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THE OTHER SIDE OF VALUE:
GOOD GROWTH AND THE GROSS PROFITABILITY PREMIUM

Robert Novy-Marx

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ABSTRACT

Profitability, as measured by gross profits-to-assets, has roughly the same power as book-to-market predicting the cross-section of average returns. Profitable firms generate significantly higher average returns than unprofitable firms, despite having, on average, lower book-to-markets and higher market capitalizations. Controlling for profitability also dramatically increases the performance of value strategies, especially among the largest, most liquid stocks. These results are difficult to reconcile with popular explanations of the value premium, as profitable firms are less prone to distress, have longer cashflow durations, and have lower levels of operating leverage, than unprofitable firms. Controlling for gross profitability explains most earnings related anomalies, as well as a wide range of seemingly unrelated profitable trading strategies.

Robert Novy-Marx
Booth School of Business
University of Chicago
5807 South Woodlawn Avenue
Chicago, IL 60637
and NBER
rnm@chicagobooth.edu

1 Introduction

Profitability has roughly the same power as book-to-market predicting the cross-section of average returns. It is also complimentary to book-to-market, contributing economically significant information above that contained in valuations. These conclusions differ dramatically from those of other studies (Fama and French (1993, 2006)), which find that profitability adds little or nothing to the prediction of returns provided by size and book-to-market. The difference is that "profitability" here is measured using gross profits, not earnings. Gross profitability represents "the other side of value." Strategies based on gross profitability generate value-like average excess returns, despite being growth strategies that provide an excellent hedge for value. Because the two effects are closely related, it is useful to analyze profitability in the context of value.

Value strategies hold firms with inexpensive assets and short firms with expensive assets. When a firm's market value is low relative to its book value, then a stock purchaser acquires a relatively large quantity of book assets for each dollar spent on the firm. When a firm's market price is high relative to its book value the opposite is true. Value strategies were first advocated by Graham and Dodd in 1934, and their profitability has been documented countless times since.

Berk (1995) argues that the profitability of value strategies is mechanical. Firms for which investors require high rates of return (i.e., risky firms) are priced lower, and consequently have higher book-to-markets, than firms for which investors require lower returns. Because valuation ratios help identify variation in expected returns, with higher book-to-markets indicating higher required rates, value firms generate higher average returns than growth firms.

A similar argument suggests that firms with productive assets should yield higher average returns than firms with unproductive assets. Productive firms for which investors demand high average returns to hold should be priced similarly to less productive firms for which investors demand lower returns. Variation in productivity therefore helps identify variation in investors' required rates of return. Because productivity helps identify this variation, with higher profitability indicating higher required rates, profitable firms generate higher average returns than unprofitable firms. This fact motivates the return-on-asset factor employed in Chen, Novy-Marx and Zhang (2010).

Gross profits is the cleanest accounting measure of true economic profitability. The farther down the income statement one goes, the more polluted profitability measures become, and the less related they are to true economic profitability. For example, a firm that has both lower production costs and higher sales than its competitors is unambiguously more profitable. Even so, it can easily have lower earnings than its competitors. If the firm is quickly increasing its sales though aggressive advertising, or commissions to its sales force, these actions can, even if optimal, reduce its bottom line income below that of its less profitable competitors. Similarly, if the firm spends on research and development to further increase its production advantage, or invests in organizational capital that will help it maintain its competitive advantage, these actions result in lower current earnings. Moreover, capital expenditures that directly increase the scale of the firm's operations further reduce its free cashflows relative to its competitors. These facts suggest constructing the empirical proxy for productivity using gross profits.[1] Scaling by a book based measure, instead of a market based measure, avoids hopelessly conflating the productivity proxy with book-to-market. I scale gross profits by book assets, not book equity, because gross profits are not reduced by interest payments and are thus independent of leverage.

Determining the best measure of productivity is, however, ultimately an empirical question. I therefore also consider profitability measures constructed using earnings and free cashflows. Popular media is preoccupied with earnings, the variable on which Wall Street analysts' forecasts focus. Financial economists are generally more concerned with free

[1] Several studies have found a role for components of the difference between gross profits and earnings. For example, Sloan (1996) and Chan et. al. (2006) find that accruals predict returns, while Chan et. al. (2001) argue that R&D and advertising expenditures have power in the cross-section. Lakonishok, Shleifer, and Vishny (1994) also find that strategies formed on the basis of cashflow (earnings plus depreciation) are more profitable than those formed on the basis of earnings alone.

cashflows, the present discounted value of which should determine a firm's value.

In a horse race between these three measures of productivity, gross profits-to-assets is the clear winner. Gross profits-to-assets has roughly the same power predicting the cross-section of expected returns as book-to-market. It completely subsumes the earnings based measure, and has significantly more power than the measure based on free cash flows. Moreover, demeaning this variable dramatically increases its power. Gross profits-to-assets also predicts long run growth in earnings and free crashflow, which may help explain why it is useful in forecasting returns.

Consistent with these results, portfolios sorted on gross-profits-to-assets exhibit large variation in average returns, especially in sorts that control for book-to-market. More profitable firms earn significantly higher average returns than unprofitable firms. They do so despite having, on average, lower book-to-markets and higher market capitalizations. That is, profitable firms are high return "good growth" stocks, while unprofitable firms are low return "bad value" stocks. Because strategies based on profitability are growth strategies, they provide an excellent hedge for value strategies, and thus dramatically improve a value investor's investment opportunity set. These results contrast strongly with those of Fama and French (2006), who find that profitability, as measured by earnings, adds little or nothing in economic terms to the prediction of returns provided by size and book-to-market.

These facts are also difficult to reconcile with the interpretation of the value premium provided by Fama and French (1993), which explicitly relates value stocks' high average returns to their low profitabilities. In particular, they note that "low-BE/ME firms have persistently high earnings and high-BE/ME firms have persistently low earnings," suggesting that "the difference between the returns on high- and low-BE/ME stocks, captures variation through time in a risk factor that is related to relative earnings performance."

My results present a similar problem for Lettau and Wachter's (2007) duration-based explanation of the value premium. In their model, short-duration assets are riskier than long duration assets, and generate higher average returns. Value firms have short durations, and consequently generate higher average returns than longer duration growth firms. In the data, however, gross profitability is associated with long run growth in profits, earnings, and free cashflows. Profitable firms consequently have longer durations than less profitable firms, and the Lettau-Wachter model therefore predicts, counter-factually, that profitable firms should underperform unprofitable firms.

The fact that profitable firms earn significantly higher average returns than unprofitable firms also poses difficulties for the "operating leverage hypothesis" of Carlson, Fisher, and Giammarino (2004), which drives the value premium in Zhang (2005) and Novy-Marx (2009, 2010a). Under this hypothesis, operating leverage magnifies firms' exposures to economic risks, because firms' profits look like levered claims on their assets. In models employing this mechanism, however, operating leverage, risk, and expected returns are generally all decreasing with profitability. This is contrary to the profitability/expected return relation observed in the data.

The paper also shows that most earnings related anomalies, as well as a large number of seemingly unrelated anomalies, are really just different expressions of three basic underlying anomalies, mixed in various proportions and dressed up in different guises. A four-factor model, employing the market and industry-adjusted value, momentum and gross profitability "factors," performs remarkably well pricing a wide range of anomalies, including (but not limited to) strategies based on return-on-equity, free cashflow growth, market power, default risk, net stock issuance and organizational capital.

Finally, the prediction that profitable firms should outperform unprofitable firms can be motivated just as easily on behavioral grounds, with an argument that is again closely related to "value." The popular behavioral explanation for the high average returns observed on value stocks, consistent with Graham and Dodd's original concept and advocated by Lakonishok, Shleifer, and Vishny (1994), is that low book-to-market stocks are on average overpriced, while the opposite is true for high book-to-market stocks. If stocks are not perfectly priced in the cross-section, then buying value stocks and selling growth stocks represents a crude but effective method for exploiting misvaluations. While there is certainly large variation in the true value of book-assets, and this drives the great majority of the observed variation in book-to-market ratios, value strategies nevertheless produce value and growth portfolios biased toward under- and over-priced stocks, respectively.

A similar argument suggests that firms with productive assets should generate higher average returns than firms with unproductive assets. If stocks are not perfectly priced in the cross-section, then among firms with similar book-to-market ratios, productive firms are on average underpriced, while the opposite is true for unproductive firms. A trading strategy that buys firms with productive assets and sells firms with unproductive assets should generate positive abnormal returns because the long and short sides of the strategy will be biased toward under- and over-priced stocks, respectively.

Distinguishing between competing stories for the observed profitability premium is, however, beyond the scope of this paper. This paper is primarily concerned with documenting the fact that gross profits-to-assets has power predicting the cross section of average returns that both rivals, and is complimentary to, that of book-to-market.

The remainder of the paper is organized as follows. Section 2 provides a simple theoretical framework for the prediction that it is gross profits, and not earnings, that is strongly associated with average returns. Section 3 presents evidence that gross profitability has power predicting long term growth in gross profits, earnings, and free cashflows. Section 4 shows that gross profits-to-assets is a powerful predictor of the cross-section of expected returns, even among the largest, most liquid stocks. It also shows that controlling for gross profits-to-assets significantly improves the performance of value strategies. Section 5 investigates a decomposition of gross profits-to-assets into asset turnover (sales-to-assets) and gross margins (gross profits-to-sales), and shows that high asset turnover primarily drives the high average returns of profitable firms, while high gross margins are the distinguishing characteristic of "good growth" stocks. Section 6 shows that controlling for industries dramatically improves the performance of strategies based on valuation and profitability.

Section 7 considers the performance of a four-factor model that employs the market and industry-adjusted value, momentum and gross profitability "factors." The model performs better than the Fama-French four-factor model, or the Chen, Novy-Marx and Zhang three-factor model, pricing a wide array of anomalies. Section 8 concludes.

2 The relation between profitability and expected returns

Fama and French (2006) illustrate the intuition that book-to-market and profitability are both positively related to expected returns using the dividend discount model in conjunction with clean surplus accounting. In the dividend discount model a stock's price equals the present value of its expected dividends, while under clean surplus accounting the change in book equity equals retained earnings. Together these imply the market value of equity (cum dividend) is

$$M_t = \sum_{\tau=0}^{\infty} \mathbf{E}_t [Y_{t+\tau} - dB_{t+\tau}] / (1+r)^{\tau}, \tag{1}$$

where Y_t is time-t earnings, $dB_t = B_t - B_{t-1}$ is the change in book equity, and r is the required rate of return on expected dividends. Holding all else equal, higher valuations imply lower expected returns, while higher expected earnings imply higher expected returns. That is, value firms should outperform growth firms, and profitable firms should outperform unprofitable firms.

Fama and French (2006) test the profitability/expected return relation with mixed results. Their cross-sectional regressions suggest that earnings is related to average returns in the manner predicted, but their portfolio tests suggest that profitability adds little or nothing to the prediction of returns provided by size and book-to-market. These empirical tests, however, employ current earnings as a simple proxy for future profitability. A deeper examination of equation (1) suggests that this proxy is poor.

To see why earnings is a poor proxy for future profitability, note that current earnings consist of the economic profits created by the firm, less investments treated as operating expenses (e.g., R&D, or advertising). Letting S denote economic profits (or "surplus") and X denote investments treated as operating expenses, the previous equation can be written, recursively, as

$$M_t = (S_t - X_t) - dB_t + \frac{\mathbf{E}_t\left[M_{t+1} \middle| X = X_t, dB = dB_t\right]}{1+r}. \tag{2}$$

This equation makes explicit the fact that the earnings process in equation (1), and consequently the expected firm value tomorrow, are linked directly to decisions the firm makes today, some of which have a material impact on current earnings. That is, when considering changes to earnings in equation (1), it makes no sense to "hold all else equal." Higher expensed investment directly reduces earnings without increasing book equity. These expenses should be associated, however, with higher future economic profits, and thus higher future dividends.

The previous equation implies

$$M_t = S_t + N_t + \frac{\mathbf{E}_t\left[M_{t+1} \middle| X, dB = 0\right]}{1+r} \tag{3}$$

where N_t is the rents to expensed earnings and retained investment,

$$N_t \equiv \frac{\mathbf{E}_t\left[M_{t+1} \middle| X = X_t, dB = dB_t\right] - \mathbf{E}_t\left[M_{t+1} \middle| X, dB = 0\right]}{1+r} - (X_t + dB_t)\,.$$

Equation (3) only depends on current expensed earnings and retained investment through N_t, the rents they generate. If the rents to "plow back" are small, then N_t is small. If a dollar of expensed investment or retained earnings under the firm's optimal policy increases the expected present value of future dividends by roughly a dollar, then the dollar of expensed investment or retained earnings has essentially no effect on the cum dividend price of the stock, and is thus uninformative. Economic profitability is, however, highly informative.

It is strongly associated with prices today, both directly through its inclusion of the right hand side of 3, and indirectly because profitability is highly persistent, and thus a component of prices tomorrow. It is consequently economic profitability, not earnings, that is related to expected returns. Conditional on economic profitability, higher valuations imply lower expected stock returns, while conditional on valuations, greater economic profitability implies higher expected stock returns. That is, value firms should outperform growth firms, and profitable firms should outperform unprofitable firms, where "profitable" here means firms that generate large economic profits, not those with high earnings.

3 Profitability and profitability growth

Before considering the asset pricing implications of profitability, I first present evidence that current profitability, and in particular gross profitability, has power predicting long term growth in gross profits, earnings, and free cashflows, all of which are important determinants of future stock prices.

Table 1 reports results of Fama-MacBeth (1973) regressions of profitability growth on current profitability. The table considers both the three and ten year growths, and employs three different measures of profitability: gross profits (GP), earnings before extraordinary items (IB), and free cashflow (NI + DP - WCAPCH - CAPX). Regressions included controls for the change in gross profits over the previous three years, size (market equity), and prior year's returns (control coefficients not reported).[2] In the regressions all variables, except prior year's returns, are scaled by assets (AT). Independent variables are Winsorized at the one and 99% levels. Test-statistics are calculated using Newey-West standard errors, with two or nine lags. The sample excludes financial firms (those with one-digit SIC codes of six). The data are annual, and cover 1962 to 2009.

[2] High valuations are strongly associated with high future gross profit growth, but not strongly associated with earnings or free cashflow growth. Gross profit growth over the preceding three years is only strongly associated with long run gross profit growth. High recent past performance predicts future gross profit and earnings growth, but is negatively associated with intermediate horizon free cashflow growth.

Table 1. Profitability and profitability growth

This table reports results of Fama-MacBeth regressions of three and ten year growth in profitability, measured by gross profits (GP), earnings before extraordinary items (IB), and free cashflow (NI + DP - WCAPCH - CAPX), on current profitability. Regressions include controls for the change in gross profits over the previous three years, size (market equity), and prior year's returns (coefficients not reported). All variables, except prior year's returns, are scaled by assets (AT). Independent variables are Winsorized at the one and 99% levels. Test-statistics are calculated using Newey-West standard errors, with two or nine lags. The sample exclude financial firms (those with one-digit SIC codes of six), and covers 1963 to 2009.

independent variables	slope coefficients and [test-statistics] from regressions of the form $y_t = \boldsymbol{\beta}'\mathbf{x}_{tj} + \epsilon_{tj}$							
	$y_t = \frac{Y_{t+3} - Y_t}{\text{AT}_t}$				$y_t = \frac{Y_{t+10} - Y_t}{\text{AT}_t}$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: gross profit growth, $Y = \text{GP}$								
GP_t/AT_t	0.18			0.23	1.00			1.29
	[6.99]			[10.8]	[4.34]			[8.34]
IB_t/AT_t		-0.68		-0.36		-3.88		-3.53
		[-3.96]		[-1.44]		[-8.59]		[-5.63]
FCF_t/AT_t			-0.36	-0.45			-1.72	-1.00
			[-5.08]	[-2.81]			[-6.35]	[-3.44]
Panel B: earnings growth, $Y = \text{IB}$								
GP_t/AT_t	0.05			0.08	0.14			0.12
	[3.97]			[4.09]	[2.58]			[2.97]
IB_t/AT_t		-0.41		-0.46		-0.04		0.25
		[-7.77]		[-11.1]		[0.15]		[0.52]
FCF_t/AT_t			-0.14	0.04			0.13	-0.32
			[-4.05]	[1.29]			[1.14]	[-1.11]
Panel C: free cashflow growth, $Y = \text{FCF}$								
GP_t/AT_t	0.08			0.13	0.26			0.32
	[2.94]			[4.93]	[2.76]			[2.78]
IB_t/AT_t		-0.13		0.34		0.85		4.34
		[-1.64]		[5.31]		[1.79]		[1.50]
FCF_t/AT_t			-0.46	-0.66			-0.64	-4.02
			[-5.11]	[-8.15]			[-2.23]	[-1.47]

The first specification of Table 1 shows that current gross profits have power predicting three year growth in gross profits, earnings, and free cashflow. Holding all else equal, an increase in current gross profits of one dollar is associated with a 18 cent average increase in gross profits three years in the future, a five cent average increase in earnings three years in the future, and an eight cent average increase in free cashflows three years in the future. In contrast, specifications (2) and (3) show that current level of earnings and current free cashflows are generally associated with lower future profitability, after controlling for the change in gross profits over the previous three years (relative to assets), size (relative to assets), and prior year's returns. The fourth specification shows that including all three measures of current profitability as explanatory variables increases the power of gross profits to predict the three year growth in gross profits, earnings, and free cashflow. Holding all else equal, and controlling for current earnings and current free cashflows, an increase in current gross profits of one dollar is associated with a 23 cent average increase in gross profits three years in the future, an eight cent average increase in earnings three years in the future, and a thirteen cent average increase in free cashflows three years in the future.

