates.

If capital is flowing to profitable firms and retracting from unprofitable firms and if the risk premium for capital investments is the same across different firms, one would expect firms' profitabilities to revert toward the same mean. Thus, for moderate differences in risk premiums the expected future level of profitability should be approximately the same for all firms, provided that the prediction horizon is sufficiently long. Obviously, monopolies, state controlled firms, or heavily regulated firms may have different long term levels of profitability than firms in more competitive environments. If mean reversion is mainly due to other factors than competition in product markets (accounting conservatism, litigation risk, income smoothing or tax planning),

[1] For a survey of this literature, see Brown (1993).

[2] For a comprehensive list of references to this body of the literature, see Rozeff (1983).

[3] There are also several statistical reasons to believe that earnings are mean reverting. Acknowledgment of bad news more quickly than good news (for reasons of accounting conservatism or litigation risk) will induce negative autocorrelation in earnings. The option to liquidate the firm if the future looks bad can together with survivorship bias also induce mean reversion in the time series of earnings, see Kothari (2001).

it is difficult to argue that the mean should be approximately the same for all firms. The level of achievable profitability in the short run may deviate from the long run average (mean). This may be a potential problem when analyzing short term changes in profitability. Firm profits revert in the short run to the short run average which again reverts to the long run average over time. The mean reversion rate may also vary between firms. We would, for instance, expect that size is important for the reversion rate. Smaller firms are probably more flexible than larger firms. We would therefore expect that small firms have higher rates of reversion than large firms.

Fama and French (2000) argue that predictability in earnings may be explained by the predictability and mean reversion in profitability. If this is the case, we suspect that this phenomenon should also apply to other performance measures such as operating income or sales. The relationship between mean reversion in profitability and the predictability of performance measures such as earnings, operating income, or sales, may help explain why it is difficult for firms to outperform other firms according to these measures for long periods of time. Chan et al. (2003) find that very few firms have consistently above median growth in sales or earnings. We have in related work, not reported here, also found that the number of growth winners were fewer than one would expect if growth were determined by pure chance (a random walk).

Several modeling approaches have been used to study mean reversion in profitability. In a first-order autoregressive model (AR(1)) the yearly change is a function of the previous year's deviation from a constant long run mean. Fama and French (2000) model yearly changes in profitability as a function of the previous year's deviation in profitability from a firm-specific time-dependent expected return level for US-listed firms for the years 1964-1996. They find a mean reversion rate of 38 percent. Allen and Salim (2005) use the same approach for listed UK-firms during the period 1982-2000 and find a rate of mean reversion of 25 percent. Both Fama and French and Allen and Salim focus on the mean reversion rate and not on the long run average of profitability. We use both an AR(1) specification and a specification where the deviation is measured relative to a firm-specific time-varying profit level.

Our contribution is to examine the presence and the level of mean reversion in asset return for non-listed firms. Our analysis is important for two reasons. First, earnings projections are crucial for the valuation of non-listed firms. Second, since non-listed firms face different challenges than listed firms with respect to governance structures as well as financing, it is not obvious that evidence from studies of listed firms automatically carry over to non-listed firms. Both Fama and French (2000) and Allen and Salim (2005) use firms' market capitalization

as an explanatory variable when they estimate firms' profitability deviations. We introduce bankruptcy risk instead of market capitalization as an explanatory variable when modeling dynamic adjustments in profitability for non-listed firms. As far as we know, ours is the first paper to do this. We estimate the bankruptcy risk for each firm based on the non-profitability variables in Altman (1968). We find that the bankruptcy probability helps explain firms' expected profitability level and subsequently in the dynamic equations determining firms' changes in profitability. Bankruptcy risk does, however, seem to be less successful when explaining dynamic adjustments at the firm level than market capitalization. While market capitalization reflects market participants' expectations about future earnings, bankruptcy risk only reflect firms' likelihood of going bankrupt based on the firms' financial ratios. We find that on average the yearly rate of mean reversion is about 44 percent. This is higher than the documented mean reversion for listed firms in the US and UK. Large firms have a slightly lower mean reversion rate and small firms have a slightly higher rate of mean reversion.

The paper is organized as follows. Section two presents the data. In section three we present the results from the regression analysis. We analyse the relationship between profitability and investment activity in section four and we conclude in the final section.

2 The data

Our data sample consists of financial reports for Norwegian joint-stock companies over the 19 years from 1988 to 2006. The data is provided by Norges Bank and D&B[4].

Figure 1 provides some main indicators for the Norwegian economy during the sample period. GDP growth was on average 2.8 percent and varied from -0.2 percent in 1988 to 5.4 percent in 1997. During the first years of the sample period, Norway experienced a serious banking crises. The crisis peaked in the autumn of 1991. The years 1988-1991 coincided with the deepest recession in Norway after World War II. The crisis was effectively over by late 1993[5]. After 1991, inflation rates have been close to the current 2.5 percent inflation target in most years. Norway is a large exporter of oil and gas. During the last years of the sample period, there was a strong boom in the Norwegian economy, partly driven by a doubling of the oil price.

[Figure 1 about here.]

[4]Earlier Dun & Bradstreet The accounts are similar to those reported to The Register of Company Accounts, see www.brreg.no/english/registers/accounts. We also have information about each company's classification according to EU's standard industry classification system (NACE Rev.1.1). NACE: Moneclature statistique des activis conomiques dans la Communat Europenne

[5]See Moe et al. (2004).

2.1 Filter rules

The data sample consists of annual unconsolidated financial statements for Norwegian joint-stock companies. To avoid noise in our estimations from a large number of very small firms, we exclude:

- Firms with asset size below NOK 1 million
- Firms with values below the 2.5 percentile or above the 97.5 percentile for variables used when performing empirical analysis in section three. These variables are Sales/Total assets, Working capital/Total assets, Retained earnings/Total assets, Equity ratio, and Dividends/Total assets.
- Firms failing a logical test for the balance sheets (total assets identical to the sum of equity and liabilities)[6]

After we have estimated bankruptcy probabilities for the firms we also exclude firms with equity less than NOK 200 000[7] We also exclude firms belonging to heavily regulated industries (finance, public administration, health, education, and international organisations[8].

