Asset-Intensity and the Cross-Section of Stock Returns

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Abstract

This paper tests the hypothesis that many investors overlook persistent firm differences in the amount of investment required to grow sales and profits. I focus on asset-intensity (operating assets/sales) as a proxy for the net investment a firm needs to attain a given growth rate and show that firms with heavy (light) asset-intensity have lower (higher) subsequent stock returns. A long/short portfolio based on this effect yields abnormal returns around 0.4% per month. Asset-heavy stocks miss consensus analyst earnings forecasts 16% more often than asset-light stocks, suggesting investor forecast error is the source of the return difference. Consistent with the hypothesis that investors make a mistake about the investment required to grow, asset-intensity is a stronger predictor when expected or ex-post investment is high.

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Introduction

This paper tests the hypothesis that many investors overlook persistent firm differences in the amount of investment required to grow, resulting in mispricing and return predictability. On average, firms with heavy asset-intensity (high operating assets to sales) require heavy investment to generate a given growth rate in sales and profit. If investors overlook asset-intensity, they will overvalue firms that require heavy investment to grow and undervalue firms that can grow with little investment. One way this might occur is if investors use industry average price-to-earnings ratios to anchor their valuations, even though these ratios ignore the role of asset intensity in translating net investment into new sales and profits.

Consistent with this hypothesis, asset-intensity is a powerful predictor of stock returns. From July 1963 to December 2006, a light-quintile-minus-heavy-quintile portfolio earns about 0.3% to 0.5% returns, characteristic-adjusted returns and risk-adjusted alphas per month; the alphas are significant at the 1% level. Excess returns are about 0.6% per month using deciles instead of quintiles. Furthermore, while the light-minus-heavy effect is stronger in small stocks, it is also significant in big stocks; hence it is present in both equal-weighted and value-weighted portfolios. The results are robust to controls for investment, accruals and return-on-equity. Asset-intensity predicts returns within industries; it is not merely an industry effect. In sum, asset-intensity is a very robust predictor of returns.

These differences in returns correspond to persistent differences in the ability of asset-light firms to convert investment into growth compared to asset-heavy firms. By definition, firms with light asset-intensity have high productivity of existing assets (i.e., high sales/assets). I document that asset-light firms also have persistently higher returns on existing assets and higher returns-on-new-investment. Consequently asset-light firms experience significantly higher growth rates in both earnings and dividends compared to asset-heavy firms.

A critical but difficult question is whether the high returns of asset-light stocks and low returns of asset-heavy stocks are due to error by some investors, or whether investors consider the low returns and alphas of asset-heavy stocks acceptable because asset-heavy stocks are less risky in some sense not captured by controls for size and value.

Several pieces of evidence suggest the behavioral story is more plausible than a risk story.

First, a behavioral story implies investors make flawed forecasts. I document that asset-heavy stocks miss analyst forecasts for earnings significantly more often than asset-light stocks; this suggests analysts' forecasts are flawed. Investors that rely on analyst forecasts will be relatively too pessimistic about the earnings of asset-light firms and relatively too optimistic about the earnings of asset-heavy firms.

Second, the specific behavioral hypothesis is that investors overlook investment required to grow; thus asset-intensity should be a stronger predictor of returns and earning surprises when expected or ex-post investment is high. Dividing stocks into growth and value, which corresponds with high or low expected growth rates[1], asset-intensity is a stronger predictor of both earnings surprises and returns among growth stocks. Dividing stocks into those who ex-post grow more or less in the following fiscal year, asset-intensity is a stronger predictor of both earnings surprises and returns among those stocks with high ex-post growth.

Third, I provide evidence against two of the most plausible rational risk stories: labor risk and bankruptcy risk. Asset-light stocks are logically (and empirically) labor-heavy stocks; one might hypothesize that labor-heavy stocks are riskier because they co-vary with investors' labor income. However, sorting on both within-industry asset-intensity and labor intensity shows that it is asset-intensity, not labor-intensity, which predicts returns. Alternatively, one might think that all stocks have similar chances of bankruptcy but asset-heavy stocks will have more assets in bankruptcy and so are safer; using Ohlson's (1980) measure I find that asset-heavy stocks have about a 4 times higher chance of bankruptcy, offset by only 1.5 times more assets per dollar of market value.

One might wonder whether high asset-intensity is mainly driven by high recent net investment or high accruals, and whether it is investment or accruals that predict returns. Several researchers find that high levels of recent investment forecast lower returns (See

[1] See for example Fama and French (1995).

Fairfield, Whisenant, and Yohn 2003; Richardson and Sloan 2003; Titman, Wei and Xie 2004; Fama and French 2006; Polk & Sapienza 2007; Cooper, Gulen and Schill 2007). Investments in net working capital are accruals; a long literature (mostly in accounting) finds that high levels of accruals predict low future stock returns (See Sloan 1996; Xie, 2001; Fairfield, Whisenant, and Yohn, 2003; Hirshleifer, Hou, Teoh and Zhang, 2004; Richardson, Sloan, Soliman, and Tuna 2004, 2005; Chan, Chan Jegadeesh, and Lakonishok, 2006; Zhang 2007). In robustness tests, I find that asset-intensity predicts returns after controlling for investment and accruals; asset-intensity is a distinct predictor of returns.

Asset-intensity is empirically and (as I argue) theoretically correlated with return-on-equity. A few authors have found that return-on-equity predicts returns (See Haugen and Baker 1996; Cohen, Gompers and Vuolteenaho 2002; Fama and French 2006). In robustness tests, I find asset-intensity predicts returns much better than return-on-equity.

There are several advantages to using asset-intensity to proxy for investment required to grow[2] instead of other proxies, such as recent new-investment-to-new-profit, book-equity-to-earnings or assets-to-profit. If we could measure true recent new-investment-to-new-profit, that might be the best measure of investment required to grow. However, it is incredibly difficult to allocate profit between the old assets and new investment; assuming that the entire change in earnings from year-to-year is due to new investment is a very noisy measure. While equity shareholders only care about their investment and earnings, book-equity-to-earnings is conceptually not a reliable long-term measure of required investment per dollar of earnings unless the current ratio of equity to debt and operating liabilities will remain constant in perpetuity–an aggressive assumption. Using assets instead of book-equity avoids assumptions about future capital structure. In general, the intuition and empirical results in this paper work with assets-to-profit[3] instead of assets-to-sales, but there are two further advantages to scaling by sales instead of profit. First, profit varies much more from year to year than sales; scaling by sales avoids some of this year-to-year variation and focuses on

[2]Investment required to grow is the mathematical inverse of return on new investment.

[3]Measures of profits generated by the assets (i.e., debt plus equity) could be NOPAT (Net Operating Profit After Tax) or informally EBIT (Earnings Before Interest and Taxes).

persistent differences. Second, using assets-to-sales instead of assets-to-profit can confirm that investors are ignoring something about the assets and not something about the profits of firms. There has been relatively little published research on the ability of an assets-to-sales ratio (in the form of asset turnover) to predict future profitability (See Fairfield & Yohn, 2001) although a working paper by Soliman (2004) finds that within-industry abnormal asset turnover is a persistent predictor of return-on-assets. It is possible that investors neglect assets-to-sales precisely because it is a more subtle predictor of the investment required to grow profits.

In the following sections I discuss the motivation, the data, the results, future research and conclusions.

Motivation

If asset-light firms require less investment to grow, then they can either grow faster than asset-heavy firms with the same investment or alternatively grow at the same rate but with less investment.

However, there are two reasons why investors are likely to under appreciate the importance of the investment required to grow, and thus undervalue asset-light firms relative to asset-heavy firms.

One reason is related to the psychology of anchoring, specifically investors may anchor on industry-wide average price-to-earnings ratios or growth rates. Psychology research has firmly established that when people make judgments by anchoring on a number and then adjusting from that number, they do not adjust enough[4]. For example, If investors decide on the value of a firm by anchoring on an industry-wide p/e ratio and then adjusting, they

[4] For example, Kahneman & Tversky (1974) asked participants to spin a wheel of fortune from 0 to 100, and then estimate whether the percentage of African countries in the UN was greater or lower than the number spun, and then estimate the exact percentage. When the wheel spun to 10, participants estimated 25% of UN countries were African; when the wheel spun to 65, participants estimated 45%. Payoffs for accuracy did not reduce the anchoring effect.

are likely to adjust insufficiently. Thus, asset-light firms should be assigned very high p/e ratios (because they can grow earnings quickly and profitably), but investors who anchor on an industry p/e ratio and then adjust will likely only give asset-light firms a moderately high p/e ratio. Similarly, asset-heavy firms should receive a very low p/e ratio (because they cannot grow earnings profitably) but investors who anchor and then adjust are likely to only give them a moderately low p/e ratio. The same idea applies to predicted growth rates of earnings–if investors anchor on the average growth rate of earnings for the industry and then adjust, they will likely underestimate the growth rate of asset-light firms and over-estimate the growth rate of asset-heavy firms.

A second reason to expect investors make a mistake when valuing asset-light versus asset-heavy firms is simply that correctly incorporating investment in valuation models is difficult; Fernandez & Carabias (2006) document common mistakes made by analysts in valuation analysis and note that one common mistake concerns required investment, especially in the terminal year of a forecast. Thus, if many investors cannot correctly forecast required investment and effectively assume all firms require the same investment to grow, they will implicitly underestimate the amount of investment required by asset-heavy firms–and be disappointed by reality–while over-estimating the amount of investment required by asset-light firms–and be pleasantly surprised by their subsequent performance.

