Information in Balance Sheets for Future Stock Returns: Evidence from Net Operating Assets [*]

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First Draft: October 12, 2006

This Draft: April 25, 2009

[*] The authors appreciate helpful comments from the seminar participants at the EAA (2007) annual congress, at the FMA (2007) annual meeting, at the H.F.A.A. (2007) annual conference, at CASS Business School, at HEC Lausanne and at the University of Piraeus. The authors also thank David Hirshleifer, Gikas Hardouvelis, Roger Huang, Hoang Huy Nguyen (FMA discussant), M. Warachka and an anonymous referee for insightful comments and suggestions. The usual disclaimer applies.

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Abstract: This paper extends the work of Hirshleifer et al. (2004) on the net operating assets (NOA) anomaly. After controlling for total accruals, we find a negative relation of NOA and asset NOA components with future stock returns. We also find that the hedge strategies on NOA and asset NOA components generate abnormal returns and constitute statistical arbitrage opportunities. Our overall analysis is highly suggesting that the NOA anomaly may be present due to a combination of opportunistic earnings management with agency related overinvestment.

Keywords: Net operating assets (NOA), stock returns, statistical arbitrage, opportunistic earnings management, overinvestment.

JEL classification: M4

1 *Introduction*

An extensive body of research in accounting and finance investigates the informational content of firm's balance sheets for their future stock price returns. Starting with Ou and Penman (1989) and followed by Holthausen and Larcker (1992), Lev and Thiagarajan (1993), Abarbanell and Bushee (1997) and Piotroski (2000) they showed that various balance sheet ratios can be used to predict future stock returns. Sloan (1996) found that firms with low working capital accruals (change in net working capital minus depreciation expense) experience higher future stock returns than firms with low working capital accruals. Fairfield at al. (2003a) showed that changes in net long term operating assets are associated with future stock returns in similar manner with working capital accruals. In follow up research, Richardson et al. (2005) extended the definition of accruals employed in Sloan (1996) to include changes in net long term operating assets and showed that this extended measure of total accruals (change in net operating assets) is associated with even greater stock returns. Chan et al. (2006) found that Sloan's (1996) results are primary attributable to inventory, accounts receivable and accounts payable accruals. Finally, Cooper et al. (2008) found that a firm's asset growth rate is also negatively related with future stock returns, while Chan et al. (2008) showed that this finding exists for all asset growth components except cash.

An important contribution to the above research is the paper of Hirshleifer et al. (2004). They found that the level of net operating assets, scaled by lagged total assets (NOA), is a strong negative predictor of future stock returns for at least three years after the balance sheet information is released. NOA represents the cumulation over time of the difference between operating income (accounting profitability) and free cash flow (cash profitability). In other words NOA is a cumulative measure of total accruals – a measure of balance sheet bloat:

$$NOA_T = \sum_0^T Operating\ Iincome_t - \sum_0^T Free\ Cash\ Flows_t = \sum_0^T Total\ Accruals_t \quad (1)$$

The key insight emerging from the above relationship is that a cumulation of accounting income without a cumulation of free cash flows raises doubts about the sustainability of current earnings performance. Hirshleifer et al. (2004) call the negative relation of NOA with future stock returns as "sustainability effect", since high NOA is an indicator of a rising trend in current accounting profitability that is unlikely to be sustained in the future: investors with limited attention focusing in accounting income can make flawed investment decisions.[1] In particular, investors overvalue firms with high NOA and undervalue

[1]Hirshleifer and Teoh (2003) suggest that information that is more salient or which requires less cognitive power is used more by investors and as a result is impounded more in the stock prices.

firms with low NOA. This leads to a NOA anomaly whereby firms with high (low) NOA experience negative (positive) future abnormal stock returns. Hirshleifer et al. (2004) also provided clear evidence that NOA is a more comprehensive measure of investor's over-optimism about the sustainability of current earnings performance that captures information over and above than contained in working capital accruals and total accruals. Further, they claimed that the level of net operating assets is superior to accruals because it captures all cumulative past changes between accounting profitability and cash profitability, rather the most recent change.[2]

The current evidence on the predictive ability of NOA for future stock returns raises several broader questions. First, previous research has not focused on the whether different forms of net operating assets are related with future stock returns as measures of the sustainability of current earnings performance. For example, as claimed by Hirshleifer at al. (2004) an important distinction based on the nature of the underlying business activity that NOA capture, is between net working capital assets (NWCA) and net non current operating assets (NNCOA). Similarly, another important distinction based on the nature of underlying benefits and obligations that NWCA and NNCOA represent, is between their asset and liability components. In particular, NWCA can be divided into working capital assets (WCA) and liabilities (WCL), while NNCOA into non current operating assets (NCOA) and liabilities (NCOL).

Second, the interpretation of the NOA anomaly is still a controversial issue. Several explanations can be put forward, but previous studies have not distinguished among them. From a rational pricing perspective, a possible explanation is that high NOA firms are less risky than low NOA firms, and therefore earn lower risk premia. As such, whether the NOA anomaly represents rational risk premium or market inefficiency is under debate. Note that based on Callen and Segal (2004) the NOA to equity market value ratio can be used to derive an accounting-based valuation model with time-varying discount rates.

Under a behavioral interpretation, the most common line of thought follows the opportunistic earnings management hypothesis of Xie (2001) and the agency related overinvestment hypothesis of Jensen (1986). According, to the opportunistic earnings management hypothesis, NOA increases as managers book sales prematurely, allocate more

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[2] In a recent paper, Richardson et al. (2006) argued that the predictive power of net operating assets does not differ from that of total accruals because net operating assets in Hirshleifer et al. (2004) are deflated by lagged total assets. Richardson et al. (2006) supported their argument with algebraic decompositions and empirical results from descriptive statistics and correlations. However, note that the measures used in Richardson et al. (2005) and Hirshleifer et al. (2004) are not mathematically equivalent. Furthermore, empirical results from descriptive statistics and correlations do not necessarily imply or infer causality for Richardson et al. (2006) argument. On the other hand, Hirshleifer et al. (2004) findings show that the level of net operating assets is a cumulative measure of investor misperceptions about the sustainability of financial performance that captures information beyond that contained in flow variables such as working capital accruals or total accruals.

overhead expenses to inventory than to cost of goods sold, capitalize operating expenses as fixed assets, select depreciation/amortization schedules that are not based on the underlying useful and salvage values of fixed assets and understate operating liabilities, in order to inflate earnings upwards. Managerial discretion calls also for write-down decisions based on subjective estimates of fair value of NOA (e.g. receivables, inventory, intangibles, property, plant and equipment).

Based on the overinvestment explanation, NOA increases as managers invest in value-destroying projects to serve their own interests. As another competing behavioral explanation one can think that hypothesis that NOA contain adverse information about firm's business conditions. Based, on this hypothesis, NOA could increase as a result of difficulties in generating sales, pressures to extend credit terms, overproduction and less efficient use of existing investments. In all above cases, high NOA provides a warning signal about the sustainability of current earnings performance. However, investors with limited attention that focus in accounting income and fail to discount for the low sustainability of current earnings performance will overvalue (undervalue) firms with high (low) NOA.

A final behavioral interpretation could draw on the idea that the sustainability effect may stem from the same patterns of investor behavior to the value/glamour effect. Lakonishok et al. (1994) postulate that investors extrapolate the weak (strong) past growth rates of value (growth) firms to form pessimistic (optimistic) expectations about their future growth rates. As growth rates mean-revert in the future, investors are negatively (positively) surprised by the performance of growth (value) firms. NOA by definition reflects all cumulative past changes between accounting profitability and cash profitability, which in turn tend to rise with sales. In other words, firms with high NOA are more likely to have high past growth in sales. As a result, the sustainability effect may arise from investor's errors in expectations about future growth.

The above behavioral hypotheses are not mutually exclusive and probably co-exist. Managers of firms that face a slowdown in business conditions could have additional motives to manipulate earnings upwards in order to meet analyst forecasts and to engage in wasteful spending that serves their own interests, thereby leading to an increase in NOA. These motives could be stronger as investors and analysts extrapolate past trends in growth rates to form expectations about future growth rates.

