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股市對長期淨營業資產之成長是否能理性反應？

Does Stock Market Misprice Growth in Long-term Net Operating Assets?

李淑華* *Shu-Hua Lee*
國立台北大學會計學系
Department of Accounting,
National Taipei University

柯伯昇 *Po-Sheng Ko*
國立高雄應用科技大學財政稅務系
Department of Public Finance and Taxation,
National Kaohsiung University of Applied Sciences

方偉廉 *Wei-Lian Fang*
銘傳大學會計學系
Department of Accounting,
Ming Chung University

李文智 *Wen-Chih Lee*
國立高雄應用科技大學財經與商務決策研究所
Graduate Institute of Finance, Economics, and Business Decision,
National Kaohsiung University of Applied Sciences

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* Corresponding author: Shu-Hua Lee
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摘要

Fairfield et al. (2003) 認為公司當年度淨營運資產增加，將會使次年度的資產報酬率下降，其原因為（1）邊際報酬遞減以及（2）保守原則。該論文也發現股市對下列兩項財務資訊均過度反應：應計項目與長期淨營業資產的成長。

本論文則認為若公司投資決策比較合乎理性投資的假設，則公司新計畫的預期投資報酬率應該會高於其資金成本率，所以平均而言，今年度資產報酬率低於資金成本率的公司若增加淨營業資產，則次年度的資產報酬率應該會上升；反之，今年度資產報酬率高於資金成本率的公司若增加淨營業資產，則次年度的資產報酬率是否增加就無法定論，因為新投資的預期報酬率不一定比舊投資的報酬率高。另本文亦討論 FWY 所提之穩健會計論點：該文認為公司增加營運資產，次年績效將會降低是因為穩健會計，但本文認為穩健會計將使投資計畫初期無法資本化支出較多，因此未來年度相對績效反而將增加，這似乎也與 FWY 之預期相反。本文之實證結果支持我們的兩項不同論點。

關鍵詞：應計異象、理性投資決策、淨營業資產、理性定價、過度反應

Abstract

Fairfield et al. (2003) propose that the reasons why firms investing more in net operating assets at current year will experience lower one-year ahead *ROA* arise from both diminishing marginal returns on investment (Stigler, 1963) and conservative accounting (Penman, 2001). They also reveal that investors appear to equivalently overprice accruals and growth in long-term net operating assets. Their evidence shows that firms with a growth in long-term net operating assets would be, on average, less profitable in the following year.

However, we argue that rational firms should invest in long-term net operating assets when the internal rates of returns of the new projects are higher than the required rate of returns. For firms with current *ROA* lower than the required rate of returns, their future *ROA* should be, on average, increasing if they increase investments. For firms with current *ROA* higher than the required rate of returns, the future ROA could be increasing or decreasing, since the result depends on the relative levels of the current ROA and the internal rate of returns of the new projects. Empirical evidence is more consistent with our rational investment argument.

The evidence is also inconsistent with FWY's argument regarding conservative accounting bias. When firms increases operating asset, conservative accounting bias means that expenditures should be expensed when incurred, not to defer them into the future. This could result in a higher one-year-ahead ROA, unless these expenditures persist into the next year. Since most projects involve some form of start-up costs, we believe that, under possible conservative accounting, the accounting treatment for the second year of the asset life would be less conservative than that of the first year. So, the second year ROA will not be, on average, decreasing as FWY expected.

Keywords: accrual anomaly, rational investment decision, net operating assets, rational pricing, over reaction

1.INTRODUCTION

Following Sloan (1996), many researchers found that investors misprice the implication of firms' accruals for future earnings. In other words, investors over-estimate the persistence of accruals. In particular, Fairfield et al. (2003) (hereafter FWY) further reveal that investors appear to equivalently overprice accruals and growth in long-term net operating assets relative to their association with one-year-ahead return on assets (ROA). They conclude that mispricing of accruals applies more broadly to growth in net operating assets and the result is consistent with both conservative accounting (Penman, 2001) and diminishing return on assets (Stigler, 1963). FWY (Fairfield et al., 2003) argue that diminishing marginal returns on investments arise when firms exploit their most profitable investment opportunities before undertaking less profitable investments. Alternatively, increasing marginal returns in divestment arise when firm divest their least profitable investments. In addition, they also show that a conservative bias in accounting procedure results in investments that appear relatively less profitable in early years and more profitable in later years, biasing accounting rates of return on new investments downward relative to the returns in existing investments. Thus, they conclude that when firms invest more in long-term net operating assets, both conservative accounting bias and diminishing marginal returns to operating assets would, on average, reduce near-term profitability.

1.1 Diminishing Marginal Returns and Rational Investment Decision

In this paper, we argue that diminishing return on assets does not describe firms' investing behavior. Rational firms should invest in long-term net operating assets when the internal rates of returns of the new projects are higher than the required rate of returns. For firms with current ROA lower than the required rate of returns, their future ROA should be, on average, increasing if they increase investments. For firms with current ROA higher than the required rate of returns, the future ROA could be increasing or decreasing, since the result depends on the relative levels of the current ROA and the internal rate of returns of the new projects. That is, if the internal rate of returns of the new projects is higher than the current ROA, then the future ROA could be increasing. In contrast, if the internal rate of returns of the new projects is less than the current ROA, the future ROA could be decreasing.

1.2 Conservative Accounting Bias

FWY find that one-year-ahead ROA would be lower when firms increase long-term operating assets in current year. They also contend that this evidence is consistent with the conservative accounting bias. Nonetheless, conservative accounting bias only states that costs with uncertain future economic benefit and some indirect costs related to the acquisition of long-term assets tend to be expensed when incurred. Expenditures which are expensed when incurred could result in a higher one-year-ahead ROA unless these expenditures persist into the next year. This seems to contradict FWY's argument. For the accounting treatment of the capitalized direct costs, it would be equally conservative for the first year and the second year of the asset life if straight-line method is used for recording the depreciation expenses. The accounting treatment of the first year of the asset life is actually more conservative then that of the second year of the asset life when accelerated methods are implemented. Therefore, we believe that, under possible conservative accounting, the accounting treatment for the second year of the asset life would be less conservative than that of the first year. So, the second year ROA will be, on average, increasing as compared to the first year.

