The Other Side of Value: The Quality Premium in Real Estate Returns

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Abstract We examine the effect of quality on price and return behavior in U.S. listed real estate. Quality real estate stocks trade at higher prices. However, similar to findings in the aggregate stock market (Asness et al., 2013), quality in listed real estate is underpriced. A long quality, short junk portfolio (QMJ) is found to produce average risk adjusted returns of 1.01 percent per month. Adding QMJ to the Fama French 3-factor model, improves the overall fit of the model on U.S. real estate stocks. Several anomalies are found during the 5-year period 2004-2008, which encompasses both the height of the U.S. real estate bubble and the subsequent financial crisis.

Keywords Quality Attributes . Firm Performance . Price and Returns of Real Estates Assets

Profitability, investment and quality have received increased recent attention in the finance literature as potential factors explaining the cross-section of average returns. Although, the significance of profitability in explaining returns has been documented in the literature more than 40 years ago (Ball and Brown, 1968), subsequent studies have challenged these findings and shown that net income has little explanatory power when added as a factor in the Fama-French model (Fama and French, 1996). Novy-Marx (2013) was the first to show that a different measure of profitability, namely gross profitability scaled by total assets has similar power as the book-to-market ratio in predicting the cross section of average returns. Ball et al. (2014) reconciled this recent evidence with Ball and Brown's (1968) findings and showed that another alternative

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measure of profitability, operating profitability, exhibits the strongest link with expected returns compared with net income and gross profit. Simultaneously, three other recent studies, Asness et al. (2013), Hou et al. (2014) and Fama and French (2015) document convincing evidence that profitability and investment (which are combined in a single quality factor in Asness et al.) are both priced factors in explaining returns.

In light of the recent focus on quality as a factor in asset pricing models, this paper examines whether quality premium exists in the cross-section of real estate equity returns. Multifactor models rely on the proposition that there are sufficient number of securities to diversify away idiosyncratic risk. We assume that when real estate stocks are held in a well-diversified portfolio the idiosyncratic risk is diversified away. Therefore the priced factors are the same as for conventional stock returns. However, given the regulatory requirements that REITs face and the distinct characteristics of real estate assets – tangibility, illiquidity, capital intensiveness and long holding periods, we argue that the quality attributes – profitability, growth, safety, and payout – may be even more important in real estate than what is observed for conventional firms. Whether quality is fully reflected in real estate prices is an empirical question. To test this proposition, we examine: (1) whether higher quality real estate stocks trade at higher prices; (2) the price of each component of quality – profitability, growth, safety, and payout; (3) whether higher quality real estate stocks are associated with higher returns; (4) the performance of a portfolio of long high quality, short low quality real estate assets; and (4) whether inclusion of a quality factor yields a superior pricing model for real estate assets. Our analyses are based on all real estate stocks listed in the U.S. from January 1999 to December 2013, totaling 438 companies covered by SNL Financial database.

We find that quality is a significant determinant of real estate prices. Specifically, for one standard deviation increase in quality, price to book ratio increases by a highly significant 4.67 percent. When we break up the sample in 5-year increments, we find that from 1999-2003, quality induces a significant increase in scaled prices. During the period 2009-2013, the price of quality is positive, albeit insignificant. However, during the period 2004-2008, which encompasses both the U.S. real estate bubble and the subsequent financial crisis, the price of quality is negative. Analyses of annual regressions reveal an insignificant effect of quality on price during the real estate boom period of 2004 - 2006, leading up to the financial crisis. As the financial crisis begins in 2007, high quality stocks post a significant 3.09 percent gain. The favorable effect of quality does not persist in 2008, but reverses to a significant valuation loss of 2.58 percent. Finally, we find that although quality has a more significant impact on the pricing of small stocks, the pattern reverses during the crisis years - quality has a greater impact on the price of big stocks. This finding suggests that investors are less concerned about quality in an advancing market, but in a contraction, our evidence points to flight to quality. Overall, these results are consistent with the notion that greater quality induces higher prices in the cross section of U.S. real estate stocks for the sample period 1999-2013.

Our next contention is that if quality is fully reflected in real estate prices, future returns of real estate assets will not be related to quality factors. To test this proposition, we calculate the time series of mean excess returns (over 1-month U.S. Treasury bill yield) of ten portfolios of real estate stocks categorized by quality scores.[1] We then estimate a cross sectional regression model for excess return of each decile against market risk, size and value factors. We focus on the difference in spread between the combined returns of high quality portfolios (in deciles 9 and 10) and the low quality portfolios (in deciles 1 and 2). The analyses reveal over the sample period

[1] Quality scores are based on Asness et al. (2013) and described in detail in the Data & Variables section

1999-2013, high quality real estate stocks outperformed low quality real estate stocks by 0.99 percent per month, on average. Breaking up the sample in 5-year increments, we find that from 1999-2003, high quality stocks outperform low quality stocks, but the superior performance of high quality stocks declines during the period 2004-2008. In 2005 and 2006, high quality stocks underperform. In 2007, there is some sign of recovery in high quality stocks, and by 2008, high quality stocks outperform low quality stocks significantly. From 2009-2013, the performance of high quality stocks relative to low quality stocks continues to improve. Overall, these results are contrary to the notion that quality is fully reflected in the prices of real estate assets. Indeed, our analyses provide compelling evidence that quality is not efficiently priced in the real estate sector.

For a different perspective on the value of quality in real estate returns, we look at the magnitude of returns attributed to higher quality versus lower quality real estate firms. We construct a long high quality, short low quality (junk) portfolio (QMJ) of real estate stocks. Similarly, we also construct portfolios for each of the four components of quality. Over the sample period 1999-2013, QMJ portfolio earns significantly positive average monthly excess returns, and we find negative average market and size factor loadings. QMJ portfolio's negative exposure to SMB implies that small real estate stocks are of low quality. QMJ portfolio has a positive HML factor loading, which suggests that high quality real estate stocks are value stocks, and are underpriced relative to the aggregate stock market. This evidence contrasts with the negative loading for HML for U.S. stocks (Asness et al. (2013)). The long/short portfolios of other quality attributes, with the exception of HpMLp, earn positive average risk adjusted returns. When we break out alphas to QMJ portfolio in five-year periods, we find the highest average monthly excess returns to QMJ for the first five years of the sample period (1999-2003), which corroborates our earlier findings with returns to portfolios ranked by quality. In the five-years that encompass the real estate boom and financial crisis (2004-2008), average excess returns and risk adjusted returns to QMJ are much lower. However, during the crisis years, excess returns to QMJ are found to be strong. As such, QMJ strategy emerges as an effective hedge against the market, with its best performance occurring during the 2007-2008 financial crisis.

We next examine if the inclusion of the QMJ factor improves the power of the traditional 3-factor model. The Fama French factors remain significant with comparable coefficients as in the baseline 3-factor model, while the QMJ factor is significantly positive, which confirms that real estate returns are influenced by quality when controlling for the traditional Fama-French factors. R-squared increases by about 0.6 percent. These results indicate that inclusion of the quality factor (QMJ) marginally improves the fit of the asset pricing model for real estate. However, the QMJ factor is economically significant since a QMJ strategy earns approximately 12 percent risk-adjusted returns per year.

Overall, our analyses provide compelling evidence that quality characteristics are persistent in real estate assets. The long investment horizon, and capital intensiveness of real estate which necessitate sustained high performance is consistent with persistence of quality attributes. Moreover, we find that quality and its components are significant factors in pricing and expected returns of real estate assets. However, payout ratio does not affect valuation of real estate stocks, which is attributable to the fact that REITs must payout 90 percent of net income by regulation. Finally, we find that a quality factor has significant explanatory power even when controlling for traditional factors – market risk, size, and value. We attribute the differences in findings between the real estate sector and the aggregate U.S. stock market to the uniqueness of real estate.

The rest of the paper proceeds as follows. Section II presents review of the literature. The main hypotheses are developed in Section III and the data and variables are described in Section

IV. We present the results from the empirical analysis in Section V and conduct robustness checks in Section VI. Section VII offers discussion of the results and Section VIII concludes.

Literature Review

The Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965; Black, 1972) marks the point of departure for numerous studies documenting multiple asset pricing anomalies and attempting to find additional priced factors. Specifically, the *size* effect (Banz (1981)) indicates an inverse relationship between stock returns and market capitalization. The *value* effect represents a positive relationship between stock returns and the ratio of cash flow, earnings or book value to market value (Basu, 1977; Reinganum, 1981; DeBondt and Thaler, 1985; Fama and French, 1992; Lakonishok, Shleifer, and Vishny, 1994). Also, relevant in this context is the literature pertaining to quality measures that predict future returns and firm fundamentals from the perspective of a discounted present value model. Campbell and Shiller (1988) develop a dynamic version of the Gordon Growth Model using a dividend price ratio that predicts future stock returns moderately well. Cohen et al. (2009) report that prices are more relevant than returns in forecasting future returns, especially for long holding periods (such as with real estate), and that book to market values can be approximated well when prices rather than returns are used as a basis. Fama and French (2006) and Vuolteenaho (2002) extend this literature to show that prices of individual firms are driven more by cash flow news than return news.

The Fama French 3-factor model and the Carhart model are among the most widely used extensions of CAPM today. Fama & French (1993) incorporate the size and value variables, which are empirically determined to help explain average returns to construct the size (SMB) and value (HML) factors and extend the single factor CAPM into what is now commonly referred to as the Fama French 3-factor model. A fourth factor, momentum, was later found to have additional explanatory power (Carhart, 1997; Fama & French, 2011). However, as recent research has revealed, these models fail to fully capture excess returns, and the search for additional sources of return anomalies continues. An evolving theme from resent studies on asset returns is the superior performance of high profitability, conservative investment and high quality stocks. Asness et al. (2013) define quality as the special attributes of a stock for which an investor is willing to pay more, ceteris paribus. Examples of *quality* characteristics in extant literature include higher returns associated with stocks that advantageously time share repurchases (Baker & Wurgler, 2002); higher returns generated by more profitable firms (Novy-Marx, 2013); higher alpha for firms with lower leverage (George & Hwang, 2010); better performance of firms with higher growth (Mohanram, 2005); and, lower returns associated with greater investment (Aharoni et al., 2013). Using a large sample of U.S. and international stocks Asness et al. (2013) examine the effect of quality on stock prices, change in the price of quality over time, ability of the price of quality to predict future returns, and explanatory power of a unifying quality factor for excess returns. The authors find that high-quality stocks have high risk-adjusted returns, a phenomenon they attribute to the observed modest impact of quality on price. In a similar vein, Hou et al (2014) examine nearly 74 asset pricing anomalies documented in the literature and conclude that an empirical q-factor model consisting of the market factor, a size factor, an investment factor and a profitability factor outperforms the Fama-French and Carhart models in capturing most of these anomalies. Finally, Fama and French (2015) also incorporate profitability and investment variables as additional factors in the Fama-French 3-factor model and show that the 5-factor model explains between 69 to 93 percent of the cross-section of stock returns.

