Accruals, cash flows, and operating profitability in the cross section of stock returns*

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Abstract

Accruals are the non-cash component of earnings. They represent adjustments made to cash flows to generate a profit measure largely unaffected by the timing of receipts and payments of cash. Prior research finds that expected returns increase in firm profitability. However, firms with high accruals generate lower returns than firms with low accruals, and this "accrual anomaly" strengthens when evaluated using asset pricing models that include a profitability factor. We show that a cash-based operating profitability measure (that excludes accruals) outperforms other measures of profitability (that include accruals) and subsumes accruals in predicting the cross section of average returns. Surprisingly, an investor can increase a strategy's Sharpe ratio more by adding just a cash-based operating profitability factor to his investment opportunity set than by adding both an accruals factor and a profitability factor that includes accruals.

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1 Introduction

Expected returns increase in profitability (e.g., Novy-Marx, 2013; Ball, Gerakos, Linnainmaa, and Nikolaev, 2014). Profitability, however, includes accruals, which are adjustments that accountants make to operating cash flows to measure earnings. Although accruals are added to cash flows to better measure current period firm performance (Dechow, 1994), Sloan (1996) documents a robust *negative* relation between accruals and the cross section of expected returns. This relation, known as the "accrual anomaly," is not explained by the Fama and French (1996) three-factor model, their recent five-factor model that includes a profitability factor (Fama and French, 2015), the Novy-Marx (2013) gross profitability factor, or the Hou, Xue, and Zhang (2015) q-factor model.[1]

In this paper, we show three primary results. First, cash-based operating profitability, a measure of profitability that is devoid of accounting accruals adjustments, outperforms other profitability measures including operating profitability, gross profitability, and net income. Second, cash-based operating profitability performs so well in explaining the cross section of expected returns that it subsumes the accrual anomaly (Sloan, 1996). In fact, investors would be better off by just adding cash-based operating profitability to their investment opportunity set than by adding both accruals and profitability strategies. Third, cash-based operating profitability explains expected returns as far as ten years ahead, suggesting that the anomaly is not due to initial mispricing of earnings or its two components: cash flows and accruals. Taken together, our results provide a simple and compelling explanation for the accruals anomaly. Firms with high accruals today earn lower future returns because they are less profitable on a cash basis.

Among profitability measures, Ball et al. (2014) find that operating profitability better explains the cross section of expected returns than other commonly used measures, such as gross profitability (Novy-Marx, 2013) or "bottom line" net income (Ball and Brown, 1968). When we regress returns on operating profitability and accruals, we find that the signs of the coefficients on these two

[1]There is a substantial literature on the accrual anomaly that includes Fama and French (2006), Hirshleifer, Hou, and Teoh (2009), Polk and Sapienza (2009), Hirshleifer and Jiang (2010), Li and Zhang (2010), Hirshleifer, Teoh, and Yu (2011), Lewellen (2011), Stambaugh, Yu, and Yuan (2012), Avramov, Chordia, Jostova, and Philipov (2013), Novy-Marx (2013), Hou et al. (2015), and Fama and French (2015).

measures differ, but the economic magnitudes are similar. These estimates suggest that a positive "shock" to operating profitability, holding everything else constant, predicts a higher average stock return for the shocked firms. However, if we fully attribute the effect of this shock to accruals—that is, these firms are more profitable only because of an increase in the non-cash portion of earnings—the offsetting slopes on operating profitability and accruals indicate that the firms' average returns would remain unchanged. In other words, the evidence implies that profitable firms earn higher average returns, but that this relation is driven by the cash portion of profitability. Any increase in profitability solely due to accruals has no relation with the cross section of expected returns. This result suggests that the difference between operating profitability and accruals (i.e., the cash component of profitability) drives the predictive power over the cross section of returns.[2]

Once we purge accruals from operating profitability, we generate a significantly stronger predictor of future stock performance and the accrual anomaly effectively disappears once we control for cash-based operating profitability. While accruals have significant incremental predictive ability relative to operating profitability, we find that accruals have no incremental power in predicting returns within portfolios sorted by cash-based operating profitability. Furthermore, a cash-based operating profitability factor prices both operating profitability and accruals in the cross section.

The economic significance of these results can be demonstrated by comparing the maximum Sharpe ratios of the portfolios generated using the traditional four factors (market, size, value, and momentum) and factors based on accruals, operating profitability, and cash-based operating profitability. Overall, combining the cash-based operating profitability factor with the traditional four factors leads to the highest Sharpe ratio. The maximum Sharpe ratio generated using the four traditional factors and just the cash-based operating profitability factor is much higher than the maximum Sharpe ratio generated using the base factors and the combination of both the accruals and operating profitability factors. This result is unusual. It implies that the cash-based operating

[2] This empirical motivation for investigating the predictive power of cash-based operating profitability is similar to Fama and French's (1992) motivation for the book-to-market ratio. Fama and French (1992) estimate cross sectional return regressions and find that the estimated slopes on two leverage measures, ln(A/ME) ("market leverage") and ln(A/BE) ("book leverage"), have opposite signs but are close to each other in magnitude. These estimates lead Fama and French (1992) to use the log book-to-market ratio—the difference between the two leverage measures—as the single regressor.

profitability factor contains more information than the combination of the accruals and operating profitability factors.

Sloan (1996) shows that the accrual component of earnings is less persistent than the cash flow component. He posits that the accrual anomaly arises because investors do not understand that accruals are less persistent than cash flows, which leads to mispricing. The idea is that if investors think that accruals and cash flows are equally persistent, then they are predictably negatively surprised when accruals do not persist, and this explains the negative relation between average returns and accruals. However, when we control for cash-based operating profitability, accruals do not explain average returns. This result is inconsistent with investors not understanding the relative persistence of accruals. If investors do not understand the persistence of accruals, then accruals would predict future surprises even when we control for cash-based operating profitability.

It could, however, be the case that the positive association between cash-based operating profitability and the cross section of average returns represents an over-reaction. Any such over-reaction to cash flows that contributes to the superiority of cash-based profitability would likely reverse within a relatively short horizon. In contrast, we find that cash-based operating profitability outperforms operating profitability (that includes accrual components) up to ten years into the future.[3] Moreover, when we examine the relation between current cash-based operating profitability and past returns, we find no evidence that our results represent reversals driven by previous underreactions to cash-based operating profitability.

This study also relates to prior research that examines the relation between cash flows and the cross section of expected returns. Foerster, Tsagarelis, and Wang (2015) examine the ability of cash flows to explain average returns relative to earnings-based profitability measures. In contrast with our study, they focus on measures of free cash flow as opposed to cash-based operating profitability and do not examine the relation between cash flows and the accrual anomaly. Desai, Rajgopal, and Venkatachalam (2004) examine whether the accruals anomaly is a manifestation of the value premium. They find that the ratio of the total cash flow from operations to price, which is proxy

[3] For an illustration of how past profitability can be informative about future returns in a rational framework, see Section 7 of Ball et al. (2014).

for the value premium, has explanatory power for the accrual anomaly. Cheng and Thomas (2006) find that abnormal accruals have incremental explanatory power controlling for operating cash flows-to-price and conclude that accruals are not part of the value premium. In contrast with these studies, we find that accruals have no incremental explanatory power when controlling for a measure of cash-based operating profitability. Moreover, our empirical tests control for the book-to-market ratio. Hence, cash-based operating profitability's relation with the cross section of expected returns is distinct from the value premium.

Our results do not imply that accruals add noise to earnings or are otherwise detrimental to evaluating firm performance. From a contracting viewpoint, accruals likely lead to a superior performance measure that reduces the ability of a manager to manipulate reported performance via the timing of cash receipts and payments. While accrual-based earnings measures aim at better capturing current period performance (Dechow, 1994), cash-based operating profitability could be more informative about future stock returns.

2 What are accruals?

The role of accounting accruals is to facilitate the periodic measurement of firm performance (Dechow, 1994). To this end, accountants calculate firm revenue as the value of goods and services delivered to customers during the period based on the expected cash receipts for such deliveries. Revenue earned during a period generally differs from cash received during the same period due to differences in the timing of cash receipts, some of which can occur in future or prior periods. Accountants adjust current period cash receipts for these timing differences by recording revenue accruals. Accountants calculate expenses as the cost of resources consumed in producing the delivered goods and services based on the expected value of cash payments for the resources used. Expense recognitions are thus also separated from the timing of payments, so accountants adjust cash payments for the timing differences; these adjustments are expense accruals. Accounting earnings are then defined as revenues minus expenses. They represent the accounting estimate of the value added by the firm in products and services delivered to customers during the period.

Timing differences between cash flows and earnings arise from two primary sources. The first source is shocks to the timing of cash inflows and outflows ("payment shocks"). For example, for firms selling on credit, there is variability in the timing of cash receipts from customers' payments. This is a source of variance in (e.g., during each fiscal year) cash flows, but accrual accounting attempts to purge this variance from earnings by booking revenue based on expected cash receipts from delivered goods and services.[4]

The second primary source of timing differences is net investment in working capital due to growth, both positive and negative.[5] Growth typically alters the optimal level of working capital, such as inventory and accounts receivable, which, other things equal, affects current-period cash flows. Firms' working capital investments, such as increases in inventory, are made on the basis of expected future levels of business, and their effects on cash flows are not caused by delivering goods and services to customers during the current period, so accountants do not allow them to affect current-period expenses and revenues. Therefore, unlike accruals and operating profitability, cash-based operating profitability contains information about profitability, payment shocks, and growth along with the accounting relations among these primitives.

3 Data

To construct our sample, we follow Novy-Marx (2013) and Ball et al. (2014). We take monthly stock returns from the Center for Research in Security Prices (CRSP) and annual accounting data from Compustat. We start our sample with all firms traded on NYSE, Amex, and NASDAQ, and exclude securities other than ordinary common shares. Delisting returns are taken from CRSP; if a delisting return is missing and the delisting is performance-related, we impute a return of -30%

[4]Payment shocks can arise from both optimal and manipulative cash flow management. As an example of optimal cash management, a manager can delay payment to suppliers who provide their customers payment terms. Other things equal, such a delay increases current-period cash flows but reduces future cash flows. As an example of manipulative cash flow management, a manager evaluated on the basis of cash flow could increase the period's reported performance by delaying payments to suppliers to subsequent financial reporting periods, even if that is sub-optimal (e.g., involves losing discounts for prompt payment).

[5]Working capital is the difference between current assets and current liabilities defined as those with a cash-to-cash cycle of less than 12 months. Changes in current assets and liabilities generate accounting accruals.

(Shumway, 1997; Shumway and Warther, 1999; Beaver, McNichols, and Price, 2007). We match the firms on CRSP against Compustat, and lag annual accounting information by the standard six months. For example, 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 with 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 exclude financial firms, which are defined as firms with one-digit standard industrial classification codes of six.

We calculate operating profitability by following the computations in Ball et al. (2014): sales minus cost of goods sold minus sales, general, and administrative expenses. This measure captures the performance of the firm's operations and is not affected by non-operating items, such as leverage and taxes. To evaluate the ability of the cash portion of operating profitability to predict returns, we remove the accrual components included in the computation of operating profitability to create the cash-based operating profitability measure. These components are the changes in accounts receivable, inventory, pre-paid expenses, deferred revenue, accounts payable, and accrued expenses. This measure differs from other commonly used measures of cash flows. For example, a common measure of cash flows used in the asset pricing literature is earnings before extraordinary items but after interest, depreciation, taxes, and preferred dividends plus depreciation (e.g., Fama and French, 1996). In contrast with cash-based operating profitability, this earnings-based measure includes accruals. Another common measure is cash flow from operations calculated as per U.S. Generally Accepted Accounting Principles, which differs from cash-based operating profitability in that it is net of interest and taxes. Moreover, in contrast with cash-based operating profitability, cash flow from operations is net of interest and is therefore a levered measure of cash flows.