The above issues motivate us to focus on the NOA anomaly in order to get a better understanding of its underlying causes. Our work is organized along three dimensions. First, we empirically investigate the relation of NOA and NOA components with future stock returns – after controlling for total accruals (TACC). That is, we examine directly whether NOA and NOA components can reflect additional information for future stock returns beyond than contained in TACC. Our analysis in this part begins with a decomposition of NOA into cumulative operating accruals (NWCA) and cumulative investing accruals (NNCOA):

$$NOA_T = NWCA_T + NNCOA_T = \sum_0^T Operating\ \ Accruals_t + \sum_0^T Investing_t\ \ Accruals_t \quad (2)$$

Then, NWCA will be decomposed into cumulative operating asset accruals (WCA) and cumulative operating liability accruals (WCL), while NNCOA into cumulative investing asset accruals (NCOA) and cumulative investing liability accruals (NCOL):

$$NWCA_T = WCA_T - WCL_T = \sum_0^T Operating\,Asset\,Accruals_t - \sum_0^T Operating_t\ Liability\,Accruals_t \quad (3)$$

$$NNCOA_T = NCOA_T - NCOL_T = \sum_0^T Investing\,Asset\,Accruals_t - \sum_0^T Investing_t\ Liability\,Accruals_t \quad (4)$$

Second, we examine whether the NOA anomaly reflects rational risk premium or market inefficiency, by investigating abnormal returns of hedge strategies based on the magnitude of each of these NOA components. Recognizing, that abnormal returns from trading strategies don't necessarily imply the rejection of market efficiency, since they could be due to mismeasured risk if the model of market returns is invalid, we also apply the statistical arbitrage test of Hogan et al. (2004) to hedge strategies based on NOA and NOA components. This test circumvents the joint hypothesis dilemma of traditional market efficiency tests since its definition is not contingent upon a specific model for market returns (or model of risk adjustment).

Third, we distinguish between different hypotheses that can be put forward to interpret the NOA anomaly. Using a modified version of the model of Chan et al. (2006) that is based on sales growth, we disaggregate NOA and NOA components into their expected and unexpected parts to examine their implications for future stock returns. The expected part reflects NOA and NOA components that are attributable to growth in output, under the assumption that there are no accounting distortions on sales (e.g. premature booking of sales). Thus, if investor's errors in expectations about future growth is the underlying culprit of the NOA anomaly, then the expected part of NOA and NOA components should have forecasting ability in predicting future stock returns. The unexpected part of NOA and NOA components will pick up either opportunistic earnings management and/or a slowdown in business conditions. Thus, the opportunistic earnings management hypothesis and the hypothesis related to slowdown in business conditions suggest that unexpected part of NOA and NOA components should have forecasting ability in predicting future stock returns. Finally, we examine more closely the role of the overinvestment hypothesis by investigating whether returns the NOA strategy, vary with the profitability of past capital investments (past return on equity). Under the overinvestment hypothesis, high (low) NOA firms with a weak (strong) background of profitable investments should experience negative (positive) future abnormal stock returns.

2 Data, Sample Formation and Variable Measurement

Our empirical tests are conducted using data from two sources. Financial statement data are obtained from the Compustat annual database and monthly stock return data are obtained from CRSP monthly files. However, we eliminate pre-1962 observations since the Compustat data prior 1962 suffers from survivorship bias (Fama and French, 1992; Sloan, 1996) and therefore, our sample covers all firm-year with available data on Compustat and CRSP for the period 1962-2003. Moreover, we exclude all firm year observations with SIC codes in the range 6000-6999 (financial firms) because the discrimination between operating activities and financing activities is not clear for these firms. Furthermore, we require as in Vuolteenaho (2002) all firms to have a December fiscal year end, in order to align accounting variables across firms and obtain tradable investment strategies for our subsequent portfolio assignments. Finally, we eliminate firm-year observations with insufficient data on Compustat to compute the primary financial statement variables used in our tests[3]. These criteria yield final sample sizes of 105,896 firm year observations with non-missing financial statement and stock return data.

As mentioned in the previous section we need NOA, NWCA, NNCOA, WCA, WCL, NCOA and NCOL to conduct empirical tests. NWCA is defined as the difference between WCA (current assets minus cash and cash equivalents) and WCL (current liabilities minus short term debt):

$$NWCA_t = WCA_t - WCL_t = (CA_t - C_t) - (CL_t - STD_t)$$

where:

- CA_t : Current assets (Compustat data item 4).
- C_t : Cash and cash equivalents (item 1).
- CL_t : Current liabilities (item 5).
- STD_t : Short term debt (item 34).

NNCOA is defined as the difference between NCOA (total assets minus current assets) and NCOL (total liabilities minus current liabilities minus long term debt):

$$NNCOA_t = NCOA_t - NCOL_t = (TA_t - CA_t) - (TL_t - CL_t - LTD_t)$$

where:

- TA_t : Total assets (item 6).

[3]In particular, we eliminate firm year observations if Compustat data items 1, 4, 5, 6 and 181 are missing in both the current and previous year and data item 18 is missing in the current year. If data items 9, 34, are missing, we set them equal to zero rather than eliminating the observation. The results are qualitatively similar if we instead eliminate these observations.

- TL_t : Total liabilities (item 181).
- LTD_t : Long term debt (item 9).

Thus, NOA is defined as the difference non cash assets (total assets minus cash and cash equivalents) and non-debt liabilities (total liabilities minus short and long term debt):

$$NOA_t = (TA_t - C_t) - (TL_t - STD_t - LTD_t)$$

Consistent with previous research, we deflate NOA and NOA components by lagged total assets. Recall also, that in our tests we also consider, total accruals (TACC), market capitalization (MV), book to market ratio (BV/MV), sales (SA, item 12) and past return on equity (ROE). Total accruals are defined as annual change in net operating assets and deflated by lagged total assets. Market capitalization is measured as price per share (item 199) times shares outstanding (item 25) at the beginning of the portfolio formation month. Note that we require at least a four-month gap between the portfolio formation month and the fiscal year end to ensure that investors have financial statement data prior to forming portfolios.[4] Book to market ratio is defined as the ratio of the fiscal year end book value of equity (item 60) to the market capitalization. Further, past return on equity is measured as the ratio of annual net income (item 18) averaged over the five years prior to portfolio formation (years -4, -3, -2, and -1 receive weights of 10%, 20%, 30% and 40% respectively) to the fiscal year end book value of equity.

Following Fairfield et al. (2003) and Hirshleifer et al. (2004), we also consider an alternative definition of NOA that is based on selection of operating assets and operating liabilities, to check for robustness in our hedge portfolio stock return tests. According to this definition, NWCA is defined as the difference WCA (account receivables plus inventories plus other current assets) and WCL (accounts payable plus other current liabilities):

$$NWCA_t = WCA_t - WCL_t = (ARE_t + INV_t + OCA_t) - (AP_t + OCL_t)$$

where:

- ARE_t : Accounts receivables (item 2).
- INV_t : Inventories (item 3).
- OCA_t : Other current assets (item 68).
- AP_t : Accounts payable (item 70).
- OCL_t : Other current liabilities (item 72)

NNCOA is defined as the difference between NCOA (net property, plant and equipment plus intangibles plus other long term assets) and NCOL (other long term liabilities):

[4] Alford et al. (1994) argue that four months after the fiscal year end, all firm's financial statement data are publicly available.

$$NNCOA_t = NCOA_t - NCOL_t = (NPPE_t + INT_t + OLA_t) - OLTL_t$$

where:

- $NPPE_t$: Net property plant and equipment (item 8).
- INT_t : Intangibles (item 33).
- OLA_t : Other long term assets (item 69).
- $OLTL_t$: Other long term liabilities (item 75)

Thus, NOA is defined as the difference between operating assets and operating liabilities:[5]

$$NOA_t = (ARE_t + INV_t + OCA_t + NPPE_t + INT_t + OLA_t) - (AP_t - OCL_t - OLTL_t)$$

The annual one-year ahead raw stock returns RET are measured using compounded 12-month buy-hold returns inclusive of dividends and other distributions from the CRSP monthly files. Then, size-adjusted returns $ARET$ are calculated by deducting the value weighted average return for all firms in the same size-matched decile, where size is measured as the market capitalization at the beginning of the return cumulation period. The size portfolios are formed by CRSP and are based on size deciles of NYSE and AMEX firms. If a firm is delisted during our future return window, then the CRSP's delisting return is considered for the calculation of the one-year ahead raw stock return, and any remaining proceeds are re-invested in the CRSP value-weighted market index. This mitigates concerns with potential survivorship biases. If a firm is delisted during our future return window as a result of poor performance and the delisting return is coded as missing by CRSP, then a delisting return of -100% is assumed. Finally, data for risk free rates, market portfolio and other mimicking portfolios (size, book to market and momentum) are obtained from Ken French's web page.[6]

3 Results

3.1. Descriptive Statistics

In table 1, we report univariate statistics for NOA and NOA components. The mean values of NOA, NWCA and NNCOA are (0.629), (0.189) and (0.44), respectively. The

[5] NOA and NOA components based on this alternative definition, are also scaled by lagged total assets.
[6] Note that we replicate all results by scaling NOA and NOA components with current total assets, average total assets, lagged or current sales, scaling TACC with average total assets, and impose a number of robustness data screens such as including NASDAQ firms, excluding firms in the bottom size deciles, excluding firms with stock price less than 5$ and assuming a return of -30% (following Shumway 1997) or a zero return for delisted firms with missed return data by CRSP. Our results remain qualitatively similar with respect to these alternative procedures.

median values of NOA, NWCA and NNCOA are (0.683), (0.163) and (0.426), respectively. These values indicate that firms have more NNCOA than NWCA. Turning to the extended decomposition, the mean values WCA, WCL, NCOA and NCOL are (0.394), (0.205), (0.505) and (0.065), respectively. The median values of WCA, WCL, NCOA and NCOL are (0.383), (0.181), (0.484) and (0.037), respectively. These values indicate that firms invest more in NCOA than WCA, but have less NCOL than WCL. Focusing on the standard deviations of the components of initial decomposition of NOA, NNCOA has the highest standard deviation (0.224) followed by NWCA (0.208). Hence, these two components represent important sources of total variation in NOA. Turning to the extended decomposition, the standard deviations of WCA, WCL, NCOA, and NCOL are (0.238), (0.129), (0.248) and (0.084), respectively. Thus, total variation in NWCA is mainly driven by WCA and total variation in NNCOA is mainly driven by NCOA.

