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Deflating profitability*

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Abstract

Gross profit scaled by book value of total assets predicts the cross-section of average returns. Novy-Marx (2013) concludes that it outperforms other measures of profitability such as bottom-line net income, cash flows, and dividends. One potential explanation for the measure's predictive ability is that its numerator—gross profit—is a "cleaner" measure of economic profitability. An alternative explanation lies in the measure's deflator. We find that net income equals gross profit in predictive power when they have consistent deflators. Deflating profit by the book value of total assets results in a variable that is the product of profitability and the ratio of the market value of equity to the book value of total assets, which is priced. We then construct an alternative measure of profitability, operating profitability, which better matches current expenses with current revenue. This measure exhibits a far stronger link with expected returns than either net income or gross profit. It predicts returns as far as ten years ahead, seemingly inconsistent with irrational pricing explanations.

JEL classifications: G12, M42.

Keywords: Gross profitability; operating profitability, asset pricing; deflators; earnings anomalies.

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1. Introduction

Ball and Brown (1968) show that earnings—defined as "bottom line" net income excluding extraordinary items—predict the cross-section of average returns. Subsequent research indicates that earnings add little incremental information over size and book-to-market (e.g., Fama and French, 1996, 2008b). Novy-Marx (2013), however, finds that a different earnings variable—gross profitability, defined as gross profit (revenue minus cost of goods sold) deflated by the book value of total assets—predicts the cross-section of expected returns as well as book-to-market, has greater predictive power than net income, and is negatively correlated with the value premium.[1] He interprets these results as showing that gross profit is a "cleaner" measure of economic profitability. These findings have attracted considerable attention, ranging from an endorsement by a market commentator (DeMuth, 2013) to the investigation of profitability as a potential factor in asset pricing models (Fama and French, 2014). Moreover, investment managers such as Dimensional Fund Advisors and AQR have modified their trading strategies to incorporate measures similar to gross profitability (Trammell, 2014).

We re-evaluate whether gross profitability has greater predictive power than net income, and then investigate the predictive power of operating profitability (revenue less cost of goods sold and selling, general & administrative expenses, but not expenditures on research & development). Our analysis therefore proceeds in two stages.

We first show that differences in deflators fully explain why gross profitability predicts future returns better than net income. When comparing the two measures, Novy-Marx (2013) deflates gross profit by the book value of total assets but deflates net income by the book value of equity. We find that the two profit variables have similar ability to predict average returns, provided they are deflated consistently. Any superiority is due to choosing different deflators.

The increased explanatory power that arises from deflating a profit variable by the book value of assets (or the book value of equity) arises from a mismatch between the profit measure's deflator and

[1] Sun, Wei, and Xie (2013) find similar results internationally.

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the deflator used for the dependent variable.[2] Relative to consistently deflating the dependent and independent variables by the market value of equity, deflating gross profit by the book value of total assets creates an explanatory variable that is the product of gross profit deflated by the market value of equity times the ratio of market value of equity to total assets (GP/AT = GP/ME $\times$ ME/AT). Fama and French (1992) find that the ratio of the market value of equity to total assets (ME/AT) is priced. Interacting gross profit with the ratio of the market value of equity to total assets can therefore increase explanatory power. However, GP/AT could also predict returns because it is a proxy for its individual components (GP/ME and ME/AT). We find that among All-but-microcaps all of the explanatory power is due to the product between these terms. Price-deflated gross profit and the ratio of the market value of equity to total assets have no independent predictive power. Among Microcaps, however, we find that the explanatory power is due to both the product and the ratio of the market value of equity to the book value of assets.

The similar predictive power of net income and gross profit when they are consistently deflated is puzzling for two reasons. First, shareholders do not have a claim on gross profit: their cash flow rights are determined after accounting for all components of net income, not merely cost of goods sold. Second, prior research finds that some of the items between gross profit and net income, such as selling, general & administrative expenses and expenditures on research & development, predict returns (e.g., Chan, Lakonishok, and Sougiannis, 2001; Eisfeldt and Papanikolaou, 2013).

Consequently, in the second stage we address the puzzlingly similar predictive power of the two measures. To do so, we build on Novy-Marx's (2013) intuition that gross profit is the "cleanest" accounting measure of economic profitability because items lower down the income statement are "polluted." This interpretation is difficult to reconcile with the finding that gross profit and net income have similar predictive power over the cross-section of average returns—pollution would suggest that net income has less predictive power. We find that the items farther down the income statement are not pure noise—it is just that in multivariate return regressions they have slopes

[2] This point is similar to that raised by Christie (1987), who notes that earnings deflators other than price give rise to a correlated omitted variables problem.

with different magnitudes and signs, due to differences in the accounting rules that govern their measurement.

Gross profit only takes into account revenue and cost of goods sold. However, selling, general & administrative expenses—the next item after cost of goods sold on the income statement—also represents to a large extent expenses incurred to generate the current period's revenue. Moreover, the allocation of expenses between cost of goods sold and selling, general & administrative expenses is not determined by Generally Accepted Accounting Principles and is largely at the discretion of firms (Weil, Schipper, and Francis, 2014). If these two items are economically similar and firms allocate expenses somewhat arbitrarily between them, we would expect that a profitability measure that subtracts both expenses from revenue would outperform gross profitability in asset pricing tests. Surprisingly, the data at a first glance disagree. Gross profitability has similar predictive power compared to an operating profitability measure that subtracts both cost of goods sold and selling, general & administrative expenses from revenue. This finding could point towards the uncomfortable conclusion that the correlation between future returns and gross profitability is spurious. That is, if gross profitability predicts returns because it more cleanly allocates current expenses against current revenue, then this measure should become stronger as we account for selling, general & administrative expenses, but it does not.

Why do these two economically similar expenses (cost of goods sold and selling, general & administrative) appear to have different relations with future returns? A potential reason lies in the treatment of Compustat data. To "facilitate" comparability across firms, Standard & Poor's combines and adjusts several income statement items reported in firms' public filings. In particular, they define selling, general & administrative expenses (Compustat item XSGA) as the sum of firms' actual reported selling, general & administrative expenses and their research & development expenditures (Compustat item XRD). Conservative accounting rules expense research & development expenditures as they are incurred, even though they are incurred largely to generate future rather than current revenues. The accounting treatment of research & development expenditures suggests that undoing Compustat's adjustment to selling, general & administrative expenses would improve the measure of operating profit.

When we undo the Compustat adjustment, we find that cost of goods sold and selling, general & administrative expenses have similar covariances with future returns. Moreover, a refined profitability measure—operating profitability—that deducts from revenue both cost of goods sold and selling, general & administrative expenses (excluding expenditures on research & development) is a significantly better predictor of future returns than gross profitability. In Fama and MacBeth (1973) regressions, the t-values for gross profitability are 5.46 for All-but-microcaps and 6.57 for Microcaps. These t-values significantly increase to 8.92 and 6.96 for our operating profitability measure. Similarly, the three-factor model alphas for strategies that purchase the stocks in the top decile and finance this purchase by selling the stocks in the bottom decile increase from 55 basis points per month (t-value = 4.18) for gross profitability to 74 basis points per month (t-value = 6.25) for operating profitability. That is, the profitability strategy's Sharpe ratio increases by over 50%. Moreover, operating profitability is significantly informative about expected returns for horizons as long as ten years.

The rest of the paper is organized as follows. Section 2 introduces the data. Section 3 quantifies the importance of deflators in horse races between gross profit and net income using Fama and MacBeth (1973) regressions. Section 4 compares gross profit and net income using portfolio sorts. Section 5 discusses mismatched deflators and empirically explores the deflator effects. Section 6 discusses Standard & Poor's adjustments to Compustat and shows that a refined operating profitability measure, obtained by undoing the Standard & Poor's adjustments to selling, general & administrative expenses, is a superior predictor of future returns. Section 7 discusses rational and irrational explanations for the predictive ability of profitability measures. Section 8 concludes.

2. Data

We obtain monthly stock returns from the Center for Research in Security Prices (CRSP) and accounting data from Compustat. Our sample starts with all firms traded on NYSE, Amex, and NASDAQ. We exclude securities other than ordinary common shares. We use CRSP delisting returns; if a delisting return is missing, and the delisting is performance-related, we impute a return of −30% (see, Shumway, 1997; Shumway and Warther, 1999; Beaver, McNichols, and Price, 2007). We then match the firms on CRSP against Compustat, and lag annual accounting information by the standard six months. If a firm's fiscal year ends in December, we assume that this information is public by the end of the following June. We start our sample in July 1963 and end it in December 2013. The sample consists of firms that have non-missing market value of equity, book-to-market, gross profit, book value of total assets, current month returns, and returns for the prior one-year period. We also follow Novy-Marx (2013) and exclude financial firms from the sample. These are firms with one-digit standard industrial classification codes of six.

We calculate the book value of equity as shareholders' equity, plus balance sheet deferred taxes, plus balance sheet investment tax credits, plus postretirement benefit liabilities, and minus preferred stock. We set missing values of balance sheet deferred taxes and investment tax credits equal to zero. To calculate the value of preferred stock, we set it equal to the redemption value if available, or else the liquidation value or the carrying value, in that order. If shareholders' equity is missing, we set it equal to the value of common equity if available, or total assets minus total liabilities. We then use the Davis, Fama, and French (2000) book values of equity from Ken French's website to fill in missing values.[3]

Gross profit (Compustat item GP) is revenue minus cost of goods sold. In the default specification we use the Novy-Marx (2013) definition of gross profitability, deflating gross profit by the book value of total assets. In alternative specifications we deflate gross profit by the book and market values of equity. When we deflate either gross profit or net income by the market value of equity, we use the market value of equity as of the end of the prior month, which is the same deflator

[3] See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/variable_definitions.html and Cohen, Polk, and Vuolteenaho (2003, p. 613) for a detailed discussion of how the book value of equity is defined.

implicit in the stock return computation.[4] We use income before extraordinary items (Compustat item IB) to proxy for "bottom line" net income.

In Fama and MacBeth (1973) regressions we re-compute the explanatory variables every month. In some of our empirical specifications, we split firms into All-but-microcaps and Microcaps. Following Fama and French (2008a), we define Microcaps as stocks with a market value of equity below the 20th percentile of the NYSE market capitalization distribution. In portfolio sorts we rebalance the portfolios annually at the end of June.

Table 1 reports summary descriptive statistics for the accounting and control variables. The deflated variables exhibit substantial outliers, pointing to a need either to trim these variables in cross-sectional regressions or to base inferences on portfolio sorts. Relative to gross profit, net income is more left-skewed, consistent with the findings of Basu (1997). Table 2 reports Pearson and Spearman rank correlations among the variables. When deflated by the book value of total assets, gross profit and income before extraordinary items exhibit relatively low correlation (0.40 and 0.40). When the variables are deflated by market value of equity, the Pearson correlation is 0.26 but the Spearman rank correlation is zero. Moreover, the correlations are low across the deflators for each profit measure. The Pearson correlation between gross profit deflated by the book value of assets with gross profit deflated by the market value of equity is 0.10. Similarly, the Pearson correlation between income before extraordinary items deflated by the book value of assets with income deflated by the market value of equity is 0.19.

These correlations are low along two important dimensions. First, gross profit and income before extraordinary items are not strongly correlated when we use the same deflator, especially when we deflate by the market value of equity. Second, the correlation is low when we compare gross profit deflated by the book value of equity with gross profit deflated by the market value of equity. Overall, deflator choice significantly affects the properties of the profit variable that is being constructed.

[4]Although the literature historically deflated book values of equity by lagged market values of equity—Fama and French (1992) introduced the convention of re-computing book-to-market ratios at the end of every June, and by using market values from the December of the prior year—research has shifted to using timely market values of equity. See, for example, Asness and Frazzini (2013) and Fama and French (2014).

3. Fama and MacBeth regressions

Table 3 presents average Fama and MacBeth (1973) slopes and their t-values for comparing the explanatory power of gross profit and income before extraordinary items. We deflate the two profit measures consistently in these comparisons, by the book value of total assets, the book value of equity, or the market value of equity. Following Novy-Marx (2013), we include the following control variables in all regressions: the natural logarithm of the book-to-market ratio, the natural logarithm of the market value of equity, and past returns for the prior month and for the prior 12-month period excluding month $t-1$. We estimate the regressions monthly using data from July 1963 through December 2013. We follow Novy-Marx (2013) and trim all independent variables to the 1st and 99th percentiles. To ensure that regression coefficients are comparable across different model specifications, we trim on a table-by-table basis. Hence, different specifications within each table panel, including the splits between All-but-microcaps and Microcaps, are based on the same observations. For example, the data underlying regression (1) in Panel A of Table 3 are the same data used in regressions (2) through (7) of the same panel.

Panel A presents results for the All-but-microcaps sample. Column (1) presents the baseline regression that includes just the control variables. In column (2) we include Novy-Marx's gross profitability measure (gross profit deflated by the book value of total assets). The coefficient on gross profitability is positive and significant (0.834 with a t-value of 5.46). Our estimate is close to the estimate presented in Panel A of Table 1 in Novy-Marx (0.750 with a t-value of 5.49), thus confirming his findings.

