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Asset Tangibility, Industry Representation and the Cross Section of Equity Returns

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Abstract

Recent theory relates expected returns and covariant risk to the investment decisions of a firm across certain stages of the business cycle. Using the Australian accounting environment that provides a wider scope for the capitalisation of intangible assets compared with the United States, this paper tests the relationship between asset tangibility and returns within the Fama and MacBeth (1973) framework. A relationship is found to exist between asset tangibility and the cross-section of equity returns. This relationship is most evident in the materials industry, which is characterised by irreversible, firm-specific assets. These results persist after controlling for firm characteristics that Fama and French (1992) show are related to returns, although the effect is largely driven by microcap stocks.

Key words: Tangibility of assets, cross-section, industry, asset pricing.

JEL classification: G12, G14

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1. Introduction

Fama and French (1992) identify a firm's size and book-to-market ratio as variables that have significant power in explaining cross-sectional variation in equity returns. An unresolved issue is what type of covariant risk, if any, is captured by these factors. A growing literature relates expected returns to the real investment decisions of a firm and time-varying systematic risk. Berk, Green, and Naik (1999) develop a model in which expected returns are conditioned by market interest rates, the systematic risk of assets-in-place, and the value of growth options available to the firm. The relative importance of assets-in-place and growth options is time variant, thereby changing the risk exposure of the firm's equity. Gomes, Kogan, and Zhang (2003) present a dynamic stochastic one-factor general equilibrium model in which the book-to-market ratio proxies for the systematic risk of the firm's assets-in-place.

Zhang (2005) and Cooper (2006) expand upon this theoretical explanation of the relationship between investment decisions and returns by suggesting a nexus between a firm's book-to-market ratio and investment irreversibility. Zhang (2005) argues that due to costly reversibility and the countercyclical pricing of risk, disinvestment of assets-in-place is difficult. Therefore, firms with a high proportion of physical assets are riskier than those with a high proportion of growth options, especially during economic contractions when the price of risk is high.

Cooper (2006) argues that costly irreversibility means that capital investment remains relatively constant across time. Those firms with physical assets-in-place are more sensitive to aggregate market conditions, given that idle capacity can be employed in boom periods to increase output without the need for costly investment. Firms with a high book-to-market ratio are those that have invested in a larger proportion of installed physical capacity and are therefore more sensitive to aggregate conditions and have high systematic risk. The Zhang

(2005) and Cooper (2006) theory is consistent with asset tangibility being priced in the cross-section of returns, particularly in industries characterised by investment in irreversible assets-in-place.

Docherty, Chan and Easton (2010) test the relationship between investment irreversibility and returns in a time-series framework. They note that Australian accounting regulations allow for wider scope to capitalise intangible assets compared with countries such as the US. These regulations provide an environment to examine the Zhang (2005) and Cooper (2006) theory. Using a long-time series to capture multiple business cycles, they find that when the Fama and French (1993) three-factor model is augmented with an additional variable representing asset tangibility, the explanatory power of the model is increased. The tangibility variable is shown to be significant in seven of eight time-series regressions. There is also some evidence that the significance of the value premium is reduced after controlling for asset tangibility.

While Docherty *et al.* (2010) provide evidence that a tangibility-augmented model captures some variation not explained by the Fama and French (1993) model they do not provide formal tests of whether there is a cross-sectional relationship between asset tangibility and returns. This paper extends upon the existing literature by using the Australian accounting environment to perform a test of the Zhang (2005) and Cooper (2006) theory using the Fama and MacBeth (1973) cross-sectional framework. This is the methodology used by Fama and French (1992) to test whether there is a relationship between firm fundamentals and the cross section of equity returns.

This paper further expands on the existing literature by testing whether asset tangibility is priced in the cross-section of returns after controlling for industry representation. This extension is necessary as the covariance risk between tangible assets and market-wide returns proposed by Zhang (2005) and Cooper (2006) is expected to be more significant in industries

where assets-in-place are firm-specific. In such industries, investment in physical capacity is largely irreversible during economic contractions, due to the firm-specific nature of the physical assets employed. This results in the firm being burdened with costly idle capacity. Similarly, during economic expansions, installed capacity facilitates growth without the need for further investment. There are both direct costs and opportunity costs incurred by firms who need to undertake further investment in firm-specific assets while the economy is expanding.