Table 2 presents pair wise correlations (Pearson) for NOA and NOA components. The correlation of NOA with NWCA (0.491) does not differ much from that of NNCOA (0.589) suggesting that these two components represent important source of the total variation in NOA. The correlation of NOA with NCOA (0.499) is higher than that of WCA (0.28), while NOA is also more negatively correlated with WCL (-0.278) compared with NCOL (-0.098). WCA and NCOA are strongly positively correlated with WCL and NCOL respectively, indicating that operating liabilities provide a significant source of financing for operating assets. Furthermore, NWCA is highly positively correlated with WCA (0.841) and negatively correlated with WCL (-0.063) and the correlation of NNCOA with NCOA (0.942) is much higher than that of NCOL (0.116). These findings confirm again, that total variation in NWCA is mainly driven by WCA and total variation in NNCOA is mainly driven by NCOA.

3.2. Cross Sectional Regressions Results

In this section, we estimate Fama and MacBeth (1973) cross sectional regressions of future raw stock returns on NOA and NOA components after controlling for TACC and report the time series averages of the resulting parameter coefficients. Following Hirshleifer et al. (2004), we also use the natural logarithm of market capitalization and the natural logarithm of book to market ratio (negative book value firms are excluded) as standard asset pricing controls in the regressions. The reported t-statistics (in parenthesis) are based on the means and standard deviations of the parameter coefficients obtained in the annual cross sectional regressions. That is, we examine directly whether NOA and NOA components can reflect additional information for future stock returns beyond than contained in TACC.

Table 3 presents our regression results for NOA, NOA components and TACC. From the first and the second row of panel A in table 3, we see that the coefficient on NOA is -0.089

(t=-5.089), while on TACC is -0.087 (-5.191). However, from the third row we see that when they are both included in the regression, the coefficient on NOA is -0.094 (t=-2.233), while on TACC is no longer statistically significant at conventional levels. Thus, consistent with Hirshleifer et al. (2004) we find that NOA subsumes the predictive power of TACC for future stock returns.

Panel B of table 3 reports results of estimating the regressions of future raw stock returns on NOA components based on our initial decomposition and TACC. From the first two rows of panel B in table 3, the coefficient on NWCA is -0.064 (t=-2.355), while on NNCOA is -0.054 (t=-2.712). Similarly, from the third row of panel B of table 3, when both they are both included in the regression the coefficient on NWCA is -0.102 (t=-3.991), while on NNCOA is -0.079 (t=-3.977). Results, from the last row reveal that once we control for TACC, the coefficients on both NWCA and NNCOA are still negative and statistically significant, while the coefficient on TACC is no longer statistically significant.

Panel C of table 3 reports results of estimating the regressions of future raw stock returns on NOA components based on our extended decomposition and TACC. From the first and the third row of panel C of table 4, the coefficient on WCA is -0.049 (t=-2.322), while on NCOA is -0.047 (t=-2.479). However, from the second and the fourth row of panel C of table 3, we do not see statistically significant coefficients for the underlying WCL and NCOL liability components. Results from the fifth row of panel B of table 3 reveal that, when both asset and liability NOA components are included in the regression their coefficients are all negative and statistically significant. Note, that the coefficients of WCL and NCOL are much different in magnitude and significance in the multivariate regression than in the univariate regressions. From a statistical perspective, this difference arises from the positive correlation of WCA with WCL and the positive correlation of NCOA and NCOL, shown in table 2. The economic rationale, for these positive correlations is straightforward: WCL and NCOL provide a significant source of financing for WCA and NCOA, respectively. These positive correlations lead to correlated omitted variables biases in the univariate regressions that are not present in the multivariate regression. This point implies that, only the coefficients in the multivariate regression represent the marginal relation of specific NOA components with future stock returns (i.e., after holding all other NOA components constant). In particular, the coefficients on WCL and NCOL reported on the fifth row of panel C of table 3 suggest that their use as a source of financing for their respective asset NOA components (WCA and NCOA), lead to negative stock returns. As such, our findings from the extended decomposition suggest that the sustainability effect is mainly driven by the asset NOA components. Similar results are found from the final row, once we control for TACC. Note, that the coefficient on TACC is not statistically significant in the presence of NOA components based on our extended decomposition.[7]

Overall, the results from table 3 indicate NOA and NOA components can reflect additional information for future stock returns beyond than contained in TACC. Thus, consistent with Hirshleifer et al. (2004), we find that TACC provides a fragmentary indicator of the degree to which operating/reporting outcomes have predictive ability for future stock price performance. NOA and NOA components are superior since they capture all cumulative past changes between accounting profitability and cash profitability, rather the most recent change.

3.3. *Stock Return Results*

In this section, we present results on whether the Hirshleifer et al. (2004) behavioral (mispricing) explanation is appropriate in interpreting the negative relation of NOA with future stock returns.[8] As argued, a high level of NOA indicates a lack of sustainability of current profitability causing, investors with limited attention that focus on accounting income to overvalue (undervalue) firms with high (low) NOA. Consistent with this interpretation, Hirshleifer et al. (2004) show that a trading strategy taking a long (short) position in firms that report low (high) NOA generate positive abnormal returns. From our regression results, we find a strong negative relation of NWCA, NNCOA, asset NOA components with future stock returns. Further, we also find that WCL and NCOL could contribute in this relation only as sources of financing for their respective asset NOA components. However, from a rational pricing perspective, this relation could be explained as compensation of higher risk. The type of risk at the center of that argument could be distress risk.[9] To assess this possibility we investigate the hedge returns of trading strategies based on the magnitude of NOA components. We rank firms annually on NOA components, and then allocate them into ten equally-sized portfolios (deciles) based on these ranks. Then, we compute separate future equally weighted annual size-adjusted returns for each portfolio and the hedge returns for the trading strategies consisting of a long (short) position in the lowest (highest) portfolio of each NOA component.

[7]To examine the effects of outliers in the NOA distribution, we follow Cooper et al. (2008) and estimate regressions by winsorizing the NOA distribution at the 1% and 99% points of the distribution. Winsorizing the data has the effect of making the predictive power of NOA and NOA components for future stock returns stronger.

[8] Hirshleifer et al. (2006) present also evidence consistent with a behavioral (mispricing) interpretation of the NOA anomaly.

[9] Khan (2008a) show that working capital accruals are correlated with economic and financial distress characteristics (low sales, low earnings, high interest expense).

In panel A of table 4 we report size-adjusted returns for portfolios and hedge strategies on NOA and the initial decomposition. On the first column we present results for the deflator (DEF ~ inverse of lagged total assets) to investigate its contribution on the performance of portfolios and hedge strategies on NOA and NOA components. As shown, the contribution of the deflator is insignificant. From the second column, consistent with our regression results and with Hirshleifer et al. (2004) evidence, we find that the return for NOA is 15.6% (t=4.07). Note that the strategy is positive in 34 of the 40 years examined, suggesting that the relation is fairly stable over time. We also find that the trading strategies taking a long (short) position in firms that report low (high) NWCA and NNCOA generate positive size-adjusted returns. In particular, the hedge return for NWCA is positive 6.2% (t=2.56), while for NNCOA is 11.7% (t=3.254). Finally, in an unreported test we find that there are no significant differences between the returns generated from the hedge strategies based on magnitude of NWCA and NNCOA (t=1.463).

In panel B of table 4 we report size-adjusted returns for portfolios and hedge strategies on the extended decomposition of NOA. Consistent with prior results from our regression tests, we find that the trading strategies taking a long (short) position in firms that report low (high) WCA and NCOA generate positive size-adjusted returns. In particular, the hedge return for WCA is 6.8% (t=2.341), while for NCOA 10.7% (t=2.77). Furthermore, in an untabulated test we find that there are no significant differences between the size-adjusted returns generated from the hedge strategies based on magnitude of WCA and NCOA (t=0.951). Finally, we do not find significant hedge returns for the underlying WCL and NCOL liability components. Overall, the results from table 4 confirm that the NOA anomaly is mainly driven by the asset NOA components.