We next examine income before extraordinary items. To compare the explanatory power of the two profit measures, we focus on t-values. The average coefficient estimates in a Fama and MacBeth (1973) regression can be interpreted as monthly returns on long-short trading strategies that trade on that part of the variation in each regressor that is orthogonal to every other regressor.[5] The t-values associated with the Fama-MacBeth slopes are therefore proportional to the Sharpe ratios of these self-financing strategies. They equal the annualized Sharpe ratios times $\sqrt{T}$, where T represents the number of years in the sample. Column (3) presents results for regressions that include income before extraordinary items deflated by the book value of total assets. For income before extraordinary items, the t-value is actually larger than for gross profit (5.80 vs. 5.46) and the Sharpe ratios implied by the t-values are not significantly different. The bottom row shows that the t-value from a test of the equality of Sharpe ratios is 0.37.[6]

In contrast with our results, in Panel A of Table 1 in Novy-Marx (2013) the average slope on income before extraordinary items is statistically insignificant (t-value = 0.84). However, in that specification, income before extraordinary items and gross profit have different deflators—income before extraordinary items is deflated by the book value of equity while gross profit is deflated by the book value of total assets. Therefore, in columns (4) and (5) we compare gross profit and income before extraordinary items when both measures are deflated by the book value of equity. Once again, t-values on both coefficients are similar in magnitude (gross profit, 4.45; income before extraordinary items, 3.78) and the Sharpe ratios do not significantly differ (t-value = -0.51).[7]

[5] The slope estimates from a month $t+1$ cross-sectional regression of a $N \times 1$ vector of returns, r_{t+1}, on a $N \times K$ data matrix X_t, which consists of a constant and $K-1$ regressors, equals $\hat{b}_{t+1} = (X_t' X_t)^{-1} X_t' r_{t+1}$. This OLS estimator can be expressed as $\hat{b}_{t+1} = w_t' r_{t+1}$, where w_t is a $N \times K$ matrix of the portfolio weights on K different trading strategies that can be constructed using information available at time t. These are K zero-investment portfolios with portfolio $j \in \{1, ..., K\}$ having a unit exposure to the factor represented by the jth variable and, by construction, zero exposures to factors represented by the other regressors. In this sense, estimating a Fama-MacBeth regression is analogous to running a multi-factor model. See Fama (1976, chapter 9) for an analysis and description of these strategies. Because our regressions control for size, value, short-term reversals, and momentum effects, the slope estimate on the profitability is conceptually similar to a multi-factor model alpha obtained from portfolio sorts.

[6] We test for the equality of Sharpe ratios using a bootstrap procedure. We resample the Fama-MacBeth regression slope estimates 1,000 times, compute annualized Sharpe ratios for each sample, and then obtain the standard error from the resulting bootstrapped distribution of differences in Sharpe ratios.

[7] Novy-Marx (2013) finds that the average slope on income before extraordinary items deflated by the book value of equity is not significantly different from zero. Our sample criteria differ from Novy-Marx (2013) along three dimensions. First, we split the sample into All-but-microcaps and Microcaps so that small firms do not overly influence the Fama-MacBeth regressions (Fama and French, 2008b). Second, we trim after imposing sample restrictions, such as removing firms with missing values for some of the independent variables. By doing so, we ensure that we trim based on the distributions of the variables actually included in the regressions. Third, we trim table-by-table instead of regression-by-regression. This approach makes the regressions within the table comparable (i.e., they are run on the same set of firms). If we revise our sample steps and sample period to match Novy-Marx (2013), the slope estimate on IB/BE is 0.21 (t-value = 0.82), which is close to that reported in Novy-Marx (2013, Table 1).

In columns (6) and (7) we further explore the role of the deflator by using the same deflator that is implicit in the dependent variable—the market value of equity. Once again, the t-values on the two profitability measures are similar in magnitude (gross profit, 3.74; income before extraordinary items, 3.11) and the Sharpe ratios implied by the t-values are not significantly different (t-value of the difference = -0.42).

Panel B presents the results for Microcaps, which represent 55% of the sample firms but only 3% of total market capitalization. For these small firms, gross profit has higher explanatory power than income before extraordinary items for all three deflators. For example, when both variables are deflated by the book value of total assets, the t-value for gross profit is almost twice the magnitude as that for income (6.57 versus 3.44) and the Sharpe ratios significantly differ (t-value = -2.92). In the regressions that deflate gross profit and income by the book and market values of equity, t-values for the gross profit variable are also larger, but to a lesser extent (2.77 versus 2.26 and 2.06 versus 1.04), and the Sharpe ratios implied by the t-values are not significantly different.

Overall, for All-but-microcap stocks, which represent 97% of the total market capitalization of publicly traded U.S. companies, we find that gross profit and income before extraordinary items have similar explanatory power when they are constructed using the same deflator. For Microcaps, however, gross profit better explains the cross-section of expected returns, though income before extraordinary items generally retains significance.

Among both All-but-microcap and Microcap stocks, the choice of deflator has a significant effect on the relation between future returns and the profit measures. Across both profit measures and both size groups, t-values are largest when the book value of total assets is the deflator, intermediate when the book value of equity is the deflator, and smallest when the market value of equity is the deflator.

4. Comparison of deflators in portfolio sorts

Given the skewed distributions and extreme observations for both profit measures presented in Table 1, portfolio tests provide a potentially robust method to evaluate predictive ability without imposing the parametric assumptions embedded in the Fama and MacBeth (1973) regressions. Table 4 therefore compares gross profit and income before extraordinary items using quintile (as in Novy-Marx (2013)) and decile portfolio sorts. For each sorting variable, the table reports portfolios' value-weighted average excess returns and three-factor model alphas and loadings on the market (MKT), size (SMB), and value (HML) factors. We no longer split the sample into All-but-microcaps and Microcaps because small stocks have only a small effect on value-weighted portfolio returns. We rebalance the portfolios annually at the end of June and the sample runs from July 1963 through December 2013.

In the left half of Panel A, we sort stocks into portfolios based on gross profitability (revenue less cost of goods sold deflated by the book value of total assets). Portfolio excess returns and three-factor model alphas increase in gross profitability, though not monotonically. The high-minus-low quintile portfolio earns an average excess return of 30 basis points per month, which is economically and statistically significant (t-value = 2.45). The three-factor model alpha is 52 basis points per month (t-value = 4.77). These results closely replicate those presented in Novy-Marx (2013, Table 2, Panel A).

The right half of Panel A presents results for portfolio sorts based on income before extraordinary items, also deflated by the book value of total assets. In contrast to gross profit, income deflated by the book value of total assets does not spread excess returns. The reason for this difference is that, whereas the net income-to-assets strategy is strongly negatively correlated with the market and size factors (see the b_{mkt} and b_{smb} estimates), the gross profit-to-assets strategy is almost neutral with respect to these factors. The net income-to-assets strategy thus implicitly carries short positions against the market and size factors. Indeed, if we estimate a "two-factor model" regression to hedge out market and size factors, the resulting alphas on the net income- and gross profit-based strategies are statistically indistinguishable. The three-factor model goes a step further by also hedging out these strategies' negative exposures to value. Accordingly, Table 4 Panel A shows for the gross profit-to-assets and net income-to-assets strategies that the three-factor model alpha estimates are statistically significant and similar in magnitude for the high-minus-low portfolios.

It is important to emphasize that an investor who considers trading a profitability strategy cares about the multi-factor model alphas and not about excess returns. A non-zero alpha implies that the factors of the asset pricing model (here, MKT, SMB, and HML) and Treasury bills cannot be combined to generate a mean-variance efficient portfolio. The significant three-factor model alphas in our tests reveal the extent to which an investor can improve the mean-variance efficiency of his or her portfolio—increase the portfolio Sharpe ratio—by tilting the portfolio toward the profitability strategy.[8] Put differently, an unconstrained investor can always tilt his or her portfolio towards a profitability strategy while trading market, size, and value factors to hedge out any unwanted risks carried by those factors. The three-factor model alpha measures the return on a "pure bet" on profitability.[9]

In Panel B we further examine the choice of deflator by using the market value of equity. The results change dramatically. In the left half, the high-minus-low quintile portfolio for gross profit earns an average excess return of 52 basis points per month (t-value = 3.28), a 60% increase over its equivalent in Panel A when the deflator is the book value of total assets. Thus, deflating by the market value of equity produces a greater separation of excess returns than deflating by the book value of total assets.

Despite the greater separation of excess returns, the large three-factor model alpha obtained when deflating gross profit by the book value of total assets decreases when we deflate by the market value of equity: from 52 basis per month (t-value = 4.77) to −6 basis points (t-value = −0.56) for the high-minus-low quintile portfolio and from 55 basis points per month (t-value = 4.18) to −13 basis points (t-value = −0.93) for the high-minus-low decile portfolio. In addition, the loadings on MKT, SMB and HML for the high-minus-low quintile and decile portfolios increase substantially.

[8]See, for example, Pástor and Stambaugh (2003, section IV) and the references therein.

[9]The argument that an investor cares about alphas and not excess returns also applies to Fama-MacBeth regressions. Because our Fama-MacBeth regressions include controls for size and value, the slope estimate on the profitability variable is the average return on a strategy that trades on the variation in profitability that is independent of size and value. In fact, if we take the monthly coefficient estimates on gross profit-to-assets and net income-to-assets presented in columns (2) and (3) of Panel A of Table 3, and run three-factor model regressions, the resulting alphas, 0.767 (t-value = 4.92) and 3.160 (t-value = 5.39), are close to the "raw" estimates reported in the table. These regressions thus confirm that the multivariate Fama-MacBeth regression estimates have alpha-like interpretations.

Importantly, the HML loadings change signs. The high-minus-low quintile's loading on HML, for example, increases from -0.5 (t-value $= -12.7$) to 0.99 (t-value $= 27.4$) when the deflator changes from the book value of total assets to the market value of equity. These results are consistent with our hypothesis that using the book value of total assets as a deflator results in a variable that is the product of profit and other factors that are priced, so that this profitability measure subsumes a large portion of the predictive power of MKT, SMB and HML for returns.

The right half of Panel B presents portfolio results for income before extraordinary items deflated by the market value equity. As is the case for gross profit, the spread in average returns increases for income before extraordinary items when it is deflated by the market value of equity. Moreover, the three-factor model alphas are no longer statistically significant for the high-minus-low quintile and decile portfolios and the three-factor model loadings increase.

Similar to the results for the Fama and MacBeth (1973) regressions, the portfolio sorts show that gross profit and income before extraordinary items have similar predictive ability when compared using the same deflator. And as with the Fama and MacBeth (1973) regressions, the three-factor model alphas for both profit measures are largest when they are deflated by the book value of total assets.

4.1. Cash flow-to-price versus cash flow-to-assets

Our results on the importance of the choice of deflator are not specific to comparisons between gross profit and net income. Consider, for example, the power of cash flow in explaining the cross-section of average returns. Fama and French (1996) show that the three-factor model explains, among many other anomalies, average returns earned by a cash flow-to-price strategy. This zero-alpha result, however, is specific to a strategy that deflates cash flow by the market value of equity. When we construct cash flow-to-price and cash flow-to-total assets variables, the 10-1 strategies' monthly three-factor model alphas are -1 basis points (t-value $= -0.07$) and 48 basis points (t-value $= 3.73$).[10] That is, the three-factor model is unable to explain the returns earned by a

[10] We follow Fama and French's (1996) definition and measure cash flow by adding deferred taxes and equity's shares of depreciation to income before extraordinary items.

cash-flow strategy when cash flow is deflated by total assets. This result mirrors the stark change in the three-factor model alphas when we switch the deflator of gross profit and income before extraordinary items from the market value of equity to the book value of total assets. We find the same effect for cash flow in Fama-MacBeth regressions. In regressions that mirror those reported in Table 3, cash flow has the highest explanatory power when deflated by the book value of total assets (the t-values are 6.6 and 3.47 in the All-but-microcaps and Microcaps samples) and the lowest explanatory power when deflated by the market value of equity (the t-values are 4.57 and 1.36).

5. Deflator effects

As discussed by Christie (1987), the economics of a return regression changes when one switches from one profit deflator to another, holding constant the deflator implied in calculating stock returns. Consider a cross-sectional regression of stock returns on gross profitability,

$$r_{i,t} = \alpha + \beta \frac{\mathrm{GP}_{i,t-1}}{\mathrm{AT}_{i,t-1}} + \varepsilon_{i,t}, \tag{1}$$

in which $\mathrm{GP}_{i,t-1}$ represents the gross profit of firm i in month $t-1$ and $\mathrm{AT}_{i,t-1}$ represents firm i's total (book) assets in month $t-1$, both lagged appropriately so that they are known to investors.