However, there exists one additional consideration. More often than not, the assets are not running at full speed in the first year of the asset life. This fact also predicts an increase of ROA in the second year of the asset life.

Based on our arguments, we re-examine whether growth in long-term net operating assets has incremental negative relations with one-year-ahead ROA and whether stock market overprices growth in long-term net operating assets relative to their association with one-year-ahead ROA in this study.

1.3 Mean-Reverting of Rate of Return

Our argument is also consistent with mean reverting behavior of earnings and returns on assets. To deal with this confounding effect, we use current ROA as control variable to control for possible mean reverting effect current ROA has on the one-year-ahead ROA. So, if we use firms with extremely low rate of return as example, the results after controlling for current ROA should be interpreted as: given same amount of current ROA, if the firms invest more in long-term net operating assets, their one-year-ahead ROA would be, on average, higher.

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1.4 Balance Sheet Bloat

Hirshleifer et al. (2004) find evidence to support their argument that when cumulative net operating incomes is greater than cumulative free cash flows, subsequent earnings would be decreasing. They propose that if investors neglect information about cash profitability, then net operating assets, the cumulating of the discrepancies between the cash and accrual incomes, measures the extent to which reporting outcomes provoke over-optimism. Since the difference between cumulative net operating income and cumulative free cash flow can be decomposed into working capital and long-term asset parts:

$$\begin{aligned} \textit{Net Operating Asset}_T &= \sum_0^T (\textit{Operating Income Before Depreciation}_t - \textit{Operating Cash Flow}_t) + \sum_0^T (\textit{Investment}_t - \textit{Depreciation}_t) \\ &= \sum_0^T \textit{Operating Accruals}_t + \sum_0^T \textit{Investment}_t \end{aligned}$$

Acquisition of a long-term operating asset in the current year certainly adds to the cumulative investments and has a propensity to increase operating accruals. Their findings seem also suggest an addition to long-term asset would decrease earnings prospect. But it is not clear whether their results are driven by the current year additions to the net operating assets or the stocks cumulated before the current year. Our study may also help when interpreting their results. In addition, the measurement of net operating asset in Hirshleifer et al. (2004) is different from FWY. In this paper, we hypothesize that the effect of long-term net operating assets on future earnings will depend on the scenarios analyzed.

2.BACKGROUND AND HYPOTHESES DEVELOPMENT

Based on the above arguments, we separate firms into two groups: low-ROA group, consisting of firms with current ROA lower than the required rate of return, and high-ROA firms, consisting of firms with current ROA higher than the required rate of return.

For low-ROA group, FWY's diminishing-return argument could not be true, if the firms make rational investment decision. FWY's H1 is slightly modified as follow (the persistence and mispricing issues of accruals would only be control variables in our research):

H1 (low): For low-ROA group, growth in long-term net operating assets has positive relations with one-year-ahead ROA, after controlling for current ROA.

We posit that rational firms should invest when the expected rate of returns of the new project is higher than the required rate of returns and accordingly, growth of long-term operating asset may not always decrease firms' future ROA. The direction of future ROA effected from current long-term net operation assets will depend on the relation between the internal rate of returns of the new projects and the current ROA. For the high-ROA group, absent empirical experience suggesting that the effect of growth of long-term operating asset on future ROA could be either positive or negative. Although we do not have directional prediction for high-ROA group based on previous suggestion, yet we still propose to test for a negative relation since FWY find one year ahead ROA would, on average, be lower for all firms.

H1 (high): For high-ROA group, growth in long-term net operating assets may have negative relations with one-year-ahead ROA, after controlling for current ROA.

As mentioned in the introduction section, we use current ROA as control variable to control for possible mean reverting effect current ROA has on the one-year-ahead ROA.

Finally, FWY's H2 would be re-examined in both the low-ROA group as well as the high-ROA group.

H2 (FWY's): After controlling for current ROA, growth in long-term net operation assets would be mispriced.

3.RESEARCH DESIGN

3.1 Sample Selection

We extract the financial data from the annual database and the stock returns data from the monthly database of the 2005 Compustat active database for the period 1985 to 2004. We compute the accrual component of earnings by reconciliation of operating incomes with operating cash flows (operating cash flows come from the Statement of Cash Flows based on SFAS No. 95). Consequently, our sample period starts on the year 1988. The sampling period is 17 years, from1988 to 2004[1]. For this sample period, we delete firm-year observations that: (1) are non-NYSE and non-AMEX firms; (2) are non-calendar year firms; and (3) have missing financial data and missing stock returns data as defined below. The final available sample comprises of 9,862 firm-years.[2]

3.2 Research Model and Variable Measurement

SFAS No. 95, in effect in 1988, requires the information necessary for computing the accrual component of earning to be identified in the operating section of the Statement of Cash Flows as part of the reconciliation of net income with operating cash flows. Prior to SFAS No. 95, firms were required to prepare a Statement of Changes in Financial Position that focused on working capital rather than cash. Since our sampling period is after 1988, we calculate total accrual ($ACCR$) as the difference between Operating income after depreciation and amortization ($OPIN$) and cash flows from operations (CFO).

$$ACCR_{it} = OPIN_{it} - CFO_{it} \quad .. \tag{1}$$

where :

$ACCR_{it}$ = total accruals of firm i at time t;

$OPIN_{it}$ = operating income after depreciation and amortization of firm i at time t.

CFO_{it} = cash flows from operations of firm i at time t;

Following Sloan (1996), we deflate $ACCR$ by contemporaneous average total assets.