Specifications (5) through (8) repeat the tests of the first four specifications, using ten year growths in profitability, as opposed to three year growths, as the dependent variables. The results are basically consistent with the test employing three year profitability growth. Current gross profits have power predicting ten year growth in gross profits, earnings, and free cashflow. Holding all else equal, an increase in current gross profits of one dollar is associated with a one dollar increase in gross profits ten years in the future, a fourteen cent average increase in earnings ten years in the future, and a 26 cent average increase in free cashflows ten years in the future. These results are little changed controlling for current earnings and free cashflow.

Including financial firms, or controlling for earnings growth or free cashflow growth instead of gross profit growth over the preceding three years, leaves the results of Table 1 qualitatively unchanged. Deflating future profits (i.e., letting the dependent variable be

$y_t = (Y_{t+N}/(1+r)^N - Y_t)/\mathrm{AT}_t$) somewhat weakens the power that current profitability has predicting gross profit growth, but generally increases the power it has predicting earnings growth and free cashflow growth.

4 Profitability and the cross-section of expected returns

Table 1 shows that current profitability, particularly as measured by gross profits, has power predicting long term growth in gross profits, earnings, and free cashflow. This section shows that current profitability also has power predicting the cross-section of expected returns.

4.1 Fama-MacBeth regressions

Table 2 shows results of regressions of firms' returns on gross profits, earnings, and free cashflow, each scaled by assets. Regressions include controls for book-to-market (log(bm)), size (log(me)), and past performance measured at horizons of one month ($r_{1,0}$) and twelve to two months ($r_{12,2}$).[3] Independent variables are Winsorized at the one and 99% levels. The sample covers July 1963 to December 2009, and excludes financial firms (i.e., those with a one-digit SIC code of six), though results including financials are qualitatively identical.[4] The table also shows results employing gross profits, earnings, and free cashflow demeaned by industry, where the industries are the Fama-French (1997) 49 industry portfolios.

[3] Book-to-market is book equity scaled by market equity, where market equity is lagged six months to avoid taking unintentional positions in momentum. Book equity is shareholder equity, plus deferred taxes, minus preferred stock, when available. For the components of shareholder equity, I employ tiered definitions largely consistent with those used by Fama and French (1993) to construct HML. Stockholders equity is as given in Compustat (SEQ) if available, or else common equity plus the carrying value of preferred stock (CEQ + PSTX) if available, or else total assets minus total liabilities (AT - LT). Deferred taxes is deferred taxes and investment tax credits (TXDITC) if available, or else deferred taxes and/or investment tax credit (TXDB and/or ITCB). Prefered stock is redemption value (PSTKR) if available, or else liquidating value (PSTKRL) if available, or else carrying value (PSTK).

[4] I employ Compustat data starting in 1962, the year of the AMEX inclusion. Because I lag accounting data to the end of June of the following year, asset pricing tests start with the returns over July 1963.

Table 2. Fama-MacBeth regressions of returns on measures of profitability

Panel A reports results from Fama-MacBeth regressions of firms' returns on gross profits (revenues minus cost of goods sold, Compustat REVT - COGS), income before extraordinary items (IB), and free cashflow (net income plus amortization and depreciation minus changes in working capital minus capital expenditures, NI + DP - WCAPCH - CAPX), each scaled by assets (AT). Panel B repeats the tests of panel A, employing profitability measures demeaned by industry (Fama-French 49). Regressions include controls for book-to-market (log(bm)), size (log(me)), and past performance measured at horizons of one month ($r_{1,0}$) and twelve to two months ($r_{12,2}$). Independent variables are Winsorized at the one and 99% levels. The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

independent variables	slope coefficients ($\times 10^2$) and [test-statistics] from regressions of the form $r_{tj} = \boldsymbol{\beta}'\mathbf{x}_{tj} + \epsilon_{tj}$ (1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: straight profitability variables						
gross profitability	0.67			0.67	0.61		0.62
	[5.06]			[5.27]	[4.88]		[4.94]
earnings		0.77		0.22		0.07	-0.28
		[1.77]		[0.49]		[0.15]	[-0.55]
free cashflow			0.65		0.31	0.91	0.73
			[2.52]		[1.20]	[2.97]	[2.44]
log(BM)	0.32	0.30	0.26	0.33	0.29	0.28	0.31
	[5.42]	[5.36]	[4.80]	[5.93]	[5.39]	[5.12]	[5.71]
log(ME)	-0.14	-0.15	-0.16	-0.13	-0.14	-0.15	-0.14
	[-3.22]	[-3.97]	[-3.95]	[-3.55]	[-3.63]	[-4.02]	[-3.62]
$r_{1,0}$	-6.10	-6.09	-6.08	-6.19	-6.18	-6.14	-6.23
	[-15.1]	[-15.3]	[-15.2]	[-15.6]	[-15.5]	[-15.5]	[-15.8]
$r_{12,2}$	0.61	0.62	0.63	0.57	0.59	0.61	0.56
	[3.28]	[3.34]	[3.42]	[3.09]	[3.18]	[3.3]	[3.07]
	Panel B: profitability variables demeaned by industry						
gross profitability	0.91			0.83	0.76		0.78
	[8.54]			[8.82]	[7.89]		[8.38]
earnings		0.87		0.28		0.09	-0.32
		[2.21]		[0.69]		[0.20]	[-0.70]
free cashflow			0.98		0.62	1.05	0.89
			[5.01]		[3.24]	[4.37]	[3.72]
log(BM)	0.32	0.29	0.27	0.32	0.3	0.27	0.3
	[5.50]	[5.01]	[4.74]	[5.38]	[5.11]	[4.75]	[5.13]
log(ME)	-0.13	-0.15	-0.15	-0.14	-0.14	-0.15	-0.14
	[-3.13]	[-3.76]	[-3.72]	[-3.48]	[-3.51]	[-3.81]	[-3.53]
$r_{1,0}$	-6.09	-6.08	-6.08	-6.12	-6.11	-6.1	-6.13
	[-15.0]	[-15.0]	[-15.0]	[-15.2]	[-15.1]	[-15.1]	[-15.2]
$r_{12,2}$	0.62	0.63	0.63	0.6	0.61	0.62	0.6
	[3.32]	[3.37]	[3.39]	[3.24]	[3.27]	[3.34]	[3.21]

The first specification of Panel A shows that gross profitability has roughly the same power as book-to-market predicting the cross-section of returns. Profitable firms generate higher average returns than unprofitable firms. The second and third specifications replace gross profitability with earnings and free cashflow, respectively. Each of these variables has power individually, though less power than gross profitability. The fourth and fifth specifications show that gross margins completely subsumes earnings, and largely subsumes free cashflow. The sixth specification shows that free cashflow subsumes earnings. The seventh specification shows that free cashflow has incremental power above that in gross profitability after controlling for earnings, but that gross profitability is still the stronger predictive variable.[5]

Panel B repeats the tests of panel A, employing gross profits-to-assets, earnings-to-assets and free cashflow-to-assets demeaned by industry. These tests tell the same basic story, though the results here are even stronger. Gross profits-to-assets is a powerful predictor of the cross-section of returns. The test-statistic on the slope coefficient on gross profits-to-assets demeaned by industry is more than one and a half times as large as that on variables associated with value and momentum (log(BM) and $r_{12,2}$). Free cashflows also has some power, though less than gross profits. Earnings convey little information regarding future performance. The use of industry-adjustment to better predict the cross-section of returns is investigated in greater detail in section 6.

Table 3 reports the time-series averages of the cross-sectional Spearman rank correlations between the independent variables employed in the Fama-MacBeth regressions of Table 2. The table shows that the earnings-related variables are, not surprisingly, all positively correlated with each other. Gross profitability and earnings are also negatively correlated

[5] Earnings before interest, taxes, depreciation and amortization (EBITDA) is equal to gross profits minus selling, general and administrative expenses (XSGA), and EBITDA and XSGA thus represent a simple decomposition of gross profits. EBITDA-to-assets and XSGA-to-assets have time-series average cross-sectional Spearman rank correlation with gross profits-to-assets of 0.51 and 0.77, respectively, and are essentially uncorrelated with each other. These variables each have significant power predicating the cross section of returns, both individually and jointly. The slope coefficients on the two, in regressions that employ both variables, are indistinguishable from each other. Gross profits-to-assets consequently subsumes both variables. Results of regressions employing these variables are presented in the appendix.

Table 3. Spearman rank correlations between independent variables

This table reports the time-series averages of the cross-section Spearman rank correlations between the independent variables employed in the Fama-MacBeth regressions of Table 2: gross profitability ((REVT - COGS)/AT), earnings (IB/AT), free cashflow ((NI + DP - WCAPCH - CAPX)/AT), book-to-market, market equity, and past performance measured at horizons of one month ($r_{1,0}$) and twelve to two months ($r_{12,2}$). The sample excludes financial firms (those with one-digit SIC codes of six), and covers 1963 to 2009.

	IB/A	FCF/A	BM	ME	$r_{1,0}$	$r_{12,2}$
gross profitability (GP/A)	0.45	0.31	-0.18	-0.03	0.02	0.09
	[58.8]	[17.6]	[-16.7]	[-2.44]	[1.81]	[6.93]
earnings (IB/A)		0.59	-0.26	0.36	0.07	0.23
		[16.4]	[-8.85]	[30.0]	[6.06]	[14.9]
free cashflows (FCF/A)			-0.03	0.19	0.07	0.18
			[-1.23]	[10.6]	[6.92]	[10.6]
book-to-market (BM)				-0.26	0.02	-0.09
				[-12.8]	[1.39]	[-4.88]
market equity (ME)					0.13	0.26
					[9.01]	[11.2]
prior month's performance ($r_{1,0}$)						0.08
						[5.22]

with book-to-market, with magnitudes similar to the negative correlation observed between book-to-market and size. Earnings and free cashflows are positively associated with size (more profitable firms have higher market values), but surprisingly the correlation between gross profitability and size is negative, though weak. These facts suggest that strategies formed on the basis of gross profits-to-assets will be growth strategies, and relatively neutral with respect to size.

Finally, it must be noted that while earnings performed poorly in Table 2, the annual accounting variables employed there are relatively stale (lagged at least six months from fiscal year end, and used for a full year), and the most recent quarterly earnings have significantly more power predicting returns than the old annual earnings employed here. Much of this additional power is not related to basic profitability, however, but can instead be attributed to post earnings announcement drift. Firms with the highest earnings over the last quarter are more likely to have quarterly earnings higher than their recent past earnings, and thus are more likely to be those with high standardized unexpected earnings (SUE, defined as the difference between the most recent quarter's earnings and earnings from the same quarter of the previous year, scaled by the standard deviation of earnings over the previous eight quarters). The time-series average cross-sectional Spearman rank correlation between quarterly ROA (quarterly earnings scaled by assets lagged one quarter) and SUE is 48.6%. High frequency return-on-assets strategies are thus formed by assigning firms to portfolios on the basis of a noisy measure of standardized unexpected earnings, and this fact partly explains their performance.

Because gross profitability appears to be the measure of basic profitability with the most power predicting the cross-section of expected returns, it is the measure I focus on for the remainder of the paper.

4.2 Sorts on profitability

The Fama-MacBeth regressions of Table 2 suggest that profitability predicts expected returns. These regressions, because they weight each observation equally, put tremendous weight on the nano- and micro-cap stocks, which make up roughly two-thirds of the market by name but less than 6% of the market by capitalization. The Fama-MacBeth regressions are also sensitive to outliers, and impose a potentially misspecified parametric relation between the variables, making the economic significance of the results difficult to judge. This section attempts to address these issues by considering the performance of portfolios sorted on profitability, non-parametrically testing the hypothesis that profitability predicts average returns.

Table 4 shows results of univariate sorts on gross profits-to-assets ((REVT – COGS) / AT). Portfolios are constructed using a quintile sort, based on New York Stock Exchange (NYSE) break points, and are rebalanced at the end of each June. The table shows the portfolios' value-weighted average excess returns, results of the regressions of the portfolios' returns on the three Fama-French factors, and the time-series average of the portfolios' gross profits-to-assets (GPA), book-to-markets (BM), and market capitalizations (ME), as well as the average number of firms in each portfolio (n). The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

The table shows that the gross profits-to-assets portfolios' average excess returns are generally increasing with profitability, with the most profitable firms earning 0.33 percent per month higher average returns than the least profitable firms, with a test-statistic of 2.63. This significant profitable-minus-unprofitable return spread is observed despite the fact that the profitable firms tend to be growth firms, while the unprofitable firms tend to be value firms. As a result, the abnormal returns of the profitable-minus-unprofitable return spread relative to the Fama-French three-factor model is 0.55 percent per month, with a test-statistic of 4.75.[6]

Consistent with the variation in HML loadings, the portfolios sorted on gross profitability exhibit large variation in book-to-market. Profitable firms tend to be growth firms, while unprofitable firms tend to be value firms. In fact, the portfolios sorted on gross profitability exhibit roughly half the variation in HML loadings and book-to-markets as the portfolios sorted on market-to-book, presented in Panel B. While the high gross profits-to-assets stocks resemble typical growth firms in both characteristics and covariances (low book-to-markets and negative HML loadings), they are extremely dissimilar in terms of average returns. That is, while the are growth firms under the standard definition, they are "good growth" firms, which tend to outperform despite their low book-to-markets.

Because the profitability strategy is a growth strategy it provides a great hedge for value strategies. The monthly average returns to the profitability and value strategies presented in Table 4 are 0.33 and 0.42 percent per month, respectively, with standard deviations of 2.96 and 3.30 percent. An investor running the two strategies together would capture both

[6] Including financial firms reduces the profitable-minus-unprofitable return spread to 0.25 percent per month, with a test-statistic of 1.86, but increases the Fama-French alpha of the spread to 0.63 percent per month, with a test-statistic of 5.71. Most financial firms end up in the first portfolio, because their large asset bases result low profits-to-assets ratios. This slightly increases the low profitability portfolio's average returns, but also significantly increases its HML loading.

Table 4. Excess returns to portfolios sorted on profitability

This table shows monthly value-weighted average excess returns to portfolios sorted on gross profits-to-assets ((REVT - COGS) / AT), employing NYSE breakpoints, and results of time-series regressions of these portfolios' returns on the Fama-French factors. It also shows time-series average portfolio characteristics (portfolio gross profits-to-assets (GPA), book-to-market (BM), average firm size (ME, in $\$10^6$), and number of firms (n)). Panel B provides similar results for portfolios sorted on book-to-market. The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

Panel A: portfolios sorted on gross profits-to-assets

		FF3 alphas and factor loadings				portfolio characteristics			
	r^e	α	MKT	SMB	HML	GPA	BM	ME	n
Low	0.28	-0.20	0.95	0.04	0.15	0.10	1.11	715	864
	[1.45]	[-2.79]	[56.7]	[1.68]	[6.08]				
2	0.38	-0.12	1.02	-0.07	0.19	0.20	0.97	1,058	644
	[1.91]	[-1.78]	[65.5]	[-3.17]	[8.25]				
3	0.49	0.01	1.02	-0.01	0.12	0.30	1.01	1,061	718
	[2.45]	[0.17]	[68.0]	[-0.24]	[5.33]				
4	0.39	0.06	1.01	0.04	-0.24	0.43	0.53	1,072	835
	[1.82]	[0.89]	[68.7]	[1.99]	[-11.0]				
High	0.61	0.35	0.92	-0.05	-0.30	0.69	0.33	1,057	1,020
	[3.04]	[5.18]	[56.7]	[-2.07]	[-12.2]				
H-L	0.33	0.55	-0.03	-0.08	-0.45				
	[2.63]	[4.75]	[-1.24]	[-2.24]	[-10.9]				

Panel B: portfolios sorted on market-to-book

		FF3 alphas and factor loadings				portfolio characteristics			
	r^e	α	MKT	SMB	HML	GPA	BM	ME	n
Low	0.79	0.07	1.01	0.26	0.53	0.21	5.49	349	755
	[3.81]	[1.05]	[60.3]	[11.2]	[20.8]				
2	0.64	-0.01	0.96	0.11	0.53	0.21	1.12	615	694
	[3.45]	[-0.19]	[74.0]	[5.87]	[27.1]				
3	0.53	0.02	0.96	0.04	0.22	0.26	0.79	797	675
	[2.81]	[0.34]	[61.3]	[1.94]	[9.53]				
4	0.44	-0.01	0.99	0.05	0.04	0.31	0.54	1,103	733
	[2.22]	[-0.23]	[77.2]	[2.82]	[2.33]				
High	0.37	0.14	0.98	-0.09	-0.40	0.43	0.25	1,841	1,022
	[1.75]	[2.97]	[87.7]	[-5.61]	[-23.7]				
H-L	-0.42	0.07	-0.04	-0.35	-0.92				
	[-3.00]	[0.76]	[-1.75]	[-12.4]	[-30.3]				

strategies' returns, 0.75 percent per month, but would face no additional risk. The monthly standard deviation of the joint strategy, despite having long/short positions twice as large as those of the individual strategies, is only 2.90 percent. As a result, the test-statistic on the average monthly returns to the 50/50 mix of profitability and value is 6.11, and its realized annual Sharpe ratio is 0.90, nearly three times the 0.32 observed on the market over the same period.