Since both of these cognitive errors would lead to similar return predictions and both are likely happening at the same time, I make no attempt to distinguish the relative importance of these two errors.

Mathematically, we can use two simple models to provide intuition for the effects of overlooking required investment for growth[5], one when when investment is fixed and growth varies and one when growth is fixed and investment varies.[6]

[5] In the language of the Hirshleifer & Teoh (2003) model of investor limited attention, this would be a parameter simplification–assuming that asset intensity does not matter.

[6] Of course, neither growth nor investment is fixed; a realistic model would recognize that investment and growth are endogenously chosen based on many inputs, including the required investment per unit of growth (i.e., the inverse of the return on new investment).

First, let's focus on the effect of overlooking investment required to grow when investment is fixed and growth varies with asset intensity. For example, this occurs when firms simply reinvest their earnings without raising new equity. When assets are entirely financed by equity, then earnings are the product of assets times return-on-assets.

$$e_t = A_t * ROA_t \tag{1}$$

Given new investment (I), the next period earnings are a function of existing assets times current return-on-assets plus net investment times the return-on-new-invested-capital[7] (RONIC).

$$e_{t+1}^{Correct} = (A_t + I_{t+1})\, ROA_{t+1} \tag{2}$$

$$e_{t+1}^{Correct} = e_t + I_{t+1} RONIC_{t+1} \tag{3}$$

If ROA is persistent (i.e., $ROA_t = ROA_{t+1} = RONIC_{t+1}$) but investors overlook this persistence, then they will be disappointed by the investments of those with low profitability and pleasantly surprised by those with high profitability. If some investors form expectations of earnings growth independent of future investment (possibly based on industry average growth rates)...

$$e_{t+1}^{Perceived} = e_t(1 + g^{Perceived}) \tag{4}$$

...then the correct earnings relative to perceived earnings will be a function of return-on-assets, and higher when there is greater investment.

$$e_{t+1}^{Correct} - e_{t+1}^{Perceived} = I_{t+1} RONIC_{t+1} - e_t g^{Perceived} \tag{5}$$

Asset productivity (Sales/Assets) predicts persistent differences in asset profitability (earnings/assets), therefore:

$$RONIC_{t+1} \propto \frac{e_t}{A_t} \propto \frac{Sales_t}{A_t} \tag{6}$$

[7] Return-on-new-investment is the inverse of investment required to grow.

Thus, one prediction of equation (10) is that if investors overlook persistent firm differences in the return-on-new-investment ($RONIC_{t+1}$), then investor mistakes are likely to be larger when investment (I_{t+1}) is higher. I will measure expected future investment, proxied by growth firms, and directly measure ex-post future investment using year-ahead investment, i.e., the investment contemporaneous with the returns. Note that the physical asset-intensity of the existing assets of the firm are accounted for in earnings through the depreciation charge; therefore investors who focus on earnings will only be fooled by the profitability of new investments.

A second simple framework is where growth is fixed, and investment varies between firms with different asset-intensity.

The Gordon dividend growth formula is a useful rule-of-thumb for valuing stocks, and it is exactly correct under the conditions that expected future growth (g) in dividends (d) is known and constant and the future discount rate (r) is known and constant.

$$V^{Correct} = \frac{d}{r-g} \tag{7}$$

But many stocks do not pay dividends. For stocks which do not pay dividends, the Gordon dividend growth model can be applied to free cash flow (c), i.e., earnings (e) minus new investment. For a firm in which all assets are financed by equity, new investment will simply be assets (A) times the (known and constant) growth rate (g):

$$V^{Correct} = \frac{c}{r-g} = \frac{e-Ag}{r-g} \tag{8}$$

Investors who focus on earnings and overlook investment required for growth will value stocks proportional[8] to earnings:

$$V^{Perceived} \propto \frac{e}{r-g} \tag{9}$$

[8] If investors believe that all firms with equal growth should have the same p/e ratio (or all firms with equal growth in the same industry) then this implicitly assumes that all firms with the same growth have the same required new investment.

If many investors overlook investment required for growth, then proxies for assets-to-profit times growth should predict returns.

$$\frac{V^{Correct}}{V^{Perceived}} \propto 1 - \frac{Ag}{e} \tag{10}$$

Given the empirical fact which I document that asset intensity is correlated with the assets to profits (i.e., the inverse of return on assets):

$$\frac{A}{e} \propto \frac{A}{Sales} \tag{11}$$

we can see one simple prediction is that asset-intensity should be a stronger predictor of returns when growth (g) is higher. Intuitively, if expected growth is high then firms which need more investment to grow will be overpriced by investors who overlook required investment. Empirically, I will proxy for long-term growth with "growth" firms, i.e., firms with high market value to book value of equity.

In order for these systematic mistakes of some investors to be reflected in asset prices, implicitly these mistakes must not be erased by rational investors who do not make mistakes. Models such as De Long et al. (1990) and Hirshleifer & Teoh (2003) provide the basic intuition: due to risk-aversion of the rational investors and transactions costs, the trades of rational investors cannot completely erase the impact of mistake-prone investors and prices reflect a weighted average of expectations of the rational and mistake-prone investors.

In reality, firms do not have a fixed growth rate or fixed investment, but the intuition gained from these two extremes is useful. First, holding growth constant, even if investors forecast earnings correctly, if they overlook investment required to grow they might be disappointed by low amounts of cash remaining to distribute to shareholders in dividends or share buybacks. Second, holding investment constant, if investors do not focus on investment required to grow they will be disappointed by the poor earnings growth of asset-heavy firms, and they will be more disappointed when investment is higher. Thus asset intensity should be a stronger predictor of stock returns and earning surprises among stocks with high expected or ex-post future investment.

Data

I analyze stocks traded on the NYSE, AMEX and NASDAQ from July 1963 to June 2006. Only firms with ordinary common equity (share codes 10 and 11 in CRSP) are included; this means that ADRs, REITs and units of beneficial interest are excluded, as are stock indexes. All return data is from CRSP. To limit the impact of tiny stocks in equal-weight analyses, I insist that stocks have a minimum market value of $25 million at close of June to be included in the following July to June analysis.

Since asset-intensity is not comparable between financial and non-financial firms, I exclude all financial firms, i.e., those with Compustat SIC codes between 6000 and 6999. Because financial firms are excluded from my analysis, but financial firms are included in the Fama-French factors and size/value portfolios, the combined value-weighted alphas and excess returns of my portfolios differ from zero.

Accounting variables are from Compustat. Accounting variables for the fiscal year ending in calendar year t are matched with returns for July of year t+1 to June of year t+2. This lag of at least six months between fiscal year-end and the initial purchase of the stock ensures that financial results will be available to the public before investment.

The core measure of asset-intensity is Total Assets (data6), minus Cash (data1) and investments (data32, if available), divided by Sales (data12). I treat missing investments data as zero since for most firms this is an irrelevant part of their business. Limited tests either omitting all investments data or strictly requiring investments data produce very similar results. The rare negative values of Sales, Total Assets, Cash or Investments are treated as missing. Asset-intensity greater than 50 is considered an error and treated as missing.

My definitions of earnings and book equity are from Fama and French (1992). Earnings are income before extraordinary items (Compustat data 18), plus change in deferred taxes (data 50, if available), minus dividends to preferred stock (data 19, if available). Book equity is common equity (data 60) plus deferred taxes (data 74, if available). Negative book equity is treated as missing.

Earnings surprise data is from the IBES Summary database. Earnings surprises are measured relative to the average analyst earnings expectation in the middle of the calendar month prior to the month of the earnings announcement; this method thus treats pre-announcements and announcements during the month of the return announcement similarly.

To test accruals, I use the definition from Sloan (1996), change in working capital minus depreciation scaled by average assets:

$$Accruals_t = \frac{\Delta WorkingCapital_t - Depr_t}{(A_t + A_{t-1})/2} \quad (12)$$

$$WorkingCapital_t = (CA_t - Cash_t) - (CL_t - STDebt_t - TaxesPayable_t) \quad (13)$$

Ohlson (1980) O-score used to predict one-year bankruptcy probabilities are calculated as follows:

$$\begin{aligned} OH_t = & -1.32 + -4.07 \ln(A_t/GNP_t) + 6.03 L_t/A_t - 1.43(CA_t - CL_t)/A_t + 0.0757 CL_t/CA_t \\ & -2.37 NI_t/A_t + 0.285 Loss_t - 1.72 NegBook_t - 0.521 \Delta NI_t - 1.83 Op_t/L_t \end{aligned} \quad (14)$$

In the above equations A_t is total assets (Compustat data 6); GNP_t is the chain-weighted annual price index for GNP set to 1 for 1968 (stocks are matched with the January price index of the year prior to the accounting fiscal year); L_t are total liabilities (data 181); CA_t is current assets (data 4); CL_t is current liabilities (data5); NI_t is net income (data 172); $Loss_t$ is 1 if net income is negative in t and t-1, and 0 otherwise; $NegBook_t$ is 1 if liabilities exceed total assets, and 0 otherwise; ΔNI_t is the change in net income divided by the sum of the absolute values of net income in t-1 and t; and Op_t is funds from operations for which I use the convention in Fama French (2006) as earnings before extraordinary items (data 18) plus income statement deferred taxes (data 50), if available, plus equity's share of depreciation expense, which I define as $MC_t/(A_t - BE_t + MC_t)$ times total depreciation expense (data 14). The probability of bankruptcy is calculated as $e^{OH_t}/\left(1 + e^{OH_t}\right)$.