We define growth in net operating assets ($GrNOA$) as annual change in net operating assets:

[1] Collins & Hribar (2002) suggest that total accruals estimated using a balance sheet approach (prior to 1988) contain measurement error when non-articulation events such as mergers, acquisitions, and divestitures are present, while the total accruals estimated directly from the statement of cash flow (post 1987).

[2] We run the test using Mishkin test (Mishkin, 1983). We also use the OLS model as suggested by Kraft et al. (2007). The results are similar, but we report the results under Mishkin test for our sample size is relatively small and for an easier comparison with FWY.

$$GrNOA_{it} = NOA_{it} - NOA_{it-1} \quad (2)$$

where net operating assets (NOA) is operating assets (excluding cash and short-term investment) minus operating liabilities：

$$NOA_{it} = (CA_{it} - CASH_{it} - STI_{it}) + PPE_{it} + INTANG_{it} + OTHERLTA_{it} - (CL_{it} - SLTD_{it} - ITP_{it}) - OTHERLTL_{it} \quad (3)$$

where:

NOA_{it}	=	net operating assets of firm i at time t;
CA_{it}	=	current assets of firm i at time t;
$CASH_{it}$	=	cash and cash equivalents of firm i at time t;
$STLI_{it}$	=	short-term investment of firm i at time t;
PPE_{it}	=	net property, plant, and equipment of firm i at time t;
$INTANG_{it}$	=	intangible assets of firm i at time t;
$OTHERLTA_{it}$	=	other long-term assets of firm i at time t;
CL_{it}	=	current liabilities of firm i at time t;
$SLTD_{it}$	=	current maturities of long-term debt of firm i at time t;
ITP_{it}	=	income taxes payable of firm i at time t;
$OTHERLTL_{it}$	=	other long-term liabilities of firm i at time t.

The final explanatory variable — growth in long-term net operating assets ($GrLTNOA$)—is defined by subtracting accruals ($ACCR$) from growth in net operation assets ($GrNOA$):

$$GrLTNOA_{it} = GrNOA_{it} - ACCR_{it} \quad (4)$$

We deflate $GrLTNOA$ by contemporaneous average total assets.

We follow FWY's model[3], but we add a dummy variable (D_{it}) to separate our sample firms into the high- ROA group and the low- ROA group by year. The benchmark to distinguish high or low ROA group are formed annually based on above and below 50 percent fractiles of the beginning ROA. This treatment of

[3] FWY's model is listed as below:

Forecasting Equation: $ROA_{t+1} = \beta_0 + \beta_1 GrLTNOA_t + \beta_2 ACC_t + \beta_3 ROA_t + e_{t+1}$

Valuation Equation: $BHAR_{t+1} = \alpha + \theta\left(ROA_{t+1} - \beta_0 - \beta*_1 \; GrLTNOA_t - \beta_2^* ACC_t - \beta_3^* ROA_t\right) + \varepsilon_{t+1}$

high-low ROA implicitly assumes that firms with ROA lower than averge are firms with new investment projects that could lead to a higher one-year ROA. The possible measurement error would lead to classification error for high-low groups and potentially would reduce the power of the test. Rejection of the null hypothesis would be an even stronger evidence supporting our argument. Thus, our results are likely to be robust under our grouping method.[4] Our model is as follows:

Forecasting Equation:

$$ROA_{it+1} = \gamma_0 + \gamma_1 GrLTNOA_{it} + \gamma_2 ACCR_{it} + \gamma_3 ROA_{it} + \gamma_4 D_{it} * GrLTNOA_{it} + \gamma_5 D_{it} + e_{it+1} \quad (5)$$

Valuation Equation:

$$MAAR_{it+1} = \alpha_0 + \alpha_1 (ROA_{it+1} - \gamma_0 - \gamma_1^* GrLTNOA_{it} - \gamma_2^* ACCR_{it} - \gamma_3^* ROA_{it} - \gamma_4^* D_{it} * GrLTNOA_{it} - \gamma_5^* D_{it}) + \varepsilon_{it+1} \quad (6)$$

where:

ROA_{it+1}	=	return on assets, defined as operating income after depreciation and amortization of firm i at $t+1$ divided by average total assets at time $t+1$;
$GrLTNOA_{it}$	=	growth in long-term net operating assets of firm i at time t, divided by average total assets at time t;
$ACCR_{it}$	=	accruals of firm i at time t, defined as model (1) and divided by average total assets at time t;
ROA_{it}	=	return on assets, defined as operating income after depreciation and amortization of firm i at time t divided by average total assets at time t;
D_{it}	=	1 if firm i at time t belongs to low-ROA group, 0 otherwise;
$MAAR_{it+1}$	=	the market-adjusted abnormal stock return of firm i at $t+1$.

The forecasting coefficients (γ_1) in model (5) is an estimate of the effect of

[4] An alternative is to group firms by comparing each firms's ROA with a measure of each individual firm's required rate of return for it's capital. But this approach also creates measurement error when estimating individual firm's required rate of return.

the growth in long-term net operating assets for high- ROA group (i. e., a measure of the ability of growth in long-term net operating assets at the current to predict one-year-ahead ROA). The valuation coefficients (γ_1^*) is the weight that the market investors appear to assign to growth in long-term net operating assets for the high- ROA group (i.e., a measure of market pricing of growth in long-term net operating assets). However, the sum ($\gamma_1 + \gamma_4$) of forecasting coefficients of model (5) estimates the ability of growth in long-term net operating assets at the current to predict one-year-ahead ROA in low- ROA group. The sum ($\gamma_1^* + \gamma_4^*$) of valuation coefficients of model (6) measures that market pricing of growth in long-term net operating assets in low- ROA group. An iterative generalized nonlinear least squares estimation procedure is applied to estimate Model (5) and (6).