We can rewrite returns as the change in the market value of equity plus dividends,

$$\frac{\triangle \mathrm{ME}_{i,t} + \mathrm{D}_{i,t}}{\mathrm{ME}_{i,t-1}} = \alpha + \beta \frac{\mathrm{GP}_{i,t-1}}{\mathrm{AT}_{i,t-1}} + \varepsilon_{i,t}. \tag{2}$$

The right-hand side variable can, in turn, be decomposed into the ratio of gross profit to the market value of equity times the ratio of the market value of equity to the book value of total assets, which Fama and French (1992) find to be correlated with average returns,

$$\frac{\triangle \mathrm{ME}_{i,t} + \mathrm{D}_{i,t}}{\mathrm{ME}_{i,t-1}} = \alpha + \beta \left(\frac{\mathrm{GP}_{i,t-1}}{\mathrm{ME}_{i,t-1}}\right) \left(\frac{\mathrm{ME}_{i,t-1}}{\mathrm{AT}_{i,t-1}}\right) + \varepsilon_{i,t}. \tag{3}$$

Alternatively, instead of the consistency of deflators guiding the decomposition, we could decompose GP/AT into the ratio of gross profit to the book value of equity times the ratio of the book value of equity to the book value of total assets,

$$r_{i,t} = \alpha + \beta \left(\frac{\mathrm{GP}_{i,t-1}}{\mathrm{BE}_{i,t-1}}\right)\left(\frac{\mathrm{BE}_{i,t-1}}{\mathrm{AT}_{i,t-1}}\right) + \varepsilon_{i,t}. \tag{4}$$

Given these decompositions, the predictive power of GP/AT could emanate from its individual components—GP/ME and ME/AT in equation (3) and GP/BE and BE/AT in equation (4)—and not from their product, per se.[11] If this is the case, then we have an omitted variable problem.[12]

Panel A of Table 5 reports regressions that include the individual components and the product for All-but-microcaps by following the decompositions in equations (3) and (4). Columns (1) and (2) analyze the two components of gross profit deflated by the book value of assets (main effects): gross profit deflated by the market value of equity (GP/ME) and the ratio of the market value of equity to the book value of assets (ME/AT). When included separately in column (1), gross profit to the market value of equity is positive and significant while the ratio of the market value of equity to the book value of assets (ME/AT) is insignificant. Column (2) reports a horserace between gross profit deflated by the book value of total assets versus gross profit deflated by the market value of equity, controlling for the term that causes them to differ (ME/AT). In this specification, the t-value for gross profit to the market value of equity is no longer statistically significant. In

[11]The decompositions in equations (3) and (4) are not unique. Christie's (1987) consistency-of-deflators argument guides the decomposition in equation (3) and the common use of book value of equity as a deflator of income (Novy-Marx, 2013) guides that in equation (4). In equation (3) the ratio of the market value of equity to the book value of total assets could be further decomposed into two terms:

$$\frac{\mathrm{GP}_{i,t-1}}{\mathrm{AT}_{i,t-1}} = \underbrace{\left(\frac{\mathrm{GP}_{i,t-1}}{\mathrm{ME}_{i,t-1}}\right)}_{\substack{\text{gross profit}\\ \text{to price}}}\underbrace{\left(\frac{\mathrm{ME}_{i,t-1}}{\mathrm{BE}_{i,t-1}}\right)}_{\substack{\text{market-}\\ \text{to-book}}}\underbrace{\left(\frac{\mathrm{BE}_{i,t-1}}{\mathrm{AT}_{i,t-1}}\right)}_{\text{book leverage}}.$$

However, because typical Fama-MacBeth regressions control for the additional market-to-book term, we do not separately examine this three-way decomposition.

[12]As an example of the omitted variable problem, consider a researcher who is unaware of the asset growth anomaly (Cooper, Gulen, and Schill, 2008) and creates a variable that is the product of gross profit deflated by the market value of equity and asset growth. In Fama-MacBeth regressions, this interaction—"profitable growth"—is statistically significant (t-value $= -6.38$) when included on its own. However, this variable loses its statistical significance (new t-value $= -0.86$) when the regression also controls for the omitted main effects, gross profit deflated by the market value of equity and asset growth.

contrast, the ratio of gross profit to assets is highly significant (t-value = 4.69), implying that the product has more explanatory power than the individual components, GP/ME and ME/AT.

Columns (3) and (4) present a similar analysis for the ratio of gross profit to the book value of equity (GP/BE). In column (3), we include the two main effects: the ratio of gross profit to the book value of equity (GP/BE) along with the ratio of the book value of equity to the book value of assets (BE/AT). In this specification, gross profit to the book value of equity is statistically significant while the ratio of the book value of equity to the book value of assets is not. When we add the product of the two variables in column (4), GP/AT, once again the product is statistically significant with a t-value of 4.19 and the individual components are insignificant.

Finally, in column (5) we run a horserace among the three deflators. When all three versions of gross profit (with the three different deflators) are included in the same regression along with the control variables, only the version of gross profit deflated by total assets is statistically significant.

In Panel B of Table 5, we carry out the same analysis for Microcaps. The results for Microcaps differ from those for All-but-microcaps. Specifically, the main effects (ME/AT and BE/AT) matter at least as much as their product (GP/AT). For example, in column (4), book equity to total assets is highly significant as is gross profit to book equity, while gross profit to total assets is not. In column (5) we again run a horserace among the three deflators and, as for All-but-microcaps, deflating by total assets has the highest explanatory power.

The results in Table 5 are consistent with gross profitability deriving a large part of its explanatory power from the interaction of several components induced by the mismatch in the deflators between the dependent and independent variables (as opposed to the individual components). However, among Microcaps the components (ME/AT and BE/AT) on their own have as much or more explanatory power as their products with profitability. We show in Appendix A.1 that portfolio sorts of stocks into deciles first by GP/ME and then by ME/AT support the same conclusion.

6. Components between gross profit and income before extraordinary items

The Fama and MacBeth (1973) regressions and portfolio tests presented in Tables 3 and 4 raise the following question. Why do gross profit and income before extraordinary items have similar predictive ability, yet income before extraordinary items is calculated after subtracting off more expenses borne by shareholders than just costs of goods sold? Novy-Marx (2013) posits that the items located on the income statement between gross profit and income before extraordinary items are less related to "true economic profitability," which we interpret as meaning they contain more noise. But if these items simply added noise, gross profit would have higher explanatory power than net income, which is not the case. Further, even if the items are noisy, they nevertheless can contain information about expected returns. Indeed, prior research finds that some of these income statement items predict the cross-section of expected returns. For example, Chan, Lakonishok, and Sougiannis (2001) find that expenditures on research & development predict future returns and Eisfeldt and Papanikolaou (2013) find that capitalized selling, general & administrative expenses also predict future returns. We therefore examine these income statement items individually.

Before presenting results, it is worth discussing the nature of the items that lie between gross profit and income before extraordinary items. We base this discussion on the classifications used in the Compustat database, which can diverge from the presentation and classification of items on income statements included in public filings. To start, gross profit (GP) is the difference between revenue and cost of goods sold (REVT − COGS). Between gross profit and income before extraordinary items (IB), there are seven Compustat items: selling, general & administrative expenses (XSGA); depreciation & amortization (DP); interest (XINT); taxes (TXT); non-operating income (NOPI); special items (SPI); and minority interest income (MII). Income before extraordinary items is therefore defined by the following accounting identity:

$$
\begin{aligned}
\text{Income before extraordinary items (IB)} \equiv\ & \text{Revenue (REVT)} \\
- & \text{ Cost of goods sold (COGS)} \\
- & \text{ Sales, general \& administrative expenses (XSGA)} \\
- & \text{ Depreciation \& amortization (DP)} \\
- & \text{ Interest (XINT)} \\
- & \text{ Taxes (TXT)} \\
+ & \text{ Non-operating income (NOPI)} \\
+ & \text{ Special items (SPI)} \\
- & \text{ Minority interest income (MII).}
\end{aligned} \tag{5}
$$

The items between gross profit and income differ economically, which likely explains why they exhibit different relations with returns (Lipe, 1986; Ohlson and Penman, 1992). For example, the relation between expected returns and depreciation & amortization, which is a function of previously purchased assets, likely differs from the relation between expected returns and operating expenses incurred in the current period such as sales, general & administrative expenses. Accounting rules require research & development expenditures to be expensed against earnings in the period in which the expenditures are made, whereas their benefits are likely to be recorded in future but not current earnings.[13] Income tax expense is based on uncertain expected future tax payments that are not discounted. Despite the fact that it reduces both net income and the book value of shareholders equity, prior research finds that it exhibits a positive association with future returns.[14] Interest

[13] Lev and Sougiannis (1996) and Chan, Lakonishok, and Sougiannis (2001) report a positive association between research & development expenditures and subsequent excess returns. Chambers, Jennings, and Thompson (2002) report evidence that this result is consistent with compensation for risk-bearing.

[14] If the market treated every expense in the same way, one would expect a *negative* correlation between income tax expenses and future average returns. The fact that the association is positive can imply that the market views such an item to contain positive news about future cash flows (profitability) or that it is associated with shocks to discount rates. Hanlon, Laplante, and Shevlin (2005) report a positive association between tax expense surprises and returns. Thomas and Zhang (2013) report this result is due in part to current tax expense predicting future profitability. Henry (2014) uses a variance decomposition to conclude that the positive correlation is in part compensation for risk, driven by discount rate news.

expense is based on historical borrowing rates and is correlated with leverage, the tax benefits of leverage, and growth. Non-operating income and special items are more likely to contain transitory gains and losses. The economically different nature of these income statement line items motivates examining these items individually.

To evaluate these effects, we include each income statement item separately in Fama and MacBeth (1973) regressions. We do, however, make two modifications. First, the distributions of NOPI, SPI, and MII include a large number of observations with values of zero. We therefore combine these items into a regressor "Other expenses." Second, in an apparent attempt to facilitate comparability across firms, Standard and Poor's defines its selling, general & administrative expenses variable (XSGA) as the sum of firms' actual reported selling, general & administrative expenses and expenditures on research & development.[15] Whereas sales, general & administrative expenses are expenses the company incurs primarily for generating the current period's revenue, research & development expenditures are largely about generating future revenue. In some specifications we therefore subtract XRD from XSGA to disentangle selling, general & administrative expenses from research & development expenses.[16] We label this new variable "reported selling, general & administrative expense" to distinguish it from the Compustat version, and compare its predictive ability to that of Compustat's adjusted measure (XSGA).[17]

[15] See p. 254 of Volume 5 of the Compustat Manual. It follows that Compustat items XSGA and XRD are not mutually exclusive.

[16] There are two accounting requirements for research & development expenditures: they are expensed (deducted from earnings) when incurred, and if the amount exceeds one percent of firm revenue it must be disclosed (either as a separate line item on the Income Statement, or in the Notes to the Accounts). If not reported as a separate line item on the Income Statement, research & development expenditures are typically included in selling, general & administrative expenses and rarely in cost of goods sold.

[17] Standard & Poor's makes other adjustments. For example, when creating the Compustat data item for cost of goods sold (COGS), Standard and Poor's often subtracts total depreciation from the cost of goods sold reported in public filings, even if some of that total was not included in the reported number. For example, the depreciation attributable to head office buildings would have been included in the amount reported for selling, general & administrative expenses, not COGS. Compustat adds a footnote to this variable to alert users to the fact that they have carried out such an adjustment. The frequency of this adjustment is not stationary through time. Standard and Poor's starts making these adjustments in 1971 and the frequency increases through the 1990s. See Lambert, Bostwick, and Donelan (2014) for a discussion of this point. In unreported analysis, we add back depreciation to cost of goods sold to examine whether this Compustat adjustment affects our inferences, and find that it does not.

6.1. Income statement components in Fama-MacBeth regressions

In Table 6 we present average Fama and MacBeth (1973) slopes along with their associated t-values for these income statement items. Consistent with Novy-Marx (2013), we deflate all accounting variables by the book value of total assets. Panel A presents results for All-but-microcap stocks and Panel B presents results for Microcaps.

Starting with All-but-microcaps, column (1) presents the baseline result that includes just the control variables along with gross profit deflated by the book value of total assets.[18] In column (2), we also include the items between gross profit and income before extraordinary items, but separate expenditures on research & development from selling, general & administrative expenses. As expected, these items enter with different magnitudes, signs, and levels of statistical significance. For example, reported selling, general & administrative expenses, taxes, and other expenses are all negative (and therefore consistent with being income-decreasing), while depreciation & amortization, research & development, and interest are all positive. Only reported selling, general & administrative expenses and other expenses are statistically significant.