To check for robustness, we also consider an alternative definition of NOA that is based on selection of operating assets and operating liabilities (see the discussion on the data section). The results in panels A and B of table 5 indicate that the two measures of NOA are very similar. The hedge size-adjusted return on NOA is 14% (t=5.878). Note that the strategy is positive in 37 of the 40 years examined, suggesting that the relation is, again, fairly stable over time. Turning to the components of the initial decomposition of NOA, we see that the hedge size-adjusted returns for NWCA and NNCOA are 5.5% (t=2.281) and 10.1% (t=3.665), respectively. Furthermore, from the extended decomposition of NOA, we see significant size-adjusted returns for the hedge strategies on the underlying WCA and NCOA asset components, while no significant returns for the hedge strategies on the underlying WCL and NCOL liability components. In particular, the hedge returns for WCA and NCOA are 6.1% (t=2.158) and 10.5% (t=3.257), respectively.

In panel C of table 5 we provide the returns for the operating assets and liabilities that are considered in the alternative definition of NOA. Turning to WCA components we see that we see that the hedge size-adjusted returns for accounts receivables (ARE, hereafter) and inventory (INV, hereafter) are 5.3% (t=2.022) and 5% (t=2.159), respectively. However, we find no significant hedge returns for other current assets (OCA). Thus, we can argue that the negative relation of WCA with future stock returns is entirely attributable to ARE and INV. Moreover, turning to WCL we see that the hedge return for AP is -5% (t=-2.495) and no significant hedge return for other current liabilities (OCL). As such, we can argue that the negative relation of WCL with future stock returns is entirely attributable to AP. For NCOA we see that the hedge size-adjusted returns for net property, plant and equipment (NPPE, hereafter) and intangibles (INT, hereafter) are 6.9% (t=2.264) and 4.4% (t=2.21), respectively. However, we find no significant hedge returns for other long term assets (OLA) and other long term liabilities (OLT). Thus, we can argue that the negative relation of NCOA with future stock returns is entirely attributable to NPPE and INT. Overall, the results from table 5 confirm again that the NOA anomaly is mainly driven by the asset NOA components.

In order to distinguish more properly between rational and irrational interpretations, it is useful to incorporate in our analysis other potential controls for risk. It is possible that firms in extreme deciles have different risk characteristics. For this purpose, we conduct time series regressions of one-year ahead raw stock returns for hedge strategies based on the magnitude of NOA and NOA components on the CAPM model which contains the excess return of the market portfolio, the Fama-French (1995) three factor model which contains the market portfolio and two factor mimicking portfolios associated with the size effect (SMB) and the book to market effect (HML) and the Carhart (1997) four factor model which adds a momentum (MOM) mimicking portfolio to the previous factors. Note, that CAPM is a theoretically motivated asset pricing model, while the Fama-French model and the Carhart model are empirically motivated. As such, readers should be very careful in interpreting factors from the Fama-French (1995) model and the Carhart (1997) model as rationally priced risk factors. Panel A of table 6, presents time series averages of annual mean intercepts alphas from those regressions. From the first row, that reports results from regressions on the CAPM, we see that NOA, NWCA, NNCOA and asset NOA components have positive risk adjusted alphas. Note also, that alphas are somewhat higher in magnitude than the respective size-adjusted returns. For liability NOA components, we see that the strategy on WCL has insignificant alphas. However, risk-adjusted alphas for the strategy on NCOL are significant and much higher than the respective size-adjusted returns, indicating a higher risk exposure for the strategy that cannot be explained by CAPM. Turning to the second and the third row, we see similar findings for the Fama-French (1995) model and the Carhart (1997) model. Overall, our findings from panel A of table 6 suggest that NOA anomaly cannot be explained by the most common factor models.

However, an immediate question in any debate over risk and mispricing is whether the model of market returns (or model of risk adjustment) with respect to which mispricing is documented is valid. Fama (1970) was among the first to observe that tests of market efficiency are joint tests of mispricing and the model of market returns. Thus, the abnormal returns from trading strategies don't necessarily imply the rejection of market efficiency, since they could be due to mismeasured risk if the model of market returns is invalid (Ball 1978).[10] In order to avoid this joint hypothesis dilemma of traditional market efficiency tests, we apply the statistical arbitrage test that is designed by Hogan et al. (2004) and defined without reference to a specific model for equilibrium returns, to hedge strategies based on NOA and NOA components.[11] To our knowledge, this is the first paper in this line of the literature that tests for statistical arbitrage of strategies on NOA and NOA components.[12]

By definition a trading strategy that constitutes statistical arbitrage opportunities must have a zero initial cost (self financing), positive expected discounted profits, a probability of a loss converging to zero and a time-averaged variance converging to zero if the probability of a loss does not become zero in finite time. In economics terms, the last condition associated with the time-averaged variance implies that a statistical arbitrage opportunity eventually produces riskless incremental profit, with an associated "Sharpe" ratio increasing monotonically through time. Note, that the concept of statistical arbitrage opportunity is similar to the limiting arbitrage opportunity used to construct Ross' APT (1976). Finally, the definition of statistical arbitrage is not contingent upon a specific asset pricing model for equilibrium returns and therefore, its existence is inconsistent with market equilibrium, and by inference, with market efficiency.

The zero initial cost (self financing) condition in these tests is enforced by is enforced by investing (borrowing) trading profits (losses) generated by each trading strategy at the risk free rate. Specifically, time series of annual hedge (raw) returns $RET\left(t_i\right)$ are first generated from hedge strategies on hedge strategies on NOA and NOA components. Then, the trading profits $V\left(t_i\right)$ of each trading strategy accumulate at the risk free rate $r\left(t_i\right)$ to yield cumulative trading profits (with $V\left(t_0\right)=0$):

$$V\left(t_i\right)=RET\left(t_i\right)+e^{r\left(t_{i-1}\right)}\cdot V\left(t_{i-1}\right) \tag{5}$$

[10]A similar argument can be put forward when the Abel and Mishkin (1983) test of rational expectations is rejected (see Khan 2008b for details).

[11]Cochrane and Saa-Requejo (2000), Bernardo and Ledoit (2000) and Carr et al. (2001) have also conducted similar tests without specifying a particular model of market returns.

[12]Hogan et al. (2004) have applied the test to momentum and value/growth strategies and find that only half of them constitute statistical arbitrage opportunities. Zhang (2006) have applied the test to industry accrual and NOA strategies and find that only the industry NOA strategy survives it.

This cumulative trading profit is then discounted each period by $e^{\sum_{i=1}^{n} \Sigma r(t_i)}$ to construct discounted cumulative trading profits $v(t_i)$ for each trading strategy. Let $\Delta v_i = v(t_i) - v(t_{i-1})$, denote the increments of the discounted cumulative profits with mean μ, growth rate of mean θ, standard deviation σ and growth rate of standard deviation λ. Assume also that Δv_i evolve according to the following stochastic process:

$$\Delta v_i = \mu \cdot i^{\theta} + \sigma \cdot i^{\lambda} \cdot z_i \qquad (6)$$

where i=1,2,…..n, z_i are $i.i.d$ $N(0,1)$ random variables with $z_0 = 0$, $v(t_0)$ and Δv_0 are equal to zero. Under the above assumed stochastic process, the discounted cumulative profits v_t are distributed as

$$v(t_n) = \sum_{i=1}^{n} \Delta v_i \sim N\left(\mu \sum_{i=1}^{n} i^{\theta}, \sigma^2 \sum_{i=1}^{n} i^{2\lambda} \right) \qquad (7)$$

and have the following log likelihood function.

$$\log L\left(\mu, \sigma^2, \theta, \lambda \middle| \Delta v\right) = -\frac{1}{2} \sum_{i=1}^{n} \log\left(\sigma^2 i^{2\lambda}\right) - \frac{1}{2\sigma^2} \sum_{i=1}^{n} \frac{1}{i^{2\lambda}} \left(\Delta v_i - \mu \cdot i^{\theta}\right)^2 \qquad (8)$$

The parameters μ, θ, σ, λ can be estimated using maximum likelihood and the associated score equations are provided in the appendix.[13] Then, assuming that $\theta = 0$, one can conduct constraint mean tests of statistical arbitrage. Under these tests a trading strategy generates statistical arbitrage with $1-\alpha$ percent confidence if the following conditions are satisfied[14]:

H1: $\mu > 0$

H2: $\lambda < 0$

The first hypothesis tests whether the mean annual incremental profit of a trading strategy is positive (second condition for statistical arbitrage) and the second, whether its time-averaged variance decreases over time (fourth condition of statistical arbitrage). Thus, a single t-test on incremental trading profits is not a valid test for statistical arbitrage since it focuses only on the second condition but ignores the fourth condition. The two parameters are tested individually with the Bonferroni inequality accounting for the combined nature of the

[13] Note that direct optimization of the likelihood function is not feasible. What is required is the solution of the non-linear system of the score equations. Standard errors and p-values are obtained directly from the (inverse of the) Hessian matrix of the system.