The nature of the Australian economy provides an opportunity to compare the relationship between asset tangibility and returns across portfolios of firms characterised by investment in physical assets with differing degrees of reversibility. The Australian equity market is characterised by a large proportion of firms in the materials industry¹. Physical assets employed by materials firms are highly firm-specific and therefore largely irreversible. In contrast, the consumer staples and industrials industries are characterised by investment in assets that are less firm-specific and therefore more readily reversible. A comparison of the relationship between asset tangibility and returns across these industries provides a test of whether there is covariant risk between firms' investment in tangible assets and market-wide returns. To support a covariant risk argument, asset tangibility should only be priced in those industries where investment in assets-in-place is largely irreversible and hence riskier.

Fama and French (2008) document the importance of testing for the pervasiveness of an anomaly across various size groupings. They identify that the asset growth and profitability anomalies are not evident in big firms. This issue is particularly pertinent in Australia, where trading is largely concentrated in the largest stocks and microcaps often exhibit illiquidity. In this paper, separate analysis is performed on big, small and microcap stocks. This allows for

¹ As reported in Table 2 below, 41.9% (327.23/780.16) of firms included in the sample are in the materials industry.

an examination of whether any association between asset tangibility and stock returns is persistent across all size groupings.

This paper provides evidence of an association between the cross-section of equity returns and the firm size, book-to-market ratio and asset tangibility variables examined. The coefficient on the asset tangibility variable is significantly different from zero at the 1% level when regressed against returns, even after controlling for both size and book-to-market. However, there is evidence that this association is largely driven by microcap stocks, as the relationship between asset tangibility and returns is not significant in the small firm and big firm size groupings. Upon augmenting the cross sectional regressions with an industry factor, the coefficient on the asset tangibility variable is only significant for the materials industry. In support of the Zhang (2005) and Cooper (2006) theory, this result suggests that asset tangibility is only priced in firms where investment is highly irreversible.

The paper proceeds as follows. Section 2 discusses the data. Section 3 describes the methodology used to test whether asset tangibility is priced in the cross-section of returns. Section 4 presents the results of the Fama and MacBeth (1973) regressions and the relationship between industry representation and the pricing of asset tangibility. Section 5 provides a summary.

2. Data

Cross-sectional tests were performed for the period January 1975 to December 2006. Monthly price relative and market capitalisation data were obtained for each firm from the Australian Graduate School of Management (AGSM). The balance sheet data (book-value of ordinary equity and net tangible assets) was obtained from Aspect Financial for the period

1992 to 2006. Prior to 1992, accounting data was collected from the Australian Stock Research Service Summarised Balance Sheet and Profit and Loss Statements.²

From 1975 to 2001, firms were classified into industries based on the Australian Securities Exchange (ASX) industry classifications, and from 2002 to 2006 based on the ten Standard and Poors Global Industry Classification Standard (GICS) sectors.³ This data was obtained from the Australian Graduate School of Management (AGSM) Share Price and Price Relative database. Chan, Lakonishok and Swaminathan (2007) argue that the use of GICS codes is an effective means of characterising industry, citing widespread use of GICS industry coding by investment portfolio managers and analysts⁴. There were insufficient firms for econometrically valid tests to be performed in the health care, telecommunication services and utilities sectors. Therefore, these firms were excluded from the sample⁵.

Firms with a negative value for book equity were also excluded from the tests. Further, financial firms were removed from the sample⁶. Both of these filters are also applied in Fama and French's (1992) cross-sectional tests.

To avoid look-ahead bias and ensure that accounting variables are known before they are used to explain returns, only firms with a balance date greater than or equal to six months

² Book Value is defined as net assets.

³ The ASX sub-industry classifications are reconciled with GICS sub-industry codes to ensure consistency.

⁴ Fama and French (1997) derived a different means of classifying industry, whereby they begin with the firms' four-digit Standard Industrial Classification (SIC) code and reorganise them into 48 groupings. However, this industry classification coding is only available for firms listed in the United States.

⁵ The firms excluded were those with an ASX industry classification (pre 2003) of 5, 18 and 21 or a GICS sector code (post 2003) of 35, 50 and 55.

⁶ The firms that were excluded were those with an ASX industry classification (pre 2003) of 16, 17, 19 and 20 or a GICS sector classification (post 2003) of 40.

prior to portfolio formation were included. This conservative six-month delay in the use of accounting data is consistent with Fama and French (1992).