A Hotelling's T^2 test is the appropriate test in the context of a Fama-MacBeth regression for testing the hypothesis that the estimated slopes on gross profit and (minus the) estimated slopes on depreciation & amortization, selling, general & administrative expenses, research & development, interest, taxes, and other expenses are all equal.[19] The distribution of the T^2-test statistic is proportional to a $F(6, 600)$-distribution.[20] The test statistic scaled to conform to this F-distribution is 9.9, so this test rejects the hypothesis of equal slopes with a p-value < 0.001. This result implies that constraining the coefficients on the components of income before extraordinary items to be the same, as in Table 3, leads to lower explanatory power. This lower explanatory power can be seen

[18] This estimate differs slightly from the estimate in Table 3 because in each table we trim observations based on all independent variables except those that only appear in columns (2) and (3) of Table 6. The sample in Table 6, therefore, differs slightly from that in Table 3.

[19] Note that gross profit enters the calculation of net income with the positive sign while the opposite is true for expenses. We therefore re-sign the expense items when performing the Hotelling's T^2 test.

[20] The connection between the T^2-test statistic F-distribution is as follows. If a random variable X follows a $T^2(p, n)$ distribution, then $\frac{n-p+1}{np}X \sim F(p, n-p+1)$. See Rencher and Christensen (2012, p. 132).

if we compare the average Adjusted R^2s between the two tables: 5.84% for column (3) of Table 3 versus 7.60% for column (2) of Table 6.

The absolute magnitudes of the average coefficient and t-value for reported selling, general & administrative expenses are similar to those for gross profit (-2.57 with a t-value of -2.94 versus 2.91 with a t-value of 3.46), which is not case for the other items. This similarity is relevant given that firms' classification of expense items as selling, general & administrative versus cost of goods sold is not determined by Generally Accepted Accounting Principles and is to a large extent discretionary (Weil, Schipper, and Francis, 2014). Economically, however, both expenses are relevant to the generation of current profit. Given their similarity and somewhat arbitrary delineation, as well as the similar magnitude and significance of their coefficients, we create an operating profit measure by subtracting both cost of goods sold and reported selling, general & administrative expenses (which excludes research & development expenditures) from revenue. We label this variable "operating profit (reported SG&A)" and evaluate its predictive power in column (5).

Column (3) demonstrates the pitfall of using Compustat's adjusted measure of selling, general & administrative expenses (XSGA) that includes expenditures on research & development. In this regression we include all of the components between gross profit and income before extraordinary items but exclude expenditures on research & development and replace reported selling, general & administrative expenses with the adjusted Compustat measure (XSGA). In this specification, the average coefficients and t-values on gross profit and selling, general & administrative expenses all attenuate by approximately one-third.

In columns (4) and (5) we compare two measures of operating profit. In column (4) we subtract Compustat's adjusted measure of selling, general & administrative expenses (XSGA) from gross profit ("operating profit (Compustat SG&A)") and in column (5) we present results for our operating profit (reported SG&A) measure. As indicated by their t-values, both operating profit measures have significantly greater predictive ability than gross profit alone.[21] However, the t-value for the operating profit measure based on reported selling, general & administrative expenses is almost double than that for gross profit (8.92 versus 5.27) and almost 50% larger than the t-value for the operating profit measure based on Compustat's adjusted XSGA (8.92 versus 6.00). These results are consistent with the noise arising from arbitrary assignment of costs between cost of goods sold and selling, general & administrative expenses canceling out when they are aggregated in our operating profit measure. Removing expenditures on research & development from Compustat's XSGA further enhances the predictive power of our operating profit (reported SG&A) measure.[22]

We find similar effects for Microcaps in Panel B. Reported selling, general & administrative expenses outperform the adjusted Compustat measure (XSGA) and our operating profit measure based on reported selling, general & administrative expenses outperforms both gross profit and the operating profit measure based on Compustat's XSGA. When we examine the other items below gross profit, a Hotelling T^2 again rejects the equality of the average regression slopes for the components of income before extraordinary items with a p-value < 0.001. There are, however, interesting contrasts with the results for All-but-microcaps. For Microcaps, the average coefficients for depreciation & amortization and research & development become positive and significant and the coefficient on interest becomes negative and significant. Hence, the relation between these items and expected returns varies with market capitalization.

[21] Note that the average R^2 does not change substantially. This is not unexpected. Because the R^2s in Table 6 are *averages* computed over cross-sectional regressions, the model that yields the highest average R^2 is not necessarily the one that contains the best predictor of average returns. To illustrate the disconnect between t-values—which quantify the association between an explanatory variable and average returns in Fama-MacBeth regressions—and R^2s, consider adding industry dummy variables to the model. The average R^2 would increase substantially because stocks within the same industry tend to co-move within a month. At the same time, however, the average long-term returns across industries are almost statistically indistinguishable from each other (Fama and French, 1997). Hence, Fama-MacBeth regressions would not reveal a significant association between the industry dummies and *average* returns.

[22] The operating profit measures include minority interests in both the numerator and denominator. These minority interests do not represent claims of common equity holders. In untabulated Fama and MacBeth (1973) regressions, we find that the average t-value for operating profit (reported SG&A) increases slightly, but not significantly, when we remove minority interests from both the numerator and denominator.

6.2. *Operating profitability in portfolio tests*

In Table 7, we examine how our operating profitability measure based on reported selling, general & administrative expenses performs in portfolio tests. When we deflate this measure by the book value of total assets, it spreads excess returns similarly to gross profitability. The average excess return on the high-minus-low decile portfolio is 29 basis points per month (t-value = 1.95) compared to 36 basis points per month (t-value = 2.64) for gross profitability. But when we compare three-factor model alphas, operating profitability significantly outperforms gross profitability. For the high-minus-low decile portfolio the alpha is 74 basis points per month (t-value = 6.25) compared to 55 basis points (t-value = 4.18) for gross profitability. Operating profitability (reported SG&A) also outperforms gross profitability when we create industry-adjusted and industry-hedged portfolios as per Novy-Marx (2013).[23] In untabulated results, the three-factor model alpha for the high-minus-low decile based on operating profitability is 59 basis points per month with a t-value of 5.40, compared to 29 basis points with a t-value of 3.68 for gross profitability.

6.3. *Operating profitability and deflator effects*

It is also interesting to understand whether the ordering of predictive power associated with the different deflators examined in the context of gross profit carries over to operating profitability. As with gross profit and net income in Table 3, we find in Appendix A.2 the greatest explanatory power when we deflate operating profit by the book value of assets and the lowest when we deflate it by the market value of equity. In Appendix A.2 we also show that operating profitability behaves similar to gross profitability in Fama-MacBeth regressions and conditional portfolio sorts that decompose operating profit-to-assets into the interactions OP/ME $\times$ ME/AT and OP/BE $\times$ BE/AT and the individual components implicit in these interactions.

[23]We form the gross profitability and operating profitability portfolios by sorting stocks into portfolios separately within each of the 49 Fama-French industries. We then finance the purchase of every stock and invest the proceeds from selling every stock by taking an offsetting position in a value-weighted portfolio of all the stocks in the industry to which the stock belongs.

6.4. Operating profitability and firm size

It is important to know whether the effect of operating profitability is a marketwide phenomenon or whether it is confined to firms of certain size (see Fama and French (2008b) for discussion). To understand this point, we examine whether the performance of operating profitability varies with firm size. Table 8 sorts stocks independently into quintiles based on operating profitability and market capitalization. We base the market capitalization quintiles on NYSE breakpoints. Panel A presents average excess returns for this two-way sort. Across the size quintiles the average returns on the high-minus-low operating profitability portfolios are significantly positive except for the largest size quintile. Moreover, average returns and their t-values for the high-minus-low operating profitability portfolios decrease monotonically in size, starting at 56 basis points per month (t-value $= 5.40$) for the smallest size quintile and ending at 19 basis points per month (t-value $= 1.46$) for the largest size quintile. The difference between the returns on the large and small high-minus-low operating profitability portfolios is statistically significant (-37 basis points with a t-value of -2.45).

Panels B and C present three-factor model alphas and their t-values for the two-way sort. Alphas are positive and statistically significant for the high-minus-low operating profitability portfolios across all size quintiles. As with excess returns, the alphas on the high-minus-low operating profitability portfolios decrease in size, starting at 71 basis points per month (t-value $= 6.99$) for the smallest size quintile and ending at 49 basis points (t-value $= 4.04$) for the largest size decile. However, the difference between these two portfolios is not statistically significant. Overall, operating profitability is associated with positive returns across the size distribution with excess returns decreasing in size.

7. Rational and irrational asset-pricing explanations

What explains the ability of profitability measures to predict future returns? Fama and French (1992) distinguish "rational asset-pricing stories" from "irrational asset-pricing stories." Under irrational pricing explanations, profitability is mispriced due to a combination of trading frictions such as limits to arbitrage and behavioral factors such as overconfidence, anchoring, confirmation bias, herding, and hindsight bias (Barberis and Thaler, 2003). If investors systematically under-react to profitability information, and if the under-reaction subsequently is corrected as arbitrage or other mechanisms become more effective, then future returns will be increasing in past profitability. Alternatively, if investors systematically over-react to profitability information—irrational investors push high-profitability firms' valuations up too much and excessively depress those of low-profitability firms—we would expect to observe a return reversal pattern similar to that in De Bondt and Thaler (1984) when we condition on lagged profitability.

Rational pricing explanations build on Fama's (1970) "joint hypothesis problem" or "bad model problem." The basic idea is that profitability and expected returns share common economic determinants such as risk, and hence profitability is informative about priced variables.[24] If priced variables unknown to the researcher are omitted from the model of expected returns employed in the research design (e.g., the CAPM) or the variables are measured with error, profitability can proxy for model error and thus be informative about expected returns (Ball, 1978).

The intuition behind this explanation is illustrated as follows. Assume that firm i invests shareholders' assets, $\mathrm{BE}_{i,t-1}$, to earn profit, $\pi_{i,t-1}$, at an average rate of return on equity, $\pi_{i,t-1}/\mathrm{BE}_{i,t-1}$. The rate of return on equity can be decomposed into the firm's opportunity cost of equity capital and a quasi-rent component, $\rho_{i,t-1}$.[25] If we ignore potential differences between the firm's opportunity cost of equity capital and investors' expected return $\mathrm{E}_{t-1}(r_i)$ at the investment date that arise due to factors such as taxes on dividend distributions and transactions costs, then

[24]Ball, Sadka, and Sadka (2009) report that the principal components of earnings and returns are highly correlated and that the sensitivities of securities' returns to the earnings factors explain a significant portion of the cross-sectional variation in returns. This finding suggests that earnings performance correlates with an underlying source of priced risk.

[25]Quasi-rents represent temporary rents that can arise from barriers to entry that limit competition in the short-run, such as innovations in products, production or marketing, and patents. In comparison with monopoly rents that arise from barriers such as licensing laws, quasi-rents are a less persistent component of accounting profit. See, for example, Alchian (1987).

$\pi_{i,t-1}/\mathrm{BE}_{i,t-1} = \mathrm{E}_{t-1}(r_i) + \rho_{i,t-1}$.[26] The evolution of expected returns over time then can be described as: $\mathrm{E}_t(r_i) = \alpha \mathrm{E}_{t-1}(r_i) + \eta_{i,t} = \alpha(\pi_{i,t-1}/\mathrm{BE}_{i,t-1} - \rho_{i,t-1}) + \eta_{i,t}$. Past profitability thus is correlated with expected returns and can also be informative about the error in expected returns.

To assist in differentiating between the rational and irrational explanations, we investigate how far into the future the predictive ability of operating profitability persists. The idea is that the effects of limits to arbitrage and other trading frictions are unlikely to persist for long periods. Hence, mispricing is more likely to be corrected over longer horizons. Expected returns, by contrast, are likely to be more stationary, and hence the informativeness of past profitability measures for future returns is likely to persist longer.

Fig. 1 plots average Fama and MacBeth (1973) regression slopes on lagged operating profitability and the 95% confidence intervals associated with these slopes. These monthly cross-sectional regressions include the same control variables as those in Table 3. The lags range up to ten years, increasing in increments of six months. In Panel A we lag all regressors while in Panel B we lag just operating profitability (i.e., we update the values of the control variables). The regressors are: prior one-month return, prior one-year return skipping the last month, log-book-to-market, log-size, and operating profitability. Operating profitability is defined as gross profit minus selling, general & administrative expenses (excluding research & development expenditures) deflated by the book value of total assets. The regressions are estimated monthly using data from July 1973 through December 2013 for stocks with a market value of equity above the 20th percentile of the NYSE market capitalization distribution (All-but-microcaps). The sample period begins in 1973 so that we can lag the regressors by up to ten years, making the regressions comparable across lags.

Panel A provides evidence on the horizon over which operating profitability has predictive ability. The value on the x-axis indicates the number of years by which the regressors are lagged. The estimates at $x = 10$, for example, explain cross-sectional variation in returns using the values of regressors recorded ten years earlier. Panel A indicates that the ability of operating profitability to

[26] For example, taxes on dividend distributions can cause the opportunity cost of an investment financed by retained earnings to differ from that of an investment financed by raising equity capital from investors, whose expected return is $\mathrm{E}_{t-1}(r_i)$. See Auerbach (2002) for a review of relevant literature.

predict future returns decays over time but is reliably positive for at least four years and persists perhaps as long as ten years. The pattern of persistence is consistent with past operating profitability and expected returns sharing common economic determinants such as risk, but with the predictive power of operating profitability decaying because the common determinants evolve over time, for example as firms' investments, financing, and operations change. Such changes would cause lagged profitability to gradually lose its predictive ability.

