Do Factors Matter?

Critical Finance Review, forthcoming

Tim Loughran
Mendoza College of Business
University of Notre Dame
Notre Dame, IN 46556-5646
Loughran.9@nd.edu

December 13, 2022

ABSTRACT

Over the past generation of market returns, factors only matter for small firms. The Fama and French (2018) 6-factor and the Hou et al. (2021) q5-factor models are commonly used to measure the performance of stock return portfolios. Importantly, I find that most of the Fama-French and q5-factor firm-level characteristics have not worked for large capitalization firms for quite a long time (i.e., 1983-2021). Small firms comprising less than 8% of the total market capitalization drive the patterns of the factor models. This paper also reexamines equity issuer performance within the context of the factor firm-level characteristics.

JEL codes: G12; G14; G34; G40
Key words: Fama-French 6-factor, q5-factor, q-factor, Market efficiency, Equity issuers

I thank Zhi Da, Paul Gao, Todd Houge, Bill McDonald, Jay Ritter, Ivo Welch (Editor), and an anonymous referee for helpful suggestions, Ken French for providing the Fama-French 6-factor returns, Lu Zhang for sharing the q5-factor returns, and James Ng for excellent research assistance.

In the last 30 years, myriad market anomalies have been documented in the fields of finance and accounting. For example, empirical evidence has been presented that share repurchasers outperform (Ikenberry, Lakonishok, and Vermaelen (1995)), share issuers underperform (Ritter (1991), Loughran and Ritter (1995), and Spiess and Affleck-Graves (1995)), and firms with aggressive accruals lag other companies (Sloan (1996)). However, many of these patterns are correlated with other patterns. That is, equity issuers tend to be growth stocks, which historically have low realized returns. Thus, a natural question that arises is whether a given pattern has incremental explanatory power, or becomes economically and statistically insignificant once other more general patterns are controlled for.

The Fama and French factor model and the Hou, Mo, Xue, and Zhang (2021) q5 model can explain away the abnormal performance of many anomalies (see Fama and French (2016) and Hou, Mo, Xue, and Zhang (2021)).[1] My paper takes a step back and seeks to understand how well some of the model's multifactor components can explain the broad cross-section of realized stock returns over long periods of time. The focus of this paper will be on both the widely used Fama and French (2018) 6-factor and the Hou, Mo, Xue, and Zhang (2021) q5-factor models.

The Fama-French factors are beta, size, book-to-market, profitability, investment, and momentum, given in equation form as:

$$R_{i,t} - R_{f_t} = a_i + b_i\left(R_{m_t} - R_{f_t}\right) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + m_i MOM_i + e_{i,t} \quad (1)$$

In equation (1), $R_{i,t}$ is the return on portfolio i for period t; R_{f_t} is the risk-free return; R_{m_t} is the return on the value-weighted (VW) market portfolio; SMB denotes the factor of small firm stock returns minus large firm stock returns; HML denotes the factor of high book-to-market stock

[1] Fama and French (1993) started with a 3-factor model (beta, size, and book-to-market), added two more factors (profitability and investment) in their Fama and French (2015) article. In the Fama and French (2018) article, momentum was included in their factor model making a total of 6 factors.

returns minus low book-to-market stock returns; RMW denotes the stock returns of high profitability firms minus the stock returns of low profitability firms; CMA denotes the stock returns of firms with low investments minus the stock returns of firms with high investments; MOM denotes the high prior year return portfolios minus low prior year return portfolios.

The Hou, Mo, Xue, and Zhang (2021) q5-factor model is created by adding expected investment-to-assets growth to the well-known q-factor paper by Hou, Xue, and Zhang (2015). Here is the Hou, Mo, Xue, and Zhang (2021) q5-factor formula:

$$Ret_t - Rf_t = a_i + b_i r\_mkt + s_i r\_me + i_i r\_ia_t + p_i r\_roe_t + g_i r\_eg_t + e_t \quad (2)$$

The q5-factor model consists of the market factor (r_mkt), a size factor (r_me), an investment factor (r_ia), a profitability factor (r_roe), and the expected investment-to-assets growth factor (r_eg). The size and investment factors in the q-factor model are effectively identical to the size and investment factors of Fama and French.[2] That is, both measure investment by the change in the firm's total assets from the prior fiscal year following the work by Cooper, Gulen, and Schill (2008). For their profitability factor, Hou et al. (2015) use quarterly income before extraordinary items scaled by lagged quarterly book equity values. The expected investment-to-assets growth factor is created by using average coefficients on Tobin's q, operating cash flows, and the change in return on equity with change in investment as the dependent variable.

My paper addresses multiple issues: 1) Do size, book-to-market, profitability, investment, momentum, and expected investment-to-assets growth have economically important factor premia; 2) Are factor premia important for firms regardless of market capitalization; and, 3) Even if the factor premia are, on average, indistinguishable from zero, in a given subperiod, can they

[2] During 1967-2021, the correlation between Fama-French's SMB and r_me of Hou et al. (2021) is more than 0.97. Similarly, the correlation between CMA and r_ia (the investment factor of Hou et al. (2021)) is more than 0.90.

explain why some portfolios have high or low realized returns? For example, even if book-to-market is not important, on average, for more than a decade growth stocks have beaten value stocks. Do portfolios that are correlated with growth, such as equity issuers, have average returns that cannot be explained by book-to-market and other factors?

Somewhat surprisingly given their widespread usage in the literature, I find that a number of the Fama and French (2018) and Hou et al. (2021) firm-level characteristics have no significant ability to explain cross-sectional returns during the last several decades for large capitalization firms. As in Fama and French (1993, 2015, 2016, 2018) and Hou, Xue, and Zhang (2015), I define large capitalization firms as being above the annual median New York Stock Exchange (NYSE) market capitalization. During 1963-2021, large capitalization firms account for, on average, over 92% of the total capitalization of the entire stock market. By construction, the Fama and French (1993, 2015, 2018) and Hou et al. (2021) models grossly overweight the return contributions of small firms (accounting for less than 8% of the total market capitalization) in the creation of their factors.

Although prior evidence by Fama and French (2008) find a *weaker* effect for the size, book-to-market, and profitability variables among larger firms, this paper reports that for large capitalization firms, the size, book-to-market, profitability, and momentum variables have *no* explanatory power in monthly cross-sectional regressions since 1983. Similarly, the size, ROE, investment, and expected investment-to-assets growth variables of Hou et al. (2021) have no significant power in explaining the cross-section of stock returns for large capitalization firms since 1998. All the variables of the Fama-French 6-factor and the Hou et al. (2021) q5-factor models have time windows in the last 60 years where they perform exceptionally well. However, most of their explanatory effect is limited to smaller capitalization firms and/or clustered in a decade or two in the distant past.

With so many anomalies and so many factors (see Cochrane (2011) and Harvey and Liu (2020)) in the extant literature, a focused critique of factor models is difficult. Although there are numerous anomalies to pick from, this paper will reexamine the performance of equity issuers in the context of the Fama and French (2018) 6-factor and Hou et al. (2021) q5-factor models. I document the poor performance of equity issuers is generally similar for small and large capitalization firms in cross-sectional regressions controlling for size, book-to-market, profitability, investment, momentum, and expected investment-to-assets growth. This finding is driven by my inclusion of stock-financed merger deals as issuers, which are often large capitalization firms that subsequently perform poorly (see Loughran and Vijh ((1997), Rau and Vermaelen (1998), and Mitchell and Stafford (2000)).

Similar to other papers, I report insignificant alphas when either the Fama and French (2018) 6-factor or the Hou et al. (2021) q5-factor models are the portfolio performance benchmark for either small or large capitalization issuers. However, given the Fama and French (1993, 2015, 2018) and Hou et al. (2021) overweighting of small capitalization firms in their factor constructions, inferences on whether large capitalization equity issuers underperform using their models are inappropriate. Analysis of large capitalization equity issuers should be made independent of the return pattern of small unprofitable and high investment stocks. Only in academics can a portfolio with less than 8% of the total market capitalization have an identical weight in creating factors as a portfolio with more than 92% of the total market capitalization.

In review, I show, across all large capitalization firms, that several of the Fama and French (2015, 2018) and Hou et al. (2021) model variables are not good predictors of realized stock returns. Most of the 6-factor and q5-factor models stock return explanatory power is clustered among smaller market value firms or in time periods decades ago. I also show that the misuse of these models substantively changes conclusions about the returns associated with equity issuance.

I Empirical Design and Data

A Fama and French 6-factor Model

The sample includes all NYSE, American Stock Exchange (Amex), and Nasdaq firms with available Wharton Research Data Services (WRDS) Center for Research in Security Prices (CRSP)/Compustat merged dataset (fundamental annual) information during the 1963-2021 time period. Following Fama and French (1992, 1993, 2015, 2016, and 2018), several data restrictions are applied to the sample. First, only firms with ordinary common equity (shrcd variable of 10 or 11), as defined by CRSP, are included. Second, all financial institutions (SIC codes 6000s) are removed from the sample. Further, all firms must have two years of returns on both CRSP and Compustat data before entering the sample. This means that recent initial public offerings (IPOs) are not included until the IPO has had at least two years of seasoning.