Parts of our regression analysis include dividend variables and default probabilities. Several changes in the tax system during the sample period are likely to have affected firms' dividend policies. Moreover, both dividends and default probabilities were marked by the banking crises during the first years of the sample period. We therefore restrict some parts of our analysis to the years 1993-2004. For more details on tax and accounting issues, see the Appendix.

2.2 Descriptive statistics

Table 1 describes the industrial structure as measured by the number of firms within different industry groups. Most firms are concentrated in Domestic trade, repair of goods sector which includes all companies within wholesale and retail trade[9], Real estate and business activities (includes commercial services)[10], Manufacturing, and Construction. The relative number of companies in the different industry groups has been fairly stable over the sample period. The

[6]We included the companies if the discrepancy was not larger than NOK 10 000.

[7]The reasone why we exclude firms only after the estimation of bankruptcy probabilities is that we want to keep many observations of bankruptcies in the sample. Firms with low levels of equity have typically a high bankruptcy risk.

[8]NACE codes 64, 65, 66, 84, 85, 86, 87, 88 and 99.

[9]The sector also includes repair of motor vehicles, motorcycles and personal and household goods.

[10]The Real estate and business activities sector includes real estate activities, renting of machinery, equipment, personal goods, and household goods, computers and related activities, research and development, and different business activities (legal, accounting, book keeping activities, tax consultancy, market research.etc).

number of non-listed firms have more than tripled during the sample period from about 15 500 in 1988 to 58 600 in 2006.

[Table 1 about here.]

We study mean reversion in return on assets (ROA), where return on assets is defined as net income before extraordinary items, but after taxes relative to year-end total assets. Descriptive statistics for ROA over the years 1988-2006 are reported in Table 2. After the end of the banking crises in 1993, median ROA has been quite stable around $8-10$ percent. The variation in ROA has increased somewhat over the sample period.

Table 3 shows descriptive statistics for a selection of financial items and ratios. The ratios are defined in Table 4. The typical firm is quite small (5.3 mill NOK), however, the much higher mean of 44.9 mill NOK tells us that there are also some large firms in the sample. The mean and median Equity/Debt ratio is around 0.56 and 0.34 respectively, and the typical firm with positive dividends paid had a ratio of Dividends/Total assets of around 5 percent. Many firms, however, do not pay dividends. The number of firms that did not pay dividend in a given year was on average about 73 percent.

[Table 2 about here.]

[Table 3 about here.]

[Table 4 about here.]

3 Empirical analysis

3.1 Modeling approach

We estimate two different specifications of mean reversion; one where we follow the approach in Fama and French (2000) and measure deviations in profitability relative to a firm-specific time-varying profit level, and one first-order autoregressive model where mean reversion is to a constant long-term level. This latter model has been widely used to model mean reversion in the real-options literature and we use the model suggested on pages 76-77 in Dixit and Pindyck (1994).

Fama and French (2000) consider a model where a firm's deviation in profitability at time t, DEV_t, influences the expected change in profitability to time $t+1$ (we drop the subscript

referring to specific firms in order to ease notation). The deviation is measured relative to a firm- and time-specific profitability level, i.e., $DEV_t = ROA_t - E_t(ROA_t)$, where ROA_t is the return on assets and $E_t(ROA_t)$ is what we would expected the return for the firm to be at time t when taking into account the return achieved by other firms and the firm's characteristics. If the firm's expected profit in year t is equal to the average profit in the sample, then the reversion would be to the sample mean. If, on the other hand, the firm has a higher expected return than the sample mean, the deviation is lower than for the average firm. The regression equation for the change in profitability for a firm is

$$\Delta ROA_{t+1} = \beta_0 + \beta_1 DEV_t + \beta_2 \Delta ROA_t + \epsilon_{t+1} \ , \tag{1}$$

where ΔROA_{t+1} is the change in profitability from time t to $t+1$ and ϵ_{t+1} is the error term. The lagged change in asset return is included to account for possible autocorrelation over time. The firm- and time-specific level of profitability $E_t(ROA_t)$ is estimated in the cross section by the regression equation

$$ROA_t = \gamma_0 + \gamma_1 Div_t/A_t + \gamma_2 I_{Div,t} + \gamma_3 PB_t + u_t, \tag{2}$$

where the explanatory variables are dividend yield (dividends Div_t to be paid the following year over assets A_t), an indicator variable ($I_{Div,t}$) equalling one if dividend is *not* allocated for the following year, PB_t is the firm's estimated bankruptcy probability at time t, and u_t is an error term. For listed firms, models of dynamic adjustments in profitability naturally include firms' market values as an explanatory variable. This is not possible for non-listed firms, and we therefore introduce bankruptcy risk as an alternative variable. Bankruptcy risk does not provide information about investors' perceptions of the level and risk of future cash flows, however, by reflecting firms' likelihood of going bankrupt, bankruptcy risk does provide some relevant information about profitability.

In the second specification we estimate the AR(1) model

$$\Delta ROA_{t+1} = a + bROA_t + \nu_{t+1} \ , \tag{3}$$

where a and b are coefficients and ν_{t+1} is the error term. Note that (1) is identical to (3) if $\beta_2 = 0$ and if the deviation is measured relative to a constant.

In order to estimate the coefficients in (1) we first estimate firms' bankruptcy probabilities.

We then estimate firms expected return in the cross section according to (2). We follow the approach of Fama and French (2000) and Allen and Salim (2005) and estimate by OLS the coefficients in the cross section separately for every year in the sample. We then take the average of the yearly coefficient estimates as our estimate for the coefficient values. The standard errors for the time-series of estimated coefficients are used to draw inferences about the mean of the yearly estimated coefficients. As noted by Fama and French, an advantage with this approach is that possible cross-correlation between firm residuals are reflected in the yearly coefficient estimates and thereby also in the standard deviation of the mean of the yearly coefficients. Serial correlation between the yearly coefficient estimates may influence the inference about the time-series mean. Fama and French (2000) report high autocorrelation in the estimates and require higher t-values for the coefficients (2.8 instead of 2.0)[11] when making inferences. We follow the same approach. Another issue that may potentially influence the results is the use of model generated variables in (1) and (2). Both the bankruptcy probability PB_t and expected profitability $E_t(ROA_t)$ are estimated variables.[12] The fact that these variables are observed with errors may potentially influence the yearly estimated coefficients.[13] Measurement errors may induce a bias towards zero in parameter estimates, and this bias is larger the larger the measurement errors. One way of correcting for measurement errors is to use GMM estimators. Another method is to use information about the variance in the measurement errors. We follow, however, the approach of Fama and French and do not correct for errors in variables. We are primarily interested in estimating the rate of mean reversion. We therefore report the coefficient estimates for two different specifications of (1) together with the coefficient estimates from (3), which does not contain any model generated variables. We then compare the mean reversion rates for the different model specifications.