4.3 Double sorts on profitability and size

The portfolio results presented in Table 4 suggest that the power that gross profits-to-assets has predicting the cross section of average returns is economically as well as statistically significant. By analyzing portfolios double sorted on size and profitability, this section shows that its power is economically significant even among the largest, most liquid stocks. Portfolios are formed by independently quintile sorting on the two variables, using NYSE breaks. The sample excludes financial firms, and covers July 1963 to December 2009.

Table 5 reports time-series average characteristics of the size portfolios. More than half of firms are in the small portfolio, but these stocks comprise less than three percent

Table 5. Size portfolio time-series average characteristics
This table reports the time-series averages of the characteristics of quintile portfolios sorted on market equity. Portfolio break points are based on NYSE stocks only. The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

	(small)	(2)	(3)	(4)	(large)
number of firms	2,429	752	485	385	334
percent of firms	55.4	17.1	11.1	8.8	7.6
average capitalization ($\$10^6$)	37.6	196	484	1,214	9,119
total capitalization ($\$10^9$)	91	147	234	467	3,045
total capitalization (%)	2.3	3.7	5.9	11.7	76.4
portfolio book-to-market	2.63	1.35	1.05	0.88	0.61
portfolio gross profits-to-assets	0.27	0.28	0.26	0.25	0.27

of the market by capitalization, while the large portfolio typically contains fewer than 350 stocks, but makes up roughly three-quarters of the market by capitalization. The portfolios exhibit little variation in profitability, but a great deal of variation in book-to-market, with the smaller stocks tending toward value and the larger stocks toward growth.

Table 6 reports the average returns to the portfolios sorted on size and gross profits-to-assets. It also shows the average returns of both sorts' high-minus-low portfolios, and results of time-series regressions of these high-minus-low portfolios' returns on the Fama-French factors. It also shows the average number of firms in each portfolio, and the average portfolio book-to-markets. Because the portfolios exhibit little variation in gross profits-to-assets within profitability quintiles, and little variation in size within size quintiles, these characteristics are not reported.

The table shows that the profitability spread is large and significant across size quintiles. The spreads are decreasing across size quintiles, but the Fama-French three-factor alpha is almost as large for the large-cap profitability strategy as it is for small-cap strategies, because the magnitudes of the negative HML loadings on the profitability strategies are increasing across size quintiles. That is, the predictive power of profitability is economically significant even among the largest stocks, and its incremental power above and beyond book-to-market is largely undiminished with size.

Among the largest stocks, the profitability spread of 29 basis points per month (test statistic of 2.05) is considerably larger that the value spread of 16 basis points per month (test statistic of 1.06). The two strategies have a negative correlation of -0.59, and consequently perform very well together. While the two strategies' realized annual Sharpe ratios over the period are only 0.30 and 0.16, respectively, a 50/50 mix of the two strategies had a Sharpe ratio of 0.49. While not nearly as large as the 0.90 Sharpe ratio observed in the previous section on the 50/50 mix of the value-weighted profitability and value strategies that trade stocks of all sizes, this Sharpe ratio still greatly exceeds the 0.32 Sharpe ratio observed on the market over the same period. It does so despite trading exclusively in the

Table 6. Double sorts on gross profits-to-assets and market equity

This table shows the value-weighted average excess returns to portfolios double sorted, using NYSE breakpoints, on gross profits-to-assets and market equity, and results of time-series regressions of both sorts' high-minus-low portfolios' returns on the Fama-French factors. The table also shows the average number of firms in each portfolio, and each portfolios' average book-to-market (the portfolios exhibit little gross-profits to asset variation within size quintiles, and little size variation within profitability quintiles). The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

Panel A: portfolio average returns and time-series regression results

		gross profits-to-asset quintiles					profitability strategies				
		L	2	3	4	H	r^e	α	β_{mkt}	β_{smb}	β_{hml}
size quintiles	S	0.36	0.60	0.76	0.85	1.03	0.67	0.62	0.06	-0.13	0.15
							[4.53]	[4.11]	[1.78]	[-2.59]	[2.73]
	2	0.33	0.69	0.66	0.70	0.87	0.54	0.54	0.02	0.05	-0.07
							[3.94]	[3.91]	[0.58]	[1.19]	[-1.40]
	3	0.35	0.69	0.70	0.64	0.77	0.42	0.40	0.09	0.18	-0.16
							[2.92]	[2.85]	[2.82]	[4.02]	[-3.14]
	4	0.42	0.57	0.57	0.62	0.80	0.38	0.46	0.02	0.21	-0.35
							[2.75]	[3.60]	[0.81]	[5.01]	[-7.66]
	B	0.26	0.34	0.46	0.34	0.55	0.29	0.54	-0.06	-0.05	-0.53
							[2.05]	[4.22]	[-1.84]	[-1.22]	[-11.6]
small-minus-big strategies	r^e	0.10	0.26	0.29	0.51	0.49					
		[0.37]	[1.29]	[1.43]	[2.52]	[2.20]					
	α	-0.16	-0.16	-0.11	-0.04	-0.09					
		[-0.97]	[-1.62]	[-1.06]	[-0.36]	[-0.79]					
	β_{mkt}	-0.05	0.01	-0.01	0.02	0.07					
		[-1.17]	[0.53]	[-0.36]	[0.75]	[2.87]					
	β_{smb}	1.53	1.34	1.34	1.33	1.45					
		[28.5]	[40.6]	[38.6]	[39.5]	[41.2]					
	β_{hml}	-0.26	0.20	0.17	0.49	0.42					
		[-4.38]	[5.51]	[4.55]	[13.4]	[10.8]					

Panel B: portfolio average number of firms (left) and portfolio book-to-markets (right)

		gross profits-to-asset quintiles					gross profits-to-asset quintiles				
		L	2	3	4	H	L	2	3	4	H
		number of firms					book-to-market				
size quintiles	S	420	282	339	416	517	4.21	4.65	2.63	1.82	1.07
	2	123	106	123	143	161	1.49	1.92	1.87	1.14	0.69
	3	84	76	80	88	104	1.26	1.46	1.2	0.93	0.54
	4	76	68	65	67	77	1.15	1.05	0.99	0.72	0.43
	B	63	64	59	61	72	0.97	0.81	0.93	0.42	0.27

largest two-thirds of fortune 500 universe.

4.3.1 Fortune 500 profitability and book-to-market strategies

While the Sharpe ratio on the large cap mixed value and growth strategy is 0.49, one and a half times that on the market, this performance is driven by the fact that the profitability strategy is an excellent hedge for value. As a result, the large cap mixed value and growth strategy has extremely low volatility (standard deviations of monthly returns of 1.59 percent), and consequently has a high Sharpe ratio despite generating relatively modest average returns (0.23 percent per month). This section shows that a simple trading strategy, based on gross profits-to-assets and book-to-market, generates average excess returns of almost eight percent per year. It does so despite trading only infrequently, in only the largest, most liquid stocks.

The strategy I consider is constructed within the 500 largest non-financial stocks for which gross profits-to-assets and book-to-market are both available. Each year I rank these stocks based on their gross profits-to-assets and book-to-market ratios. At the end of each June the strategy buys one dollar of each of the 150 stocks with the highest average of the profitability and value ranks, and shorts one dollar of each of the 150 stocks with the lowest average ranks.[7] The performance of this strategy is provided in Table 7. The table also shows, for comparison, the performance of similarly constructed strategies based on profitability and value individually.

This simple strategy generates average excess returns of 0.64 percent per month, and has a realized annual Sharpe ratio of 0.76, almost two and a half times that observed on the market. These large firms returned on average 0.41 percent per month over the period, so the strategy makes 58 percent of its profits on the long side, and 42 percent on the short

[7] Well known firms among those with the highest combined gross profits-to-assets and book-to-market ranks at the end of the sample are Astrazeneca, SAP, Sun Microsystems, Sears and JC Penny, while the lowest ranking firms include Vertex Pharmaceuticals, Plum Creek Timber, Marriott International, Lockheed Martin and Delta Airlines. Among the largest firms held on the long side of the strategy are Intel, ConocPhillips, CVS, Home Depot and Time Warner, while the short side includes Intel, Apple, GE, Oracle and McDonalds.

Table 7. Performance of large stock profitability and value strategies

This table shows the performance of portfolios formed using only the 500 largest non-financial firms for which gross profits-to-assets (GPA) and book-to-market (BM) are both available. Portfolios are tertile sorted on GPA (Panel A), BM (Panel B), and the sum of the firms' GPA and BM ranks within the sample (Panel C). It also shows time-series average portfolio characteristics (portfolio GPA, portfolio BM, average firm size (ME, in $\$10^6$), and number of firms (n)). The sample covers July 1963 to December 2009.

Panel A: portfolios sorted on gross profits-to-assets

		FF3 alphas and factor loadings				portfolio characteristics			
	r^e	α	MKT	SMB	HML	GPA	BM	ME	n
Low	0.34	-0.17	1.02	-0.03	0.23	0.13	1.02	5,529	150
	[1.70]	[-2.18]	[54.1]	[-1.25]	[8.07]				
2	0.54	-0.00	1.13	0.11	0.08	0.31	0.85	7,536	200
	[2.37]	[-0.01]	[72.7]	[5.12]	[3.48]				
High	0.63	0.25	1.03	0.08	-0.17	0.64	0.41	8,940	150
	[2.90]	[3.80]	[66.6]	[3.78]	[-7.53]				
H-L	0.28	0.42	0.00	0.11	-0.40				
	[2.38]	[3.90]	[0.05]	[3.20]	[-10.5]				

Panel B: portfolios sorted on book-to-market

	r^e	α	MKT	SMB	HML	GPA	BM	ME	n
Low	0.35	0.07	1.10	0.04	-0.49	0.51	0.25	10,086	150
	[1.40]	[1.05]	[68.0]	[1.91]	[-19.9]				
2	0.49	-0.01	1.07	0.07	0.09	0.34	0.58	7,004	200
	[2.33]	[-0.22]	[78.7]	[3.66]	[4.33]				
High	0.68	0.02	1.02	0.06	0.53	0.22	1.54	5,092	150
	[3.49]	[0.28]	[71.9]	[3.06]	[24.9]				
H-L	0.34	-0.06	-0.08	0.02	1.02				
	[2.22]	[-0.72]	[-4.49]	[0.68]	[37.0]				

Panel C: portfolios sorted on average gross profits-to-assets and book-to-market ranks

	r^e	α	MKT	SMB	HML	GPA	BM	ME	n
Low	0.15	-0.22	1.13	0.01	-0.27	0.22	0.45	7,499	150
	[0.59]	[-2.43]	[52.5]	[0.26]	[-8.27]				
2	0.57	0.10	1.01	0.03	0.10	0.38	0.68	8,518	200
	[2.89]	[1.90]	[85.3]	[1.53]	[5.31]				
High	0.78	0.16	1.08	0.15	0.30	0.45	1.20	5,669	150
	[3.68]	[2.69]	[75.1]	[7.72]	[13.8]				
H-L	0.64	0.39	-0.05	0.15	0.56				
	[5.21]	[3.77]	[-1.92]	[4.38]	[15.6]				

side. The strategy requires little rebalancing, because both gross profits-to-assets and book-to-market are highly persistent. Only one-third of each side of the strategy turns over each year.

4.4 Double sorts on profitability and book-to-market

The negative correlation between profitability and book-to-market observed in Table 4 suggests that the performance of value strategies can be improved by controlling for profitability, and that the performance of profitability strategies can be improved by controlling for book-to-market. A univariate sort on book-to-market yields a value portfolio "polluted" with unprofitable stocks, and a growth portfolio "polluted" with profitable stocks. A value strategy that avoids holding stocks that are "more unprofitable than cheap," and avoids selling stocks that are "more profitable than expensive," should outperform conventional value strategies. Similarly, a profitability strategy that avoids holding stocks that are profitable but "fully priced," and avoids selling stocks that are unprofitable but "cheap," should outperform conventional profitability strategies.

This section tests these predictions by analyzing the performance of portfolios independently double sorted on gross profits-to-assets and book-to-market. Portfolios are formed by independently quintile sorting on the two variables, using NYSE breaks. The sample excludes financial firms, and covers July 1963 to December 2009. Table 8 shows the double sorted portfolios' average returns, the average returns of both sorts' high-minus-low portfolios, and results of time-series regressions of these high-minus-low portfolios' returns on the Fama-French factors. It also shows the average number of firms in each portfolio, and the average size of firms in each portfolio. Because the portfolios exhibit little variation in gross profits-to-assets within profitability quintiles, and little variation in gross book-to-market within book-to-market quintiles, these characteristics are not reported.

The table confirms the prediction that controlling for profitability improves the performance of value strategies and controlling for book-to-market improves the performance

Table 8. Double sorts on gross profits-to-assets and book-to-market

This table shows the value-weighted average excess returns to portfolios double sorted, using NYSE breakpoints, on gross profits-to-assets and book-to-market, and results of time-series regressions of both sorts' high-minus-low portfolios' returns on the Fama-French factors. The table also shows the average number of firms, and the average size of firms, in each portfolio (the portfolios exhibit little gross-profits to asset variation within book-to-market quintiles, and little book-to-market variation within profitability quintiles). The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

Panel A: portfolio average returns and time-series regression results

		gross profits-to-asset quintiles					profitability strategies				
		L	2	3	4	H	r^e	α	β_{mkt}	β_{smb}	β_{hml}
book-to-market quintiles	L	-0.13	0.13	0.23	0.23	0.55	0.68	0.86	-0.25	-0.27	-0.00
							[3.71]	[4.88]	[-6.03]	[-4.67]	[-0.07]
	2	0.17	0.27	0.38	0.70	0.88	0.71	0.70	-0.13	0.26	-0.00
							[4.09]	[4.02]	[-3.19]	[4.54]	[-0.02]
	3	0.36	0.35	0.72	0.66	0.85	0.49	0.27	0.09	0.52	0.10
							[2.74]	[1.66]	[2.21]	[9.72]	[1.76]
	4	0.45	0.59	0.90	1.02	0.94	0.49	0.37	0.06	0.65	-0.16
							[2.69]	[2.33]	[1.61]	[12.65]	[-2.78]
	H	0.62	0.82	0.95	1.12	1.03	0.42	0.35	-0.05	0.50	-0.09
							[2.36]	[2.09]	[-1.25]	[9.19]	[-1.53]
book-to-market strategies	r^e	0.75	0.69	0.72	0.89	0.49					
		[3.58]	[3.65]	[3.84]	[4.94]	[2.56]					
	α	0.43	0.31	0.41	0.43	-0.08					
		[2.60]	[1.91]	[2.36]	[3.07]	[-0.54]					
	β_{mkt}	-0.17	-0.06	-0.05	-0.05	0.03					
		[-4.36]	[-1.51]	[-1.13]	[-1.67]	[0.90]					
	β_{smb}	-0.02	0.27	0.33	0.76	0.75					
		[-0.39]	[5.00]	[5.78]	[16.8]	[16.2]					
	β_{hml}	0.95	0.81	0.58	0.70	0.87					
		[16.2]	[13.8]	[9.42]	[14.2]	[17.2]					

Panel B: portfolio average number of firms (left) and average firm size (right, $\$10^6$)

		gross profits-to-asset quintiles					gross profits-to-asset quintiles				
		L	2	3	4	H	L	2	3	4	H
		number of firms					average firm size				
BM quintiles	L	194	102	128	194	342	620	1,367	1,802	2,581	2,315
	2	104	95	129	169	191	950	1,652	1,550	1,140	617
	3	112	104	127	144	142	921	1,352	1,165	500	261
	4	144	129	127	127	118	881	1,056	583	247	170
	H	174	151	135	120	108	509	385	419	182	92

of profitability strategies. The average value spread across gross profits-to-assets quintiles is 0.71 percent per month, and in every book-to-market quintile exceeds the 0.42 percent per month spread on the unconditional value strategy presented in Table 4. The average profitability spread across book-to-market quintiles is 0.56 percent per month, and in every book-to-market quintile exceeds the 0.33 percent per month spread on the unconditional profitability strategy presented in Table 4.