As in Fama and French (1993, 2015, 2016, 2018), the portfolios are formed annually as of June of year t. Because the paper uses accounting information from the prior fiscal year, there is at least a 6-month delay from the fiscal year ending date to when performance is analyzed to allow the accounting information to be disclosed to the public. In each cohort year, 1963 to 2021, the monthly returns (including dividends) start in July of year t and end in June of year t+1, except for the year beginning July of 2021. CRSP stock returns end in December of 2021. CRSP number of shares (item shrout) and the cumulative factor to adjust shares outstanding (item cfacshr) for fiscal-year-end t-1 and fiscal-year-end t-2 are required. Firms must also have an available CRSP market value as of June of year t, December of year t-1, and total assets (item at) for the fiscal year ending in any month in both fiscal years t-1 and t-2.

Following the same methodology of the Fama and French (1993, 2015, 2018) factors, firms must have a non-negative book value of equity. Book value of equity from Compustat is book value of equity (item ceq) + deferred tax and investment credit (item txditc) minus book value of preferred stock (using availability order of redemption (item pstkrv), liquidation (item pstkl), and then par value (item pstk)). BV/MV is defined as book value of equity at the end of fiscal year in year t-1 divided by market value of equity in December of year t-1. Profitability (OP) is operating profit/book value defined as [(revenue (item revt) - cost of goods sold (item cogs) – selling, general administrative expense (item xsga) – interest expense (item xint))/book value of equity]. Firms must have a non-missing revenue value and at least one of the costs (i.e., either COGS, SG&A, or interest expense) to be included in the sample. Investment (INV) is defined as ((total assets (item at) in year t-1 minus total assets in year t-2)/ total assets in year t-2). Prior year stock returns (Prior Yr) is defined as the average arithmetic monthly return from month-12 to month-2 (updated monthly). Detailed variable definitions are provided in the appendix.

B Hou, Mo, Xue, and Zhang (2021) q5-factor Model

Because the q-factor model clearly dominates the Fama-French factor model in head-to-head spanning tests (Hou, Mo, Xue, and Zhang (2019)), their model should be included in my analysis. In addition, Hou et al. (2019) show clearly that the q5-factor model has a more solid theoretical foundation than the Fama-French model. The q5-factor model is an extension of the q-factor model by Hou, Xue, and Zhang (2015); the only difference is that the q5 model has an added expected investment-to-assets growth factor. As noted earlier, the q5 model is similar to the Fama and French 6-factor model. For example, both models have size and investment factors. Although both models have a profitability factor scaled by book value of equity measure, their specific definition differs slightly. Fama and French measure profitability on an annual basis while Hou, Xue, and Zhang (2015) use quarterly income before extraordinary items scaled by lagged quarterly book value of equity. Importantly, the q5-factor model includes neither a value-minus-growth variable nor does it have a momentum factor while it does have an expected investment-to-assets growth variable.

Expected investment-to-assets growth is calculated monthly using average slopes from the prior cross-sectional regressions, with the future change in investment as the dependent variable. The independent variables are log(Tobin's q), operating cash flows (Cop), and change in return on equity (dRoe). The Tobin's q variable is defined as (one-month lagged CRSP market value of equity + long term debt (item dltt) + short-term debt (item dlc))/total assets (item at). The operating cash flows variable, Cop, is defined as (revenue (item revt) - cost of goods sold (item cogs) - selling, general, and administrative expenses (item xsga) + research & development (R&D) expenditures (item xrd) – change in accounts receivable (item rect) - change in inventory (item invt) - change in prepaid expenses (item xpp) + change in deferred revenue (item drc + drlt) + change in trade accounts payable (item ap) + change in accrued expenses (item xacc)/total assets (item at).

Notice that R&D expenditures are *added* in the creation of operating cash flows, thereby eliminating its net effect. This is surprising because R&D expenses are actual cash expenses which should lower a firm's cash flows. That is, Merck in fiscal year 2020 actually spent $13.6 billion on R&D which significantly lowered both Merck's net income and cash flows. Even accounting rules treat R&D as an operating activity expense, which is why accountants do not add it back on the Cash Flow statement when computing operating cash flows. Because Hou et al. (2021) use the operating cash flow definition of Ball et al. (2016), this R&D assumption might overstate the true cash flows of high R&D spending firms.

The variable change in return on equity, dRoe, is defined as ROE minus the lagged 4-quarter ROE value. ROE is defined as Compustat quarterly income before extraordinary items (item ibq)/1-quarter lagged book value of equity. The variable ROE is calculated using the most recent quarterly earnings announcement dates (item rdq) if available, else it is required that the fiscal quarter occurred at least 4-months ago. Book value of equity is defined as book equity of shareholders' equity, plus balance-sheet deferred taxes and investment tax credit (item txditcq) if available, minus the book value of preferred stock (item pstkrq, if available, else carrying value of preferred stock (item pstkq)). Depending on availability, the paper uses stockholders' equity (item seqq), or common equity (item ceqq) plus the carrying value of preferred stock (item pstkq), or total assets (item atq) minus total liabilities (item ltq) in that order as the definition of shareholders' equity. Observations with negative book value of equity are dropped. Missing values of txditcq, pstkrq, and pstkq are set to zero.

Each month, expected investment-to-assets growth, E_t(d_INV), is created by using the most recent log(q), Cop, and dRoe values with average slopes from the prior 120-month rolling window (30-month minimum) cross-sectional regressions. The dependent variable in the cross-sectional regressions is the future change in investment-to-assets growth, a variable called d_INV (next year's INV value minus INV in the current year). To minimize the influence of microcap firms, the regressions are estimated using weighted least squares with market value of equity as weights. Detailed variable definitions are provided in the appendix.

II Empirical Results

Although the Fama and French (2018) 6-factor model and the Hou, Mo, Xue, and Zhang (2021) q5-factor model are widely used in the literature, how well do the individual firm characteristics explain the cross-section of realized returns? Is the explanatory power of the factors significant when the sample consists of only firms above the median NYSE capitalization? Do the slope coefficients on the 6-factor and q5-factor variables differ dramatically between small and large capitalization firms? Is the ability of the firm characteristics to explain returns also present in out-of-sample tests?

A Fama-MacBeth (1973) Cross-sectional Monthly Regressions of the 6-factor Characteristics

The paper will first focus on the Fama and French 6-factor model. Panel A of Table 1 reports the average coefficients from Fama-MacBeth (1973) cross-sectional regressions with a dependent variable of raw monthly returns on individual stocks:

$$R_{i,t} = a_0 + a_1 \log(MV)_{i,t} + a_2 \log(BV/MV)_{i,t} + a_3\, OP_{i,t} + a_4\, INV_{i,t} + a_5\, \text{Prior Yr}_{i,t} + e_{i,t} \qquad (3)$$

The five explanatory variables are the natural logarithm of the market value of equity as of June of year t, the natural logarithm of the BE/ME ratio using the book value of equity at the end of the fiscal year in year t-1 divided by the market value of equity as of December of year t-1, OP is the firm's lagged operating profit scaled by book value of equity, investment (INV) is the change in total assets between prior fiscal years, while Prior Yr is the average arithmetic monthly return from month-12 to month-2 (updated monthly). Consistent with the prior literature, the values of log(MV), log(BV/MV), OP, INV, and Prior Yr are winsorized at the 1% and 99% levels. The

T-statistics (in parentheses) are created by dividing the average coefficient value by its time-series standard error.[3]

[Table 1 here]

Each panel in Table 1 has three rows of regression results: for all firms, for only small capitalization firms, and for only large capitalization firms. Panel A reports the average coefficient values during the 1963-2021 time period (702 months). When all firms with available data are included in the regressions, the coefficients imply that low market capitalization, high BV/MV, high profitability, low investment, and prior high positive stock return momentum firms have higher realized returns. These results, at first glance, support the notion that size, book-to-market, profitability, investment, and momentum are key determinants of the cross-section of realized stock returns.

When the sample contains only small capitalization firms (in row 2), the results are almost identical to the all firm patterns. Because in most years there are far more small firms than large firms, the all firms' coefficients are dominated by the patterns among small firms. In the last row of Panel A, when the sample contains only firms above the median NYSE capitalization, the only significant variables are OP, INV, and Prior Yr. Interestingly, the investment (i.e., asset growth) return relation among large firms is completely counter to the evidence of Fama and French (2008). In that paper the two authors report, "Even in the extremes, there is no asset growth anomaly in the average returns on the big stocks that account for more than 90% of total market cap" (page 1655). Note that in Fama and French (2008), the asset growth anomaly is portrayed as being weak

[3] Fama and French (1992) report in their Table III average coefficient values for log(MV) and log(BV/MV) of -0.11 (T-statistic of -1.99) and 0.35 (T-statistic 4.44), respectively. Their time period is July 1963 to December 1990 (330 months). Using an identical time period, my average coefficient values differ only slightly from the results of Fama and French (1992): -0.09 (T-statistic of -1.61) for log(MV) and 0.34 (T-statistic of 4.49) for log(BV/MV).

while in Fama and French (2015) the same variable (with a new variable name) is a key component of their factor model.

