q^5

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Abstract

In a multiperiod investment framework, firms with high expected growth earn higher expected returns than firms with low expected growth, holding investment and expected profitability constant. This paper forms cross-sectional growth forecasts and constructs an expected growth factor that yields an average premium of 0.84% per month ($t = 10.27$) in the 1967–2018 sample. The q^5 model, which augments the Hou-Xue-Zhang (2015) q-factor model with the expected growth factor, shows strong explanatory power in the cross section and outperforms the Fama-French (2018) 6-factor model.

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1 Introduction

Cochrane (1991) shows that in a multiperiod investment framework, firms with high expected investment growth should earn higher expected returns than firms with low expected investment growth, holding current investment and expected profitability constant. Intuitively, the extra productive assets next period produced from current investment, net of depreciation, are worth of the market value (marginal q) that equals the present value of cash flows in subsequent periods. The next period marginal q is then part of the expected marginal benefit of current investment. Per the first principle of investment, the marginal q in turn equals the marginal cost of investment, which increases with investment. High investment next period then signals high marginal q next period. Consequently, to counteract the high expected marginal benefit of current investment, high expected investment (relative to current investment) must imply high current discount rates.

Motivated by this economic insight, we perform cross-sectional forecasting regressions of future investment-to-assets changes on current Tobin's q, operating cash flows, and the change in return on equity. Conceptually, we motivate the instruments from the investment literature (Fazzari, Hubbard, and Petersen 1988; Erickson and Whited 2000; Liu, Whited, and Zhang 2009). Empirically, we show that cash flows and the change in return on equity are reliable predictors of investment-to-assets changes, but not Tobin's q. An independent 2×3 sort on size and the expected 1-year-ahead investment-to-assets change yields an expected investment growth factor, with an average premium of 0.84% per month ($t = 10.27$) from January 1967 to December 2018. The q-factor model cannot explain this factor premium, with an alpha of 0.67% ($t = 9.75$). As such, the expected growth factor represents a new dimension of the expected return variation missed by the q-factor model.

We augment the q-factor model with the expected growth factor to form the q^5 model and then stress-test it along with other recently proposed factor models. As testing deciles, we use a large set of 150 significant anomalies with NYSE breakpoints and value-weighted returns compiled by Hou, Xue, and Zhang (2019). As competing factor models, we examine the q-factor model; the Fama-

French (2015) 5-factor model; the Stambaugh-Yuan (2017) 4-factor model; the Fama-French (2018) 6-factor model; the Fama-French alternative 6-factor model with the operating profitability factor, RMW, replaced by a cash-based profitability factor, RMWc; the Barillas-Shanken (2018) 6-factor model; as well as the Daniel-Hirshleifer-Sun (2019) 3-factor model. The Barillas-Shanken specification includes the market factor, SMB, the investment and return on equity factors from the q-factor model, the Asness-Frazzini (2013) monthly formed HML factor, and the momentum factor, UMD.

Improving on the q-factor model substantially, the q^5 model is the best performing model among all the factor models. Across the 150 anomalies, the average magnitude of the high-minus-low alphas is 0.19% per month, dropping from 0.28% in the q-factor model. The number of significant high-minus-low alphas ($|t| \geq 1.96$) is 23 in the q^5 model (6 with $|t| \geq 3$), dropping from 52 in the q-factor model (25 with $|t| \geq 3$). The number of rejections by the Gibbons, Ross, and Shanken (1989) test is also smaller, 57 versus 101. The q^5 model improves on the q-factor model across most anomaly categories, especially in the investment and profitability categories.

The q-factor model already compares well with the Fama-French 6-factor model. The average magnitude of the high-minus-low alphas is 0.3% per month in the 6-factor model (0.28% in the q-factor model). The numbers of significant high-minus-low 6-factor alphas are 74 with $|t| \geq 1.96$ and 37 with $|t| \geq 3$, which are higher than 52 and 25 in the q-factor model, respectively. However, the number of rejections by the Gibbons-Ross-Shanken test is 91, which is lower than 101 in the q-factor model. Replacing RMW with RMWc improves the 6-factor model's performance. The average magnitude of the high-minus-low alphas falls to 0.27%. The number of significant high-minus-low alphas drops to 59 with $|t| \geq 1.96$ but is still higher than 52 in the q-factor model. The number of rejections by the Gibbons-Ross-Shanken test is 71. Although substantially lower than 101 in the q-factor model, the number of rejections is higher than 57 in the q^5 model.

The Stambaugh-Yuan model is comparable with the q-factor model. The number of high-minus-low alphas with $|t| \geq 1.96$ is 64, which is higher than 52 in the q-factor model. However, the number of rejections by the Gibbons-Ross-Shanken test is 87, which is lower than 101 in the q-factor model. The Barillas-Shanken 6-factor model performs poorly. The numbers of significant high-minus-low alphas are 63 with $|t| \geq 1.96$ and 37 with $|t| \geq 3$, and the number of rejections by the Gibbons-Ross-Shanken test is 132 (out of 150 anomalies). Exacerbating the value-versus-growth anomalies, the Daniel-Hirshleifer-Sun 3-factor model also performs poorly, with the second highest average magnitude of high-minus-low alphas, 0.37% per month, and the highest mean absolute alpha, 0.14%.

Our work makes two major contributions. First, we bring the expected growth to the front and center of asset pricing research. Prior work has examined investment and profitability (Fama and French 2015; Hou, Xue, and Zhang 2015), but the expected growth has been largely ignored. Guided by the investment theory, we incorporate the expected growth factor into the q-factor model. Empirically, we show that this extension helps resolve many empirical difficulties of the q-factor model, such as the anomalies based on R&D-to-market as well as operating and discretionary accruals. Intuitively, R&D expenses depress current earnings but induce future growth. In addition, given the level of earnings, high accruals imply low cash flows (internal funds available for investments) and, consequently, low expected growth going forward. By more than halving the number of anomalies unexplained by the q-factor model from 52 to 23, with only one extra factor, the q^5 model makes further progress toward the important goal of dimension reduction (Cochrane 2011).

Second, we conduct the largest-to-date empirical horse race of recently proposed factor models. Prior studies use only relatively small sets of testing portfolios (Fama and French 2015, 2018; Hou, Xue, and Zhang 2015; Stambaugh and Yuan 2017). To provide a broad perspective, we increase the number of testing anomalies drastically to 150. Barillas and Shanken (2018) conduct Bayesian tests with only 11 factors and downplay the importance of testing assets. We show that inferences on relative performance clearly depend on the choice of testing assets. In particular, the presence of both UMD and the monthly formed HML causes difficulties in capturing the annually formed value-versus-growth anomalies (such as book-to-market) in the Barillas-Shanken model, difficulties that are absent from the Fama-French 5-factor model and the q-factor model. As such, it is crucial to use a large set of testing assets to draw reliable inferences. Our extensive evidence on how a given anomaly can be explained by different factor models is also important in its own right. Finally, our work stands out in that while we attempt to tie our factors to the first principle of real investment in economic theory, other recently proposed factor models are all largely statistical in nature.