Panel B reports on the ability of operating profitability to predict returns at increasing lags when the control variables (but not profitability) are updated over time. We expect updating the values of book-to-market to better control for variation over time in at least two sources of error in profitability as a predictor of expected returns, and thereby increase the average slope on profitability in the Fama and MacBeth (1973) regressions, especially at longer lags. First, we expect variation over time in quasi-rents to be correlated with the book-to-market ratio, because information about quasi-rents likely affects price but goes mostly unrecorded on cost-based balance sheets. Second, we expect variation over time in book-to-market to be correlated with any effect of taxes on the profitability levels that firms require from investments financed by retained earnings (Auerbach, 2002), because changes in retained earnings are incorporated in the book value of equity. Consistent with the expectation that updating the control variables removes error in using profitability to predict expected returns, the average slope on profitability decays more slowly over time in Panel B than in Panel A. It is reliably positive for most of the ten-year prediction period.

The results in both Panels (especially in Panel B) are difficult to reconcile with market mispricing being the explanation for operating profitability's predictive power. If market mispricing is the correct explanation, then mispricing must persist uncorrected for a large number of years to be consistent with these results. We caution, however, that these results are not conclusive. Neither explanation offers precise predictions of the shape that Fig. 1 should take.

8. Conclusion

We examine the source of gross profitability's ability to predict differences in average returns and re-evaluate whether gross profitability has greater predictive power than net income. We find that net income "loses" to gross profitability only because net income is usually deflated by either the market or book value of equity, whereas gross profitability deflates gross profit (revenue minus cost of goods sold) by book value of total assets. A regression of returns on gross profitability generates a variable that is the product of gross profit and the ratio of the market value of equity to the book value of total assets, which is priced. We then take Novy-Marx's (2013) intuition about focusing on those income statement items that relate to current revenue further and construct a measure of operating profit with a far stronger link with expected returns than either net income or gross profit. It predicts returns as far as ten years ahead, seemingly inconsistent with irrational pricing explanations.

Appendix A

A.1. Interactions in portfolio sorts

We use portfolio sorts to allow for non-linearities in the relation between gross profit and the ratio of the market value of equity to the book value of assets. Non-linearities would not necessarily be evident in Table 5's Fama-MacBeth regressions. In Table A1 we first sort stocks into deciles based on GP/ME and then, within each GP/ME decile, we sort stocks into quintiles by ME/AT. The table reports monthly Fama-French three-factor alphas and their associated t-values for each value-weighted portfolio. The first row and first column present alpha estimates for *unconditional* sorts on ME/AT and GP/ME. The last row ("average 1,. . . ,10") reports for each ME/AT quintile the alpha of a portfolio that invests an equal amount into each of the associated GP/ME decile portfolios. Similarly, the last column ("average 1,. . . ,5") reports for each GP/ME decile the alpha of a portfolio that invests an equal amount into each of the associated ME/AT quintiles.

An important takeaway from this table is that the "All" row, which sorts unconditionally on ME/AT, spreads returns similarly to the "Average 1,. . . ,10" row, which sorts ME/AT conditional on GP/ME. The similar explanatory power of the two rows implies that ME/AT by itself generates almost as much alpha as the product (GP/AT) shown on the last row. In the portfolio sorts ME/AT is more important than in the Fama-MacBeth regressions presented in Panel A of Table 5. This difference is likely driven by the fact that the portfolio returns are value-weighted but the sorts are based on all stocks (using NYSE breakpoints). Hence, the portfolio tests are somewhat between Panels A and B of Table 5. An additional takeaway is that the last column ("average 1,. . . ,5") demonstrates that these effects are non-linear, with ME/AT having the largest effect for firms in the top decile of GP/ME.

A.2. The role of deflators in operating profitability

Table A2 presents average Fama and MacBeth (1973) regression slopes and their t-values from cross-sectional regressions that predict monthly returns using operating profit. We deflate operating profit by the book value of assets, the book value of equity, and the market value of equity. As with gross profit and net income in Table 3, operating profit has the highest predictive power when we deflate it by the book value of assets and the lowest when we deflate by the market value of equity. This ordering holds for both All-but-microcaps and Microcaps.

We next repeat the analyses presented in Tables 5 and A1 replacing gross profitability with operating profitability. Table A3 presents Fama-MacBeth regressions for operating profitability and its components and Table A4 presents portfolio sorts of ME/AT conditional on OP/ME. Overall, the results for operating profitability are similar to those for gross profitability. However, a notable difference between Tables A1 and A4 is that the product (OP/AT) plays a greater role for operating profitability, as evidenced by the greater spread of returns on the last row compared to the unconditional ME/AT sort presented on the first row.

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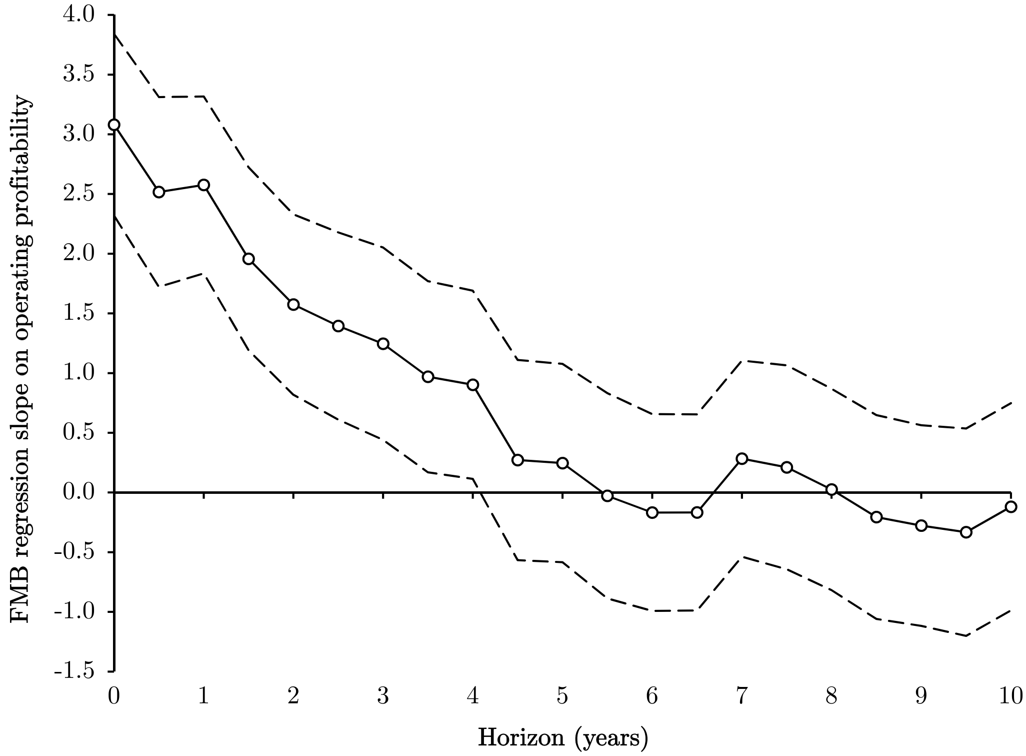
Panel A: Lag all explanatory variables



Panel B: Lag only operating profitability

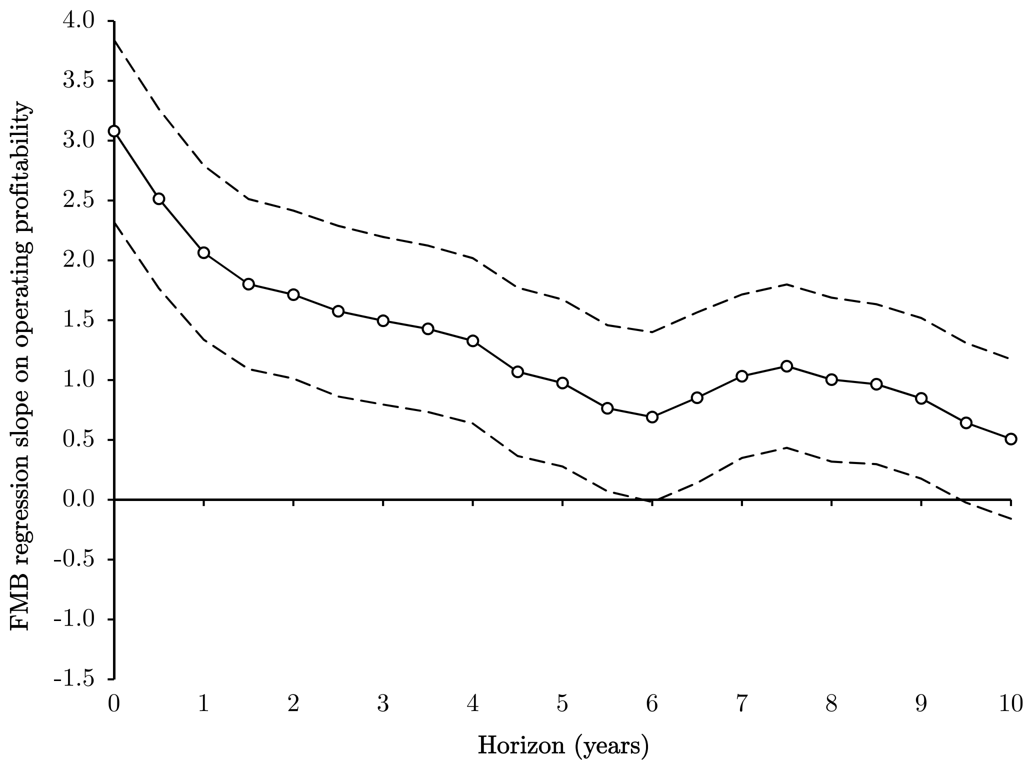


Fig. 1. **Fama-MacBeth regressions of stock returns on lagged operating profitability.** This figure plots average Fama and MacBeth (1973) regression slopes and the 95% confidence intervals associated with these slopes from cross-sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1973 through December 2013 for stocks with a market value of equity above the 20th percentile of the NYSE market capitalization distribution (All-but-microcaps). The regressors are: prior one-month return, prior one-year return skipping a month, log-book-to-market, log-size, and operating profitability. Operating profitability is defined as gross profit minus selling, general & administrative expenses (excluding research & development expenditures) deflated by the book value of total assets. In Panel A we lag all regressors by the value indicated on the x-axis. The estimates at $x = 10$, for example, explain cross-sectional variation in returns using the values of regressors recorded 10 years earlier. In Panel B we lag only operating profitability and keep the values of the other regressors current.

Table 1: Descriptive statistics, 1963–2013

This table presents descriptive statistics for the variables used in our analysis. We deflate accounting variables by both the book value of total assets and the market value of equity. The accounting variables are taken from Compustat and are defined as follows with the relevant Compustat items in parentheses: gross profit (GP); income before extraordinary items (IB); selling, general & administrative expenses excluding research & development (XSGA − XRD); depreciation & amortization (DP); research & development (XRD); interest (XINT); taxes (TXT); other expenses (NOPI + SPI − MII). The other variables used in our analysis are defined as follows: log(BE/ME) is the natural logarithm of the book-to-market ratio; log(ME) is the natural logarithm of the market value of equity; $r_{1,1}$ is the prior one month return; $r_{12,2}$ is the prior year's return skipping the last month. Our sample period starts in July 1963 and ends in December 2013.