There is a dramatic difference in some of the coefficient values as the sample changes from only small firms to only large firms. For example, the coefficient on log(MV) for small firms changes from -0.22 (T-statistic of -4.45) to -0.05 (T-statistic of -1.48) for large firms. The coefficient on log(BV/MV) for large firms is less than half of the respective coefficient value of small firms (0.10 versus 0.21). Although significant in both samples, the INV coefficient drops from -0.87 for small firms to -0.38 for large firms. Conversely, the coefficient on Prior Yr is much higher for large firms (7.40) than its coefficient value for small firms (2.85).

In terms of economic significance, for large firms, going from the 75th percentile of market value to the 25th percentile adds an insignificant 10 basis points per month higher returns. A coefficient of 0.10 on log(BV/MV) implies that as the BV/MV ratio increases from 0.25 for a growth firm to 1.0 for a value firm, (ln(0.25) = -1.39, ln(1) = 0), the average monthly return increases by 14 basis points for a large firm, an economically insignificant effect of less than 2% per year. The coefficient of 0.36 on OP for large capitalization firms implies that as the operating profit increases from 0.21 (25th percentile) to 0.40 (75th percentile), the average monthly return increases by an economically modest 7 basis points per month. For momentum among large firms, going from the 25th percentile to the 75th percentile adds 22 basis points per month (about 2.6% on an annualized basis). Thus, using 702 months of data (1963-2021), size and book-to-market are not statistically nor economically significant predictors of realized returns when the sample is restricted to the most meaningful firms (i.e., those above the median NYSE market value firm). Loughran (1997) and Fama and French (2006) have already documented the lack of a meaningful BV/MV relation with stock returns for bigger capitalization US firms.

In Panel B of Table 1, if the time period is restricted to the 234 months during 1963-1982 (first two decades of the data), size, BV/MV, OP, INV, and Prior Yr are all significant in explaining returns. This is true (with two exceptions) whether the model contains all firms, only small firms, or only large firms. The exceptions are the log(BV/MV) and INV variables when only large capitalization firms are in the sample. The coefficient value on log(BV/MV) in the last row of Panel B is 0.24 (T-statistic of 1.87) while INV has a coefficient value of -0.40 (T-statistic of -1.67). Given that 1963-1982 has a substantial time overlap with the original work by Fama and French (1992, 1993), Jegadeesh and Titman (1993), and Carhart (1997) documenting the power of size, BE/MV, and momentum, the explanatory power of the firm-level characteristics is not surprising.

The real test for the asset pricing characteristics is focusing more on the out-of-sample period, especially for large firms which make up the vast majority of where investors have their money. In Panel C, when the time period is restricted to the last 468 months of data (1983-2021), with the exception of investment, the characteristic relations with stock returns are often insignificant. For example, size has a negative and significant coefficient for the all and small firm samples, but is insignificant when the universe is restricted to only large firms. Likewise, BV/MV and OP both have positive and significant coefficients for the all and small firm universes, yet have insignificant coefficient values when only large firms are included. Prior stock performance is statistically insignificant for each of the three samples.

On a positive note, the investment characteristic is clearly the most consistent variable. Its coefficient value is always negative and statistically significant at the 1% level when the sample is restricted to the 1983-2021 time period. Both small and large firms with more aggressive asset growth have lower subsequent stock returns.

To highlight more precisely where the Fama-French 6-factor model characteristics have explanatory power, Figure 1 reports the results by decade during 1963-2021. For each 10-year period (i.e., 1963-72; 1973-82; 1983-92; …), the coefficients from the Fama-MacBeth cross-sectional regressions in equation (2) are presented. Red cells represent average coefficient values that are both negative and have a T-statistic of -2 or less. Blue cells represent average coefficient values that are both positive and have a T-statistic of 2 or more. Blank cells represent average coefficient values that are not significant. In addition, the figure presents results by size categories (top 25%, top 50%, top 75%, and all firms) using only NYSE firms to determine the various size breakpoints. Panels A to E in Figure 1 report the results by each of the characteristics.

[Figure 1 here]

Figure 1 reports that since 1993, with one exception, the Fama-French 6-factor characteristics do a poor job explaining stock returns regardless of which firms are in the sample. For example, the significance of size (Panel A) is clustered primarily in a few Januaries in the mid-1970s.[4] Book-to-market (Panel B) performs poorly outside of the 1973-1982 and 1983-1992 periods. In fact, during 2012-2021, growth firms actually significantly outperformed value firms when the sample contains only firms in the largest quartile of market capitalization. In Panel C, operating profit has a positive and significant coefficient only in the 2013-2021 time period for the all firms sample. Momentum (Panel E) never has a significant coefficient value in any of the cells post-1992.

Impressively, investment (Panel D) has a negative and significant coefficient when the sample includes all firms for each of the 6 subperiods. However, in the 1963-1972, 2003-2012,

[4] If Januaries in 1974, 1975, and 1976 are removed from the all firms regression, size has a negative but statistically insignificant coefficient value for the 1973-1982 time period. The stock returns for small firms crushed the performance of large firms in the month of January in the mid-1970s.

and 2013-2021 time periods, investment fails to have a significant coefficient once the sample contains only firms in the three largest size quartiles. Thus, since 2002, investment fails to explain stock return patterns for all but the smallest market value quartile of firms.

B Value minus Growth, the Redundant Factor

Fama and French (2015) argue that their HML variable is a redundant factor in the presence of RMW and CMA. Specifically, they state, "The average HML return is captured by the exposures of HML to other factors. Thus, in the five-factor model, HML is redundant for describing average returns, at least in U.S. data for 1963–2013" (page 12). Table 2 addresses whether BV/MV is a significant variable in explaining the cross-section of realized returns without profitability and investment being in the same regression. Panel A of Table 2 includes all firms while Panel B runs a separate analysis on the basis of only small or large capitalization firms.

[Table 2 here]

During 1963-2021, Panel A reports that both log(MV) and log(BV/MV) have significant coefficient values. Thus, small firms and value firms have higher realized returns. Without market value being in the cross-sectional regressions, log(BV/MV) still has a significant coefficient value (0.37, T-statistic of 6.69). If different sample periods are analyzed, the coefficient on log(BV/MV) (0.17, T-statistic of 1.60) is not significant during 1996-2021 for the universe of all firms. Thus, in the last 312 months of data, even without profitability and investment being in the regressions, BV/MV has no power in describing the cross-section of returns when all firms are present.

In Panel B, when the sample includes only small capitalization firms or only large capitalization companies during 1963-2021, log(MV) and log(BV/MV) are only significant when the sample includes firms less than or equal to the median NYSE capitalization. During 1963-

2021, log(BV/MV), with or without log(MV) in the same regression, has no power to explain realized returns of large capitalization firms. Clearly, the presence of the profitability or investment firm-level characteristics is not material in the inability of book-to-market to significantly describe stock return patterns over long periods of time. Book-to-market is not a redundant factor, it is a nonexistent variable for explaining all stock returns since 1995 or since 1963 for large capitalization firms.

C Fama-MacBeth (1973) Cross-sectional Monthly Regressions of the q5-factor Characteristics

The q5-factor model of Hou et al. (2021) is a recent important framework that appears to explain the cross-section of realized stock returns. Panel A of Table 3 reports the average coefficients from Fama-MacBeth (1973) cross-sectional regressions with a dependent variable of raw monthly returns on individual stocks:

$$R_{i,t}= a_0 + a_1 \log(MV)_{i,t} + a_2 ROE_{i,t} + a_3 INV_{i,t} + a_4 E_t(d\_INV)_{i,t} + e_{i,t} \qquad (4)$$

The four explanatory variables are the natural logarithm of the market value of equity as of June of year t, ROE is quarterly income before extraordinary items (item ibq)/1-quarter lagged book value of equity, investment (INV) is the change in total assets between prior fiscal years, while expected investment-to-assets growth, E_t(d_INV), is calculated monthly using winsorized average slopes from the prior 120-month rolling window regressions, with change in investment-to-assets (d_INV) as the dependent variable and log(q), Cop, and dRoe as the independent variables. Each month, the values of log(MV), ROE, INV, and Et(d_INV) are winsorized at the 1% and 99% levels. The T-statistics (in parentheses) are created by dividing the average coefficient value by its time-series standard error. Due to missing Compustat quarterly book equity data and the requirement of a minimum of 30 months of prior cross-sectional regressions to create the investment-to-assets variable, the q5 sample starts slightly later than the Fama-French sample time period.

[Table 3 here]

Each panel in Table 3 has three rows of regression results: for all firms, for only small capitalization firms, and for only large capitalization firms. Panel A reports the average coefficient values during the 1975-2021 time period (588 months). As with the Fama-French 6-factor model, the results of the q5 model are quite strong when all firms are in the cross-sectional regressions and the entire sample period is included. Row 1 of Table 3 indicates that low market capitalization, high ROE, low investment, and high expected investment-to-assets growth firms have higher realized stock returns. The pattern remains the same when only firms less than or equal to the median NYSE firm are in the regressions (see row 2). When only large firms are included in the regressions, the coefficient values for size and ROE are no longer statistically significant. However, in the row 3 regressions, both INV and Et(d_INV) have the predicted coefficient signs and are statistically significant.