We initially follow Sloan (1996) and compute our accruals measure using balance sheet items on Compustat (e.g., changes in accounts receivable, accounts payable, deferred revenue, and inventory). We use balance sheet accruals to create the cash-based operating profitability and accruals measures, because cash flow statement accruals are available only starting in 1988. Hribar and

Collins (2002) show that balance sheet accruals can be affected by large corporate investment and financing decisions such as equity offerings and mergers and acquisitions. In what follows, we also construct accruals and cash-based operating profitability measures using information from cash flow statements for the post-1988 sample. We provide detailed descriptions and formulas for operating profitability, cash-based operating profitability, and accruals in the Appendix.

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.[6] 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 (2008), 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.

Panel A of Table 1 reports summary descriptive statistics for the accounting and control variables. We calculate the descriptive statistics as the time series averages of the percentiles. The deflated variables exhibit outliers, pointing to the need either to trim these variables in cross sectional regressions or to base inferences on portfolio sorts. At the mean, annual operating profitability is approximately 13% of total assets and accruals are −2.8% of total assets, with depreciation and amortization contributing to the negative sign. At the mean, annual cash-based operating profitability is 11.7% of total assets.

Panel B presents the Pearson and Spearman correlations between operating profitability, accruals, and cash-based operating profitability. Several patterns emerge. First, the operating prof-

[6]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.

itability measures are highly correlated (Pearson, 0.844; Spearman, 0.804). Second, accruals and operating profitability are positively correlated (Pearson, 0.165; Spearman, 0.132). Third, when we removed accruals from operating profitability, accruals and cash-based operating profitability are negatively correlated (Pearson, −0.253; Spearman, −0.280). This negative correlation implies that firms that are profitable because of high accruals generate low cash flows and, conversely, firms that generate high cash flows record low or negative accruals. In what follows, we explore this relation between accruals and cash-based operating profitabilty in Fama and MacBeth (1973) regressions and portfolio sorts.

4 The cross section of returns

4.1 Fama and MacBeth regressions

Table 2 presents average Fama and MacBeth (1973) estimates (multiplied by 100) and their t-values for cash-based profitability, operating profitability, and accounting accruals, all of which are deflated by the year $t-1$ value of total assets. The definitions of these variables are provided in the Appendix. Following prior studies (e.g., 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 Ball et al. (2014) and trim all independent variables to the 1st and 99th percentiles. To ensure that regression coefficients from different model specifications are comparable across columns, we trim on a consistent table-by-table basis, with the exception of column (1), which is shown for comparison purposes. Hence, the different specifications shown in columns (2)–(7) of each panel are based on the same observations.

To compare the explanatory power of the profitability measures and accruals, 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.[7] The t-values associated with the Fama-MacBeth slopes are therefore proportional to the Sharpe ratios of these self-financing strategies. They equal annualized Sharpe ratios times $\sqrt{T}$, where T represents the number of years in the sample.

Panel A presents results for the All-but-microcaps sample. Column (1) replicates the results with respect to operating profitability presented in Table 6 of Ball et al. (2014). In this column, we trim the sample based on just operating profitability and the control variables. In the remaining columns, we require information on accruals and cash-based operating profitability and also trim based on these variables to keep the sample comparable across the columns. In column (1), the t-value associated with operating profitability is 8.97. When we restrict the sample to firms with non-missing values for accruals and cash-based operating profitability in column (2), the t-value associated with operating profitability decreases to 6.97.

In column (3), the t-value of associated with accruals is -4.4. This result replicates the long standing accrual anomaly documented by Sloan (1996)—that is, firms with high accruals on average earn low returns. When operating profitability and accruals are both included in the regression model, column (4) shows that operating profitability does not explain the accrual anomaly or vice versa. In fact, the t-values associated with both operating profitability and accruals increase in absolute value relative to their stand-alone equivalents in columns (2) and (3). This finding is consistent with the estimates in Fama and French (2015), which indicate that including a profitability factor into an asset pricing model worsens the model in terms of its ability to price accrual-sorted portfolios.

In column (5), we exclude accruals related to operating profitability and examine the predictive power of cash-based operating profitability. The t-value associated with this measure is 9.84. This estimate represents a significant improvement over operating profitability shown in column (2). If we view the Fama-MacBeth regression slopes as monthly returns on long-short strategies that trade on operating profitability and cash-based operating profitability, a comparison of the estimates

[7]See Chapter 9 of Fama (1976) for an analysis and description of these strategies; see Ball et al. (2014) for additional discussion.

in columns (2) and (5) suggests that the annualized Sharpe ratio of the profitability strategy increases by over 40% (t-value = 4.91) when we move from earnings-based profitability to cash-based profitability.[8] Ball et al. (2014) find that operating profitability has greater explanatory power than either gross profitability or net income. Hence, the significant increase from column (2) to column (4) implies that cash-based operating profitability dominates operating profitability, gross profitability, and net income.

When both cash-based operating profitability and accruals are simultaneously included in a regression (column (6)), cash-based operating profitability remains highly significant (t-value of 7.4) but subsumes the effect of accounting accruals, which becomes statistically indistinguishable from zero (t-value of 0.02). The fact that cash-based operating profitability subsumes accruals is inconsistent with Sloan's (1996) argument that investors do not understand that accruals are less persistent than cash flows and are therefore predictably surprised when accruals do not persist. If investors are unable to distinguish between differences in persistence for accruals and cash flows, then accruals would predict future surprises even when we control for cash-based operating profitability.

When we run a horse race between operating profitability and cash-based operating profitability (column (7)), operating profitability loses most of its predictive power and its t-value decreases to 1.19. The cash-based operating profitability wins this horse race with a t-value of 5.83.

Panel B of Table 2 reports the same regressions for the sample of Microcaps. These results mimic those reported for the All-but-microcaps sample. Both operating profitability and accruals are strong predictors of future returns. When operating profitability and accruals are used in separate regressions, their corresponding t-values are 5.24 (column (2)) and −6.41 (column (3)). When these variables are in the same regression, their t-values increase in absolute magnitude to 5.78 and −8.43 (column (4)). The cash-based profitability measure, however, continues to dominate with a t-value of 9.5 (column (5)). A comparison between columns (2) and (5) suggests

[8] We follow Ball et al. (2014) and test for the equality of Sharpe ratios using a bootstrap procedure. We resample the Fama and MacBeth (1973) regression slope estimates one thousand times, compute annualized Sharpe ratios for each sample, and then obtain the standard error from the resulting bootstrapped distribution of differences in Sharpe ratios.

that the annualized Sharpe ratio associated with a profitability strategy increases by 0.65 (t-value = 3.29) when we move to a cash-based measure. Similar to Panel A's sample, cash-based operating profitability subsumes the explanatory power of accruals (column (6)) and wins the horse race with operating profitability (column (7)).

In Figure 1, we plot ten year rolling averages of the t-values associated with the Fama-MacBeth slopes for operating profitability, accruals, cash-based operating profitability, and momentum presented in columns (2), (3), and (5) of Table 2 Panel A. The value on the x-axis indicates the end point of the ten year average. The first point, for example, is for June 1973 and it reports the rolling average of the t-values associated with operating profitability, accruals, cash-based operating profitability, and momentum from the Fama-MacBeth regressions using data from July 1963 through June 1973. We report the momentum slopes for reference because this anomaly is remarkably pervasive across markets, asset classes, and time periods (see, e.g., Asness, Moskowitz, and Pedersen, 2013).

Over the sample period, the t-values are positive for both operating profitability and cash-based operating profitability. Comparing the two, the t-values for cash-based operating profitability are, in general, larger in magnitude. For accruals, the rolling average is negative up to 2008. Starting around 2004, the t-values on all three strategies attenuate toward zero, indicating a structural shift beginning during the prior decade. Importantly, this shift is not specific to the earnings variable—the momentum slopes also turn statistically insignificant in the most recent decade. This result is also consistent with prior findings that almost *all* anomalies generated lower returns during this period (e.g., Green, Hand, and Soliman, 2011; Keloharju, Linnainmaa, and Nyberg, 2014).

Alternative specification. In constructing the accruals and cash-based operating profitability measures presented in Table 2, we use the balance sheet approach to calculate accruals. Hribar and Collins (2002) show that accruals taken from the balance sheet can be affected by corporate events such as mergers and acquisitions. For example, a large increase in inventory or accounts receivable could be due to a merger. In our analysis, we use balance sheet accruals because they cover the sample period starting in 1963, which is commonly used in prior asset pricing research.

An alternative approach that is not affected by such large corporate events is to calculate accruals using information from the cash flow statement. However, U.S. firms were only required to report cash flow statements starting in 1988, so accruals data are not available from that source prior to then.

To evaluate whether our results are affected by the use of balance sheet accruals, we replicate Panel A of Table 2 using cash flow statement accruals to generate our accruals and cash-based operating profitability measures.[9] The results for these regressions are presented in Table 3. We estimate two specifications. In the first, we use an accruals measure based on the cash flow statement. In the second specification, we use cash flow statement accruals to create both the accruals and the cash-based operating profitability measures. The results for both specifications mimic those presented in Panel A of Table 2. The t-values, however, attenuate due to the shorter sample period. Overall, cash-based operating profitability has the strongest predictive power relative to the measures of profitability considered in prior research. In addition, this proxy still subsumes the long standing accrual anomaly.

4.2 Portfolio sorts

Given the skewed distributions and extreme observations for the profit measures and accruals (see Table 1), we also perform portfolio tests, which provide a potentially more robust method to evaluate predictive ability without imposing the parametric assumptions embedded in the Fama and MacBeth (1973) regressions. Table 4 compares operating profitability, accruals, and cash-based operating profitability in quintile and decile portfolio sorts. For each sorting variable, the table reports portfolios' value-weighted average excess returns and three-factor model alphas. The loadings on the market (MKT), size (SMB), and value (HML) factors are omitted to preserve space. We no longer split the sample into All-but-microcaps and Microcaps because small stocks have only a negligible 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.

[9] We describe the construction of these measures in the Appendix.

An investor who considers trading a profitability or accruals 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 therefore reveal the extent to which the mean-variance efficiency of an investor's portfolio can be improved—its Sharpe ratio increased—by tilting the portfolio toward the profitability strategy.[10] Put differently, an unconstrained investor can always tilt a portfolio toward 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 or accruals.[11]

The results in the table indicate that all three variables—operating profitability, accruals, and cash-based profitability—significantly predict future returns in portfolio sorts. The high-minus-low quintile (decile) portfolio formed on the basis of operating profitability earns a three-factor model alpha of 56 (75) basis points per month and these alpha estimates are associated with a t-value of 5.81 (5.99). Accruals are slightly weaker in portfolio sorts. Specifically, the long-short quintile (decile) strategy formed on the basis of accruals earn an alpha of -29 (-43) basis points with a t-value of -3.0 (-3.25). Similar to the Fama-MacBeth horse races among the measures presented in Table 2, cash-based profitability continues to exhibit the strongest predictive power. The high-minus-low quintile (decile) strategy earns a three-factor model alpha of 72 (90) basis points per month with a t-value of 8.21 (8.5).