Our work is related to Ball et al. (2016), who show that cash-based profitability outperforms earnings-based profitability in forecasting returns. We provide an economic interpretation by linking cash flows and accruals to the expected growth. George, Hwang, and Li (2018) show that the ratio of current price to 52-week high price contains information about future investment growth, and this information helps explain the accrual and R&D-to-market anomalies. We also build on Watts (2003a, 2003b), Penman and Zhu (2014), and Lev and Gu (2016), among others, who argue that accounting conservatism, such as expensing R&D and other intangible investments, makes earnings a poor indicator of future growth. Penman and Zhu show that several anomaly variables forecast earnings growth in the same direction of forecasting returns. While earnings growth has received much attention from analysts and academics alike, guided by the investment theory, we instead focus on investment growth. Forward-looking in nature, investment growth is broader than earnings growth because investment reflects expectations of future cash flows and discount rates.

The rest of the paper is organized as follows. Section 2 motivates the expected growth factor. Section 3 forms cross-sectional growth forecasts and constructs the expected growth factor. Section 4 stress-tests the factor models. Finally, Section 5 concludes. A separate Internet Appendix details mathematical derivations, variable definitions, portfolio construction, and supplementary results.

2 Economic Foundation

We motivate the expected growth factor from the multiperiod investment framework (Cochrane 1991). Time is discrete, and the horizon infinite. Heterogeneous firms use capital and costlessly adjustable inputs to produce a homogeneous output. These inputs are chosen each period to maximize operating profits (defined as revenue minus the costs of these inputs). Taking operating profits as given, firms choose investment to maximize their market value of equity.

Let $\Pi_t = X_t A_t$ be date-t operating profits of an individual firm, in which A_t is productive assets, and X_t return on assets (a measure of profitability). We suppress the firm index for notational simplicity. The next period profitability, X_{t+1}, is stochastic, subject to aggregate and firm-specific shocks. Let I_t denote investment and δ the depreciation rate of assets, then $A_{t+1} = I_t + (1-\delta)A_t$. To change the scale of assets, the firm incurs adjustment costs, which are quadratic, $(a/2)(I_t/A_t)^2 A_t$, in which $a > 0$. We assume that the firm finances investments only with internal funds and equity (no debt) and pay no taxes. The net payout of the firm is $D_t = X_t A_t - I_t - (a/2)(I_t/A_t)^2 A_t$. If $D_t \geq 0$, the firm distributes it to shareholders. A negative D_t means the external equity.

Let M_{t+1} be the stochastic discount factor, which is correlated with the aggregate component of X_{t+1}. The firm chooses the optimal investment stream, $\{I_{t+s}\}_{s=0}^{\infty}$, to maximize the cum-dividend market equity, $V_t \equiv E_t\left[\sum_{s=0}^{\infty} M_{t+s} D_{t+s}\right]$. The first principle of real investment implies that $E_t[M_{t+1} r_{t+1}^I] = 1$, in which the investment return is defined as:

$$r_{t+1}^I \equiv \frac{X_{t+1} + (a/2)\left(I_{t+1}/A_{t+1}\right)^2 + (1-\delta)\left[1 + a\left(I_{t+1}/A_{t+1}\right)\right]}{1 + a\left(I_t/A_t\right)}. \quad (1)$$

Intuitively, the investment return is the marginal benefit of investment at time $t+1$ divided by the marginal cost of investment at t. The first principle, $E_t[M_{t+1} r_{t+1}^I] = 1$, says that the marginal cost equal the next period marginal benefit discounted to time t with the stochastic discount factor. In the numerator of the investment return, X_{t+1} is the marginal profits produced by an extra unit of assets, $(a/2)(I_{t+1}/A_{t+1})^2$ is the marginal reduction in adjustment costs, and the last term in the numerator is the marginal continuation value of the extra unit of assets, net of depreciation.

Let $P_t = V_t - D_t$ denote the ex-dividend equity value, and $r_{t+1}^S = (P_{t+1} + D_{t+1})/P_t$ the stock return. Cochrane (1991) uses no-arbitrage argument to argue, and Restroy and Rockinger (1994) prove under constant returns to scale that the stock return equals the investment return period by period and state by state (the Internet Appendix). As such, equation (1) implies that the stock return equals the next period marginal benefit of investment divided by the current marginal cost of investment. Intuitively, firms will keep investing until the marginal cost of investment, which rises with investment, equals the present value of an extra unit of assets, the present value given by the next period marginal benefit of investment discounted by the discount rate (the stock return).

In a two-period model, in which $I_{t+1} = 0$, equation (1) collapses to $r^S_{t+1} = (X_{t+1} + 1 - \delta)/(1 + aI_t/A_t)$. All else equal, low investment stocks should earn higher expected returns than high investment stocks, and high expected profitability stocks should earn higher expected returns than low expected profitability stocks. Intuitively, given expected profitability, high costs of capital give rise to low net present values of new projects and low investment. Given investment, high expected profitability imply high discount rates, which are necessary to counteract the high expected profitability to induce low net present values of new projects. Hou, Xue, and Zhang (2015) build on these insights to construct the investment and return on equity (Roe) factors in the q-factor model.

In the multiperiod framework, equation (1) says that holding investment and expected profitability constant, the expected return also increases with the expected investment-to-assets growth. The right-hand side of equation (1) can be decomposed into the "dividend yield" and the "capital gain." The former is $[X_{t+1} + (a/2)(I_{t+1}/A_{t+1})^2]/(1 + aI_t/A_t)$, which largely conforms to the two-period model, as the squared term, $(I_{t+1}/A_{t+1})^2$, is economically small. The "capital gain," $(1 - \delta)(1 + aI_{t+1}/A_{t+1})/(1 + aI_t/A_t)$, is the growth of marginal q (the market value of an extra unit of assets). Although the "capital gain" involves the unobservable parameter, a, it is roughly proportional to the investment-to-assets growth, $(I_{t+1}/A_{t+1})/(I_t/A_t)$ (Cochrane 1991). As such, the expected investment-to-assets growth is the third "determinant" of the expected return.

The intuition is analogous to that underlying the positive relation between the expected return and the expected profitability. The term, $1 + aI_{t+1}/A_{t+1}$, is the marginal cost of investment next period, which, per the first principle of investment, equals the marginal q next period (the present value of cash flows in all future periods arising from one extra unit of assets next period). The expected marginal q is then part of the expected marginal benefit of current investment. This term is absent from the two-period model, which abstracts from growth in subsequent periods. As such, in the multiperiod framework, high expected investment (relative to current investment) must imply high discount rates to counteract the high expected marginal benefit of current investment.

3 The Expected Growth Factor

Motivated by equation (1), we cross-sectionally forecast investment-to-assets growth in Section 3.1 and construct the expected investment growth factor to form the q^5 model in Section 3.2.