The Mishkin test includes two stages. In the first stage, we impose no constraints on γ_q and γ_q^* and jointly estimate model (5) and (6) to test whether the valuation coefficients (γ_q^*) significantly different from the counterpart forecasting coefficients (γ_q). In the second stage, we jointly estimated model (5) and (6) after imposing the rational pricing constrains, $\gamma_q = \gamma_q^*$, where q=1, 2, 3, 4 and/or 5. The likelihood ratio statistics in Mishkin test, which is also distributed asymptotically as $\chi^2_{(k)}$ under the null hypothesis, is

$$2NLn(SSR^c / SSR^u) \sim \chi^2_{(k)} \tag{7}$$

where

k = the number of rational pricing constrain;

N = the number of observations;

Ln = the natural logarithm operator;

SSR^c = the sum of squared residuals from the constrained system;

SSR^u = the sum of squared residuals from the unconstrained system.

If the likelihood ratio statistics (i. e., $2NLn(SSR^c / SSR^u)$) is less than the critical value of $\chi^2_{(k)}$ under the null hypothesis, which, in our application, is that the market rationally prices the variable or variables ($GrLTNOA$, $ACCR$, ROA , $D*GrLTNOA$ and/or D) with respect to their associations with one-year-ahead earnings.

4.EMPIRICAL RESULTS

4.1 Descriptive Statistics

Table 1 reports the descriptive statistics on market-adjusted abnormal stock returns, one-year-ahead ROA, current ROA, total accrual, growth in long-term net operating assets, and growth in long-term net operating assets for the low-ROA group and the high-ROA group . In panel A, $GrLTNOA$ and $ACCR$ are not deflated by average total assets. The mean (median) $ACCR$ is approximately -46 (-1) millions, suggesting that total accruals, on average, result in a decrease in operating incomes. The mean and the median of $GrLTNOA$ are approximately 217 millions and 12 millions, respectively. Firms in our sample are generally increasing investments in long-term net operating assets over the sample period. The average market-adjusted abnormal stock return is 17.77 percent. The median of market-adjusted abnormal stock return is 2.10 percent. Over 50 % firm-year observations in our sample have positive abnormal stock return.

From panel B, we report the descriptive statistics of the model's variables. The mean and the media of current ROA are 7.41 percent and 8.92 percent, which are less than those of FWY's results (0.114 and 0.109, respectively). The mean of $ACCR$ is negative (-0.0106), which is about half of FWY's result (-0.020), but the negative sign is consistent with many previous literatures (Sloan, 1996; Xie, 2001; among others). The mean of $GrLTNOA$ (0.0667) is smaller than that of FWY's result (0.090).

In addition, we compute the statistics of $GrLTNOA$ in different ROA groups. Panel C of Table 1 reports that the mean of $GrLTNOA$ in high-ROA group and the mean of $GrLTNOA$ in low-ROA group are 0.0593 and 0.0831, respectively. It implies that the investment of long-term net operating assets in low-ROA group is even more than that in high-ROA group.

Table 1 Descriptive statistics

Variables	Mean	Median	Variance	Max	Min
Panel A: Original variables before deflation					
$MAAR_{it+1}$	0.1777	0.0210	7.2088	217.0066	-27.7540
$GrLTNOA_{it}$ (Note 2)	217.4788	12.4010	3,761,055.27	59,387.000	-69,701.000
$ACCR_{it}$ (Note 2)	-45.8093	-1.1835	-450,580.29	8,173.6090	-14,000.3820
Panel B: Variables deflated by average total assets					
ROA_{it+1}	0.0751	0.0874	0.0361	0.9523	-4.4898
$GrLTNOA_{it}$	0.0667	0.0342	0.2236	22.2670	-27.7541
$ACCR_{it}$	-0.0106	-0.0041	0.0137	1.0065	-2.8069
ROA_{it}	0.0741	0.0892	0.0489	1.0613	-6.6495
$D_{it} * GrLTNOA_{it}$	0.0335	0.0000	0.1288	22.2670	-17.5145
Panel C: $GrLTNOA_{it}$ in different ROA groups					
high-ROA group	0.0593	0.0328	0.1488	1.4305	-27.7541
low-ROA group	0.0831	0.0395	0.2811	22.2670	-17.5145

Note 1: The sample size is 9,862 firm-years from 1988 to 2004.

Note 2: Unit: USD million.

Note 3: ROA_{it+1} = return on assets, defined as operating incomes after depreciation and amortization of firm *i* at *t*+1 divided by average total assets at time *t*+1; $GrLTNOA_{it-k}$ = growth in long-term net operating assets of firm *i* at time *t*- *k*, divided by average total assets; $ACCR_{it}$ = accruals of firm *i* at time *t*, defined as model (1) and divided by average total assets; ROA_{it} = return on assets, defined as operating income after depreciation and amortization of firm *i* at time *t* divided by average total assets at time *t*; D_{it} =1 if firm *i* at time *t* belongs to low-ROA group, 0 otherwise; $MAAR_{it+1}$ = the market-adjusted abnormal stock return of firm *i* at *t*+1.

Table 2 shows correlations among market-adjusted abnormal stock returns, one-year-ahead ROA, current ROA, total accruals, growth in long-term net operating assets, and dummy variable multiples by the variable of growth in long-term net operating assets. Correlations of growth in long-term net operating assets to one-year-ahead ROA and to current ROA are negative, which implies that increasing investments in long-term net operating assets has negative incremental effect on one-year-ahead ROA and on current ROA. The correlation between current ROA and one-year-ahead ROA is highly positive. Firms with high level of profitability in the current year (current ROA) tend to have high ROA in the following year (one-year-ahead ROA). From the unconditional correlations in Table 2, we find that more profitability in the current year (current ROA) is associated with more total accruals (the correlation coefficient is 0.6196). It implies that controlling for current profitability is necessary for our study.