Panel B restricts the sample to the 1975-1997 time period (270 months). All three rows of panel B have the same patterns as what is contained in panel A. That is, the q5-factor firm characteristics significantly explain stock returns when all firms or only small firms are in the sample. During the earlier subperiod, expected investment-to-assets growth is the strongest variable; doing particularly well among large capitalization firms (in contrast to the other independent variable) with a coefficient value of 3.57 (T-statistic of 3.55).

When the sample is restricted to 1998-2021 (288 months), the empirical patterns become weaker. For example, E_t(d_INV) even has the wrong expected coefficient sign when the sample is restricted to all firms or small firms. The negative coefficient implies that firms with higher expected investment-to-assets growth have lower realized returns. Size, ROE, and INV all do well when the sample contains only small firms. However, when only large firms are included in row 3, none of the q5-factor characteristics are statistically significant. The failure of the q5-factor characteristics to explain the stock returns of firms above the median NYSE company over the last 288 months of data is similar to the inability of the Fama-French 6-factor characteristics in recent times to explain returns.

To assist the reader in understanding where the q5-factor characteristics perform best, Figure 2 reports the coefficients from the Fama-MacBeth cross-sectional regressions in equation (3) by decade (1975-2021). Due to sample requirement differences, the time period differs slightly in Figure 2 compared to Figure 1. As before, the figure presents results by size categories (i.e., top 25%, top 50%, top 75%, and all firms) using NYSE determined break points. Panels A to D in Figure 2 report the results for each of the Hou et al. (2021) firm-characteristics.

[Figure 2 here]

Figure 2 reports that most of the q5-factor firm-characteristics have moments of excellence in explaining stock returns across various size groups. For example, market value of equity does great during 1975-1982, investment is powerful during 1993-2002, and expected investment-to-assets growth explains the cross-section of stock returns well prior to 1993. However, focusing on the three decades after 1993, the performance of the q5-factor firm-characteristics is quite sketchy. Post-1993, out of 12 possible cells, both ROE and expected growth have only one statistically significant cell. Investment has a strong 1993-2002 window, but is only significant during 2003-2012 when all firms are included in the cross-sectional regressions.

Broadly speaking, the results in Tables 1 and 3 and Figures 1 and 2 are consistent with the important evidence of McLean and Pontiff (2016) and Linnainmaa and Roberts (2018), who show the weak out-of-sample performance of numerous documented cross-sectional relations in the finance literature. In particular, Linnainmaa and Roberts (2018) report the insignificant performance of the profitability and investment factors during the Fama and French pre-sample time period of 1926-1962. Because the vast majority of investor funds are in firms above the yearly median NYSE market value (on average, over 92% during my time period), these results call into question the finance literature's widespread adoption of the Fama-French (2018) 6-factor and Hou et al. (2021) q5-factor models to measure abnormal stock performance.

D Measuring Abnormal Performance of Equity Issuers

Can the firm characteristics of the 6-factor or q5-factor models explain the subsequent performance of equity issuers? Like Fama and French (2016), I will use the change in CRSP split-adjusted shares to identify equity issuers because of its ease of use, its inclusion of stock-financed mergers as equity issuers, and its long time series. To be precise, the split-adjusted change in shares is (cfacshr in year t-1/cfacshr in year t-2) * shares outstanding in year t-1 (item shrout) minus shares outstanding in year t-2 divided by shares outstanding in year t-2.

Following Fama and French (2016), my paper narrows the window of equity issuer subsequent performance to at most only 12 months beginning at least 6 months after the equity issuance. Both Fama and French (2016) and Huang and Ritter (2022) report that higher share issuance is linked with worse subsequent stock performance. This paper will use a 5% cutoff to classify firms as an equity issuer. In a given month, about 20% of the sample universe is categorized as an equity issuer using the 5% cutoff.

To gauge whether stock issuers underperform, I first control for size, BV/MV, OP, INV, and Prior Yr of Fama-French in monthly cross-sectional regressions. As before, the dependent variable is the raw monthly return (including dividends) on individual stocks:

$$R_{i,t}= a_0 + a_1 \log(MV)_{i,t} + a_2 \log(BV/MV)_{i,t} + a_3\, OP_{i,t} + a_4\, INV_{i,t} + a_5\, Prior\ Yr_{i,t} + a_6\, Issue\ Dummy_{i,t} + e_{i,t} \quad (5)$$

Where the Issue Dummy takes a value of one if the change in shares after adjusting for stock splits from the prior fiscal year is more than 5%, else zero. Table 4 reports the average coefficients and T-statistics for the sample during 1963-2021. In row 1, the coefficient on Issue Dummy is -0.16 (T-statistic of -2.65). Thus, controlling for size, BV/MV, operating profit, investment, and momentum, stock issuers underperform by 16 basis points per month. In rows 2 and 3, the sample is categorized by small and large firms. Interestingly, the underperformance of stock issuers is stronger for large firms. Small issuers underperform by 13 basis points per month while issuers above the median NYSE firm underperform by 21 basis points per month (T-statistic of -3.23 and 2.52% on an annualized basis).

[Table 4 here]

Table 5 repeats the analysis using the q5-factor firm characteristics. Specifically, the dependent variable is the raw monthly return (including dividends) on individual stocks:

$$R_{i,t}= a_0 + a_1 \log(MV)_{i,t} + a_2\, ROE_{i,t} + a_3\, INV_{i,t} + a_4\, E_t(d\_INV)_{i,t} + a_5\, Issue\ Dummy_{i,t} + e_{i,t} \quad (6)$$

Where the Issue Dummy takes a value of one if the change in shares after adjusting for stock splits from the prior fiscal year is more than 5%, else zero. Controlling for the q5-factor characteristics, equity issuers underperform by 20 basis points per month (T-statistic of -2.24) if all firms are included, 21 basis points per month (T-statistic of -2.10) if only small firms are included, and 20 basis points per month (T-statistic of -2.36) if the sample contains only large firms. Clearly, including the expected investment-to-assets growth variable doesn't explain away equity issuer underperformance.

[Table 5 here]

E Calendar-Time Fama-French 6-factor and q5-factor Regressions

Starting with Loughran and Ritter (1995), Brav and Gompers (1997), and Teoh, Welch, and Wong (1998), researchers often use factor models to gauge abnormal performance for share issuers. As noted earlier, the Fama-French 6-factors are beta, SMB (small firm returns minus big firm returns), HML (value firm returns minus growth firm returns), RMW (robust profitability returns minus weak profitability returns), CMA (conservative investment returns minus aggressive investment returns), and MOM (high prior year returns minus low prior year returns). The q5-factor model contains r_mkt (market excess returns), r_me (size factor), r_ia (investment factor), r_roe (profitability factor), and r_eg (expected investment-to-assets factor). See Professor Ken French's data library (https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html) and https://global-q.org/factors.html for the specific construction of their factors.

Panel A of Table 6 reports the calendar-time Fama-French factor regression results for the equally weighted issuance stock returns during 1963-2021 (702 months). In the first row of Panel A, the 3-factor intercept is -0.29 (T-statistic of -2.76) implying that a portfolio of share issuers underperforms by almost 3.5% on an annualized basis after controlling for the Fama-French 3-factors. In row 2, the Fama-French 3-factor intercept is -0.24 (T-statistic of -1.97) if the sample contains only small issuers during the entire time period. This implies an almost 3% annualized underperformance by small issuers. The third row reports a 3-factor intercept of -0.30 (T-statistic of -3.44) when only large issuers are included in the sample (3.6% on an annualized basis).

[Table 6 here]

In line with the empirical evidence of Fama and French (2016) and Huang and Ritter (2022), if the Fama-French 6-factor model is used instead of the 3-factor model, no issuer abnormal performance is reported during 1963-2021. That is, in fourth row of Panel A in Table 6, the 6-factor intercept is 0.08 (T-statistic of 0.80). Thus, issuers have an insignificant outperformance of 8 basis points per month during 1963-2021 using the 6-factor model. The last two rows of Panel A categorize the sample by small and large capitalization issuers. The Fama and French 6-factor intercept is 0.14 for small issuers and 0.03 for large issuers. Neither of these intercepts are statistically significant.

Panel B of Table 6 reports that if the q5-factor model is used, the alphas are positive. Issuers outperform non-issuers by 22 basis points per month in row 1. Small equity issuers significantly outperform by 30 basis points per month (T-statistic of 2.24) while outperformance is 11 basis points per month (T-statistic of 1.20) for large equity issuers.

Tables 4 and 5 report statistically significant poor performance for issuers in monthly cross-sectional regressions while Table 6 present no abnormal negative performance for issuers over identical time periods if the Fama-French 6-factor or the q5-factor models are used. Why the difference? Part of the explanation deals with the excessive impact that small firms have in the creation of the 6-factor and q5-factor models.

Fama and French (2015) and Hou, Mo, Xue, and Zhang (2021), like early work by Fama and French (1993), construct the factors by creating six (2 by 3) different value-weighted stock portfolios. In the first sort, the median NYSE firm divides the yearly sample into small and large firms. Then, using the NYSE breakpoints of the 30^{th} and 70^{th} percentiles of either BV/ME, OP, INV, or Prior Yr, the intersections of the two sorts produce six different value-weighted (VW) stock return portfolios. Thus, Fama and French's RMW (robust profitability minus weak profitability) factor is the equally weighted (EW) average of the two high OP portfolio returns (small robust + large robust) minus the EW average of the two low OP portfolio returns (small weak + large weak).