Mirroring the proliferation of research in mainstream finance to identify factors that contribute to persistent anomalies on common stock returns, a substantial literature has developed on the cross sectional determinants of REIT returns, and interest in this line of research keeps growing. Chiang et al. (2006) apply the Fama-French 3-factor model to REITs, and find that better test specifications are provided and returns are more accurately captured when REIT-mimicking portfolios are used. The authors further show that when REIT-mimicking portfolios are used to create the Fama-French 3-factors, the resulting REIT betas converge to those indicated by the NCREIF Index which uses returns on direct real estate investment. This evidence is consistent with the presence of a link between REIT returns and those of an underlying real estate factor (Lee & Mei, 1994; Ziering et al., 1997). Chui et al. (2003) and Derwall (2009) find that momentum dominates REIT returns. Specifically, Chui et al. (2003) study excess returns of U.S. listed REITs using the Fama-French 3-factor model, plus several additional factors, including turnover, volume, analyst coverage and momentum, and find that turnover and momentum are significant determinants of REIT returns, while book to market ratio is not. Finally, divergence between REIT and non-REIT stock returns is evident in their differential relationships with the same set of variables including book to market ratio and institutional ownership, Fed interest rate policy (Goebel et al., 2013), and systematic volatility. As DeLisle et al. (2013) shows, the last factor is not priced in REIT returns. Notwithstanding the growing evidence, however, to the best of our knowledge, the significance of quality as an additional factor in explaining real estate returns remains unexplored.

Hypotheses

In general, real estate assets are associated with relatively long investment horizons. For instance, long-term leases frequently represent cash flows generated by investment grade real estate, and it is common practice to match these long-term assets with long-term liabilities (often fixed rate debt). As such, it is intuitive that during normal business cycles, real estate assets, on average, have more stable quality characteristics such as profitability, growth and safety measures than the overall U.S. stock market. Further, the payout component of quality is expected to be the most predictable due to the high proportion of REITs in our sample and their mandatory dividend payout of 90 percent of net income.

H1: Quality is a persistent characteristic in the performance of real estate assets.

Under the premise that higher quality entails stability of profitability, growth, safety and payout, it follows from the efficient market hypothesis that higher quality implies lower risk, resulting in lower return and correspondingly higher price. In essence, since investors are expected to be willing to pay more for lower risk, higher quality real estate stocks are expected to command higher market prices, ceteris paribus (Asness et al., 2013).

H2: Higher quality of real estate stocks is reflected in higher prices

At the individual property level, investment grade real estate represents the highest quality real estate stock. As previously noted, long-term holding periods and capital intensiveness of real estate assets require high level of expertise and delivery of stable profitability, growth, and safety for sustained performance of real estate investment[2]. However, given that quality is already reflected in prices (H2), we expect that high quality real estate stocks are not associated with higher returns compared to low quality real estate stocks, which implies uniform risk adjusted returns across all levels of quality.

H3: Real estate risk adjusted returns do not vary with quality

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[2] Payout is excluded here as it is not directly related to successful property investment and management, but is rather a byproduct.

Extant research with non-real estate U.S. stocks reveals that high quality stocks have low correlation with the market risk factor, resulting in higher risk adjusted returns than excess returns on a long high quality, short low quality portfolio (Asness et al., 2013). Hypothesis H3 implies that this anomaly will be corrected in our sample of U.S. real estate stocks. Note that rejecting H3 would imply that the observed differential returns may represent results of an anomaly, data mining or quality being a priced factor. Furthermore, examining the returns from a long high quality, short low quality portfolio, if H3 holds such a portfolio would not be associated with higher risk-adjusted returns. In contrast, higher returns of the QMJ portfolio would suggest that returns to quality are either an anomaly, or due to additional risk factor.

H4: A long high quality, short low quality portfolio of real estate assets will not yield higher risk-adjusted returns.

Finally, given a long high quality, short low quality real estate portfolio is not expected to produce a positive alpha, the addition of quality as a fourth factor in an asset pricing model will have no additional explanatory power on the cross section of real estate returns. Accordingly, we state our fifth hypothesis:

H5: Inclusion of a quality factor does not create a superior asset pricing model for real estate stocks.

Data & Variables

Our sample consists of all real estate stocks listed in the U.S. from January 1999 to December 2013, totaling 438 companies covered by SNL Financial database. 387 of these stocks are Real Estate Investment Trusts (REITs) and 51 are Real Estate Operating Companies (REOCs). Monthly stock prices and returns, as well as accounting data are collected from SNL Financial database. Total monthly returns include capital appreciation and reinvestment of dividends. We calculate excess returns as monthly log returns, net of the 1-month U.S. Treasury bill rate. Outliers are identified by winsorizing the 1st and 99th percentile returns. We obtain the factors of the Fama and French (1993) 3-factor model - market risk (MKT), size (small firms minus big firms, SMB), and value (high book to market value ratio firms minus low book to market value ratio firms, HML) – from Ken French's Data Library (2014). The construction of the fourth factor in our model – high quality minus low quality (QMJ) - is described later in the paper.

Quality Metric

Quality measures are based on quarterly accounting values following Asness et al. (2013).[3] However, some modifications have been made to adapt the metrics to the uniqueness of real estate companies' accounting practice and to more accurately reflect their significance. Specifically, since real estate properties is the primary asset of the firms in our sample, for which depreciation expenses are significant, we exclude depreciation expense to avoid skewing profitability measures. Following extant research, we use funds from operations (FFO) as a more meaningful and appropriate profitability measure for real estate firms.

We measure profitability as the ratio of funds from operations (FFO) to total assets, ratio of FFO to book equity, and ratio of cash flow from operating activities to total assets (CFOA). The first two measures correspond to return on assets (ROA), and return on equity (ROE) for non-real estate firms. Book equity is defined as tangible common equity. Next, each stock is ranked each month by its ROA, creating a vector of ranks (r). The cross sectional mean (μ) and the cross sectional standard deviation (σ) of the vector of ranks (r) are then created. We then convert ROA for each stock to a standardized z-score following Asness et al. (2013) as follows: $z_{ROA} = (r_{ROA} -$

[3] For detailed description of the method, see Altman (1968), Ang, Hodrick, Xing, and Zhang (2006), Daniel and Titman (2006), Penman, Richardson, and Tuna (2007), Campbell, Hilscher, and Szilagyi (2008), Chen, Novy-Marx and Zhang (2011), Novy-Marx (2012), Frazzini and Pedersen (2013) and Asness and Frazzini (2013)

μ_{ROA})/σ_{ROA}. The same method is employed for the other two variables, ROE and CFOA. The total profitability score for each company in each month is calculated as the average of these three individual component z-scores: Profitability = (z_{ROA} + z_{ROE} + z_{CFOA})/3

Growth is measured as the change in the profitability variable as a percentage of three-year lagged value of total assets over the prior three-year period. For example, change or growth in ROA is calculated as funds from operations in year t, minus funds from operations in year t-3, divided by total assets in year t-3 (FFO_t-FFO_{t-3})/ $TotAssts_{t-3}$. As with profitability, individual z-scores are averaged to compute an overall growth measure: Growth = ($z\Delta_{ROA}$ + $z\Delta_{ROE}$ + $z\Delta_{CFOA}$)/3

Safety is measured by leverage, volatility and bankruptcy risk. Leverage (LEV) is calculated as negative total debt divided by total assets (-TotDebt/TotAssts).[4] Volatility (VOL) is derived from the standard deviation of ROE (= FFO/BkEq) over a 3-year period.[5] Bankruptcy risk (AZ) is assessed using a variant of the Altman Z-score, as the weighted average of working capital (WC), retained earnings (RetEarns), earnings before interest, taxes, depreciation, and amortization (EBITDA), market value of equity (MktCap), and sales. Given real estate companies report sales inconsistently, total revenue (TotRev) is used as a proxy for sales. Working Capital is generally calculated as current assets minus current liabilities. However, because these aggregate values are not available through the data provider, working capital is calculated as cash plus account receivables, plus trading account securities, plus securities available for sale, plus current inventory, minus short term debt (Cash + ARs + TAS + AFSS + Cinv) – STD. Further, due to the inconsistent reporting of working capital among real estate companies, missing values are replaced with values

[4] The negative sign signifies that as leverage contributes negatively to the safety measure.

[5] The 1-year standard deviation of ROE was also calculated for comparison and indicated an aggregate mean of less than half that of the 3-year. However, once incorporated into the overall safety score and used in regressions, the resulting safety coefficients were not substantially different from those associated with the 3-yr standard deviation.

in the previous quarter. The Altman (1968) Z-score is given by:

AZ = (1.2*WC + 1.4* RetEarns + 3.3* EBITDA+ 0.6* MktCap + TotRev)/TotAssts.

A safety z-score is computed by averaging the z-scores of leverage (LEV), volatility (VOL) and bankruptcy risk (AZ): Safety = $(z_{LEV} + z_{VOL} + z_{AZ})/3$

Payout is measured as the average of the z-scores of payout of funds from operations (FFOP), dividend payout (DIVP) and dividend yield (DY): Payout = $(z_{FFOP} + z_{DIVP} + z_{DY})/3$

Finally, the overall quality score for each company in each month is the sum of the z-scores of profitability, growth, safety and payout:

Quality = z (Profitability + Growth + Safety + Payout).

Quality Portfolios

Each month, stocks are sorted by their quality scores. *Quality* is then categorized into ten deciles - P1 is the decile with the lowest quality scores and P10 is the decile with the highest quality scores. Stocks are assigned to one of these ten quality portfolios on a monthly basis. Because of the relative homogeneity of the sample, value weighting is not employed.

Analysis and Results

Persistence of quality characteristics of real estate assets

We sort stocks into ten portfolios by their quality scores each month, and calculate average quality score for each portfolio on a monthly basis. The time series (moving) average of cross sectional means of quality scores is reported at month end at the time of portfolio creation and every 5-years thereafter spanning the fifteen years of the study period. Standard errors are adjusted for heteroskedasticity and autocorrelation. In the same manner, the persistence of each of the four components of quality (profitability, growth, safety and payout) is calculated. Table I summarizes the persistence of quality by reporting cumulative average quality scores at time t (January 1999), t+60 months (December 2003), t+120 months (December 2008) and t+180 months (December 2013). The spread between the highest and lowest quality portfolios is indicated by (P10 – P1) in the far right hand column. Standard errors for the final period, t +180 months, are shown in parentheses below relevant quality scores. The results indicate that quality and its components are stable over time, especially over the ten-year period from t + 60 months (December 2003) to t + 180 months (December 2013). The mean quality scores for the full period, t + 180 months, are statistically significant.

Table II presents the contrasting persistence in quality between real estate stocks and the overall U.S. stock market as reported by Asness et al. (2013). The standard deviation of the spread between portfolios (from portfolio creation to ten years out (t+ 120 months)) with the highest and lowest quality scores clearly highlights that the real estate sample has lower standard deviations for all quality attributes, and therefore, stronger persistence on average than that of the aggregate U.S. stock market. This evidence is indicative of the homogeneity of the real estate sample relative to the heterogeneity of the sample used by Asness et al. (2013), and supports hypothesis 1 (H1) that quality is persistent in real estate and this persistence is stronger on average than that of the overall U.S. stock market. Payout, the least persistent quality characteristic in Asness et al.'s (2013) sample - based on its standard deviation over ten years - is the most persistent quality characteristic in our real estate sample. The high persistence of payout in real estate sector relative to both Asness et al.'s (2013) sample and to other quality characteristics within our sample is attributable to the mandate that REITs must pay out ninety percent of earnings.