Firm size was measured as its market capitalisation in December of year $t-1$. The book-to-market ratio was calculated as book value of common equity divided by the market capitalisation of the firm at the accounting balance date. This procedure ensures that the accounting variable in the numerator of the ratio is contemporaneous with the market value used in the denominator. The degree of asset tangibility, referred to hereafter as the tangibility ratio⁷, was measured as the ratio of net tangible assets to the book value of equity, as measured at the accounting balance date. All variables were recalculated annually.

Fama and French (2008) identify that regressions estimated on the overall market can be dominated by microcap stocks because they are so plentiful and have a tendency to have more extreme values of explanatory variables and greater volatility. This issue is evident in the Australian market, given the mean (median) market capitalisation for December 2006 was \$563.12 million (\$28.27 million). To overcome this problem, as well as estimating regressions for the overall market, separate analysis is provided for microcaps, small firms and big firms. To construct these size groupings, the approach of Gray and Johnson (forthcoming) is replicated such that big stocks represent the largest 90% of market capitalisation, small stocks comprise the next 7% and micro stocks denote the remaining

⁷ An alternative proxy for asset tangibility is the ratio of net tangible assets to market value of ordinary equity; however this variable is highly correlated with the book-to-market ratio and was therefore not included in the study.

3%⁸. This results in 68% of firms being allocated to the microcap grouping, 17% to the small firm grouping and 15% to the big firm grouping⁹.

3. Methodology

3.1 Portfolio Returns Analysis

Firms were sorted into one of five portfolios based on their tangibility ratio. The sorts were undertaken separately for all three size groupings and the overall market. The five portfolios were formed in December of each year and the portfolios were reformed annually. It was not possible to sort into quintiles using the tangibility ratios because for any year, on average, 56% of all listed firms did not capitalise any intangible assets. Therefore, all firms with no capitalised intangibles were allocated to the first portfolio (no intangibles). Those firms that do capitalise intangible assets are ranked and partitioned into quartiles. Firms that capitalised some intangible assets but were in the top quartile with respect to the proportion of tangible assets were allocated to the “high” tangibility ratio portfolio while firms that capitalised intangible assets and were in the bottom quartile of tangibility ratios were allocated to the “low” tangibility ratio portfolio. Both equally-weighted and value-weighted returns were calculated for all portfolios.¹⁰ Based on the Cooper (2006) and Zhang (2005) theory of investment irreversibility, it is hypothesised that the portfolio of firms that do not capitalise

⁸ As noted in Gray and Johnson (forthcoming) this approach is substantively similar to the size partitions created by Fama and French (2008). Their big, small and micro groupings represent 90.48%, 6.45% and 3.07% of market capitalisation respectively.

⁹ Gray and Johnson (forthcoming) report a substantively similar number of 70%, 16% and 14% in microcap, small and big firm groupings respectively after adopting the same methodology. Fama and French (2008) report that 60% of firms in their sample are categorised as microcaps, while 20% are small firms and 20% are big firms.

¹⁰ Previous studies, such as Fama and French (1992), sort each of the variables into deciles and report the average returns on each portfolio. Decile analysis is not practical in this study due to the distribution of the tangibility ratio.

any intangible assets should earn excess returns compared with those in the “low” tangibility portfolio.

Table 1 provides summary statistics that characterise the stocks included in each of the portfolios formed from the sort on the tangibility ratio. From Panel B, there is no apparent relationship between the tangibility ratio and size for small and micro firms, justifying the examination of the relationship between tangibility and returns across size partitions. There is a relationship between market capitalisation and tangibility of assets for big firms, with the average market capitalisation of firms that do not capitalise any intangible assets (\$1659.34 million) being substantially smaller than those that capitalise the highest proportion of intangible assets (\$10092.09 million). Panel C reports a negative relationship between asset tangibility and the book-to-market ratio. This association is strongest for microcap firms. By construction, the average tangibility ratio decreases across the table. Of note, Panel D reports that the dispersion in tangibility ratio values is largest for microcap stocks, ranging from 0.990 in the “high” tangibility portfolio to 0.535 in the “low” tangibility portfolio. The inter-relationships between variables documented in Table 1 highlight the need to control for firm size and book-to-market ratio in the cross sectional regressions.