3.2 Bankruptcy risk

The total number of bankrupt firms with at least one matched financial report in the filtered sample is approximately 11 800 for the years 1991-2006. The majority of the bankrupt firms delivered their last financial report two years before the bankruptcy year (approximately 46 percent). Approximately 20 percent of the bankrupt firms delivered their last financial report the year prior to the bankruptcy year. The remaining bankrupt firms, approximately 34 percent,

[11] For an explanation of this approach, see, e.g., pages 420-422 in Greene (1993).

[12] Note that the error u_t is equal to the firm- and time-specific deviation in (1).

[13] For a general description of the error-in-variables problem, see, e.g., pages 279-287 in Greene (1993). For a discussion of the issue of error-in-variables problem related to Fama and MacBeth (1973), see, e.g., Shanken (1992).

delivered their last financial statements more than two years before the bankruptcy year. We define bankruptcy as the event that the firm is registered as bankrupt in any year during the three years following the year when the prediction is made. We consider the variables in the well known Z-score model of Altman (1968). These variables are asset turnover AT, working capital $WCAP$, return on assets ROA, retained earnings RE, and the equity ratio EQ.[14]. In addition we use a size variable $SIZE$. The variables are defined in Table 4. Descriptive statistics for the Altman variables are provided in Table 3.

Table 5 shows the result of the logit regressions. We start by using the five original Altman-variables. The signs are negative for all variables except for asset turnover AT, meaning that an increase in numerical value of the variable reduces the bankruptcy probability. In the second specification we add the size variable. The coefficient is negative meaning that large firms have lower bankruptcy risk than small firms. When size is included the sign of asset turnover AT becomes negative. Since we want to use the estimated bankruptcy probabilities to estimate expected profitability in the cross section, it is necessary to exclude profitability from the regressions. The models in the three right-hand columns in Table 5 do therefore not include profitability. The exclusion of ROA does not change very much the coefficients for the other variables. When we include indicator variables for industries we see that bankruptcy risk increases for firms in Manufacturing (I_4), Construction (I_6), and Domestic trade, repair of goods (I_7). Firms in Real estate, business activities (I_{10}) have lower bankruptcy risk. We use the model including indicator variables for industries to estimate expected profitability in (2).

[Table 5 about here.]

3.3 Expected profitability

We start by estimating (2) with and without bankruptcy risk (Model A and B respectively), see Table 6. We use three different samples in the estimation; all firms, small firms and large firms. Small (large) firms are defined as firms below (above) the median of total assets. Since changes in the tax system at the end of the sample period and the banking crisis at the beginning of the sample period are likely to have affected firms' dividend policies, we report results for an alternative 12 year period, 1993-2004.

Panel A shows that the signs of the coefficients for dividend yield, the dummy for non-payment of dividend, and the bankruptcy probability are as expected. The coefficient for

[14]In Altman's original model the market value of equity was used to compute the equity ratio.

dividend yield is positive at 0.72 with a t-value of 4.0. The indicator for non-payment of dividends is, however, not significantly different from zero. The coefficient for bankruptcy risk is -0.61 with a t-value of -2.1. The significance level for bankruptcy risk is higher for large firms (t-value of -3.5). For small firms, the bankruptcy risk is not significant. The explanatory power of Model A is 0.27, 0.30, and 0.22 for all firms, small firms, and large firms respectively. Models that do not include bankruptcy risk have a slightly lower R^2 than models where bankruptcy risk is included.

Models C and D are, respectively, Model A and B with added indicator variables equaling one if a firm belong to a specific industry. We include four industries: Manufacturing (I_4), Construction (I_6), Domestic trade, repair of goods (I_7), and Real estate, business activities (I_{10}). In general, industry sector does not explain much of firms' profitability. For small firms, the I_7 sector has a significant small negative effect on profitability.

Results from similar estimations for the whole period are reported in Panel B. As is evident from the table, the regression model fits the data much less for the full sample period.

We use the model with bankruptcy probability and industry dummies for all firms when estimating expected profitability $E_t(ROA_t)$ in the adjustment equation (1). We also tried to estimate expected profitability for large (small) firms separately when estimating the adjustment equation for large (small) firms. Interestingly, the fit for the adjustment equation is better when we estimate the deviation based on all firms in the cross section.

[Table 6 about here.]

[Table 7 about here.]

3.4 Change in profitability

Table 7 shows the estimated coefficients from the regressions of yearly changes in profitability. We consider four specifications. Model I is equal to (1). In Model II we have included both ROA_t and $E_t(ROA_t)$ as separate variables. Mean reversion, here expressed as a correction of deviation from expected return, implies that the coefficient for ROA_t is negative and the coefficient for $E_t(ROA_t)$ is positive. Fama and French argue that if $E_t(ROA_t)$ is well measured, then both coefficients should be close in absolute value. Model III is a model that includes only lagged change in profitability and Model IV is the first-order autoregressive model in 1. Panel A shows the estimated coefficients based on the years 1994-2004 and Panel B shows the result

when the whole sample period is used. Table 7 also shows the coefficients for small and large firms as measured by total assets.

Panel A shows that the mean reversion rate is 44 percent according to Model I. The reversion rate is 49 percent for small firms and 40 percent for large firms. The reversion rates are approximately the same when the whole sample period is used (Panel B). When expected profitability is included in the regression (Model II) we find that the coefficient for ROA_t is negative and the coefficient for $E_t(ROA_t)$ is positive, indicating mean reversion. The absolute values of the coefficients are, however, not close. The coefficients have the same signs when we split the sample according to size. In absolute values the coefficients are higher for small firms than for large firms. The reason why the coefficients for profitability and expected profitability are not close in absolute value may be that the estimated profitability level is not correctly measuring the level that profitability deviations should be measured against. Another reason may be that the model specification in (1) is not the proper one for non-listed firms during the sample period[15].