Do higher quality real estate stocks trade at higher prices?

Now that composite quality and its components have been established as persistent characteristics of real estate stocks, we focus on how quality is priced. To that end, we estimate the following cross-sectional regression:

$$P_{i,t} = \alpha + \beta_i \, Quality_{i,t} + \varepsilon_{j,t} \quad (1)$$

$P_{i,t}$ is the market price to book value ratio of firm i's stock at the end of month t. Quality is the composite quality score for firm i at the end of month t. The scaled price of each firm is regressed on its overall quality score on a monthly basis. Standard errors are corrected for heteroskedasticity and autocorrelation. Given that quality measures are z-scores, the interpretation is that if quality improves by one standard deviation, the price to book ratio increases by (β) percent.

We report the results in Table III. Model 1 is estimated with quality as the only explanatory variable. In model 2, we add market capitalization and lagged 12-month cumulative returns of the stock to control for size and momentum, respectively, and indicator variables representing time to control for market conditions. Market capitalization is measured in millions of dollars and lagged 12-month cumulative returns are measured in log percent form. We find that quality is a significant determinant of market to book value ratio. Specifically, for one standard deviation increase in quality, price to book increases by a highly significant 4.67 percent. The effect of quality on scaled prices increases slightly to 4.86 percent when controlling for size, momentum and market environment.

Next, we estimate the following model for the effect of each component of quality on price to book ratio with and without controls for size, momentum and market conditions,

$$P_{i,t} = \alpha + \beta_1 Profitability_{i,t} + \beta_2 Growth_{i,t} + \beta_3 Safety_{i,t} + \beta_4 Payout_{i,t} + \varepsilon_{j,t} \quad (2)$$

The results are presented in columns 3 through 7 in Table III. We find profitability and growth are significantly positive in the univariate regressions. However, only profitability remains positive in the multivariate regression model including all components of quality (Model 7). The significantly negative coefficient of safety in both univariate and multivariate models, while counter-intuitive, resonates with similar results in Asness et al. (2013). Asness et al. (2013) attribute the negative contribution of safety to a flat security market line (Black, Jensen, & Scholes, 1972; Frazzini & Pedersen, 2013) and leverage constraints (Black, 1972; Frazzini & Pedersen, 2013). These authors argue that when leverage is constrained, investors seek riskier (higher beta) assets, resulting in higher prices for more risky assets and lower prices for less risky assets. In view of the relatively low beta - less than 1 – of REITs, this is a plausible explanation in the U.S. real estate market. Another potential explanation for the negative price of safety is that REITs are more prone to be dependent upon debt for growth and acquisition of new properties because of their requirement to payout ninety percent of net income in dividends. Because of this provision, declining leverage (increasing safety) may be perceived by the market as a negative signal of poor investment opportunity. Finally, the non-significance of payout confirms our expectation that payout is not a differentiating factor in the pricing of listed real estate, because of the regulatory requirement that REITs must payout ninety percent of net income. In essence, since payout is a predictable factor among REITs, the payout requirement behaves as a benchmark. The negative coefficient on the payout variable, albeit insignificant, may indicate that REITs paying higher dividends than required by law (and thereby retaining less cash for investments) are penalized with a lower priced stock.

To check the robustness of the price regressions over time, we break up the sample by firm size, and in 5-year increments. We also isolate the years of 2007-2008, the financial crisis period, because controlling for the overall market environment is critical for obtaining results not skewed by the crisis. Table IV, Panel A presents price regressions on quality during each five-year time period within the sample. From 1999-2003, a one standard deviation increase in quality induces a significant 4.37 percent increase in scaled prices. This gain in price is comparable to the price of quality for the overall 15-year sample period 1999-2013. During the period 2009-2013, the price of quality is still positive, though insignificant. However, during the period 2004-2008, which encompasses both the U.S. real estate bubble and the subsequent financial crisis, the price of quality is negative.

For greater insight on the behavior of real estate asset prices during the financial crisis, we estimate yearly regressions on quality over the period 2004-2008, when controlling for size, momentum and market conditions. The results of the annual regressions are reported in Table IV, Panel B. The analyses reveal a negative but insignificant effect of quality on price during the real estate boom period of 2004 - 2006, leading up to the financial crisis, followed by a significant 3.09 percent gain as the financial crisis begins in 2007. Interestingly, the favorable effect of quality does not persist in 2008, the second year of the crisis, but reverses to a significant valuation loss of 2.58 percent. This analyses suggests that investors are less concerned about quality in an expansionary market, but in a contraction, the evidence points to flight to quality.

Table IV, Panel C shows the pricing of quality for small and big stocks. Over the whole study period (1999-2013), quality is significantly and positively related to price for both small and big stocks, though quality has a more significant impact on the pricing of small stocks. However, during the crisis years, the pattern reverses - quality has a greater impact on the price of big stocks. In 2007, there is a significantly positive effect of 7.15 percent on the price of big stocks. In 2008, the price of quality turns negative, albeit insignificantly. This evidence of relatively higher value of big stocks during the crisis years corroborates the phenomenon of flight to safer stocks in an environment of high uncertainty.

Consistent with our second hypothesis (H2), the above results are consistent with the notion that greater quality induces higher prices in the cross section of U.S. real estate stocks for the sample period 1999-2013. Indeed, quality accounts for nearly 12 percent of observed prices of publicly traded real estate firms. However, the price of quality varies over time, and it is especially volatile during the five-year period that encompasses the real estate bubble and the financial crisis (2004-2008). Moreover, of the seven scaled price regressions presented in Table III, the highest R^2 of 24.4 percent is observed for the model which includes all four components of quality together with controls for size, momentum and indicators for quarterly market conditions. Our analyses confirms that three of the four components of quality considered in this study – profitability, growth, safety – make significant contributions to price of real estate assets, when controlling for the standard factors in the Fama and French 3-factor model.

Is quality a priced factor in real estate returns?

If quality is fully reflected in real estate prices, future returns of real estate assets will not be related to quality factors. To test this hypothesis (H3), excess returns over 1-month U.S. Treasury bill yield, and risk adjusted returns, or alphas or real estate assets, are analyzed for portfolios categorized by quality. First, stocks are sorted by quality scores and ten decile portfolios are created each month. Then stocks are assigned to one of the ten portfolios by quality score. The time series of mean excess returns is calculated for each quality portfolio. Second, the following cross sectional regression (3) is estimated for each decile with only the market factor, MKT, based on the CAPM 1-factor model as the explanatory model, and then adding size and value factors

SMB and HML (Fama & French, 1993)[6]. Standard errors are adjusted for heteroskedasticity and autocorrelation.

$$R_t = \alpha + \beta^{MKT} MKT_t + \beta^{SMB} SMB_t + \beta^{HML} HML_t + \varepsilon_t \quad (3)$$

Table V reports excess returns and alphas with robust standard errors in parentheses below. The far right hand column reports the difference or spread between the combined returns from high quality portfolios 9 and 10 and those from low quality portfolios 1 and 2[7]. Returns and alphas in bold print are significant. The analyses reveal that while average excess returns do not increase monotonically as quality increases, we find a discernibly positive trend in returns as quality goes up. Moreover, the positive spread in the far right column indicates that high quality stocks have higher average excess returns than low quality or junk stocks. Over the sample period 1999-2013, high quality real estate stocks outperformed low quality real estate stocks by nearly 1 percent per month, on average. When adjusted for systematic risk with the CAPM model, high quality portfolios outperform low quality portfolios by 0.59 percent per month. When using a 3-factor model, the outperformance of high versus low quality real estate increases to 0.93 percent per month. This evidence implies that high quality listed real estate assets are less sensitive to size (SMB) and value (HML) factors than low quality real estate assets. In other words, our data indicate a positive link between quality and size, and quality and growth attributes.

Next, we divide the sample in 5-year increments, and also isolate the financial crisis years

[6] Initially the 4-factor model including momentum (Jegadeesh & Titman, 1993 high quality portfolios outperform low quality portfolios by 0.585 percent per month over the study period; Asness, 1994; Carhart, 1997) was also applied to risk adjust returns. However, across all quality levels, the 4-factor alphas were consistently larger (more positive or less negative) than 3-factor alphas, and did not add to the objective of risk adjustment. These results imply that real estate stocks move in opposition to stock market momentum. Therefore, the 4-factor model has been excluded from the final presentation of results.

[7] This is also the basis of the quality minus junk (QMJ) factor, which will be described in greater detail later on.

2007-2008. Table VI Panel A reports excess returns and 3-factor alphas over three periods - from 1999-2003, 2004-2008 (2007-2008), and 2009-2013. From 1999-2003, high quality stocks outperformed low quality stocks by 1.93 percent per month in terms of excess returns, and by 1.67 percent on a risk adjusted basis using the 3-factor model. The superior performance of high quality stocks declines dramatically during the period 2004-2008, with 0.21 percent and 0.12 percent being the excess returns and 3-factor alphas, respectively. From 2009-2013, the performance of high quality stocks relative to low quality stocks improves to 0.63 percent per month in excess returns, and 0.75 percent per month in 3-factor alphas. The evidence over the years is consistent with previously discussed flight to quality during the crisis years, and a reversal after market conditions improve.

For better understanding of return behavior during the five-year period including the height of the real estate bubble and the subsequent financial crisis, we analyze the returns to quality annually over the period 2004-2008. The results are summarized in Table VI, Panel B. During the three years (2004-2006) leading up to the financial crisis, quality stocks underperform on a risk adjusted basis, as indicated by the negative 3-factor spreads in the far right columns. In 2005 and 2006, quality stocks underperform also without adjustment for risk, as illustrated by the negative excess returns. In 2007, average unadjusted returns are positive, but risk adjusted returns are still negative. By 2008, high quality stocks outperform low quality stocks significantly by 2.12 percent per month on unadjusted basis, and by 3.97 percent per month on risk-adjusted basis. The trend of higher risk adjusted returns, first observed in 2008, continues for the following five-year period.

Contrary to hypothesis H3 that quality is fully reflected in the prices in real estate assets, our analyses provide significant evidence that quality is not efficiently priced. While returns do not increase monotonically with quality, we find clear evidence of a trend of higher returns to higher quality as reflected in generally positive spreads of high quality stocks relative to low quality stocks. In addition, we find evidence of flight to quality in market downturns. This evidence challenges limited market efficiency, and implies underpricing of quality in listed real estate assets. As such, we reject hypothesis H3 that quality is a priced factor in real estate returns.