4.4.1 Double sorts on profitability and book-to-market split by size

Table 8 shows that profitability strategies constructed within book-to-market quintiles are more profitable than the unconditional profitability strategy, while value strategies constructed within profitability quintiles are more profitable than the unconditional value strategy. The book-to-market sort yields a great deal of variation in firm size, however, especially among the more profitable stocks, making the results more difficult to interpret. The next two tables address this by double sorting on profitability and book-to-market within the large and small cap universes, respectively, where these are defined as firms with market capitalizations above and below the NYSE median. The gross profits-to-assets and book-to-market breaks are determined using all large or small non-financial stocks (NYSE, AMEX and NASDAQ).

Table 9 shows the large cap results, which are largely consistent with the all-stock results presented in Table 8. Again, controlling for profitability improves the performance of value strategies and controlling for book-to-market improves the performance of profitability strategies. The average large cap value spread across gross profits-to-assets quintiles is 0.64 percent per month, and in every book-to-market quintile exceeds the 0.29 percent per month spread generated by the unconditional large cap value strategy. The average large cap profitability spread across book-to-market quintiles is 0.54 percent per month, and in every book-to-market quintile exceeds the 0.36 percent per month spread generated by the unconditional large cap profitability strategy. These results should be treated cautiously,

Table 9. Double sorts on gross profits-to-assets and book-to-market, large stocks

This table shows the value-weighted average excess returns to large cap portfolios double sorted on gross profits-to-assets and book-to-market, and results of time-series regressions of both sorts' high-minus-low portfolios' returns on the Fama-French factors. Large cap is defined as bigger than the NYSE median. The table also shows the average number of firms, and the average size of firms, in each portfolio (the portfolios exhibit little gross-profits to asset variation within book-to-market quintiles, and little book-to-market variation within profitability quintiles). The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

Panel A: portfolio average returns and time-series regression results

		gross profits-to-asset quintiles					profitability strategies				
		L	2	3	4	H	r^e	α	β_{mkt}	β_{smb}	β_{hml}
book-to-market quintiles	L	-0.13	0.00	0.20	0.20	0.53	0.65	0.84	-0.38	-0.20	0.05
							[2.50]	[3.33]	[-6.43]	[-2.45]	[0.61]
	2	0.10	0.22	0.38	0.44	0.69	0.59	0.57	-0.14	0.01	0.18
							[2.80]	[2.69]	[-2.87]	[0.14]	[2.43]
	3	0.15	0.28	0.41	0.72	0.59	0.44	0.37	-0.04	0.09	0.13
							[2.25]	[1.89]	[-0.86]	[1.44]	[1.91]
	4	0.29	0.41	0.79	0.55	0.80	0.50	0.31	0.15	0.26	0.16
							[2.66]	[1.65]	[3.41]	[4.20]	[2.35]
	H	0.49	0.66	0.85	1.03	0.99	0.50	0.49	0.05	0.26	-0.19
							[2.06]	[2.02]	[0.95]	[3.33]	[-2.25]
book-to-market strategies	r^e	0.62	0.66	0.65	0.83	0.46					
		[2.15]	[2.87]	[2.87]	[4.06]	[1.83]					
	α	0.33	0.26	0.28	0.35	-0.03					
		[1.39]	[1.46]	[1.40]	[1.98]	[-0.12]					
	β_{mkt}	-0.39	-0.20	-0.06	0.02	0.04					
		[-7.11]	[-4.68]	[-1.29]	[0.39]	[0.79]					
	β_{smb}	0.01	0.08	0.05	0.64	0.47					
		[0.15]	[1.34]	[0.79]	[11.2]	[6.22]					
	β_{hml}	1.10	1.12	0.92	0.76	0.85					
		[13.2]	[17.8]	[13.1]	[12.2]	[10.2]					

Panel B: portfolio average number of firms (left) and average firm size (right, $\$10^6$)

		gross profits-to-asset quintiles					gross profits-to-asset quintiles				
		L	2	3	4	H	L	2	3	4	H
		number of firms					average firm size				
BM quintiles	L	16	18	26	47	89	2,753	2,858	3,568	6,842	6,435
	2	20	30	41	54	51	4,609	3,427	4,118	4,621	2,901
	3	28	38	50	49	30	2,535	3,506	3,464	2,729	1,656
	4	50	52	46	30	16	2,399	3,116	2,898	1,584	1,344
	H	80	57	32	15	8	2,302	2,667	2,329	1,373	1,180

Table 10. Double sorts on gross profits-to-assets and book-to-market, small stocks
This table shows the value-weighted average excess returns to large cap portfolios double sorted on gross profits-to-assets and book-to-market, and results of time-series regressions of both sorts' high-minus-low portfolios' returns on the Fama-French factors. Small cap is defined as smaller than the NYSE median. The table also shows the average number of firms, and the average size of firms, in each portfolio (the portfolios exhibit little gross-profits to asset variation within book-to-market quintiles, and little book-to-market variation within profitability quintiles). The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

Panel A: portfolio average returns and time-series regression results

		gross profits-to-asset quintiles					profitability strategies				
		L	2	3	4	H	r^e	α	β_{mkt}	β_{smb}	β_{hml}
book-to-market quintiles	L	-0.43	-0.08	0.15	0.37	0.68	1.12	1.12	-0.00	-0.23	0.13
							[5.69]	[5.68]	[-0.10]	[-3.52]	[1.85]
	2	0.42	0.37	0.50	0.76	1.02	0.60	0.49	0.02	-0.23	0.39
							[2.79]	[2.30]	[0.44]	[-3.32]	[5.16]
	3	0.36	0.65	0.74	0.92	1.19	0.82	0.68	0.12	0.09	0.17
							[4.80]	[3.90]	[3.00]	[1.61]	[2.83]
	4	0.77	0.93	1.12	1.02	0.85	0.08	0.00	0.01	0.19	0.06
							[0.50]	[0.03]	[0.29]	[3.44]	[1.06]
	H	0.75	0.94	0.99	1.22	1.12	0.36	0.41	-0.15	0.17	-0.05
							[2.04]	[2.27]	[-3.64]	[2.92]	[-0.82]
book-to-market strategies	r^e	1.19	1.02	0.84	0.85	0.43					
		[4.62]	[4.66]	[4.30]	[4.27]	[2.10]					
	α	0.82	0.75	0.59	0.63	0.10					
		[4.27]	[4.30]	[4.03]	[3.94]	[0.66]					
	β_{mkt}	0.02	-0.14	-0.16	-0.17	-0.13					
		[0.34]	[-3.40]	[-4.56]	[-4.54]	[-3.66]					
	β_{smb}	-0.52	-0.22	-0.20	-0.17	-0.12					
		[-8.28]	[-3.93]	[-4.19]	[-3.16]	[-2.32]					
	β_{hml}	1.18	0.93	0.89	0.79	1.00					
		[17.4]	[15.2]	[17.0]	[13.9]	[18.1]					

Panel B: portfolio average number of firms (left) and average firm size (right, $\$10^6$)

		gross profits-to-asset quintiles					gross profits-to-asset quintiles				
		L	2	3	4	H	L	2	3	4	H
		number of firms					average firm size				
BM quintiles	L	140	75	76	97	139	79	92	104	112	102
	2	86	84	105	125	131	78	110	111	105	91
	3	79	101	120	125	105	83	111	101	90	77
	4	85	126	123	108	84	80	93	79	64	57
	H	118	143	110	82	67	58	64	55	46	38

however, as among large cap stocks there are very few unprofitable growth or profitable value firms, and the low-low and high-high corners are consequently very thin.

Table 10 shows the small cap results, which differ somewhat from the all-stock results presented in Table 8. Here controlling for profitability has little impact on the performance of value strategies, and controlling for book-to-market has little impact on the performance of profitability strategies. The average small cap value spread across gross profits-to-assets quintiles is 0.87 percent per month, only slightly higher than the 0.83 percent per month spread generated by the unconditional small cap value strategy. The average small cap profitability spread across book-to-market quintiles is 0.60 percent per month, slightly less than the 0.63 percent per month spread generated by the unconditional small cap profitability strategy.

4.4.2 Conditional value and profitability "factors"

Table 8 suggests that HML would be more profitable if it were constructed controlling for profitability. This section confirms this hypothesis explicitly. It also shows that a "profitability factor," constructed using a similar methodology, has a larger information ratio relative to the three Fama-French factors than does UMD.

These conditional value and profitability factors are constructed using the same basic methodology employed in the construction of HML. Instead of using a tertile sort on book-to-market, however, they use either 1) tertile sorts on book-to-market within gross profitability deciles, or 2) tertile sorts on gross profitability within book-to-market deciles. That is, a firm is deemed a "value" ("growth") stock if it has a book-to-market higher (lower) than 70 percent of the NYSE firms in the same gross profitability decile, and is considered "profitable" ("unprofitable") if it has a gross profits-to-assets higher (lower) than 70 percent of the NYSE firms in the same book-to-market decile. Table 11 shows results of time-series regressions employing these HML-like factors, HML|GP ("HML conditioned on gross profitability") and PMU|BM ("profitable-minus-unprofitable condi-

Table 11. HML constructed conditioning on gross profitability

This table shows the performance of HML-like factors based on 1) book-to-market within gross profitability deciles (HML | GP), and 2) gross profitability within book-to-market deciles (PMU | BM). That is, a firm is deemed a "value" ("growth") stock if it has a book-to-market higher (lower) than 70% of the NYSE firms in the same gross profitability decile, and is considered "profitable" ("unprofitable") if it has a gross profits-to-assets higher (lower) than 70% of the NYSE firms in the same book-to-market decile. The strategies exclude financial firms (those with one-digit SIC codes of six). The table shows the factors' average monthly excess returns, and time series regression of the strategies' returns on HML and the three Fama-French factors. The sample covers July 1963 to December 2009.

independent variables	dependent variable									
	HML | GP			PMU | BM			HML		PMU	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
intercept	0.54	0.22	0.22	0.49	0.49	0.52	0.42	-0.06	0.33	0.03
	[5.00]	[4.37]	[4.29]	[5.40]	[5.41]	[5.66]	[3.34]	[-1.12]	[3.37]	[0.83]
MKT			-0.03			-0.07				
			[-2.22]			[-3.15]				
SMB			0.05			0.04				
			[3.32]			[1.48]				
HML		0.77	0.77		-0.01	-0.03				
		[45.4]	[42.9]		[-0.42]	[-1.07]				
HML | GP								1.04		-0.32
								[47.3]		[-21.3]
PMU | BM								-0.16		0.97
								[-6.26]		[53.1]
adj.-R^2 (%)		78.7	79.1		0.0	1.3		80.0		84.6

tioned on book-to-market"), over the sample July 1963 to December 2009.

The first specification shows that controlling for profitability does indeed improve the performance of HML. HML | GP generates excess average returns of 0.54 percent per month over the sample, with a test statistic of 5.00. This compares favorably with the 0.42 percent per month, with a test statistic of 3.34, observed on HML. The second and third specifications show that HML | GP has an extremely large information ratio relative to HML and the three Fama-French factors (abnormal return test-statistics exceeding four). It is essentially orthogonal to momentum, so also has a large information ratio relative to the three Fama-French factors plus UMD.

The fourth specification shows that the profitability factor constructed controlling for book-to-market is equally profitable. PMU|BM generates excess average returns of 0.49 percent per month, with a test statistic of 5.40. The fifth and sixth specifications show that PMU|BM has an enormous information ratio relative to HML and the three Fama-French factors. In fact, its information ratio relative to the three Fama-French factors exceeds that of UMD (abnormal return test-statistics of 5.41 and 5.66, respectively). It is essentially orthogonal to momentum, so has a similarly large information ratio relative to the three Fama-French factors plus UMD.

The fifth and sixth specifications show that while canonical HML has a high realized Sharpe ratio over the sample, it is inside the span of HML|GP and PMU|BM. HML loads heavily on HML|GP (slope of 1.04), and garners a moderate, though highly significant, negative loading on PMU|BM (slope of -0.16). These loadings explain all of the performance of HML, which has completely insignificant abnormal returns relative to these two factors. Including the market and SMB as explanatory variables has essentially no impact on this result.

The last two specifications consider a profitability factor constructed without controlling for book-to-market. They show that this factor generates significant average returns, but is much less profitable than the factor constructed controlling for book-to-market. This factor is also long "real" profitability, with a 0.97 loading on PMU|BM, but short "real" value, with a -0.32 loading on HML|GP.

The conditional value and profitability factors HML|GP and PMU|BM are studied in greater detail in Section 7. It particular, Section 7 shows that replacing the canonical value factor HML with these conditional factors improves the performance of the Fama-French model pricing a wide variety of anomaly trading strategies. In fact, it shows that the alternative model employing HML|GP and PMU|BM even out performs the Fama-French model pricing the canonical Fama-French (1993) test assets, the 25 portfolios sorted on size and book-to-market.

5 Margins or turnover?

Firm profitability is driven by two dimensions, asset turnover and gross margins,

$$\frac{\text{gross profits}}{\text{assets}} = \underbrace{\frac{\text{sales}}{\text{assets}}}_{\substack{\text{asset}\\ \text{turnover}}} \times \underbrace{\frac{\text{gross profits}}{\text{sales}}}_{\substack{\text{gross}\\ \text{margins}}},$$

a decomposition known in the accounting literature as the "Du Pont model." Asset turnover, which quantifies the ability of assets to "generate" sales, is often regarded as a measure of efficiency. Gross margins, which quantifies how much of each dollar of sales goes to the firm, is a measure of profitability. It relates directly, in standard oligopoly models, to firms' market power. Asset turnover and gross margins are generally negatively related. A firm can increase sales, and thus asset turnover, by lowering prices, but lower prices reduces gross margins. Conversely, a firm can increase gross margins by increasing prices, but this generally reduces sales, and thus asset turnover.[8]

Given this simple decomposition of gross profitability into asset turnover and gross margins, it seems natural to ask which of these two dimensions of profitability, if either, drives profitability's power to predict the cross-section of returns. The results of this section suggest that both dimensions have power, but that this power is subsumed by basic profitability. That is, it appears that the decomposition of profitability into asset turnover and gross margins does not add any incremental information beyond that contained in gross profitability alone. The results do suggest, however, that high asset turnover is more directly associated with higher returns, while high margins are more strongly associated with "good growth." That is, high sales-to-assets firms tend to outperform on an absolute basis, while firms that sell their goods at high mark-ups tend to be growth firms that outperform

[8] The time-series average of the Spearman rank correlation of firms' asset turnovers and gross margins in the cross-section is -0.27, in the sample spanning 1963 to 2009 that excludes financial firms. Both asset turnover and gross margins are strongly positively correlated with gross profitability in the cross-section (time-series average Spearman rank correlations of 0.67 and 0.43, respectively).

Table 12. Fama-MacBeth regressions with asset turnover and gross margins

This table reports results from Fama-MacBeth regressions of firms' returns on profitability (gross profits-to-assets, measured as revenues minus cost of goods sold (REVT - COGS) scaled by assets (AT)), asset turnover (REVT / AT), and gross margins (GP / REVT). Regressions include controls for book-to-market (log(bm)), size (log(me)), and past performance measured at horizons of one month ($r_{1,0}$) and twelve to two months ($r_{12,2}$). Independent variables are Winsorized at the one and 99% levels. The sample covers July 1963 to December 2009, and excludes financial firms (those with one-digit SIC codes of six).

independent variables	slope coefficients ($\times 10^2$) and [test-statistics] from regressions of the form $r_{tj} = \boldsymbol{\beta}'\mathbf{x}_{tj} + \epsilon_{tj}$ (1)	(2)	(3)	(4)	(5)	(6)	(7)
profits-to-assets	0.67			0.79	0.77		0.86
	[5.06]			[6.57]	[5.65]		[5.59]
asset turnover		0.10		-0.05		0.13	-0.04
		[2.28]		[-1.28]		[2.96]	[-0.91]
gross margins			0.33		0.19	0.36	0.11
			[3.41]		[1.68]	[3.46]	[0.66]
log(BM)	0.32	0.29	0.32	0.32	0.35	0.31	0.34
	[5.42]	[5.00]	[5.59]	[5.56]	[5.98]	[5.43]	[5.95]
log(ME)	-0.14	-0.14	-0.14	-0.14	-0.13	-0.14	-0.13
	[-3.22]	[-3.23]	[-3.42]	[-3.27]	[-3.17]	[-3.21]	[-3.15]
$r_{1,0}$	-6.10	-6.09	-5.98	-6.14	-6.10	-6.08	-6.15
	[-15.1]	[-15.2]	[-14.7]	[-15.3]	[-15.1]	[-15.1]	[-15.3]
$r_{12,2}$	0.61	0.62	0.67	0.60	0.60	0.62	0.60
	[3.28]	[3.34]	[3.57]	[3.23]	[3.25]	[3.36]	[3.23]

their peers.