The standard first-order autoregressive model (model IV) performs reasonably well. The performance, as measured by the average R^2, is only a couple of percentage points below the average R^2 for the alternative models (models I and II). The rate of mean reversion is 0.48 when the estimation is made for all firms. The rate of mean reversion is highest for the small firms (0.52) and lowest for large firms (0.45). When the whole period is used (Panel B), the reversion rates are 1-2 percentage points higher.

[Table 8 about here.]

[Table 9 about here.]

4 Profitability and investment

If the documented mean reversion is due to capital flowing into profitable firms and retracting from unprofitable firms, we should see a relation between profitability and investment activity. This because the flow of capital to firms are likely to be used for financing investments.

Panel A in Figure 2 shows the fraction of the number of investing firms for different levels of profitability relative to the total number of investing firms. We consider a firm as having

[15]We estimated, but do not report, model (1) for Norwegian firms listed on the Oslo Stock Exchange for the sample period using market values instead of bankruptcy probabilities in (2). We did not get significant results, which may be due to too few firms in the cross-section. The difference in absolute value between the estimated coefficients were about 10 percentage points, which is lower than the difference we find for non-listed firms.

invested when total assets increase from one year to the next by at least 30 percent and we measure the profitability the year before the "investment year". As expected, the fraction is increasing with increasing profitability. The fraction of investing firms is below 0.5 when the profitability is equal to the mean. This means that the majority of investments are made by firms with above-mean profitability the previous year. The fraction of investing firms is quickly reduced at lower levels of profitability. Firms with a profitability of 3 or more percentage points below the mean constitute only 30 percent of all investing firms.

We would expect firms to invest when profitability is close to or above the mean. If the profitability of the investment is approximately the same as the profitability of firms' total assets in place, we would expect the net present value of the investment to be zero when firms' profitability is approximately equal to the mean. This because expected long turn average profitability should give the owners exactly the required profitability on their investment. The net present value should, accordingly be negative (positive) when profitability is below (above) the mean. If, however, the profitability of firms' investments are higher than the current profitability on assets, the "threshold" profitability giving zero net present value will be lower than the mean. We do, however, not se any sharp increase in the fraction of the firms that invest at the mean profitability level in Panel A. Panel B shows the change in the fraction of investing firms. We see that the top level is 1-2 percentage points below the mean when we use the mean for the whole sample period.

If one takes into account firms' possible options to delay the investment decision, we would expect that the profitability threshold making investing a better alternative than delaying the investment decision to be even higher than the mean profitability level. The fact that some firms may have options to delay the investment decisions while others do not, may be the reason why it does not seem to be a distinct threshold level of profitability triggering investment.

[Figure 2 about here.]

5 Conclusions

Economic theory predicts that firms operating in a competitive environment should have mean reverting profitability. In this paper we study the presence and the level of mean reversion in profitability for non-listed firms in Norway. The literature dealing with prediction of accounting-based firm performance is almost exclusively based on data for listed firms. Our main contribution is to extend the literature to the much larger universe of non-listed firms. Non-listed firms

account for a large portion of economic activity worldwide.

We document mean reversion in profitability for non-listed firms. On average, the yearly rate of mean reversion is about 44 percent. Large firms are shown to have a lower mean reversion rate than small firms, a result that could indicate that smaller firms are more flexible than larger firms. Mean reversion in profitability suggests a positive relation between profitability and investment activity. We find some evidence that the fraction of investing firms is indeed increasing with increasing profitability. Finally we find that the mean reversion rate for non-listed firms in Norway is higher than the mean reversion rate found for listed firms in the US and UK.

A Specific data issues

A.1 Consolidated versus unconsolidated statements

Consolidated statements are available for the years 1992-2006. The number of group accounts grew each year from 1992 to 1998. From 1999 and onwards, it was not mandatory to submit consolidated accounts for sub-groups.[16] In addition, it was no longer mandatory for companies defined as "small" to submit consolidated statements. The new rules made the number of group accounts drop from about 10200 in 1998 to 3200 in 1999. Since we don't have information about ownership or cross-ownership, we cannot select sub-samples based on this variable. In order to secure comparability over time we therefore focus on only unconsolidated accounts in our analysis.

A.2 Changes in legislation and accounting rules

Several events were important for financial reporting in Norway during the sample period:

The *1992 tax reform* The tax reform introduced a new method for reporting taxes. Before 1992, only taxes payable the following year were included in the profit- and loss statements. From 1992 and later the statement also included taxes payable beyond the following year ("deferred taxes"). Before 1992 the liability side of the balance sheet included untaxed reserves. When performing analysis on accounting data before the tax reform in 1992, it was customary to split these reserves between equity and debt according to the effective tax rate. This method is shown on, e.g., page 96 in Kinserdal (1983). With an effective tax rate s, a fraction s of the reserves was added to the company's debt and a fraction $1-s$ was added to equity. We use this approach (with s equal to 0.4) to amend equity and debt in the reports for the years 1988-1991.

The *1999 accounting reform* The accounting reform changed the specification requirements for the profit- and loss statement and the balance sheet. An important change was the reclassification of write-downs of fixed assets and intangible assets from being extraordinary costs to being operating costs. The reclassification makes it difficult to compare operating profit and profit before extraordinary items before and after 1999. We therefore amended the profit- and loss statements before 1999 by reclassifying write-downs as an operating cost and

[16] Consider the case where company A owns company B which owns company C. B and C are considered to be a sub-group, and B may make consolidated accounts for the group $(B+C)$. A will submit consolidated accounts for the group $A+B+C$.

by recomputing operating profit and profit before extraordinary items.[17]

The *2006 tax reform* The tax code was changed making dividends paid in 2006 or later taxable for non-corporate shareholders. This caused high payments of dividends before 2006 and very low payment of dividends in 2006. For a description of this reform, see Allstadsæter and Fjærli (2009).

[17]For a recent description of the Norwegian account law in English, we refer readers to Revisorforeningen (2007). An English translation of the law may also be found, e.g., on pages 315-351 in Kinserdal (2001).

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Figure 1: GDP growth, inflation and oil prices 1988-2006

The figure shows Norwegian GDP growth and inflation (left axis) as well as oil prices in US$ (right axis) over the period 1988-2006. GDP growth is calculated based on fixed 2000 prices. Oil prices are in fixed 2007 US$.