3.1 Cross-sectional Growth Forecasts

A technical issue arises in that firm-level investment is frequently negative, making the growth rate of investment-to-assets not well defined. As such, we forecast future investment-to-assets changes. Forecasting changes captures the essence of the economic insight that all else equal, high expected investment-to-assets relative to current investment-to-assets must imply high discount rates.

Our forecasting framework is based on monthly Fama-MacBeth (1973) cross-sectional predictive regressions. At the beginning of each month t, we measure current investment-to-assets as total assets (Compustat annual item AT) from the most recent fiscal year ending at least four months ago minus the total assets from one year prior, scaled by the 1-year-prior total assets. The left-hand side variables in the cross-sectional regressions are investment-to-assets changes, denoted $\mathrm{d}^{\tau}\mathrm{I/A}$, in which $\tau = 1, 2$, and 3 years. We measure $\mathrm{d}^{1}\mathrm{I/A}$, $\mathrm{d}^{2}\mathrm{I/A}$, and $\mathrm{d}^{3}\mathrm{I/A}$ as investment-to-assets from the first, second, and third fiscal year after the most recent fiscal year end minus the current investment-to-assets, respectively. The sample is from July 1963 to December 2018.

3.1.1 Predictors Based on A Priori Conceptual Arguments

Which variables should one use to forecast investment-to-assets changes? Our goal is a conceptually motivated yet empirically validated specification for the expected investment-to-assets changes. To this end, we turn to the investment literature in macroeconomics and corporate finance for guidance.

Keynes (1936) and Tobin (1969) argue that a firm should invest if the ratio of its market value to the replacement costs of its assets (Tobin's q) exceeds one. Lucas and Prescott (1971) and Mussa (1977) show that optimal investment requires the marginal cost of investment to equal marginal q. With quadratic adjustment costs, this first-order condition of investment can be rewritten as a linear regression of investment-to-assets on marginal q, which is unobservable. Hayashi (1982) shows that under constant returns to scale, marginal q equals average q, which is observable.

Although marginal q should theoretically summarize the impact of all other variables on investment, firms' internal cash flows typically have economically large and statistically significant slopes once included in the investment-q regression. For example, Fazzari, Hubbard, and Petersen (1988) and Gilchrist and Himmelberg (1995) show that the cash flows effect on investment is especially strong for firms that are more financially constrained. However, the economic interpretation of the cash flows effect is controversial.[1] We remain agnostic about the exact interpretation of the cash flows effect, which is not related to our asset pricing objectives, at least not directly. As such, we include both Tobin's q and cash flows on the right-hand side of our forecasting regressions.

Both Tobin's q and cash flows are slow-moving. To help capture the short-term dynamics of investment-to-assets changes, we also include the change in return on equity over the past four quarters, denoted dRoe, on the right-hand side of our forecasting regressions. Intuitively, firms that experience recent increases in profitability tend to raise future investments in the short term, and firms that experience recent decreases in profitability tend to reduce future investments.[2] Finally, we use only three instruments to keep our empirical specification parsimonious. This parsimony

[1]Using measurement error-consistent generalized methods of moments, Erickson and Whited (2000) find that cash flows do not matter in the investment-q regression even for financially constrained firms and interpret the cash flows effect as indicative of measurement errors in Tobin's q. In addition, the investment-cash flows relation can arise theoretically even without financial constraints (Gomes 2001; Alti 2003; Abel and Eberly 2011). Finally, in a model with financial constraints, cash flows matter only if one ignores marginal q (Gomes 2001).

[2]Novy-Marx (2015) argues that the investment framework cannot explain momentum. However, Liu, Whited, and Zhang (2009) show that firms that experience recent, positive earnings shocks have higher average future investment growth than firms that experience recent, negative earnings shocks. Liu and Zhang (2014) show that this future investment growth spread is temporary, converging within 12 months, and helps explain the short duration of price and earnings momentum. Goncalves, Xue, and Zhang (2019) show that a detailed treatment of aggregation and capital heterogeneity enables the investment model to explain value and momentum simultaneously via structural estimation. We instead form firm-level cross-sectional forecasts, on which we further construct an expected growth factor.

is necessary to guard against in-sample overfitting at the expense of the out-of-sample forecasting performance (Hastie, Tibshirani, and Friedman 2009, Chapter 7).

3.1.2 Measurement

Monthly returns are from the Center for Research in Security Prices (CRSP) and accounting information from the Compustat Annual and Quarterly Fundamental Files. We require CRSP share codes to be 10 or 11. Financial firms and firms with negative book equity are excluded.

Our measure of Tobin's q is standard (Kaplan and Zingales 1997). At the beginning of each month t, current Tobin's q is the market equity (price per share times the number of shares outstanding from CRSP) plus long-term debt (Compustat annual item DLTT) and short-term debt (item DLC) scaled by book assets (item AT), all from the most recent fiscal year ending at least four months ago. For firms with multiple share classes, we merge the market equity for all classes.

We follow Ball et al. (2016) in measuring operating cash flows, denoted Cop. At the beginning of each month t, we measure current Cop as total revenue (Compustat annual item REVT) minus cost of goods sold (item COGS), minus selling, general, and administrative expenses (item XSGA), plus research and development expenditures (item XRD, zero if missing), minus change in accounts receivable (item RECT), minus change in inventory (item INVT), minus change in prepaid expenses (item XPP), plus change in deferred revenue (item DRC plus item DRLT), plus change in trade accounts payable (item AP), and plus change in accrued expenses (item XACC), scaled by book assets, all from the fiscal year ending at least four months ago. Missing annual changes are set to zero.

We adopt the Cop variable because it is likely the most accurate measure of cash flows. A more popular measure of cash flows in the investment literature is earnings before extraordinary items but after interest, depreciation, and taxes (Compustat annual item IB) plus depreciation. For instance, Li and Wang (2017) use this measure, along with Tobin's q and prior 11-month returns to forecast capital expenditure growth. However, as argued in Ball et al. (2016), because this measure includes accruals such as changes in accounts payable, accounts receivable, and inventory, it does not accurately capture internal funds available for investments. In particular, given earnings, accruals tend to reduce internal cash flows and dampen future investment growth. In addition, unlike earnings, Cop explicitly recognizes R&D expenses as a form of investments that induce future growth.

The change in return on equity, dRoe, is Roe minus the 4-quarter-lagged Roe. Roe is income before extraordinary items (Compustat quarterly item IBQ) scaled by the 1-quarter-lagged book equity. We compute dRoe with earnings from the most recent announcement dates (item RDQ), and if not available, from the fiscal quarter ending at least four months ago (Hou, Xue, and Zhang 2019). Finally, missing dRoe values are set to zero in the cross-sectional forecasting regressions.