Table 12 shows results of Fama-MacBeth regressions of firms' returns on gross profitability, asset turnover, and gross margins. These regressions include controls for book-to-market (log(bm)), size (log(me)), and past performance measured at horizons of one month ($r_{1,0}$) and twelve to two months ($r_{12,2}$). Independent variables are Winsorized at the one and 99 percent levels. The sample covers July 1963 to December 2009, and excludes financial firms (those with one-digit SIC codes of six).

Specification one, which employs gross profitability, is identical to the first specification in Table 2. It shows the baseline result, that gross profitability has roughly the same power as book-to-market predicting the cross-section of returns. The second and third specifications replace gross profitability with asset turnover and gross margins, respectively. Each of these variables has power individually, especially gross margins, but less power than gross profitability. The fourth specification shows that gross margins completely subsumes asset turnover, but that including asset turnover increases the coefficient estimated on gross profitability, and improves the precision with which it is estimated. The fifth specification shows that gross margins has some incremental power after controlling for gross profitability. The sixth and seventh specifications show that asset turnover and gross margins both have power when used together, but neither has power when used in conjunction with gross profitability.

Table 13 shows results of univariate sorts on asset turnover and gross margins. These tests employ the same methodology as that employed in Table 4, replacing gross profitability with asset turnover and gross margins. The table shows the portfolios' value-weighted average excess returns, results of time-series regression of the portfolios' returns on the three Fama-French factors, and the time-series averages of the portfolios' gross profits-to-assets (GPA), book-to-markets (BM), and market capitalizations (ME), as well as the average number of firms in each portfolio (n).

Panel A provides results for the five portfolios sorted on asset turnover. The portfolios' average excess returns are increasing with asset turnover, but show little variation in loadings on the three Fama-French factors. As a result, the high-minus-low turnover strategy produces significant average excess returns that cannot be explained by the Fama-French model. The portfolios show a great deal of variation in gross profitability, with more profitable firms in the high asset turnover portfolios. They show some variation in book-to-market, with the high turnover firms commanding higher average valuation rations, but this variation in book-to-market across portfolios is not reflected in the portfolios' HML loadings.

Panel B provides results for the five portfolios sorted on gross margins. Here the port-

Table 13. Excess returns to portfolios sorted on asset turnover and gross margins
This table shows monthly value-weighted average excess returns to portfolios sorted on asset turnover (REVT / AT, Panel A) and gross margins ((REVT - COGS) / REVT, Panel B). It also shows results of time-series regressions of these portfolios' returns on the Fama-French factors, and time-series average portfolio characteristics (portfolio gross profits-to-assets (GPA), book-to-market (BM), average firm size (ME, in $\$10^6$), and number of firms (n)). The sorts employ NYSE breakpoints. The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

		FF3 alphas and factor loadings				portfolio characteristics			
	r^e	α	MKT	SMB	HML	GPA	BM	ME	n
				panel A: portfolios sorted on asset turnover					
Low	0.25	-0.12	0.92	-0.05	0.00	0.13	0.93	954	908
	[1.34]	[-1.57]	[49.6]	[-2.10]	[0.15]				
2	0.43	0.09	1.00	-0.06	-0.15	0.26	0.71	1,408	718
	[2.13]	[1.51]	[71.2]	[-3.25]	[-7.09]				
3	0.49	0.10	1.01	0.00	-0.09	0.34	0.79	1,287	709
	[2.43]	[2.05]	[85.4]	[-0.02]	[-4.91]				
4	0.53	0.08	1.01	0.04	0.01	0.37	0.61	838	801
	[2.59]	[1.39]	[73.7]	[2.32]	[0.64]				
High	0.62	0.17	0.96	0.17	-0.01	0.48	0.57	602	945
	[2.96]	[2.03]	[47.5]	[6.13]	[-0.19]				
H-L	0.36	0.30	0.04	0.22	-0.01				
	[2.66]	[2.18]	[1.17]	[5.05]	[-0.20]				
				panel B: portfolios sorted on gross margins					
Low	0.41	-0.17	1.03	0.28	0.17	0.16	1.07	498	906
	[1.93]	[-2.76]	[72.3]	[14.5]	[8.18]				
2	0.48	-0.04	1.00	0.04	0.21	0.26	0.87	1,072	672
	[2.43]	[-0.59]	[62.7]	[1.97]	[8.64]				
3	0.45	-0.04	1.04	-0.03	0.13	0.27	1.04	952	674
	[2.23]	[-0.80]	[84.3]	[-1.58]	[7.18]				
4	0.44	0.04	0.97	-0.03	-0.01	0.29	0.68	976	763
	[2.29]	[0.74]	[79.0]	[-1.76]	[-0.28]				
High	0.44	0.21	0.94	-0.10	-0.35	0.36	0.44	1,461	1,027
	[2.19]	[4.59]	[86.4]	[-6.40]	[-21.64]				
H-L	0.02	0.38	-0.09	-0.38	-0.53				
	[0.22]	[4.38]	[-4.42]	[-13.5]	[-17.3]				

folios' average excess returns exhibit little variation across portfolios, but large variation in their loadings on SMB and especially HML, with the high margin firms covarying more with large growth firms. As a result, while the high-minus-low turnover strategy does not produce significant average excess returns, it produces highly significant abnormal returns relative to the Fama-French model, 0.42 percent per month with a test statistic of 4.77. The portfolios show less variation in gross profitability than do the portfolios sorted on asset turnover, though the high margin firms are more profitable, on average, than the low margin firms. The portfolios sorted on gross margins exhibit far more variation in book-to-market, however, than the asset turnover portfolios, with high margin firms commanding high valuations ratios. These firms are emphatically growth firms, both possessing the defining characteristic (low book-to-markets) and garnering large negative loadings on the canonical value factor. These growth firms selected on the basis of gross margins are "good growth" firms, however, which dramatically outperform their peers in size and book-to-market.

6 Controlling for industries

Table 2 suggests that industry-adjusted gross profitability has more power than gross profitability predicting the cross-section of expected returns. This fact suggests that strategies formed on the basis of industry-adjusted characteristics should outperform similar strategies constructed on the basis of unadjusted characteristics. If this is true, then the industry-adjusted strategies might "explain" the performance of conventional strategies, in the sense that the conventional strategies might not generate abnormal returns relative to the industry-adjusted strategies, while the conventional strategies have no hope of explaining the performance of the industry-adjusted strategies.

Cohen and Polk (1998), Asness, Porter and Stevens (2000) and Novy-Marx (2009, 2010a) all consider strategies formed on the basis of industry-adjusted book-to-market. Asness, Porter and Stevens (2000) also consider strategies formed on industry-adjusted past performance. These papers find that strategies formed on the basis of industry-adjusted book-to-market and past performance do outperform their conventional counterparts. These industry-adjusted strategies do not, however, generate higher average returns. Their improved performance is driven by a reduction in the strategies' volatilities. While this is undeniably an important determinant of performance, it raises questions regarding whether the industry-adjusted characteristics are really more strongly associated with expected returns. Strategies formed on the basis of industry-adjusted characteristics are much more balanced across industries. It is possible that the improved performance of industry-adjusted value and momentum strategies comes simply from reducing the strategies' exposure to industry related-volatility unrelated to average returns.

While I consider strategies formed on the basis of industry-adjusted characteristics, I also consider an alternative adjustment for industry exposure. This alternative adjustment simply involves hedging away the industry exposure from strategies formed on the basis of conventional characteristics. That is, these strategies are formed by assigning stocks to the portfolios on the basis of unadjusted characteristics, and holding offsetting positions of equal magnitudes in each stocks' industry (i.e., the Fama-French 49 value-weighted industry portfolios). This helps identify the true importance of industry adjusting characteristics, by quantifying the extent to which performance can be improved by simply reducing industry driven volatility unrelated to expected returns. The strategies hedged of industry exposure and the hedge portfolios also represent a clean decomposition of the conventional strategies' returns into intra-industry and industry components, which makes it simple to quantify how much of the conventional strategies' variation is due to industry exposure.

Table 14 presents the performance of 1) strategies formed on the basis of unadjusted characteristics; 2) strategies formed on the basis of unadjusted characteristics but hedged for industry exposure; 3) the previous strategies' industry-hedges; 4) strategies formed on the basis of characteristics demeaned by industry; 5) strategies formed on the basis of the mean industry characteristics; and 6) strategies formed on the basis of characteristics demeaned by industry and hedged for industry exposure. All strategies are formed using the procedure employed in the construction of HML or UMD. Panel A employs book-to-market as the primary sorting characteristic. Panel B employs performance over the first eleven months of the preceding year. Panel C employs gross profits-to-assets and, because the strategies are constructed employing industry adjustments, includes financial firms.

The first column of Table 14 shows the average excess returns to HML-like factors constructed on the basis of unadjusted book-to-market, past performance and gross profitability. That is, it shows the performance of the canonical Fama-French factors HML and UMD, and a profitable-minus-unprofitable factor, PMU. Over the sample, which covers July 1963 to December 2009, HML generates average excess returns of 0.42 percent per month, with a test-statistic equal to 3.34, and has a realized annual Sharpe ratio of 0.49. UMU generates average excess returns of 0.72 percent per month, with a test-statistic of 3.90, and has a realized annual Sharpe ratio of 0.57. PMU generates average excess returns of 0.23 percent per month, with a test-statistic equal to 2.36, and has a realized annual Sharpe ratio of 0.35.

The second column shows the performance of the strategies hedged of industry exposure. Hedging the strategies decreases the average returns generated by all three strategies, but increases all three strategies' Sharpe ratios. While hedged HML, UMD and PMU generate excess average returns over the sample of only 0.37, 0.63 and 0.15 percent per month, respectively, the strategies' realized annual Sharpe ratios are 0.91, 0.79 and 0.53, far in excess of their conventional counterparts. In all three cases the strategies either "price" or "over-price" their conventional counterparts. HML and UMD have significant negative abnormal returns relative to the hedged strategies, while PMU has statistically insignificant returns relative to the hedged strategy.

The third column shows the performance of the hedges. The results here contrast strongly with those presented in the second column. Only the momentum strategy generates significant excess average returns, and these are relatively modest. That is, while

Table 14. Factors constructed with industry controls

This table reports the average excess returns to industry-adjusted "factors," constructed employing the HML construction methodology, and the results of regressions of the canonical factors on these alternative factors' returns. Panels A, B and C show results for strategies formed on the basis of book-to-market, performance over the first eleven months of the preceding year, and gross profits-to-assets, respectively. The first column presents the canonical strategies (i.e., no industry adjustments). The second column shows strategies hedged for industry exposure, where each stock position is off-set with an opposite position in the firm's industry (Fama-French 49, value-weighted). The third column shows the industry hedge. The fourth and fifth columns show strategies constructed using a tertile sort on the primary sorting characteristic demeaned by industry, and sorted on the industry characteristic, respectively. The sixth column shows strategies constructed by sorting on the characteristic demeaned by industry and hedged for industry exposure. The sample covers July 1963 to December 2009.

	methodology used in strategy construction					
	canonical	hedged for industry	the industry hedge	industry-adjusted sort	industry sort	adjusted sort and hedged returns
panel A: alternative HMLs, and results from regressions of HML on these alternatives						
$\mathbf{E}[r^e]$	0.42	0.37	0.05	0.39	0.06	0.43
	[3.34]	[6.24]	[0.72]	[5.11]	[0.43]	[6.78]
α		-0.20	0.34	-0.03	0.37	-0.24
		[-2.60]	[6.22]	[-0.33]	[5.32]	[-2.98]
β		1.66	1.67	1.14	0.78	1.54
		[31.0]	[49.2]	[23.1]	[34.9]	[29.3]
adj.-R^2 (%)		63.3	81.3	48.9	68.6	60.6
panel B: alternative UMDs, and results from regressions of UMD on these alternatives						
$\mathbf{E}[r^e]$	0.72	0.63	0.17	0.63	0.62	0.62
	[3.90]	[5.36]	[2.34]	[5.13]	[4.00]	[5.21]
α		-0.21	0.35	-0.13	0.10	-0.19
		[-3.14]	[3.73]	[-1.56]	[1.00]	[-3.12]
β		1.49	2.23	1.36	1.01	1.48
		[63.2]	[41.2]	[48.0]	[35.9]	[69.3]
adj.-R^2 (%)		87.8	75.3	80.5	69.8	89.6
panel C: alternative PMUs, and results from regressions of PMU on these alternatives						
$\mathbf{E}[r^e]$	0.23	0.15	0.08	0.26	0.16	0.25
	[2.36]	[3.60]	[0.82]	[4.13]	[1.24]	[4.98]
α		0.15	0.16	0.12	0.14	0.06
		[1.51]	[3.82]	[1.22]	[2.20]	[0.61]
β		0.57	0.92	0.45	0.59	0.70
		[5.94]	[50.4]	[7.01]	[28.3]	[9.01]
adj.-R^2 (%)		5.8	82.0	8.0	59.0	12.6

there is some momentum at the industry level, industry average book-to-market and industry average profitability appear totally unrelated to expected returns. Even so, the industry related components contribute most of the volatility of HML and PMU. While contributing only 10% (0.05/0.43) of HML's average excess returns, industry exposure drives 49% (81.3%/1.67) of the factor's variation. Similarly, industry exposure contributes only 34% (0.08/0.23) of PMU's average excess returns, but drives 89% (82.0%/0.92) of its variation.

The fourth and fifth columns show the performance of the strategies constructed on the basis of characteristics demeaned by industry, and industry average characteristics, respectively. Column four shows that sorting on industry-adjusted characteristics improves the performance of the value and momentum strategies. This improvement is slightly less pronounced, however, than that achieved by simply hedging for industry exposure. This suggests that much of the benefit realized by forming strategies on the basis of industry-adjusted book-to-market and past performance comes simply from reducing the strategies' industry exposures.

With gross profitability the situation is very different. Industry-adjusting gross profitability does reduce the volatility of the associated factor, but it also increases its average returns, suggesting that industry-adjusted profitability is truly more strongly associated with average excess returns. The strategy formed on the basis of industry adjusted gross profitability generates excess average returns a third higher than the unadjusted strategy, 0.26 percent per year with a test-statistic of 4.13, and has a higher Sharpe ratio of 0.61.

The sixth column shows that hedging the remaining industry exposure of the strategies formed on the basis of the industry-adjusted characteristics further improves the strategies' performances. This is especially true for PMU and, to a lesser extent, HML. The average annual Sharpe ratios of the strategies formed on the basis of industry-adjusted book-to-market, past performance and gross profitability, and hedged for industry exposure, are 0.99, 0.76 and 0.73, respectively, much higher than the 0.49, 0.57 and 0.35 achieved by their conventional counterparts. The performance of these strategies suggests that it is worthwhile investigating whether they have any power to "explain" anomalies.

7 Explaining anomalies

This section considers how both the conditional value and profitability factors considered in Table 11, and the industry-adjusted factors shown in the last column of Table 14, perform "pricing" a wide array of anomalies. This is not meant to suggest that these factors are associated with priced risk. They do appear to be useful, however, in identifying underlying commonalities in seemingly disparate anomalies. The Fama-French model's success explaining long run reversals can be interpreted in a similar fashion. Even if one does not believe that the Fama-French factors truly represent priced risk factors, they certainly "explain" long run reversals in the sense that buying long term losers and selling long term winners yields a portfolio long small and value firms, and short large and growth firms. An investor can largely replicate (or even improve on) the performance of value strategies using the right "recipe" of Fama-French factors, and long run reversals do not, consequently, represent a truly distinct anomaly.

In much the same sense, regressions employing these industry-adjusted factors suggest that most earnings related anomalies (e.g., strategies based on price-to-earnings, or free cashflow growth), and a large number of seemingly unrelated anomalies (e.g., strategies based on default risk, or net stock issuance), are really just different expressions of just three underlying basic anomalies (industry-adjusted value, momentum and gross profitability), mixed in various proportions and dressed up in different guises.

The anomalies considered here include:

1. *Anomalies related to the construction of the Fama-French factors, the Chen, Novy-Marx and Zhang factors, and PMU*:* strategies sorted on size, book-to-market, past performance, investment, quarterly return-on-assets, and gross profitability;

2. *Earnings related anomalies:* strategies sorted on earnings-to-price, changes in free

cashflow, asset turnover, gross margins, and standardized unexpected earnings, as well as the HML-like factors considered in Table 11, constructed by sorting on profitability within book-to-market deciles, and sorting on book-to-market within profitability deciles; and

3. *The anomalies considered by Chen, Novy-Marx and Zhang (2010):* strategies sorted on the failure probability measure of Campbell, Hilscher, and Szilagyi (2008), the default risk "O-score" of Ohlson (1980), net stock issuance, asset growth, total accruals, and (not considered in CNZ (2010)) the organizational capital based strategy of Eisfeldt and Papanikolaou (2009).