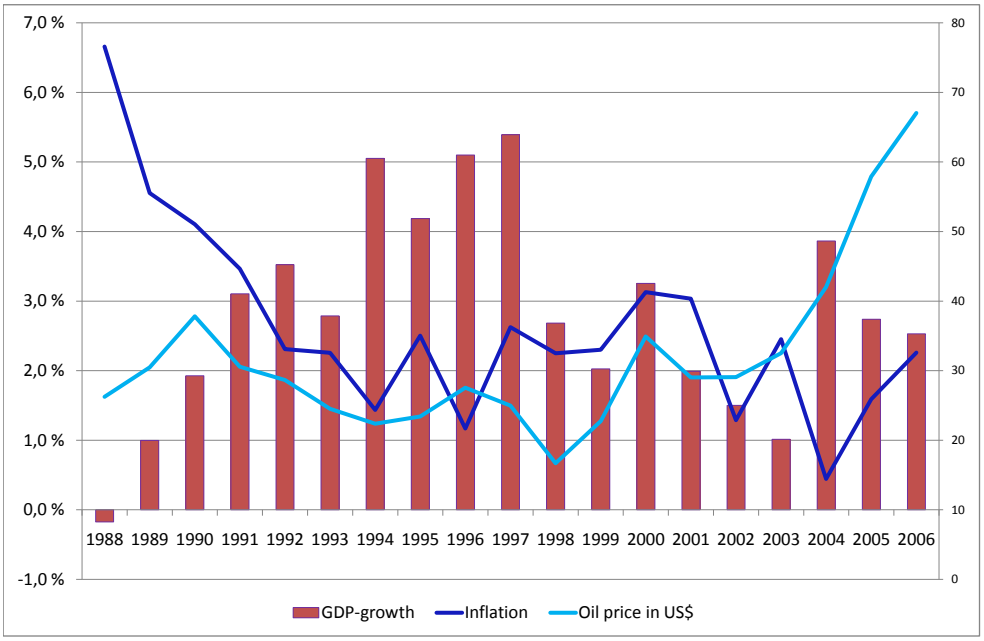
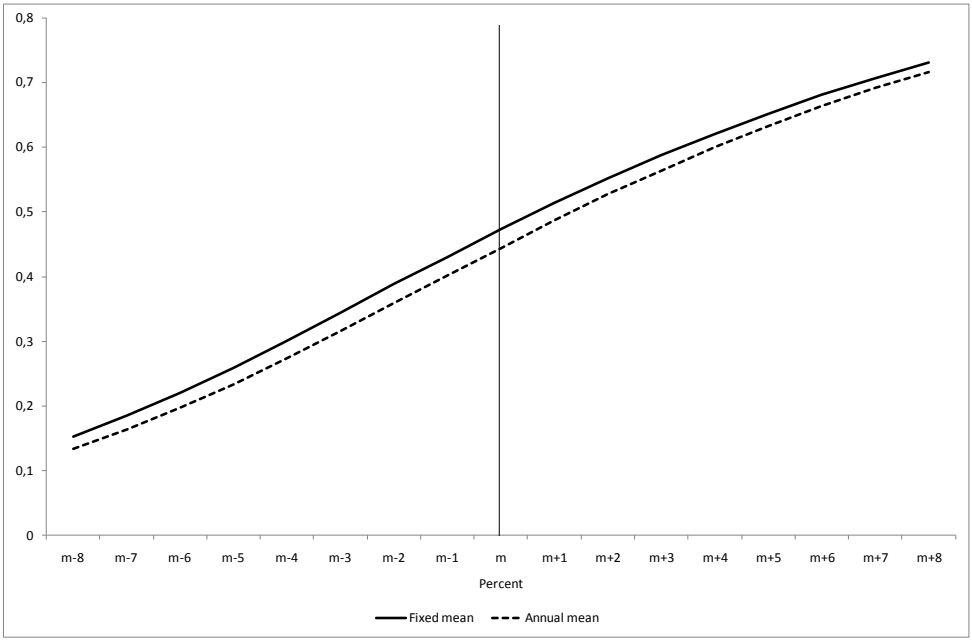


Figure 2: The relationship between profitability and investment 1988-2006

For every year t in the period 1988-2005 we count the number of firms N_t that increase total assets by at least 30 percent during the next year. N_t is a proxy for the number of firms that invest. We then count the number of investing firms dependent on their level of profitability in year t, $(N_t \mid ROA_t)$. Panel A reports the average of the fraction of investing firms, i.e., $(N_t \mid ROA_t)/N_t$, for different profitability levels. The profitability levels are normalized relative to the mean m. For example, $m-3$ means a profitability level equal to the mean less 3 percentage points. We measure investment fractions either relative to the yearly mean of profitability (the dotted line) or relative to the mean profitability for the years 1988-2005 (the solid line). Panel B reports the change in the fraction of investing firms, i.e., the "derivative" of the schedules in Panel A.