			Percentiles				
Variable	Mean	SD	1st	25th	50th	75th	99th
Accounting variables scaled by total book assets							
Gross profit	0.371	0.297	−0.305	0.190	0.340	0.513	1.230
Income before extraordinary items	0.001	0.189	−0.734	−0.009	0.041	0.076	0.229
Sales, general & administrative	0.242	0.263	−0.241	0.081	0.195	0.346	1.090
Depreciation & amortization	0.043	0.038	0.002	0.024	0.036	0.053	0.168
Research & development	0.034	0.087	0.000	0.000	0.001	0.037	0.367
Interest	0.019	0.021	0.000	0.006	0.016	0.028	0.077
Taxes	0.032	0.043	−0.065	0.007	0.026	0.051	0.160
Other expenses	−0.001	0.077	−0.135	−0.016	−0.006	0.003	0.224
Accounting variables scaled by market value of equity							
Gross profit	0.720	1.746	−0.190	0.216	0.415	0.781	5.409
Income before extraordinary items	−0.032	0.835	−1.734	−0.006	0.055	0.092	0.344
Sales, general & administrative	0.504	1.404	−0.125	0.075	0.220	0.516	4.682
Depreciation & amortization	0.098	0.319	0.001	0.021	0.048	0.096	0.842
Research & development	0.035	0.147	0.000	0.000	0.001	0.028	0.430
Interest	0.067	0.314	0.000	0.005	0.020	0.058	0.732
Taxes	0.038	0.172	−0.228	0.012	0.036	0.065	0.252
Other expenses	0.010	0.515	−0.341	−0.021	−0.006	0.004	0.651
Other variables							
log(BE/ME)	−0.543	0.933	−3.217	−1.055	−0.456	0.050	1.485
log(ME)	4.552	1.969	0.647	3.119	4.424	5.875	9.405
$r_{1,1}$	0.013	0.152	−0.305	−0.063	0.001	0.071	0.489
$r_{12,2}$	0.146	0.590	−0.669	−0.174	0.055	0.326	2.199

Table 2: Correlations, 1963–2013

This table presents Pearson (Panel A) and Spearman rank (Panel B) correlations between the variables used in our analysis. We deflate accounting variables by both the book value of total assets and the market value of equity. The accounting variables are taken from Compustat and are defined as follows with the relevant Compustat items in parentheses: gross profit (GP); income before extraordinary items (IB); selling, general & administrative expenses excluding research & development (XSGA − XRD); depreciation & amortization (DP); research & development (XRD); interest (XINT); taxes (TXT); other expenses (NOPI + SPI − MII). Our sample period starts in July 1963 and ends in December 2013.

Panel A: Pearson correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Scaled by book value of total assets:																
(1)	Gross profit	1.00														
(2)	Income before extraordinary items	0.40	1.00													
(3)	Sales, general & administrative	0.81	−0.02	1.00												
(4)	Depreciation & amortization	0.07	−0.21	0.04	1.00											
(5)	Research & development	−0.24	−0.59	−0.21	0.03	1.00										
(6)	Interest	−0.11	−0.16	−0.03	0.08	−0.08	1.00									
(7)	Taxes	0.36	0.33	0.08	−0.08	−0.08	−0.22	1.00								
(8)	Other expenses	0.02	−0.46	0.02	0.16	0.13	0.04	−0.13	1.00							
Scaled by market value of equity:																
(9)	Gross profit	0.10	0.01	0.11	0.02	−0.04	0.06	−0.04	0.02	1.00						
(10)	Income before extraordinary items	0.05	0.19	−0.02	−0.09	−0.04	−0.05	0.08	−0.17	0.26	1.00					
(11)	Sales, general & administrative	0.14	−0.03	0.20	0.02	−0.05	0.08	−0.08	0.03	0.88	−0.05	1.00				
(12)	Depreciation & amortization	−0.02	−0.06	−0.01	0.25	−0.04	0.11	−0.09	0.06	0.71	−0.07	0.61	1.00			
(13)	Research & development	−0.03	−0.10	−0.02	0.02	0.14	0.00	−0.03	0.04	0.76	0.26	0.51	0.57	1.00		
(14)	Interest	−0.03	−0.01	−0.02	0.01	−0.04	0.17	−0.07	0.01	0.38	−0.46	0.40	0.51	0.24	1.00	
(15)	Taxes	0.02	0.02	0.00	−0.01	0.00	−0.01	0.07	−0.02	0.81	0.47	0.50	0.51	0.85	0.23	1.00
(16)	Other expenses	0.00	−0.12	0.01	0.06	0.00	0.01	−0.06	0.27	0.01	−0.74	0.14	0.10	−0.05	0.29	−0.20

Panel B: Spearman rank correlations

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Scaled by book value of total assets:																
(1)	Gross profit	1.00														
(2)	Income before extraordinary items	0.40	1.00													
(3)	Sales, general & administrative	0.81	0.01	1.00												
(4)	Depreciation & amortization	0.11	−0.11	0.03	1.00											
(5)	Research & development	0.06	−0.34	0.09	0.03	1.00										
(6)	Interest	−0.14	−0.18	−0.11	0.14	−0.23	1.00									
(7)	Taxes	0.44	0.68	0.12	−0.05	−0.10	−0.27	1.00								
(8)	Other expenses	0.10	−0.29	0.09	0.16	0.12	0.15	−0.14	1.00							
Scaled by market value of equity:																
(9)	Gross profit	0.41	−0.03	0.42	0.10	−0.12	0.28	−0.07	0.21	1.00						
(10)	Income before extraordinary items	0.21	0.74	−0.06	−0.14	−0.33	−0.08	0.44	−0.29	0.00	1.00					
(11)	Sales, general & administrative	0.40	−0.19	0.59	0.05	−0.06	0.19	−0.16	0.18	0.89	−0.21	1.00				
(12)	Depreciation & amortization	−0.10	−0.30	−0.06	0.48	−0.08	0.39	−0.30	0.23	0.62	−0.30	0.53	1.00			
(13)	Research & development	0.04	−0.35	0.08	0.07	0.82	−0.12	−0.14	0.16	0.13	−0.42	0.17	0.18	1.00		
(14)	Interest	−0.16	−0.25	−0.09	0.08	−0.16	0.67	−0.31	0.15	0.59	−0.25	0.51	0.73	0.09	1.00	
(15)	Taxes	0.23	0.44	0.03	−0.07	−0.19	−0.03	0.67	−0.10	0.26	0.55	0.08	0.01	−0.12	0.01	1.00
(16)	Other expenses	0.09	−0.29	0.08	0.12	0.22	0.02	−0.06	0.78	0.12	−0.46	0.13	0.18	0.27	0.07	−0.17

Table 3: Fama-MacBeth regressions

This table presents average Fama and MacBeth (1973) regression slopes and their t-values from cross-sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1963 through December 2013. Panel A presents results for All-but-microcaps and Panel B presents results for Microcaps. Microcaps are stocks with market values of equity below the 20th percentile of the NYSE market capitalization distribution. In each panel, gross profit and income before extraordinary items are deflated by the book value of total assets, the book value of equity, and the market value of equity. We trim all independent variables to the 1st and 99th percentiles. The last row reports the difference in Sharpe ratios between the self-financing strategy based on income before extraordinary items and the self-financing gross profit strategy (see text for details). We compute t-values for the differences in Sharpe ratios by bootstrapping the Fama-MacBeth slope estimates 1,000 times.

Panel A: All-but-microcaps

		Accounting variables deflated by:					
Explanatory		Total assets		Book equity		Market equity	
variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gross profit		0.834		0.272		0.350	
		(5.46)		(4.45)		(3.74)	
Income before extraordinary items			3.335		1.259		1.766
			(5.80)		(3.78)		(3.11)
log(BE/ME)	0.291	0.380	0.376	0.346	0.336	0.208	0.244
	(3.87)	(4.88)	(4.71)	(4.36)	(4.14)	(2.71)	(3.43)
log(ME)	−0.070	−0.061	−0.082	−0.066	−0.082	−0.061	−0.075
	(−1.79)	(−1.55)	(−2.18)	(−1.70)	(−2.17)	(−1.59)	(−1.96)
$r_{1,1}$	−3.223	−3.307	−3.239	−3.366	−3.273	−3.353	−3.308
	(−7.30)	(−7.63)	(−7.46)	(−7.79)	(−7.52)	(−7.70)	(−7.59)
$r_{12,2}$	1.019	1.039	1.061	1.015	1.037	1.024	1.032
	(5.52)	(5.70)	(5.77)	(5.63)	(5.67)	(5.67)	(5.66)
Adjusted R^2	5.35%	5.89%	5.84%	5.80%	5.77%	5.74%	5.80%
Difference in Sharpe Ratios			0.049		−0.094		−0.089
			(0.37)		(−0.51)		(−0.42)

Panel B: Microcaps

Explanatory variable	(1)	Accounting variables deflated by: Total assets (2)	Total assets (3)	Book equity (4)	Book equity (5)	Market equity (6)	Market equity (7)
Gross profit		0.867		0.140		0.112	
		(6.57)		(2.77)		(2.06)	
Income before extraordinary items			1.996		0.663		0.434
			(3.44)		(2.26)		(1.04)
log(BE/ME)	0.552	0.562	0.549	0.566	0.531	0.511	0.541
	(8.39)	(8.37)	(8.44)	(8.20)	(7.83)	(7.85)	(8.59)
log(ME)	−0.180	−0.166	−0.209	−0.168	−0.205	−0.174	−0.185
	(−2.82)	(−2.58)	(−3.48)	(−2.61)	(−3.39)	(−2.72)	(−3.07)
$r_{1,1}$	−5.776	−5.871	−5.915	−5.856	−5.891	−5.841	−5.868
	(−13.23)	(−13.53)	(−13.84)	(−13.47)	(−13.70)	(−13.42)	(−13.67)
$r_{12,2}$	1.153	1.095	1.117	1.117	1.115	1.132	1.140
	(6.24)	(5.94)	(6.22)	(6.12)	(6.17)	(6.19)	(6.25)
Adjusted R^2	2.84%	3.03%	3.22%	2.99%	3.15%	2.95%	3.17%
Difference in Sharpe Ratios			−0.441		−0.072		−0.144
			(−2.92)		(−0.42)		(−0.81)

Table 4: Portfolio results

This table reports value-weighted average excess returns and three-factor model alphas and MKT, SMB, and HML loadings for portfolios sorted by gross profit and income before extraordinary items ("net income"). In Panel A we deflate gross profit and net income by the book value of total assets. In Panel B we deflate these variables by the market value of equity. We sort stocks into deciles based on NYSE breakpoints at the end of each June and hold the portfolios for the following year. The sample starts in July 1963 and ends in December 2013.

Panel A: Gross profit and income before extraordinary items deflated by book value of total assets

	Sort by gross profit / total assets					Sort by net income / total assets				
	Average	Three-factor model				Average	Three-factor model			
Portfolio	return	α	b_{mkt}	b_{smb}	b_{hml}	return	α	b_{mkt}	b_{smb}	b_{hml}
1 (low)	0.349	−0.168	0.943	0.045	0.113	0.466	−0.269	1.215	0.663	−0.080
	(1.83)	(−1.90)	(45.24)	(1.54)	(3.55)	(1.63)	(−2.37)	(45.32)	(17.46)	(−1.96)
2	0.404	−0.188	0.955	−0.035	0.353	0.557	−0.189	1.146	0.297	0.289
	(2.23)	(−2.50)	(53.67)	(−1.38)	(13.05)	(2.43)	(−2.36)	(60.53)	(11.09)	(10.02)
3	0.429	−0.127	1.029	−0.097	0.201	0.447	−0.168	1.037	0.019	0.269
	(2.21)	(−1.66)	(56.97)	(−3.80)	(7.31)	(2.26)	(−2.19)	(57.14)	(0.73)	(9.71)
4	0.457	−0.103	1.026	−0.034	0.175	0.515	−0.027	0.931	−0.054	0.263
	(2.33)	(−1.33)	(55.72)	(−1.31)	(6.25)	(2.93)	(−0.39)	(55.75)	(−2.29)	(10.36)
5	0.602	0.066	1.016	0.003	0.099	0.525	0.003	0.952	0.065	0.102
	(3.04)	(0.84)	(55.21)	(0.12)	(3.55)	(2.78)	(0.04)	(52.56)	(2.52)	(3.69)
6	0.558	0.028	0.997	0.119	0.029	0.572	0.033	0.979	−0.034	0.180
	(2.80)	(0.39)	(58.69)	(4.94)	(1.11)	(3.09)	(0.48)	(61.18)	(−1.48)	(7.38)
7	0.499	0.046	1.044	0.045	−0.188	0.539	0.017	0.984	−0.038	0.130
	(2.33)	(0.59)	(56.84)	(1.72)	(−6.72)	(2.93)	(0.29)	(68.68)	(−1.86)	(5.94)
8	0.441	0.062	0.975	−0.001	−0.264	0.552	0.097	0.988	−0.106	−0.008
	(2.15)	(0.79)	(52.70)	(−0.06)	(−9.38)	(2.94)	(1.51)	(64.99)	(−4.93)	(−0.34)
9	0.615	0.270	0.929	−0.019	−0.282	0.476	0.058	0.970	−0.055	−0.118
	(3.17)	(3.86)	(56.16)	(−0.81)	(−11.18)	(2.51)	(0.96)	(67.85)	(−2.70)	(−5.42)
10 (high)	0.707	0.383	0.903	−0.055	−0.279	0.548	0.270	0.922	−0.121	−0.380
	(3.66)	(4.63)	(46.20)	(−1.99)	(−9.38)	(2.86)	(4.39)	(63.45)	(−5.88)	(−17.18)
High − Low	0.358	0.551	−0.040	−0.101	−0.392	0.082	0.539	−0.293	−0.784	−0.300
(deciles)	(2.64)	(4.18)	(−1.30)	(−2.28)	(−8.27)	(0.47)	(4.11)	(−9.46)	(−17.88)	(−6.37)
High − Low	0.296	0.523	−0.051	−0.051	−0.503	0.038	0.429	−0.233	−0.550	−0.363
(quintiles)	(2.45)	(4.77)	(−1.97)	(−1.40)	(−12.73)	(0.29)	(4.18)	(−9.58)	(−16.00)	(−9.83)