All ratios and growth rates, except CRSP returns, Ohlson probabilities of bankruptcy and return-on-new-invested-capital (RONIC), are winsorized at the 1% and 99% levels prior to calculating moments or running regressions. CRSP returns and Ohlson probabilities are not winsorized. RONIC is winsorized at the 5% and 95% levels.

Risk-factor returns for Mkt-Rf, SMB, HML, and UMD are from Ken French's website.

Results

Asset Intensity Predicts Financial Performance

Each July, stocks are sorted into five asset-intensity quintiles and the portfolio averages calculated. Light-Heavy tracks the performance of the light quintile minus the heavy quintile. Table 1 reports the time-series averages and t-statistics of these portfolios.

Panel A shows that asset-light stocks on average require $0.36 of assets per dollar of sales, while asset-heavy stocks require $2.69 of assets per dollar of sales. Asset-light firms have significantly higher returns-on-equity than asset-heavy stocks (10.99% versus -1.65%), but only slightly higher prices (measured by slightly lower earnings yields).

Panel B shows that asset-light forms have consistently higher return-on-investment in the year after portfolio formation, whether measured as return-on-new-invested-capital (RONIC), return-on-assets, or return-on-equity.

Return-on-new-invested-capital (RONIC) divides the change in EBIT by the change in operating assets, if the change in operating assets is positive. This implicitly assumes that all of the change in EBIT is due to the change in operating assets, a very weak assumption producing very noisy estimates. In order to reduce the noise in this measure, I winsorize the estimated RONIC at the 5th and 95th percentiles, which correspond to values of -188% and 228% respectively. Given the noise in this measure I do not believe the reported means reflect true return-on-new-investment; readers should focus on the relative differences not absolute magnitudes of RONIC across portfolios.

Using return-on-equity 10 years after portfolio formation, there is still a significant difference between the asset-light stocks and asset-heavy stocks. Thus, asset-intensity reflects persistent differences in the return on capital, i.e., the inverse of the amount of new capital required per dollar of new profit.

A natural question is how there can be persistent differences in the return-on-investment of different firms, because (a) if managers correctly pursue shareholder value then they should invest until the marginal return on investment is equal to the required return on capital, and (b) in a competitive market abnormally high returns on investment should be competed away by new entry and/or capacity expansion. Thus, in the background there must be some model of how these differences in return-on-investment persist in the face of rational investment. Mathematically, it could be that the very last dollar of investment earns exactly the cost of capital in both asset-light and asset-heavy firms, while the first dollar of net investment earns very high returns for asset-light firms but only moderate returns for asset-heavy firms, such that the average return on incremental investment is higher for asset-light firms. In this setting, the manager would be investing appropriately and there would be no incentive for competitive entry since the marginal return on investment was equal to the required return on capital, even though the incremental returns on investment were greater than the required return on capital. In this setting, the only outstanding question is what differences in pricing power generate the differences in returns on the first dollar of investment for asset light and asset heavy firms. Alternatively, it is possible that the marginal returns on investment differ between asset-heavy and asset-light firms and these differences persist due to frictions. For example, if asset-light firms could face financing constraints that prevent expansion until the marginal return on investment equals the cost of capital. Or managers of asset-heavy firms might sub-optimally over-invest due to agency conflicts or cognitive errors. Further research on the sources of these persistent differences in incremental returns on investment could prove insightful, but is not the focus of this paper.

Panel C shows that asset-light firms have higher earnings and dividend growth than asset-heavy firms. Since earnings can be negative and growth is not meaningful when changing between negative or zero and positive values, I measure asset growth as change in earnings divided by starting book equity. Asset-light firms grow earnings by on average

3.9% of book equity, while asset-heavy firms only grow earnings by 2.6% of book equity. Since not all stocks pay dividends, I calculate the growth in the portfolio's total dividends. On average, asset-light firms grow dividends by 12.5 compared to 7.5% for asset-heavy firms. These results are consistent with the idea that asset-light firms get a higher return on their reinvested earnings, and consequently grow faster.

Intuitively, asset-light firms seem more likely to have intangible assets like brands, human capital or research and development. A natural question is thus whether investors undervalue asset-light firms because they make a mistake in valuing intangible assets, as opposed to my story that investors are making a mistake about the investment required to grow asset-light firms. A simple thought experiment suggests that the mistake is about ease of growing profits, not intangible assets. Imagine two firms with equal total assets and the same productivity and return on their total assets, except half of the assets of the first are intangible assets and thus not visible on the balance sheet (while the second firm has all tangible assets). Certainly, the first firm will have a higher return on their tangible assets and be classified as asset-light. However, there is no reason why the first firm can grow their earnings any faster than the second firms over the long run, since the first firm needs just as much investment to grow it simply invests half in tangible and half in intangible assets. The first firm would have more room for manipulation–it could temporarily stop investing in its brand or intellectual capital and thus appear to have high earnings growth for a while. But over the long run, the firm with intangible assets could not grow earnings faster than the firm with only tangible assets if they both had the same return on total assets. Thus, the fact that asset-light firms have higher earnings growth and higher dividend growth than asset-heavy firms is inconsistent with the idea that investors simply undervalue intangible assets but consistent with the idea that investors do not fully appreciate how easily asset-light firms can grow.

Table 1 also shows that asset-heavy stocks issue more debt and equity than asset-light stocks. Again, since some firms have no debt and thus growth in debt may not be meaningful, I scale debt issuance by total assets. On average asset-light firms increase debt by

4.2% of assets, compared to 6.1% for asset-heavy firms. To measure net equity issuance, I use the change in split-adjusted shares outstanding. Shares outstanding could increase due to stock mergers, employee stock options, or secondary equity offerings. Asset-Light firms on average increase their shares outstanding by 3.3% compared to asset-heavy firms which increase their shares outstanding by 6.2% on average. These results are consistent with the high-investment needs of asset-heavy firms.

Overall, the results show that asset-light firms require less investment to grow and consequently grow faster than asset-heavy firms.

Asset Intensity predicts returns and alphas

As in Table 1, each July 1 stocks are sorted into five-asset-intensity quintiles and the equal or value-weighted returns of the portfolio are calculated each month. Table 2 shows that asset-light firms earn higher returns, characteristic-adjusted returns and alphas than asset-heavy firms, using both equal-weight and value-weight portfolios. A light-quintile-minus-heavy-quintile earns 46 basis points per month on an equal-weight basis, and a statistically insignificant 25 basis points on a value-weight basis . Controlling for the size and value characteristics of each stock, the light-minus-heavy portfolio earns 49 basis points per month with equal-weight portfolios and 34 basis points per month with value-weighted portfolios. Finally, controlling for risk-loadings on size and value instead of the size and value-characteristics, as well as loadings on a momentum factor, the light-minus-heavy portfolio earns 43 basis points of alpha per month using equal-weight portfolios and 37 basis points per month on a value-weight basis. In other results not shown in the tables, I find the returns, characteristic-adjusted returns and alphas are around 0.6% per month using deciles instead of quintiles.

Asset-light firms are typically smaller and more growth–i.e., they have lower book-to-market ratios. Panels B and C show that asset-light stocks load positively on the Small (SMB) risk factor and negatively on the Value (HML) risk factors.

Whether the return predictability appears to come from the asset-heavy or asset-light stocks depends upon how abnormal returns are calculated. On an equal-weight basis using characteristic-adjustments, heavy stocks earn -33 basis points per month compared to +17 basis points per month for light stocks. Value-weighted characteristic adjusted returns show similar magnitudes for light and heavy. By contrast, the positive alphas of light stocks are larger in magnitude than the negative alphas for heavy stocks. The same pattern appears for within-industry sorts on asset intensity in Table 6 later: characteristic-adjustment suggest the effect is stronger among heavy stocks while alphas suggest the effect is stronger among asset-light stocks.

Of course, this return-predictability is also consistent with asset-light (heavy) firms having a rationally expected higher (lower) return; predictability by itself does not prove whether that predictability is due to investor error or rationally expected differences in required returns.

Asset Intensity predicts analyst forecast errors

For Table 3, each July 1 stocks are sorted into five quintiles with equal number of stocks based on asset-intensity. For each year from July 1 to June 30, the four quarters of earnings surprises relative to analyst forecasts are averaged across all stocks in each portfolio. Time-series averages and t-statistics of the portfolios are reported. Percent Meet Prior Month (Year) Forecast is the frequency that IBES-reported earnings are equal or higher than the average analyst estimate from middle of the prior (10-month prior) calendar month. Surprise/|E| is the surprise scaled by earnings= $\frac{ActualEarnings_t - AverageAnalystEstimate_{t-1}}{(|ActualEarnings_t| + |AverageAnalystEstimate_{t-1}|)/2}$.

There are several reasons to average surprise data by year, rather than by month or quarter. Frazzini and Lamont (2006) document that earnings report months are not evenly distributed across months (because most firms have December fiscal year ends). Furthermore, although firms report earnings each quarter, these reports are not evenly spaced every three months because there is a difference in reporting the comprehensive, audited annual results versus quarterly results. Finally, delays in reporting are often associated with financial problems. Averaging surprise data by year rather than quarter mitigates concerns that timing is correlated with performance. In robustness tests, results are slightly stronger if earning surprises are averaged by month, using only those stocks that reported earnings that month.