Panel A



Panel B

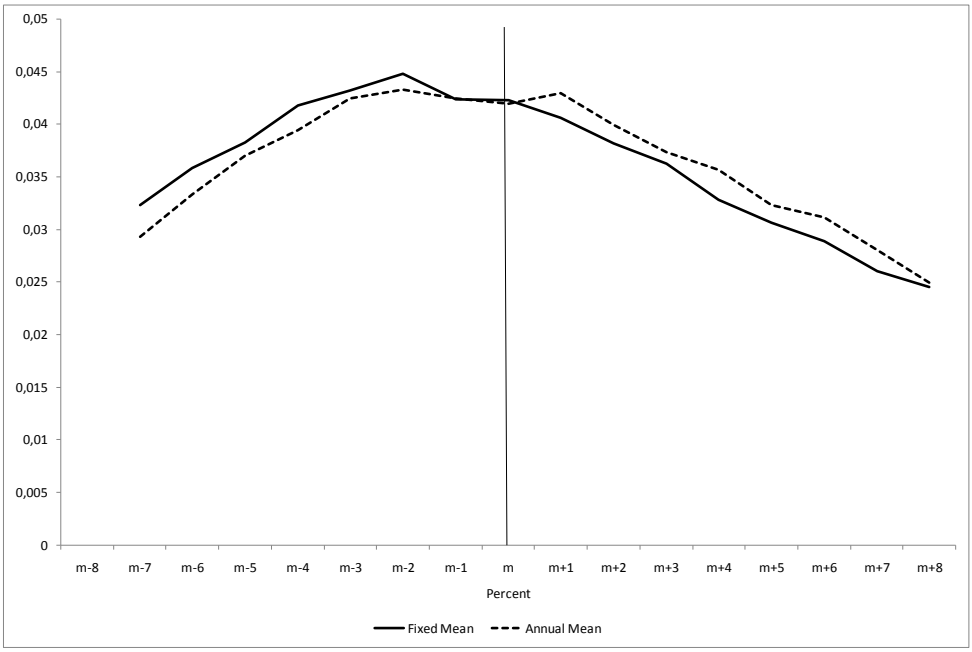


Table 1: Industrial structure

The table reports the number of companies within each industry group each year during the period 1988-2006. Industry groups are classified using the Standard Industrial Classification (SIC2002). The industry codes are:

1	Agriculture, hunting, and forestry	6	Construction
2	Fishing	7	Domestic trade, repair of goods
3	Oil and gas extraction, mining	8	Hotels and restaurants
4	Manufacturing	9	Transport and communication
5	Electricity, gas, and water supply	10	Real estate, business activities

Year	1	2	3	4	5	6	7	8	9	10	Sum
1988	62	292	183	2 791	43	1 369	5 035	281	841	4 603	15 500
1989	72	289	213	2 939	54	1 487	5 529	316	1 002	5 285	17 186
1990	98	318	246	3 348	70	1 644	6 785	418	1 279	6 067	20 273
1991	106	308	256	3 513	80	1 662	7 724	451	1 356	6 400	21 856
1992	114	388	235	3 688	81	1 820	8 454	517	1 486	6 887	23 670
1993	129	463	273	3 852	124	1 948	9 163	607	1 629	7 278	25 466
1994	147	559	275	4 035	124	2 264	9 842	679	1 754	7 753	27 432
1995	191	642	276	4 238	166	2 727	10 673	719	2 065	8 533	30 230
1996	204	672	274	4 533	178	3 228	11 883	819	2 267	9 697	33 755
1997	218	704	302	4 836	204	3 805	12 936	945	2 629	11 071	37 650
1998	251	755	319	5 037	240	4 155	13 514	1 062	2 734	12 063	40 130
1999	263	784	320	5 069	288	4 403	13 984	1 170	2 715	12 900	41 896
2000	295	759	315	5 249	288	4 719	14 505	1 283	2 877	13 907	44 197
2001	322	757	331	5 237	294	4 867	14 518	1 260	2 939	14 333	44 858
2002	313	726	330	5 127	298	4 828	14 518	1 307	2 974	14 264	44 685
2003	359	631	351	5 142	329	4 967	14 798	1 343	3 004	14 817	45 741
2004	368	697	370	5 233	364	5 240	14 949	1 367	3 097	15 920	47 605
2005	507	733	385	5 587	387	6 383	16 634	1 583	3 445	18 479	54 123
2006	579	769	415	5 701	429	7 287	17 264	1 721	3 677	20 846	58 688
Average	256	602	306	4 546	224	3 851	12 021	988	2 386	11 701	36 880
Percent	0.7	1.6	0.8	12.3	0.6	10.4	32.6	2.7	6.5	31.7	100.0

Table 2: Return on assets - Descriptive statistics 1988-2006

The table reports descriptive statistics (minimum, median, mean, standard deviation) for return on assets (ROA) for non-listed firms over the years 1988-2006. ROA is defined as net income before extraordinary items, but after taxes, relative to year-end total assets. We also report the number of companies (N).

Year	N	Mean	Median	Max	Min	Std
1988	14962	0.0790	0.0798	0.3075	-0.3324	0.0844
1989	16623	0.0742	0.0756	0.3137	-0.3167	0.0855
1990	19555	0.0757	0.0768	0.3271	-0.3589	0.0888
1991	21093	0.0869	0.0863	0.3503	-0.3359	0.0913
1992	22816	0.0954	0.0933	0.3774	-0.2727	0.0881
1993	24518	0.1005	0.0951	0.3731	-0.2379	0.0870
1994	26415	0.1051	0.0973	0.3827	-0.1995	0.0862
1995	29117	0.0994	0.0921	0.3754	-0.2252	0.0880
1996	32496	0.1012	0.0938	0.3883	-0.2591	0.0915
1997	36229	0.1088	0.0983	0.4250	-0.2594	0.0994
1998	38745	0.1067	0.0954	0.4367	-0.2959	0.1033
1999	40485	0.1065	0.0937	0.4464	-0.2904	0.1017
2000	42641	0.1011	0.0881	0.4574	-0.3323	0.1070
2001	43270	0.0984	0.0884	0.4279	-0.3526	0.1049
2002	43178	0.1047	0.0933	0.4538	-0.3340	0.1086
2003	44221	0.1043	0.0895	0.4706	-0.3103	0.1099
2004	45991	0.1154	0.0949	0.5141	-0.2730	0.1155
2005	52246	0.1231	0.0981	0.5219	-0.2696	0.1194
2006	56697	0.1232	0.1000	0.5107	-0.2520	0.1158
Mean	34 279	0.1005	0.0910	0.4137	-0.2899	0.0987
Median	36 229	0.1012	0.0933	0.4250	-0.2904	0.0994
Max	56 697	0.1232	0.1000	0.5219	-0.1995	0.1194
Min	14 962	0.0742	0.0756	0.3075	-0.3589	0.0844

Table 3: Descriptive statistics for selected financial items and ratios 1988-2006

The table reports descriptive statistics (mean, median, max, min, std) for the variables Total assets, Sales/ Total assets, Working Capital/Total assets, Dividends/Total assets, Equity/Debt, Retained earnings/Total assets over the years 1988-2006. [1)] Measured in Million NOK. [2)] Indicator variable equalling 1 in the case of dividends are *not* paid.