[TABLE ONE ABOUT HERE]

3.2 Fama and MacBeth (1973) Regressions

A cross-sectional framework was employed to test the relationship between each of the independent variables and monthly returns at the individual firm level. Consistent with Fama and French (1992), the cross-sectional tests were performed within the Fama and MacBeth

(1973) framework. The slopes on multiple regressions provide a direct estimation of the marginal effect of a change in asset tangibility on equity returns. Fama and French (2008) show that outliers may be influential in Fama and MacBeth regressions, and therefore returns on portfolio sorts are used to validate the regression results. All regressions were estimated for the overall market and for the three size groupings.

The magnitude and significance of the average coefficients across the time series were calculated using the weighted-least-squares approach (see Greene (2008)). This methodology is preferable in cross-sectional asset pricing tests as it weights each coefficient by the inverse of its standard error, thereby placing greater importance on those variables that are more precisely estimated.

The Fama and MacBeth (1973) framework provides an investigation of the joint explanatory power of all variables and provides a test of whether there is a significant relationship between asset tangibility and returns after controlling for other characteristics related to returns. If investment irreversibility is a separate covariant risk factor, the coefficient on the asset tangibility variable should be significant after controlling for the size and book-to-market factors. Furthermore, if the association between asset tangibility and returns is pervasive, the coefficients on these variables should be significant across all size groupings.

The regressions use natural logs of the size and book-to-market variables, as Fama and French (1992) show that logs are the optimal functional form for capturing the size and book-

to-market effects in average returns. The logarithm is also taken of the asset tangibility ratio to maintain consistency with the other variables.¹¹

The four regressions that test for the relationship between returns and asset tangibility, size and book-to-market ratio can be specified as follows:

$$R_{i,m} = \alpha_0 + \gamma_1 \ln(NTA/B_{i,n}) + \varepsilon_{i,m} \quad (1)$$

$$R_{i,m} = \alpha_0 + \gamma_1 \ln(NTA/B_{i,n}) + \gamma_3 \ln(SIZE_{i,n}) + \varepsilon_{i,m} \quad (2)$$

$$R_{i,m} = \alpha_0 + \gamma_2 \ln(NTA/B_{i,n}) + \gamma_3 \ln(B/M_{i,n}) + \varepsilon_{i,m} \quad (3)$$

$$R_{i,m} = \alpha_0 + \gamma_1 \ln(NTA/B_{i,n}) + \gamma_2 \ln(SIZE_{i,n}) + \gamma_3 \ln(B/M_{i,n}) + \varepsilon_{i,m} \quad (4)$$

where $R_{i,m}$ is the one-month return on company i in month m , $SIZE_{i,n}$ is the market capitalisation for stock i calculated in December of year n , $B/M_{i,n}$ is the book-to-market ratio for stock i calculated using book-value of equity and market capitalisation from the accounting balance date and $NTA/B_{i,n}$ is the asset tangibility ratio for stock i calculated at the accounting balance date.

The correlation matrix for each of the transformed independent variables is reported in Table 2. Size and book-to-market ratio are negatively correlated (-0.212%). This result is consistent with Fama and French (1992), as well as prior Australian research (see O'Brien et. al., 2008). Size is uncorrelated with the tangibility ratio (-0.023%), and there is a small negative correlation between the book-to-market ratio and the tangibility ratio (-0.197%). The

¹¹ To ensure that the results are not dependent upon the functional form of the asset tangibility variable, robustness tests were performed where all firms with no capitalised intangible assets were removed from the sample and where the logarithm of the tangibility variable was not taken. The results were substantively unaffected by these changes.

magnitude of the correlations between each of the variables indicates that multicollinearity does not appear to be a problem.

[INSERT TABLE TWO HERE]

3.3 Industry-Augmented Regressions

Zhang (2005) argues that the risk of investment irreversibility is derived from technological frictions and industry demand. Based on this theory, it is expected that any observed relationship between asset tangibility and returns should vary across industries, according to the nature of physical assets employed in each industry.

To control for industry representation, Equation 4 is augmented with six dummy variables, one for each of the GICS sectors included in this study. This procedure allows for an investigation of whether the risk factors examined in this paper are specific to particular industry characteristics. Separate analysis of microcap, small and big firms is not reported within each of the industry classifications, as limitations with the sample size mean these results are not statistically valid.

Table 3 reports the summary statistics for the six industries examined in this paper. The materials industry is the largest of the six industries comprising over 40% of all firms. The concentration of firms in this industry and the differences between the firm-specific character of assets in the materials industry when compared with those in other industries provides an ideal setting to empirically examine the Zhang (2005) and Cooper (2006) theory with respect to investment irreversibility.