Panel B: Gross profit and income before extraordinary items deflated by market value of equity

	Sort by gross profit / market value					Sort by net income / market value				
	Average	Three-factor model				Average	Three-factor model			
Portfolio	return	α	b_{mkt}	b_{smb}	b_{hml}	return	α	b_{mkt}	b_{smb}	b_{hml}
1 (low)	0.390	0.085	1.058	−0.018	−0.558	0.488	−0.075	1.174	0.428	−0.325
	(1.69)	(1.29)	(68.23)	(−0.83)	(−23.62)	(1.74)	(−0.59)	(38.89)	(10.01)	(−7.06)
2	0.333	−0.064	0.971	−0.176	−0.092	0.392	0.015	1.107	0.051	−0.478
	(1.79)	(−1.03)	(65.93)	(−8.42)	(−4.09)	(1.62)	(0.18)	(55.97)	(1.83)	(−15.86)
3	0.456	0.016	0.937	−0.122	0.032	0.517	0.079	1.041	−0.019	−0.182
	(2.61)	(0.29)	(71.86)	(−6.64)	(1.61)	(2.49)	(1.17)	(65.33)	(−0.83)	(−7.48)
4	0.518	0.035	0.905	−0.099	0.171	0.419	−0.011	0.953	−0.121	−0.018
	(3.07)	(0.56)	(61.83)	(−4.79)	(7.67)	(2.28)	(−0.16)	(57.41)	(−5.14)	(−0.71)
5	0.668	0.152	0.909	−0.007	0.191	0.480	−0.001	0.941	−0.121	0.133
	(3.88)	(2.37)	(60.02)	(−0.32)	(8.30)	(2.66)	(−0.01)	(52.23)	(−4.75)	(4.85)
6	0.714	0.110	0.948	0.046	0.339	0.517	0.001	0.918	−0.057	0.213
	(3.93)	(1.52)	(55.22)	(1.91)	(12.98)	(2.96)	(0.01)	(54.15)	(−2.36)	(8.24)
7	0.892	0.175	1.031	0.235	0.401	0.534	−0.005	0.886	0.003	0.276
	(4.37)	(2.32)	(57.79)	(9.30)	(14.77)	(3.09)	(−0.07)	(48.87)	(0.12)	(9.99)
8	0.814	0.067	1.051	0.297	0.414	0.696	0.097	0.932	−0.009	0.383
	(3.80)	(0.78)	(51.40)	(10.27)	(13.30)	(3.88)	(1.23)	(50.25)	(−0.33)	(13.56)
9	0.820	−0.035	1.100	0.419	0.552	0.771	0.079	0.948	0.132	0.514
	(3.59)	(−0.39)	(52.30)	(14.07)	(17.24)	(4.04)	(0.89)	(45.30)	(4.46)	(16.13)
10 (high)	0.982	−0.041	1.146	0.739	0.724	0.826	0.024	1.029	0.268	0.606
	(3.71)	(−0.36)	(42.63)	(19.44)	(17.68)	(3.83)	(0.24)	(42.53)	(7.83)	(16.46)
High − Low	0.592	−0.126	0.088	0.758	1.282	0.338	0.100	−0.145	−0.159	0.931
(deciles)	(2.87)	(−0.93)	(2.73)	(16.69)	(26.24)	(1.59)	(0.57)	(−3.50)	(−2.73)	(14.79)
High − Low	0.515	−0.056	0.094	0.595	0.991	0.367	0.054	−0.146	0.037	0.998
(quintiles)	(3.28)	(−0.56)	(3.97)	(17.72)	(27.42)	(2.05)	(0.42)	(−4.77)	(0.85)	(21.36)

Table 5: Interactions in Fama-MacBeth regressions

This table presents average Fama and MacBeth (1973) regression slopes and their t-values from cross-sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1963 through December 2013. Panel A presents results for All-but-microcaps and Panel B presents results for Microcaps. Microcaps are stocks with a market value of equity below the 20th percentile of the NYSE market capitalization distribution. We trim all independent variables to the 1st and 99th percentiles.

Panel A: All-but-microcaps

Explanatory	Regression				
variable	(1)	(2)	(3)	(4)	(5)
GP/ME	0.287	0.066			0.017
	(3.63)	(0.78)			(0.76)
ME/AT	−0.011	−0.010			
	(−0.66)	(−0.59)			
GP/BE			0.104	0.045	−0.007
			(4.03)	(1.65)	(−0.08)
BE/AT			0.274	0.013	
			(1.60)	(0.07)	
GP/AT		0.667		0.612	0.713
= (GP/ME) × (ME/AT)		(4.69)		(4.19)	(5.09)
= (GP/BE) × (BE/AT)					
log(BE/ME)	0.178	0.298	0.316	0.347	0.355
	(2.59)	(4.13)	(4.64)	(4.99)	(4.60)
log(ME)	−0.054	−0.057	−0.057	−0.058	−0.053
	(−1.47)	(−1.55)	(−1.55)	(−1.58)	(−1.45)
$r_{1,1}$	−2.695	−2.727	−2.670	−2.746	−2.710
	(−6.44)	(−6.60)	(−6.41)	(−6.68)	(−6.54)
$r_{12,2}$	0.859	0.872	0.857	0.864	0.873
	(5.76)	(5.87)	(5.88)	(5.96)	(5.97)
Adjusted R^2	5.88%	6.31%	5.84%	6.26%	6.18%

Panel B: Microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)
GP/ME	−0.010	−0.035			0.065
	(−0.34)	(−0.99)			(2.32)
ME/AT	0.070	0.077			
	(2.40)	(2.65)			
GP/BE			0.051	0.127	−0.071
			(2.73)	(3.57)	(−1.83)
BE/AT			0.741	0.884	
			(4.47)	(5.10)	
GP/AT = (GP/ME) × (ME/AT) = (GP/BE) × (BE/AT)		0.406		0.086	0.350
		(3.11)		(0.63)	(2.60)
log(BE/ME)	0.497	0.519	0.465	0.454	0.516
	(7.89)	(7.84)	(7.48)	(7.39)	(7.72)
log(ME)	−0.410	−0.411	−0.414	−0.413	−0.407
	(−6.00)	(−6.04)	(−6.01)	(−6.02)	(−5.99)
$r_{1,1}$	−5.806	−5.861	−5.832	−5.891	−5.826
	(−15.15)	(−15.38)	(−15.25)	(−15.47)	(−15.26)
$r_{12,2}$	0.753	0.717	0.751	0.714	0.735
	(4.99)	(4.80)	(5.11)	(4.92)	(4.94)
Adjusted R^2	3.03%	3.20%	2.96%	3.13%	3.19%

Table 6: Fama-MacBeth regressions for the components of income before extraordinary items

This table presents average Fama and MacBeth (1973) regression slopes and their t-values from cross-sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1963 through December 2013 separately for All-but-microcaps (Panel A) and Microcaps (Panel B). Microcaps are stocks with a market value of equity below the 20th percentile of the NYSE market capitalization distribution. All accounting variables are deflated by the book value of total assets. We trim all independent variables to the 1st and 99th percentiles.

Panel A: All-but-microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)
Gross profit	0.794	2.914	2.117		
	(5.27)	(3.46)	(2.44)		
Operating profit (Compustat SG&A)				2.349	
				(6.00)	
Operating profit (reported SG&A)					3.134
					(8.92)
Depreciation & amortization		1.785	2.540		
		(1.33)	(1.89)		
Compustat SG&A expenses			−1.636		
			(−1.82)		
Reported SG&A		−2.568			
		(−2.94)			
Research & development		1.324			
		(0.88)			
Interest		1.977	−0.614		
		(0.97)	(−0.27)		
Taxes		−0.681	−0.041		
		(−0.42)	(−0.03)		
Other expenses		−1.406	−1.101		
		(−1.63)	(−1.27)		
log(BE/ME)	0.375	0.442	0.388	0.378	0.443
	(5.08)	(6.33)	(5.22)	(5.01)	(5.91)
log(ME)	−0.063	−0.074	−0.079	−0.087	−0.087
	(−1.61)	(−2.04)	(−2.16)	(−2.33)	(−2.24)
$r_{1,1}$	−3.290	−3.689	−3.594	−3.235	−3.161
	(−7.57)	(−8.99)	(−8.56)	(−7.46)	(−7.24)
$r_{12,2}$	1.010	0.998	0.971	1.019	1.059
	(5.46)	(5.63)	(5.38)	(5.48)	(5.66)
Adjusted R^2	5.83%	7.60%	7.03%	5.83%	5.72%

Panel B: Microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)
Gross profit	0.754	2.291	1.511		
	(5.67)	(3.42)	(2.20)		
Operating profit (Compustat SG&A)				1.309	
				(3.31)	
Operating profit (reported SG&A)					2.449
					(6.96)
Depreciation & amortization		3.087	3.345		
		(2.90)	(3.14)		
Compustat SG&A expenses			−0.920		
			(−1.30)		
Reported SG&A		−1.907			
		(−2.78)			
Research & development		3.015			
		(2.09)			
Interest		−3.713	−5.495		
		(−1.99)	(−2.91)		
Taxes		1.088	1.384		
		(0.83)	(1.05)		
Other expenses		−2.254	−2.214		
		(−2.49)	(−2.45)		
log(BE/ME)	0.517	0.616	0.557	0.505	0.507
	(8.15)	(9.99)	(8.97)	(8.26)	(7.97)
log(ME)	−0.182	−0.228	−0.204	−0.225	−0.262
	(−2.82)	(−3.75)	(−3.35)	(−3.73)	(−4.31)
$r_{1,1}$	−5.871	−6.118	−6.110	−5.953	−5.894
	(−13.49)	(−14.53)	(−14.38)	(−13.92)	(−13.57)
$r_{12,2}$	1.067	1.086	1.047	1.092	1.079
	(5.68)	(6.17)	(5.86)	(5.99)	(5.80)
Adjusted R^2	2.99%	3.91%	3.71%	3.20%	3.09%

Table 7: Portfolio results for operating profitability

This table reports value-weighted excess returns and three-factor model alphas and MKT, SMB, and HML loadings for portfolios sorted by operating profitability, defined as gross profit minus selling, general & administrative expenses (excluding research & development expenditures) deflated by the book value of total assets. We sort stocks into deciles based on NYSE breakpoints at the end of each June and hold the portfolio for the following year. The sample starts in July 1963 and ends in December 2013.

	Average	Three-factor model			
Portfolio	return	α	b_{mkt}	b_{smb}	b_{hml}
1 (low)	0.264	−0.457	1.175	0.481	0.057
	(1.03)	(−4.73)	(51.51)	(14.90)	(1.63)
2	0.411	−0.211	1.051	0.037	0.257
	(2.03)	(−2.66)	(56.04)	(1.40)	(9.01)
3	0.468	−0.157	0.982	0.061	0.341
	(2.49)	(−2.11)	(55.86)	(2.45)	(12.75)
4	0.437	−0.162	0.981	0.069	0.266
	(2.33)	(−2.36)	(60.65)	(3.02)	(10.81)
5	0.577	0.051	0.959	−0.050	0.184
	(3.19)	(0.74)	(59.54)	(−2.21)	(7.51)
6	0.506	−0.007	0.964	−0.035	0.132
	(2.74)	(−0.09)	(56.22)	(−1.44)	(5.04)
7	0.490	−0.040	0.994	−0.060	0.154
	(2.62)	(−0.60)	(63.09)	(−2.70)	(6.42)
8	0.635	0.140	1.033	−0.019	−0.017
	(3.21)	(2.28)	(71.47)	(−0.95)	(−0.78)
9	0.535	0.093	0.976	−0.083	−0.041
	(2.87)	(1.53)	(68.16)	(−4.11)	(−1.87)
10 (high)	0.554	0.283	0.932	−0.083	−0.437
	(2.81)	(4.79)	(66.81)	(−4.19)	(−20.56)
High − Low	0.290	0.739	−0.244	−0.564	−0.493
(deciles)	(1.95)	(6.25)	(−8.71)	(−14.24)	(−11.59)
High − Low	0.209	0.543	−0.160	−0.287	−0.485
(quintiles)	(1.89)	(5.87)	(−7.30)	(−9.27)	(−14.55)

Table 8: Two-way portfolio sorts for operating profitability and market capitalization

This table reports value-weighted excess returns, three-factor model alphas, and the t-values associated with the three-factor model alphas for portfolios sorted by market capitalization and operating profitability, defined as gross profit minus selling, general & administrative expenses (excluding research & development expenditures) deflated by the book value of total assets. We sort stocks into quintiles based on NYSE breakpoints at the end of each June and hold the portfolios for the next year. The market capitalization and operating profitability sorts are independent of each other. The sample starts in July 1963 and ends in December 2013.