Table 5 examines the explanatory power of accruals that is incremental to the profitability measures by performing two-way sorts and then estimating three-factor model alphas. The initial sort is performed on either operating profitability (Panel A) or cash-based operating profitability (Panel B). The second sort is then a conditional sort on accruals: we sort stocks within each

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

[11]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.

operating profitability (or cash-based operating profitability) decile into quintiles based on accruals over total assets.

The results in Panel A show that accruals continue to predict future returns when holding operating profitability constant. In nine out of ten deciles, high-accruals firms earn lower three-factor model alphas than low-accruals firms, and these alphas are significant at the 5% level in four of these deciles. The last row ("Average 1,...,10") averages out operating profitability. For example, the number in the first column, 0.116, is the three-factor model alpha associated with a strategy that invests the same amount into each of the ten low-accruals portfolios shown in this same column. The high accruals-minus-low accruals strategy on this row, which is operating-profitability neutral, earns a three-factor model alpha of -31 basis points per month (t-value $= -3.62$). This estimate is close to that shown on the first line that performs a univariate sort based on accruals over assets. An unconditional high-minus-low accruals strategy earns an alpha of -29 basis points per month (t-value $= -3.0$). These results therefore suggest that operating profitability is powerless in explaining away the accrual anomaly.

Panel B shows that when the portfolios are formed based on cash-based profitability, the three-factor model alphas associated with the accrual portfolios are very different. First, only the high-minus-low accrual strategies associated with cash-based operating profitability decile three is statistically significant at the 5% level and, in this case, the three-factor model alpha is *positive*. Second, the last row shows that a sort on accruals does not predict average returns when holding cash-based operating profitability constant. The high-minus-low accruals strategy, which is now cash-based operating profitability neutral, has a three-factor model alpha of -4 basis points (t-value $= -0.42$).

The results in Table 5 closely mimic Table 2's Fama-MacBeth regression evidence: whereas operating profitability is, at best, unrelated to the accrual anomaly, a cash-based operating profitability strategy subsumes it. The practical implication of these results is that an investor who trades cash-based operating profitability would find it less useful to condition separately on both accruals and profitability.

5 Cash-based operating profitability factor

We next construct a factor that captures the relation between average returns and cash-based operating profitability. We augment the Fama and French (1993) three-factor model with this factor and then examine the augmented model's ability to price accruals in the cross section of stock returns. For comparison, we also construct a factor based on the operating profitability measure proposed in Ball et al. (2014).

We follow the six-portfolio methodology in Fama and French (2015) to construct the profitability factors; this is also the same methodology as that used in Fama and French (1993) to construct the HML factor. We first sort stocks by size into small and large sub-groups depending on whether a company is below or above the median NYSE market capitalization breakpoint. We then perform an independent sort based on operating profitability into "weak" (i.e., below the 30th NYSE percentile breakpoint) and "robust" (i.e., above the 70th NYSE percentile breakpoint). These sorts produce six value-weighted portfolios. The operating profitability factor, RMW_{OP}, is constructed by taking the average of the two robust profitability portfolios minus the average of the two weak profitability portfolios. The cash-based operating profitability factor, RMW_{CbOP}, is constructed in the same way, except that the second sort is on cash-based operating profitability. Following the methodology in Fama and French (2015), the SMB factors in the models augmented with the profitability factors are the averages of two possible SMB factors: one based on the six size-BE/ME portfolios and the other based on the size size-profitability portfolios.

The results of this analysis are presented in Table 6. Panel A presents average annualized returns in excess of one-month Treasury bill rates based on a two-way independent sort on size and accruals into 25 equal portfolios. Consistent with prior studies, average returns decrease in both size and accruals. Panel B presents three-factor model alphas and the corresponding t-values for the same 25 portfolios. The number of significant t-values in the high as well as the low accruals quintiles indicates that the three-factor model does not price accruals well.

Panel C shows that a four-factor model, constructed by augmenting the three-factor model with the operating profitability factor (RMW_{OP}), is also unable to price accruals. In fact, the more pronounced alphas for the high and, in particular, for the low accruals quintiles generally indicate that the model does worse when the operating profitability factor is included. This evidence is consistent with the findings of Fama and French (2015) and also lines up with our evidence in Table 2. Namely, the accrual anomaly strengthens when we condition on operating profitability.

Panel D replaces the operating profitability factor with the cash-based operating profitability factor, $\mathrm{RMW}_{\mathrm{CbOP}}$, and the performance of the model in pricing accruals improves considerably. In particular, the alphas and the associated t-values in the high and the low accruals quintiles become lower in magnitude and generally lose statistical significance. For example, none of the t-values within the five high accruals portfolios are statistically significant at conventional levels.

We next compare the performance of the three-factor model with the models augmented with the profitability factors. In Panel E, we use five test statistics to the compare the models: GRS is the Gibbons, Ross, and Shanken (1989) test statistic; $\mathrm{A}|\hat{\alpha}|$ is the average regression intercept; $^{\mathrm{A}(|a_i|)}/_{\mathrm{A}(|\bar{r}_i|)}$ is Fama and French's (2014b) measure that captures the dispersion of alphas left unexplained by the model; $^{\mathrm{A}(\hat{\alpha}^2)}/_{\mathrm{A}(\hat{\mu}^2)}$ is Fama and French's (2014b) measure of the proportion of the cross sectional variance of expected returns left unexplained by the model; $A(R^2)$ is the average of the regression R^2s.

Compared to the three-factor model, the model augmented with the operating profitability factor, $\mathrm{RMW}_{\mathrm{OP}}$, does worse for four out of the five statistics: the Gibbons et al. (1989) test statistic is larger (4.06 versus 3.59); the average regression intercept, $\mathrm{A}|\hat{\alpha}|$, is higher (0.156 versus 0.115); the proportion of the dispersion of expected returns left unexplained by the model, $^{\mathrm{A}(|a_i|)}/_{\mathrm{A}(|\bar{r}_i|)}$, is higher (96% versus 71%); and the proportion of cross sectional variance of expected returns left unexplained by the model, $^{\mathrm{A}(\hat{\alpha})}/_{\mathrm{A}(\hat{\mu})}$, is higher (91% versus 46%). With respect to $A(R^2)$, the two models perform equally (90%). These results are similar to those presented in Fama and French (2015).

When we next evaluate the model augmented with the cash-based operating profitability factor, $\mathrm{RMW}_{\mathrm{CbOP}}$, we find that this version outperforms both the model with operating profitability factor in four dimensions: GRS; $\mathrm{A}|\hat{\alpha}|$l; $\mathrm{A}|\hat{\alpha}|$; $^{\mathrm{A}(\hat{\alpha}^2)}/_{\mathrm{A}(\hat{\mu}^2)}$. Importantly, this model also outperforms the three-factor model based on the GRS test and its performance in terms of the other statistics is comparable to that of the three-factor model. With respect to $A(R^2)$, all three models perform equally (90%).

The results in Table 6 indicate that an asset pricing model with a cash-based operating profitability factor describes expected returns of portfolios formed based on independent sorts of stocks on size and accruals well. While this model is still rejected by the Gibbons et al. (1989) test, it is useful to put this estimate into perspective by considering how well the standard three-factor model prices the (equally standard) 25 value-weighted portfolios formed from independent sorts of stocks on size and book-to-market. Over the same 1963 through 2013 sample period, the GRS test rejects the three-factor model with a test statistic of 3.52. If the three-factor model is viewed as the benchmark for capturing the key variation in expected returns present in portfolios sorted on size and book-to-market, then the model augmented with the cash-based operating profitability factor, RMW_{CbOP}, captures, for all practical purposes, the variation present in portfolios sorted on size and accruals.

6 Investment opportunity sets and ex post maximum Sharpe ratios

We can compute Sharpe ratios associated with different sets of factors to measure the economic significance of our results from an investor's viewpoint. In this section, we construct ex post tangency portfolios from the traditional four factors (market, size, value, and momentum) and factors based on accruals, operating profitability, and cash-based operating profitability. Differences in Sharpe ratios measure how much investors could improve the mean-variance efficiency of their portfolios by augmenting the investment opportunity set with accruals, operating profitability, and cash-based operating profitability.

For operating profitability and cash-based operating profitability, the factors are the same as those used previously, RMW_{OP} and RMW_{CbOP}. We use the same factor construction methodology to create the accruals factor. That is, we form the six value-weighted portfolios through independent sorts on size and accruals and then take the difference between the average returns on the low and high accruals portfolios. Following the methodology in Fama and French (2015), the SMB factor in the model with the four traditional factors and the accruals factor is the average of the two possible SMB factors: one based on the six size-BE/ME portfolios and the other based on the six size-accruals portfolios. Similarly, the SMB factors in the models augmented with the profitability factors are the averages of the two possible SMB factors: one based on the six size-BE/ME portfolios and the other based on the size size-profitability portfolios. In the model with both profitability and accruals factors, the SMB factor is from the model without the accruals factor.

The results for this analysis are presented in Table 7. Panel A presents the average annualized returns, standard deviations, and t-values for the four traditional factors and the three earnings related factors. Among the earnings related factors, accruals has the lowest average annualized return (2.9%) and the lowest t-value (3.65). The average annualized returns and t-values are higher for the profitability factor. However, the cash-based operating profitability factor does significantly better than the operating profitability factor with respect to the average annualized return (4.82% versus 3.53%) and the t-value (6.3 versus 3.97).

Panel B presents the tangency portfolio weights along with Sharpe ratios. The (annualized) Sharpe ratio on the market portfolio over our sample period is 0.39, and it increases to 1.07 when we construct the (ex post) mean-variance efficient portfolio using also the size, value, and momentum factors. An investor who trades the market along with these three factors would benefit by adding the accruals factor to the investment opportunity set. By doing so, the ex post maximum Sharpe ratio increases to 1.13. Both operating profitability and cash-based operating profitability are, however, far more valuable to the investor than the accruals factor. Adding the operating profitability factor instead of the accruals factor increases the Sharpe ratio to 1.4, and adding the cash-based operating profitability factor increases it to 1.7.

Moreover, the results show that the cash-based operating profitability (but not the operating profitability) factor subsumes accruals. An investor who is already trading the cash-based operating profitability strategy would benefit little from adding the accruals factor to the investment opportunity set—the ex post maximum Sharpe ratio increases from 1.7 to 1.72. In contrast, for an investor trading the operating profitability factor, adding the accruals factor would be approximately as valuable—as indicated by the increase in the Sharpe ratio—as it would be when not trading the profitability factor at all.

If an investor trades the base factors along with the operating profitability and accruals factors, the ex post maximum Sharpe ratio that the investor could achieve is lower than if the investor traded the base assets along with the cash-based operating profitability factor, 1.7 versus 1.58. An investor would therefore do better by adding cash-based operating profitability to the investment opportunity set than by separately adding *both* accruals and operating profitability. This result is unusual. By solving for the *ex post* optimal combination of strategies, one would expect to achieve a higher Sharpe ratio than that for cash-based operating profitability by combining accruals and operating profitability. That is, one would expect (at the very least) to recover something very similar to cash-based operating profitability from the two components (operating profitability and accruals) that went into its construction. Instead, by collapsing accruals and operating profitability into six portfolios, an investor loses valuable information about future returns, which cannot be recovered by trading both factors at the same time. This result implies that the construction of the cash-based operating profitability factors generates a more power signal, which results in a higher Sharpe ratio.