[14] See in the appendix the appropriate conditions for statistical arbitrage under the unconstraint mean tests and in Hogan et al. (2004) for further details on the differences between the constraint and unconstraint tests of statistical arbitrage.

hypothesis test. The Bonferroni inequality stipulates that the sum of the p-values from the individual tests becomes the upper bound for the type I error of the statistical arbitrage tests.[15]

In panel B of table 6 we report the results from statistical arbitrage tests on hedge portfolio strategies based on the magnitude of NOA and NOA components. Starting with the strategy on NOA, it has a mean annual discounted incremental profit (μ) equal 3.9% (p=0.000), and a growth rate of standard deviation (λ) equal to -0.366 (p=0.007). Thus, the strategy constitutes statistical arbitrage opportunities at the 1% level. Turning to the components of initial decomposition of NOA, the hedge strategy on NWCA survives the statistical arbitrage test at the 5% level, while on NNCOA at the 1% level. In particular, the mean annual discounted incremental profit for the strategy on NWCA is 1.2 % (p=0.015), while for the strategy NNCOA is 3.3 % (p=0.000) with estimated growth rates of standard deviation equal to -0.447 (p=0.003) and -0.489 (p=0.000), respectively. Similarly, for the asset components of extended NOA decomposition, the hedge strategy on WCA strategy constitutes statistical arbitrage opportunities at the 5% level, while on NCOA at the 1% level.

On the other hand, the hedge strategies on WCL and NCOL components do not survive the statistical arbitrage test. Note that the hedge strategy on NCOL is found to have the highest risk exposure. As such, abnormal returns (risk adjusted alphas from CAPM, Fama-French model and Carhart model) on this strategy can be explained only by applying the statistical arbitrage test. Overall, our findings indicate that the strategies on NOA, NWCA, NNCOA and the asset NOA components converge to riskless arbitrages with decreasing time averaged variance. Thus, these findings confirm previous findings that NOA anomaly comes from the asset side of the NOA components. These findings are, however, difficult to reconcile with the notion of market efficiency and provide support on Hirshleifer et al. (2004) behavioral interpretation of the NOA effect.

3.4. Expected and Unexpected NOA and NOA components

Our evidence from the stock return tests is consistent with Hirshleifer et al. (2004) investor’s misperception of firms with bloated balance sheets. The rationale of those misperceptions remains ambiguous. Several explanations, that are not mutually exclusive, can be but forward. Firms with bloated balance sheets are more likely to have high past growth in sales. Lakonishok et al. (1994) argue that investors extrapolate past growth rates of firms to form expectations about their future growth rates. As such, investor’s errors in expectations about future growth could be an explanation for negative (positive) future abnormal stock

[15] Note that these hypotheses are the economic hypotheses for the presence of statistical arbitrage. The statistical hypotheses under testing are $\mu = 0$ and $\lambda = 0$ that correspond to absence of arbitrage.

returns of high (low) NOA firms. However, NOA could increase as a result of opportunistic earnings management and/or a slowdown in firm's business conditions. In both cases, high NOA provides a warning signal about the sustainability of current earnings performance. Investors with limited attention that focus in accounting income and fail to discount for the low sustainability of current earnings performance will overvalue (undervalue) firms with high (low) NOA. Consequently, this leads to a NOA anomaly whereby firms with high (low) NOA experience negative (positive) future abnormal stock returns. In order to distinguish between these competing explanations, we decompose NOA and NOA components into their expected and unexpected parts and examine their relation with future stock returns. Our work is consistent with other methods in the accounting literature to detect earnings management (see Beneish 1997). The decomposition will be made using a modified version of the model of Chan et al. (2006) [16] that is based on the idea that the expected level of each component of NOA for a firm is closely related to the level of current sales SA_t as follows:

$$E_t\left(NOA_t\right) = \frac{\sum_{k=1}^{5}\left(NOA\right)_{t-k}}{\sum_{k=1}^{5}\left(SA\right)_{t-k}} SA_t \tag{9}$$

In this model, the expected part of each componet of NOA is assumed to be stable proportion of firm sales. To smooth out transitory fluctuations we estimate this proportion as the ratio of a moving average of the past five years of the actual level of each componet of NOA to a moving average of the past five years of sales. Then, the unexpected part of each componet of NOA is defined as the difference between the actual level of each componet of NOA and its corresponding expected level:

$$U_t\left(NOA_t\right) = NOA_t - E_t\left(NOA_t\right) \tag{10}$$

The expected part reflects NOA and NOA components that are attributable to growth in output. Thus, if investor's errors in expectations about future growth, is the underlying cause of the NOA anomaly then the expected part of NOA and NOA components should have forecasting ability in predicting future stock returns. The unexpected part of NOA and NOA components will pick up opportunistic earnings management and/or a slowdown in business conditions. Thus, the opportunistic earnings management hypothesis and the hypothesis related to slowdown in business conditions suggest that unexpected part of NOA and NOA components should have forecasting ability in predicting future stock returns.

However, as documented by Thomas and Zhang (2000) and McNichols (2000) any misspecification in these decompositions can result in misleading inferences. In particular, a potential limitation of our model is that the expected part could also be affected by managerial

[16] In our work we do not use the Jones (1991) model and follow the approach of Chan et al. (2006), since we recognize that few firms have sufficiently long time series to ensure a reliable estimation of a regression model to extract the expected and unexpected part of each component of NOA.

violation of sales (e.g., overstatement of accounts receivables). Thus, the predictive ability of the expected part for future stock returns could be overstated. On the other hand, the predictive ability of the unexpected part for future stock returns could be understated to the extent that it is contaminated by the expected part.

In table 7 we report size-adjusted returns for portfolios and hedge strategies on the expected and unexpected parts of NOA and NOA components. Starting with panel A, we see that see that the hedge strategies on the expected parts of NOA, and NOA components are not profitable. As such, it does not seem to be the case, investor's extrapolation of past performance, is the culprit of the NOA anomaly. Turning to panel B, we find that the size-adjusted return for the unexpected part of NOA is 8.7% (t=4.885). Note that the strategy is positive in 30 of the 36 years examined. We also find that the trading strategies taking a long (short) position in firms that low (high) unexpected part of NWCA and NNCOA generate positive size-adjusted returns. In particular, the hedge return for NWCA is 5.1% (t=3.443), while for NNCOA is 8.1% (t=4.561). Turning to the asset components of extended NOA decomposition, the hedge return on the unexpected part of WCA is 6.5% (t= 3.669), while on the unexpected part of NCOA is 8.5% (t= 4.542). Recall also from the previous section that the spread in size-adjusted returns for NOA, NWCA, NNCOA, WCA and NCOA is 15.6% (t=4.07), 6.2% (t=2.56), 11.7% (t=3.254), 6.8% (t=2.341) and 10.7% (t=2.77), respectively. Those strategies are also found to constitute statistical arbitrage opportunities. As such, opportunistic earnings management and/or slowdown in firm's business conditions could explain partially the NOA anomaly. In other words, the overinvestment hypothesis could also have a potentially important role in explaining the sustainability effect. Finally, we do not find significant hedge returns for the unexpected parts of WCL and NCOL components.

3.5. Overinvestment and NOA anomaly

As mentioned in the introduction, a high level of NOA may arise as firm executives engage in wasteful spending to serve their own interests, rather than returning funds to shareholders. In such a case, high NOA provides a warning signal about the sustainability of current earnings performance. However, investors with limited attention that focus in accounting income and fail to discount for the low sustainability of current earnings performance will overvalue (undervalue) firms with high (low) NOA. Consequently, this leads to a NOA anomaly whereby firms with high (low) NOA experience negative (positive) future abnormal stock returns.

In order to examine more closely the role of the agency related overinvestment as a contributing factor in the NOA anomaly, we examine whether returns on the NOA strategy vary with the past return on equity (past net income relative to current book value of equity).

Chan et al. (2008) argue that past return on equity (ROE) can be used as an indicator of managerial discretion to use profits from past investment to increase shareholder wealth. As such, managers of high NOA firms with weak profitability of past investments relative to current total equity, have a higher likelihood to make decisions that serve their own interest. In comparison, managers of low NOA firms with strong profitability of past investments relative to current total equity, have a higher likelihood to make decisions that serve shareholder interests. Thus, under the overinvestment hypothesis, high (low) NOA firms with low (high) past ROE should experience negative (positive) future abnormal stock returns.

In table 8, we report size-adjusted returns for portfolios and hedge strategies on NOA after controlling for past ROE. In order to implement this two-dimensional strategy, each year we sort firms based on the magnitude of NOA and into ten equally-sized deciles. Subsequently, firms within each NOA decile are sorted into ten equally-sized deciles based on the magnitude of past ROE. Given that our focus is on extreme deciles, we combine deciles 2-9 together. As shown, from the first row low NOA firms with high past ROE experience positive size adjusted stock returns of about 7.1% (t= 2.696). The return of low NOA firms with low past ROE, although is positive, it is not statistically significant. Turning, to the third row we see that the size adjusted return of high NOA firms with low past ROE is -9.3% (t=-3.634), while of those high past ROE is statistically insignificant. Further, the return from a joint hedge strategy taking a long position in (NOA(1), ROE(10)) and a short position in (NOA(10), ROE(1)) is 16.4% (t=3.986) and indistinguishable to that of a pure strategy NOA. In summary, the above results suggest that overinvestment hypothesis could also have a potentially important role in explaining investor’s misperceptions of firms with bloated balance sheets.