	Mean	Median	Max	Min	Std
Total assets[1)]	44.9	5.3	166,200.0	1.0	720.6
Sales/assets	1.8394	1.7082	7.2500	0.0697	1.3381
Working capital	0.1888	0.1652	0.7468	-0.4614	0.2206
Retained earnings	0.1643	0.1301	0.6429	-0.5549	0.1638
Equity ratio	0.5641	0.3353	4.2302	0.0002	0.6487
Dividend yield	0.0764	0.0546	0.4974	0.0000	0.0586
Indicator non-payment[2)]	0.7316	-	1	0	-

Table 4: Definitions

Working capital	(short term assets - short term debt)/ total assets
Retained earnings	(book equity - paid in equity)/ total assets
Return on assets	earnings before extraordinary items and interests after taxes / total assets
Equity ratio	book equity / debt
Dividend yield	dividends allocated for payment next year /total assets

Table 5: Estimated parameters for prediction of bankruptcy within 3 years

Logit estimation of bankruptcy within 3 years. The regression period is 1989-2000. The variables are asset turnover AT, working capital $WCAP$, retained earnings RE, profitability ROA, equity ratio EQ, and a size variable $SIZE$ (log of total assets). We exclude firms with values below the 2.5 percentile value or above the 97.5 percentile value for the variables AT, $WCAP$, RE, ROA, and EQ. The indicator variables for industry i is I_i. The industries are: Manufacturing (4), Construction (6), Domestic trade, repair of goods (7), and Real estate, business activities (10). Significance at the 1 and 5 percent level are marked by $**$ and $*$, respectively.

CONST	-2.833^{**}	-1.326^{**}	-2.996^{**}	-1.528^{**}	-1.611^{**}
	(-167.94)	(-18.02)	(-181.66)	(-20.78)	(-21.16)
AT	0.010	-0.029^{**}	0.006	-0.032^{**}	-0.088^{**}
	(1.77)	(-5.06)	(1.19)	(-5.55)	(-13.76)
$WCAP$	-0.552^{**}	-0.554^{**}	-0.691^{**}	-0.689^{**}	-0.821^{**}
	(-12.85)	(-12.98)	(-16.09)	(-16.16)	(-18.66)
RE	-2.345^{**}	-2.245^{**}	-3.082^{**}	-2.993^{**}	-2.944^{**}
	(-36.18)	(-34.26)	(-50.30)	(-48.31)	(-46.27)
ROA	-3.374^{**}	-3.368^{**}			
	(-44.39)	(-44.61)			
EQ	-1.541^{**}	-1.510^{**}	-1.482^{**}	-1.453^{**}	-1.421^{**}
	(-27.32)	(-26.64)	(-26.01)	(-25.34)	(-24.17)
$SIZE$		-0.170^{**}		-0.165^{**}	-0.142^{**}
		(-20.81)		(-20.28)	(-17.45)
I_4					0.411^{**}
					(14.21)
I_6					0.325^{**}
					(10.39)
I_7					0.129^{**}
					(4.89)
I_{10}					-0.741^{**}
					(-23.72)
N	496 735	496 735	496 735	496 735	496 735
Log likelihood	-59 459	-59 226	-60 455	-60 234	-59 334
LR	19 380	19 845	17 388	17 829	19 628
Prob	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.1401	0.1435	0.1257	0.1289	0.1419
AUROC	0.8071	0.8096	0.7986	0.8000	0.8097

Table 6: Regression to determine expected asset return

For every year an OLS regression of asset return $E_t(ROA_t)$ is made. The regression equation is

$$ROA_t = a + b_1 x_{1,t} + b_2 x_{2,t} ... + \epsilon_t,$$

where the explanatory variables x are dividend yield (dividends Div_t to be paid the following year over assets A_t), an indicator variable (I_{Div}) equalling one if dividend is not allocated for the following year, estimated probability of bankruptcy within the next 3 years (PB), and indicator variables I_k equalling one if the firm belong to industry k. The industries are: Manufacturing (4), Construction (6), Domestic trade, repair of goods (7), and Real estate, business activities (10). The reported coefficients are the mean of the coefficients for the year-by-year regressions. The t-value is given in parentheses.

Model	DIV/A	I_{Div}	PB	I_4	I_6	I_7	I_{10}	$CONST$	$\overline{R^2}$	$\overline{N}$
					Panel A: 1993-2004					
					All firms					
A	0.721	-0.005	-0.614					0.088	0.270	28 666
	(4.0)	(-0.6)	(-2.1)					(10.9)		
B	0.720	-0.008						0.079	0.259	28 666
	(3.6)	(-0.7)						(10.2)		
C	0.721	-0.004	-0.644	-0.004	0.002	-0.006	-0.004	0.092	0.272	28 666
	(4.0)	(-0.5)	(-2.0)	(-0.7)	(0.2)	(-1.0)	(-0.6)	(10.3)		
D	0.718	-0.008		-0.007	-0.002	-0.005	0.003	0.082	0.262	28 666
	(3.5)	(-0.7)		(-1.4)	(-0.2)	(-1.0)	(0.3)	(8.1)		
					Small firms					
A	0.778	-0.004	-0.519					0.089	0.301	14 286
	(3.4)	(-0.4)	(-1.3)					(6.1)		
B	0.773	-0.006						0.080	0.291	14 286
	(3.2)	(-0.5)						(7.5)		
C	0.772	-0.005	-0.483	-0.007	-0.002	-0.010	0.000	0.094	0.304	14 286
	(3.4)	(-0.4)	(-1.2)	(-1.6)	(-0.2)	(-2.5)	(0.0)	(7.9)		
D	0.763	-0.007		-0.010	-0.004	-0.009	0.006	0.085	0.297	14 286
	(3.1)	(-0.6)		(-3.0)	(-0.5)	(-2.0)	(0.6)	(8.8)		
					Large firms					
A	0.611	-0.005	-0.811					0.091	0.215	14 380
	(4.8)	(-0.8)	(-3.5)					(17.4)		
B	0.619	-0.010						0.080	0.198	14 380
	(4.0)	(-1.2)						(12.0)		
C	0.611	-0.005	-0.881	0.000	0.003	-0.003	-0.006	0.094	0.219	14 380
	(4.8)	(-0.7)	(-3.3)	(0.0)	(0.2)	(-0.3)	(-0.8)	(9.7)		
D	0.618	-0.010		-0.004	-0.001	-0.002	0.001	0.081	0.201	14 380
	(4.0)	(-1.1)		(-0.5)	(-0.1)	(-0.3)	(0.2)	(7.1)		