Table 3 shows that as a group, asset-light firms meet or beat analyst forecasts more often than asset-heavy firms, using both month-ahead and year-ahead analyst earnings forecasts. Empirically, these results are consistent with Barton and Simko (2002). Since firms often pre-announce news about their performance, I use the average (often called "consensus") analyst earnings forecasts from the middle of the month prior to the calendar month in which their earnings were announced. On an equal-weight basis, asset-heavy firms meet or beat month-ahead forecasts only about 52% of the time (i.e., miss 48%), while asset-light firms meet or beat forecasts about 58% of the time (i.e., miss 42%)[9]. The results are even stronger on a value-weighted basis–i.e., weighting each firm observation by their market value of equity. Whether or not firms meet analyst forecasts is statistically analogous to a median; looking at the mean value of the surprise, scaled by earnings, we see the same pattern: asset-heavy firms disappoint significantly more often than asset-light firms. Investors who use analyst forecasts without considering this difference in optimism/pessimism for asset-heavy/light stocks will implicitly behave as if they are making forecast errors.

It is tempting to immediately interpret these forecast errors as cognitive mistakes by analysts and to assume that analysts tried to pick their forecasts such that firms would meet or beat exactly 50% of the time. However, Lim (2001) argues that some analyst optimism is rational in order to get favorable access to information; Hong and Kubik (2003) find analysts are rewarded in their careers for optimism about investment banking clients; Chen and Jiang (2002) argue analysts overreact to favorable public information. Since asset-heavy stocks issue much more debt[10] (and slightly more equity) and thus are more likely to require investment banking business, analysts might have greater incentives for optimism about asset-heavy firms. On the other hand, since there is little difference in

[9] Thus, asset-heavy firms miss analyst forecasts 16% ($48\%/42\% - 1$) more often than asset-light firms.

[10] Table 1 shows that asset heavy firms issue slightly more debt as a percentage of starting debt, but unreported results find asset-heavy firms have significantly more starting debt than asset-light firms.

debt and equity issuance for the 80% of firms outside the asset-heavy quintile, it is unclear why analysts should be overly pessimistic about the asset light firms. Ultimately, while this pattern of earning surprises is consistent with a cognitive mistake, further research into the nature of analyst biases for asset-heavy stocks is warranted.

In the motivation section, I argued that asset-heavy firms will either have slower earnings growth holding investment constant or require greater investment holding earnings growth constant. While earnings surprises (i.e., analysts forecasts versus actual earnings) can identify slower-than-expected earnings growth for asset-heavy firms, there is little or no ability (to my knowledge) to track investment surprises. The long-term consequence of higher-than-expected investment is lower-than-expected cash for dividends and share-repurchases. It is difficult to track dividend surprises because there is more limited data on dividend forecasts and if dividend levels are announced independent of the reporting of financial results then it is difficult to identify surprises. And although the number of outstanding shares is implicitly considered in earnings-per-share forecasts, there is no tracking (to my knowledge) of planned-net-share-issuance surprises.

Asset Intensity is a stronger predictor among growth stocks

My hypothesis is that many investors overlook the investment required to grow sales and earnings in the future, and since asset-heavy stocks require more investment than asset-light stocks, asset-heavy stocks will repeatedly disappoint investors relatively and earn lower returns. This intuition suggests that asset-intensity should matter more among stocks which have high long-term growth prospects and thus need more investment. Fama and French (1995) document that growth stocks have higher expected growth than value-stocks, so I split stocks into Value and Growth as a proxy for expected growth.

After dividing stocks into Value and Growth based on their book-to-market ratio relative to the NYSE median book-to-market, within each group I divide stocks into five asset-intensity quintiles. The Light-Heavy portfolio is long the Light portfolio and short the Heavy portfolio. The Diff. in Diff. portfolio is long the Growth Light-Heavy portfolio and short the Value Light-Heavy portfolio. The equal-weight returns and earnings surprises of each portfolio are calculated as described in Tables 2 and 3.

Table 4 documents that while on an equal-weight basis the light-minus-heavy portfolio earns positive alpha among both value and growth stocks, it earns significantly higher alpha among growth stocks. Furthermore, the earning surprises follow the same pattern as the returns: there is a bigger spread in the percent that meet forecasts between the Light and Heavy stocks among the Growth stocks compared to among the Value stocks. Thus, the returns and earning surprise data is consistent with the hypothesis that investors are making a mistake about the interaction between asset-intensity and future investment.

This pattern of earning surprises is a strong argument for investor error over rationally-expected cash-flows explaining the return pattern.

Asset Intensity is a stronger predictor among stocks with high ex-post investment

Table 5 is constructed in the same manner as Table 4, but the first division is into those stocks with Low versus High year-ahead (i.e., ex-post) investment, measured as the growth in total assets. The division between Low-Growth and High-Growth does not represent an investable strategy, because investors cannot know exactly which will have low or high growth ahead of time. But dividing stocks into Low and High ex-post growth is useful for understanding the mechanism by which asset-intensity predicts returns. The results confirm the investment-related hypothesis: asset-intensity is a stronger predictor of returns and earning surprises when there is higher investment. The fact that asset-intensity is a stronger predictor of returns when there is high ex-post investment is harder to reconcile with a story about misvaluation of intangible assetsor previous earnings management. The fact that asset-intensity is a stronger predictor of analyst forecast errors when there is high ex-post investment is hard to reconcile with a rational story.

An additional finding of this analysis is that earning surprises are consistently higher for the high ex-post asset-growth stocks compared to the low ex-post asset-growth stocks.

Mechanically, if firms invest more than expected at the beginning of the quarter that should increase their total sales and profits for the quarter. Since analysts make earnings forecasts, not earnings-per-dollar-of-assets forecasts, firms should be able to surprise analysts simply by investing more than expected. Further research into the general effects of ex-post investment on analyst surprises and returns would be insightful.

Robustness tests: controls for investment, accruals and ROE

From a strictly empirical perspective, one important contribution of this paper is documenting that asset-to-sales predicts returns. Previous research has found that recent investment, recent accruals and recent return-on-equity (ROE) all can predict returns. High recent investment will drive up the asset-intensity ratio. Low ROE could be due to high levels of assets. Richardson et al. (2006) find empirically that accruals are correlated with declines in sales-to-assets. So there is reason to wonder whether asset-intensity predicts financial results and returns after controls for investment, ROE and accruals.

To test net investment, I use the log of the growth in total assets (Compustat data item 6), from Cooper Gulen & Schill (2007). This measure of investment implicitly includes both acquisitions and capital expenditures; unreported tests using capital expenditures alone, scaled by average assets, find that capital expenditures is a much weaker and statistically insignificant predictor of returns.

To test ROE, I divide earnings by book equity. (See the Data section for a description of these calculations).

To test accruals, I use the definition from Sloan (1996), change in working capital plus depreciation scaled by average assets.

All regressions control for the well-known predictors of performance and returns: size (log of equity market value in June prior to returns) and value (ratio of book value from fiscal year to market value in December of fiscal year), Monthly return regressions also control for momentum (log return from 12 months prior to 1 month prior).

Table 6, panel A reports the mean and standard deviations of the independent variables.

Table 6, panel B, uses a pooled regression to predict the future financial performance reported in Table 1, after controlling for the other known predictors and using industry dummy variables. Standard errors are clustered at the year-level, since the dependent variables are essentially year-to-year changes (when one independent variable is the lagged value of the dependent variable) and thus likely independent across years but correlated within a given year[11]. The log of the asset intensity ratio is a statistically significant predictor of return-on-investment, growth and capital-raising after all of these controls, confirming the results displayed in Table 1.

Table 6, panel C, shows the results of a traditional Fama-Macbeth regression predicting monthly returns. Each month a cross-sectional regression predicts stock returns minus the risk-free rate. The coefficients from each month are averaged over all months and the time-series t-statistics reported. The log of the asset-intensity ratio is a robust predictor of monthly returns after all controls. Panel D reports the results of a value-weighted Fama-Macbeth regression, where each observation is weighted by its market value at the close of the preceding month; this value-weighted Fama-Macbeth regression is the regression analogy to value-weighted portfolio sorts. Importantly, log of the asset-intensity ratio is highly statistically significant on a value-weighted basis, as well as an equal-weighted basis.

Within-industry asset-intensity predicts performance and returns

Is the asset-intensity phenomenon primarily an industry effect? Table 7 shows that Asset-Intensity is a strong predictor or returns, characteristic-adjusted returns, and alphas within 2-digit SIC industries. This is consistent with investors giving insufficient consideration to relative differences in asset-intensity within industries. Thus, Asset-Intensity predicts returns both across and within industries.

[11] Per the suggestion of Petersen (2006), I have also tried using firm-level clustering of standard errors instead and the t-statistics in that case are much larger than clustering by year, and not much different from no clustering at all, confirming the intuition that there is little need to cluster by firm but clustering by year is important.

Labor-intensity and within-Industry asset-intensity

Intuitively, asset-intensity should be strongly negatively correlated with labor-intensity. And if investors are worried about the covariance of their human capital with stock returns, they might consider labor-intensive stocks to be riskier[12]. A natural question is whether it is labor intensity or asset-intensity that predicts returns.