4 Conclusion

Hirshleifer et al. (2004) find that the level of NOA is a strong negative predictor of future stock returns for at least three years after balance sheet information is released and call this relationship “the sustainability effect”: a high level of NOA indicates a lack of sustainability of current profitability causing investors with limited attention, that focus only in accounting income, to overvalue (undervalue) firms with high (low) NOA.

In this paper we extend Hirshleifer et al. (2004) notion of sustainability with future stock returns and empirically validate their claims. In particular, we find that, after controlling for total accruals, there is a negative relation of the level of NOA with future stock returns. Our results indicate that this relation is mostly, if not exclusively, driven from the asset side of the NOA components. Hedge strategies based on the magnitude of these components generate positive hedge abnormal returns and constitute statistical arbitrage opportunities. In contrast, liability NOA components lead, almost in all cases, in insignificant security mispricing. As such, these findings corroborate Hirshleifer et al. (2004) findings on investors' misperception of firms with bloated balance sheets and suggest that they directly associated with the implications of operating assets about the sustainability of current earnings performance.

Consistent with opportunistic earnings management and/or a slowdown in firm's business conditions, we find that the unexpected part of NOA is negatively associated with future stock returns and this negative association applies to the unexpected part of the asset NOA components. However, it appears that there is no significant relation between the expected part of NOA and NOA components with future stock returns, contrary to the hypothesis that the anomaly arises from investor's errors in expectation about future growth. At the same time we cannot rule out an important role for agency related overinvestment. In particular, only high (low) NOA firms with low (high) past ROE are found to experience negative (positive) future abnormal stock returns. If the NOA anomaly is solely driven by opportunistic earnings management and/or slowdown in firm's business conditions, then it should not hinge on investor's misperceptions of managerial investing decisions. Overall, our evidence suggests that the above hypotheses should be treated as supplementary in the interpretation the NOA anomaly.

Appendix

A. Parameters Estimates for the Statistical Arbitrage Test

The parameters μ , θ , σ , λ are estimated from the following system of four equations with four unknowns:

$$\frac{\partial \log L\left(\mu,\sigma^2,\theta,\lambda \middle| \Delta v\right)}{\partial \mu}: \ \mu = \frac{\sum_{i=1}^{n} \Delta v_i i^{\theta-2\lambda}}{\sum_{i=1}^{n} i^{2(\theta-\lambda)}} \tag{1}$$

$$\frac{\partial \log L\left(\mu,\sigma^2,\theta,\lambda \middle| \Delta v\right)}{\partial \sigma^2}: \ \sigma^2 = \frac{1}{n}\sum_{i=1}^{n}\frac{1}{i^{2\lambda}}\left(\Delta v_i - \mu i^{\theta}\right)^2 \tag{2}$$

$$\frac{\partial \log L\left(\mu,\sigma^2,\theta,\lambda \middle| \Delta v\right)}{\partial \theta}: \ \sum_{i=1}^{n} \Delta v_i \log(i) i^{\theta-2\lambda} = \mu \sum_{i=1}^{n} \log(i) i^{2(\theta-\lambda)} \tag{3}$$

$$\frac{\partial \log L\left(\mu,\sigma^2,\theta,\lambda \middle| \Delta v\right)}{\partial \lambda}: \ \sigma^2 \sum_{i=1}^{n} \log(i) = \sum_{i=1}^{n} \frac{\log(i)}{i^{2\lambda}}\left(\Delta v_i - \mu i^{\theta}\right)^2 \tag{4}$$

Note that by assuming, $\theta = 0$ and $\lambda = 0$ we get the standard MLE estimators of the mean and the variance of the incremental trading profits of each strategy:

$$\mu = \frac{1}{n}\sum_{i=1}^{n} \Delta v_i \ \text{ and } \ \sigma^2 = \frac{1}{n}\sum_{i=1}^{n}\left(\Delta v_i - \mu\right)^2$$

B. Unconstraint Mean Test of Statistical Arbitrage

Under the unconstraint mean test, a trading strategy generates statistical arbitrage with $1-\alpha$ percent confidence if the following conditions are satisfied:

H1: $\mu > 0$

H2: $\lambda < 0$

H3: $\theta > \max\left\{\lambda - \frac{1}{2}, -1\right\}$

with the sum of p values for the individual tests forming an upper bound for the type I error a.

Note that by assuming $\theta = 0$ the unconstraint mean test of statistical arbitrage is reduced to a constraint mean test, while by assuming $\theta = 0$ and $\lambda = 0$ it is reduced to a single t-test.

Finally, for the test of H2 to be well defined, we have to assume that the parameter space for λ is the whole real live, although for v_t to have a well defined distribution we need $\lambda \le 0$.

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Table 1: Univariate Statistics for NOA and NOA Components

Parameter	Mean	Median	Std. Dev.
NOA	0.629	0.683	0.234
$NWCA$	0.189	0.163	0.208
$NNCOA$	0.44	0.426	0.224
WCA	0.394	0.383	0.238
WCL	0.205	0.181	0.129
$NCOA$	0.505	0.484	0.248
$NCOL$	0.065	0.037	0.084

Notes: Table 1 reports univariate statistics for NOA and NOA components. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. Working capital assets WCA are defined as the difference between current assets CA (data item 4) and cash and cash equivalents C (data item 1). Working capital liabilities WCL are defined as the difference between current liabilities CL (data item 5) and short term debt STD (data item 34). Net working capital assets $NWCA$ are equal to the difference between working capital assets WCA and working capital liabilities WCL. Non current operating assets $NCOA$ are defined as the difference between total assets TA (data item 6) and current assets CA. Non current operating liabilities $NCOL$ are defined as the difference between total liabilities TL (data item 181), current liabilities CL and long term debt LTD (data item 9). Net non current operating assets $NNCOA$ are equal to the difference between non current operating assets $NCOA$ and non current operating liabilities $NCOL$. Net operating assets NOA are equal to the sum of net working capital assets $NWCA$ and net non current operating assets $NNCOA$. NOA and NOA components (described above) are deflated by lagged total assets

Note, that in our tests we also consider, market capitalization MV, book to market ratio BV/MV, total accruals $TACC$, sales SA (item 12) and past return on equity ROE. Total accruals $TACC$ are defined as annual change in net operating assets ΔNOA and deflated by lagged total assets. Market capitalization MV is measured as price per share (item 199) times shares outstanding (item 25) at the beginning of the portfolio formation month (four months after fiscal year end). Book to market ratio BV/MV is defined as the ratio of the fiscal year end book value of equity (item 60) to the market capitalization MV. Further, past return on equity ROE is measured as the ratio of annual net income (item 18) averaged over the four years prior to portfolio formation (years -4, -3, -2, and -1 receive weights of 10%, 20%, 30% and 40% respectively) to the fiscal year end book value of equity BV.

NOA and NOA components on Table 5 are calculated from an alternative definition of NOA that is employed in Fairfield et al. (2003) and Hirshleifer et al. (2004). According to this definition, working capital assets WCA are defined as the sum of accounts receivables ARE (data item 2), inventories INV (data item 3) and other current assets OCA (data item 68). Working capital liabilities WCL are defined as the sum of accounts payable AP (data item 70) and other current liabilities OCL (data item 72). Net working capital assets $NWCA$ are equal to the difference between working capital assets WCA and working capital liabilities WCL. Non current operating assets $NCOA$ are defined as the sum of net, property, plant and equipment $NPPE$ (data item 8), intangibles INT (data item 33) and other long term assets OLA (data item 69). Non current operating liabilities $NCOL$ are defined as other long term liabilities $OLTL$ (data item 75). Net non current operating assets $NNCOA$ are equal to the difference between non current operating assets $NCOA$ and non current operating liabilities $NCOL$. Net operating assets NOA are equal to the sum of net working capital assets $NWCA$ and net non current operating assets $NNCOA$. NOA and NOA components (described above) are deflated by lagged total assets

Table 2: Pearson Correlations among *NOA* and *NOA* Components

Parameter	*NOA*	*NWCA*	*NNCOA*	*WCA*	*WCL*	*NCOA*	*NCOL*
NOA	**1**	**0.491**	**0.589**	**0.28**	**-0.278**	**0.499**	**-0.098**
NWCA	**0.491**	**1**	**-0.414**	**0.841**	**-0.063**	**-0.453**	**-0.236**
NNCOA	**0.589**	**-0.414**	**1**	**-0.488**	**-0.232**	**0.942**	**0.116**
WCA	**0.28**	**0.841**	**-0.488**	**1**	**0.487**	**-0.527**	**-0.255**
WCL	**-0.278**	**-0.063**	**-0.232**	**0.487**	**1**	**-0.24**	**-0.09**
NCOA	**0.499**	**-0.453**	**0.942**	**-0.527**	**-0.24**	**1**	**0.442**
NCOL	**-0.098**	**-0.236**	**0.116**	**-0.255**	**-0.09**	**0.442**	**1**

Notes: Table 2 presents pair-wise (Pearson) correlations for *NOA* and *NOA* components. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. *NOA* and *NOA* components are defined in Table 1. Bold numbers indicate significance at less than 5% level.