To further demonstrate the economic significance of the results, in Figure 2 we plot the cumulative returns on the operating profitability, accruals, and cash-based operating profitability strategies for one dollar invested in each of the strategies at the end of June 1963. For comparison, we also plot the cumulative returns on a dollar invested in the CRSP value-weighted market index minus the one-month T-bill return. For the operating profitability, accruals, and cash-based operating profitability strategies, we calculate the cumulative returns by saving the alphas and residuals from Table 4's regressions for the high-minus-low decile strategies and then compounding these estimates over the sample period. The values of the four strategies as of December 2013 are \$71.5 (operating profitability), \$9.8 (accruals), \$191.9 (cash-based operating profitability), and \$11.0 (market).

7 Increasing the predictive horizon

7.1 Fama-MacBeth regressions using lagged profitability and accruals

We next examine how far out accruals and cash-based operating profitability predict returns and compare their predictive ability with operating profitability. The first three panels in Figure 3 plot average Fama and MacBeth (1973) regression slopes on the earnings-related variables and their corresponding 95% confidence intervals from cross-sectional regressions of monthly returns on the control variables and lagged values of the three earnings-related variables. The lags increase in increments of six months up to ten years. The control variables are: prior one-month return, prior one-year return skipping a month, log-book-to-market, and log-size. The regressions are estimated for each month from July 1973 through December 2013 using data for All-but-microcaps. This restriction ensures that the same left-hand side data are used for all lags.

Panels A and B of Figure 3 show that operating profitability and cash-based operating profitability predict returns persistently over at least a ten-year horizon. The earnings-related variables become stale as the return horizon increases, but they continue to have predictive ability that is incremental to the updated control variables. While the predictive ability decays over time, it remains reliably positive. The persistent predictive power is consistent with the operating profitability variables and expected returns sharing common economic determinants such as risk. This persistence does not appear consistent with mispricing of earnings or its cash and accruals components when announced, because limits to arbitrage and other trading frictions are unlikely to persist for so long, whereas the determinants of expected returns are likely to be more stationary.

Panel C of Figure 3 shows that accruals predict returns only one year ahead, and even then the statistical significance is marginal. After a one-year lag, the upper confidence bounds mostly exceed zero. However, the point estimates of the slopes are positive after seven years, suggesting weak predictive power in contrast with cash-based operating profitability and operating profitability.

To compare the explanatory power of the earnings-related variables presented in Panels A, B, and C, we plot the t-values for their slope coefficients in Panel D. Consistent with the regressions presented in Table 2, the t-values for cash-based operating profitability are, in general, higher than those for either operating profitability or accruals.[12] In Panel E, we next plot the mean and 95% confidence interval for the differences in Sharpe ratios between cash-based operating profitability and operating profitability at the various horizons. Consistent with Panel D, the mean difference in Sharpe ratios decreases over time, but stays positive out to seven years. The 95% confidence interval is above zero out to four years, implying that an investor would do significantly better with cash-based operating profitability than operating profitability over at least a four-year horizon.

7.2 Estimates of long-term return effects

What is the total long-term effect of differences in cash-based operating profitability on stock returns? To demonstrate the long-term effect, Figure 4 plots cumulative average Fama and MacBeth (1973) regression slopes from Panel B of Figure 3. In the regressions, we increase the lagged values of cash-based operating profitability in monthly increments up to ten years. We estimate the regressions each month from July 1973 through December 2013 using data for All-but-microcaps so that the same data are used for all lags. We then take cumulative sums of the slopes each month and base the confidence intervals on the time-series variation in these sums.

Figure 4 is interpreted as follows. At $x = 0$, the curve has the value of 0.028.[13] At this lag, we do not measure any long-term effects—this estimate is the same as the slope on cash-based operating profitability reported in column (5) of Panel A of Table 2, except that the sample period here starts in 1973. At $x = 1/12$ month, the curve has the value of 0.054. This value represents the sum of the slopes from the same-month regression (0.028) and another regression that lags cash-based

[12]For expository purposes, we multiple the t-values for accruals by negative one.

[13]The y-axis in Figure 4 differs from the y-axis in Figure 3. In Figure 4, we do not multiply the Fama-MacBeth regression slopes by 100 so that the y-axis value of 1.0 represents a one-to-one correspondence between the difference in cash-based operating profitability and cumulative stock returns.

operating profitability by one month (0.026); the next point at $x = 2/12$ adds the coefficient from yet another regression that now lags the cash-based operating profitability by two months; and so forth. As we increase the lag, we sum over all monthly regressions up to that point. The curve in Figure 4 is equivalent to the area under the curve in Panel B of Figure 3.

These cumulative regression slopes have two interpretations. First, mirroring the usual interpretation of the Fama-MacBeth regression coefficients as returns on particular long-short strategies, these sums of regression slopes measure the *cumulative* returns on the same long-short strategies. Because we lag cash-based operating profitability, but update the values of all other regressors, Figure 4 describes cumulative returns on the same long-short strategy up to ten years, except that the weights are shifted to keep the cash-based operating profitability strategy orthogonal to the updated values of the control variables.[14]

The second interpretation is the one that applies to all multivariate regressions. The cumulative slope measures the long-term marginal effect—holding constant the updated values of the control variables—of an increase in cash-based operating profitability. At the two-year mark, for example, the sum of the monthly regression slopes equals 0.5. This estimate implies that a 10% increase in cash-based operating profitability (relative to other firms in the cross section) at time t translates into $(0.5) \times 10\% = 5\%$ cumulative returns over the next two years. Suppose, for example, that we take a firm for which the book value of total assets equals the market value of equity. If such a firm experiences a \$1M increase in cash-based operating profitability, Figure 4 shows that, on average, shareholders reap *more than \$1M* in additional returns (including both capital gains and distributions) over the next five years. At the five-year mark, the cumulative effect crosses the 1.0 threshold.

These cumulative returns could represent a reversal. For example, it could be that investors

[14] This methodology is the Fama-MacBeth equivalent of the portfolio-sort methodology of Jegadeesh and Titman (1993). They use portfolio sorts to study the profitability of different momentum strategies for holding periods longer than one month while avoiding the use of overlapping returns. They resolve the overlapping-returns problem by measuring returns on multiple strategies each month and then averaging over these strategies—this average represents a return on a strategy with a holding period longer than a month. Our methodology is analogous. We estimate multiple Fama-MacBeth regressions each month t for different lags, and then take sums of the slope estimates to measure cumulative returns on the strategies represented by these regression slopes.

consistently under-react to announcements of cash-based operating profitability and these under-reactions lead to positive future returns. To investigate this possibility, in untabulated tests, we reverse the timing of the Fama-MacBeth regressions so that we examine the relation of current cash-based operating profitability with past returns. Reversals would imply that past returns are negatively correlated with current cash-based operating profitability. In contrast, we find that they are positively associated. Taken together, our estimates show that firms that are more profitable today on a cash basis earn higher returns in the future and earned higher returns in the past.

8 Conclusion

We study a cash-based measure of operating profitability that is devoid of accounting accruals adjustments. This measure significantly outperforms operating profitability (Ball et al., 2014) in explaining the cross section of expected returns and subsumes the accruals anomaly (Sloan, 1996). In fact, investors would be better off by just adding cash-based operating profitability to their investment opportunity set than by adding both accruals and profitability strategies. While accrual accounting aims at offering a better way of measuring the *current* period performance (Dechow, 1994), there is no good reason to expect that the accruals and cash flow components that jointly comprise earnings will have a similar predictive power with respect to future returns.

Our evidence implies high average returns for profitable firms; however, any increase in profitability that is solely due to accruals has no relation with the cross section of expected returns. Once one purges accruals from operating profitability, a significantly stronger predictor of future stock performance obtains. These results do not imply that accruals add noise to earnings or are otherwise detrimental to performance measurement. Accounting accruals aim at generating a measure of the current period performance, which is useful from a contracting perspective (e.g., for performance evaluation) as compared to cash-based measures. Cash-based profitability, in contrast, provides a stronger signal of future returns.

APPENDIX—Measuring operating profitability, cash-based operating profitability, and accruals

This appendix describes how we define operating profitability, cash-based operating profitability, and accruals. All are deflated by the book value of total assets in year $t-1$. The names of Compustat variables are provided in parentheses.

Operating profitability

The definition of Operating profitability follows Ball et al. (2014):

$$\begin{aligned}\text{Operating profitability} \equiv\ & \text{Revenue (REVT)} \\ & - \text{Cost of goods sold (COGS)} \\ & - \text{Reported sales, general, and administrative expenses (XSGA}-\text{XRD)},\end{aligned}$$

in which "Reported sales, general, and administrative expenses" subtracts off expenditures on research and development to undo the adjustment that Standard & Poor's makes to firms' accounting statements.

Cash-based operating profitability

We convert operating profitability to a cash basis by adding or subtracting changes in the balance-sheet items associated with the income-statement items that enter the calculation of operating profitability,

$$\begin{aligned}
\text{Cash-based operating profitability} \quad = \quad & \text{Operating Profitability} \\
& - \Delta(\text{Accounts receivable (RECT)}) \\
& - \Delta(\text{Inventory (INVT)}) \\
& - \Delta(\text{Pre-paid expenses (XPP)}) \\
& + \Delta(\text{Deferred revenue (DRC+DRLT)}) \\
& + \Delta(\text{Trade accounts payable (AP)}) \\
& + \Delta(\text{Accrued expenses (XACC)}).
\end{aligned}$$

All changes are computed on year-to-year basis. Instances where balance sheet accounts have missing values are replaced with zero values for the computation of Cash-based operating profitability and accruals.

In Table 3, we use cash flow statement accruals to convert operating profitability to a cash basis,

$$\begin{aligned}
\text{Cash-based operating profitability} \quad = \quad & \text{Operating Profitability} \\
& - \text{Accounts Receivable/Decrease (RECCH)} \\
& - \text{Inventory/Decrease (INVCH)} \\
& - \text{Accounts Payable and Accrued Liabilities/Increase (APALCH)}.
\end{aligned}$$

Accruals

In our main analysis, accruals are calculated using the balance sheet approach in accordance with Sloan (1996) as follows:

$$\begin{aligned}
\text{Accruals} \equiv\ & \Delta(\text{Current Assets (ACT)}) - \Delta(\text{Cash (CH)}) \\
& - [\Delta(\text{Current Liabilities(LCT)}) - \Delta(\text{Debt in current liabilities (DLC)}) \\
& - \Delta(\text{Income taxes payable (TXP)})] - \text{Depreciation (DP)}.
\end{aligned}$$

In Table 3, we calculate the accruals measure using cash flow statement as follows:

$$\begin{aligned}
\text{Accruals} =\ & -\text{Accounts Receivable/Decrease (RECCH)} \\
& - \text{Inventory/Decrease (INVCH)} \\
& - \text{Accounts Payable and Accrued Liabilities/Increase (APALCH)} \\
& - \text{Asset and Liabilities/Other/Net Change (AOLOCH)} \\
& - \text{Income Taxes/Accrued/Increase (APALCH)}.
\end{aligned}$$