As noted by Loughran and Ritter (2000), the creation of the Fama-French factors significantly overweight the influence of small firms. However, in the Fama and French methodology, the VW returns on a portfolio of small growth firms are given an *identical* weight in the factor construction as the VW returns on a portfolio of large growth firms. During my time period, the aggregate market value of firms at or below the median NYSE capitalization, on average, is less than 8% while the average market capitalization of large firms is over 92% of the total market, in spite of there being significantly more small firms than large firms. The equal weighting of large and small portfolios allows the Fama and French and Hou et al. factors to be driven by the returns of illiquid, small capitalization firms.

These results raise serious questions about the efficacy of using the Fama and French 6-factor and the q5-factor models to create return benchmarks. Alternatively stated, because some of the documented cross-sectional patterns have a stronger relation among small firms than large firms (see my Tables 1 and 3), using an EW average of a strong and weak pattern results in a benchmark return that assumes that both small and large firms have the same average pattern. This difference in characteristic effects overstates the ability of the factors to explain the stock return performance for large issuers.

III Conclusion

The Fama and French (2018) 6-factor and the Hou et al. (2021) q5-factor models has substantively affected how academic researchers gauge the portfolio stock performance of equity issuers, stock repurchasers, and other market anomalies. I document the lack of explanatory power of the size, book-to-market, profitability, and momentum firm-level characteristics during 1983-2021 when the sample is restricted to large capitalization firms. Large firms are those above the annual median NYSE capitalization. Likewise, during 1998-2021, none of the Hou et al. (2021) q5-factor characteristics have statistically significant coefficient values when the sample is restricted to large firms.

The explanatory power of the 6-factor and the q5-factor model firm-level characteristics is primarily concentrated among small capitalization firms and/or in narrow time windows. The lack of any significant explanatory power for most of the Fama-French (2018) and Hou et al. (2021) components over a long time period for firms that, on average, comprise over 92% total market capitalization is troubling. This absence of explanatory power is consistent with the important work of McLean and Pontiff (2016) and Hou, Xue, and Zhang (2020) who document the poor out-of-sample return predictability of many variables linked with stock returns.

My paper also reexamines the subsequent performance of equity issuers. In contrast to other papers, I report that large capitalization equity issuers generally underperform to about the same extent as small capitalization issuers do when comparing issuers in cross-sectional regressions controlling for size, book-to-market, profitability, investment, momentum, and expected investment-to-assets. When the focus is on measuring abnormal returns of large firms, it does not make sense to use the alpha from a Fama and French (2018) 6-factor or the Hou et al. (2021) q5-factor models as the test of whether abnormal returns exist. The commonly used factor models grossly overweight small, illiquid stocks in their factor construction and should not be used to analyze portfolios consistently dominated by large market capitalization firms.

References

Ball, R., Gerakos, J., Linnainmaa, J.T. and Nikolaev, V. (2016). "Accruals, cash flows, and operating profitability in the cross section of stock returns". *Journal of Financial Economics* 121(1), pp. 28–45.

Brav, A. and Gompers, P.A. (1997). "Myth or reality? The long-run underperformance of initial public offerings: Evidence from venture and nonventure capital-backed companies". *Journal of Finance* 52(5), pp. 1791–1821.

Carhart, M.M. (1997). "On persistence in mutual fund performance". *Journal of Finance* 52(1), pp. 57–82.

Cochrane, J.H. (2011). "Presidential address: Discount rates". *Journal of Finance* 66(4), pp. 1047–1108.

Cooper, M.J., Gulen, H. and Schill, M.J. (2008). "Asset growth and the cross-section of stock returns". *Journal of Finance* 63(4), pp. 1609–1651.

Fama, E.F. and French, K.R. (1992). "The cross-section of expected stock returns". *Journal of Finance* 47(2), pp. 427–465.

Fama, E.F. and French, K.R. (1993). "Common risk factors in the returns on stocks and bonds". *Journal of Financial Economics* 33(1), pp. 3–56.

Fama, E.F. and French, K.R. (2006). "The value premium and the CAPM". *Journal of Finance* 61(5), pp. 2163–2185.

Fama, E.F. and French, K.R. (2008). "Dissecting anomalies". *Journal of Finance* 63(4), pp. 1653–1678.

Fama, E.F. and French, K.R. (2015). "A five-factor asset pricing model". *Journal of Financial Economics* 116(1), pp. 1–22.

Fama, E.F. and French, K.R. (2016). "Dissecting anomalies with a five-factor model". *Review of Financial Studies* 29(1), pp. 69–103.

Fama, E.F. and French, K.R. (2018). "Choosing factors". *Journal of Financial Economics* 128(2), pp. 234–252.

Fama, E.F. and MacBeth, J.D. (1973). "Risk, return, and equilibrium: Empirical tests". *Journal of Political Economy* 81(3), pp. 607–636.

Harvey, Campbell R. and Liu, Yan (2020). "A Census of the Factor Zoo". Duke University working paper (https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3341728).

Hou, K., Mo, H., Xue, C. and Zhang, L. (2019). "Which factors?" *Review of Finance* 23(1), pp. 1–35.

Hou, K., Mo, H., Xue, C. and Zhang, L. (2021). "An augmented q-factor model with expected growth". *Review of Finance* 25(1), pp. 1–41.

Hou, K., Xue, C. and Zhang, L. (2015). "Digesting anomalies: An investment approach". *Review of Financial Studies* 28(3), pp. 650–705.

Hou, K., Xue, C. and Zhang, L. (2020). "Replicating anomalies". *Review of Financial Studies* 33(5), pp. 2019–2133.

Huang, R. and Ritter, J.R. (2022). "The puzzle of frequent and large issues of debt and equity". *Journal of Financial and Quantitative Analysis* 57(1), pp. 170–206.

Ikenberry, D., Lakonishok, J. and Vermaelen, T. (1995). "Market underreaction to open market share repurchases". *Journal of Financial Economics* 39(2-3), pp. 181–208.

Jegadeesh, N. and Titman, S. (1993). "Returns to buying winners and selling losers: Implications for stock market efficiency". *Journal of Finance* 48(1), pp. 65–91.

Linnainmaa, J.T. and Roberts, M.R. (2018). "The history of the cross-section of stock returns". *Review of Financial Studies* 31(7), pp. 2606–2649.

Loughran, T. (1997). "Book-to-market across firm size, exchange, and seasonality: Is there an effect?" *Journal of Financial and Quantitative Analysis* 32(3), pp. 249–268.

Loughran, T. and Ritter, J.R. (1995). "The new issues puzzle". *Journal of Finance* 50(1), pp. 23–51.

Loughran, T. and Ritter, J.R. (2000). "Uniformly least powerful tests of market efficiency". *Journal of Financial Economics* 55(3), pp. 361–389.

Loughran, T. and Vijh, A.M. (1997). "Do long-term shareholders benefit from corporate acquisitions?" *Journal of Finance* 52(5), pp. 1765–1790.

McLean, R.D. and Pontiff, J. (2016). "Does academic research destroy stock return predictability?" *Journal of Finance* 71(1), pp. 5–32.

Mitchell, M.L. and Stafford, E. (2000). "Managerial decisions and long-term stock price performance". *Journal of Business* 73(3), pp. 287–329.

Rau, P.R. and Vermaelen, T. (1998). "Glamour, value and the post-acquisition performance of acquiring firms". *Journal of Financial Economics* 49(2), pp. 223–253.

Ritter, J.R. (1991). "The long-run performance of initial public offerings". *Journal of Finance* 46(1), pp. 3–27.

Sloan, R.G. (1996). "Do stock prices fully reflect information in accruals and cash flows about future earnings?" *Accounting Review* 71(3), pp. 289–315.

Spiess, D.K. and Affleck-Graves, J. (1995). "Underperformance in long-run stock returns following seasoned equity offerings". *Journal of Financial Economics* 38(3), pp. 243–267.

Teoh, S.H., Welch, I. and Wong, T.J. (1998). "Earnings management and the long-run market performance of initial public offerings". *Journal of Finance* 53(6), pp. 1935–1974.

Appendix A: Variable definitions for the Fama and French 6-factor model and the Hou, Mo, Xue, and Zhang (2021) q5-factor model

log(MV)	Defined as the natural log of market value of equity (in $ millions) as of June of year t. This variable is from CRSP.
log(BV/MV)	Defined as the natural log of book value of equity in year t-1 / CRSP market value of equity in December of year t-1. Book value of equity from Compustat is book value of equity (item ceq) + deferred tax and investment credit (item txditc) minus book value of preferred stock (using availability order of redemption (item pstkrv), liquidation (item pstkl), and then par value (item pstk)). Firms with negative book value of equity are excluded.
OP	Defined as operating profit/book value [(revenue (item revt) minus cost of goods sold (item cogs) – selling, general administrative expense (item xsga) – interest expense (item xint))/book value of equity]. Firms must have non-missing of revenue and at least one of the costs (i.e., either COGS, SG&A, or interest expense) to be included in the sample. Thus, zero-revenue biotech companies are screened out. This variable is from Compustat.
INV	Defined as ((total assets (item at) in year t-1 minus total assets in year t-2)/ total assets in year t-2). This variable is from Compustat.
Prior Yr	Defined as the average arithmetic monthly return from month-12 to month-2 (updated monthly). This variable is from CRSP.
Small Firm	Firms with a June of year t market value of equity less than or equal to the median NYSE-listed market value of equity in June of year t are defined as a small firm. This variable is from CRSP.
Large Firm	Firms with a June of year t market value of equity greater than the median NYSE-listed market value of equity in June of year t are defined as a large firm. This variable is from CRSP.
SMB	SMB (Small Minus Big) is the average return on the nine small stock portfolios (stratified by BV/MV, OP, and INV) minus the average return on the nine big stock portfolios (stratified by BV/MV, OP, and INV). This variable is from Fama and French (2015) and French's website.
HML	HML (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios. This variable is from Fama and French (2015) and French's website.