To my knowledge, there is no convention for measuring the labor intensity of firms; I measure it as the share of expense on labor and capital that is devoted to labor. Accordingly, I define labor intensity as labor expense divided by labor expense plus depreciation expense plus a capital charge of 8% on all property, plant and equipment. Unfortunately, data on labor expense is sparse in Compustat. Among stocks with data on labor expense, there is a very high negative correlation between labor-intensity and asset-intensity. However, there is a weaker correlation between labor intensity and within-industry asset-intensity.

Table 8 documents that after sorting all stocks with labor expense data into labor-intensity quintiles, crossing these with stocks' within-industry asset-intensity quintiles, and then calculating the returns and alphas of those portfolios, the asset-intensity quintiles predict returns much better than the labor-intensity quintiles. Within each labor-intensity quintile, the alphas for the Light-Heavy portfolios are usually statistically significant, while within each asset-intensity quintile, the Hi-Lo labor-intensity quintiles earn alphas statistically indistinguishable from zero, and often negative. Thus, I conclude it is asset-intensity and not labor-intensity that explains returns.

Bankruptcy risk

One might speculate that firms all firms are equally likely to go bankrupt, but asset-heavy firms will have more assets and equity in the event of bankruptcy and so are safer in terms of bankruptcy risk.

I estimate expected probabilities of bankruptcy using the empirically derived formula

[12] On the other hand, since labor income for individuals is an expense for firms, labor-heavy (i.e., asset-light) firms might be a hedge to labor income risk.

from Ohlson (1980). The first term Ohlson uses to predict bankruptcy is total assets, and he finds that holding everything else constant, firms with more assets are less likely to go bankrupt. Thus, we might even expect to find that asset-heavy firms have less risk of bankruptcy.

Table 9 documents that asset-heavy firms are about 4 times *more* likely to go bankrupt than asset-light firms. Mathematically, asset-heavy firms have lower profitability and weak financial ratios which outweighs any benefit derived from having more assets. So in terms of the probability of bankruptcy, asset-heavy firms are more risky than asset-light firms.

Of course, in the event of bankruptcy, asset-heavy firms should presumably have more assets than asset-light firms; significantly greater collateral might outweigh a slightly higher chance of bankruptcy. Table 9 documents that asset-heavy firms only have about 1.5 times as many assets and book-equity per dollar of market value as asset-light firms to offset the 4 times greater chance of bankruptcy[13]. It seems unlikely that this slightly higher amount of collateral can outweigh the greatly higher chance of bankruptcy for asset-heavy stocks.

If instead of weighting firms equally we weight firms by market value (not shown in the table), the estimated probabilities of bankruptcy on a value-basis are practically zero: asset-heavy stocks only have a 0.15% estimated chance of going bankrupt in the next year, and asset-Light stocks have a 0.04% estimated chance. It is hard to see how differences in bankruptcy risk could ever hope to explain the differences in value-weighted returns.

Other Explanations

Several other possible explanations are worth discussing.

One plausible explanation could be that asset-light firms have more operating leverage, in the sense that a given contemporaneous percentage change in sales will have a larger percentage change in profits per dollar of investment. In results not shown here, I find that

[13] Since these are true probabilities, not risk-adjusted (i.e., "risk-neutral") probabilities, it is difficult to precisely compare the 1.5 times greater book equity with the 4 times greater chance of bankruptcy. Also, it is theoretically possible that firms have differential exposure to some catastrophic, systemic risk that has never been realized in the United States and thus is missed by Ohlson's estimated probabilities of bankruptcy.

the returns-on-equity of asset-light firms are slightly more sensitive to contemporaneous changes in sales than asset-heavy firms; however I find that sorting directly on this measure of operating leverage does not predict returns.

Related to operating leverage, asset-heavy firms have higher margins than asset-light firms, although as demonstrated by Table 1 these higher margins are not high-enough to equalize returns-on-assets. In results not published here, I find that sorting on margins directly does not predict returns.

Asset light firms have equal or higher trading volumes both in dollars and as a percentage of shares outstanding on an equal and value-weight basis in results not shown here. In a sampling of bid-ask spreads on NYSE stocks, the asset-light and asset-heavy firms seem to have similar bid-ask spreads. Thus, asset-light stocks appear to be as easy or easier to trade than asset-heavy stocks.

Asset-intensity as a concept lends itself to many possible rational stories. As a general test of any rational risk story, I have conducted analysis similar to Daniel and Titman (1997) by constructing an asset intensity factor, sorting firms within each characteristic quintile by their loading on the asset-intensity factor over the past 36 months, and then seeing whether the characteristics or covariances better predict returns. Consistent with my behavioral story, the characteristics are significant predictors of returns while the covariances are not.

Consistent with the idea that having low asset-intensity leads to better future performance and higher future returns, I find that stocks which lower their asset-intensity (i.e., become asset-light*er*) have better subsequent performance and returns. However, the year-to-year change in asset-intensity is consistently a weaker predictor of performance and returns than ending asset-intensity.

Future Research

Future research could provide insight on outstanding questions about the precise mechanism by which asset intensity predicts returns.

This paper argues that asset-intensity predicts returns through the mechanism of net investment required per dollar of new profit, which is the inverse of return on new invested capital. The empirical measure of return on new invested capital used here is very crude: the change in profit divided by the change in operating assets, when operating assets have increased. This crude measure suffers from the very strong assumption that all of the change in profit is due to the change operating assets. More sophisticated measures of the return on new invested capital, perhaps by including forecasts of the change in profit on existing assets, would be a useful refinement.

Firms can have a heavy asset-intensity, i.e., low sales to assets, because the firm has unused capacity or because they are operating at normal capacity but the firm inherently requires heavy investment per dollar of sales. The marginal cost of new sales is very different when there is unused capacity versus an inherent need for high investment to grow. The guiding assumption in this analysis is that firms with heavy asset-intensity require heavy investment to expand, but if there is unused capacity than in the short-term new sales require negligible investment. Analysis of industry level capacity utilization could help understand the connection between capacity utilization and asset intensity.

An outstanding question is the role of acquisitions in the measure of asset-intensity and its connection to marginal return on investment. If acquirers pay more for a target than the book value of the target's assets they will record the difference as an asset of goodwill. If these acquirers wish to expand via further acquisitions, this goodwill may be representative of the investment needed to grow, but if these firms wish to expand internally it is not clear whether goodwill should predict the investment needed to expand. Unreported results find asset-intensity is a stronger predictor among stocks with low intangibles to assets, but that using operating assets minus intangibles in asset-intensity is a worse predictor of returns than using operating assets alone. Further research on the connection between acquisitions, goodwill and asset-intensity would be useful.

Novy-Marx (2007) measures operating leverage as the ratio of costs to book assets or market assets. Since costs are highly correlated with sales, costs-to-book-assets is negative 85% correlated on a rank basis with assets-intensity. Interestingly, sorting on costs-to-assets instead of asset-intensity generates a return-spread but not an alpha-spread. Further research to understand this connection is warranted.

Hirshleifer et al. (2004) analyze whether bloated balance sheets, measured as net operating assets (i.e., net of operating liabilities) scaled by total assets, can predict returns. Their measure is weakly correlated with asset-intensity. Further analysis of this connection might provide insights.

Lim (2001), Hong and Kubik (2003), and Chen and Liang (2006) find rational reasons for analyst optimism: access to information and career rewards for optimism about investment banking clients. Thus, an important question is whether analysts make inadvertent or deliberate errors in their relatively pessimist forecasts about asset-light firms compared to asset-heavy firms. If forecast errors about asset-heavy stocks are deliberate due to analyst incentives, then changes in the incentives of analysts (for example, recent attempts to separate analyst compensation from investment banking business) will affect whether these forecast errors continue. A related question concerns the relationship between specific accounting line items and forecast errors. For example, asset-heavy firms have more negative special items (although unreported regressions find that special items alone do not explain the differences in forecast surprises). A more comprehensive analysis into which kinds of analysts, firms, and accounting line-items explain surprise differences between asset-heavy and asset-light firms would be insightful.

Conclusion

This paper tests a simple hypothesis: that many investors overlook persistent firm differences in the investment required to grow, perhaps because they anchor on industry price-to-earnings multiples for valuation. Because asset-light firms require less investment than asset-heavy firms to grow at the same rate, asset-light firms should pleasantly surprise investors by growing their earnings and dividends more quickly without needing as much new debt and equity relative to asset-heavy firms.

This paper documents that asset-light firms do indeed grow their earnings and dividends more quickly than asset-heavy firms, without raising more capital. Correspondingly, asset-light firms earn higher returns, characteristic-adjusted returns and four-factor risk-adjusted returns.

In general, it is extremely difficult to determine whether strong or weak financial performance and stock returns were expected by investors. However, this paper documents that asset-light stocks meet or beat analyst forecasts more often than asset-heavy stocks, consistent with the idea that investors are making forecast errors about asset-light versus asset-heavy stocks. When future investment is high, asset-intensity is an even stronger predictor of returns and earning surprises. Two specific plausible rational stories, labor risk and bankruptcy risk, are rejected empirically. In sum, the evidence for an investor mistake instead of rationally expected differences in returns is reasonably strong given the inherent difficulty of the question.

Several analyses suggest that investors are making a mistake about investment required to grow and not some other mistake. The performance and return prediction is significant after controls for recent investment, recent accruals and recent return-on-equity. Asset-intensity is a strong predictor within industries, not only across industries. Notably, since asset-intensity is a stronger predictor of both surprises and returns when firms have high future investment, it appears that investment is the mechanism by which asset-intensity predicts returns.