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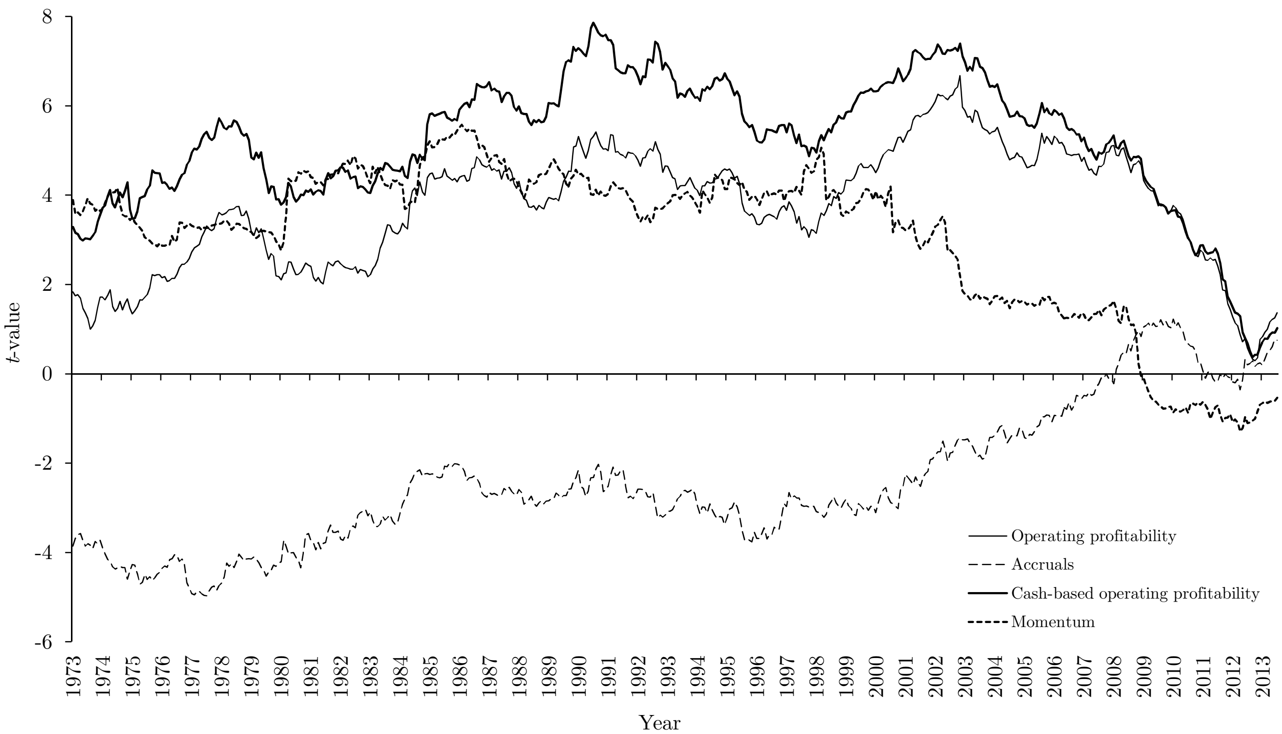


Figure 1: **Subsample analysis of operating profitability, accruals, cash-based operating profitability, and momentum in Fama-MacBeth regressions.** This figure presents t-values associated with rolling ten-year averages of Fama-MacBeth regression slopes from columns (2), (3), and (5) of Table 2. Each ten-year period ends on the date indicated on the x-axis. The first points, for example, are for June 1973 and they report the t-values associated with operating profitability, accruals, cash-based operating profitability, and mometum from Fama-MacBeth regressions estimated using data from July 1963 through June 1973. Momentum is the slope on the prior one-year return skipping a month ($r_{12,2}$) shown in column (2) of Table 2.

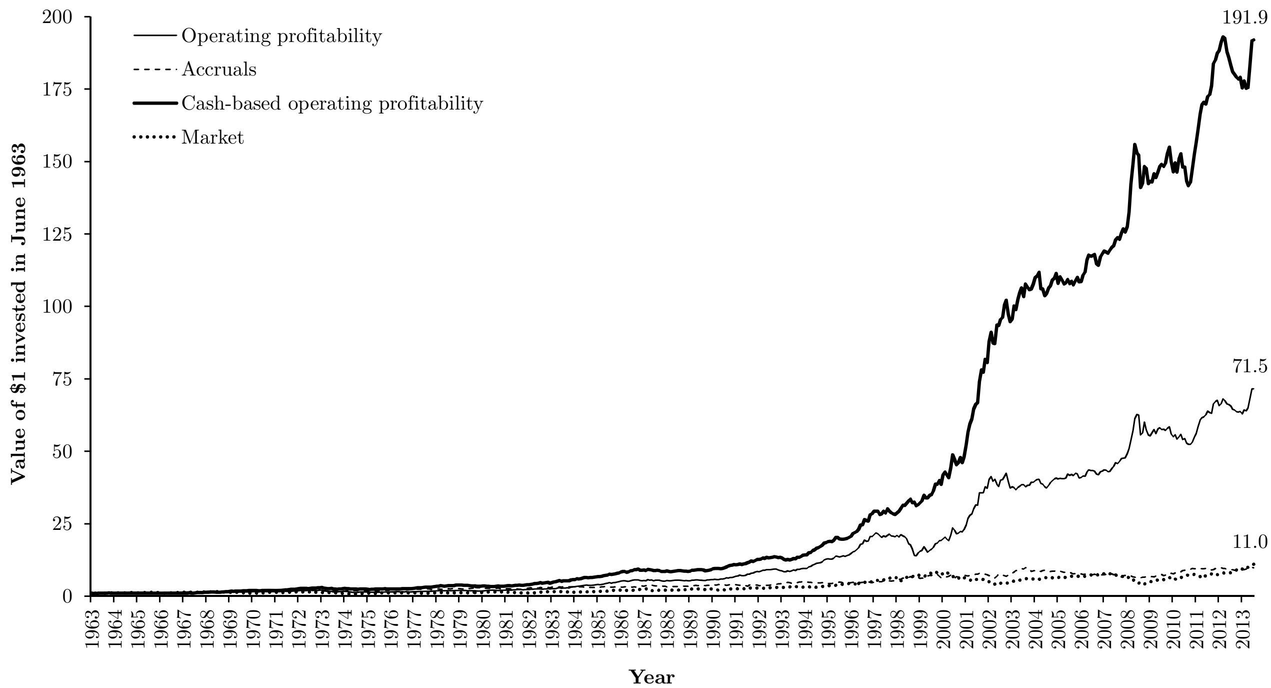
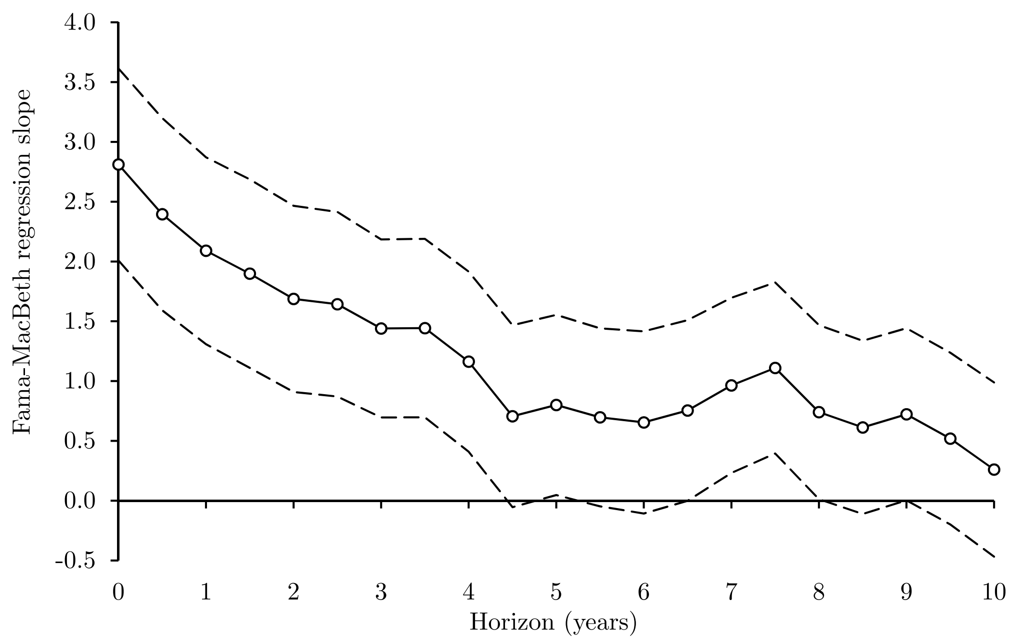
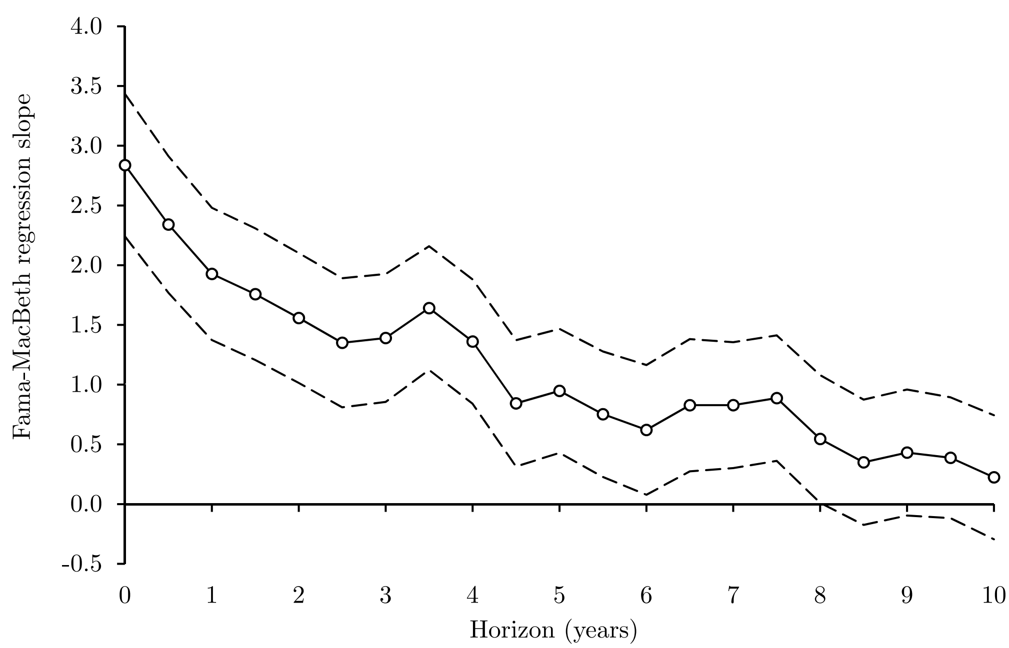


Figure 2: **Cumulative returns on operating profitability, accruals, cash-based operating profitability, and the market, 1963–2013.** We measure returns on operating profitability, accruals, and cash-based operating profitability by saving the alphas and residuals from Table 6's regressions for the high-minus-low decile strategies. These numbers represent the returns on strategies that trade each anomaly while being neutral with respect to the market and the size and value factors. This figure takes these estimates and compounds them to measure the growth of one dollar invested in each strategy at the end of June 1963. The return on the market strategy is the return on the CRSP value-weighted market index minus the one-month T-bill. The December 2013 values of the four strategies are $71.5 (operating profitability), $9.8 (accruals), $191.9 (cash-based operating profitability), and $11.0 (market).