Panel A: Excess returns

	Market capitalization, ME						
Operating						Q5 − Q1	
profitability	Q1	Q2	Q3	Q4	Q5	Mean	t-value
Q1	0.51	0.42	0.47	0.44	0.31	−0.20	−0.85
Q2	0.86	0.81	0.66	0.56	0.36	−0.50	−2.87
Q3	0.97	0.85	0.75	0.67	0.48	−0.48	−2.61
Q4	0.91	0.80	0.79	0.76	0.51	−0.41	−2.31
Q5	1.07	0.94	0.83	0.78	0.51	−0.56	−2.83
Q5 − Q1							
Mean	0.56	0.52	0.37	0.34	0.19	−0.37	−2.45
t-value	5.40	4.52	3.06	2.90	1.46	−2.45	

Panel B: Three-factor model alphas

Operating	Market capitalization, ME					
profitability	Q1	Q2	Q3	Q4	Q5	Q5 − Q1
Q1	−0.40	−0.44	−0.29	−0.21	−0.26	0.14
Q2	−0.04	−0.03	−0.07	−0.10	−0.18	−0.14
Q3	0.08	0.07	0.01	−0.01	0.05	−0.03
Q4	0.08	0.02	0.08	0.11	0.06	−0.02
Q5	0.30	0.23	0.21	0.28	0.23	−0.08
Q5 − Q1	0.71	0.67	0.50	0.49	0.49	0.08

Panel C: Three-factor model α's t-values

Operating	Market capitalization, ME					
profitability	Q1	Q2	Q3	Q4	Q5	Q5 − Q1
Q1	−4.13	−5.26	−3.15	−2.26	−2.68	1.07
Q2	−0.58	−0.47	−0.83	−1.36	−2.47	−1.56
Q3	1.27	1.16	0.08	−0.15	0.84	−0.28
Q4	1.20	0.28	1.02	1.37	0.95	−0.26
Q5	4.07	3.15	2.81	3.85	4.50	−0.90
Q5 − Q1	6.99	5.93	4.15	4.48	4.04	−1.48

Table A1: Interactions in portfolio sorts

This table reports monthly three-factor model alphas and the associated t-values for portfolios sorted by gross profit deflated by the market value of equity and then conditionally sorted by the ratio of the market value of equity to the book value of total assets. We sort stocks at the end of each June and hold the portfolios for the following year. The sample starts in July 1963 and ends in December 2013.

GP/ME		ME/AT quintile						Average
decile	All	1	2	3	4	5	$5-1$	1,...,5
All		−0.157	0.021	−0.020	0.040	0.141	0.298	
		(−2.14)	(0.33)	(−0.33)	(0.71)	(3.46)	(3.41)	
1	0.085	−0.318	−0.044	−0.261	−0.089	0.271	0.589	−0.088
	(1.29)	(−2.44)	(−0.37)	(−2.20)	(−0.73)	(2.77)	(3.45)	(−1.36)
2	−0.064	−0.235	−0.362	−0.031	−0.156	0.147	0.382	−0.127
	(−1.03)	(−1.89)	(−3.20)	(−0.24)	(−1.36)	(1.39)	(2.38)	(−2.00)
3	0.016	−0.088	−0.085	0.044	−0.034	0.121	0.209	−0.009
	(0.29)	(−0.75)	(−0.73)	(0.37)	(−0.31)	(1.22)	(1.37)	(−0.15)
4	0.035	0.072	−0.073	−0.008	−0.024	0.224	0.151	0.038
	(0.56)	(0.64)	(−0.60)	(−0.06)	(−0.20)	(2.08)	(1.00)	(0.64)
5	0.152	−0.070	0.038	0.042	0.177	0.379	0.449	0.113
	(2.37)	(−0.60)	(0.32)	(0.35)	(1.36)	(3.49)	(2.91)	(1.88)
6	0.110	0.086	0.007	0.100	0.231	0.136	0.049	0.112
	(1.52)	(0.69)	(0.06)	(0.84)	(1.83)	(1.15)	(0.30)	(1.70)
7	0.175	0.031	0.060	0.161	0.231	0.218	0.187	0.140
	(2.32)	(0.22)	(0.46)	(1.31)	(1.66)	(1.77)	(0.99)	(1.98)
8	0.067	−0.212	0.098	0.004	0.194	0.280	0.492	0.073
	(0.78)	(−1.38)	(0.73)	(0.03)	(1.49)	(2.34)	(2.69)	(0.93)
9	−0.035	−0.391	−0.065	−0.004	0.125	0.177	0.568	−0.032
	(−0.39)	(−2.12)	(−0.44)	(−0.02)	(0.91)	(1.49)	(2.71)	(−0.37)
10	−0.041	0.193	0.576	0.437	0.464	0.257	0.064	0.385
	(−0.36)	(0.89)	(3.20)	(2.30)	(3.03)	(1.82)	(0.27)	(3.48)
$10-1$	−0.126	0.510	0.620	0.698	0.552	−0.014	−0.525	0.473
	(−0.93)	(1.99)	(2.77)	(3.03)	(2.78)	(−0.08)	(−1.79)	(3.54)
Average		−0.093	0.015	0.048	0.112	0.221	0.314	
1,...,10		(−1.50)	(0.27)	(0.81)	(2.03)	(3.68)	(3.84)	

Table A2: Comparison of deflators for operating profit

This table presents average Fama and MacBeth (1973) regression slopes and their t-values from cross-sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1963 through December 2013 separately for both All-but-microcaps and Microcaps. We deflate operating profit by the book value of total assets, the book value of equity, or the market value of equity. We trim all independent variables to the 1st and 99th percentiles. Microcaps are stocks with a market value of equity below the 20th percentile of the NYSE market capitalization distribution.

	All-but-microcaps			Microcaps		
	Operating profit deflated by:			Operating profit deflated by:		
Explanatory variable	Total assets	Book equity	Market equity	Total assets	Book equity	Market equity
Operating profit	3.212	0.952	1.472	2.646	0.808	0.641
	(9.64)	(7.18)	(6.97)	(8.13)	(5.91)	(3.53)
log(BE/ME)	0.459	0.380	0.121	0.560	0.567	0.482
	(5.83)	(4.74)	(1.66)	(8.18)	(8.22)	(7.81)
log(ME)	−0.086	−0.085	−0.075	−0.255	−0.224	−0.202
	(−2.21)	(−2.20)	(−1.93)	(−4.13)	(−3.57)	(−3.20)
$r_{1,1}$	−3.180	−3.246	−3.234	−5.986	−5.934	−5.899
	(−7.30)	(−7.45)	(−7.39)	(−13.63)	(−13.53)	(−13.39)
$r_{12,2}$	1.098	1.053	1.054	1.106	1.123	1.159
	(5.96)	(5.80)	(5.83)	(5.94)	(6.03)	(6.21)
Adjusted R^2	5.76%	5.65%	5.59%	3.16%	3.09%	3.04%

Table A3: Operating profit and interactions in Fama-MacBeth regressions

This table presents average Fama and MacBeth (1973) regression slopes and their t-values from cross-sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1963 through December 2013. Panel A presents results for All-but-microcaps and Panel B presents results for Microcaps. Microcaps are stocks with a market value of equity below the 20th percentile of the NYSE market capitalization distribution. We trim all independent variables to the 1st and 99th percentiles.

Panel A: All-but-microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)
OP/ME	1.091	0.706			0.100
	(6.23)	(3.78)			(1.89)
ME/AT	−0.013	−0.023			
	(−0.73)	(−1.29)			
OP/BE			0.300	0.149	0.495
			(5.60)	(2.81)	(2.50)
BE/AT			0.276	−0.261	
			(1.59)	(−1.45)	
OP/AT		2.196		2.564	2.339
= (OP/ME) × (ME/AT)		(7.25)		(8.36)	(7.94)
= (OP/BE) × (BE/AT)					
log(BE/ME)	0.120	0.260	0.323	0.410	0.354
	(1.81)	(3.83)	(4.71)	(5.75)	(4.72)
log(ME)	−0.065	−0.084	−0.063	−0.089	−0.080
	(−1.75)	(−2.25)	(−1.70)	(−2.43)	(−2.15)
$r_{1,1}$	−2.603	−2.575	−2.620	−2.603	−2.556
	(−6.19)	(−6.18)	(−6.27)	(−6.29)	(−6.11)
$r_{12,2}$	0.871	0.928	0.868	0.917	0.927
	(5.82)	(6.17)	(5.92)	(6.27)	(6.26)
Adjusted R^2	5.77%	6.13%	5.78%	6.09%	5.99%

Panel B: Microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)
OP/ME	−0.074	−0.163			0.152
	(−0.58)	(−1.20)			(2.30)
ME/AT	0.074	0.081			
	(2.53)	(2.73)			
OP/BE			0.074	0.182	−0.293
			(1.56)	(2.72)	(−2.04)
BE/AT			0.656	0.724	
			(3.95)	(4.22)	
OP/AT		1.298		0.585	1.164
= (OP/ME) × (ME/AT)		(4.06)		(1.75)	(3.74)
= (OP/BE) × (BE/AT)					
log(BE/ME)	0.494	0.501	0.451	0.412	0.482
	(8.04)	(7.95)	(7.41)	(6.77)	(7.98)
log(ME)	−0.407	−0.454	−0.422	−0.462	−0.449
	(−6.05)	(−7.18)	(−6.23)	(−7.26)	(−7.13)
$r_{1,1}$	−5.783	−5.856	−5.840	−5.913	−5.830
	(−15.14)	(−15.43)	(−15.33)	(−15.60)	(−15.38)
$r_{12,2}$	0.760	0.727	0.753	0.716	0.747
	(5.04)	(4.90)	(5.15)	(4.98)	(5.07)
Adjusted R^2	3.14%	3.37%	3.00%	3.22%	3.37%

Table A4: Operating profit and interactions in portfolio sorts

This table reports three-factor model alphas for portfolios sorted by operating profit deflated by the market value of equity and then conditionally sorted by the ratio of the market value of equity to the book value of assets. We sort stocks at the end of each June and hold the portfolio for the following year. The sample starts in July 1963 and ends in December 2013.

OP/ME		ME/AT quintile						Average
decile	All	1	2	3	4	5	5 − 1	1,...,5
All		−0.157	0.021	−0.020	0.040	0.141	0.298	
		(−2.14)	(0.33)	(−0.33)	(0.71)	(3.46)	(3.41)	
1	0.033	−0.529	−0.504	−0.201	−0.198	0.235	0.764	−0.240
	(0.45)	(−2.76)	(−3.55)	(−1.60)	(−1.73)	(2.34)	(3.51)	(−3.10)
2	0.092	−0.308	−0.027	−0.033	0.031	0.278	0.585	−0.012
	(1.39)	(−2.65)	(−0.23)	(−0.29)	(0.30)	(2.56)	(3.56)	(−0.19)
3	−0.015	−0.428	−0.089	−0.043	−0.016	0.215	0.643	−0.072
	(−0.24)	(−3.42)	(−0.75)	(−0.38)	(−0.17)	(1.95)	(3.91)	(−1.19)
4	0.038	−0.312	−0.059	−0.031	0.186	0.120	0.431	−0.019
	(0.56)	(−2.57)	(−0.46)	(−0.26)	(1.69)	(1.02)	(2.55)	(−0.31)
5	−0.002	−0.116	0.063	−0.130	0.052	−0.066	0.049	−0.040
	(−0.03)	(−0.97)	(0.53)	(−1.21)	(0.47)	(−0.48)	(0.28)	(−0.59)
6	0.031	−0.295	−0.227	−0.047	0.214	0.155	0.449	−0.040
	(0.39)	(−2.46)	(−1.90)	(−0.38)	(1.72)	(1.16)	(2.61)	(−0.56)
7	0.042	−0.217	−0.028	0.145	−0.047	0.288	0.505	0.028
	(0.55)	(−1.91)	(−0.23)	(1.20)	(−0.40)	(2.19)	(2.98)	(0.41)
8	0.049	0.046	−0.090	−0.134	−0.044	0.486	0.440	0.053
	(0.66)	(0.39)	(−0.79)	(−1.15)	(−0.33)	(3.72)	(2.45)	(0.80)
9	0.220	0.076	−0.005	0.055	0.222	0.460	0.384	0.162
	(2.71)	(0.55)	(−0.04)	(0.44)	(1.61)	(3.48)	(2.10)	(2.12)
10	−0.030	0.319	0.275	0.193	0.550	0.741	0.422	0.415
	(−0.26)	(1.52)	(1.51)	(1.14)	(3.17)	(5.21)	(1.73)	(4.06)
10 − 1	−0.063	0.848	0.779	0.394	0.748	0.506	−0.342	0.655
	(−0.45)	(3.15)	(3.35)	(1.82)	(3.74)	(2.87)	(−1.07)	(5.17)
Average		−0.176	−0.069	−0.023	0.095	0.291	0.467	
1,...,10		(−3.02)	(−1.25)	(−0.43)	(1.74)	(5.52)	(6.01)	