Asset-intensity as a concept naturally lends itself to rational risk-related stories and other behavioral stories. While I have shown evidence against rational explanations related to labor-intensity and bankruptcy risk, there are undoubtedly other possible stories to consider. It is my hope that this empirical research inspires a broad range of further theoretical explanations, both rational and behavioral, so we can fully contrast this paper's explanation–that investors overlook the investment required to grow–with a rich set of alternative explanations for the ability of asset-intensity to predict stock returns. But any alternative story must explain not only why asset-intensity predicts returns, but also why asset-intensity predicts analyst earning surprises and why asset-intensity is a stronger predictor of both returns and surprises when future investment is high. Further research awaits.

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TABLE I: Financial Performance

Each calendar year, stocks are sorted into five quintiles with equal number of stocks based on Asset Intensity, $\frac{TotalAssets_{i,t}-Cash_{i,t}-Invest_{i,t}}{Sales_{i,t}}$. Data is from fiscal years 1962 to 2005. Time-series standard errors are reported based on the annual averages for each portfolio. Earnings are Income before extraordinary items, plus change in deferred taxes, minus preferred dividends. ROE=$\frac{Earnings_{i,t}}{BookEquity_{i,t}}$.Starting Earnings Yield is the portfolio earnings divided by portfolio market cap, i.e., $\frac{\sum Earnings_{i,t}}{\sum MarketEquity_{i,t}}$. Return-On-New-Invested-Capital =RONIC= $\frac{\Delta EBIT_{i,t}}{\Delta OperatingAssets_{i,t}}$. Return-on-Assets=$\frac{EBIT_{i,t}}{OperatingAssets_{i,t}}$. Change in Earnings = $\frac{Earnings_{i,t+1}-Earnings_{i,t}}{BookEquity_{i,t}}$. Dividend Growth is for the portfolio, $\frac{\sum Dividends_{p,t+1}-\sum Dividends_{p,t}}{\sum Dividends_{p,t}}$. Change in Debt = $\frac{Debt_{i,t+1}-Debt_{i,t}}{TotalAssets_{i,t}}$ using long-term and short-term debt. Net Share Growth =$\frac{Shares_{i,t+1}-Sharess_{i,t}}{Sharess_{i,t}}$, using CRSP shares outstanding adjusted for stock splits. All ratios are winsorized at the 1% and 99% levels, except for RONIC which is winsorized at 5% and 95%, prior to calculating means.

Panel A. Starting Financial Ratios

Asset Intensity Quintile		Asset Intensity	ROE (Percent)	Starting Earnings Yield (Percent)
Light 1		0.36	10.99	6.52
2		0.57	9.36	6.77
3		0.74	7.41	6.29
4		1.02	4.93	6.29
Heavy 5		2.69	-1.65	7.31
Light-Heavy	Mean	-2.33	12.64	-0.79
	t	[-35.24]	[12.45]	[-2.28]

Panel B. Future Return on Investment

Asset Intensity Quintile		Year Ahead Return on New Invested Capital (Percent)	Year Ahead Return on Assets (Percent)	Year Ahead Return on Equity (Percent)	10 Years Ahead Return on Equity (Percent)
Light 1		20.99	15.37	11.84	10.28
2		17.17	11.52	9.79	9.94
3		17.07	8.66	7.95	8.89
4		16.06	4.05	5.33	7.26
Heavy 5		9.21	-7.32	-0.19	6.67
Light-Heavy	Mean	11.77	22.70	12.03	3.61
	t	[8.37]	[12.05]	[11.37]	[6.99]

Panel C. Future Growth & Capital Raising

Asset Intensity Quintile		Year Ahead Change in Earnings (Scaled by BE) (Percent)	Year Ahead Dividend Growth (Percent)	Year Ahead Change in Debt (Scaled by Assets) (Percent)	Year Ahead Net Share Growth (Percent)
Light 1		3.90	12.50	4.19	3.29
2		2.66	10.56	3.96	3.24
3		2.38	8.75	4.03	3.20
4		2.10	7.53	4.54	3.91
Heavy 5		1.32	7.54	6.05	6.20
Light-Heavy	Mean	2.58	4.96	-1.86	-2.91
	t	[6.34]	[5.18]	[-4.74]	[-9.39]

TABLE II: Monthly Returns, Characteristic-Adjusted Returns, & Alphas

Each July 1, stocks are sorted into five quintiles with equal number of stocks based on Asset Intensity, $\frac{TotalAssets_{i,t} - Cash_{i,t} - Invest_{i,t}}{Sales_{i,t}}$. Portfolios are formed and the monthly equal or value weighted return is calculated. Characteristic-Adjusted Returns control for size and value by subtracting the corresponding equal-weight or value-weight return for a stock's assigned Fama-French 25 Size-Value portfolio. Alphas (intercepts) are calculated when the time-series of monthly returns are regressed against the Mkt-Rf, SMB, HML, and UMD factor returns:

$$R_{p,t} - R_{f,t} = \alpha + \beta\,(Mkt - Rf_t) + s\,(SMB_t) + h\,(HML_t) + u\,(UMD_t) + \varepsilon_t$$

Returns are from July 1963 to Dec. 2006. All returns are in percents.

Panel A. Average Monthly Returns

Asset Intensity Quintile		Equal-Weight: Return - Rf	Equal-Weight: Char-Adjusted Return	Value-Weight: Return - Rf	Value-Weight: Char-Adjusted Return
Light 1		0.84	0.17	0.65	0.18
2		0.79	0.07	0.51	0.03
3		0.70	-0.01	0.52	0.06
4		0.62	-0.09	0.44	-0.03
Heavy 5		0.39	-0.33	0.40	-0.15
Light-Heavy	Mean	0.46	0.49	0.25	0.34
	t	[3.89]	[4.47]	[1.66]	[2.91]

Panel B. Alphas- Equal Weight

Asset Intensity Quintile		Coefficients: Alpha	Mkt-Rf	SMB	HML	UMD	t Alpha
Light 1		0.33	1.03	0.78	-0.01	-0.20	[4.34]
2		0.22	1.04	0.81	0.04	-0.18	[3.42]
3		0.09	1.07	0.74	0.07	-0.15	[1.55]
4		0.01	1.08	0.68	0.09	-0.15	[0.20]
Heavy 5		-0.10	1.01	0.58	0.09	-0.22	[-1.01]
Light-Heavy	Mean	0.43	0.01	0.20	-0.10	0.02	[3.60]
	t	[3.60]	[0.46]	[5.42]	[-2.36]	[0.77]	

Panel C. Alphas - Value Weight

Asset Intensity Quintile		Coefficients: Alpha	Mkt-Rf	SMB	HML	UMD	t Alpha
Light 1		0.32	1.02	0.10	-0.31	-0.05	[3.45]
2		0.10	1.02	0.11	-0.27	0.03	[1.36]
3		0.09	0.98	-0.01	-0.08	0.01	[1.43]
4		-0.03	0.99	-0.10	0.04	0.01	[-0.54]
Heavy 5		-0.05	0.93	-0.14	0.15	-0.03	[-0.74]
Light-Heavy	Mean	0.37	0.09	0.24	-0.47	-0.02	[2.86]
	t	[2.86]	[2.88]	[5.85]	[-9.75]	[-0.69]	

TABLE III: Earning Surprises Relative Analyst Forecasts

Each July 1, stocks are sorted into five quintiles with equal number of stocks based on Asset Intensity, $\frac{TotalAssets_{i,t} - Cash_{i,t} - Invest_{i,t}}{Sales_{i,t}}$. For each year from July 1 to June 30, the four quarters of earnings surprises relative to analyst forecasts are averaged across all stocks in each portfolio. Time-series averages and t-statistics of the portfolios are reported. For value-weighted statistics, each observation is weighted by its market value at the close of June prior to portfolio formation. Percent Meet Prior Month (Year) Forecast is the frequency that IBES-reported earnings are equal or higher than the average analyst estimate from middle of the prior (10-month prior) calendar month. Surprise/|E| is the surprise scaled by earnings= $\frac{ActualEarnings_t - AverageAnalystEstimate_{t-1}}{(|ActualEarnings_t| + |AverageAnalystEstimate_{t-1}|)/2}$. Analyst forecast data is from July 1984 to Dec. 2006. Percent Meet Prior Month (Year) Forecast is the frequency that IBES-reported earnings are equal or higher than the average analyst estimate from middle of the prior (10-month prior) calendar month. All surprises are in percents.