Return on a long high quality, short poor quality real estate portfolio

Given the rejection of Hypothesis H3, we next seek to determine the magnitude and significance of differential returns to higher quality versus lower quality real estate firms. We construct a long high quality, short low quality (junk) portfolio of real estate stocks. The quality minus junk factor (QMJ) is constructed by subtracting the cumulative excess returns on the two lowest quality portfolios (P1 and P2) from the cumulative excess returns of the two highest quality portfolios (P9 and P10) for each month (i,t). The time series of average cross sectional mean monthly excess returns to QMJ is then calculated as follows:

$$QMJ = (r_{P9} + r_{P10}) - (r_{P1} + r_{P2}) \quad (4)$$

This simplified portfolio construction, or spread, deviates from the methodology in Fama & French (1992, 1993 & 1996) and Asness & Frazzini (2013). The rationale for this divergence is specific to the real estate sample. Unlike the aggregate stock market in which individual stocks are heterogeneous in size, industry, and even country of origin, the sample of real estate stocks is relatively homogenous. All firms operate in the same industry and country and are comparable in size. To elaborate, compared to the median market capitalization of 21.3 percent of the average value for firms listed on the New York Stock Exchange (NYSE), the real estate sample has a median market capitalization of 40.4 percent of its average value, and the 75th percentile is only

107.8 percent of its average market cap.[8] Given the relative homogeneity of the sample, sorting by size, or value weighting is not very effective. Further, since our study focuses on the spread in returns among the ten quality portfolios, the simplified investment strategy of long high quality, short junk portfolio consistently captures returns to quality. Given that the actual QMJ portfolio is the time series average of monthly cross sectional difference in returns between high quality and low quality assets, the crude spread ((P9 + P10) – (P1 + P2)) serves as a close approximation of the relation between quality and performance.

Following the same approach as for the QMJ, we also construct portfolios for each of the four components of quality: profitability, growth, safety and payout. Portfolios of profitable minus unprofitable (PMU), growth minus mature (GMM), safe minus volatile (SMV), and high payout minus low payout (HpMLp), provide more granular information on the source of returns to long/short investment strategies focused on individual aspects of quality.

Table VII reports average monthly excess returns and alphas to long/short portfolio QMJ and the corresponding statistics for long/short portfolios on quality components, PMU, GMM, SMV and HpMLp. Standard errors are corrected for heteroskedasticity and autocorrelation and statistical significance is denoted by bold print. All the excess returns to long/short portfolios are significant, although the sign varies. Over the sample period 1999-2013, QMJ portfolio earns significant average monthly excess returns of 0.97 percent, and average monthly risk adjusted returns of 1.01 percent. In keeping with higher risk adjusted returns, we find negative average market and size factor loadings of -0.041 and -0.168, respectively. QMJ portfolio's negative exposure to SMB imply that small real estate stocks are junk stocks. Asness et al. (2013) find

[8] The NYSE's average and median market capitalizations are \$8.9 billion and \$1.9 billion, respectively (NYSE, 2014). In contrast, the real estate sample has an average and median market capitalization of \$1.867 billion and \$755 million, respectively, with a 75th percentile of \$2 billion.

similar results for the aggregate stock market. But, upon closer examination, they find support for the size effect in that big stocks, though more likely to be quality stocks, underperform small, quality stocks. In other words, when comparing stocks of similar quality, smaller stocks significantly outperform larger ones, which is consistent with our finding with prices that larger firms are more expensive. The positive factor loading for HML for our sample of real estate assets contrasts with the negative loading for HML for U.S. stocks documented in Asness et al. (2013). This evidence suggests that high quality real estate stocks are value stocks, and are underpriced relative to the aggregate stock market. In essence, the positive HML loading reflects the sensitivity between the lower price (higher returns) and high book to market ratio (high value) of quality real estate stocks.

The long/short portfolios of other quality attributes, with the exception of HpMLp, earn positive average risk adjusted returns. PMU has the highest average monthly alpha followed by GMM. While PMU and SMV move with the market, GMM and HpMLp, move against the market. Only HpMLp has positive exposure to small stocks, as reflected in its average monthly SMB coefficient. Only GMM has negative exposure to value stocks, as indicated by its average monthly HML coefficient.

We report the correlation of excess returns for each long/short portfolio in Table VIII. Only SMV is negatively correlated with the QMJ factor. This result corroborates the significantly negative price of safety reported earlier. All other portfolios are positively correlated with QMJ. A trade-off between safety and growth is implied in the negative correlation between GMM and SMV, suggesting that growth is accompanied by high leverage and/or high earnings volatility. Similarly, the negative relationship between SMV and HpMLp implies a trade-off between safety and payout, suggesting higher dividends induce greater financial risk for real estate assets.

In Table IX, we break out returns and alphas to QMJ in five-year periods, and also isolate the 2007-2008 financial crisis. Robust standard errors are reported below returns and alphas, and bold print denotes statistical significance. The first five years of the sample period (1999-2003) produce the highest average monthly excess returns to QMJ of 1.92 percent, which corroborates our earlier findings with returns to portfolios ranked by quality. Average monthly 3-factor alpha is minimally lower, 1.8 percent, for the same period. In the five-years that encompass the real estate boom and financial crisis (2004-2008), average excess returns and risk adjusted returns to QMJ are much lower, albeit still positive and significant, with averages of 0.19 percent and 0.22 percent per month, respectively. Upon further investigation of the crisis years 2007-2008, excess returns and alpha to QMJ are found to be very strong, averaging 1.37 percent and 1.56 percent per month, respectively. More recently, from 2009-2013, alphas remained higher than returns, though the size of both, 0.58 percent, and 0.71 percent, respectively, are substantially reduced from the corresponding levels during the financial crisis.

Overall, results for the sample period 1999-2013 support the hypothesis that QMJ portfolio's risk adjusted returns exceed its unadjusted returns. As such, QMJ strategy emerges as an effective hedge against the market, with its best performance occurring during the 2007-2008 financial crisis. Since QMJ is a long high quality, short low quality portfolio, these results also support the notion that high quality real estate stocks are associated with low betas.

Does inclusion of a quality factor improve the asset pricing model for real estate stocks?

In view of the significantly positive alpha generated by the QMJ portfolio, its inclusion as an additional factor in the asset pricing model should further explain the cross section of real estate returns. To examine the validity of this premise, the cross sectional regression model below is estimated first to ascertain the power of the traditional 3-factor model for real estate assets:

$$R_t = \alpha + \beta^{MKT} MKT_t + \beta^{SMB} SMB_t + \beta^{HML} HML_t + \varepsilon_t \quad (5)$$

Monthly Excess returns are regressed on market risk, size and value factors. Table X shows the regression results in column (1), which indicates a R-squared of 20.0 percent. All three factors are positive and highly significant, with the value factor being the most dominant. With the base model established, we add the QMJ portfolios as a fourth factor.

$$R_t = \alpha + \beta^{MKT} MKT_t + \beta^{SMB} SMB_t + \beta^{HML} HML_t + \beta^{QMJ} QMJ_t + \varepsilon_t \quad (6)$$

Excess returns are regressed monthly on the market, size and value factors, as well as the quality factor. Table X, column (2) reports the results. As in the 3-factor model, all three factors remain significant with comparable coefficients, and the QMJ factor is significantly positive, which confirms that real estate returns are influenced by the quality of assets when controlling for the traditional Fama-French three factors. These results support the hypothesis that inclusion of the quality factor (QMJ) improves the fit of the asset pricing model for real estate. One caveat is in order. The R-squared for the expanded model is 20.6 percent, so the overall fit of the 4-factor model with QMJ as an additional variable is comparable to the 3-factor model. In light of the low R-squared in the 3-factor model, and the potential for bias due to omitted variables (e.g. the real estate factor (Lee & Mei, 1994), and the momentum factor (Goebel, 2013)), the improvement in explanatory power after adding the QMJ factor should be interpreted with caution.[9] Indeed, given the potential for omitted variable bias in conjunction with the use of Fama-French factors for a real estate specific sample, the interpretation of the improvement in fit is difficult, at best.

A growing body of research suggests that the market factor is a weak predictor of expected returns, overestimating the market premium for high beta stocks and underestimating it for low

[9] We omitted these factors to focus on the quality factor.

beta stocks (Black, Jensen, & Scholes, 1972; Fama & MacBeth, 1973; Fama & French, 1992; Frazzini & Pedersen, 2013). As such, the single-factor model will systematically underestimate excess returns for high beta stocks and overestimating it for low beta stocks. REITs are traditionally low beta stocks. Further, the higher risk adjusted returns and negative average MKT coefficient (see Table 5) associated with the QMJ factor (long low beta stocks and short high beta stocks) implies that high quality real estate stocks are low beta stocks. The low risk of high quality stocks follows also from the implication that one measure of high quality is the stability of the four attributes of quality. This phenomenon raises the final question: does the 3-factor and the 4-factor model including QMJ accurately predict alpha in real estate stocks? Fama and French (2014) propose that by assuming that all stocks have a beta of 1, and removing the MKT factor as an explanatory variable, a more efficient estimate of alpha can be achieved. Following this technique, the asset pricing model is reestimated as follows:

$$r_t = \alpha + \beta^{SMB}\, SMB_t + \beta^{HML}\, HML_t + \beta^{QMJ}\, QMJ_t + \varepsilon_t \quad (6)$$

Table X, column (3) presents the results of the above model. As reported in column (1), prior to the inclusion of the QMJ factor, the 3-factor model reveals insignificant risk adjusted returns (alpha) of -0.02 percent per month. With the inclusion of the QMJ factor, the 4-factor model shows a significantly positive effect of quality, and alpha is significantly negative at -0.15 percent. As reported in column (3), when removing the market factor, alpha increases to a positive, albeit insignificant 0.04 percent per month. This result implies using only the three factors, size, value and quality underestimates the expected return. In addition, the overall fit of the modified model declines from 20.6 percent to 8.9 percent due to exclusion of the market factor.

Next, we estimate the models (5) and (6) for each five-year period over the study period. Results are reported in Table XI. Chronological trends reflect that REIT exposure to the market factor has increased since the mid-1990s, after dropping considerably prior to that. Conceivably, the 2007-2008 financial crisis is responsible for driving REIT returns more in line with the overall stock market, although the trend of increasing beta began prior to the crisis. REIT exposure to the size factor (SMB) declines over the study period. REIT exposure to the value factor (HML) has increased, indicating that the link between value stocks and REIT performance has strengthened over time. Simultaneously, the explanatory power of the Fama-French 3-factor model appears to have declined precipitously since the 1990s. These results stand in opposition to Chaing et al. (2006), who attribute the decline in R^2 since the 1990s to a decline in REIT return sensitivity to the market. Clearly, our results indicate that real estate assets' sensitivity to market (beta) is increasing. Clayton & Mackinnon (2003) suggest that the sensitivity of REIT returns to large cap stocks declined over time while its sensitivity to small cap stocks increased. This notion supports our results for HML, but not SMB exposure.

For the 4-factor model including QMJ, the null hypothesis of alpha not being significantly different from 0 can be rejected in every period except 2004-2008. Indeed, alpha is significantly negative in all other periods. The finding of predominantly negative alpha is consistent with the notion that real estate stocks are low beta stocks. During 1999-2003 and 2009-2013, alpha increases with the removal of the market factor as a regressor. However, during the five-year period from 2004-2008, exclusion of the market factor results in a lower alpha. Isolating the financial crisis period 2007-2008, the reversal in alpha is even greater, from -0.66 percent in the 4-factor model, declining to -2.13 percent per month when excluding the market factor. It appears that the crisis strongly influenced the reversal in alpha during the period 2004-2008. Finally, as is evident in the increasing value of the constant in every period excepting the crisis in 2007-2008, the removal of the market factor corrects for the underestimation of the premium associated with

U.S. real estate stocks.