Table 2 Pearson correlation matrix

	ROA_{it+1}	$MAAR_{it+1}$	$GrLTNOA_{it}$	$ACCR_{it}$	ROA_{it}	$D_{it} * GrLTNOA_{it}$
ROA_{it+1}	1.00000					
$MAAR_{it+1}$	0.03106 0.0020	1.00000				
$GrLTNOA_{it}$	-0.07220 <.0001	-0.01191 0.2371	1.00000			
$ACCR_{it}$	0.43386 <.0001	-0.05855 <.0001	-0.14299 <.0001	1.00000		
ROA_{it}	0.79191 <.0001	-0.07276 <.0001	-0.11198 <.0001	0.61960 <.0001	1.00000	
$D_{it} * GrLTNOA_{it}$	-0.10469 <.0001	-0.00915 0.3633	0.75239 <.0001	-0.17407 <.0001	-0.1694 5 <.0001	1.00000

Note 1: The sample size is 9,862 firm-years from 1985 to 2004.

Note 2: ROA_{it+1} = return on assets, defined as operating incomes after depreciation and amortization of firm *i* at *t*+1 divided by average total assets at time *t*+1; $GrLTNOA_{it-k}$ = growth in long-term net operating assets of firm *i* at time *t*- *k*, divided by average total assets; $ACCR_{it}$ = accruals of firm *i* at time *t*, defined as model (1) and divided by average total assets; ROA_{it} = return on assets, defined as operating income after depreciation and amortization of firm *i* at time *t* divided by average total assets at time *t*; D_{it} =1 if firm *i* at time *t* belongs to low-ROA group, 0 otherwise; $MAAR_{it+1}$ = the market-adjusted abnormal stock return of firm *i* at *t*+1.

4.2 The Mishkin Test—the results from duplication of FWY's test

We duplicate FWY's test by the use of our sample and the results are shown in Table 3. As compared to FWY's results (see Table 4 on page 365 of Fairfield et al. (2003)), the forecasting coefficient of $GrLTNOA$ in ours research is not significantly positive (0.004), as compared to FWY's significantly negative result (-0.04). We posit that rational firms should invest when the expected rate of returns of the new project is higher than the required rate of returns and accordingly, growth of long-term operating asset may not always decrease firms' future ROA. The results from our sample seem to be more consistent with our rational investment argument. We shall report results of further investigation on the forecasting coefficient of $GrLTNOA$ by separating the firms into high-ROA and low-ROA groups in the next section (see Table 4).

The signs of forecasting coefficients on the other variables ($ACCR$ and current ROA) are similar to FWY's results, but the coefficient on $ACCR$ (-0.148) is more negative than theirs (-0.06). Same as FWY's results, the signs of valuation coefficients on all variables are all positive. But the magnitudes of valuation coefficients in our study are generally bigger.

Table 3 Regression Results of Rationally Pricing of Growth in Long-Term Net Operating Assets (Not Separated by Different ROA Group), Accruals and ROA with Respect to Their Implications for One-Year-Ahead ROA (the duplication of FWY's model)

Forecasting Equation: $ROA_{it+1} = \gamma_0 + \gamma_1 GrLTNOA_{it} + \gamma_2 ACCR_{it} + \gamma_3 ROA_{it} + \mu_{it+1}$

Valuation Equation:

$$MAAR_{it+1} = \alpha_0 + \alpha_1(ROA_{it+1} - \gamma_0 - \gamma_1^* GrLTNOA_{it} - \gamma_2^* ACCR_{it} - \gamma_3^* ROA_{it}) + \xi_{it+1}$$

Panel A: Market Pricing of $GrLTNOA$, $ACCR$ and ROA with Respect to Their Implications for One-Year Ahead ROA

Forecasting Coefficients			Valuation Coefficients		
Parameter	Estimate	Asymptotic Std. Error	Parameter	Estimate	Asymptotic Std. Error
γ_1 ($GrLTNOA$)	0.004	0.002	γ_1^* ($GrLTNOA$)	0.132	0.058
γ_2 ($ACCR$)	-0.148***	0.013	γ_2^* ($ACCR$)	0.425**	0.296
γ_3 (ROA)	0.730***	0.007	γ_3^* (ROA)	1.472***	0.231
R^2=0.6324			R^2=0.0074		

Panel B: Tests of Rational Pricing of current $GrLTNOA$, $ACCR$ and ROA

Null Hypotheses	Mishkin test: Mishkin χ^2 [Note 2]	Mishkin test: Marginal Significant Level
$GrLTNOA$, $ACCR$ and ROA : $\gamma_1^* = \gamma_1$, $\gamma_2^* = \gamma_2$ and $\gamma_3^* = \gamma_3$	45.942***	<0.000
$GrLTNOA$: $\gamma_1^* = \gamma_1$	4.686**	0.030
$ACCR$: $\gamma_2^* = \gamma_2$	3.566**	0.059
ROA : $\gamma_3^* = \gamma_3$	19.536***	<0.000

Note 1: ROA_{it+1} = return on assets, defined as operating incomes after depreciation and amortization of firm *i* at *t*+1 divided by average total assets at time *t*+1; $GrLTNOA_{it-k}$ = growth in long-term net operating assets of firm *i* at time *t*- *k*, divided by average total assets; $ACCR_{it}$ = accruals of firm *i* at time *t*, defined as model (1) and divided by average total assets; ROA_{it} = return on assets, defined as operating income after depreciation and amortization of firm *i* at time *t* divided by average total assets at time *t*; $MAAR_{it+1}$ = the market-adjusted abnormal stock return of firm *i* at *t*+1.

Note 2: Mishkin $\chi^2 = 2NLn(SSR^c / SSR^u)$.

Note 3: Asterisks indicate significant at 1% level (*), 5% level (**), and 10% level (***).

Note 4: There are 9,862 firm-years from 1985 to 2004.

As reported in panel B, the test of rational pricing of the overall model suggests that we reject the null hypothesis that the market rationally prices $GrLTNOA$, $ACCR$, and current ROA to their implications for one-year-ahead ROA. Same as FWY, tests of the rationality of individual variables are all significant. More specifically, our results suggest that the market appears to also respectively overvalue the three variables relative to their ability to predict future profitability (one-year-ahead ROA). While in FWY, current ROA is underpriced by the market.