Table 3: Regressions of RET on NOA, NOA Components and $TACC$

Panel A: Regressions of RET on NOA and $TACC$

Intercept	$Ln(MV)$	$Ln(BV/MV)$	NOA	$TACC$
0.332 (4.355)	-0.019 (-2.3)	0.033 (2.943)	-0.089 (-5.089)	
0.278 (3.875)	-0.02 (-2.364)	0.026 (2.315)		-0.087 (-5.191)
0.331 (3.938)	-0.019 (-2.321)	0.034 (3.281)	-0.094 (-2.233)	0.003 (0.066)

Panel B: Regressions of RET on NOA components (Initial Decomposition) and $TACC$

Intercept	$Ln(MV)$	$Ln(BV/MV)$	$NWCA$	$NNCOA$	$TACC$
0.29 (4.081)	-0.021 (-2.514)	0.031 (2.776)	-0.064 (-2.355)		
0.291 (3.86)	-0.018 (-2.233)	0.031 (2.785)		-0.054 (-2.712)	
0.332 (4.421)	-0.019 (-2.394)	0.033 (2.886)	-0.102 (-3.991)	-0.079 (-3.977)	
0.333 (4.011)	-0.019 (-2.434)	0.033 (3.218)	-0.108 (-2.603)	-0.085 (-1.9)	0.002 (0.049)

Panel C: Regressions of RET on NOA components (Extended Decomposition) and $TACC$

Intercept	$Ln(MV)$	$Ln(BV/MV)$	WCA	$-WCL$	$NCOA$	$-NCOL$	$TACC$
0.297 (4.22)	-0.02 (-2.541)	0.029 (2.556)	-0.049 (-2.322)				
0.28 (3.997)	-0.02 (-2.396)	0.029 (2.523)		0.044 (1.439)			
0.288 (3.835)	-0.018 (-2.193)	0.032 (2.827)			-0.047 (-2.479)		
0.269 (3.756)	-0.02 (-2.451)	0.03 (2.74)				-0.047 (-0.916)	
0.336 (4.601)	-0.02 (-2.522)	0.032 (2.811)	-0.103 (-3.884)	-0.088 (-2.509)	-0.084 (-4.353)	-0.149 (-3.064)	
0.34 (4.193)	-0.02 (-2.531)	0.033 (3.179)	-0.112 (-2.495)	-0.088 (-2.338)	-0.096 (-2.111)	-0.158 (-2.815)	0.015 (0.333)

Notes: Table 3 presents results from regressions of annual one-year ahead raw returns RET on NOA, NOA and $TACC$. Following the Fama and McBeth (1973), we estimate annual cross-sectional regressions and report the time series averages of the parameter coefficients along with their associated t-statistics (in parenthesis). The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. RET are measured using compounded 12-month buy-hold returns inclusive of dividends and other distributions from the CRSP monthly files. $Ln(MV)$ is the natural logarithm of market capitalization and $Ln(BV/MV)$ is the natural logarithm of the book to market ratio All other variables are defined in Table 1.

Table 4: $SRET$ for Portfolios on NOA and NOA components

Panel A: $SRET$ for Portfolios sorted by Components on Initial Decomposition of NOA				
Deciles	DEF	NOA	$NWCA$	$NNCOA$
1st Decile	0.01	0.081	0.022	0.061
2nd Decile	0.014	0.058	0.026	0.034
3rd Decile	0.009	0.035	0.029	0.032
4th Decile	0.015	0.033	0.024	0.037
5th Decile	0.029	0.029	0.017	0.015
6th Decile	0.019	0.021	0.023	0.016
7th Decile	0.017	0.022	0.023	0.02
8th Decile	0.026	-0.019	0.019	0.002
9th Decile	0.012	-0.026	0.016	-0.004
10th Decile	0.006	-0.075	-0.04	-0.056
Hedge	0.004	0.156	0.062	0.117
t-statistic	0.15	4.07	2.56	3.254

Panel B: $SRET$ for Portfolios sorted by Components on Extended Decomposition of NOA				
Deciles	WCA	$-WCL$	$NCOA$	$-NCOL$
1st Decile	0.022	-0.011	0.062	0.009
2nd Decile	0.024	0.011	0.035	0.009
3rd Decile	0.023	0.016	0.04	0.01
4th Decile	0.022	0.022	0.025	0.012
5th Decile	0.042	0.015	0.014	0.012
6th Decile	0.025	0.019	0.03	0.019
7th Decile	0.026	0.016	0.006	0.023
8th Decile	0.016	0.025	0.002	0.026
9th Decile	0.005	0.021	-0.009	0.008
10th Decile	-0.047	0.025	-0.045	0.03
Hedge	0.068	-0.036	0.107	-0.021
t-statistic	2.341	-1.625	2.77	-0.597

Notes: Table 4 presents annual mean values of one-year ahead size-adjusted stock returns $SRET$ for each portfolio based on the magnitude of DEF, NOA and NOA components. Firms are ranked annually on DEF, NOA and NOA components and then allocated into ten equal-sized portfolios (deciles) based on these ranks. Hedge represents the return to a portfolio consisting of a long position in the lowest decile and a short position in the highest decile. The t-statistic examines the statistical significance of the hedge return. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. $SRET$ are calculated by deducting from RET (defined in table 2), the value weighted average return for all firms in the same size-matched decile, where size is measured as the market capitalization at the beginning of the return cumulation period. DEF is the inverse of lagged total assets (defined in table 1), while NOA and NOA components are defined in table 1.

Table 5: $SRET$ for Portfolios on NOA and NOA components

Panel A: $SRET$ for Portfolios sorted by Components on Initial Decomposition of NOA			
Deciles	NOA	$NWCA$	$NNCOA$
1st Decile	0.066	0.008	0.044
2nd Decile	0.059	0.026	0.049
3rd Decile	0.04	0.024	0.029
4th Decile	0.018	0.038	0.017
5th Decile	0.05	0.015	0.019
6th Decile	0.01	0.022	8E-04
7th Decile	0.012	0.018	0.023
8th Decile	-0.019	0.011	0.009
9th Decile	-0.027	0.017	0.001
10th Decile	-0.074	-0.046	-0.057
Hedge	0.14	0.055	0.101
t-statistic	5.878	2.281	3.665

Panel B: $SRET$ for Portfolios sorted by Components on Extended Decomposition of NOA				
Deciles	WCA	$-WCL$	$NCOA$	$-NCOL$
1st Decile	0.017	-0.012	0.053	0.012
2nd Decile	0.012	0.0235	0.034	0.005
3rd Decile	0.028	0.017	0.046	0.007
4th Decile	0.027	0.0049	0.01	0.014
5th Decile	0.036	0.0093	0.017	0.01
6th Decile	0.012	0.0225	0.018	-0.003
7th Decile	0.028	0.0176	0.009	-0.01
8th Decile	0.011	0.01	0.001	0.046
9th Decile	0.006	0.016	-0.002	0.04
10th Decile	-0.044	0.023	-0.052	0.011
Hedge	0.061	-0.035	0.105	0.001
t-statistic	2.158	-1.499	3.257	-0.007

Notes: Panels A and B of Table 5 presents annual mean values of one-year ahead size-adjusted stock returns $SRET$ for each portfolio based on the magnitude of NOA and NOA components. Firms are ranked annually on NOA and NOA components and then allocated into ten equal-sized portfolios (deciles) based on these ranks. Hedge represents the return to a portfolio consisting of a long position in the lowest decile and a short position in the highest decile. The t-statistic examines the statistical significance of the hedge return. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. $SRET$ are defined in Table 4, while NOA and NOA components are measured from an alternative definition that is employed in Fairfield et al. (2003) and Hirshleifer et al. (2004) studies and described on Table 1.