RMW	RMW (Robust Minus Weak) is the average return in a given month on the two robust operating profitability portfolios (highly profitable) minus the average return on the two weak operating profitability portfolio (lowly profitable). This variable is from Fama and French (2015) and French's website.
CMA	CMA (Conservative Minus Aggressive) is the average return in a given month on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios. This variable is from Fama and French (2015) and French's website.
MOM	MOM (Momentum) is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios. This variable is from Fama and French (2018) and French's website.
RetM	The value-weighted return in a given month for U.S. firms on CRSP from Ken French's website.
Rf	Rf is the one-month Treasury bill rate for a given month. The variable is from Ken French's website.
ROE	ROE is defined as Compustat quarterly income before extraordinary items (item ibq)/1-quarter lagged book value of equity. Book value of equity is defined as book equity of shareholders' equity, plus balance-sheet deferred taxes and investment tax credit (item txditcq) if available, minus the book value of preferred stock (item pstkrq, if available, else carrying value of preferred stock (item pstkq)). Depending on availability, the paper uses stockholders' equity (item seqq), or common equity (item ceqq) plus the carrying value of preferred stock (item pstkq), or total assets (item atq) minus total liabilities (item ltq) in that order as the definition of shareholders' equity. The variable is from Compustat.
$E_t(d\_INV)$	Expected investment-to-assets growth is calculated monthly using winsorized average slopes from the prior 120-month rolling window (30 months minimum) regressions, with change in investment in assets as the dependent variable (d_INV). The independent variables are log(Tobin's q), operating cash flows (Cop), and change in return on equity (dRoe). Each month, the values of log(q), Cop, dRoe, and d_INV are winsorized at the 1% and 99% levels. To minimize the influence of microcap firms, the regressions are estimated using weighted least squares with market value of equity as weights.

d_INV The future change in investment-to-assets is defined as next year's INV minus INV in the current year. This variable is from Compustat and is winsorized at the 1% and 99% levels.

log(q) The Tobin's q variable is defined as the natural log of (one-month lagged CRSP market value of equity + long term debt (item dltt) + short-term debt (item dlc))/total assets (item at). The variable is from both CRSP and Compustat and is winsorized at the 1% and 99% levels each month.

Cop The operating cash flows variable, Cop, is defined as (revenue (item revt) – cost of goods sold (item cogs) – selling, general, and administrative expenses (item xsga) + R&D expenditures (item xrd) – change in accounts receivable (item rect) – change in inventory (item invt) – change in prepaid expenses (item xpp) + change in deferred revenue (item drc + drlt) + change in trade accounts payable (item ap) + change in accrued expenses (item xacc)/total assets (item at). Cop is set to missing if revenue it is less $0, missing, or is equal to zero. Cop is also set to missing if both items xsga and cogs are missing. The variables xacc, invt, rect, xrd, drc, drlt, and xpp are set to zero if they are missing. Missing annual changes are set to zero. The variable Cop is from Compustat and is winsorized at the 1% and 99% levels each month.

dRoe The variable change in return on equity, dRoe, is defined as ROE minus the lagged 4 quarter ROE value. ROE is defined as Compustat quarterly income before extraordinary items (item ibq)/1-quarter lagged book value of equity. Book value of equity is defined as book equity of shareholders' equity, plus balance-sheet deferred taxes and investment tax credit (item txditcq) if available, minus the book value of preferred stock (item pstkrq, if available, else carrying value of preferred stock (item pstkq)). Depending on availability, the paper uses stockholders' equity (item seqq), or common equity (item ceqq) plus the carrying value of preferred stock (item pstkq), or total assets (item atq) minus total liabilities (item ltq) in that order as the definition of shareholders' equity. The dRoe variable is from Compustat and is winsorized at the 1% and 99% levels each month.

r_mkt The market excess returns variable is from Hou, Xue, and Zhang (2015) and the global-q.org website.

r_me The size q-factor, r_me, is the difference in a given month between the average returns on the nine small portfolios and the average returns on the nine big portfolios. This variable is from Hou, Xue, and Zhang (2015) and the global-q.org website.

r_roe	The profitability q-factor, r_roe is the difference in a given month between the average returns on the six high ROE portfolios and the average returns on the six low ROE portfolios. This variable is from Hou, Xue, and Zhang (2015) and the global-q.org website.
r_ia	The investment q-factor, r_ia, is the difference in a given month between the average returns on the six low investment portfolios and the average returns on the six high investment portfolios. This variable is from Hou, Xue, and Zhang (2015) and the global-q.org website.
r_eg	The expected investment-to-assets growth factor, r_eg, is the difference in a given month between the average returns on the two high expected growth portfolios and the average returns on the two low expected growth portfolios. This variable is from Hou, Mo, Xue, and Zhang (2021) and the global-q.org website.
Issue Dummy	Dummy variable set to one if the change in shares after adjusting for stock splits from the prior fiscal year is more than 5%, else zero. The change in shares is (cfacshr in year t-1 / cfacshr in year t-2)*shares outstanding in year t-1 (item shrout) minus shares outstanding in year t-2 divided by shares outstanding in year t-2. The variable cfacshr is the cumulative factor to adjust shares outstanding. This variable is from CRSP.

Figure 1: Time Series Pattern for Each Fama-French Firm-Characteristics by Decade, 1963-2021

Panel A: Significance values for log(market value of equity)

Size Group	1963-72	1973-82	1983-92	1993-02	2003-12	2013-21
Top 25%						
Top 50%						
Top 75%						
All firms						

Panel B: Significance values for log(book-to-market)

Size Group	1963-72	1973-82	1983-92	1993-02	2003-12	2013-21
Top 25%						
Top 50%						
Top 75%						
All firms						

Panel C: Significance values for Operating Profit (OP)

Size Group	1963-72	1973-82	1983-92	1993-02	2003-12	2013-21
Top 25%						
Top 50%						
Top 75%						
All firms						

Panel D: Significance values for Investment (INV)

Size Group	1963-72	1973-82	1983-92	1993-02	2003-12	2013-21
Top 25%						
Top 50%						
Top 75%						
All firms						

Panel E: Significance values for Momentum (MOM)

Size Group	1963-72	1973-82	1983-92	1993-02	2003-12	2013-21
Top 25%						
Top 50%						
Top 75%						
All firms						

Explanations: This figure reports the output from Fama-MacBeth (1973) cross-sectional regressions. The 1963-2021 time period is divided into 6-decade subperiods. Red cells represent average coefficient values that are both negative and have a T-statistic of -2 or less. Blue cells represent average coefficient values that are both positive and have a T-statistic of 2 or more. Blank cells represent average coefficient values that are not significant. The T-statistics are calculated based on the standard deviation of the coefficients from the monthly regressions. The Top 25% row represents all NYSE, Amex, and Nasdaq firms in the top quarter of market value of equity as of June in year t using only NYSE firms to determine the subperiod size cutoffs.

Interpretation: Since 1993, with one exception, the Fama-French 6-factor characteristics do a poor job explaining stock returns regardless of which firms are in the sample.

Figure 2: Time Series Pattern for Each Hou, Mo, Xue, and Zhang (2021) Firm-Characteristics by Decade, 1975-2021

Panel A: Significance values for log(market value of equity)

Size Group	1975-82	1983-92	1993-02	2003-12	2013-21
Top 25%					
Top 50%					
Top 75%					
All firms					

Panel B: Significance values for Profitability (ROE)

Size Group	1975-82	1983-92	1993-02	2003-12	2013-21
Top 25%					
Top 50%					
Top 75%					
All firms					

Panel C: Significance values for Investment (INV)

Size Group	1975-82	1983-92	1993-02	2003-12	2013-21
Top 25%					
Top 50%					
Top 75%					
All firms					

Panel D: Significance values for Expected Investment-to-assets Growth (E_t(d_INV))

Size Group	1975-82	1983-92	1993-02	2003-12	2013-21
Top 25%					
Top 50%					
Top 75%					
All firms					

Explanations: This figure reports the output from Fama-MacBeth (1973) cross-sectional regressions. The 1975-2021 time period is divided into 5-decade subperiods. Red cells represent average coefficient values that are both negative and have a T-statistic of -2 or less. Blue cells represent average coefficient values that are both positive and have a T-statistic of 2 or more. Blank cells represent average coefficient values that are not significant. The T-statistics are calculated based on the standard deviation of the coefficients from the monthly regressions. The Top 25% row represents all NYSE, Amex, and Nasdaq firms in the top quarter of market value of equity as of June in year t using only NYSE firms to determine the subperiod size cutoffs.