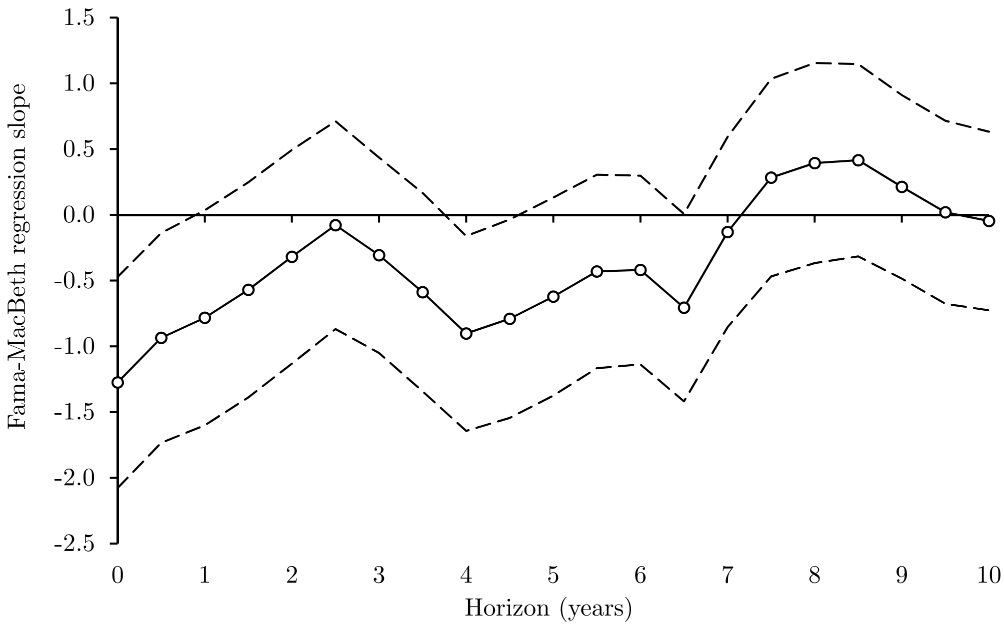
Panel A: Operating profitability



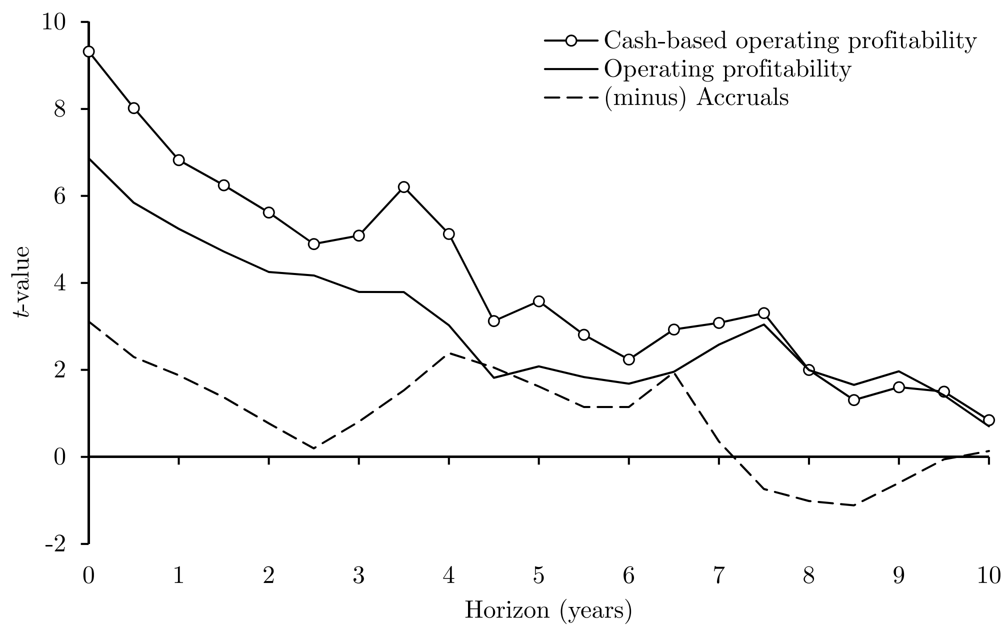
Panel B: Cash-based operating profitability



Panel C: Accruals



Panel D: Comparison of t-values



Panel E: Differences in Sharpe ratios between cash-based operating profitability and operating profitability

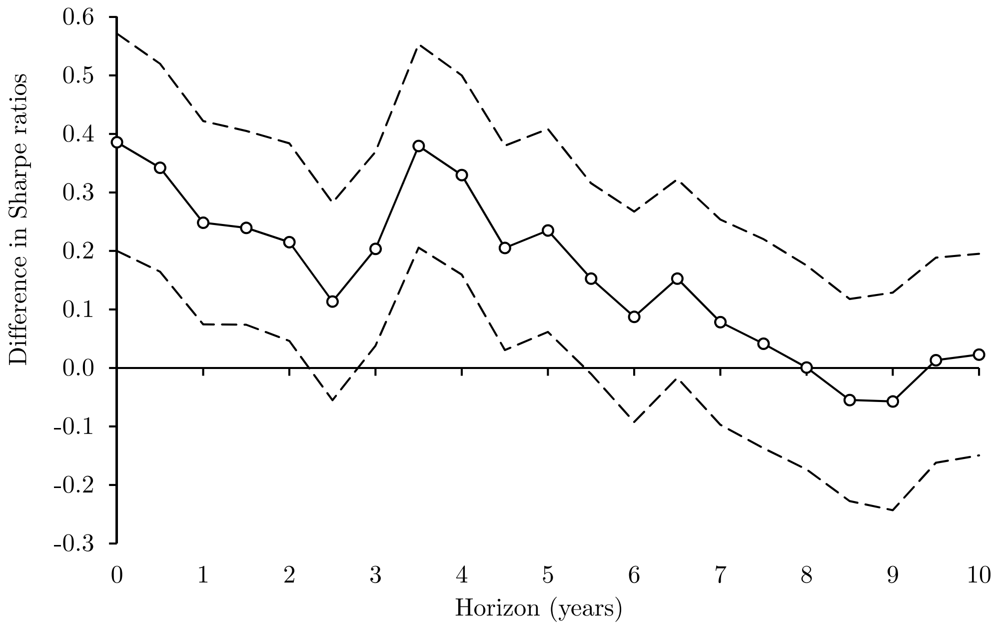


Figure 3: **Fama-MacBeth regression slopes.** Panels A, B, and C of the figure present average Fama and MacBeth (1973) regression slopes (multiplied by 100) and their corresponding 95% confidence intervals from regressions of returns on control variables and lagged values of the three earnings-related variables: operating profitability, cash-based operating profitability, and accruals. Panel D compares the t-values from these regressions. For ease of comparison, we multiply the t-values for accruals by negative one. Panel E presents the mean and 95% confidence interval for differences in Sharpe ratios between cash-based operating profitability and operating profitability. These Sharpe ratios are computed by viewing the Fama-MacBeth slope estimates as returns on long-short trading strategies that trade on that part of the variation in each regressor that is orthogonal to every other regressor. The control variables in the regressions are: prior one-month return, prior one-year return skipping a month, log-book-to-market, and log-size. The lags increase in increments of six months up to ten years. The control variables (but not the three earnings-related variables) are updated over time. The regressions are estimated for each month from July 1973 through December 2013 using data for All-but-microcaps. The same data are used for all lags.

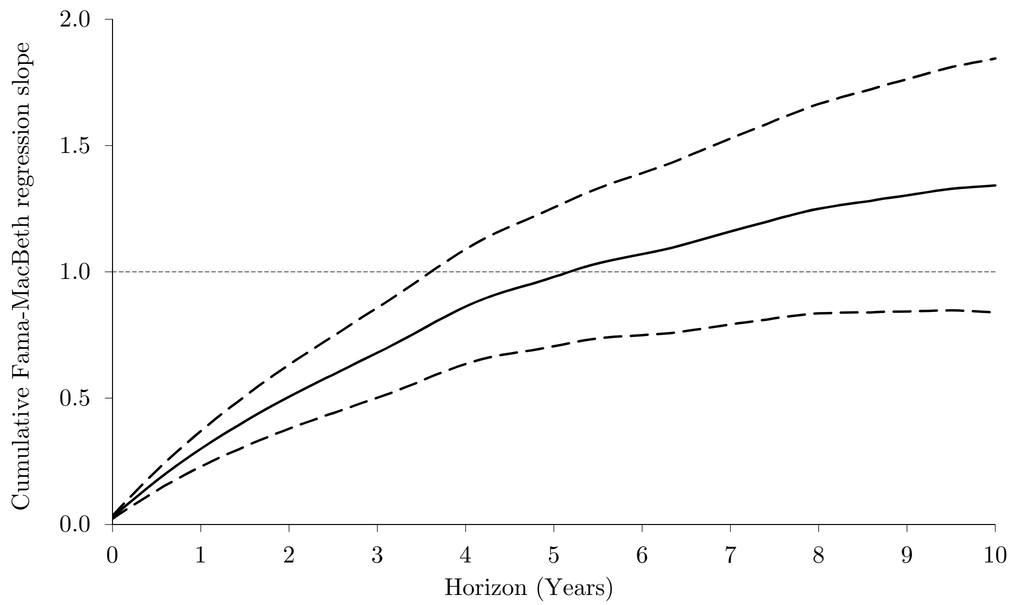


Figure 4: **Cumulative Fama-MacBeth regression slopes.** This figure presents cumulative average Fama and MacBeth (1973) regression slopes and their corresponding 95% confidence intervals from regressions of returns on control variables and lagged values of cash-based operating profitability. The control variables are: prior one-month return, prior one-year return skipping a month, log-book-to-market, and log-size. The lags increase in monthly increments up to ten years. The regressions are estimated for each month from July 1973 through December 2013 using data for All-but-microcaps. The same data are used for all lags.

Table 1: Descriptive statistics, 1963–2013

Panel A presents distributions for the variables used in our analysis. We calculate the descriptive statistics as the time series averages of the percentiles. Operating profitability (OP) is gross profit minus selling, general, and administrative expenses (excluding research and development expenditures) deflated by the book value of total assets. Accruals is the change in current assets minus the change in cash, the change in current liabilities, the change in current debt, the change in income taxes payable, and depreciation deflated by the book value of total assets. Cash-based operating profitability (CbOP) is operating profitability minus the change in accounts receivable, the change in inventory, and the change in prepaid expenses, plus the change in deferred revenues, the change in accounts payable, and the change in accrued expenses, deflated by the book value of assets. We describe the construction of operating profitability, accruals, and cash-based operating profitability in the Appendix. 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; and $r_{12,2}$ is the prior year's return skipping the last month. Panel B presents Pearson and Spearman rank correlations between operating profitability, accruals, and cash-based operating profitability. Our sample period starts in July 1963 and ends in December 2013.

Panel A: Distributions

			Percentiles				
Variable	Mean	SD	1st	25th	50th	75th	99th
Accounting variables / book value of total assets							
Operating profitability	0.129	0.158	−0.386	0.078	0.138	0.203	0.468
Accruals	−0.028	0.114	−0.344	−0.069	−0.027	0.016	0.236
Cash-based operating profitability	0.117	0.174	−0.420	0.056	0.126	0.195	0.490
Control variables in regressions							
log(BE/ME)	−0.550	0.935	−3.225	−1.065	−0.464	0.045	1.481
log(ME)	4.550	1.968	0.647	3.117	4.422	5.871	9.403
$r_{1,1}$	0.013	0.152	−0.304	−0.063	0.001	0.071	0.490
$r_{12,2}$	0.146	0.590	−0.669	−0.174	0.055	0.326	2.199

Panel B: Correlations

	Pearson			Spearman		
	OP	Accruals	CbOP	OP	Accruals	CbOP
OP	1			1		
Accruals	0.165	1		0.132	1	
CbOP	0.844	−0.253	1	0.804	−0.280	1

Table 2: Profitability and accruals in Fama-MacBeth regressions

This table presents average Fama and MacBeth (1973) regression slopes (multiplied by 100) 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. Operating profitability is gross profit minus selling, general, and administrative expenses (excluding research and development expenditures) deflated by the book value of total assets. Accruals is the change in current assets minus the change in cash, the change in current liabilities, the change in current debt, the change in income taxes payable, and depreciation deflated by the book value of total assets. Cash-based operating profitability is operating profitability minus the change in accounts receivable, the change in inventory, and the change in prepaid expenses, plus the change in deferred revenues, the change in accounts payable, and the change in accrued expenses, deflated by the book value of assets. We describe the construction of operating profitability, accruals and cash-based operating profitability in the Appendix. Variables in regressions (2) through (7) are trimmed at the 1st and 99th percentiles based on all explanatory variables. The first column does not require non-missing accruals or cash-based operating profitability, while the remaining columns require non-missing values. Our sample period starts in July 1963 and ends in December 2013.