The average market capitalisation of firms is similar for all industries, with the exception of the consumer staples sector where firms have a mean market capitalisation that is ten times

larger than those in the next biggest industry. The average book-to-market ratio is also comparable across industries. However, there is a difference between the mean firm asset tangibility ratios in the energy (0.954) and materials (0.960) industries compared with those in the other four industries. These two industries have a higher proportion of tangible assets.

[TABLE THREE ABOUT HERE]

4. Results

4.1 Portfolio Returns Analysis

Table 4 reports the average portfolio returns following the sort on the tangibility ratio. In Panel A (Panel B) equal (value) weighted returns are calculated for each portfolio. When the overall market is considered, there appears to be a significant asset tangibility effect. The equally weighted returns in Panel A decrease almost monotonically from 1.7% per month for the portfolio with no intangible assets to 0.6% for the portfolio of firms with a tangibility ratio in the largest quartile. The spread (no intangible assets portfolio less low tangibility ratio portfolio) is 0.6% per month, which is statistically different from zero at the 5% confidence level. The relationship between asset tangibility and returns persists when portfolio returns are value weighted (Panel B). The spread is 0.6% per month and statistically significantly different from zero at the 1% confidence level.

An analysis of the size groupings shows the degree to which the association between asset tangibility and returns is pervasive. There is strong evidence of an association between asset tangibility and returns in microcap stocks. The spread between returns on the zero intangible asset portfolio and the low tangibility portfolio is 0.008 (0.011) in Panel A (Panel B). This spread is significantly different from zero at the 1% confidence level for both equally

weighted and value-weighted return calculations. However, it is unlikely that returns on this trading strategy would be economically significant, given difficulties associated with short selling Australian microcap stocks and the high trading costs of such strategies. The difficulty in short selling is highlighted by the data provided in Table 1 Panel B, which shows that the average market capitalisation of microcap stocks with the lowest proportion of tangible assets is just \$15.09 million.

The trading spread is positive but insignificant for the small and big firm groupings in Panel A and Panel B. There does not appear to be a relationship between asset tangibility and returns in these size groupings. The fact that the association between asset tangibility and returns appears to be driven by microcap stocks indicates that while this relationship is statistically significant, it does not appear to be economically implementable.

[TABLE FOUR ABOUT HERE]

4.2 Fama and MacBeth (1973) Regressions

Table 5 reports the results of the Fama and MacBeth (1973) regressions used to estimate the regressions between the three explanatory variables and returns, as specified in Equations 1 to 4. Panel A reports the estimation of each regression for the overall market, while Panels B, C and D report the separate regressions for the microcap, small and big firms respectively.

In Panel A, the coefficient on the tangibility variable (0.010) is positive and significantly different from zero at the 1% confidence level in the univariate regression (Model 1). The coefficient on the tangibility variable remains positive and significantly different from zero at

the 1% confidence level for all pooled regressions, even after controlling for size and the book-to-market effect. This result is consistent with a risk-based explanation for investment irreversibility. A firm that employs a larger (smaller) proportion of tangible assets is expected to have a greater (lesser) degree of investment irreversibility and have a higher (lower) expected return. This is because the returns of firms that invest in assets-in-place covary more strongly with market returns across business cycles.

The results for the sample of microcap firms, reported in Panel B, show that the coefficient on the tangibility variable is positive and significantly different from zero at the 1% confidence level in the univariate regression. The sign and significance of this coefficient persists after controlling for firm size and book-to-market ratio. As outlined above, it is unlikely that a trading strategy based on this asset tangibility effect would be implementable for microcap stocks. In Model 4, the coefficient on the size effect is negative and significantly different from zero at the 1% confidence level, although the coefficient on the book-to-market variable is not significant.

Panels C and D report that the coefficient on the tangibility variable is not significant for any of the regressions estimated for the small firm or big firm groupings. As such, this anomaly does not appear to be pervasive across size groupings. Of interest, the coefficient on the size variable is not significantly different from zero for any of the regressions in the small or big firm groupings, while the coefficient on the book-to-market variable is positive and significantly different from zero at the 5% confidence level in all regressions. This result provides further evidence that value firms earn a premium over growth firms. This result is

consistent with prior evidence that the size effect is most prevalent in the smallest firms while the book-to-market effect is pervasive across size groupings¹².