Robustness Checks

To check the robustness of our results, four panels were considered to identify the one best suited for the analysis: 1) an unbalanced panel with 29,105 observations from 342 firms, missing values included in quality scores, and funds from operations (FFO) used as the basis of profitability and growth ratios; 2) a balanced panel (no time gaps) containing 11,794 observations from 70 firms, missing values included in quality scores, and FFO used as the basis of profitability and growth ratios; 3) an unbalanced panel with 9,814 observations from 174 firms, no missing component values of quality (e.g., all observations contained profitability, growth, safety and payout scores), and earnings before interest, taxes, depreciation, and amortization (EBITDA) used as the basis of profitability and growth ratios; and 4) an unbalanced panel of 8,096 observations from 152 firms, no missing component values of quality, with FFO used as the basis of profitability and growth ratios. While all scenarios yielded qualitatively similar results in price and return models, scenarios 2-4 had greatly reduced number of observations and introduced survivorship bias with either incomplete quality components or discontinuous monthly observations. For these reasons, panel 1 was selected for analysis.

Discussion and Interpretation

Based on our analyses, quality is a persistent and predictable characteristic in U.S. real estate returns. We find that from 1999-2013, the components of quality - profitability, growth, safety and payout are more persistent for real estate assets than for the aggregate stock market, as documented by Asness et al. (2013). Payout is the most predictable component, which is attributable to the regulatory requirement of 90 percent payout by REITs.

Our analyses reveal several important patterns in the cross-section of real estate returns. One, although quality is a significant determinant of price of real estate assets, the explanatory power of quality is limited to 11.5 percent. Asness et al. (2013) also report low R-squared in their analyses of the impact of quality for the aggregate stock market, and suggest three possible reasons: a) limited market efficiency, which implies underpricing of quality and higher risk adjusted returns for high quality stocks; b) inadequate quality measure that does not capture market's perception of quality, implying no relationship between returns and quality as measured by Asness et al. (2013); or c) an inadequate quality measure that does not capture risk(s) associated with quality, implying that risk adjusted returns are independent of quality. For our real estate sample, high (low) quality stocks are associated with higher (lower) risk-adjusted returns. Specifically, using the Fama-French 3-factor model, the relationship between high quality and higher returns strengthens in 2008 and 2009-2013. Even in periods when risk adjusted returns are not higher than excess returns, the difference in alpha on high quality and low quality stocks remains positive, indicating superior performance by quality stocks. As such, reasons b and c proposed by Asness et al. (2013) can be rejected. It is therefore likely that reason a, limited market efficiency is responsible for the limited explanatory power of quality on returns. In essence, quality is not fully priced in listed real estate stocks for the sample period 1999-2013.

Two, on average, we find a significantly positive price associated with quality of real estate stocks. Moreover, the price of quality in small real estate stocks is proportionately higher than in big real estate stocks during the sample period. However, during the financial crisis, this trend reverses, and the price of quality in big stocks becomes greater, indicating flight to security. This trend was especially strong during the financial crisis (2007-2008), which indicates flight to security.[10] On the other hand, during the boom years of 2004-2006, which encompassed the height of the U.S. real estate bubble and led up to the crisis, quality is negatively priced. This evidence suggests that quality is less valued in a boom market, especially one characterized by a real estate bubble, when all real estate assets, on average, are overpriced. Asness et al. (2013) also report low price of quality in the period prior to the 2007 global financial crisis. Prior evidence on low price of quality preceding downturns include the height of the internet bubble in February 2000, and just before the 1987 stock market crash (Asness et al., 2013).

Three, returns to QMJ portfolio are significant across time periods and are highest during the financial crisis. However, although QMJ is highly significant, with the inclusion of QMJ as a regressor, the overall fit of the model improves only marginally, still leaving the vast majority of the cross section of U.S. listed real estate returns unexplained. Yet, the average monthly returns attributed to the factor is smaller than that of all other control variables. It is possible that other omitted variables in the multi-factor model suppress the true impact of the addition of a QMJ factor. For example, REIT momentum has been found to be a dominant factor of REIT returns (Goebel, 2013). Further, the real estate factor, which drives not only direct real estate but also listed real estate assets (Lee & Mei, 1994), is not captured by the 3-factor model or the additional QMJ factor. The importance of these factors is borne out by the evidence that in assessing the performance of REITs, the CAPM and Fama-French 3-factor models have been found to lead to Type I error, with better specification achieved when mimicking portfolios are constructed using REITs, rather than all firms from the aggregate stock market (Chiang, 2006).

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[10] As previously mentioned, the price of quality jumps from -1.97 percent in 2006 to 3.09 percent in 2007. But price declines drastically in 2008, to -2.58 percent. Given the ongoing financial crisis, this is unexpected. A potential interpretation is that after the initial flight to security, further information about the extent to which real estate was overpriced resulted in a pull back or partial reversal from the previous year's quality price gains.

Four, when the market factor is dropped from the pricing model following Fama and French (2014), the constant or alpha of the real estate stocks increases, implying low beta of REITs. However, an anomaly was observed during the financial crisis of 2007-2008, when alpha turned lower or more negative. Therefore, the technique of dropping the market factor to correct for underestimation of alpha in low beta samples may not work in all market conditions. Alternatively, low beta real estate stocks may become more correlated with the market during financial crises, and thereby require risk adjustment with the market factor to accurately capture alpha. However, this alternative explanation appears unlikely given QMJ alphas are highest during the period 2007-2008. Thus, quality outperforms during financial crisis, but the modified model (without the market factor) no longer correctly predicts alpha because high quality real estate stocks are no longer low beta stocks.

Finally, results from this study, specifically the higher risk adjusted returns to QMJ and its negative market and size exposures, suggest that a long high quality, short junk portfolio is a hedge against the market, and also a hedge against the loss of diversification in times of financial crisis, defying the argument that real estate stocks have higher covariance with the market (or beta) during crises. Our analyses further support previous findings that since the mid-1990s, the explanatory power of the Fama-French 3-factor model in the cross-section of REIT returns is declining, even while REIT market betas appear to be increasing, contrasting the conclusion made by Chiang et al. (2006).

Conclusion

This paper contributes to the literature on REITs and other listed real estate stocks by examining price and return behavior during the recent period that encompasses the real estate expansionary period that began in the 1990s, followed by the U.S. real estate bubble and subsequent financial crisis. To our knowledge, this paper is the first to add a quality factor to the empirical asset pricing model applied to REITs and REOCs. We closely follow the aggregate stock market studies by Asness et al. (2013), and to a lesser extent, Fama and French (2015). However, we present unique results that contrast with the findings of these two papers. Specifically, in contrast with Asness et al. (2013), we find quality to be a more predictable characteristic in U.S. listed real estate than in the aggregate U.S. stock market. Similar to findings for the aggregate stock market in Asness et al. (2013), quality in listed real estate appears to be underpriced as implied by the limited explanatory power of the price of quality and higher risk adjusted returns to quality. However, a long quality, short junk portfolio (QMJ) for real estate stocks produced average risk-adjusted returns of 1.01 percent per month, considerably higher than the 0.68 percent per month reported by Asness et al. (2013) for a long quality, short junk portfolio in the aggregate stock market. Further, in Asness et al. (2013), the QMJ factor has negative exposure to the market, size and value factors, whereas for real estate stocks, the QMJ factor has negative exposure to the market and size factors, but positive exposure to the value factor. The positive HML factor loading implies sensitivity of the quality factor to lower price (and therefore, higher returns), or low book to market stocks and may be attributed to the negative price of quality during the boom period (2004-2006) and in 2008. The positive HML factor loading for real estate vs. the negative factor loading for the aggregate stock market suggests that quality is relatively more underpriced in real estate stocks than in the aggregate stock market for the period, 1999-2013.

The explanatory power of the Fama-French 3-factor model for real estate stocks has declined since the mid-1990s. Interestingly, we find that the declining trend is present even in the face of a significant increase in R^2 during the financial crisis. Unlike the aggregate stock market, adding QMJ to the Fama-French 3-factor model improves the overall fit of the model for U.S. real estate stocks, but not materially. Finally, following removal of the market factor from the asset pricing model, as suggested by Fama and French (2014), appears to correct underestimation of alpha in historically low beta real estate stocks; however, this technique does not lead to any improvement in alpha during the financial crisis. This result suggests that low beta real estate stocks became more highly correlated with the market during the crisis.

Our findings should be of interest to alpha and hedging strategies, as well as risk-adjustment. First, a long quality, short junk portfolio is found to be a positive alpha strategy for a portfolio of listed real estate stocks that has yielded, on average, 1 percent per month on a risk-adjusted basis. The returns and factor loadings of other long/short portfolios (PMU, GMM, SMV and HpMLp) can also be exploited in alpha strategies. Second, for the purpose of risk-adjusting real estate stocks, adding a quality factor to the Fama-French 3-factor model does not result in a material increase in explanatory power. Inclusion of a quality factor may lead to a significantly superior risk-adjusted model only if simultaneously adjusted for other industry specific factors.

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Table I Persistence of Quality Scores & Components