Table 5: $SRET$ for Portfolios on NOA and NOA components

Panel C: $SRET$ for Portfolios sorted by Components of $NWCA$					
Deciles	ARE	INV	OCA	$-AP$	$-OCL$
1st Decile	0.038	0.019	0.006	-0.024	0.024
2nd Decile	-0.008	0.004	0.022	0.014	0.01
3rd Decile	0.009	0.008	0.018	0.0004	0.015
4th Decile	0.024	0.03	0.035	-0.005	0.003
5th Decile	0.046	0.021	0.02	0.03	0.019
6th Decile	0.026	0.033	0.006	0.022	0.004
7th Decile	0.018	0.02	0.019	0.021	0.012
8th Decile	-0.003	0.022	0.002	0.026	0.005
9th Decile	-0.002	0.007	0.007	0.021	0.006
10th Decile	-0.015	-0.031	-0.004	0.026	0.035
Hedge	0.053	0.05	0.01	-0.05	-0.011
t-statistic	2.022	2.159	0.399	-2.495	-0.375

Panel D: $SRET$ for Portfolios sorted by Components of $NNCOA$				
Deciles	$NPPE$	INT	OLA	$-OLTL$
1st Decile	0.027	0.02	0.032	0.012
2nd Decile	0.036	0.042	0.019	0.005
3rd Decile	0.025	0.024	0.014	0.007
4th Decile	0.035	0.018	0.024	0.014
5th Decile	0.014	0.019	0.006	0.01
6th Decile	0.005	0.007	0.011	-0.003
7th Decile	0.024	0.02	0.01	-0.01
8th Decile	0.006	0.003	0.009	0.046
9th Decile	0.002	0.002	0.012	0.04
10th Decile	-0.042	-0.023	-0.005	0.011
Hedge	0.069	0.044	0.037	0.001
t-statistic	2.264	2.21	1.622	-0.007

Notes: Panels C and D of Table 5 presents annual mean values of one-year ahead size-adjusted stock returns $SRET$ for each portfolio based on the magnitude of NOA and NOA components. Firms are ranked annually on NOA and NOA components and then allocated into ten equal-sized portfolios (deciles) based on these ranks. Hedge represents the return to a portfolio consisting of a long position in the lowest decile and a short position in the highest decile. The t-statistic examines the statistical significance of the hedge return. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. $SRET$ are defined in Table 4, while NOA and NOA components are measured from an alternative definition of NOA that is employed in Fairfield et al. (2003) and Hirshleifer et al. (2004) studies and described on Table 1.

Table 6: Alphas from Factor Models and Statistical Arbitrage Opportunities for Hedge Strategies on NOA and NOA components

Panel A: Alphas from Factor Models for Hedge Strategies on NOA and NOA components							
Model	NOA	$NWCA$	$NNCOA$	WCA	$-WCL$	$NCOA$	$-NCOL$
CAPM	0.176 (4.176)	0.069 (1.996)	0.168 (4.001)	0.058 (1.867)	-0.019 (-0.804)	0.164 (0.046)	-0.073 (-1.684)
Fama-French	0.223 (4.103)	0.102 (3.444)	0.207 (3.686)	0.094 (2.289)	-0.030 (-0.948)	0.215 (3.517)	-0.155 (-2.786)
Carhart	0.196 (2.899)	0.093 (2.495)	0.170 (2.448)	0.069 (1.937)	-0.003 (0.090)	0.166 (2.203)	-0.127 (-1.837)

Panel B: Statistical Arbitrage Opportunities for Hedge Strategies on NOA and NOA components							
Parameter	NOA	$NWCA$	$NNCOA$	WCA	$-WCL$	$NCOA$	$-NCOL$
μ (mean)	0.039	0.012	0.033	0.013	-0.006	0.03	-0.01
λ (growth rate of st.dev.)	-0.366	-0.447	-0.489	-0.583	-0.819	-0.366	-0.209
H1 (μ>0)	0.000	0.015	0.000	0.034	0.097	0.000	0.092
H2 (λ<0)	0.007	0.003	0.000	0.000	0.000	0.008	0.055
Sum (H1+H2)	0.007	0.018	0.000	0.034	0.097	0.008	0.147
Statistical Arbitrage	Yes	Yes	Yes	Yes	No	Yes	No

Notes: Panel A of table 6 reports time series averages of annual mean intercepts alphas from time series regressions of one-year ahead raw stock returns RET on the CAPM model which contains the excess return of the market portfolio, the Fama-French three factor model which contains the market portfolio and two factor mimicking portfolios associated with the size effect (SMB) and the book to market effect (HML) and the Carhart four factor model which adds a momentum (MOM) mimicking portfolio to the previous factors, for hedge portfolio strategies based on the magnitude of NOA and NOA components. Panel B of table 6 presents results from statistical arbitrage tests on one-year ahead raw stock returns RET for hedge portfolio strategies based on the magnitude of NOA and NOA. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. Data for the risk free rates, market portfolio and other mimicking portfolios (size, book to market and momentum) are obtained from Ken French's web page. RET are defined in Table 3, while NOA and NOA components are defined in Table 1.

Table 7: $SRET$ for Portfolios on the Expected and Unexpected Parts of NOA and NOA Components.

Panel A: $SRET$ for Portfolios Sorted by Expected Parts of NOA and NOA components							
Deciles	NOA	$NWCA$	$NNCOA$	WCA	$-WCL$	$NCOA$	$-NCOL$
1st Decile	0.028	0.046	0.019	0.019	0.039	0.017	0.024
2nd Decile	0.03	0.025	0.035	0.02	0.031	0.042	0.015
3rd Decile	0.03	0.031	0.034	0.032	0.042	0.034	0.024
4th Decile	0.021	0.029	0.03	0.035	0.036	0.034	0.025
5th Decile	0.037	0.023	0.029	0.047	0.045	0.027	0.025
6th Decile	0.038	0.045	0.028	0.044	0.04	0.033	0.036
7th Decile	0.026	0.022	0.032	0.019	0.025	0.031	0.04
8th Decile	0.018	0.038	0.027	0.028	0.014	0.015	0.031
9th Decile	0.033	0.013	0.028	0.035	0.02	0.03	0.034
10th Decile	0.044	0.033	0.043	0.025	0.012	0.042	0.05
Hedge	-0.016	0.013	-0.024	-0.006	0.027	-0.025	-0.026
t-statistic	-0.545	0.532	-0.914	-0.23	1.159	-0.763	-0.708

Panel B: $SRET$ for Portfolios Sorted by Unexpected Parts of NOA and NOA components							
Deciles	NOA	$NWCA$	$NNCOA$	WCA	$-WCL$	$NCOA$	$-NCOL$
1st Decile	0.063	0.052	0.056	0.05	0.043	0.061	0.009
2nd Decile	0.061	0.042	0.054	0.055	0.035	0.057	0.025
3rd Decile	0.055	0.05	0.054	0.052	0.011	0.042	0.027
4th Decile	0.034	0.032	0.036	0.033	0.026	0.044	0.023
5th Decile	0.045	0.032	0.036	0.033	0.024	0.04	0.058
6th Decile	0.035	0.026	0.03	0.038	0.027	0.022	0.039
7th Decile	0.029	0.02	0.031	0.029	0.024	0.031	0.029
8th Decile	0.004	0.026	0.018	0.016	0.032	0.023	0.044
9th Decile	0.004	0.021	0.017	0.013	0.027	0.009	0.019
10th Decile	-0.024	0.002	-0.025	-0.015	0.054	-0.024	0.032
Hedge	0.087	0.05	0.081	0.065	-0.011	0.085	-0.023
t-statistic	4.885	3.443	4.561	3.669	-0.779	4.542	-1.652

Notes: Panel A and B of Table 7 present annual mean values of one-year ahead size-adjusted stock returns $SRET$ for each portfolio based on the magnitude of the expected and unexpected parts of NOA and NOA components. Firms are ranked annually on the expected and unexpected parts of NOA and NOA components. Hedge represents the return to a portfolio consisting of a long position in the lowest decile and a short position in the highest decile. The t-statistic examines the statistical significance of the hedge return. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. $SRET$ are defined in Table 4, while the expected and unexpected parts of NOA and NOA components are defined as in equation (9) and (10).

Table 8: $SRET$ for Portfolios on NOA after controlling for ROE

	Pure Portfolios	**Interacted Portfolios**		
Groups		$ROE(1)$	$ROE(2-9)$	$ROE(10)$
$NOA(1)$	0.069 (2.823)	0.108 (1.264)	0.064 (2.815)	0.071 (2.696)
$NOA(2-9)$	0.024 (3.588)	0.028 (1.7)	0.025 (3.298)	0.008 (0.774)
$NOA(10)$	-0.053 (-4.16)	-0.093 (-3.634)	-0.055 (-3.738)	0.001 (0.05)
Hedge	0.122 (3.682)	0.201 (2.472)	0.119 (3.614)	0.07 (2.254)
Joint Strategy : Long on $\{NOA(1), ROE(10)\}$ **& Short on** $\{NOA(10), ROE(1)\}$				0.164 (3.986)
Difference: Joint Strategy and NOA **strategy**				0.042 (0.756)

Notes: Table 8 presents annual mean values of one-year ahead size-adjusted stock returns $SRET$ for each portfolio based on the magnitude of NOA, after controlling for ROE. Firms are ranked annually on NOA and then allocated into ten equal-sized portfolios (deciles) based on these ranks. Subsequently, firms within each NOA decile are sorted into ten equally-sized deciles based on the magnitude of ROE. Given that our focus is on extreme deciles, we combine deciles 2-9 together. Hedge represents the return to a portfolio consisting of a long position in the lowest decile and a short position in the highest decile. The t-statistic examines the statistical significance of the hedge return. The sample consists of 105,896 firm year observations covering firms (except financial firms) with available data on Compustat and CRSP for the period 1962-2003. $SRET$ are defined in table 4, while NOA and ROE are defined in table 1.