4.3 The Mishkin Test—the results of our model

Panel A of Table 4 reports the jointly estimated coefficients for model (5) and (6) obtained in the first stage (no constraints). Panel B reports a result of Mishkin test of rationally pricing constrains. We jointly estimate model (5) and (6) again in the second stage, after imposing the rational pricing constraints (i.e., $\gamma_q = \gamma_q^*$, q=1, 2, 3, 4 and 5). Overall model test reveals a significant likelihood ratio statistics of 45.380 (p<0.000) and suggests that we reject the null hypothesis that the market rationally prices $GrLTNOA$ (respectively for high-ROA and low-ROA groups), $ACCR$, and current ROA to their implications for one-year-ahead ROA.

From panel A, we compare the forecasting coefficients on growth in long-term net operating assets ($GrLTNOA$) in different ROA groups. The forecasting coefficients of $GrLTNOA$ in high-ROA group is significantly negative (-0.011, p=0.003). The forecasting coefficients of $D*GrLTNOA$ is 0.025 (p<0.000), which means that the forecasting coefficient of $GrLTNOA$ in low-ROA group is significantly positive 0.014 (the p value of F test is <0.000). Consistent with our rational investment hypothesis, we find that the effects on growth in long-term net operating assets to one-year-ahead ROA in high-ROA and low-ROA groups are different. In contrast, FWY expect both diminishing marginal returns on investment and conservative accounting to contribute to a negative incremental relation between one-year-ahead profit and growth in long-term net operating assets, regardless of the firms' current ROA levels.

For growth in long-term net operating assets ($GrLTNOA$) in high-ROA group, the positive valuation coefficient (γ_1^*=0.037) is larger than the negative forecasting coefficient (γ_1=-0.011). It suggests that the market overprices relative to its ability to forecast one-year-ahead earnings in high-ROA group. However, the test statistics is not significant[5]. For growth in long-term net operating assets ($GrLTNOA$) in low-ROA group, the valuation coefficients ($\gamma_1^* + \gamma_4^*$=0.190) is larger than the forecasting coefficients ($\gamma_1 + \gamma_4$=0.014). It suggests that the market overprices growth in long-term net operating assets relative to its ability to forecast one-year-ahead earnings in low-ROA group. The test statistic is significant (p=0.022) from panel B of Table 4[6].

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5 In additional untabulated analysis, we regress simultaneously the model (5) and (6) in just the high-ROA group, the market also overprices growth in long-term net operating assets relative to its ability to forecast one-year-ahead earnings, and the statistics of rational pricing on $GrLTNOA$ is also not significant.

6 In an un-tabulated analysis, we regress simultaneously the model (5) and (6) in just low-ROA group, the market also overprices growth in long-term net operating assets relative to its ability to forecast one-year-ahead earnings , but the statistics of rational pricing on $GrLTNOA$ is significant (p=0.055).

Table 4 Regression Results of Rationally Pricing of Growth in Long-Term Net Operating Assets (Separated by Different ROA Group), Accruals and ROA with Respect to Their Implications for One-Year-Ahead ROA

Forecasting Equation:

$$ROA_{it+1} = \gamma_0 + \gamma_1 GrLTNOA_{it} + \gamma_2 ACCR_{it} + \gamma_3 ROA_{it} + \gamma_4 D_{it} * GrLTNOA_{it} + \gamma_5 * D_{it} + e_{it+1} \quad (5)$$

Valuation Equation:

$$MAAR_{it+1} = \alpha_0 + \alpha_1 (ROA_{it+1} - \gamma_0 - \gamma_1^* GrLTNOA_{it} - \gamma_2^* ACCR_{it} - \gamma_3^* ROA_{it} - \gamma_4^* D_{it} * GrLTNOA_{it} - \gamma_5^* D_{it}) + \varepsilon_{it+1} \quad (6)$$

Panel A: Market Pricing of $GrLTNOA$, $ACCR$, ROA, $D * GrLTNOA$ and D with Respect to Their Implications for One-Year Ahead ROA

Forecasting Coefficients			Valuation Coefficients		
Parameter	Estimate	Asymptotic Std. Error	Parameter	Estimate	Asymptotic Std. Error
γ_1 ($GrLTNOA$)	-0.011***	0.004	γ_1^* ($GrLTNOA$)	0.037	0.087
γ_2 ($ACCR$)	-0.156***	0.013	γ_2^* ($ACCR$)	0.380	0.297
γ_3 (ROA)	0.709***	0.007	γ_3^* (ROA)	1.387***	0.233
γ_4 ($D * GrLTNOA$)	0.025***	0.005	γ_4^* ($D * GrLTNOA$)	0.153	0.116
γ_5 (D)	-0.029***	0.003	γ_5^* (D)	-0.084	0.061
R^2=0.6376			R^2=0.0076		

Panel B: Tests of Rational Pricing of current $GrLTNOA$, $ACCR$, ROA, $D * GrLTNOA$ and D

Null Hypotheses	Mishkin test	
	Mishkin χ^2 (Note 2)	Marginal Significant Level
$GrLTNOA$, $ACCR$, ROA, $GrLTNOA + D * GrLTNOA$ And D: $\gamma_1^* = \gamma_1$, $\gamma_2^* = \gamma_2$, $\gamma_3^* = \gamma_3$, $\gamma_1^* + \gamma_4^* = \gamma_1 + \gamma_4$ and $\gamma_5^* = \gamma_5$	45.380***	<0.000
$GrLTNOA + D * GrLTNOA$: $\gamma_1^* + \gamma_4^* = \gamma_1 + \gamma_4$	5.268**	0.022
$GrLTNOA$: $\gamma_1^* = \gamma_1$	0.318	0.572
$ACCR$: $\gamma_2^* = \gamma_2$	3.271**	0.071
ROA: $\gamma_3^* = \gamma_3$	15.996***	<0.000
$D * GrLTNOA$: $\gamma_4^* = \gamma_4$	1.286	0.257
D: $\gamma_5^* = \gamma_5$	0.878	0.349

Note 1: ROA_{it+1} = return on assets, defined as operating incomes after depreciation and amortization of firm i at t+1 divided by average total assets at time t+1; $GrLTNOA_{it-k}$ = growth in long-term net operating assets of firm i at time t- k, divided by average total assets; $ACCR_{it}$ = accruals of firm i at time t, defined as model (1) and divided by average total assets; ROA_{it} = return on assets, defined as operating income after depreciation and amortization of firm i at time t divided by average total assets at time t; D_{it} =1 if firm i at time t belongs to low-ROA group, 0 otherwise; $MAAR_{it+1}$ = the market-adjusted abnormal stock return of firm i at t+1.