I also consider the model's performance pricing portfolios double quintile sorted on 1) size and book-to-market; 2) investment and return-on-assets; and 3) gross profits-to-assets and book-to-market.

The factors employed to price the anomalies are constructed, again, using the basic methodology employed in the construction of HML. The primary characteristic on which they are sorted (book-to-market, performance over the first eleven months of the preceding year, or gross profitability-to-assets) is demeaned by industry, however, and the strategies' returns are hedged for industry exposure. The characteristics of these factors, denoted HML*, UMD* and PMU*, are shown in Table 15, together with the characteristics of the non-market Fama-French factors (SMB, HML and UMD) and the non-market Chen, Novy-Marx and Zhang factors (INV and ROA). The Fama-French factors come from Ken French's data library (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html). INV and ROA come from the Chen-Zhang data library (http://apps.olin.wustl.edu/faculty/chenl/linkfiles/data_equity.html).

The top panel shows that all eight factors, with the exception of SMB, generate statistically significant average excess returns over the sample, January 1972 to June 2009, which is determined by the availability of the quarterly earnings date employed in the construction of ROA. It also shows that all three of the industry-adjusted factors have Sharpe ratios

Table 15. Alternative factor characteristics

This table shows the returns to the Fama-French factors (HML, SMB and UMD), the Chen, Novy-Marx and Zhang factors (INV and ROA), and factors based on industry-adjusted book-to-market, performance over the first eleven months of the preceding year, and gross profitability scaled by book assets, where each of these characteristics are demeaned by industry (the Fama-French 49 industry), and the resultant factors are hedged for industry exposure (HML*, UMD* and PMU*). The table also shows each factor's abnormal returns relative to the other two models, and how they load on the other model's factors. The sample covers January 1972 to June 2009.

	dependent variable							
	SMB	HML	UMD	INV	ROA	HML*	UMD*	PMU*
$\mathbf{E}[r^e]$	0.19	0.43	0.78	0.35	0.76	0.46	0.65	0.27
	[1.24]	[2.95]	[3.58]	[3.89]	[3.85]	[6.50]	[4.70]	[4.81]
α				**0.17**	**0.58**	**0.25**	**0.28**	**0.31**
				[2.05]	**[3.34]**	**[5.62]**	**[6.57]**	**[6.03]**
MKT				-0.05	-0.06	0.01	-0.07	-0.08
				[-2.56]	[-1.47]	[1.13]	[-6.84]	[-6.52]
SMB				0.09	-0.49	0.10	-0.07	-0.10
				[3.69]	[-9.10]	[6.93]	[-5.37]	[-6.38]
HML				0.30	0.18	0.41	-0.10	-0.06
				[10.7]	[2.94]	[26.2]	[-6.56]	[-3.50]
UMD				0.07	0.28	0.01	0.58	0.05
				[4.29]	[7.63]	[1.14]	[63.8]	[4.03]
α	**0.33**	**0.19**	**0.46**			**0.40**	**0.49**	**0.17**
	[2.32]	**[1.47]**	**[2.15]**			**[5.92]**	**[3.68]**	**[4.12]**
MKT	0.13	-0.15	-0.04			-0.04	-0.08	-0.05
	[4.04]	[-5.10]	[-0.87]			[-2.94]	[-2.79]	[-5.63]
INV	0.11	0.63	0.24			0.30	0.06	-0.05
	[1.48]	[9.37]	[2.16]			[8.71]	[0.92]	[-2.44]
ROA	-0.30	0.10	0.32			-0.03	0.21	0.18
	[-8.96]	[3.21]	[6.32]			[-2.07]	[6.73]	[18.2]
α	**0.32**	**-0.19**	**-0.37**	**0.10**	**-0.21**			
	[1.97]	**[-1.87]**	**[-4.80]**	**[1.10]**	**[-1.31]**			
MKT	0.12	-0.13	0.09	-0.07	0.03			
	[3.52]	[-6.21]	[5.50]	[-3.53]	[0.98]			
HML*	-0.02	1.49	0.24	0.51	0.36			
	[-0.16]	[23.8]	[4.90]	[8.76]	[3.48]			
UMD*	0.03	-0.15	1.54	0.08	0.25			
	[0.54]	[-4.72]	[62.7]	[2.73]	[4.88]			
PMU*	-0.72	0.29	0.02	-0.03	2.34			
	[-5.33]	[3.52]	[0.30]	[-0.45]	[17.5]			

exceeding those on any of the Fama-French or Chen, Novy-Marx and Zhang factors. The second panel shows that the four Fama-French factors explain roughly half the returns to INV, but do not significantly reduce the information rations of ROA or any of the industry-adjusted factors. The third panel shows that the three Chen, Novy-Marx and Zhang factors explain more than half of the returns to HML, and 40 percent of the returns to UMD, but as noted by Chen, Novy-Marx and Zhang (2010), they worsen the pricing of SMB. This panel also shows that the Chen, Novy-Marx and Zhang factors cannot price the industry-adjusted factors, all of which have abnormal return test-statistics in excess of four. The last panel shows that only SMB and UMD have significant abnormal returns relative to the industry-adjusted four-factor model. The model slightly worsens the pricing of SMB, similar to the Chen, Novy-Marx and Zhang three-factor model. It also over-prices UMD, which generates a highly significant negative 37 basis points per month relative to the industry-adjusted factors.

The fact that the industry-adjusted factors do a better job pricing the factors from the Fama-French and Chen, Novy-Marx and Zhang models than either of the models do pricing these alternative factors suggests that these factors might perform better pricing anomalies. This possibility is investigated now.

7.1 Anomalies related to the factors' construction

Table 16 investigates six anomaly strategies related directly to the construction of the Fama-French factors, the Chen, Novy-Marx and Zhang factors, and PMU*. The six strategies shown are constructed by sorting on size, book-to-market, performance over the first eleven months of the preceding year, investment-to-assets, quarterly return on assets, and industry-adjusted gross profitability-to-assets. All six strategies are long/short extreme deciles of a sort on the corresponding sorting variable, using NYSE breaks. Returns are value weighted. All the portfolios are rebalanced annually, at the end of June, except for the strategies based on past performance and return-on-assets, which are rebalanced monthly. The return-on-assets strategy excludes financial firms (i.e., those with one-digit SIC codes of six). The profitability strategy is hedged for industry exposure. The sample covers January 1972 through June 2009, and is determined by the availability of monthly earnings data.

Panel A of Table 16 shows the six strategies' average monthly excess returns. As expected, all the strategies, with the exception of the size strategy, exhibit highly significant average excess returns over the sample.

Panel B shows the strategies' abnormal returns relative to 1) the Fama-French three-factor model plus UMD (hereafter referred to, for convenience, as the "Fama-French four-factor model"), and 2) the five-factor model obtained by replacing HML with the value factor that conditions on gross profitability and the gross profitability factor that conditions on book-to-market, HML|GP and PMU|BM, both considered in Table 11 (hereafter referred to, for convenience, as the "Fama-French five-factor model"). The top two lines show that the Fama-French four-factor model prices the strategies based on size and book-to-market. It struggles, however, with the extreme sort on past performance, despite the fact that this is the same variable used in the construction of UMD. The model explains only about a third of the performance of the investment based strategy, and fails to help in the pricing of the return-on-assets and profitability based strategies. The bottom two lines show that replacing the HML with the conditional value and profitability factors improves the model's performance, especially pricing the strategies based on return-on-assets and gross profitability. Across strategies the substitution reduces the root-mean-pricing error from 0.43 to 0.33 percent per month.

Panel C provides the six strategies' abnormal returns relative to the Chen, Novy-Marx and Zhang three-factor model. The model does a good job pricing the return-on-assets strategy, explains roughly a third of the momentum returns, and half the performance of the strategy based on investment. A variation on this model, which replaces the high frequency return-on-assets factor (ROA) with the low frequency industry-adjusted gross profitability factor (PMU*), performs similarly (because the results are so similar, they are not presented

Table 16. Anomaly strategy average excess returns and abnormal performance
Panel A reports the average excess returns to strategies formed by sorting on the six variables used in the construction of the Fama-French factors (market capitalization, book-to-market and performance over the first eleven months of the preceding year), the Chen, Novy-Marx and Zhang factors (investment-to-assets and return on assets, excluding financial firms), and profitability (gross profits-to-assets, demeaned by industry and hedged for industry exposure). All strategies are long-short extreme deciles from a sort on the corresponding variable, employing NYSE breaks. Portfolio returns are value-weighted. The momentum and return-on-assets strategies are rebalanced monthly, while the other strategies are rebalanced annually, at the end of June. Panel B reports abnormal returns relative to the Fama-French four-factor model, and the five-factor model that replaces HML with the conditional value and profitability factors HML | GP and PMU | BM. Panel C reports abnormal returns relative to the Chen, Novy-Marx and Zhang model. Panel D reports abnormal returns relative to the market and industry-adjusted HML, UMD and PMU, with factor loadings. The sample covers January 1972 to June 2009.

	sorting variable used in anomaly strategy's construction						
	market capitalization	book-to-market	prior year's return	investment-to-assets	return-on-assets	gross profitability	RMS p.e.
Panel A: anomaly strategy average excess returns							
$\mathbf{E}[r^e]$	-0.10	0.55	1.56	-0.62	0.71	0.23	0.78
	[-0.44]	[2.93]	[4.70]	[-3.94]	[3.07]	[2.60]	
Panel B: abnormal returns relative to the FF 4- and 5-factor models							
α_{FF4}	0.05	-0.00	0.55	-0.35	0.76	0.32	0.43
	[0.37]	[-0.02]	[4.21]	[-2.35]	[4.23]	[3.96]	
α_{FF5}	-0.02	-0.03	0.54	-0.30	0.50	0.14	0.33
	[-0.14]	[-0.31]	[4.05]	[-1.97]	[3.12]	[1.93]	
Panel C: abnormal returns relative to the CNZ Q-theory 3-factor model							
α_{q3}	-0.40	0.51	1.08	-0.32	0.13	0.23	0.54
	[-1.80]	[2.74]	[3.32]	[-2.70]	[1.01]	[2.94]	
Panel D: abnormal returns relative to MKT, HML*, UMD* and PMU*							
α	-0.45	-0.14	-0.10	-0.36	-0.02	-0.00	0.25
	[-1.90]	[-0.90]	[-0.64]	[-2.18]	[-0.08]	[-0.06]	
MKT	0.04	-0.03	0.06	0.13	-0.08	-0.06	
	[0.79]	[-1.03]	[1.89]	[3.60]	[-1.91]	[-3.94]	
HML*	-0.41	1.70	0.46	-0.70	-0.10	-0.05	
	[-2.84]	[17.8]	[4.82]	[-6.91]	[-0.83]	[-1.21]	
UMD*	0.45	-0.03	2.26	-0.15	0.43	0.06	
	[6.06]	[-0.57]	[45.9]	[-2.83]	[6.99]	[2.57]	
PMU*	0.98	-0.38	0.06	0.45	2.08	0.98	
	[5.06]	[-2.98]	[0.47]	[3.33]	[13.0]	[16.9]	

explicitly). The canonical CMZ model, and the version employing PMU*, primarily differ in their pricing of the strategy based on gross profitability. The model employing ROA does not improve the pricing of the strategy, while that employing PMU* performs very well pricing this strategy.

Panel D shows that the four-factor model employing the market and industry-adjusted HML, UMD and PMU performs no better than the Fama-French and Chen, Novy-Marx and Zhang models pricing the investment strategy, and, like the Chen, Novy-Marx and Zhang model, somewhat worsens the pricing of the size strategy. It prices the momentum strategy much better than the canonical four-factor model primarily because the momentum strategy loads much more heavily on UMD* than it does on UMD (loadings of 2.30 and 1.40, respectively). This probably reflects, at least partly, the fact that selection into the extreme deciles of past performance are little influenced by industry performance. Canonical UMD, which is constructed using the less aggressive tertile sort, is formed more on the basis of past industry performance. It consequently exhibits more industry driven variation in returns, and looks less like the decile sorted momentum strategy. This model performs as well as the Fama-French model pricing the value strategy, and as well as the Chen, Novy-Marx and Zhang model pricing the return-on-assets strategy. It does a good job, unlike either the Fama-French or Chen, Novy-Marx and Zhang models, pricing the strategy based on gross profitability.

In addition to generally "explaining" the six anomalies, in the sense that the anomalies tend to have insignificant information ratios relative to the alternative four-factor model, the model also performs well in the sense that it dramatically reduces the strategies' root-mean-squared pricing error. The root-mean-squared average excess return across the six anomalies is 0.78 percent per month. The root-mean-squared pricing error relative to the alternative four-factor model is only 0.25 percent per month, which compares favorably to the 0.43, 0.33 and 0.54 percent per month root-mean-squared pricing errors observed relative to the Fama-Fench four and five-factor models, and the Chen, Novy-Marx and

Zhang three-factor model.

7.2 Earnings related anomalies

Table 17 considers seven earnings-related anomalies. These strategies are constructed by sorting on earnings-to-price, the one year change in free cashflow scaled by assets, asset turnover, gross margins, and standardized unexpected earnings, book-to-market within gross profits-to-assets deciles, and gross profits-to-assets within book-to-market deciles. They are again long/short extreme deciles of a sort on the corresponding sorting variable, using NYSE breaks. The asset turnover, gross margin, and conditional value and profitability strategies exclude financial firms (i.e., those with one-digit SIC codes of six). Returns are value weighted. Portfolios are rebalanced annually, at the end of June, except for the strategy based on standardized unexpected earnings, which is rebalanced monthly, and excludes financial firms (i.e., those with one-digit SIC codes of six). The sample covers January 1972 through June 2009, and is determined by the availability of monthly earnings data. The strategy based on SUE requires earnings from the same quarter one year prior to portfolio construction, and consequently this return series starts later, in October 1972.[9]

Panel A of Table 17 shows the seven strategies' average monthly excess returns. All of the strategies, with the exception of that based on gross margins, exhibit highly significant average excess returns over the sample.

Panel B reports abnormal returns relative to the Fama-French four-factor model, and the five-factor model that replaces HML with HML|GP and PMU|BM. The top two lines show that the canonical Fama-French four-factor model performs extremely poorly pricing earnings related anomalies. All seven strategies have highly significant four-factor alphas. The bottom two lines show that the five-factor model performs much better pricing the

[9] I construct SUE here directly from the most recent quarterly earnings, as the difference between the most recent quarter's earnings and earnings from the same quarter of the previous year, scaled by the standard deviation of earnings over the previous eight quarters. This strategy performs better, and is more difficult to explain, than that formed on the basis of earnings per share, like that employed in Chan, Jegadeesh, and Lakonishok (1996).

earning related anomalies. Substituting HML with the conditional value and profitability factors reduces the root-mean-pricing error across the seven strategies from 0.51 to 0.38 percent per month. The model performs particularly well on the asset turnover and profitability strategies, and improves the pricing of all the strategies, with the exception of that based on SUE.

Panel C provides the seven strategies' abnormal returns relative to the Chen, Novy-Marx and Zhang three-factor model. This model reduces the pricing errors of all of the earnings related anomalies, but can only truly be said to explain the returns to the strategy based on asset turnover and gross margins. The variation on this model, which replaces the high frequency return-on-assets factor (ROA) with the low frequency industry-adjusted gross profitability factor (PMU*), again performs similarly (results untabulated). The model employing PMU* instead of ROA performs better pricing the free cashflow growth and profitability strategies, but worse pricing the standardized unexpected earnings and value strategies.

Panel D shows that the four-factor model employing the market and industry-adjusted HML, UMD and PMU explains the returns to all of the strategies, with the exception of post earnings announcement drift. All of the strategies have large, significant loadings on PMU*, especially the earnings-to-price and asset turnover strategies, which are also intra-industry value strategies. The model prices the free cashflow growth strategy primarily through the virtue of a large positive loading on the profitability factor. It does well pricing the strategy based on gross margins, despite the fact that the high margin firms tend to be growth firms, which drives the strategy's large Fama-French alpha, because the high margin firms also tend to be profitable. The resulting large positive PMU* loading effectively offsets the pricing effect of the large negative HML* loading. The model prices conditional profitability and value through large loadings on the industry-adjusted profitability and book-to-market factors, respectively.