1999-2013		P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	**P10-P1**
Quality	t	-3.214	-1.217	-0.584	-0.193	0.018	0.255	0.543	0.869	1.210	2.007	**5.221**
Quality	t + 60M	-3.398	-1.663	-0.862	-0.356	-0.022	0.265	0.598	0.991	1.452	2.434	**5.832**
Quality	t + 120M	-3.279	-1.555	-0.818	-0.340	-0.010	0.290	0.625	1.017	1.511	2.458	**5.737**
Quality	t + 180M	-3.317	-1.665	-0.894	-0.346	0.016	0.350	0.713	1.127	1.628	2.570	**5.887**
std errors	t + 180M	(0.040)	(0.035)	(0.022)	(0.011)	(0.007)	(0.012)	(0.016)	(0.022)	(0.027)	(0.033)	
Profitability	t	-1.494	-0.839	-0.489	-0.393	-0.188	0.016	0.300	0.617	0.950	1.339	**2.833**
Profitability	t + 60M	-1.442	-0.997	-0.616	-0.366	-0.094	0.087	0.328	0.551	0.870	1.305	**2.747**
Profitability	t + 120M	-1.428	-1.019	-0.634	-0.356	-0.089	0.132	0.370	0.627	0.900	1.302	**2.730**
Profitability	t + 180M	-1.433	-1.016	-0.631	-0.346	-0.068	0.154	0.406	0.677	0.956	1.341	**2.774**
std errors	t + 180M	(0.009)	(0.011)	(0.009)	(0.007)	(0.010)	(0.010)	(0.011)	(0.013)	(0.012)	(0.013)	
Growth	t	-1.485	-1.131	-0.707	-0.354	0.000	0.283	0.636	0.990	1.273	1.556	**3.041**
Growth	t + 60M	-1.470	-1.133	-0.817	-0.487	-0.154	0.164	0.491	0.833	1.169	1.511	**2.981**
Growth	t + 120M	-1.427	-1.108	-0.802	-0.501	-0.171	0.146	0.468	0.803	1.125	1.473	**2.900**
Growth	t + 180M	-1.406	-1.091	-0.768	-0.471	-0.163	0.125	0.455	0.793	1.102	1.432	**2.838**
std errors	t + 180M	(0.013)	(0.012)	(0.012)	(0.012)	(0.014)	(0.016)	(0.013)	(0.016)	(0.015)	(0.014)	
Safety	t	-1.391	-0.819	-0.575	-0.311	-0.146	0.032	0.237	0.561	0.952	1.455	**2.846**
Safety	t + 60M	-0.679	-0.371	-0.300	-0.241	-0.172	-0.056	0.081	0.306	0.664	1.245	**1.924**
Safety	t + 120M	-0.700	-0.401	-0.288	-0.232	-0.130	-0.047	0.114	0.298	0.640	1.210	**1.910**
Safety	t + 180M	-0.699	-0.396	-0.336	-0.217	-0.127	-0.039	0.126	0.311	0.633	1.214	**1.913**
std errors	t + 180M	(0.017)	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.013)	(0.012)	
Payout	t	-1.468	-0.944	-0.657	-0.453	-0.160	0.191	0.475	0.654	0.947	1.299	**2.767**
Payout	t + 60M	-1.381	-1.239	-0.768	-0.422	-0.111	0.183	0.439	0.680	0.959	1.301	**2.682**
Payout	t + 120M	-1.411	-1.161	-0.699	-0.364	-0.052	0.214	0.461	0.691	0.944	1.291	**2.702**
Payout	t + 180M	-1.386	-1.155	-0.722	-0.370	-0.058	0.217	0.465	0.701	0.950	1.292	**2.678**
std errors	t + 180M	(0.007)	(0.017)	(0.012)	(0.010)	(0.008)	(0.006)	(0.007)	(0.007)	(0.006)	(0.009)	

This table summarizes quality persistence by showing time series average quality scores at time t (January 1999), t+60 months (December 2003), t+180 months (December 2008) and t+240 months (December 2013). First, stocks are sorted into ten monthly portfolios by quality score. Then the quality average of each portfolio is calculated monthly. The time series (moving) average of cross sectional means is reported month end, at time of portfolio creation and every 5-years thereafter, for fifteen years. The spread between the highest and lowest quality portfolios is indicated by P10 – P1, in the far right column. Standard errors are adjusted for heteroskedasticity and autocorrelation and listed in parentheses beneath the quality scores. The four components of quality (profitability, growth, safety and payout) are reported in the same manner.

Table II Persistence in U.S. Listed Real Estate vs. U.S. Total Stock Market

	Asness et al. (2013) Results- Overall U.S. Stock Market					Persistence - U.S. Real Estate Sample				
	Profitability P10-P1	Growth P10-P1	Safety P10-P1	Payout P10-P1	Quality P10-P1	Profitability P10-P1	Growth P10-P1	Safety P10-P1	Payout P10-P1	Quality P10-P1
t	3.200	3.150	2.950	3.030	2.940	2.833	3.041	2.846	2.767	5.221
t + 60M	1.900	0.510	1.460	0.860	1.200	2.747	2.981	1.924	2.682	5.832
t + 120M	1.530	0.580	0.980	0.460	0.980	2.730	2.900	1.910	2.702	5.737
s.d.	0.877	1.504	1.027	1.383	1.074	0.055	0.071	0.536	0.044	0.329

This table shows a comparison between the quality persistence results and those presented by Asness et al. (2013) on the overall U.S. stock market. By looking at the spreads between highest and lowest quality scored portfolios and calculating their standard deviations (s.d.) from portfolio creation (t) to ten years out (t+ 120M), we see that the sample has lower standard deviations across the board, and therefore, displays stronger persistence and better predictability than the aggregate U.S. stock market. The U.S. real estate sample reflects results during sample period, 1999-2003.

Table III Regression Results: The Price of Quality and its Components

VARIABLES	(1) Price/Book	(2) Price/Book	(3) Price/Book	(4) Price/Book	(5) Price/Book	(6) Price/Book	(7) Price/Book
Market cap		0.00690**					0.00598**
(size)		(0.00269)					(0.00252)
12 mo. return		6.699**					3.777*
(momentum)		(3.270)					(2.044)
Quality	4.672***	4.863***					
	(1.052)	(1.079)					
Profit			18.25***				17.86***
			(2.409)				(2.873)
Growth				5.646***			-2.106
				(1.791)			(1.936)
Safety					-17.30***		-28.07***
					(4.902)		(6.388)
Payout						-1.246	-5.856
						(3.314)	(3.587)
Constant	131.2***	99.14***	134.2***	124.3***	134.1***	132.2***	117.5***
	(6.794)	(16.39)	(6.718)	(11.04)	(6.942)	(6.963)	(14.79)
Observations	30,240	29,105	28,833	21,827	29,539	29,127	21,826
Number of SNL Institutions	347	342	341	271	342	342	271
R-squared overall	0.115	0.190	0.169	0.107	0.115	0.101	0.244
Wald	1076	1286	999.1	1199	1154	1185	1256
p-value	0	0	0	0	0	0	0

This table shows the results of univariate and multivariate regressions using price to book ratio as the dependent variable and quality and its components as independent variables. Quality is the overall quality score for each individual firm (i) at the end of each month (t). The scaled price of each firm is regressed on its overall quality score per monthly observation. Standard errors are corrected for heteroskedasticity and autocorrelation. Given quality measures are z-scores, the interpretation follows that if quality improves by one standard deviation, the price to book ratio increases by x percent. In order to further determine the explanatory power of quality on prices, market capitalization and lagged 12-month returns are added to control for size and momentum, respectively, and time dummies are employed to control for market conditions on a quarterly basis. Market capitalization is in millions of dollars (U.S.) and lagged 12-month returns are in log and percent form. In the same way, scaled prices are regressed on the components of quality (profitability, growth, safety and payout). Results are reflected for U.S. listed real estate during the sample period, 1999-2003. Time dummies have been applied to control for quarterly market conditions. Robust standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table IV – Panel A The Price of Quality in 5-yr Increments

VARIABLES	(1999-2003) Price/Book	(2004-2008) Price/Book	(2009-2013) Price/Book
Market cap (size)	0.0105	0.00980***	0.00661***
	(0.00744)	(0.00321)	(0.00256)
12 mo. return (momentum)	8.945*	26.58***	3.308*
	(5.278)	(8.569)	(1.755)
Quality	4.365***	-0.266	1.943
	(0.876)	(1.690)	(1.414)
Constant	97.69***	54.74	91.30***
	(26.35)	(42.34)	(10.85)
Observations	11,018	9,183	8,904
Number of SNL Institutions	235	213	195
R-squared overall	0.0901	0.175	0.170
Wald	422.7	632	581.1
p-value	0	0	0

This table shows the average monthly price of quality for 1999-2003, 2004-2008 and 2009-2013, using price to book ratio as the dependent variable and quality as an independent variable. In order to further determine the explanatory power of quality on prices, market capitalization and lagged 12-month returns are added to control for size and momentum, respectively, and time dummies are employed to control for market conditions on a quarterly basis. Market capitalization is in millions of dollars (U.S.) and lagged 12-month returns are in log and percent form. Quality is the overall quality score for each individual firm (i) at the end of each month (t). The scaled price of each firm is regressed on its overall quality score per monthly observation. Standard errors are corrected for heteroskedasticity and autocorrelation. Given quality measures are z-scores, the interpretation follows that if quality improves by one standard deviation, the price to book ratio increases by x percent. Robust standard errors in parentheses. Time dummies have been applied to control for quarterly market conditions.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table IV – Panel B The Price of Quality by Year, 2004 – 2008

VARIABLES	(2004) Price/Book	(2005) Price/Book	(2006) Price/Book	(2007) Price/Book	(2008) Price/Book
Market cap (size)	0.0189***	0.0156***	0.0103**	0.0172***	0.0164***
	(0.00275)	(0.00440)	(0.00488)	(0.00385)	(0.00415)
12 mo. return (momentum)	6.192	34.67***	34.62***	39.33**	208.3***
	(7.883)	(5.928)	(11.43)	(19.78)	(65.83)
Quality	-0.591	-0.307	-1.968	3.086**	-2.577*
	(1.416)	(1.027)	(1.382)	(1.487)	(1.518)
Constant	151.6***	19.06	64.21	40.90	-779.6***
	(38.62)	(29.35)	(54.11)	(89.69)	(301.9)
Observations	1,974	2,021	1,907	1,661	1,620
Number of SNL Institutions	178	182	172	152	141
R-squared overall	0.0852	0.173	0.172	0.155	0.172
Wald	197	102	151	254.1	444.3
p-value	0	0	0	0	0

This table reports the average monthly price of quality using price to book ratio as the dependent variable and quality as an independent variable. In order to further determine the explanatory power of quality on prices, market capitalization and lagged 12-month returns are added to control for size and momentum, respectively, and time dummies are employed to control for market conditions on a quarterly basis. Market capitalization is in millions of dollars (U.S.) and lagged 12-month returns are in log and percent form. Quality is the overall quality score for each individual firm (i) at the end of each month (t). The scaled price of each firm is regressed on its overall quality score per monthly observation. Standard errors are corrected for heteroskedasticity and autocorrelation. Given quality measures are z-scores, the interpretation follows that if quality improves by one standard deviation, the price to book ratio increases by x percent. Regression results are reported for each year from 2004-2008. The years leading up to the global financial crisis, 2004-2006, were characterized by a real estate bubble. The crisis began in 2007 and continued through 2008. Robust standard errors in parentheses. Time dummies have been applied to control for quarterly market conditions.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table IV – Panel C The Price of Quality in Small & Big Real Estate Stocks

VARIABLES	(1) 1999-2013 Small cap Price/Book	(2) 1999-2013 Big cap Price/Book	(3) 2007 Small Cap Price/Book	(4) 2007 Big Cap Price/Book	(5) 2008 Small Cap Price/Book	(6) 2008 Big Cap Price/Book
Market cap (size)	0.0798***	0.00556*	0.122***	0.0127***	0.0803***	0.0140***
	(0.0194)	(0.00317)	(0.0219)	(0.00452)	(0.0145)	(0.00410)
12 mo. return	10.16***	3.716	48.59*	28.89	287.7***	93.04*
(momentum)	(2.988)	(3.491)	(25.26)	(21.69)	(51.82)	(49.64)
Quality	4.336***	2.987*	0.485	7.151**	-0.771	-6.960
	(1.284)	(1.712)	(1.028)	(3.248)	(0.820)	(4.665)
Constant	55.45***	127.6***	-75.87	134.1	-1,187***	-229.0
	(15.98)	(18.58)	(117.2)	(101.4)	(236.6)	(225.4)
Observations	14,590	14,515	833	828	813	807
Number of SNL Institutions	244	184	82	82	82	78
R-squared overall	0.136	0.184	0.121	0.0788	0.0601	0.118
Wald	948	1511	116.6	210.9	313	278.3
p-value	0	0	0	0	0	0