The results from the Fama and MacBeth (1973) regressions are comparable to those from returns in portfolio sorts across all three size groupings, validating the finding that there appears to be an association between asset tangibility and returns that is driven by microcap stocks.

[TABLE FIVE ABOUT HERE]

4.3 Industry-Augmented Regressions

The results of the industry-augmented regressions are reported in Table 6. The coefficient on the size variable is negative and significantly different from zero at the 5% confidence level for all industries except consumer staples. As such, there is strong evidence that small firms return a premium over large firms across the majority of market sectors. The consumer staples industry has very few micro-cap firms and an average market capitalisation that is substantially greater than all other industries. This concentration of large firms may explain why the size factor is not significant for this industry.

The coefficient on the book-to-market variable is positive and statistically significantly different from zero at the 5% level in three of the six industries. The book-to-market effect may be explained, to some extent by industry representation, particularly given that Table 3 reports that the average book-to-market ratio of firms is similar across industries. This result

¹² Fama and French (1992) argued that the small firm effect is primarily explained by microcap stocks. This was confirmed in Australia by O'Brien et al. (2008).

is consistent with Zhang (2005), who argues that the value premium can be explained by technological and industry factors.

The coefficient on the asset tangibility variable is positive and significantly different from zero at the 1% confidence level for the materials industry, but insignificant for all other industries. Therefore, the observed positive relationship between asset tangibility and returns can be predominantly attributed to the materials sector. This is because the materials sector is characterised by a high proportion of tangible assets that are irreversible. Such investment results in costly unproductive capacity during an economic contraction, but provides opportunities for growth without further investment during economic expansions.

The significance of this tangibility variable in only the materials industry shows that there is an association between it and returns and this is consistent with a risk-based explanation, as it indicates that there is an association between investment in assets-in-place and equity returns that only exists in those industries that employ irreversible, firm-specific assets. In such industries, there may be a covariant risk between the firms' investment in tangible assets and market-wide returns.

[TABLE SIX ABOUT HERE]

5. Summary

Zhang (2005) and Cooper (2006) argue that unproductive physical capacity is costly in contracting conditions, but provides growth opportunities during economic expansions. This provides covariant risk between firms' investment in tangible assets and market-wide returns.

This paper uses the tangibility of assets as a proxy for assets-in-place and tests whether there is a relationship between this factor and returns in a cross-sectional framework. Further tests

are performed to determine whether this relationship persists after controlling for industry representation and the Fama and French (1992) factors. The proxy employed to measure asset tangibility is the ratio of net tangible assets to book value.

The relationship between asset tangibility and returns is tested using a two-staged approach. The first test is an analysis of returns on characteristic sorted portfolios. For micro cap stocks, the zero investment portfolio of taking a long position in firms with no intangible assets and a short position in the portfolio consisting of firms with the smallest proportion of tangible assets results in a positive return of 1.1% per month, which is statistically different from zero at the 1% confidence level. However, it is unlikely that this return is economically significant, as limits on short selling and transaction costs would likely inhibit this trading strategy. Significant positive returns are not generated on the equivalent investment strategies for portfolios of small and big stocks.

Fama and MacBeth (1973) regressions are also used to test for the existence of an association between asset tangibility and returns. A positive and statistically significant relationship between returns and the tangibility ratio is reported when regressions are estimated for the overall market. However, there is evidence that this association is not pervasive across size groupings and can be largely explained by microcap stocks.

The premium earned on firms with a higher proportion of tangible assets is found to be driven by the materials industry. This result is consistent with the investment irreversibility theory as tangible assets in the materials industry are more firm-specific than in any other sector, making investment in that sector highly irreversible. Therefore this paper provides evidence of an association between tangibility and returns that is consistent with the Zhang (2005) and Cooper (2006) theory that investment irreversibility is a covariant risk factor priced in the cross section of equity returns.

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Table 1: Summary Statistics for Asset Tangibility Portfolios

This table reports summary statistics for the four portfolios sorted on tangibility ratio. Each year from 1975 to 2006, firms were sorted into five portfolios based on an independent ranking on each variable. The average of each variable is calculated for each year and time-series averages for the each of these portfolios are reported in the table below. The first column reports the characteristics of firms that have no capitalised intangible assets. The final column reports the characteristics of firms with the lowest tangibility ratio.