Table 6 continued

Model	DIV/A	I_{Div}	PB	I_4	I_6	I_7	I_{10}	$CONST$	$\overline{R^2}$	$\overline{N}$
					Panel B: 1988-2006					
					All firms					
A	0.827	-0.004	-0.735					0.092	0.217	26 277
	(2.8)	(-0.3)	(-1.0)					(6.5)		
B	0.839	-0.007						0.081	0.197	26 277
	(2.6)	(-0.5)						(9.7)		
C	0.839	-0.004	-0.768	-0.003	0.000	-0.006	-0.004	0.096	0.223	26 277
	(2.8)	(-0.2)	(-0.9)	(-0.4)	(0.0)	(-0.9)	(-0.5)	(6.5)		
D	0.840	-0.007		-0.006	-0.004	-0.005	0.004	0.083	0.202	26 277
	(2.6)	(-0.5)		(-1.4)	(-0.2)	(-0.8)	(0.6)	(8.1)		
					Small firms					
A	0.895	-0.005	-0.663					0.095	0.245	13 090
	(2.3)	(-0.3)	(-0.7)					(3.4)		
B	0.887	-0.006						0.083	0.221	13 090
	(2.3)	(-0.4)						(5.9)		
C	0.897	-0.005	-0.625	-0.006	-0.003	-0.009	0.000	0.099	0.252	13 090
	(2.3)	(-0.3)	(-0.6)	(-0.6)	(-0.2)	(-1.6)	(0.1)	(3.7)		
D	0.872	-0.007		-0.009	-0.005	-0.008	0.009	0.087	0.230	13 090
	(2.3)	(-0.5)		(-1.7)	(-0.4)	(-1.4)	(0.6)	(7.3)		
					Large firms					
A	0.704	-0.005	-0.874					0.093	0.179	13 188
	(3.2)	(-0.5)	(-1.9)					(12.8)		
B	0.746	-0.010						0.082	0.157	13 188
	(2.7)	(-1.0)						(12.6)		
C	0.715	-0.005	-0.942	0.000	0.000	-0.004	-0.005	0.097	0.186	13 188
	(3.1)	(-0.4)	(-1.6)	(0.1)	(0.0)	(-0.5)	(-0.7)	(9.4)		
D	0.748	-0.010		-0.004	-0.005	-0.004	0.002	0.083	0.162	13 188
	(2.7)	(-1.0)		(-0.6)	(-0.3)	(-0.4)	(0.4)	(8.1)		

Table 7: Change in asset return

For every year an OLS regression of change in asset return ΔROA_{t+1} is made. The regression equation is

$$\Delta ROA_{t+1} = a + b_1 x_{1,t} + b_2 x_{2,t} ... + \epsilon_{t+1},$$

where the explanatory variables x are asset return in year t, ROA_t, the time t estimated asset return, $E_t(ROA_t)$, the deviation in asset return from expected asset return $DEV_t = ROA_t - E_t(ROA_t)$, and the lagged one-year change in asset return, ΔROA_t. The reported coefficients are the mean of the coefficients for the year-by-year regressions. Small (large) firms are firms with assets size below (above) the median level of asset size. The t-values are given in parentheses.

Model	DEV	ROA	$E(ROA)$	ΔROA	$CONST$	$\overline{R^2}$	$\overline{N}$
			Panel A: 1994-2004				
			All firms				
I	-0.44			-0.21	0.00	0.25	21,393
	(-13.1)			(-7.3)	(-0.8)		
II		-0.46	0.22	-0.18	0.02	0.26	21,393
		(-14.0)	(5.1)	(-6.8)	(3.9)		
III				-0.38	0.00	0.14	21,393
				(-14.1)	(-0.5)		
IV		-0.48			0.048	0.22	21,393
		(-12.7)			(12.2)		
			Small firms				
I	-0.49			-0.22	0.00	0.27	9,779
	(-14.3)			(-8.3)	(-0.6)		
II		-0.50	0.25	-0.19	0.03	0.29	9,779
		(-14.3)	(5.4)	(-6.9)	(4.1)		
III				-0.41	0.00	0.16	9,779
				(-19.0)	(-0.3)		
IV		-0.52			0.057	0.25	9,779
		(-13.6)			(12.6)		
			Large firms				
I	-0.40			-0.18	-0.01	0.22	11,615
	(-10.7)			(-5.9)	(-1.0)		
II		-0.42	0.18	-0.16	0.02	0.24	11,615
		(-12.2)	(4.1)	(-6.0)	(3.8)		
III				-0.35	0.00	0.12	11,615
				(-10.0)	(-0.7)		
IV		-0.45			0.041	0.21	11,615
		(-11.9)			(10.6)		

Table 7 continued

Model	DEV	ROA	$E(ROA)$	ΔROA	$CONST$	$\overline{R^2}$	$\overline{N}$
			Panel B: Period 1990-2006				
			All firms				
I	-0.44			-0.20	0.00	0.25	19,728
	(-8.8)			(-4.7)	(-0.6)		
II		-0.46	0.17	-0.18	0.03	0.27	19,728
		(-9.9)	(2.1)	(-5.2)	(3.0)		
III				-0.38	0.00	0.15	19,728
				(-12.2)	(-0.2)		
IV		-0.50			0.05	0.24	19,728
		(-9.3)			(9.8)		
			Small firms				
I	-0.49			-0.21	0.00	0.28	8,975
	(-8.4)			(-5.3)	(-0.5)		
II		-0.50	0.20	-0.18	0.03	0.30	8,975
		(-8.8)	(2.0)	(-5.3)	(3.1)		
III				-0.40	0.00	0.17	8,975
				(-17.7)	(-0.2)		
IV		-0.54			0.06	0.26	8,975
		(-8.5)			(9.3)		
			Large firms				
I	-0.40			-0.18	0.00	0.23	10,754
	(-8.5)			(-3.9)	(-0.7)		
II		-0.42	0.15	-0.16	0.02	0.25	10,754
		(-10.5)	(2.5)	(-4.3)	(3.2)		
III				-0.35	0.00	0.12	10,754
				(-8.3)	(-0.3)		
IV		-0.46			0.04	0.22	10,754
		(-10.4)			(8.4)		