This table shows the average monthly price of quality for big and small stocks for the entire sample period, 1999-2003 and for years, 2007 and 2008, separately. Small and big stocks defined by the median market capitalization for the sample. Using price to book ratio as the dependent variable and quality as an independent variable, along with market capitalization and lagged 12-month returns in order to control for size and momentum, respectively. Time dummies are employed to control for market conditions on a quarterly basis. Market capitalization is in millions of dollars (U.S.) and lagged 12-month returns are in log and percent form. Quality is the overall quality score for each individual firm (i) at the end of each month (t). The scaled price of each firm is regressed on its overall quality score per monthly observation. Standard errors are corrected for heteroskedasticity and autocorrelation. Given quality measures are z-scores, the interpretation follows that if quality improves by one standard deviation, the price to book ratio increases by x percent. Robust standard errors in parentheses. Time dummies have been applied to control for quarterly market conditions
*** p<0.01, ** p<0.05, * p<0.1

Table V Returns & Alphas by Quality Portfolio

U.S. Sample 1999-2013	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	-0.185	**0.615**	**0.719**	**0.633**	**0.646**	**0.548**	**0.881**	**0.554**	**0.797**	**0.623**	0.990	
	(0.160)	(0.143)	(0.132)	(0.109)	(0.145)	(0.129)	(0.107)	(0.115)	(0.115)	(0.123)		
CAPM alpha	**-0.362**	**0.370**	**0.515**	**0.371**	**0.449**	**0.319**	**0.673**	**0.242**	**0.242**	**0.351**	0.585	
	(0.143)	(0.135)	(0.134)	(0.117)	(0.131)	(0.126)	(0.116)	(0.123)	(0.123)	(0.138)		
3-factor alpha	**-0.625**	-0.060	0.069	-0.049	0.046	-0.100	**0.292**	-0.122	0.185	0.061	0.931	
	(0.146)	(0.128)	(0.135)	(0.113)	(0.126)	(0.116)	(0.106)	(0.117)	(0.114)	(0.125)		
R-squared (3-factor)	0.091	0.225	0.237	0.241	0.226	0.235	0.234	0.209	0.208	0.203	0.211	avg
(Coefficients based on 3-factor model)											Avg. Loadings	
MKT	**0.492**	**0.625**	**0.588**	**0.566**	**0.570**	**0.534**	**0.559**	**0.506**	**0.530**	**0.549**	0.552	avg
	(0.065)	(0.038)	(0.032)	(0.029)	(0.035)	(0.030)	(0.026)	(0.030)	(0.030)	(0.034)		
SMB	**0.309**	**0.463**	**0.391**	**0.365**	**0.360**	**0.392**	**0.338**	**0.333**	**0.329**	**0.277**	0.356	avg
	(0.055)	(0.043)	(0.038)	(0.031)	(0.038)	(0.035)	(0.030)	(0.033)	(0.032)	(0.031)		
HML	**0.338**	**0.634**	**0.666**	**0.663**	**0.663**	**0.682**	**0.621**	**0.568**	**0.577**	**0.573**	0.599	avg
	(0.075)	(0.046)	(0.040)	(0.034)	(0.035)	(0.039)	(0.036)	(0.039)	(0.035)	(0.036)		

This table reports the time series average of cross sectional, monthly excess returns and risk adjusted returns (alphas), by quality portfolio for the sample period 1999-2003. It also reports the coefficients or factor loadings reported in the 3-factor Fama French regressions. First, stocks are monthly sorted by quality score and ten decile portfolios are created. Then stocks are assigned monthly to one of the ten portfolios by quality score. The time series mean excess return is calculated for each quality portfolio. Second, cross sectional regression (2) is run, first, using only the market factor, MKT, based on the CAPM 1-factor model, and then adding size and value factors SMB and HML (Fama French (1993)). Standard errors are adjusted for heteroskedasticity and autocorrelation and reported in parentheses beneath average return. The far right column reports the average, monthly difference, or spread, between the combined returns from high quality portfolios 9 and 10 and those from low quality portfolios 1 and 2. Returns and alphas in bold print are those that are statistically significant at 90% or higher (having p- values less than 0.1%).

Table VI – Panel A Returns to Quality in 5-yr Increments, Isolating Crisis

1999-2003	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	**-0.844**	**0.574**	**0.733**	**0.726**	**0.805**	**0.582**	**0.856**	**0.544**	**0.866**	**0.791**	1.927	
	(0.270)	(0.239)	(0.198)	(0.166)	(0.183)	(0.188)	(0.158)	(0.163)	(0.189)	(0.204)		
3-factor alpha	**-1.157**	-0.026	0.091	0.126	0.215	-0.020	**0.330**	-0.125	0.216	0.275	1.674	
	(0.274)	(0.256)	(0.219)	(0.169)	(0.181)	(0.184)	(0.156)	(0.177)	(0.211)	(0.211)		
R-squared (3-factor)	0.035	0.091	0.100	0.116	0.108	0.107	0.104	0.117	0.094	0.092	0.096	avg

2004-2008	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	-0.098	0.135	0.246	0.155	0.127	0.116	**0.768**	0.159	**0.380**	-0.132	0.211	
	(0.250)	(0.237)	(0.220)	(0.211)	(0.254)	(0.216)	(0.212)	(0.213)	(0.203)	(0.214)		
3-factor alpha	-0.131	0.026	0.238	0.043	0.074	0.054	**0.635**	0.096	**0.359**	-0.340	0.124	
	(0.216)	(0.176)	(0.187)	(0.170)	(0.241)	(0.186)	(0.195)	(0.208)	(0.182)	(0.239)		
R-squared (3-factor)	0.115	0.257	0.229	0.258	0.243	0.248	0.282	0.240	0.251	0.257	0.238	avg

2009-2013	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	**0.560**	**1.181**	**1.207**	**1.034**	**0.993**	**0.963**	**1.034**	**0.990**	**1.155**	**1.216**	0.630	
	(0.261)	(0.253)	(0.259)	(0.245)	(0.304)	(0.232)	(0.216)	(0.207)	(0.210)	(0.195)		
3-factor alpha	**-0.458**	-0.243	-0.163	-0.319	-0.323	-0.158	-0.285	-0.105	-0.074	0.121	0.748	
	(0.235)	(0.211)	(0.245)	(0.234)	(0.242)	(0.173)	(0.207)	(0.192)	(0.185)	(0.180)		
R-squared (3-factor)	0.161	0.360	0.407	0.374	0.349	0.373	0.365	0.315	0.357	0.319	0.338	avg

This table reports the time series average of cross sectional, monthly excess returns and risk adjusted returns, alphas, by quality portfolio for the sample periods 1999-2003, 2004-2008 and 2009-2013. First, stocks are monthly sorted by quality score and ten decile portfolios are created. Then stocks are assigned monthly to one of the ten portfolios by quality score. The time series mean excess return is calculated for each quality portfolio. Second, cross sectional regression (2) is run, first, using only the market factor, MKT, based on the CAPM 1-factor model, and then adding size and value factors SMB and HML (Fama French (1993)). Standard errors are adjusted for heteroskedasticity and autocorrelation and reported in parentheses beneath average return. The far right column reports the average, monthly difference, or spread, between the combined returns from high quality portfolios 9 and 10 and those from low quality portfolios 1 and 2. Returns and alphas in bold print are those that are statistically significant at 90% or higher (having p- values less than 0.1%).

Table VI - Panel B Annual Breakout of Returns to Quality from 2004-2008

U.S. Sample 2004	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	1.304	1.541	**1.728**	**1.615**	**2.305**	**1.910**	**2.349**	**2.286**	1.887	1.677	0.719	
	(0.512)	(0.378)	(0.454)	(0.320)	(0.368)	(0.344)	(0.305)	(0.327)	(0.354)	(0.395)		
3-factor alpha	0.567	-0.113	0.368	0.190	**1.023**	0.133	**0.873**	**0.968**	-0.175	-0.077	-0.706	
	(0.713)	(0.449)	(0.541)	(0.455)	(0.568)	(0.464)	(0.451)	(0.528)	(0.508)	(0.546)		
R-squared (3-factor)	0.075	0.181	0.133	0.140	0.175	0.201	0.154	0.136	0.221	0.223	0.164	avg

U.S. Sample 2005	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	0.998	0.829	0.368	0.245	-0.820	-0.128	**0.759**	-0.217	0.167	-0.051	-1.711	
	(0.431)	(0.346)	(0.328)	(0.352)	(0.627)	(0.345)	(0.387)	(0.397)	(0.387)	(0.271)		
3-factor alpha	**1.243**	0.654	0.471	-0.265	-1.166	-0.238	**0.297**	**-0.791**	-0.133	-0.280	-2.310	
	(0.579)	(0.424)	(0.418)	(0.405)	(0.847)	(0.443)	(0.359)	(0.477)	(0.422)	(0.302)		
R-squared (3-factor)	0.027	0.159	0.102	0.232	0.098	0.180	0.188	0.130	0.165	0.206	0.149	avg

U.S. Sample 2006	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	1.291	1.661	**1.796**	**1.617**	**1.619**	**1.651**	**2.220**	**1.394**	1.547	1.072	-0.333	
	(0.433)	(0.395)	(0.289)	(0.319)	(0.372)	(0.346)	(0.396)	(0.411)	(0.363)	(0.287)		
3-factor alpha	**1.791**	**2.568**	**2.424**	**1.618**	**1.144**	**2.304**	**2.184**	**1.794**	**1.675**	**1.211**	-1.473	
	(0.692)	(0.487)	(0.372)	(0.405)	(0.572)	(0.473)	(0.628)	(0.513)	(0.506)	(0.470)		
R-squared (3-factor)	0.059	0.214	0.175	0.170	0.117	0.159	0.098	0.181	0.145	0.124	0.144	avg

U.S. Sample 2007	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	-1.535	-2.024	**-1.453**	**-1.851**	**-1.368**	**-1.909**	**-1.439**	**-1.709**	-0.915	-1.903	0.741	
	(0.466)	(0.457)	(0.415)	(0.440)	(0.416)	(0.427)	(0.474)	(0.534)	(0.440)	(0.467)		
3-factor alpha	-0.469	**-1.284**	**-1.228**	**-2.083**	**-1.668**	**-1.957**	**-1.462**	**-1.391**	-0.376	**-2.534**	-1.157	
	(0.585)	(0.551)	(0.590)	(0.547)	(0.651)	(0.473)	(0.661)	(0.649)	(0.580)	(0.550)		
R-squared (3-factor)	0.072	0.355	0.211	0.325	0.219	0.276	0.247	0.208	0.210	0.282	0.241	avg

U.S. Sample 2008	P1 (Low)	P2	P3	P4	P5	P6	P7	P8	P9	P10 (High)	(P9+P10) - (P1+P2)	
Excess Returns	-3.504	-2.093	**-1.905**	**-1.570**	**-1.521**	**-1.589**	-0.639	**-1.580**	-1.274	-2.199	2.124	
	(0.745)	(0.623)	(0.637)	(0.673)	(0.616)	(0.565)	(0.667)	(0.522)	(0.448)	(0.594)		
3-factor alpha	**-1.739**	-0.245	1.067	**1.231**	**1.081**	**1.177**	**1.949**	**1.501**	**1.930**	0.058	3.972	
	(0.874)	(0.599)	(0.755)	(0.507)	(0.619)	(0.632)	(0.500)	(0.486)	(0.509)	(0.798)		
R-squared (3-factor)	0.171	0.363	0.365	0.354	0.478	0.389	0.514	0.426	0.402	0.351	0.381	avg

This table reports the time series average of cross sectional, monthly excess returns and risk adjusted returns, alphas, by quality portfolio for each year between 2004 and 2008. First, stocks are monthly sorted by quality score and ten decile portfolios are created. Then stocks are assigned monthly to one of the ten portfolios by quality score. The time series mean excess return is calculated for each quality portfolio. Second, cross sectional regression (2) is run, first, using only the market factor, MKT, based on the CAPM 1-factor model, and then adding size and value factors SMB and HML (Fama French (1993)). Standard errors are adjusted for heteroskedasticity and autocorrelation and reported in parentheses beneath average return. The far right column reports the average, monthly difference, or spread, between the combined returns from high quality portfolios 9 and 10 and those from low quality portfolios 1 and 2. Returns and alphas in bold print are those that are statistically significant at 90% or higher (having p- values less than 0.1%). 2004-2006 were the years leading up to the global financial crisis and were characterized by a real estate bubble. The crisis began in 2007 and continued through 2008.