3.1.3 Forecasting Results

Panel A of Table 1 shows monthly cross-sectional regressions of future investment-to-assets changes on the log of Tobin's q, $\log(q)$, cash flows, Cop, and the change in return on equity, dRoe. We winsorize both the left- and right-hand side variables each month at the 1–99% level. To control for the impact of microcaps, we use weighted least squares with the market equity as the weights.

To gauge the out-of-sample performance of the cross-sectional forecasts, at the beginning of each month t, we construct the expected τ-year-ahead investment-to-assets changes, denoted $E_t[\mathrm{d}^\tau\mathrm{I/A}]$, in which $\tau = 1, 2$, and 3 years, by combining the most recent winsorized predictors with the average slopes estimated from the prior 120-month rolling window (30 months minimum). The most recent predictors, $\log(q)$ and Cop, in calculating $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ are from the most recent fiscal year ending at least four months ago as of month t, and dRoe is computed using the latest announced earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago.

The average slopes in calculating $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ are estimated from the prior rolling window regressions, in which $\mathrm{d}^\tau\mathrm{I/A}$ is from the most recent fiscal year ending at least four months ago as of month t, and the regressors are further lagged accordingly. For instance, for $\tau = 1$, the regressors in the latest monthly cross-sectional regression are further lagged by 12 months relative to the most recent predictors that we combine with the slopes in calculating $E_t[\mathrm{d}^1\mathrm{I/A}]$. Finally, we report the time series averages of cross-sectional Pearson and rank correlations between $E_t[\mathrm{d}^\tau \mathrm{I/A}]$ calculated at the beginning of month t and the subsequent τ-year-ahead investment-to-assets changes after month t.

Panel A shows that Tobin's q alone is a weak predictor of investment-to-assets changes. At the 1-year horizon, the slope, 0.02, is economically small, albeit significant. The R^2 is only 1%, which is not surprising in forecasting changes.[3] In untabulated results, we show that the time series average of the contemporaneous cross-sectional Pearson correlation between $\log(q)$ and investment-to-assets is 0.23, and the rank correlation 0.3. The investment theory predicts a tight relation of Tobin's q with the current investment level, but not necessarily with future investment-to-assets changes.

Cash flows perform substantially better than Tobin's q in forecasting investment-to-assets changes. When used alone, Cop has significant slopes that range from 0.42 to 0.46 (t-values above 10). The in-sample R^2 varies from 3% to 4%. More important, the out-of-sample correlations are much higher than those with Tobin's q. At the 1-year horizon, for example, the Pearson and rank correlations are 0.14 and 0.18, respectively, both of which are significant at the 1% level. Finally, the change in return on equity, dRoe, performs better than Tobin's q, but not cash flows. When used alone, the dRoe slopes range from 0.75 to 0.95, with t-values above 7.5. The in-sample R^2 starts at 2.2% at the 1-year horizon and drops to 1.5% at the 3-year horizon. The out-of-sample correlations are also substantially higher than those with Tobin's q. At the 1-year horizon, the Pearson and rank correlations are 0.07 and 0.13, both of which are significant at the 1% level.

In our benchmark specification with $\log(q)$, Cop, and dRoe together, the slopes are similar to those from univariate regressions. At the 1-year horizon, for instance, the Cop slope remains large and significant, 0.52, the $\log(q)$ slope becomes weakly negative, -0.03, and the dRoe slope stays significant at 0.77. The in-sample R^2 increases to 6.4%. The out-of-sample Pearson and rank correlations, which are important for constructing the expected growth factor, are 0.14 and 0.21, respectively, both of which are highly significant. At the 3-year horizon, the $\log(q)$ and Cop slopes both in-

[3]For example, Chan, Karceski, and Lakonishok (2003) document a low amount of predictability for earnings growth, even with a myriad of predictors, including valuation ratios.

crease in magnitude to -0.09 and 0.75, respectively, but the dRoe slope falls slightly to 0.72. The in-sample R^2 rises to 9%, and the out-of-sample correlations rise slightly to 0.15 and 0.22, respectively.

3.2 The Expected Growth Premium

Armed with the cross-sectional forecasts of investment-to-assets changes, we study the expected growth premium via portfolio sorts. We form the expected growth deciles, construct an expected growth factor, and then augment the q-factor model with the new factor to form the q^5 model.

3.2.1 Deciles

At the beginning of each month t, we form deciles based on the expected investment-to-assets changes, $E_t[\mathrm{d}^\tau \mathrm{I/A}]$, with $\tau = 1, 2$, and 3 years. As in Table 1, we calculate $E_t[\mathrm{d}^\tau \mathrm{I/A}]$ by combining the most recent winsorized predictors with the average slopes from the prior 120-month rolling window (30 months minimum). We sort all stocks into deciles based on the NYSE breakpoints of the ranked $E_t[\mathrm{d}^\tau \mathrm{I/A}]$ values and calculate the value-weighted decile returns for the current month t. The deciles are rebalanced at the beginning of month $t + 1$.

Panel A of Table 2 shows that the expected growth premium is reliable in portfolio sorts. The high-minus-low $E_t[\mathrm{d}^1 \mathrm{I/A}]$ decile earns on average 1.07% per month ($t = 6.48$), and the high-minus-low $E_t[\mathrm{d}^2 \mathrm{I/A}]$ and $E_t[\mathrm{d}^3 \mathrm{I/A}]$ deciles earn on average about 1.18%, with t-values above seven. From Panel B, the expected growth premium cannot be explained by the q-factor model. The high-minus-low alphas are 0.86%, 0.93%, and 1.01% ($t = 6.19, 5.53$, and 6.01) over the 1-, 2-, and 3-year horizons, respectively. The mean absolute alphas across the deciles are 0.23%, 0.21%, and 0.24%, respectively, and the q-factor model is strongly rejected by the Gibbons, Ross, and Shanken (1989, GRS) test on the null that the alphas are jointly zero across a given set of deciles (untabulated).

Panel C reports the expected investment-to-assets changes, and Panel D the average subsequently realized changes across the $E_t[\mathrm{d}^\tau \mathrm{I/A}]$ deciles. Both the expected and realized changes are value-weighted at the portfolio level with the market equity as the weights. Reassuringly, the expected changes track the subsequently realized changes closely. In particular, at the 1-year horizon, the expected changes rise monotonically from -15.21% per annum for decile one to 7.65% for decile ten, and the average realized changes from -16.69% for decile one to 5.96% for decile ten. The increases in the expected and average realized changes are both strictly monotonic. The time series average of cross-sectional correlations between the expected and realized changes is 0.64, which is highly significant (untabulated). The evidence for the 2- and 3-year horizons is largely similar, with average cross-sectional correlations of 0.7 and 0.67, respectively. The evidence indicates that our empirical specification for the expected investment-to-assets changes seems to be effective.

3.2.2 A Common Factor

In view of the expected growth premium largely unexplained by the q-factor model, we set out to construct an expected growth factor, denoted R_{Eg}. We form R_{Eg} from an independent 2×3 sort on the market equity and the expected 1-year-ahead investment-to-assets change, $E_t[\text{d}^1\text{I/A}]$.