Interpretation: Focusing on the three decades after 1993, the performance of the q5-factor firm-characteristics is generally weak in explaining stock returns.

Table 1: Average Parameter Values from Monthly Cross-Sectional Regressions of Percentage Stock Returns on Size, Book-to-Market, Profitability, Investment, and Prior Returns, 1963-2021

$R_{i,t} = a_0 + a_1 \log(MV)_{i,t} + a_2 \log(BV/MV)_{i,t} + a_3 OP_{i,t} + a_4 INV_{i,t} + a_5 \text{Prior } Yr_{i,t} + e_{i,t}$

Panel A: Firms during 1963-2021 (N = 702 months)

Model	Intercept	Log (MV)	Log (BV/MV)	OP	INV	Prior Yr
All firms	2.00	–0.14	0.19	0.32	–0.82	3.48
	(6.39)	(–4.01)	(3.88)	(3.15)	(–11.17)	(2.32)
All small cap firms	2.35	–0.22	0.21	0.33	–0.87	2.85
	(7.13)	(–4.45)	(4.14)	(3.09)	(–11.09)	(1.94)
All large cap firms	1.21	–0.05	0.10	0.36	–0.38	7.40
	(3.01)	(–1.48)	(1.39)	(2.27)	(–3.52)	(3.31)

Panel B: Firms during 1963-1982 (N = 234 months)

Model	Intercept	Log (MV)	Log (BV/MV)	OP	INV	Prior Yr
All firms	1.98	–0.17	0.22	0.43	–0.90	10.10
	(3.57)	(–2.68)	(2.42)	(2.59)	(–5.59)	(3.41)
All small cap firms	2.19	–0.22	0.25	0.41	–0.99	8.53
	(3.75)	(–2.38)	(2.51)	(2.30)	(–5.66)	(2.90)
All large cap firms	1.41	–0.12	0.24	0.68	–0.40	16.03
	(2.41)	(–2.01)	(1.87)	(2.20)	(–1.67)	(4.23)

Panel C: Firms during 1983-2021 (N = 468 months)

Model	Intercept	Log (MV)	Log (BV/MV)	OP	INV	Prior Yr
All firms	2.01	–0.12	0.18	0.26	–0.78	0.17
	(5.30)	(–2.99)	(3.03)	(2.05)	(–10.35)	(0.10)
All small cap firms	2.43	–0.22	0.20	0.28	–0.81	0.00
	(6.08)	(–3.77)	(3.30)	(2.16)	(–10.29)	(0.00)
All large cap firms	1.11	–0.02	0.03	0.20	–0.36	3.09
	(2.10)	(–0.44)	(0.32)	(1.11)	(–3.42)	(1.12)

Explanations: The sample includes all NYSE, Amex, and Nasdaq firms with available CRSP and Compustat information during the 1963-2021 time period. Small capitalization firms have a market value of equity less than or equal to the median NYSE firm as of June of year t. Large capitalization firms have a market value of equity greater than the median NYSE firm as of June of year t. MV is market value of equity (in millions $) as of June of year t. BV/MV is book value of equity in year t-1 / market value of equity in year t-1. Firms with negative book value of equity are excluded. OP is operating profit/book value [(revenue minus cost of goods sold – selling, general administrative expense – interest expense)/book value of equity]. INV is investment ((total assets in year t-1–total assets in year t-2)/ total assets in year t-2). Prior Yr is average arithmetic monthly return from month-12 to month-2 (updated monthly). The values of log(MV), log(BV/MV), OP, INV, and Prior Yr are winsorized at the 1% and 99% levels. The T-statistics (in parentheses) are calculated based on the standard deviation of the 702, 234, or 468 coefficients from the monthly regressions, the procedure introduced by Fama and MacBeth (1973).

Interpretation: Since 1983, the Fama-French log(MV), log(BV/MV), OP, and Prior Yr characteristics are not statistically significant if the sample is restricted to firms above the median NYSE firm.

Table 2: Average Parameter Values from Monthly Cross-Sectional Regressions of Percentage Stock Returns on Size and Book-to-Market, 1963-2021 (702 months)

$R_{i,t} = a_0 + a_1 \log(MV)_{i,t} + a_2 \log(BV/MV)_{i,t} + e_{i,t}$

Panel A: All Firms

Model	Intercept	Log (MV)	Log (BV/MV)
All firms (1963-2021)	2.01	–0.12	0.26
	(5.75)	(–3.00)	(4.31)
All firms (1963-2021)	1.50		0.37
	(6.48)		(6.69)
All firms (1963-1995)	1.95	–0.12	0.33
	(4.69)	(–2.38)	(4.89)
All firms (1996-2021)	2.08	–0.12	0.17
	(3.53)	(–1.87)	(1.60)

Panel B: Only Small or Large Capitalization Firms (1963-2021)

Model	Intercept	Log (MV)	Log (BV/MV)
Only small cap firms	2.36	–0.21	0.30
	(6.43)	(–3.74)	(4.74)
Only small cap firms	1.58		0.39
	(6.48)		(6.69)
Only large cap firms	1.39	–0.04	0.09
	(3.20)	(–1.09)	(1.32)
Only large cap firms	1.13		0.12
	(5.47)		(1.77)

Explanations: The sample includes all NYSE, Amex, and Nasdaq firms with available CRSP and Compustat information during the 1963-2021 time period. Small capitalization firms have a market value of equity less than or equal to the median NYSE firm as of June of year t. Large capitalization firms have a market value of equity greater than the median NYSE firm as of June of year t. MV is market value of equity (in millions $) as of June of year t. BV/MV is book value of equity in year t-1 / market value of equity in year t-1. Book value of equity is book value of equity + deferred tax and investment credit minus book value of preferred stock (using availability order of redemption, liquidation, and then par value). Firms with negative book value of equity are excluded. The values of log(MV) and log(BV/MV) are winsorized at the 1% and 99% levels. The T-statistics (in parentheses) are calculated based on the standard deviation of the 702, 390, or 312 coefficients from the monthly regressions, the procedure introduced by Fama and MacBeth (1973).

Interpretation: The presence of the profitability or investment firm-level characteristics is not material in the inability of book-to-market to significantly describe stock return patterns over long periods of time.

Table 3: Average Parameter Values from Monthly Cross-Sectional Regressions of Percentage Stock Returns on Size, Profitability, Investment, and Expected Growth, 1975-2021

$R_{i,t} = a_0 + a_1 \log(MV)_{i,t} + a_2 ROE_{i,t} + a_3 INV_{i,t} + a_4 E_t(d\_INV)_{i,t} + e_{i,t}$

Panel A: Firms during 1975-2021 (N = 558 months)

Model	Intercept	Log (MV)	ROE	INV	E_t(d_INV)
All firms	2.31	–0.17	2.31	–0.68	2.21
	(6.60)	(–4.63)	(3.97)	(–7.54)	(3.58)
All small cap firms	2.64	–0.25	2.63	–0.71	2.13
	(7.17)	(–4.61)	(4.42)	(–7.66)	(3.40)
All large cap firms	1.65	–0.07	0.77	–0.33	2.43
	(3.52)	(–1.66)	(1.01)	(–2.48)	(3.01)

Panel B: Firms during 1975-1997 (N = 270 months)

Model	Intercept	Log (MV)	ROE	INV	E_t(d_INV)
All firms	2.49	–0.19	2.86	–0.78	4.78
	(5.44)	(–3.67)	(3.66)	(–5.69)	(8.91)
All small cap firms	2.74	–0.26	3.11	–0.79	4.94
	(5.81)	(–3.61)	(4.12)	(–5.81)	(9.16)
All large cap firms	1.78	–0.08	1.69	–0.44	3.57
	(3.09)	(–1.40)	(1.31)	(–2.10)	(3.55)

Panel C: Firms during 1998-2021 (N = 288 months)

Model	Intercept	Log (MV)	ROE	INV	E_t(d_INV)
All firms	2.13	–0.15	1.80	–0.59	–0.20
	(4.07)	(–2.92)	(2.09)	(–4.95)	(–0.19)
All small cap firms	2.54	–0.25	2.18	–0.64	–0.50
	(4.53)	(–3.00)	(2.39)	(–5.03)	(–0.46)
All large cap firms	1.53	–0.06	-0.09	–0.22	1.36
	(2.09)	(–0.97)	(-0.10)	(–1.35)	(1.09)

Explanations: The sample includes all NYSE, Amex, and Nasdaq firms with available CRSP and Compustat information during the 1975-2021 time period. Small capitalization firms have a market value of equity less than or equal to the median NYSE firm as of June of year t. Large capitalization firms have a market value of equity greater than the median NYSE firm as of June of year t. MV is market value of equity (in millions $) as of June of year t. ROE is quarterly income before extraordinary items (item ibq)/1-quarter lagged book value of equity. INV is investment ((total assets in year t-1–total assets in year t-2)/ total assets in year t-2). Expected investment-to-assets growth (E_t(d_INV)) is calculated monthly using winsorized average slopes from the prior 120-month rolling window regressions, with change in investment in assets (d_INV) as the dependent variable and log(q), Cop, and dRoe as the independent variables. The values of log(MV), ROE, INV, and E_t(d_INV) are winsorized at the 1% and 99% levels. The T-statistics (in parentheses) are calculated based on the standard deviation of the 558, 270, or 288 coefficients from the monthly regressions, the procedure introduced by Fama and MacBeth (1973).