Note 2: Mishkin $\chi^2 = 2NLn(SSR^c / SSR^u)$.

Note 3: Asterisks indicate significant at 1% level (*), 5% level (**), and 10% level (***).

Note 4: There are 9,862 firm-years from 1985 to 2004.

For total accruals ($ACCR$) and current ROA, the coefficients of forecasting equation and valuation equation is similar to the result of Table 3. We reject the rational pricing of total accrual. The valuation coefficients (γ_2^*=0.380) is larger than the forecasting coefficients (γ_2=-0.156), and the signs are opposite. The likelihood ratio statistics of 3.271 in panel B of Table 4 is significant at the 0.10 level, indicating that the overpricing of total accrual ($\gamma_2^* > \gamma_2$) is statistically significant. The overpricing condition also appears at the variable of current ROA .The valuation coefficients (γ_3^* =1.387) the market assigns to current ROA is larger than the forecasting coefficients (γ_3=0.709). The likelihood ratio statistics reject the rational pricing hypothesis of current ROA at significance less than the 0.01 level.

4.4 The Hedge-Portfolio Test

The Mishkin test suggests that the market acts as if it assigns a *larger* valuation coefficient of growth in long-term net operating assets relative to its forecasting coefficient. From the previous results appear that the opposite effects on growth in long-term net operating assets to one-year-ahead ROA exist in high- ROA and low- ROA groups, that there are significantly negative in high- ROA group and significantly positive in low- ROA group, respectively. The market overpricing condition is still held in high- ROA group and low- ROA group. We assess the robustness of our inference that non-rational pricing of growth in long-term net operating assets with a calendar-time portfolio regression described in Fama & French (1993). The hedge-portfolio tests respectively run in high- ROA group and low- ROA group.

We group firms into portfolio deciles each year based on the ranking of growth in long-term net operating assets ($GrLTNOA$). If a trading strategy that is that long in the lowest $GrLTNOA$ decile and short in the highest $GrLTNOA$ decile yields positive abnormal returns in next year, then this would further support inferences from the Mishkin test that the market overprices $GrLTNOA$ in the portfolio formation year. We regress these adjusted returns for $GrLTNOA$ portfolios on market, firm size, and book-to-market factors as shown in Equation (8):

$$R_{pt} - R_{ft} = \alpha_p + b_p(R_{mt} - R_{ft}) + s_p(SMB_t) + h_p(HML_t) + \xi_{pt} \tag{8}$$

where,

R_{pt} = the value-weighted monthly return on the $GrLTNOA$ portfolio;

R_{ft} = the one-month Treasury bill rate at the beginning of the month;

R_{mt} = the value-weighted monthly return on all NYSE and AMEX stocks;

SMB_t = the difference between value-weighted monthly returns of portfolios of small and large stocks (below or above the median of all NYSE and AMEX);

HML_t = the difference between value-weighted monthly returns of high and low book-to-market stocks(above and below the 70 percent and 30 percent fractiles of book-to-market, respectively).

We calculate returns for the 12 months beginning from the April following the fiscal year-end. Table 5 reports the average of the 122 monthly abnormal returns (the estimate of the intercept, α_p) on the highest portfolio and the lowest portfolio deciles after controlling for the market, firm size, and book-to-market factors.

Panel A of Table 5 reports the results for low-ROA group, and Panel B reports the results for high-ROA group. For both highest $GrLTNOA$ portfolios, we find evidence of negative abnormal returns in the year after portfolio formation, but it is not significant. The estimated mean monthly abnormal returns (i.e., the intercepts) imply one-year-ahead annual abnormal returns of approximately –8.17 percent to low-ROA group and –3.61 percent to high-ROA group, respectively. In contrast, for both lowest $GrLTNOA$ portfolios, we find evidence of positive abnormal returns in the year after portfolio formation: the monthly average one-year-ahead annual abnormal returns of approximately 15.14 percent to low-ROA group and 2.31 percent to high-ROA group, respectively. It is significant (p=0.05) for low-ROA group, but not significant for high-ROA group.

In addition, we test the abnormal returns in next year of hedge portfolio formed by long in the lowest $GrLTNOA$ decile and short in the highest $GrLTNOA$ decile. For low-ROA group, the result reveals that the annual abnormal returns of hedge portfolio in next year is significantly positive 23.31 percent (p=0.027). However for high-ROA group, the result reveals that the annual abnormal return of hedge portfolio in next year is insignificantly positive 5.92

percent. The one-year-ahead significantly positive abnormal returns to hedge portfolio in low- ROA group are more consistent with the market overpricing result of the Mishkin test in low- ROA group. However, the hedge portfolio test result in high- ROA group does not suggest that the market overprices growth in long-term net operating assets, and which is also consistent with the inference from the Mishkin test in high- ROA group.