At the beginning of each month t, we use the beginning-of-month median NYSE market equity to split stocks into two groups, small and big. Independently, we split all stocks into three groups, low, median, and high, based on the NYSE breakpoints for the low 30%, median 40%, and high 30% of the ranked $E_t[\text{d}^1\text{I/A}]$ values. Taking the intersection of the two size and three $E_t[\text{d}^1\text{I/A}]$ groups, we form six benchmark portfolios. Monthly value-weighted portfolio returns are calculated for the current month t, and the portfolios are rebalanced at the beginning of month $t+1$. Designed to mimic the common variation related to $E_t[\text{d}^1\text{I/A}]$, the expected growth factor, R_{Eg}, is the difference (high-minus-low), each month, between the simple average of the returns on the two high $E_t[\text{d}^1\text{I/A}]$ portfolios and the simple average of the returns on the two low $E_t[\text{d}^1\text{I/A}]$ portfolios.

Panel A of Table 3 reports the properties for the six size-$E_t[\text{d}^1\text{I/A}]$ benchmark portfolios. The small-high portfolio earns the highest average excess return of 1.31% per month ($t = 4.94$), and the big-low portfolio earns the lowest, 0.17% ($t = 0.72$). The average market equity is the smallest, 0.15 $billion, for the small-low portfolio, which also has the highest number of stocks on average,

968. The average market equity is the highest, 10.01 \$billion, for the big-high portfolio. The lowest number of stocks on average, 141, belongs to the big-low portfolio. The total market equity aggregated across all firms within a portfolio as a fraction of the entire market equity is the lowest for the small-high portfolio, 2.1%, and the highest for the big-high portfolio, 33.9%.

The expected 1-year-ahead investment-to-assets changes, $E_t[\mathrm{d}^1\mathrm{I/A}]$, is the lowest, -11.36% per annum, for the small-low portfolio, and the highest, 4.35%, for the small-high portfolio. Similarly, the average realized 1-year changes, $\mathrm{d}^1\mathrm{I/A}$, is the lowest, -11.24%, for the small-low portfolio, and the highest, 5.51%, for the small-high portfolio. The dispersions in $E_t[\mathrm{d}^1\mathrm{I/A}]$ and $\mathrm{d}^1\mathrm{I/A}$ are smaller, but remain large, 12.36% and 12.96%, respectively, among big firms. Finally, $E_t[\mathrm{d}^1\mathrm{I/A}]$ is only weakly related to Tobin's q, but its relations with Cop and dRoe are strongly positive.

Panel B reports properties of the expected growth factor, R_{Eg}. From January 1967 to December 2018, its average return is 0.84% per month ($t = 10.27$). The q-factor regression of R_{Eg} yields an economically large alpha of 0.67% ($t = 9.75$). As such, the expected growth factor captures a new dimension of the expected return variation that is missed by the q-factor model.

The subsequent five regressions in Panel B identify the sources behind the expected growth premium. To this end, we form factors on $\log(q)$, Cop, and dRoe, by interacting each of them separately with the market equity in 2×3 sorts. Cop is the most important component of the expected growth premium. Augmenting the Cop factor into the q-factor model reduces the alpha of R_{Eg} from 0.67% per month ($t = 9.75$) to 0.37% ($t = 6.35$). dRoe plays a more limited role. Adding the dRoe factor into the q-factor model reduces the alpha only slightly to 0.63% ($t = 8.56$). Tobin's q is negligible on its own but more visible when used together with Cop and dRoe. Adding the $\log(q)$, Cop, and dRoe factors into the q-factor model yields an alpha of 0.25% ($t = 4.04$), which is lower than 0.33% ($t = 5.2$) when adding only the Cop and dRoe factors.[4]

[4]We form the $\log(q)$ and Cop factors with annual sorts to facilitate comparison with the existing literature (Ball et al. 2016). In untabulated results, we have also examined the $\log(q)$ and Cop factors with monthly sorts that are analogous to our construction of the expected growth factor. Tobin's q continues to play a negligible role when used alone. Adding the monthly sorted Cop factor into the q-factor model yields an alpha of 0.27% ($t = 5.16$) for the expected growth factor, and adding all three monthly formed factors reduces the alpha further to 0.16% ($t = 2.9$).

Finally, Panel C shows that the expected growth factor has positive correlations of 0.34 and 0.51 with the investment and Roe factors but negative correlations of −0.46 and −0.37 with the market and size factors in the q-factor model. The correlations are 0.71 with the Cop factor and 0.42 with the dRoe factor. All the correlations are significantly different from zero.

3.2.3 The q^5 Model

We augment the q-factor model with the expected growth factor to form the q^5 model. The expected excess return of an asset, denoted $E[R^i - R^f]$, is described by the loadings of its returns to five factors, including the market factor, R_{Mkt}, the size factor, R_{Me}, the investment factor, $R_{\text{I/A}}$, the return on equity factor, R_{Roe}, and the expected growth factor, R_{Eg}. The first four factors are identical to those in the q-factor model. Formally, the q^5 model says that:

$$E[R^i - R^f] = \beta^i_{\text{Mkt}}\, E[R_{\text{Mkt}}] + \beta^i_{\text{Me}}\, E[R_{\text{Me}}] + \beta^i_{\text{I/A}}\, E[R_{\text{I/A}}] + \beta^i_{\text{Roe}}\, E[R_{\text{Roe}}] + \beta^i_{\text{Eg}}\, E[R_{\text{Eg}}], \qquad (2)$$

in which $E[R_{\text{Mkt}}], E[R_{\text{Me}}], E[R_{\text{I/A}}]$, $E[R_{\text{Roe}}]$, and $E[R_{\text{Eg}}]$ are the expected factor premiums, and β^i_{Mkt}, β^i_{Me}, $\beta^i_{\text{I/A}}$, β^i_{Roe}, and β^i_{Eg} are their factor loadings, respectively.

As its first test, not surprisingly, the expected growth factor explains the deciles on the expected 1-year-ahead investment-to-assets changes, $E_t[\text{d}^1\text{I/A}]$, on which the expected growth factor is based (the Internet Appendix). The high-minus-low decile earns a q^5 alpha of only −0.15% per month ($t = -1.5$), due to a large expected growth factor loading of 1.5 ($t = 26.75$). The mean absolute alpha is only 0.07%, and the GRS test cannot reject the q^5 model ($p = 0.13$). More important, reassuringly, the expected growth factor also explains the $E_t[\text{d}^2\text{I/A}]$ and $E_t[\text{d}^3\text{I/A}]$ deciles. The high-minus-low alphas are only −0.05% ($t = -0.43$) and 0.05 ($t = 0.38$), the mean absolute alphas 0.07% and 0.09%, and the GRS p-values 0.49 and 0.12, respectively.