Panel A: All-but-microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)	(6)	(7)
Operating profitability	3.041	2.556		2.554			0.616
	(8.97)	(6.97)		(7.01)			(1.19)
Accruals			−1.576	−1.758		0.010	
			(−4.40)	(−4.99)		(0.02)	
Cash-based operating profitability					2.653	2.572	2.116
					(9.84)	(7.40)	(5.83)
log(BE/ME)	0.435	0.373	0.222	0.337	0.341	0.326	0.342
	(5.93)	(5.16)	(3.37)	(4.73)	(4.87)	(4.61)	(4.81)
log(ME)	−0.085	−0.098	−0.094	−0.110	−0.107	−0.111	−0.107
	(−2.19)	(−2.51)	(−2.41)	(−2.83)	(−2.76)	(−2.85)	(−2.76)
$r_{1,1}$	−3.181	−3.362	−3.467	−3.429	−3.401	−3.448	−3.413
	(−7.30)	(−7.77)	(−8.01)	(−7.99)	(−7.86)	(−8.04)	(−7.95)
$r_{12,2}$	1.052	0.979	0.882	0.936	0.943	0.928	0.944
	(5.65)	(5.33)	(4.83)	(5.13)	(5.14)	(5.10)	(5.17)
Adjusted R^2	5.65%	5.47%	5.25%	5.66%	5.38%	5.65%	5.63%

Panel B: Microcaps

Operating profitability	2.136	2.085		2.302			0.210
	(6.19)	(5.24)		(5.78)			(0.42)
Accruals			−2.007	−2.544		−0.801	
			(−6.41)	(−8.43)		(−1.85)	
Cash-based operating profitability					2.471	2.249	2.192
					(9.50)	(6.55)	(7.23)
log(BE/ME)	0.479	0.430	0.421	0.407	0.416	0.407	0.403
	(7.55)	(6.41)	(6.48)	(6.04)	(6.49)	(6.22)	(6.03)
log(ME)	−0.264	−0.260	−0.192	−0.249	−0.251	−0.245	−0.255
	(−4.35)	(−4.26)	(−3.01)	(−4.08)	(−4.01)	(−3.99)	(−4.18)
$r_{1,1}$	−5.852	−6.307	−6.220	−6.364	−6.306	−6.353	−6.367
	(−13.46)	(−14.03)	(−13.74)	(−14.17)	(−14.02)	(−14.17)	(−14.18)
$r_{12,2}$	1.042	0.913	0.918	0.861	0.886	0.864	0.872
	(5.59)	(4.99)	(4.94)	(4.71)	(4.86)	(4.72)	(4.76)
Adjusted R^2	3.07%	3.11%	2.88%	3.18%	3.01%	3.15%	3.18%

Table 3: Profitability and accruals in Fama-MacBeth regressions: Alternative specifications using the statement of cash flows

This table presents average Fama and MacBeth (1973) regression slopes (multiplied by 100) and their t-values from cross sectional regressions that predict monthly returns. The regressions are estimated monthly using data from July 1988 through December 2013 using All-but-microcaps. Operating profitability is gross profit minus selling, general, and administrative expenses (excluding research and development expenditures) deflated by the book value of total assets. Accruals is the change in current assets minus the change in cash, the change in current liabilities, the change in current debt, the change in income taxes payable, and depreciation deflated by the book value of total assets. Cash-based operating profitability is operating profitability minus the change in accounts receivable, the change in inventory, and the change in prepaid expenses, plus the change in deferred revenues, the change in accounts payable, and the change in accrued expenses, deflated by the book value of assets. In Specification 1, we construct the accruals measure using cash flow statement accruals. In Specification 2, we use cash flow statement accruals to construct both the accruals and cash-based operating profitability measures. The sample stays constant across regressions (1) through (4) and then again in regressions (5) through (8). Variables are trimmed at the 1st and 99th percentiles based on the explanatory variables used in the first two columns: operating profitability, book-to-market, size, prior one-month return, and prior one-year return skipping a month. Our sample period starts in July 1988 and ends in December 2013.

	Specification 1				Specification 2			
	Accruals from the statement of cash flows				Accruals and cash-based operating profitability from the statement of cash flows			
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Operating profitability	2.387			0.573	2.758			0.167
	(5.08)			(0.77)	(5.54)			(0.19)
Accruals	−2.247		−0.563		−2.605		−0.544	
	(−3.74)		(−0.84)		(−4.23)		(−0.78)	
Cash-based operating profitability		2.364	2.251	1.823		2.855	2.689	2.630
		(6.34)	(5.65)	(3.30)		(6.48)	(5.68)	(3.69)
log(BE/ME)	0.232	0.240	0.222	0.235	0.262	0.267	0.245	0.258
	(2.42)	(2.47)	(2.31)	(2.46)	(2.62)	(2.65)	(2.45)	(2.60)
log(ME)	−0.086	−0.086	−0.088	−0.084	−0.081	−0.080	−0.082	−0.080
	(−1.48)	(−1.46)	(−1.51)	(−1.44)	(−1.36)	(−1.35)	(−1.40)	(−1.37)
$r_{1,1}$	−1.385	−1.312	−1.367	−1.376	−1.150	−1.098	−1.166	−1.154
	(−2.23)	(−2.11)	(−2.21)	(−2.23)	(−1.82)	(−1.73)	(−1.85)	(−1.83)
$r_{12,2}$	0.417	0.430	0.412	0.434	0.474	0.488	0.465	0.486
	(1.61)	(1.66)	(1.59)	(1.68)	(1.84)	(1.90)	(1.81)	(1.89)
Adjusted R^2	4.91%	4.65%	4.83%	4.92%	5.06%	4.81%	5.02%	5.11%

Table 4: Returns on portfolios sorted by operating profitability, accruals, and cash-based operating profitability

This table reports value-weighted average excess returns and three-factor model alphas for portfolios sorted by operating profitability, accruals, and cash-based operating profitability, each scaled 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 portfolios for the following year. The sample starts in July 1963 and ends in December 2013.

	Operating profitability		Accruals		Cash-based operating profitability	
Portfolio	Average return	FF3 α	Average return	FF3 α	Average return	FF3 α
1 (low)	0.268	−0.469	0.695	0.219	0.146	−0.556
	(1.04)	(−4.42)	(3.04)	(2.13)	(0.55)	(−6.75)
2	0.402	−0.225	0.611	0.136	0.337	−0.318
	(2.02)	(−2.88)	(3.19)	(1.79)	(1.57)	(−3.99)
3	0.500	−0.148	0.528	0.105	0.451	−0.121
	(2.62)	(−1.92)	(2.85)	(1.41)	(2.42)	(−1.69)
4	0.485	−0.105	0.541	0.057	0.502	−0.108
	(2.65)	(−1.45)	(2.94)	(0.84)	(2.61)	(−1.55)
5	0.512	−0.011	0.599	0.114	0.575	0.011
	(2.73)	(−0.14)	(3.39)	(1.80)	(3.08)	(0.15)
6	0.568	0.049	0.561	0.107	0.430	−0.081
	(3.13)	(0.66)	(3.16)	(1.72)	(2.44)	(−1.26)
7	0.531	−0.012	0.561	0.140	0.606	0.093
	(2.81)	(−0.18)	(3.08)	(2.14)	(3.35)	(1.50)
8	0.670	0.170	0.433	−0.039	0.606	0.128
	(3.45)	(2.75)	(2.25)	(−0.56)	(3.22)	(1.98)
9	0.524	0.085	0.440	−0.019	0.616	0.177
	(2.83)	(1.42)	(2.05)	(−0.27)	(3.24)	(3.15)
10 (high)	0.558	0.284	0.311	−0.208	0.620	0.347
	(2.83)	(4.68)	(1.22)	(−2.49)	(3.23)	(5.90)
High-Low	0.289	0.752	−0.384	−0.427	0.474	0.903
(deciles)	(1.84)	(5.99)	(−2.76)	(−3.25)	(3.16)	(8.50)
High-Low	0.218	0.558	−0.273	−0.294	0.377	0.720
(quintiles)	(1.87)	(5.81)	(−2.66)	(−3.00)	(3.33)	(8.21)

Table 5: Incremental information in accruals: A portfolio-sort analysis

This table reports monthly three-factor model alphas and the associated t-values for portfolios sorted by operating profitability (Panel A) or cash-based operating profitability (Panel B) and then conditionally sorted by the ratio of accruals 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.

Panel A: Portfolios sorted by operating profitability and accruals

OP/AT		Accruals/AT quintile						Average
decile	All	1	2	3	4	5	5 − 1	1,...,5
All		0.182	0.077	0.121	0.049	−0.113	−0.294	
		(2.66)	(1.46)	(2.43)	(0.96)	(−1.83)	(−3.00)	
1	−0.469	−0.322	−0.531	−0.289	−0.482	−0.801	−0.479	−0.485
	(−4.42)	(−1.49)	(−3.16)	(−1.84)	(−3.51)	(−5.37)	(−1.99)	(−4.70)
2	−0.225	−0.071	−0.073	−0.068	−0.194	−0.540	−0.469	−0.189
	(−2.88)	(−0.47)	(−0.54)	(−0.54)	(−1.56)	(−3.65)	(−2.42)	(−2.58)
3	−0.148	−0.263	−0.208	0.115	0.006	−0.225	0.038	−0.115
	(−1.92)	(−1.81)	(−1.65)	(0.93)	(0.05)	(−1.62)	(0.20)	(−1.60)
4	−0.105	−0.046	−0.085	0.063	−0.177	−0.373	−0.327	−0.124
	(−1.45)	(−0.32)	(−0.74)	(0.55)	(−1.46)	(−2.80)	(−1.77)	(−1.78)
5	−0.011	0.086	0.039	−0.062	0.233	−0.184	−0.269	0.023
	(−0.14)	(0.59)	(0.32)	(−0.54)	(1.99)	(−1.38)	(−1.43)	(0.37)
6	0.049	0.298	0.067	0.124	−0.218	−0.304	−0.602	−0.006
	(0.66)	(1.95)	(0.56)	(1.01)	(−1.88)	(−2.44)	(−3.00)	(−0.10)
7	−0.012	0.383	−0.074	0.027	−0.039	0.014	−0.369	0.062
	(−0.18)	(3.01)	(−0.59)	(0.23)	(−0.32)	(0.10)	(−2.00)	(1.01)
8	0.170	0.202	0.063	0.295	0.165	0.065	−0.137	0.158
	(2.75)	(1.50)	(0.58)	(2.54)	(1.44)	(0.50)	(−0.71)	(2.65)
9	0.085	0.177	0.270	0.183	−0.002	−0.057	−0.235	0.114
	(1.42)	(1.35)	(2.61)	(1.66)	(−0.02)	(−0.51)	(−1.38)	(2.00)
10	0.284	0.715	0.848	0.794	0.795	0.461	−0.254	0.723
	(4.68)	(4.67)	(7.01)	(7.71)	(7.52)	(3.59)	(−1.29)	(11.77)
10 − 1	0.752	1.036	1.379	1.084	1.277	1.262	0.226	1.208
	(5.99)	(4.30)	(6.33)	(5.63)	(7.29)	(6.48)	(0.78)	(9.98)
Average		0.116	0.032	0.118	0.009	−0.194	−0.310	
1,...,10		(1.72)	(0.68)	(2.46)	(0.18)	(−3.38)	(−3.62)	