Interpretation: During 1998-2021, when only large firms are included in monthly cross-sectional regressions, none of the q5-factor characteristics are statistically significant.

Table 4: Average Parameter Values from Monthly Cross-Sectional Regressions of Percentage Stock Returns on Size, Book-to-Market, Profitability, Investment, Momentum, and an Issue Dummy, 1963-2021 (702 months)

$$R_{i,t} = a_0 + a_1 \log(MV)_{i,t} + a_2 \log(BV/MV)_{i,t} + a_3\, OP_{i,t} + a_4\, INV_{i,t} + a_5\, \text{Prior Yr}_{i,t} + a_6\, \text{Issue Dummy}_{i,t} + e_{i,t}$$

Model	Intercept	Log (MV)	Log (BV/MV)	OP	INV	Prior Yr	Issue Dummy
All Firms	2.03	–0.14	0.18	0.29	–0.76	3.43	–0.16
	(6.63)	(–4.06)	(3.77)	(3.02)	(–10.40)	(2.30)	(–2.65)
Only Small Firms	2.38	–0.22	0.21	0.30	–0.82	2.79	–0.13
	(7.35)	(–4.46)	(4.05)	(3.00)	(–10.34)	(1.91)	(–1.81)
Only Large Firms	1.26	–0.06	0.09	0.33	–0.28	7.40	–0.21
	(3.18)	(–1.62)	(1.30)	(2.11)	(–2.61)	(3.31)	(–3.23)

Explanations: The sample includes all NYSE, Amex, and Nasdaq firms with available CRSP and Compustat information during the 1963-2021 time period. MV is market value of equity (in millions $) as of June of year t. BV/MV is book value of equity in year t-1 / market value of equity in year t-1. Book value of equity is book value of equity + deferred tax and investment credit minus book value of preferred stock (using availability order of redemption, liquidation, and then par value). OP is operating profit/book value (revenue minus cost of goods sold – selling, general administrative expense – interest expense/book value of equity). INV is investment ((total assets in year t-1–total assets in year t-2)/ total assets in year t-2). Prior Yr is average arithmetic monthly return from month-12 to month-2 (updated monthly). Issue Dummy takes a value of one if the change in shares after adjusting for stock splits from the prior fiscal year is more than 5%, else zero. The values of log(MV), log(BV/MV), OP, INV, and Prior Yr are winsorized at the 1% and 99% levels. The T-statistics are in parentheses.

Interpretation: Controlling for size, BV/MV, operating profit, investment, and momentum, large capitalization stock issuers underperform by more than small capitalization stock issuers.

Table 5: Average Parameter Values from Monthly Cross-Sectional Regressions of Percentage Stock Returns on Size, Profitability, Investment, Expected Growth, and an Issue Dummy 1975-2021

$$R_{i,t} = a_0 + a_1 \log(MV)_{i,t} + a_2\, ROE_{i,t} + a_3\, INV_{i,t} + a_4\, E_t(d\_INV)_{i,t} + a_5\, \text{Issue Dummy}_{i,t} + e_{i,t}$$

Model	Intercept	Log (MV)	ROE	INV	Et(d_INV)	Issue Dummy
All Firms	2.34	–0.17	2.19	–0.61	2.20	–0.20
	(6.90)	(–4.73)	(3.93)	(–7.01)	(3.61)	(–2.24)
Only Small Firms	2.68	–0.26	2.48	–0.63	2.14	–0.21
	(7.49)	(–4.69)	(4.37)	(–6.87)	(3.47)	(–2.10)
Only Large Firms	1.68	–0.07	0.73	–0.25	2.38	–0.20
	(3.65)	(–1.74)	(0.97)	(–2.03)	(2.96)	(–2.36)

Explanations: The sample includes all NYSE, Amex, and Nasdaq firms with available CRSP and Compustat information during the 1975-2021 time period. Small capitalization firms have a market value of equity less than or equal to the median NYSE firm as of June of year t. Large capitalization firms have a market value of equity greater than the median NYSE firm as of June of year t. MV is market value of equity (in millions $) as of June of year t. ROE is quarterly income before extraordinary items (item ibq)/1-quarter lagged book value of equity. INV is investment ((total assets in year t-1–total assets in year t-2)/ total assets in year t-2). Expected investment-to-assets growth (E_t(d_INV)) is calculated monthly using winsorized average slopes from the prior 120-month rolling window regressions, with change in investment in assets (d_INV) as the dependent variable and log(q), Cop, and dRoe as the independent variables. The values of log(MV), ROE, INV, and E_t(d_INV) are winsorized at the 1% and 99% levels. Issue Dummy takes a value of one if the change in shares after adjusting for stock splits from the prior fiscal year is more than 5%, else zero. The T-statistics (in parentheses) are calculated based on the standard deviation of the 558 coefficients from the monthly regressions, the procedure introduced by Fama and MacBeth (1973).

Interpretation: Controlling for the q5-factor characteristics, equity issuers underperform by 20 basis points per month if all firms are included, 21 basis points per month if only small firms are included, and 20 basis points per month if the sample contains only large firms.

Table 6: Calendar-Time Fama-French 6-factor (Panel A) and the q5-factor model (Panel B) Regression of Equity Issuers with an Issuance of more than 5%

Panel A: Fama-French 6-factor model regressions, 1963-2021

$$Ret_t – Rf_t= a_i + b_i(RetM_t-Rf_t) + s_iSMB_t+ h_iHML_t+ r_iRMW_t + c_iCMA_t+ m_iMOM_t + e_t$$

Coefficient Estimates

Sample	a	b	s	h	r	c	m	R^2_{adj}
All Firms	–0.29	1.15	1.07	–0.16				86%
	(–2.76)	(46.66)	(30.35)	(–4.47)				
Small Firms	–0.24	1.14	1.28	–0.15				84%
	(–1.97)	(39.68)	(31.22)	(–3.48)				
Large Firms	–0.30	1.23	0.46	–0.21				88%
	(–3.44)	(60.71)	(15.71)	(–7.06)				
All Firms	0.08	1.08	0.96	–0.21	–0.47	–0.04	–0.23	90%
	(0.80)	(47.15)	(29.72)	(–4.79)	(–10.68)	(–0.62)	(–10.19)	
Small Firms	0.14	1.06	1.16	–0.21	–0.51	–0.00	–0.24	88%
	(1.25)	(39.03)	(30.18)	(–4.08)	(–9.61)	(–0.06)	(–9.10)	
Large Firms	0.03	1.15	0.39	–0.16	–0.25	–0.28	–0.21	91%
	(0.37)	(60.03)	(14.63)	(–4.44)	(–6.77)	(–5.06)	(–11.31)	

Panel B: Hou et al. (2021) q5-factor regressions, 1967-2021

$$Ret_t – Rf_t= a_i + b_ir\_mkt + s_ir\_me+ i_ir\_ia_t+ p_ir\_roe_t + g_ir\_eg_t+ e_t$$

Coefficient Estimates

Sample	a	b	s	i	p	g	R^2_{adj}
All Firms	0.22	1.08	0.83	–0.26	–0.61	–0.15	89%
	(1.94)	(42.92)	(23.68)	(–4.79)	(–13.50)	(–2.36)	
Small Firms	0.30	1.06	1.01	–0.24	–0.69	–0.16	87%
	(2.24)	(35.79)	(24.23)	(–3.79)	(–12.90)	(–2.12)	
Large Firms	0.11	1.16	0.29	–0.42	–0.34	–0.12	90%
	(1.20)	(55.18)	(9.95)	(–9.24)	(–8.93)	(–2.26)	

Explanations: Equally weighted monthly portfolio returns for firms with a split adjusted increase of more than 5% in number of shares outstanding between fiscal years t-1 and t-2 are. The subscript i denotes portfolio i while the subscript t denotes month t. Small firms have a market value of equity equal or less than the median NYSE firm as of June of year t. Large firms have a market value of equity greater than the median NYSE firm as of June of year t. RetM is the value-weighted return of all firms on CRSP while Rf is the one-month Treasury bill rate. The Fama-French factors are from Ken French's website using the 2x3 sorts with the 6 value-weight portfolios formed on size and book-to-market, the 6 value-weight portfolios formed on size and operating profitability, and the 6 value-weight portfolios formed on size and investment. SMB denotes the factor of small firm stock returns minus large firm stock returns. HML denotes the factor of high book-to-market stock returns minus low book-to-market stock returns. RMW denotes the stock returns of high profitability firms minus the stock returns of low profitability firms. CMA denotes stock returns of firms with low investments minus the stock returns of firms with high investments. MOM denotes high prior year returns minus low prior year returns. The T-statistics are in parentheses. The q5-factor variables are r_mkt (market excess returns), r_me (size factor), r_ia (investment factor), r_roe (profitability factor), and r_eg (expected investment-to-assets factor).

Interpretation: There is present no abnormal negative performance for stock issuers if the Fama-French 6-factor or the q5-factor models are used.