3.2.4 Alternative Specifications

We have also experimented with two alternative specifications of the expected growth factor. Both yield somewhat higher expected growth factor premiums (the Internet Appendix).

First, we use the percentile rankings of the log of Tobin's q, Cop, and dRoe to forecast the percentile rankings of investment-to-assets changes and to form the expected growth factor. The alternative factor premium is 0.9% per month ($t = 10.46$). The q-factor alpha of the alternative factor is 0.6% ($t = 8.87$). The correlation between the alternative and benchmark expected growth factors is 0.86. However, in head-to-head spanning tests, the benchmark factor cannot fully subsume the alternative factor, with a significant alpha of 0.13% ($t = 2.4$). However, the alternative factor can subsume the benchmark factor, with an insignificant alpha of 0.11% ($t = 1.65$).

Second, instead of the expected 1-year-ahead investment-to-assets changes, we form the expected growth factor on the composite score that equal-weights a stock's percentile rankings of the log of Tobin's q, Cop, and dRoe (each realigned to yield a positive slope in forecasting returns). The alternative expected growth factor formed on the composite score earns on average 0.86% per month ($t = 9.37$), and its q-factor alpha is 0.45% ($t = 6.33$). The correlation between the alternative and benchmark expected growth factors is far from perfect, 0.63. In head-to-head spanning tests, the benchmark factor cannot subsume the alternative factor, with an alpha of 0.26% ($t = 3.14$), and the alternative factor cannot subsume the benchmark factor, with an alpha of 0.36% ($t = 4.86$).

More important, the benchmark q^5 model subsumes the alternative factor, with an alpha of 0.12% ($t = 1.75$), but the alternative q^5 model with the alternative expected growth factor cannot subsume the benchmark expected growth factor, with an alpha of 0.48% ($t = 6.4$). This evidence is important as it indicates that our cross-sectional growth forecasts capture valuable pricing information about the expected return, going beyond the simple, mechanical rule of equal-weighting.

4 Stress-testing Factor Models

The most stringent test of the q^5 model is to confront it with a vast set of testing anomaly portfolios. We also conduct a large-scale empirical horse race with other recently proposed factor models. We set up the playing field in Section 4.1, discuss the overall performance of different factor models in Section 4.2, and detail individual factor regressions in Section 4.3.

4.1 The Playing Field

We describe testing portfolios as well as all the factor models in the empirical horse race.

4.1.1 Testing Portfolios

We use the 150 anomalies that are significant at the 5% level with NYSE breakpoints and value-weighted returns from January 1967 to December 2018 (Hou, Xue, and Zhang 2019). Table 4 provides the detailed list, which includes 39, 15, 26, 40, 26, and 3 across the momentum, value-versus-growth, investment, profitability, intangibles, and trading frictions categories, respectively.[5] The Internet Appendix details the variable definitions and portfolio construction.

The list contains 52 anomalies that cannot be explained by the q-factor model. Prominent examples include cumulative abnormal stock returns around quarterly earnings announcement dates (Chan, Jegadeesh, and Lakonishok 1996), customer momentum (Cohen and Frazzini 2008), and segment momentum (Cohen and Lou 2012) in the momentum category; net payout yield (Boudoukh et al. 2007) in the value-versus-growth category; operating accruals (Sloan 1996), discretionary accruals (Xie 2001), net operating assets (Hirshleifer et al. 2004), and net stock issues (Pontiff and Woodgate 2008) in the investment category; asset turnover (Soliman 2008) and operating profits-to-assets (Ball et al. 2015) in the profitability category; R&D-to-market (Chan, Lakonishok, and Sougiannis 2001) and seasonalities (Heston and Sadka 2006) in the intangibles category.

4.1.2 Factor Models

In addition to the q and q^5 models, we examine six other models, including (i) the Fama-French (2015) 5-factor model; (ii) the Fama-French (2018) 6-factor model with RMW; (iii) the Fama-French alternative 6-factor model with RMWc; (iv) the Barillas-Shanken (2018) 6-factor model; (v) the Stambaugh-Yuan (2017) 4-factor model; and (vi) the Daniel-Hirshleifer-Sun (2019) 3-factor model.

[5] In their original 1967–2016 sample, Hou, Xue, and Zhang (2019) report 158 significant anomalies, including 36, 29, 28, 35, 26, and 4 across the momentum, value-versus-growth, investment, profitability, intangibles, and trading frictions categories, respectively. We extend the sample through December 2018. The big news is in the value-versus-growth category, in which the number of significance drops drastically from 29 to 15. The number of significance increases slightly in the momentum and profitability categories but stays largely the same in the other three categories.

Fama and French (2015) incorporate two factors that are similar to our investment and Roe factors into their original 3-factor model to form their 5-factor model. RMW is the high-minus-low operating profitability factor, in which operating profitability is total revenue minus cost of goods sold, minus selling, general, and administrative expenses, and minus interest expense, all scaled by the book equity. CMA is the low-minus-high investment factor. RMW and CMA are formed via independent 2×3 sorts by interacting operating profitability, and separately, investment-to-assets, with size. Fama and French (2018) further add the momentum factor, UMD, from Jegadeesh and Titman (1993) and Carhart (1997), into their 5-factor model to form their 6-factor model. UMD is formed in each month t by interacting prior 11-month returns (skipping month $t-1$) with size. We obtain the data of the Fama-French five and six factors from Kenneth French's Web site.

Fama and French (2018) also introduce an alternative 6-factor model, in which RMW is replaced by a cash-based profitability factor, denoted RMWc.[6] Their cash profitability measure is a variant of Ball et al.'s (2016), with the book equity (not book assets) as the denominator, but without adding back R&D expenses. The construction of RMWc is analogous to RMW. Since the RMWc data are not provided on Kenneth French's Web site, to facilitate comparison, we reproduce RMWc based on the same Fama-French sample that includes financial firms and firms with negative book equity, except that the positive book equity is required for HML, RMW, and RMWc.

Barillas and Shanken (2018) also propose a 6-factor model, including the market factor, SMB from the Fama-French (2015) 5-factor model, the investment and Roe factors from the q-factor model, the Asness-Frazzini (2013) monthly sorted HML factor, denoted HML^{m}, and the momentum factor, UMD. Barillas and Shanken argue that their 6-factor model outperforms the q-factor model and the Fama-French 5-factor model in their Bayesian comparison tests. Asness and Frazzini construct HML^{m} from monthly sequential sorts on, first, size, and then book-to-market, in which

[6] Cash-based profitability is revenues (Compustat annual item REVT) minus cost of goods sold (item COGS, zero if missing), minus selling, general, and administrative expenses (item XSGA, zero if missing), minus interest expense (item XINT, zero if missing) minus change in accounts receivable (item RECT), minus change in inventory (item INVT), minus change in prepaid expenses (item XPP), plus change in deferred revenue (item DRC plus item DRLT), plus change in trade accounts payable (item AP), and plus change in accrued expenses (item XACC), scaled by the book equity. At least one of the three items (COGS, XSGA, and XINT) must be nonmissing.

the market equity is updated monthly, and the book equity is from the fiscal year ending at least six months ago. To ease comparison, we obtain the HML^{m} data from the AQR's Web site.