Panel B: Portfolios sorted by cash-based operating profitability and accruals

CbOP/AT decile	All	Accruals/AT quintile 1	2	3	4	5	5 − 1	Average 1,...,5
All		0.182	0.077	0.121	0.049	−0.113	−0.294	
		(2.66)	(1.46)	(2.43)	(0.96)	(−1.83)	(−3.00)	
1	−0.556	−0.571	−0.427	−0.558	−0.377	−0.646	−0.075	−0.516
	(−6.75)	(−3.50)	(−3.08)	(−3.92)	(−2.70)	(−4.65)	(−0.36)	(−6.50)
2	−0.318	−0.293	−0.072	−0.362	−0.482	−0.347	−0.054	−0.311
	(−3.99)	(−1.95)	(−0.53)	(−2.76)	(−3.24)	(−2.43)	(−0.28)	(−4.13)
3	−0.121	−0.443	−0.166	0.064	−0.140	0.046	0.489	−0.128
	(−1.69)	(−3.10)	(−1.40)	(0.55)	(−1.15)	(0.33)	(2.49)	(−1.91)
4	−0.108	−0.311	−0.082	0.048	−0.057	−0.136	0.175	−0.108
	(−1.55)	(−2.16)	(−0.66)	(0.42)	(−0.45)	(−1.06)	(0.93)	(−1.64)
5	0.011	0.125	−0.040	0.084	−0.105	−0.032	−0.157	0.006
	(0.15)	(0.91)	(−0.31)	(0.77)	(−0.84)	(−0.25)	(−0.88)	(0.10)
6	−0.081	0.143	−0.049	−0.146	−0.119	−0.177	−0.320	−0.070
	(−1.26)	(1.04)	(−0.40)	(−1.33)	(−0.96)	(−1.57)	(−1.68)	(−1.20)
7	0.093	0.006	0.142	0.103	0.081	0.112	0.105	0.089
	(1.50)	(0.05)	(0.93)	(0.89)	(0.70)	(1.02)	(0.62)	(1.54)
8	0.128	0.159	0.258	0.161	0.102	−0.055	−0.215	0.125
	(1.98)	(1.04)	(1.88)	(1.38)	(0.90)	(−0.49)	(−1.07)	(2.14)
9	0.177	0.445	0.134	0.230	0.073	0.255	−0.190	0.228
	(3.15)	(2.93)	(1.10)	(2.29)	(0.70)	(2.10)	(−0.96)	(4.09)
10	0.347	0.758	0.895	0.745	0.823	0.619	−0.139	0.768
	(5.90)	(4.84)	(6.10)	(6.23)	(8.12)	(5.59)	(−0.75)	(12.66)
10 − 1	0.903	1.329	1.322	1.303	1.200	1.265	−0.064	1.284
	(8.50)	(6.44)	(6.49)	(6.79)	(6.86)	(7.03)	(−0.24)	(12.75)
Average 1,...,10		0.002	0.059	0.037	−0.020	−0.036	−0.038	
		(0.03)	(1.16)	(0.87)	(−0.41)	(−0.65)	(−0.42)	

Table 6: Pricing 25 portfolios sorted by size and accruals

This table shows annualized alphas and t-values associated with those alphas for 25 portfolios formed by independent sorts on size and total accruals (Sloan, 1996). We sort stocks into quintiles based on NYSE breakpoints at the end of each June and hold the portfolios for the following year. Panel A shows the annualized returns in excess of the one-month Treasury bill. Panels B through D show alphas and t-values for the Fama and French (1993) three-factor model and two augmented versions of this model that add either the operating-profitability factor or the cash-based operating profitability factors. These profitability factors are formed using the same six-portfolio methodology as that in Fama and French (2015); that is, we first sort stocks by size into small (below the 50th NYSE percentile) and big (above 50th NYSE percentile) and (independently) by profitability to "weak" (below the 30th NYSE percentile) and "robust" (above the 70th NYSE percentile), and then define each factor as the difference $(1/2) \times$ (small-robust + big-robust) $-$ $(1/2) \times$ (small-weak + big-weak). Following the methodology in Fama and French (2015), the SMB factors in the models augmented with the profitability factors are the averages of the two possible SMB factors: one based on the six size-BE/ME portfolios and the other based on the size size-profitability portfolios. Panel E shows five test statistics that evaluate model performance: $A|\hat{\alpha}|$ is the average regression intercept; GRS is the Gibbons et al. (1989) test statistic; $A(|a_i|)/A(|\bar{r}_i|)$ is Fama and French's (2014b) measure that captures the dispersion of alphas left unexplained by the model; $A(\hat{\alpha}^2)/A(\hat{\mu}^2)$ is Fama and French's (2014b) measure of the proportion of the cross sectional variance of expected returns left unexplained by the model; $A(R^2)$ is the average of the regression R^2s. The sample starts in July 1963 and ends in December 2013.

Panel A: Average annualized excess returns

	Accruals				
Size	Low	2	3	4	High
Small	11.69	13.51	10.36	10.67	7.46
2	10.81	11.44	10.58	9.66	6.78
3	10.76	9.72	10.32	9.36	5.53
4	9.45	9.05	7.79	8.27	8.42
Big	7.16	5.66	6.45	5.01	3.50

Panel B: Three-factor model

	Annualized alphas					t-values				
	Accruals					Accruals				
Size	Low	2	3	4	High	Low	2	3	4	High
Small	0.85	2.98	0.13	0.76	−3.15	0.83	3.49	0.15	0.83	−3.80
2	0.80	1.65	1.41	−0.04	−2.82	0.89	2.03	1.66	−0.05	−3.35
3	1.69	1.16	1.86	0.82	−3.06	1.66	1.32	2.11	0.97	−3.22
4	1.49	1.28	−0.14	0.99	1.20	1.36	1.54	−0.18	1.19	1.17
Big	2.60	1.02	1.76	0.67	−0.33	2.64	1.35	2.42	0.88	−0.31

Panel C: Three-factor model + operating-profitability factor

	Annualized alphas					t-values				
	Accruals					Accruals				
Size	Low	2	3	4	High	Low	2	3	4	High
Small	3.50	4.37	1.97	2.11	−2.06	3.50	5.01	2.29	2.36	−2.56
2	2.15	1.96	1.99	0.01	−3.23	2.41	2.39	2.25	0.02	−3.95
3	2.46	1.53	2.28	0.83	−4.00	2.33	1.63	2.49	0.94	−4.22
4	1.92	1.38	−0.01	0.71	0.99	1.69	1.59	−0.01	0.83	0.95
Big	2.83	1.19	0.76	−0.92	−1.79	2.78	1.53	1.04	−1.22	−1.64

Panel D: Three-factor model + cash-based operating-profitability factor

	Annualized alphas					t-values				
	Accruals					Accruals				
Size	Low	2	3	4	High	Low	2	3	4	High
Small	2.01	3.99	1.61	1.57	−1.01	1.87	4.37	1.78	1.68	−1.20
2	1.67	2.14	1.99	−0.04	−1.41	1.78	2.52	2.17	−0.04	−1.64
3	2.00	1.55	1.98	1.79	−1.48	1.82	1.60	2.09	1.96	−1.47
4	2.15	1.83	1.17	1.34	1.86	1.82	2.03	1.42	1.49	1.70
Big	1.15	−0.05	1.35	−0.15	0.30	1.10	−0.06	1.75	−0.19	0.26

Panel E: Test statistics

Model	GRS	$A(\|\hat{\alpha}\|)$	$A(\|a_i\|)/A(\|\bar{r}_i\|)$	$A(\hat{\alpha}^2)/A(\hat{\mu}^2)$	$A(R^2)$
Three-factor	3.59	0.115	0.71	0.46	0.90
Three-factor + RMW_{OP}	4.06	0.156	0.96	0.91	0.90
Three-factor + RMW_{CbOP}	2.22	0.125	0.77	0.47	0.90

Table 7: Maximum ex post Sharpe ratios

This table presents the maximum ex post Sharpe ratios that be can achieved by using different combinations of factors and the weights on each factor required to achieve the maximum Sharpe ratio. The factors include the traditional four factors: the market return minus the risk free rate, MKT; size, SMB; value, HML; and momentum, UMD. ln addition, we construct three additional factors based on accruals, operating profitability, and cash-based operating profitability. We generate these factors using the same six-portfolio methodology as that in Fama and French (2015); that is, we first sort stocks by size into small (below the 50th NYSE percentile) and big (above 50th NYSE percentile) and (independently) to "weak" (below the 30th NYSE percentile) and "robust" (above the 70th NYSE percentile) profitability, and then define each portfolio as the difference $(1/2) \times$ (small-robust + big-robust) − $(1/2) \times$ (small-weak + big-weak). For the accruals factor the "robust" and "weak" labels are reversed. Following the methodology in Fama and French (2015), the SMB factor in the model with the four traditional factors and the accruals factor is the average of the two possible SMB factors: one based on the six size-BE/ME portfolios and the other based on the six size-accruals portfolios. Similarly, the SMB factors in the models augmented with the profitability factors are the averages of the two possible SMB factors: one based on the six size-BE/ME portfolios and the other based on the size size-profitability portfolios. In the model with both profitability and accruals factors, the SMB factor is from the model without the accruals factor. Panel A shows the annualized average returns and standard deviations of the monthly factors. The SMB factor in this panel is the SMB factor from the three-factor model. Panel B shows the weights and the Sharpe ratio of the maximum ex post Sharpe ratio portfolio. The sample starts in July 1963 and ends in December 2013.

Panel A: Annualized returns and standard deviations on factors

	Factor						
	MKT	SMB	HML	UMD	ACC	RMW_{OP}	RMW_{CbOP}
Average annualized return	5.98	3.07	4.50	8.40	2.90	3.53	4.82
Annualized standard deviation	15.54	10.76	9.95	14.76	5.64	6.31	5.42
t-value	2.73	2.02	3.21	4.04	3.65	3.97	6.30

Panel B: Tangency portfolio weights and Sharpe ratios

	Weights							Sharpe
Factors	MKT	SMB	HML	UMD	ACC	RMW_{OP}	RMW_{CbOP}	ratio
MKT	100%							0.39
MKT, SMB, HML	26%	21%	53%					0.76
MKT, SMB, HML, UMD	20%	13%	41%	26%				1.07
MKT, SMB, HML, UMD, ACC	16%	9%	26%	19%	29%			1.13
MKT, SMB, HML, UMD, RMW_{OP}	12%	8%	30%	10%		39%		1.40
MKT, SMB, HML, UMD, RMW_{OP}, ACC	9%	8%	20%	6%	34%	23%		1.58
MKT, SMB, HML, UMD, RMW_{CbOP}	11%	9%	25%	5%			50%	1.70
MKT, SMB, HML, UMD, RMW_{CbOP}, ACC	11%	9%	22%	4%	9%		46%	1.72