	No Intangibles	High	2	3	Low
Panel A: Number of firms					
Overall Market	456.26	89.1	91.09	95.62	97.48
Micro	325.75	51.36	57.71	62.21	68.65
Small	72.79	17.56	17.87	18.09	16.02
Big	57.72	20.18	15.51	15.32	12.81
Panel B: Market capitalisation (\$ million)					
Overall Market	103.89	463.19	372.67	315.33	1122.52
Micro	11.70	17.22	17.47	16.83	15.09
Small	173.99	172.84	177.91	176.81	191.66
Big	1659.34	2818.93	2665.87	2176.98	10092.09
Panel C: Book-to-market ratio					
Overall Market	1.192	1.334	1.384	1.409	1.877
Micro	1.317	1.572	1.633	1.602	2.084
Small	0.973	1.111	1.064	1.172	1.494
Big	0.751	0.933	0.965	0.919	1.180
Panel D: Tangibility ratio					
Overall Market	1	0.990	0.944	0.848	0.553
Micro	1	0.990	0.945	0.846	0.535
Small	1	0.990	0.943	0.850	0.613
Big	1	0.991	0.944	0.851	0.613

Table 2: Correlation matrix of the transformed variables

This table reports the correlations between the three variables used in the regression analysis. Each year, from 1975 to 2006, the correlations between the transformed variables are calculated. The time-series averages of the monthly correlations are reported in the table below.

	Ln(Size)	Ln(B/M)
Ln(B/M)	-0.212	
Ln(NTA/B)	-0.023	-0.197

Table 3: Descriptive statistics for industries

This table presents summary statistics for each of the six industries. Each year, from 1975 to 2006, firms are sorted into six industries based on their GICS code. The equally-weighted average market capitalisation, book-to-market ratio and tangibility ratio are calculated for each industry. The time-series averages of these variables are reported in the table below.

	Mean Number of Firms	Mean Market Capitalisation (\$ million)	Mean Book-to- Market Ratio	Mean Tangibility Ratio
Energy (GICS 10)	197.52	80.33	1.420	0.954
Materials (GICS 15)	327.23	267.98	1.280	0.960
Industrials (GICS 20)	102.15	239.93	1.317	0.863
Consumer Discretionary (GICS 25)	73.00	344.45	1.332	0.823
Consumer Staples (GICS 30)	34.10	3774.32	1.282	0.879
Information Technology (GICS 45)	46.16	57.34	1.201	0.744
All Industries	780.16	364.73	1.321	0.917

Table 4: Summary Returns Statistics for Size, Book-to-Market and Tangibility

This table reports monthly returns on the portfolios formed following a sort on the tangibility ratio of each firm. Each month, from January 1975 to December 2006, the return is calculated for each portfolio. Equal-weighted returns are reported in Panel A and value-weighted returns in Panel B. The returns reported in the table are the time-series average of the monthly portfolio returns. The second last column reports the spread (the returns generated on the portfolio with no intangible assets less the returns on the portfolio with the highest proportion on intangible assets). Associated *t*-statistics are reported in parentheses in the final column.

	No Intangibles	High	2	3	Low	Spread	t (Spread)
Panel A: Equal-Weighted Portfolio Returns							
Overall market	0.017	0.015	0.015	0.015	0.011	0.006	(2.154*)
Micro	0.019	0.016	0.014	0.015	0.011	0.008	(3.63**)
Small	0.014	0.011	0.016	0.013	0.011	0.003	(1.202)
Big	0.013	0.015	0.015	0.013	0.011	0.002	(0.753)
Panel B: Value-Weighted Portfolio Returns							
Overall market	0.014	0.010	0.009	0.010	0.008	0.006	(3.51**)
Micro	0.030	0.022	0.019	0.022	0.019	0.011	(4.593**)
Small	0.014	0.012	0.016	0.012	0.012	0.002	(1.133)
Big	0.014	0.017	0.014	0.014	0.011	0.003	(0.772)