Stambaugh and Yuan (2017) group 11 anomalies into two clusters based on pairwise cross-sectional correlations. The first cluster, denoted MGMT (management) contains net stock issues, composite issues, accruals, net operating assets, investment-to-assets, and the change in gross property, plant, and equipment plus the change in inventories scaled by lagged book assets. The second cluster, denoted PERF (performance), includes failure probability, O-score, momentum, gross profitability, and return on assets. The variables in each cluster are realigned to yield positive low-minus-high returns. The composite scores, MGMT and PERF, are defined as a stock's equal-weighted rankings across all the variables within a given cluster. Stambaugh and Yuan form their factors from monthly independent 2×3 sorts from interacting size with each of the composite scores.

However, as shown in Hou et al. (2019), Stambaugh and Yuan (2017) deviate from the traditional factor construction (Fama and French 1993) in two important aspects. First, the NYSE-Amex-NASDAQ breakpoints of 20th and 80th percentiles are used, as opposed to the common NYSE breakpoints of 30th and 70th, when sorting on the composite scores. Second, the size factor contains stocks only in the middle portfolios of the composite score sorts, as opposed to stocks from all portfolios. Hou et al. show that the Stambaugh-Yuan factors are sensitive to their factor construction, and their nontraditional construction exaggerates their factors' explanatory power. In our sample from January 1967 to December 2018, the replicated MGMT and PERF factors earn on average 0.45% per month ($t = 4.53$) and 0.51% ($t = 3.95$), whereas the original factors earn 0.55% ($t = 4.37$) and 0.72% ($t = 4.74$), respectively. To level the playing field, we opt to use the replicated factors via the traditional approach. The Internet Appendix details our replication procedure.

Daniel, Hirshleifer, and Sun (2019) propose a 3-factor model that includes the market factor, a financing factor (FIN), and a post-earnings-announcement-draft factor (PEAD). FIN is constructed on the Pontiff-Woodgate (2008) 1-year net issuance and the Daniel-Titman (2006) 5-year composite issuance. PEAD is formed on cumulative abnormal returns around the most recent earnings announcement, Abr. FIN is from annual sorts, and PEAD monthly sorts, both 2×3 with size.

However, as shown in Hou et al. (2019), Daniel, Hirshleifer, and Sun (2019) also deviate from the traditional approach. First, only Abr is used, even though standardized unexpected earnings, Sue, and revisions in analysts earnings forecasts, Re, are perhaps more common measures of post-earnings-announcement-draft (Chan, Jegadeesh, and Lakonishok 1996). Second, the NYSE breakpoints of the 20th and 80th percentiles are adopted, instead of the common 30th and 70th percentiles. Finally, the net issuance sort and its combination with the composite issuance sort seem ad hoc.[7] Hou et al. show that the Daniel-Hirshleifer-Sun factors are also sensitive to the factor construction, and their nontraditional construction exaggerates the factors' explanatory power.

To ensure that we compare apples with apples, we replicate the Daniel-Hirshleifer-Sun factors via the traditional approach. We form the replicated PEAD factor by sorting on the simple average of a stock's percentile rankings on Sue, Abr, and Re (if available). An advantage is that doing so allows us to start the sample in January 1967, which is the same starting point for all the other factors. In contrast, Daniel et al. (2019) start only in July 1972. We use the same composite score approach from Stambaugh and Yuan (2017) to combine the two share issuance measures. We then split stocks on the composite FIN and PEAD scores based on their NYSE breakpoints of the 30th and 70th percentiles. From January 1967 to December 2018, the replicated FIN and PEAD factors earn on average 0.3% per month ($t = 2.43$) and 0.7% ($t = 7.82$), whereas the original factors, which start from July 1972, earn 0.78% ($t = 4.41$) and 0.62% ($t = 7.93$), respectively. The Internet Appendix details our replication procedure and the results with the PEAD factor based on Abr only.

[7]Daniel, Hirshleifer, and Sun (2019) first split all repurchasing firms (with negative net issuance) into two groups based on the NYSE median. Second, all equity issuing firms (with positive net issuance) are split into three groups based on the NYSE breakpoints of the 30th and 70th percentiles. Third, firms with the most negative net issuance are assigned to the low net issuance portfolio, those with the most positive net issuance to the high portfolio, and all other firms to the middle portfolio. Finally, if a firm belongs to the high portfolios per both issuance measures, or to the high portfolio per one issuance measure, but missing the other, the firm is assigned to the high FIN portfolio. If a firm belongs to the low portfolios per both measures, or to the low portfolio per either one, but missing the other, the firm belongs to the low FIN portfolio. In all the other cases, the firm belongs to the middle FIN portfolio.

4.1.3 Sharpe Ratios

Table 5 reports monthly Sharpe ratios for individual factors and maximum Sharpe ratios for all the factor models. The maximum Sharpe ratio for a given factor model is calculated as $\sqrt{\mu_f' V_f^{-1} \mu_f}$, in which μ_f is the vector of mean factor returns, and V_f the variance-covariance matrix of the factor returns in the model (MacKinlay 1995). From Panel A, the individual Sharpe ratio is the highest, 0.44, for the expected growth factor, R_{Eg}, followed by the PEAD factor, 0.32. The investment factor, $R_{\mathrm{I/A}}$, has a Sharpe ratio of 0.2, which is higher than 0.15 for CMA. The Roe factor, R_{Roe}, has a Sharpe ratio of 0.22, which is higher than 0.13 for RMW and 0.19 for RMWc.

Panel B shows that the q^5 model has the highest maximum Sharpe ratio, 0.63, among all the factor models. The Sharpe ratio for the q-factor model is 0.42, which compares favorably with 0.37 for the Fama-French (2018) 6-factor model, but falls slightly short of 0.43 for their alternative 6-factor model. The Barillas-Shanken (2018) 6-factor model has a higher Sharpe ratio of 0.48 than the q-factor model. Based on this evidence, Barillas and Shanken argue that their 6-factor model is a better model than the q-factor model (and that testing assets are largely irrelevant). Our extensive evidence based on 150 anomalies casts doubt on their conclusion (Sections 4.2 and 4.3).[8]

4.2 The Big Picture of the Model Performance

4.2.1 Performance Across All 150 Anomalies

Panel A of Table 6 shows the overall performance of the factor models in explaining the 150 significant anomalies. The q^5 model is the overall best performer. The q-factor model performs well too, with a lower number of significant high-minus-low alphas but a higher number of rejections by the GRS test than the Fama-French 6-factor model and the Stambaugh-Yuan model. The Fama-French 5-factor, the Barillas-Shanken, and the Daniel-Hirshleifer-Sun models all perform poorly.