Panel A. Equal Weight

Asset Intensity Quintile			Percent Meet Prior Month Forecast (Percent)	Percent Meet Prior Year Forecast (Percent)	Surprise/|E| (Percent)
Light	1		58.44	41.45	-7.92
	2		56.49	39.30	-11.38
	3		54.80	37.17	-13.76
	4		54.08	37.11	-14.81
Heavy	5		51.98	38.75	-12.16
Light-Heavy		Mean	6.46	2.70	4.24
		t	[8.06]	[2.25]	[3.15]

Panel B. Value Weight

Asset Intensity Quintile			Percent Meet Prior Month Forecast (Percent)	Percent Meet Prior Year Forecast (Percent)	Surprise/|E| (Percent)
Light	1		67.77	52.86	-0.04
	2		63.80	52.10	-2.90
	3		65.29	50.68	-1.83
	4		60.66	43.16	-5.13
Heavy	5		58.66	43.04	-3.88
Light-Heavy		Mean	9.11	9.82	3.84
		t	[3.84]	[3.24]	[4.24]

TABLE IV: Expected Growth & Asset Intensity

Each July 1, stocks are divided into value and growth stocks based on their book-to-market ratio relative to the NYSE median. Portfolios at the intersection of Value/Growth and the five asset-intensity quintiles are formed. Light-Heavy is the Light quintile minus the Heavy quintile. Diff. in Diff. is the Light-Heavy portfolio of the Growth stocks minus the Light-Heavy portfolio of the Value stocks. Each month, the equal-weighted return of the portfolio is calculated. The time-series of monthly portfolio returns are regressed against the Mkt-Rf, SMB, HML, and UMD factor returns and the alpha (intercept) reported.

$$R_{p,t} - R_{f,t} = \alpha + \beta\,(Mkt - Rf_t) + s\,(SMB_t) + h\,(HML_t) + u\,(UMD_t) + \varepsilon_t$$

Returns are from July 1963 to Dec. 2006. For each year from July 1 to June 30, the four quarters of earnings surprises relative to analyst forecasts are averaged across all stocks in each portfolio. Time-series averages and t-statistics of the portfolios are reported. Percent Meet Prior Month Forecast is the frequency that IBES-reported earnings are equal or higher than the average analyst estimate from the middle of the prior calendar month. Analyst forecast data is from July 1984 to Dec. 2006. All alphas and surprises are in percents.

Asset Intensity Quintile			Alphas		Percent Meet Prior Month Analyst Forecast	
			Value	Growth	Value	Growth
Light	1		0.32	0.33	55.39	59.52
	2		0.27	0.21	53.44	58.13
	3		0.21	0.06	51.51	56.76
	4		0.10	-0.05	50.96	56.31
Heavy	5		0.07	-0.30	52.01	51.88
Light-Heavy		Mean	0.26	0.63	3.38	7.64
		t	[2.09]	[4.03]	[3.04]	[9.16]
Diff. in Diff.		Mean		0.37		4.27
		t		[2.43]		[3.57]

TABLE V: Ex-post Growth & Asset Intensity

Each July 1, stocks are divided evenly into low-growth or high-growth based on their year-ahead (i.e., ex-post) growth in total assets relative to the cross-sectional median. Portfolios at the intersection of low-growth/high-growth and the five asset-intensity quintiles are formed. Light-Heavy is the Light quintile minus the Heavy quintile. Diff. in Diff. is the Light-Heavy portfolio of the High-Growth stocks minus the Light-Heavy portfolio of the Low-Growth stocks. Each month, the equal-weighted return of the portfolio is calculated. The time-series of monthly portfolio returns are regressed against the Mkt-Rf, SMB, HML, and UMD factor returns and the alpha (intercept) reported.

$$R_{p,t} - R_{f,t} = \alpha + \beta\,(Mkt - Rf_t) + s\,(SMB_t) + h\,(HML_t) + u\,(UMD_t) + \varepsilon_t$$

Returns are from July 1963 to Dec. 2006. For each year from July 1 to June 30, the four quarters of earnings surprises relative to analyst forecasts are averaged across all stocks in each portfolio. Time-series averages and t-statistics of the portfolios are reported. Percent Meet Prior Month Forecast is the frequency that IBES-reported earnings are equal or higher than the average analyst estimate from the middle of the prior calendar month. Analyst forecast data is from July 1984 to Dec. 2006. All alphas and surprises are in percents.

Asset Intensity			Alphas		Percent Meet Prior Month Analyst Forecast	
Quintile			Low Growth	High Growth	Low Growth	High Growth
Light	1		0.45	0.65	54.36	62.25
	2		0.38	0.38	52.28	60.85
	3		0.26	0.26	51.75	58.85
	4		0.15	0.23	52.79	56.65
Heavy	5		0.26	0.13	51.45	53.16
Light-Heavy		Mean	0.18	0.52	2.91	9.09
		t	[1.51]	[3.85]	[2.87]	[7.95]
Diff. in Diff.		Mean		0.34		6.18
		t		[2.93]		[4.88]

TABLE VI: Robustness Tests With Controls For Investment, Accruals and ROE

Means and standard deviations of independent variables are reported. Ln B/M $= ln\left(\frac{BookEquity_{i,t}}{MarketEquity_{i,t,Dec.}}\right)$.Ln ME $= ln\left(MarketEquity_{i,t,June}\right)$. Log Return from 12 months ago 1 month ago is a measure of momentum. Log Asset Growth$= ln\left(\frac{Assets_{i,t+1}}{Assets_{i,t}}\right)$. Accruals are scaled by assets as in Sloan (1996). ROE is Return-On-Equity$=\frac{Earnings_{i,t}}{BookEquity_{i,t}}$. Ln Asset Intensity = $\ln\left(\frac{TotalAssets_{i,t}-Cash_{i,t}-Invest_{i,t}}{Sales_{i,t}}\right)$. All ratios are winsorized at the 1% and 99% levels prior to calculating means and standard deviations or using in regressions.

Panel A. Means and Standard Deviations

	Ln B/M	Ln ME	Ln 12-1 Return	Ln Asset Growth	Accruals	ROE	Ln Asset Intensity
Mean	-0.64	5.44	0.02	0.14	0.01	0.03	-0.19
Std. Dev.	0.86	1.61	0.48	0.25	0.08	0.38	0.71

Panel B. Future Financial Performance

The following pooled regressions are run with dependent variable Y:

$$Y_{i,t+1} = \gamma_Y Y_{i,t} + \gamma_{AI} AI_{i,t} + \gamma_{bm} BM_{i,t} + \gamma_{me} ME_{i,t} + \gamma_{tag} TAg\,\mathrm{row}_{i,t} + \gamma_a ACC_{i,t} + + \gamma_{roe} ROE_{i,t} + Ind + \varepsilon_t$$

Y is the dependent variable. Ind are dummy variables for each 2-digit SIC codes from Compustat. Standard errors are clustered at the year level. $AI = \ln\left(\frac{TotalAssets_{i,t}-Cash_{i,t}-Invest_{i,t}}{Sales_{i,t}}\right)$. See text for definitions of other control variables. All ratios are winsorized at the 1% and 99% levels prior to regressions.

				Coefficient Estimates			
Dependent Variable (t+1)	Dependent Variable (t)	Ln B/M	Ln ME	Ln Asset Growth	Accruals	ROE	Ln Asset Intensity
RONIC	-0.01	-7.28	3.19	-19.24	-33.62	-0.24	-10.05
Return-on-Assets	0.80	-0.76	1.50	-11.33	6.35	-0.09	-5.81
Return-on-Equity		-1.98	2.12	-5.84	3.28	0.41	-8.54
Return-on-Equity (t+10)		0.31	1.42	-5.67	3.80	0.17	-2.26
Earnings Change / BE		-1.74	1.16	-8.30	-4.04	-0.27	-5.42
Growth in Total Dividends		-2.17	0.37	16.37	-12.53	0.37	-3.46
Debt Change / Assets	0.00	-2.01	-0.42	7.11	1.04	0.02	0.79
Net Share Issuance		-1.00	-0.48	5.05	1.23	-0.07	1.32
				t statistics			
Dependent Variable (t+1)	Dependent Variable (t)	Ln B/M	Ln ME	Ln Asset Growth	Accruals	ROE	Ln Asset Intensity
RONIC	-1.15	-5.80	4.36	-7.23	-4.04	-6.66	-8.73
Return-on-Assets	55.12	-1.09	4.92	-2.46	0.77	-6.20	-5.50
Return-on-Equity		-3.08	7.34	-2.00	0.58	23.62	-11.25
Return-on-Equity (t+10)		0.47	5.33	-3.11	0.78	7.28	-4.00
Earnings Change / BE		-4.34	5.10	-6.73	-1.46	-14.54	-16.97
Growth in Total Dividends		-2.46	0.94	7.15	-1.68	9.52	-4.28
Debt Change / Assets	-0.47	-10.55	-6.99	9.22	0.89	5.35	4.05
Net Share Issuance		-6.14	-6.63	9.38	1.06	-10.88	8.89

Panel C. Fama-Macbeth Regressions Predicting Returns - Equal Weight

From July 1963 to December 2006, each month a cross-sectional regression predicts stock returns minus the risk-free rate.

$$R_{i,t+1} - rf_{i,t+1} = int_i + \gamma_{bm} BM_{i,t} + \gamma_{me} ME_{i,t} + \gamma_{mo} Mom_{i,t} + \gamma_{tag} TAg\,\mathrm{row}_{i,t} + \gamma_a ACC_{i,t} + + \gamma_{roe} ROE_{i,t} + \gamma_{AI} AI_{i,t} + \varepsilon_t$$

The coefficients from each month are averaged over all months and the time-series t-statistics reported. $AI = \ln\left(\frac{TotalAssets_{i,t} - Cash_{i,t} - Invest_{i,t}}{Sales_{i,t}}\right)$. See data description for definitions of other control variables. All ratios are winsorized at the 1% and 99% levels prior to regressions.