*Denotes significance at the 5% confidence level

**Denotes significance at the 1% confidence level

Table 5: Fama and MacBeth (1973) Regressions

This table reports the coefficients on the Fama and MacBeth (1973) regressions. In each month from January 1975 to December 2006, a cross sectional ordinary least squares regression is used to estimate the following equations:

$$R_{i,m} = \alpha_0 + \gamma_1 \ln(NTA/B_{i,n}) + \varepsilon_{i,m} \quad (1)$$

$$R_{i,m} = \alpha_0 + \gamma_1 \ln(NTA/B_{i,n}) + \gamma_3 \ln(SIZE_{i,n}) + \varepsilon_{i,m} \quad (2)$$

$$R_{i,m} = \alpha_0 + \gamma_2 \ln(NTA/B_{i,n}) + \gamma_3 \ln(B/M_{i,n}) + \varepsilon_{i,m} \quad (3)$$

$$R_{i,m} = \alpha_0 + \gamma_1 \ln(NTA/B_{i,n}) + \gamma_2 \ln(SIZE_{i,n}) + \gamma_3 \ln(B/M_{i,n}) + \varepsilon_{i,m} \quad (4)$$

The values reported in the table are the time series average values of the coefficients, calculated using the Weighted Least Squares method. Associated *t*-statistics are reported in parentheses under the relevant coefficients.

Model	α	Size	B/M	Tangibility	Adj. R^2
Panel A: Overall market					
1	0.023 (7.452**)			0.010 (3.203**)	0.002
2	0.103 (8.53**)	-0.005 (-8.315**)		0.011 (3.621**)	0.010
3	0.024 (8.112**)		0.004 (4.781**)	0.013 (4.238**)	0.009
4	0.098 (7.725**)	-0.005 (-7.199**)	0.002 (2.225**)	0.013 (4.353**)	0.018
Panel B: Microcap firms					
1	0.027 (7.787**)			0.015 (3.754**)	0.002
2	0.218 (11.763**)	-0.013 (-11.823**)		0.016 (4.027**)	0.008
3	0.028 (8.139**)		0.004 (3.456**)	0.019 (4.881**)	0.009
4	0.21 (10.804**)	-0.012 (-10.79**)	0.001 (1.154)	0.018 (4.755**)	0.015

Panel C: Small firms

1	0.013 (5.776**)			0.004 (0.688)	0.006
2	0.017 (0.706)	-0.001 (-0.232)		0.004 (0.741)	0.007
3	0.015 (6.871**)		0.003 (2.222*)	0.003 (0.45)	0.022
4	0.022 (0.925)	-0.001 (-0.371)	0.003 (2.291*)	0.003 (0.518)	0.023

Panel D: Big firms

1	0.014 (5.955**)			0.003 (0.441)	0.009
2	0.020 (1.597)	-0.001 (-0.435)		0.002 (0.417)	0.017
3	0.016 (7.154**)		0.003 (3.144**)	0.005 (0.808)	0.023
4	0.019 (1.552)	0.000 (-0.235)	0.003 (2.995**)	0.005 (0.83)	0.031

*Denotes significance at the 5% confidence level

**Denotes significance at the 1% confidence level

Table 6: Industry-augmented Fama and MacBeth (1973) Regressions

This table reports the coefficients on the Fama and MacBeth (1973) regressions estimated at an industry level. In each month from January 1975 to December 2006, a cross sectional ordinary least squares regression is used to estimate Equation 4 augmented with dummy variables representing each of the six industries. The values reported in the table are the time series average values of the coefficients, calculated using the Weighted Least Squares method. *t*-statistics are reported in parentheses.

	Alpha	Ln(Size)	Ln(B/M)	Ln(NTA/B)
Energy (GICS 10)	0.1440 (7.7728**)	-0.0073 (-7.4696**)	0.0035 (2.5219*)	0.0067 (0.9460)
Materials (GICS 15)	0.0982 (6.8659**)	-0.0045 (-6.2597**)	0.0028 (2.6533**)	0.0209 (3.9116**)
Industrials (GICS 20)	0.0489 (4.7356**)	-0.0019 (-3.2420**)	0.0021 (1.5747)	0.0126 (1.9051)
Consumer Discretionary (GICS 25)	0.0483 (3.8018**)	-0.0017 (-2.3898*)	0.0025 (1.5609)	0.0057 (0.7824)
Consumer Staples (GICS 30)	0.0213 (1.5390)	-0.0002 (-0.2933)	-0.0022 (-0.9033)	0.0209 (1.0215)
Information Technology (GICS 45)	0.0292 (0.3435)	-0.0070 (-2.211*)	0.0115 (2.6364**)	0.0121 (0.6185)

*Denotes significance at the 5% confidence level.

**Denotes significance at the 1% confidence level.