Table 5 Results of Abnormal Stock Returns to Portfolio of High vs. Low growth in long-term net operating assets in Next Year after Portfolio Formation (Separated by Different ROA Group)

Panel A: Low- ROA group				
	Highest portfolio		Lowest portfolio	
Fama-French Parameters	Monthly Average	t-statistics	Monthly Average	t-statistics
Intercept (α_p)	-0.0071	-1.18	0.0118*	1.98
Market factor (b_p)	1.4505***	9.68	1.1611***	7.78
Size factor (s_p)	0.0072	0.35	0.0018	0.09
Book-to-market factor (h_p)	0.3774***	2.63	0.2240	1.57
Adjusted R^2		0.4733		0.3513
Hedge (Note 3)	0. 2331** (p=0.027)			

Panel B: High- ROA group				
	Highest portfolio		Lowest portfolio	
Fama-French Parameters	Monthly Average	t-statistics	Monthly Average	t-statistics
Intercept (α_p)	-0.0031	-1.06	0.0019	0.62
Market factor (b_p)	0.9297***	12.91	0.8505***	11.13
Size factor (s_p)	0.0222**	2.27	0.0090	0.87
Book-to-market factor (h_p)	0.0961	1.39	-0.0179	-0.24
Adjusted R^2		0.6042		0.5096
Hedge (Note 3)	0.0592 (p=0.239)			

Note 1: Asterisks indicate significant at 1% level (*), 5% level (**), and 10% level (***).

Note 2: Portfolio deciles are formed annually based on the ranking of growth in long-term net operating assets ($GrLTNOA$). We estimate the following Fama & French (1993) regression:

$$R_{pt} - R_{ft} = \alpha_p + b_p(R_{mt} - R_{ft}) + s_p(SMB_t) + h_p(HML_t) + \xi_{pt}$$

Where R_{pt} = the value-weighted monthly return on the $GrLTNOA$ portfolio; R_{ft} = the one-month Treasury bill rate at the beginning of the month; R_{mt} = the value-weighted monthly return on all NYSE and AMEX stocks; SMB_t = the difference between value-weighted monthly returns of portfolios of small and large stocks (below or above the median of all NYSE and AMEX); HML_t = the difference between value-weighted monthly returns of high and low book-to-market stocks(above and below the 70 percent and 30 percent fractiles of book-to-market, respectively).

Note 3: It' is annual abnormal returns and p value for F test is in the parentheses.

5.CONCLUSION

Fairfield et al. (2003) suggest that both diminishing marginal returns on investment and conservative accounting lead to the conclusion that firms investing more in net operating assets in current year will experience lower one-year ahead ROA. They also reveal that investors appear to equivalently overprice accruals and growth in long-term net operating assets. They argue that firms with a growth in long-term net operating assets would be less profitable in the following year. In this study, we separate firms into high-ROA and low-ROA groups to test whether firms make rational investment decisions and how the stock market react to the firms decisions. For the low-ROA group, the empirical evidence is more consistent with our argument that, after controlling for current ROA, there are significantly positive effects on growth in long-term operation assets to one-year ahead ROA and the stock market significantly over values growth in long-term operation assets. For the high-ROA group, there are significantly negative effects on growth in long-term operation assets to one-year ahead ROA, but our result shows no significant evidence that the stock market over values growth in long-term operation assets.

The results from our sample seem to be more consistent with our rational investment argument. We believe that rational firms should invest when the expected rate of returns of the new project is higher than the required rate of returns and accordingly, so growth of long-term operating asset may not always decrease firms' future ROA.

The evidence is also inconsistent with FWY's argument regarding conservative accounting bias. When firms increases operating asset, conservative accounting bias means that expenditures should be expensed when incurred, not to defer them into the future. This could result in a higher one-year-ahead ROA, unless these expenditures persist into the next year. So, the second year ROA will not be, on average, decreasing as FWY expected.

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About the Author

Shu-Hua Lee

Shu-Hua Lee is an assistant professor at the Department of Accounting, National Taipei University. She holds a Ph.D. in Accounting from National Taiwan University. Her research interests include market based accounting research and auditing issues. She has published academic papers (including accepted ones) in Advances in Quantitative Analysis of Finance and Accounting, Sun Yat-Sen Management Review, Review of Securities and Futures Markets, International Journal of Accounting Studies, Journal of Financial Studies, Journal of Management and System.

E-mail: shuhua@mail.ntpu.edu.tw

Po-Sheng Ko

Po-Sheng Ko is an associate professor at the Department of Public Finance and Taxation, National Kaohsiung University of Applied Sciences, Kaohsiung, Taiwan. He completed his Ph. D. degree at the Department of Economics, University of Utah, U.S.A.. His research areas include Pricing Policies and Strategies, Spatial Competition and Strategies, Financial Management, and Econometric Analysis. Related studies have been published in Advances in Quantitative Analysis of Finance and Accounting, Review of Pacific Basin Financial Markets and Policies, International Journal of Electronic Finance, Journal of Management, Bulletin of Educational Research, Taiwanese Journal of Sociology, Taiwan Banking and Finance Quarterly, Journal of Taiwan Bank, Journal of Monetary Market, Journal of Management Science and Statistical Decision, Journal of Intelligence and Innovation.

E-mail: psko@cc.kuas.edu.tw

Wei-Lian Fang

Wei-Lian Fang is Assistant Professor of Department of Accounting, Ming Chuan University. He holds a Ph.D. in Accounting from National Taiwan University, and mainly engages in empirical financial accounting research. His essay has been accepted by NTU Management Review (forthcoming).

E-mail: wlfang@mcu.edu.tw

Wen-Chih Lee

Wen-Chih Lee is Professor of Graduate Institute of Commerce, National Kaohsiung University of Applied Science. He holds a Ph.D. in Accounting from National Taiwan University. His research interests include financial accounting and audit market and ever published academic papers in International Journal of Accounting, Review of Quantitative Finance and Accounting, Advances in Quantitative Analysis of Finance and Accounting, Advances in Investment Analysis and Portfolio Management, PanPacific Management Review, Journal of Management, Sun Yat-Sen Management Review, Journal of Financial Studies, Review of Securities and Futures Markets, Chiao Da Management Review, Asia Pacific Management Review and Journal of Management and System.

E-mail: wenchih@cc.kuas.edu.tw