	Coefficients							
				Ln 12-1	Ln Asset			Ln Asset
	Intcpt	Ln B/M	Ln ME	Return	Growth	Accruals	ROE	Intensity
(1)	0.69	-	-	-	-	-	-	-0.24
(2)	1.17	0.31	-0.06	-	-	-	-	-0.27
(3)	1.16	0.32	-0.08	1.03	-	-	-	-0.26
(4)	1.24	0.26	-0.08	1.01	-0.71	-	-	-0.24
(5)	1.20	0.30	-0.08	1.01	-	-1.06	-	-0.27
(6)	1.15	0.32	-0.08	1.02	-	-	-0.12	-0.26
(7)	1.26	0.25	-0.09	0.97	-0.58	-0.80	0.21	-0.23
	t Statistics							
				Ln 12-1	Ln Asset			Ln Asset
	Intcpt	Ln B/M	Ln ME	Return	Growth	Accruals	ROE	Intensity
(1)	2.76	-	-	-	-	-	-	-3.65
(2)	2.77	3.55	-1.22	-	-	-	-	-4.23
(3)	3.07	4.07	-1.84	4.82	-	-	-	-4.32
(4)	3.34	3.48	-1.86	4.69	-3.62	-	-	-3.90
(5)	3.18	3.88	-1.94	4.69	-	-1.96	-	-4.54
(6)	3.15	4.24	-1.96	4.79	-	-	-0.37	-4.31
(7)	3.57	3.62	-2.29	4.49	-2.78	-1.30	0.66	-3.70

Panel D. Fama-Macbeth Regressions Predicting Returns - Value Weight

From July 1963 to December 2006, each month a cross-sectional regression predicts stock returns minus the risk-free rate.

$$R_{i,t+1} - rf_{i,t+1} = int_i + \gamma_{bm} BM_{i,t} + \gamma_{me} ME_{i,t} + \gamma_{mo} Mom_{i,t} + \gamma_{tag} TAg\,\text{row}_{i,t} + \gamma_a ACC_{i,t} + + \gamma_{roe} ROE_{i,t} + \gamma_{AI} AI_{i,t} + \varepsilon_t$$

The coefficients from each month are averaged over all months and the time-series t-statistics reported. $AI = \ln\left(\frac{TotalAssets_{i,t} - Cash_{i,t} - Invest_{i,t}}{Sales_{i,t}}\right)$. See data description for definitions of other control variables. All ratios are winsorized at the 1% and 99% levels prior to regressions.

	Coefficients							
				Ln 12-1	Ln Asset			Ln Asset
	Intcpt	Ln B/M	Ln ME	Return	Growth	Accruals	ROE	Intensity
(1)	0.47	-	-	-	-	-	-	-0.15
(2)	1.03	0.15	-0.05	-	-	-	-	-0.27
(3)	0.93	0.18	-0.05	1.01	-	-	-	-0.26
(4)	1.01	0.16	-0.06	1.01	-0.55	-	-	-0.25
(5)	1.05	0.15	-0.07	0.98	-	-3.02	-	-0.28
(6)	0.91	0.20	-0.05	1.01	-	-	0.07	-0.26
(7)	1.06	0.16	-0.07	0.97	-0.18	-3.15	0.21	-0.27

	t Statistics							
				Ln 12-1	Ln Asset			Ln Asset
	Intcpt	Ln B/M	Ln ME	Return	Growth	Accruals	ROE	Intensity
(1)	2.38	-	-	-	-	-	-	-1.73
(2)	2.54	1.50	-1.46	-	-	-	-	-3.28
(3)	2.42	2.06	-1.58	3.54	-	-	-	-3.46
(4)	2.72	1.84	-1.75	3.62	-2.19	-	-	-3.38
(5)	2.75	1.73	-1.95	3.43	-	-4.15	-	-3.67
(6)	2.40	2.00	-1.61	3.59	-	-	0.14	-3.34
(7)	2.89	1.75	-2.12	3.51	-0.68	-4.11	0.39	-3.46

TABLE VII: Within Industry Asset Intensity

Each year, within each 2-digit SIC code from Compustat, stocks are sorted into five quintiles with equal number of stocks based on Asset Intensity, $\frac{TotalAssets_{i,t} - Cash_{i,t} - Invest_{i,t}}{Sales_{i,t}}$. Portfolios are formed and the monthly equal or value weighted return is calculated. Characteristic-Adjusted Returns control for size and value by subtracting the corresponding equal-weight or value-weight return for a stock's assigned Fama-French 25 Size-Value portfolio. Alphas (intercepts) are calculated when the time-series of monthly returns are regressed against the Mkt-Rf, SMB, HML, and UMD factor returns:

$$R_{p,t} - R_{f,t} = \alpha + \beta\,(Mkt - Rf_t) + s\,(SMB_t) + h\,(HML_t) + u\,(UMD_t) + \varepsilon_t$$

Returns are from July 1963 to Dec. 2006. All returns are in percents.

Panel A. Returns and Characteristic-Adjusted Returns

Witihin Industry Asset Intensity Quintile			Equal-Weight Return - Rf	Equal-Weight Char-Adjusted Return	Value-Weight Return - Rf	Value-Weight Char-Adjusted Return
Light	1		0.83	0.16	0.58	0.07
	2		0.80	0.10	0.55	0.10
	3		0.75	0.02	0.53	0.02
	4		0.64	-0.08	0.45	-0.01
Heavy	5		0.31	-0.38	0.32	-0.16
Light-Heavy		Mean	0.52	0.54	0.26	0.23
		t	[7.92]	[7.60]	[2.56]	[2.64]

Panel B. Alphas - Equal Weight

Within Industry Asset Intensity Quintile			Coefficients Alpha	Mkt-Rf	SMB	HML	UMD	t Alpha
Light	1		0.30	1.02	0.79	-0.03	-0.16	[4.42]
	2		0.22	1.02	0.72	0.06	-0.14	[4.10]
	3		0.18	1.02	0.68	0.09	-0.16	[3.50]
	4		0.05	1.06	0.66	0.13	-0.17	[0.90]
Heavy	5		-0.20	1.09	0.76	0.02	-0.25	[-2.47]
Light-Heavy		Mean	0.50	-0.07	0.03	-0.05	0.09	[7.46]
		t	[7.46]	[-4.29]	[1.63]	[-1.99]	[5.45]	

Panel C. Alphas - Value Weight

Within Industry Asset Intensity Quintile			Coefficients Alpha	Mkt-Rf	SMB	HML	UMD	t Alpha
Light	1		0.19	1.02	0.11	-0.32	0.02	[2.52]
	2		0.12	0.98	-0.07	-0.11	0.04	[2.25]
	3		0.10	1.00	-0.06	-0.04	-0.01	[2.02]
	4		0.00	0.96	-0.09	0.02	0.01	[-0.06]
Heavy	5		-0.13	1.02	0.05	0.02	-0.07	[-2.41]
Light-Heavy		Mean	0.32	0.01	0.06	-0.34	0.09	[3.38]
		t	[3.38]	[0.27]	[2.07]	[-9.65]	[4.11]	

TABLE VIII: Labor Intensity

Stocks are divided into labor-intensity quintiles based on $\frac{LaborExpense}{LaborExpense+Depreciation+PPE*8\%}$. Portfolios at the intersection of labor-intensity and the five within-industry asset-intensity quintiles are formed and the monthly equal or value weighted return is calculated. The time-series of monthly returns are regressed against the Mkt-Rf, SMB, HML, and UMD factor returns and the alpha (intercept) reported.

$$R_{p,t} - R_{f,t} = \alpha + \beta\,(Mkt - Rf_t) + s\,(SMB_t) + h\,(HML_t) + u\,(UMD_t) + \varepsilon_t$$

Returns are from July 1963 to Dec. 2006. All alphas are in percents.

			Alphas				Hi-Lo	
Asset Intensity			Labor Intensity					
Quintile		Hi 5	4	3	2	Lo 1	Alpha	t
Light 1		0.26	0.25	0.25	0.41	0.21	0.09	[0.23]
2		0.18	0.21	0.17	0.44	0.08	0.08	[0.23]
3		-0.30	0.10	-0.11	0.40	0.29	-0.60	[-2.22]
4		0.02	-0.28	0.05	-0.06	0.18	-0.15	[-0.60]
Heavy 5		-0.22	-0.07	-0.45	-0.21	-0.02	-0.20	[-0.69]
Light-Heavy	Alpha	0.48	0.32	0.70	0.59	0.26		
	t	[1.68]	[1.10]	[2.49]	[2.05]	[0.64]		
Average Asset Intensity (Light-Heavy)					Alpha	0.45		
					t	[3.34]		
							Alpha	t
Average Labor Intensity (Hi-Lo)							-0.13	[-0.80]

TABLE IX: Bankruptcy Risk

Each July 1, stocks are sorted into 5 quintiles with equal number of stocks based on Asset Intensity, $\frac{TotalAssets_{i,t} - Cash_{i,t} - Invest_{i,t}}{Sales_{i,t}}$. Ohlson (1980) O-score is used to predict one-year bankruptcy probabilities (See data description for calculation). Book-Equity-to-Market-Equity is $\frac{BookEquity_{i,t}}{MarketEquity_{i,t}}$. Assets-to-Market-Equity is $\frac{TotalAssets_{i,t}}{MarketEquity_{i,t}}$. Time-series standard errors are reported based on the annual averages for each portfolio. Data is from fiscal years 1962 to 2005. Probabilities are in percent.

Asset Intensity Quintile			Probability of Bankruptcy (Percent)	Book Equity to Mkt. Equity	Assets to Mkt. Equity
Light	1		0.61	0.66	1.11
	2		0.56	0.75	1.24
	3		0.65	0.77	1.36
	4		1.07	0.80	1.51
Heavy	5		2.81	0.88	1.90
Light-Heavy		Mean	-2.20	-0.22	-0.80
		t	[-6.66]	[-14.12]	[-16.82]