Table VII Returns & Alphas to Long Quality, Short Junk Portfolios

1999-2013	QMJ	PMU	GMM	SMV	HpMLp
Excess Returns	**0.968**	**1.595**	**1.109**	**0.293**	**-0.070**
	(0.017)	(0.020)	(0.027)	(0.008)	(0.013)
CAPM alpha	**1.007**	**1.588**	**1.143**	**0.234**	**-0.037**
	(0.017)	(0.020)	(0.025)	(0.008)	(0.015)
3-factor alpha	**1.006**	**1.529**	**1.195**	**0.281**	**-0.265**
	(0.015)	(0.017)	(0.026)	(0.008)	(0.010)
(Coefficients based on 3-factor model)					
MKT	**-0.041**	**0.089**	**-0.100**	**0.198**	**-0.131**
	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)
SMB	**-0.168**	**-0.102**	**-0.042**	**-0.129**	**0.232**
	(0.006)	(0.004)	(0.004)	(0.003)	(0.004)
HML	**0.176**	**0.254**	**-0.089**	**0.017**	**0.340**
	(0.009)	(0.007)	(0.003)	(0.005)	(0.006)

This table shows average, monthly excess returns and alphas to long/short portfolio QMJ and its components, PMU, GMM, SMV and HpMLp for the sample period, 1999-2003. The quality minus junk factor (QMJ) is constructed by first, subtracting the excess returns from the two lowest quality portfolios (P1 and P2) from those of the two highest portfolios (P9 and P10), for every monthly observation, ((i),(t)). The time series average cross sectional mean is then calculated in order to arrive at monthly excess returns to QMJ. Second, cross sectional regression (2) is run, first, using only the market factor, MKT, based on the CAPM 1-factor model, and then adding size and value factors SMB and HML (Fama French (1993)). Standard errors are corrected for heteroskedasticity and autocorrelation and statistical significance at 90% or higher is denoted by bold print. In the same manner, long/short portfolios are created for each component of quality based on excess returns to profitability, growth, safety and payout.

Table VIII Long Quality, Short Junk Portfolio Correlations

1999-2013	QMJ	PMU	GMM	SMV	HpMLp
			Excess Returns		
QMJ	1.000				
PMU	0.786	1.000			
GMM	0.520	0.504	1.000		
SMV	-0.020	0.008	-0.092	1.000	
HpMLp	0.552	0.300	0.169	-0.437	1.000

This table shows the average correlations of monthly excess returns attributed to quality minus junk (QMJ) and those attributed to all components of QMJ, profitability minus junk (PMU), growing minus mature (GMM), safe minus volatile (SMV) and high payout minus low payout (HpMLp). The correlations are reported for the sample period 1999-2003.

Table IX – Returns to QMJ in 5-yr Increments, Isolating Crisis

1999-2003	QMJ	PMU	GMM	SMV	HpMLp
Excess Returns	**1.924**	**2.704**	**2.350**	**0.502**	**0.419**
	(0.015)	(0.012)	(0.014)	(0.012)	(0.012)
3-factor alpha	**1.820**	**2.485**	**2.518**	**0.414**	**-0.114**
	(0.018)	(0.011)	(0.014)	(0.013)	(0.010)

2004-2008	QMJ	PMU	GMM	SMV	HpMLp
Excess Returns	**0.192**	**1.002**	**0.509**	**-0.042**	**-0.328**
	(0.022)	(0.031)	(0.011)	(0.008)	(0.009)
3-factor alpha	**0.220**	**1.000**	**0.410**	**0.122**	**-0.504**
	(0.030)	(0.029)	(0.016)	(0.007)	(0.016)

2007-2008	QMJ	PMU	GMM	SMV	HpMLp
Excess Returns	**1.367**	**2.460**	**0.895**	**-0.103**	**0.053**
	(0.013)	(0.026)	(0.013)	(0.013)	(0.007)
3-factor alpha	**1.563**	**2.771**	**1.389**	**-0.689**	**0.489**
	(0.023)	(0.030)	(0.017)	(0.014)	(0.010)

2009-2013	QMJ	PMU	GMM	SMV	HpMLp
Excess Returns	**0.582**	**0.818**	**0.173**	**0.384**	**-0.509**
	(0.019)	(0.017)	(0.012)	(0.008)	(0.026)
3-factor alpha	**0.714**	**0.548**	**0.364**	**0.124**	**-0.425**
	(0.021)	(0.019)	(0.014)	(0.007)	(0.024)

This table shows average, monthly excess returns and alphas to long/short portfolio QMJ and its components, PMU, GMM, SMV and HpMLp for sample sub periods, 1999-2003, 2004-2008, 2007-2008 and 2009-2013. The quality minus junk factor (QMJ) is constructed by first, subtracting the excess returns from the two lowest quality portfolios (P1 and P2) from those of the two highest portfolios (P9 and P10), for every monthly observation, ((i),(t)). The time series average cross sectional mean is then calculated in order to arrive at monthly excess returns to QMJ. Second, cross sectional regression (2) is run, first, using only the market factor, MKT, based on the CAPM 1-factor model, and then adding size and value factors SMB and HML (Fama French (1993)). Standard errors are corrected for heteroskedasticity and autocorrelation and statistical significance at 90% or higher is denoted by bold print. In the same manner, PMU, GMM SMV and HpMLp are constructed based on excess returns to profitability, growth, safety and payout. 2007-2008, which is a subset of the greater 5-year period, 2004-2008, isolates returns to QMJ during the global financial crisis.

Table X Adding QMJ to the RHS and Adjusting for the Market Factor Issue

VARIABLES	(1) Returns	(2) Returns	(3) Returns
MKT	0.551***	0.556***	
	(0.0161)	(0.0162)	
SMB	0.356***	0.377***	0.520***
	(0.0133)	(0.0137)	(0.0178)
HML	0.597***	0.576***	0.484***
	(0.0178)	(0.0173)	(0.0195)
QMJ		0.125***	0.105***
		(0.0143)	(0.0142)
Constant	-0.0237	-0.148***	0.0413
	(0.0442)	(0.0395)	(0.0391)
Observations	30,218	30,218	30,218
Number of SNL Institutions	346	346	346
R-squared overall	0.200	0.206	0.0868
Wald	1606	1602	870.7
p-value	0	0	0

This table shows regression results associated with equations, (4), (5) & (6), and reflects the different asset pricing models employed to risk adjust sample returns for the period, 1999-2013. Excess returns are regressed monthly on the market, size and value factors (3-factor model), and the time series average of cross sectional returns to each factor are reported in column (1). Excess returns are regressed monthly on the market, size and value, and quality factors (4-factor model), and the time series average of cross sectional returns to each factor are reported in column (2). In column (3), the market factor (MKT) is removed from the right hand side of the regression equation, and excess returns are regressed monthly on the size, value, and quality factors (modified 3-factor model), with the time series average of cross sectional returns to each factor reported. Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table XI Adding QMJ to RHS of Model & Removing MKT Factor in 5-yr Increments, Isolating Crisis

VARIABLES	(1) 1999-2003 Returns	(2) 1999-2003 Returns	(3) 2004-2008 Returns	(4) 2004-2008 Returns	(5) 2007-2008 Returns	(6) 2007-2008 Returns	(7) 2009-2013 Returns	(8) 2009-2013 Returns
MKT	0.348***		0.706***		0.654***		0.748***	
	(0.0209)		(0.0220)		(0.0233)		(0.0260)	
SMB	0.322***	0.267***	0.351***	0.849***	0.204***	0.602***	0.184***	0.838***
	(0.0155)	(0.0147)	(0.0301)	(0.0326)	(0.0742)	(0.0795)	(0.0353)	(0.0396)
HML	0.453***	0.224***	0.486***	0.494***	0.875***	0.848***	0.414***	0.982***
	(0.0215)	(0.0156)	(0.0353)	(0.0363)	(0.0847)	(0.0848)	(0.0300)	(0.0356)
QMJ	0.0824***	0.0856***	0.289***	0.368***	0.344***	0.605***	0.0378*	0.0862***
	(0.0167)	(0.0165)	(0.0252)	(0.0249)	(0.0488)	(0.0466)	(0.0215)	(0.0212)
Constant	-0.143**	-0.00957	0.0578	-0.125*	-0.664***	-2.133***	-0.209***	0.710***
	(0.0704)	(0.0704)	(0.0615)	(0.0702)	(0.112)	(0.123)	(0.0593)	(0.0597)
Observations	11,505	11,505	9,673	9,673	3,411	3,411	9,040	9,040
Number of SNL Institutions	246	246	221	221	166	166	196	196
R-squared overall	0.0859	0.0376	0.255	0.152	0.307	0.177	0.324	0.204
Wald	570.7	360.8	1554	859.8	1297	395.5	1134	998.5
p-value	0	0	0	0	0	0	0	0

This table shows regression results associated with equations, (4), (5) & (6), and reflects the different asset pricing models employed to risk adjust sample returns for the periods 1999-2003, 2004-2008, 2007-2008 and 2009-2013. Excess returns are regressed monthly on the market, size and value factors (3-factor model), and the time series average of cross sectional returns to each factor are reported in column (1). Excess returns are regressed monthly on the market, size, value, and quality factors (4-factor model), and the time series average of cross sectional returns to each factor are reported in columns (1), (3), (5) and (7). In column (2), (4), (6) and (8), the market factor (MKT) is removed from the right hand side of the regression equation, and excess returns are regressed monthly on the size, value, and quality factors (modified 3-factor model), with the time series average of cross sectional returns to each factor reported. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1