The alternative four-factor model again also performs well in the sense that it dra-

Table 17. Earnings anomaly average excess returns and abnormal performance

Panel A reports the average excess returns to seven earnings related anomalies. The strategies are formed by sorting on earnings-to-price, the one year change in free cashflow-to-assets, asset turnover, gross margins, standardized unexpected earnings, book-to-market within gross profits-to-assets deciles, and gross profits-to-assets within book-to-market deciles. All strategies are value-weighted long/short extreme decile portfolios employing NYSE breaks. Asset turnover and gross margin strategies exclude financials (i.e., firms with one-digit SIC codes of six). The earnings-to-price and unexpected earnings strategies are rebalanced monthly, while the other strategies are rebalanced annually, at the end of June. Panel B reports abnormal returns relative to the Fama-French four-factor model, and the five-factor model that replaces HML with the conditional value and profitability factors HML | GP and PMU | BM. Panel C reports abnormal returns relative to the Chen, Novy-Marx and Zhang model. Panel D reports abnormal returns relative to the market and industry-adjusted HML, UMD and PMU, with factor loadings. The sample covers January 1972 to June 2009.

	sorting variable used in anomaly strategy's construction							
	earnings-to-price	cashflow growth	asset turnover	gross margins	SUE	BM|GPA	GPA|BM	RMS p.e.
Panel A: anomaly strategy average excess returns and FF 4-factor alphas								
$\mathbf{E}[r^e]$	1.10	0.44	0.50	0.10	0.78	0.66	0.48	0.65
	[4.70]	[3.42]	[2.71]	[0.70]	[4.42]	[3.45]	[3.03]	
Panel B: abnormal returns relative to the FF 4-factor and 5-factor models								
α_{FF4}	0.73	0.43	0.44	0.49	0.60	0.07	0.52	0.51
	[3.49]	[3.26]	[2.31]	[3.94]	[4.02]	[0.52]	[3.23]	
α_{FF5}	0.56	0.27	-0.13	0.30	0.71	-0.14	-0.01	0.38
	[2.63]	[2.03]	[-0.88]	[2.67]	[4.69]	[-1.21]	[-0.05]	
Panel C: abnormal returns relative to the CNZ Q-theory 3-factor model								
α_{q3}	0.62	0.31	0.13	0.14	0.49	0.64	0.30	0.43
	[3.23]	[2.34]	[0.72]	[0.94]	[2.96]	[3.37]	[1.87]	
Panel D: abnormal returns relative to MKT, HML*, UMD* and PMU*								
α	-0.05	0.21	-0.09	0.19	0.48	-0.24	0.04	0.23
	[-0.22]	[1.46]	[-0.52]	[1.29]	[2.85]	[-1.47]	[0.23]	
MKT	-0.08	0.06	0.27	-0.04	0.06	-0.02	0.05	
	[-1.77]	[1.86]	[7.08]	[-1.28]	[1.57]	[-0.69]	[1.41]	
HML*	1.11	0.01	0.09	-0.56	-0.36	1.81	0.20	
	[8.07]	[0.12]	[0.85]	[-6.12]	[-3.50]	[17.8]	[2.04]	
UMD*	0.48	0.10	-0.12	-0.04	0.64	0.10	-0.11	
	[6.77]	[2.18]	[-2.16]	[-0.83]	[12.1]	[1.85]	[-2.27]	
PMU*	1.38	0.54	1.99	0.87	0.26	-0.04	1.55	
	[7.49]	[4.53]	[13.6]	[7.07]	[1.93]	[-0.29]	[11.9]	

matically reduces the strategies' root-mean-squared pricing error. The root-mean-squared average excess return across the seven anomalies is 0.65 percent per month. The root-mean-squared pricing error relative to the alternative four-factor model is only 0.23 percent per month, which again compares favorably to the 0.51, 0.38 and 0.43 percent per month root-mean-squared pricing errors observed relative to the Fama-Fench four- and five-factor models, and the Chen, Novy-Marx and Zhang three-factor model.

7.3 Other anomalies

Table 18 investigates the five strategies considered, along with value, momentum, and post earnings announcement drift, by Chen, Novy-Marx and Zhang (2010). These five strategies are based on the failure probability measure of Campbell, Hilscher, and Szilagyi (2008), the default risk "O-score" of Ohlson (1980), net stock issuance, asset growth, and total accruals. The table also analyzes the performance of Eisfeldt and Papanikolaou's (2009) organizational capital based strategy.[10] All six anomalies are constructed as long/short extreme decile strategies, and portfolio returns are value-weighted. The strategies based on failure probability and Ohlson's O-score are rebalanced monthly, while the other four strategies are rebalanced annually, at the end of June. The performance of the first five strategies comes from the Chen-Zhang Data Library. The sample covers January 1972 through June 2009, and is determined by the availability of quarterly earnings data. Due to more stringent data requirements, the failure probability series is not available until mid-1975.

Panels A and B of Table 18 shows the six strategies' average monthly excess returns, and their abnormal returns relative to the Fama-French four factor model. All of the

[10] This strategy is based on their accounting based measure of organizational capital, which accumulates selling, general and administrative expenses (XSGA), the accounting variable most likely to include spending on the development of organizational capital. The stock of organizational capital is assumed to depreciate at a rate of 15% per year, and the initial stock is assumed to be ten times the level of selling, general and administrative expenses that first appear in the data. Results employing this measure are not sensitive to these choices. The trading strategy is formed by sorting on the organizational capital measure within industries.

strategies exhibit highly significant average excess returns and four-factor alphas over the sample. The bottom two lines of Panel B also show that replacing HML with HML|GP and PMU|BM improves the model's performance pricing all the strategies, especially the strategies based on failure probability, Ohlson's O-score and total accruals. While this variation on the Fama-French model stills fails to accurately price any of the anomalies considered in Table 18, the substitution reduces the root-mean-pricing error across the six strategies from 0.66 to 0.49 percent per month.

Panel C provides the six strategies' abnormal returns relative to the Chen, Novy-Marx and Zhang three-factor model. This model improves the pricing of all six anomalies, and performs better than the Fama-French four- and five-factor models pricing all the anomalies except that based on total accruals. The model does particularly well pricing the strategy based on Ohlson's O-score and asset growth. The variation on the CNZ model that replaces the high-frequency ROA factor with PMU* performs even better, especially on the strategies based on Campbell, Hilscher, and Szilagyi's (2008) measure of failure probability and Eisfeldt and Papanikolaou's (2009) measure of organizational capital (results untabulated).

Panel D shows that the four-factor model employing the market and industry-adjusted HML, UMD and PMU performs better still, explaining the performance of all six strategies. The model explains the poor performance of the high failure probability and high default probability firms primarily through large, negative loadings on the industry-adjusted profitability factor. That is, firms with extremely low industry-adjusted gross profits-to-assets tend to be firms that both the Campbell, Hilscher, and Szilagyi (2008) and Ohlson (1980) measures predict are more likely to default. The fact that the model performs well pricing these two strategies is especially remarkable given that these anomalies only exist at the monthly frequency, in the sense that strategies based on the same sorting variables do not produce significant excess returns when rebalanced annually. The model explains the net stock issuance anomaly primarily through negative loadings on HML* and PMU*. That is, net issuers tend to be industry-adjusted growth stocks with low industry-adjusted

Table 18. More anomaly strategy average excess returns and abnormal performance
Panel A reports the average excess returns to the anomalies considered in Chen, Novy-Marx and Zhang (2010), strategies based on the failure probability measure of Campbell, Hilscher, and Szilagyi (2008), the default risk "O-score" of Ohlson (1980), net stock issuance, asset growth, and total accruals. These strategies' performances come from Chen and Zhang's Data Library (http://apps.olin.wustl.edu/faculty/chenl/linkfiles/data_equity.html). It also reports the performance of Eisfeldt and Papanikolaou's (2009) organizational capital based strategy. The failure probability and O-score strategies are rebalanced monthly, while the other strategies are rebalanced annually, at the end of June. Panel B reports abnormal returns relative to the Fama-French four-factor model, and the five-factor model that replaces HML with the conditional value and profitability factors HML | GP and PMU | BM. Panel C reports abnormal returns relative to the Chen, Novy-Marx and Zhang model. Panel D reports abnormal returns relative to the market and industry-adjusted HML, UMD and PMU, with factor loadings. The sample covers January 1972 to June 2009.

	sorting variable used in anomaly strategy's construction						
	failure probability	Ohlson's O-score	net stock issuance	asset growth	total accruals	org. capital	RMS p.e.
	Panel A: anomaly strategy average excess returns						
$\mathbf{E}[r^e]$	-1.29	-0.72	-0.52	-0.54	-0.83	0.44	0.78
	[-3.48]	[-2.60]	[-4.33]	[-2.88]	[-4.58]	[3.52]	
	Panel B: abnormal returns relative to the FF 4-factor and 5-factor models						
α_{FF4}	-1.16	-0.74	-0.45	-0.53	-0.42	0.28	0.66
	[-4.56]	[-4.28]	[-4.09]	[-2.82]	[-2.74]	[2.41]	
α_{FF5}	-0.73	-0.54	-0.29	-0.56	-0.36	0.27	0.49
	[-2.98]	[-3.31]	[-2.67]	[-2.88]	[-2.21]	[2.23]	
	Panel C: abnormal returns relative to the CNZ Q-theory 3-factor model						
α_{q3}	-0.55	-0.16	-0.32	-0.27	-0.56	0.28	0.38
	[-2.23]	[-0.77]	[-2.89]	[-1.49]	[-3.61]	[2.18]	
	Panel D: abnormal returns relative to MKT, HML*, UMD* and PMU*						
α	0.33	0.20	-0.13	-0.38	-0.27	0.21	0.27
	[1.14]	[0.88]	[-1.04]	[-1.79]	[-1.51]	[1.52]	
MKT	0.25	0.12	0.10	0.14	0.11	-0.00	
	[4.06]	[2.39]	[3.70]	[3.15]	[2.79]	[-0.07]	
HML*	-0.63	0.17	-0.50	-0.26	-1.19	0.05	
	[-3.47]	[1.13]	[-6.53]	[-1.95]	[-10.6]	[0.61]	
UMD*	-0.96	-0.69	-0.07	-0.11	-0.11	0.19	
	[-10.3]	[-9.34]	[-1.88]	[-1.64]	[-1.95]	[4.39]	
PMU*	-2.91	-2.21	-0.57	-0.10	0.09	0.33	
	[-12.3]	[-11.6]	[-5.64]	[-0.57]	[0.58]	[2.91]	

profitability. The model explains the out-performance of high organizational capital firms primarily through a positive loading PMU*, suggesting that firms with large stocks of organizational capital, at least as quantified by the Eisfeldt and Papanikolaou (2009) measure, are more profitable than those with small stocks of organizational capital. Direct investigation of portfolios underlying organizational capital strategy confirms this prediction. Decile portfolios sorted on organizational capital show strong monotonic variation in gross profitability.

The alternative four-factor model again also performs well in the sense that it dramatically reduces the strategies' root-mean-squared pricing error. The root-mean-squared average excess return across the six anomalies is 0.78 percent per month. The root-mean-squared pricing error relative to the alternative four-factor model is only 0.27 percent per month, which again compares favorably to the 0.66, 0.49 and 0.38 percent per month root-mean-squared pricing errors observed relative to the Fama-Fench four- and five-factor models, and the Chen, Novy-Marx and Zhang three-factor model.

7.4 Other test assets

This section considers the performance of the models pricing the canonical Fama-French (1993) test assets, portfolios double quintile sorted on size and book-to-market. It also consider the performance of the models pricing portfolios double sorted on investment and return-on-assets, and portfolios double sorted on gross profits-to-assets and book-to-market.

7.4.1 Portfolios sorted on size and book-to-market

The top left panel of Figure 1 shows the realized average monthly value-weighted excess returns to 25 portfolios sorted on size and book-to-market (NYSE breaks), plotted as a function of their CAPM predicted returns. The CAPM predicts the portfolios will all generate returns similar to the market, because they all have market loadings close to one. The

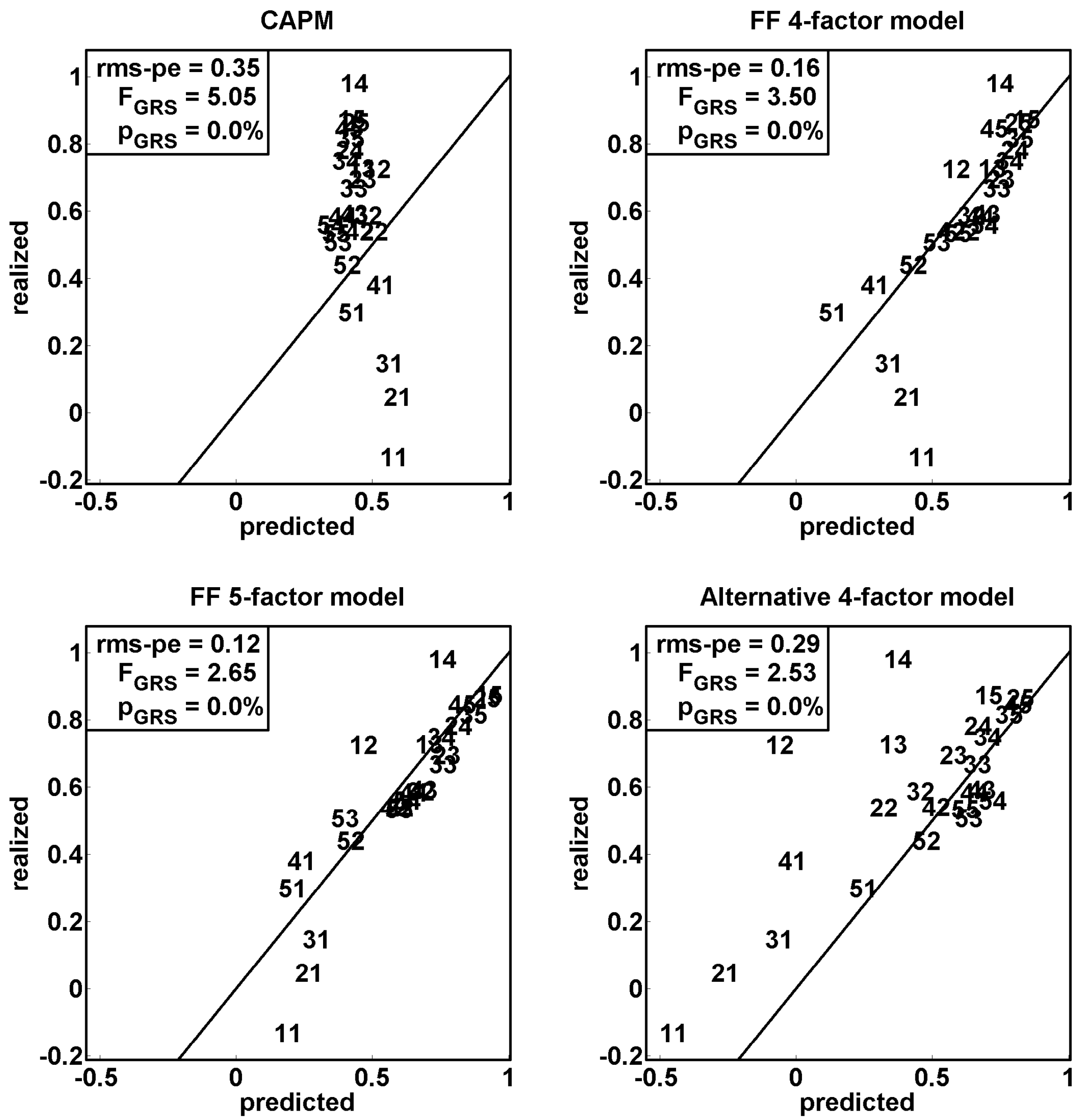

Figure 1. Excess returns to portfolios sorted on size and book-to-market
This figure shows the average excess monthly returns (actual vs. predicted) to portfolios independently double quintile sorted on size and book-to-market. The figure shows predicted returns under the CAPM (top left), Fama-French four-factor model (top right), the five-factor model that replaces the canonical value factor HML with the conditional value and profitability factors HML | GP and PMU | BM (bottom left), and the four-factor model employing the market, and the industry-adjusted value, momentum and profitability factors HML*, UMD*, and PMU* (bottom right). The indices run from low to high, and correspond to the sorting variable (first then second). The sample excludes financial firms, and covers January 1972 to December 2008.

portfolios actually exhibit a large degree of variation in their average returns, and consequently have a large CAPM root-mean-squared pricing error of 0.35 percent per month. A GRS test emphatically rejects the hypothesis that the portfolios' true expected abnormal returns relative to the CAPM are jointly zero.

The top right panel depicts the portfolios' realized returns as a function of their Fama-French four-factor model predicted returns. The Fama-French model generally does a good job pricing the portfolios. The root-mean-squared pricing error of the 25 portfolios relative to the model is only 0.16 percent per month. The model struggles, however, pricing the small growth portfolios. Because of this, and the fact that the model explains a large part of the portfolios' variations, a GRS test rejects the hypothesis that the 25 pricing errors are jointly zero.

The bottom left panel depicts the portfolios' realized returns as a function of their returns predicted by the five-factor model that replaces HML with HML|GP and PMU|BM. This model performs even better. The root-mean-squared pricing error of the 25 portfolios is only 0.12 percent per month. The improved performance can largely be attributed to the model's performance on the small growth portfolios. These portfolios have large, significant negative loadings on PMU|BM, and as a consequence have low model-predicted expected returns. A GRS test still rejects the hypothesis that the 25 pricing errors are jointly zero, but less emphatically than it does for the Fama-French four factor model.

The bottom right panel depicts the portfolios' realized returns as a function of their returns predicted by the four-factor model employing the market and industry-adjusted value, momentum and profitability. This model's statistical performance is similar to the Fama-French five-factor model. It performs much worse, however, in reducing the portfolios' root-mean-squared pricing errors, despite doing a good job explaining the returns to the nano-cap growth portfolio, which is notoriously difficult to price.

7.4.2 Portfolios sorted on investment and return-on-assets

The top left panel of Figure 2 shows the realized average monthly value-weighted excess returns to 25 portfolios sorted on investment and quarterly return-on-assets (NYSE breaks), plotted as a function of their CAPM predicted returns. The CAPM again predicts all the portfolios will generate returns similar to the market. The portfolios actually exhibit a large degree of variation in their average returns, and consequently have a large CAPM root-mean-squared pricing error of 0.31 percent per month. A GRS test emphatically rejects the hypothesis that the portfolios' true expected abnormal returns relative to the CAPM are jointly zero.

The top right panel depicts the portfolios' realized returns as a function of their Fama-French four-factor model predicted returns. The Fama-French model improves the pricing of the 25 portfolios sorted on investment and return-on-assets, reducing the root-mean-squared pricing error to 0.23 percent per month. This improvement occurs because HML and UMD help explain the investment and return-on-asset spreads, respectively. The high investment firms tend to be growth firms, while the high return-on-asset firms tend to be recent winners. Despite this, the model is unable to fully explain return-on-assets spreads, because the high return-on-assets firms out perform the low return-on-assets firms despite being larger and having higher valuations. The model particularly struggles pricing the high investment/low return-on-assets firms, which generate extremely low average returns (average excess returns of -0.39 percent per month). The highest investment, lowest return-on-assets portfolio generates negative abnormal Fama-French returns of more than eight percent per year. A GRS test emphatically rejects the hypothesis that the portfolios' true expected abnormal returns relative to the Fama-French four-factor model are jointly zero.

The bottom left panel depicts the portfolios' realized returns as a function of their returns predicted by the five-factor model that replaces HML with HML|GP and PMU|BM. This model again performs better than the canonical four-factor model. The root-mean-squared pricing error of the 25 portfolios is only 0.20 percent per month. The improved

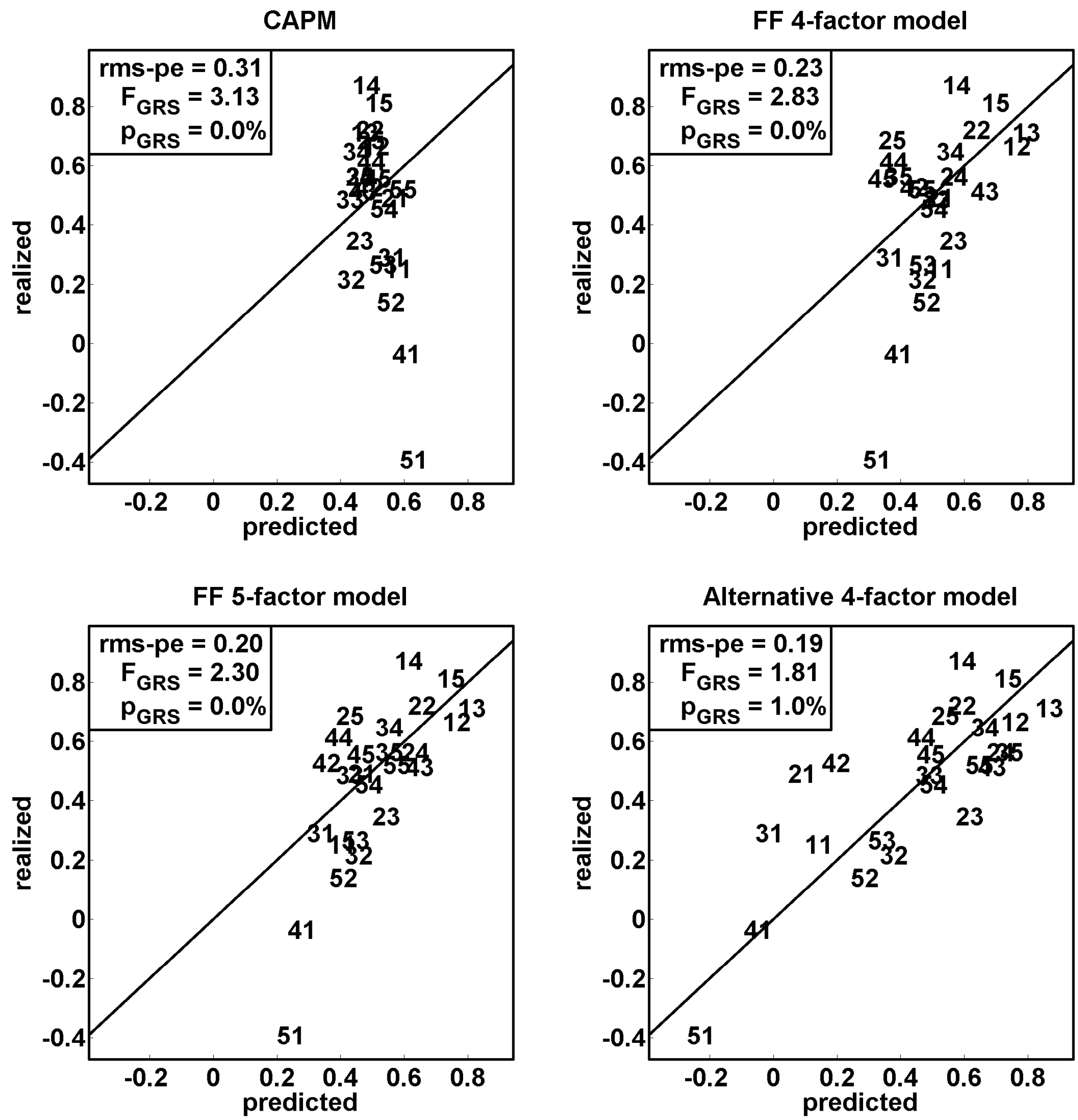

Figure 2. Excess returns to portfolios sorted on investment and return-on-assets
This figure shows the average excess monthly returns (actual vs. predicted) to portfolios independently double quintile sorted on investment and quarterly return-on-assets. The figure shows predicted returns under the CAPM (top left), Fama-French four-factor model (top right), the five-factor model that replaces the canonical value factor HML with the conditional value and profitability factors HML|GP and PMU|BM (bottom left), and the four-factor model employing the market, and the industry-adjusted value, momentum and profitability factors HML*, UMD*, and PMU* (bottom right). The indices run from low to high, and correspond to the sorting variable (first then second). The sample excludes financial firms, and covers January 1972 to December 2008.

performance comes largely because the model does better pricing the high investment/low return-on-assets portfolios.

The bottom right panel depicts the portfolios' realized returns as a function of their returns predicted by the four-factor model employing the market and industry-adjusted value, momentum and profitability. This model performs even better than the five-factor model employing HML | GP and PMU | BM, with a root-mean-squared pricing error of only 0.19 percent per month. It does a particularly good job pricing the high investment/low return-on-assets portfolio. Is is also rejected less emphatically by the GRS test.

7.4.3 Portfolios sorted on gross profits-to-assets and book-to-market

The top left panel of Figure 3 shows the realized average monthly value-weighted excess returns to 25 portfolios sorted on gross profits-to-assets and book-to-market (NYSE breaks), plotted as a function of their CAPM predicted returns. The CAPM again predicts all the portfolios will generate returns similar to the market. The portfolios actually exhibit a large degree of variation in their average returns, and consequently have a large CAPM root-mean-squared pricing error of 0.38 percent per month. A GRS test emphatically rejects the hypothesis that the portfolios' true expected abnormal returns relative to the CAPM are jointly zero.

The top right panel depicts the portfolios' realized returns as a function of their Fama-French four-factor model predicted returns. The Fama-French model improves the pricing of the 25 portfolios sorted on investment and return-on-assets, reducing the root-mean-squared pricing error to 0.24 percent per month. The model under-prices the profitable portfolios, however, which all have positive four-factor alphas, and over-prices the unprofitable stocks, which all have negative four factor alphas. It performs particularly poorly pricing the unprofitable growth stocks, which generate extremely low average returns (average excess returns of -0.14 percent per month). As a result, a GRS test rejects that the pricing errors are jointly zero.

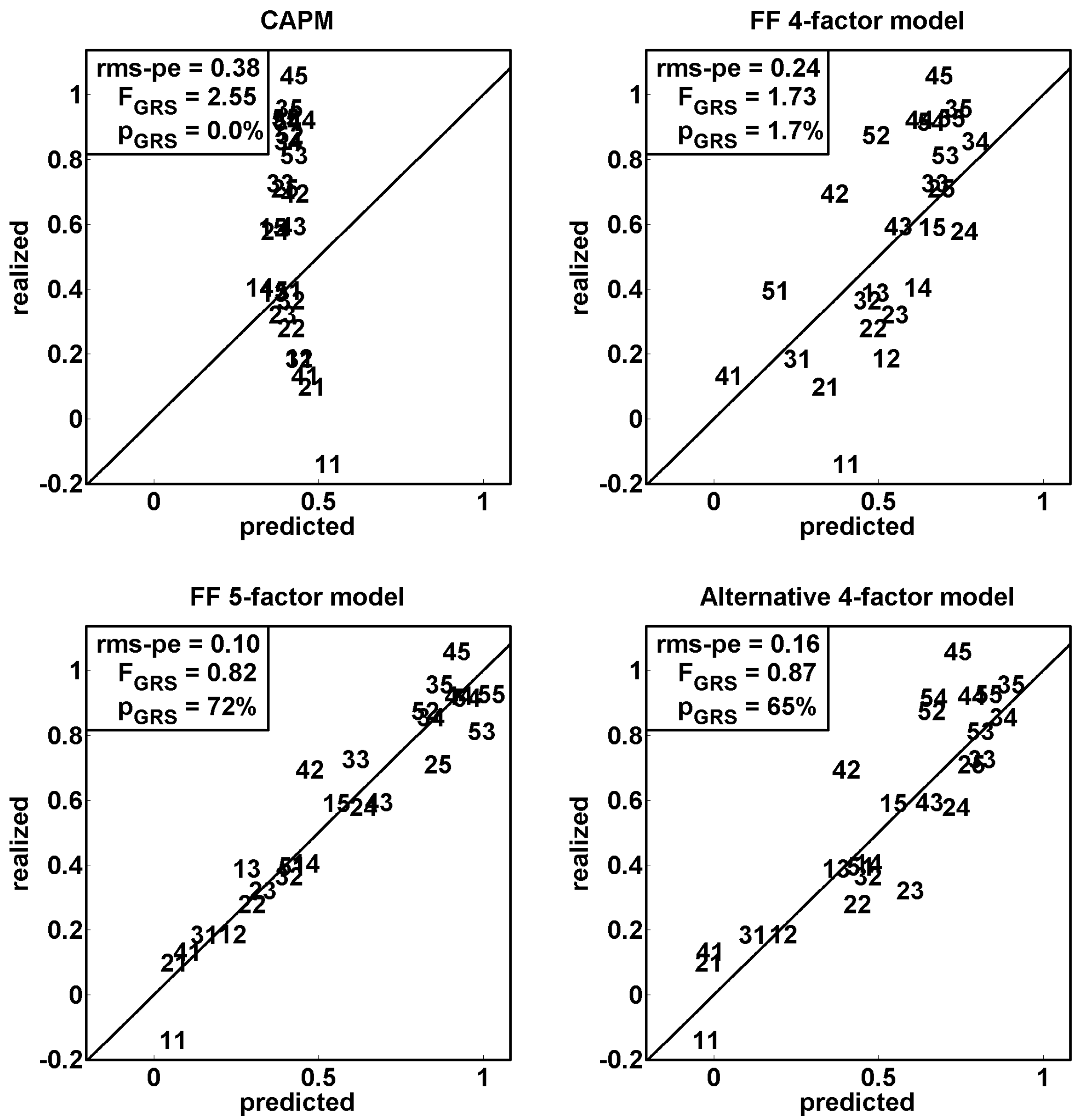

Figure 3. Excess returns to portfolios sorted on gross profits-to-assets and book-to-market
This figure shows the average excess monthly returns (actual vs. predicted) to portfolios independently double quintile sorted on gross profits-to-assets and book-to-market. The figure shows predicted returns under the CAPM (top left), Fama-French four-factor model (top right), the five-factor model that replaces the canonical value factor HML with the conditional value and profitability factors HML | GP and PMU | BM (bottom left), and the four-factor model employing the market, and the industry-adjusted value, momentum and profitability factors HML*, UMD*, and PMU* (bottom right). The indices run from low to high, and correspond to the sorting variable (first then second). The sample excludes financial firms, and covers January 1972 to December 2008.

The five-factor model that replaces HML with HML | GP and PMU | BM performs much better. The bottom left panel depicts the portfolios' realized returns as a function of their model predicted returns, and here the root-mean-squared pricing error is only 0.10 percent per month. The model even does well with the hard to price unprofitable growth portfolio. A GRS test fails to reject that the pricing errors are jointly zero.

The alternative four-factor model also performs well pricing these portfolios. The portfolios' root-mean-squared pricing error is 0.16 percent per month, and the model performs particularly well on the unprofitable growth portfolio. Its statistical performance is on par with that of the five-factor model employing HML | GP and PMU | BM.

8 Conclusion

Profitability, as measured by gross profits-to-assets, has roughly the same power as book-to-market predicting the cross-section of average returns. Profitable firms generate significantly higher average returns than unprofitable firms, despite having, on average, lower book-to-markets and higher market capitalizations. Controlling for profitability also dramatically increases the performance of value strategies. These results are difficult to reconcile with popular explanations of the value premium, as profitable firms are less prone to distress, have longer cashflow durations, and have lower levels of operating leverage, than unprofitable firms. Controlling for gross profitability explains most earnings related anomalies, as well as a wide range of seemingly unrelated profitable trading strategies.

A Appendix: regressions employing EBITDA and XSGA

Earnings before interest, taxes, depreciation and amortization is gross profits minus operating expenses, which largely consist of selling, general and administrative expenses. Table 19 shows results of Fama-MacBeth regressions employing gross-profits-to-assets, and a decomposition of gross-profits-to-assets into EBITDA-to-assets and XSGA-to-assets. Earnings before interest, taxes, depreciation and amortization is gross profits minus operating expenses, which largely consist of selling, general and administrative expenses. The

Table 19. Fama-MacBeth regressions employing EBITDA and XSGA

This table reports results from Fama-MacBeth regressions of firms' returns on gross profits (revenues minus cost of goods sold, Compustat REVT - COGS), earnings before interest, taxes, depreciation, and amortization (EBITDA), and selling, general, and administrative expenses (XSGA), each scaled by assets (AT). Regressions include controls for book-to-market (log(bm)), size (log(me)), and past performance measured at horizons of one month ($r_{1,0}$) and twelve to two months ($r_{12,2}$). Independent variables are Winsorized at the one and 99% levels. The sample excludes financial firms (those with one-digit SIC codes of six), and covers July 1963 to December 2009.

independent variables	slope coefficients ($\times 10^2$) and [test-statistics] from regressions of the form $r_{tj} = \boldsymbol{\beta}'\mathbf{x}_{tj} + \epsilon_{tj}$					
	(1)	(2)	(3)	(4)	(5)	(6)
gross profitability	0.67			0.58	1.27	
	[5.06]			[4.40]	[4.17]	
EBITDA-to-assets		0.99		0.49		1.30
		[3.26]		[1.53]		[4.01]
XSGA-to-assets			0.68		-0.43	0.79
			[4.42]		[-1.39]	[5.34]
log(BM)	0.32	0.30	0.36	0.33	0.35	0.35
	[5.42]	[5.40]	[6.57]	[6.07]	[6.20]	[6.16]
log(ME)	-0.14	-0.16	-0.11	-0.14	-0.14	-0.14
	[-3.22]	[-4.24]	[-2.58]	[-3.79]	[-3.60]	[-3.66]
$r_{1,0}$	-6.10	-6.12	-6.18	-6.23	-6.31	-6.32
	[-15.1]	[-15.4]	[-15.2]	[-15.7]	[-15.7]	[-15.8]
$r_{12,2}$	0.61	0.61	0.62	0.57	0.58	0.58
	[3.28]	[3.30]	[3.36]	[3.07]	[3.17]	[3.17]

table shows that both EBITDA-to-assets and XSGA-to-assets have power explaining the cross-section of average returns, either individually or jointly, but neither has power in regressions that include gross profits-to-assets. Because gross profits-to-assets is essentially EBITDA-to-assets and XSGA-to-assets, all three variables cannot be used together.

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