The q-factor model leaves 52 significant high-minus-low alphas with $|t| \geq 1.96$ and 25 with

[8] Hou et al. (2019) perform factor spanning tests and examine the conceptual foundation behind the factor models. Their key finding is that the q-factor model largely subsumes the Fama-French 5- and 6-factor models in spanning tests, and the q^5 model subsumes the Stambaugh-Yuan (2017) 4-factor model.

$|t| \geq 3$. The average magnitude of the high-minus-low alphas is 0.28% per month. Across all the 150 sets of deciles, the mean absolute alpha is 0.11%, but the q-factor model is still rejected by the GRS test at the 5% level in 101 sets of deciles. The q^5 model improves on the q-factor model substantially. The average magnitude of the high-minus-low alphas is 0.19% per month. The number of significant high-minus-low alphas is 23 with $|t| \geq 1.96$ and 6 with $|t| \geq 3$, dropping from 52 and 25, respectively, in the q-factor model. The mean absolute alpha across all the deciles is 0.1%. Finally, the q^5 model is rejected by the GRS test in only 57 sets of deciles, and this number of GRS rejections represents a reduction of 44% from 101 in the q-factor model.

The Fama-French 5-factor model performs poorly. The model leaves 100 high-minus-low alphas with $|t| \geq 1.96$ and 69 with $|t| \geq 3$, both of which are the highest across all the factor models. The average magnitude of the high-minus-low alphas is 0.43% per month. The model is also rejected by the GRS test in 112 sets of deciles. The Fama-French 6-factor model performs better. The numbers of high-minus-low alphas with $|t| \geq 1.96$ and $|t| \geq 3$ fall to 74 and 37, respectively. The average magnitude of the high-minus-low alphas drops to 0.3%, and the number of GRS rejections to 91. However, other than the lower number of GRS rejections, the 6-factor model underperforms the q-factor model in the average magnitude of high-minus-low alphas and the numbers of high-minus-low alphas with $|t| \geq 1.96$ and with $|t| \geq 3$.

Replacing RMW with RMWc in the Fama-French 6-factor model improves its performance. The average magnitude of high-minus-low alphas falls to 0.27% per month, which is on par with the q-factor model. The number of significant high-minus-low alphas with $|t| \geq 1.96$ drops to 59, which is still higher than 52 in the q-factor model. Finally, the number of GRS rejections falls to 71, which is substantially lower than 101 in the q-factor model but still higher than 57 in the q^5 model. The q^5 model also outperforms the alternative 6-factor model with RMWc in all the other metrics.

The Barillas-Shanken 6-factor model performs poorly. The average magnitude of the high-minus-low alphas is 0.29% per month. The numbers of significant high-minus-low alphas with

$|t| \geq 1.96$ and $|t| \geq 3$ are 63 and 37, respectively. The mean absolute alpha across all the deciles is 0.13%. Finally, the number of GRS rejections is 132 (out of 150)! This number of rejections is the highest among all the factor models. The Stambaugh-Yuan 4-factor model performs well. It underperforms the q-factor model in terms of the number of high-minus-low alphas with $|t| \geq 1.96$ (64 versus 52) but outperforms in the number of rejections by the GRS test (87 versus 101). However, the q^5 model substantially outperforms the Stambaugh-Yuan model in all the metrics.

Finally, the Daniel-Hirshleifer-Sun 3-factor model performs poorly. The average magnitude of the high-minus-low alphas is 0.37% per month, which is the second highest among all the factor models. The numbers of significant high-minus-low alphas with $|t| \geq 1.96$ and $|t| \geq 3$ are 70 and 33, respectively. The mean absolute alpha across all the deciles is 0.14%, which is the highest among all the models. Finally, the number of GRS rejections is 97.[9]

4.2.2 Performance Across Each Category of Anomalies

Panels B–G of Table 6 show that the q^5 model improves on the q-factor model across most of the six categories of anomalies, especially in the investment and profitability categories.

Momentum From Panel B of Table 6, the improvement in the momentum category is noteworthy. Across the 39 significant momentum anomalies, the average magnitude of the high-minus-low q^5 alphas is 0.17% per month (0.25% in the q-factor model). The q^5 model reduces the number of significant high-minus-low alphas with $|t| \geq 1.96$ from 11 to 4 (3 to 1 with $|t| \geq 3$), the mean absolute alpha from 0.1% per month slightly to 0.09%, and the number of rejections by the GRS test from 24 to 15.

The Fama-French 5-factor model shows no explanatory power for momentum, leaving 37 out of 39 high-minus-low alphas with $|t| \geq 1.96$ (29 with $|t| \geq 3$) as well as the GRS rejections in 36 sets of deciles. The average magnitude of the high-minus-low alphas, 0.62% per month, and the mean

[9]The Internet Appendix shows that the Daniel-Hirshleifer-Sun model with the PEAD factor based on Abr only performs better from July 1972 to December 2018. The average magnitude of the high-minus-low alphas is 0.32% per month (0.28% in the q-factor model and 0.2% in the q^5 model), the number of high-minus-low alphas with $|t| \geq 1.96$ is 59 (49 in q and 23 in q^5), the number of high-minus-low alphas with $|t| \geq 3$ is 13 (23 in q and 5 in q^5), the mean absolute alpha 0.12% (0.12% in q and 0.1% in q^5), and the number of GRS rejections 67 (87 in q and 53 in q^5).

absolute alpha across all the deciles, 0.15%, are the highest among all the factor models.

Even with UMD, the Fama-French 6-factor model still leaves 19 high-minus-low alphas significant with $|t| \geq 1.96$ and 6 with $|t| \geq 3$. The 6-factor model is rejected by the GRS test in 21 sets of deciles. Changing RMW to RMWc in the Fama-French 6-factor model improves the metrics to 14, 5, and 18, respectively. However, the alternative 6-factor model underperforms the q^5 model in all the metrics, including the number of GRS rejections (18 versus 15) and the number of significant high-minus-low alphas (14 versus 4 with $|t| \geq 1.96$ and 5 versus 1 with $|t| \geq 3$).

Other than the slightly lower average magnitude of the high-minus-low alphas, 0.23% versus 0.25% per month, the Barillas-Shanken 6-factor model underperforms the q-factor model. The numbers of high-minus-low alphas with $|t| \geq 1.96$ and $|t| \geq 3$ are 12 and 4, in contrast to 11 and 3 in the q-factor model, respectively. The mean absolute alpha is 0.12%, and the number of GRS rejections 33. Both are higher than 0.1% and 24 in the q-factor model, respectively. The Stambaugh-Yuan 4-factor model performs poorly, leaving 19 high-minus-low alphas with $|t| \geq 1.96$ and 6 with $|t| \geq 3$. The average magnitude of the high-minus-low alphas is 0.32% (0.25% in the q-factor model). Finally, the Daniel-Hirshleifer-Sun 3-factor model underperforms the q-factor model with a higher mean absolute alpha of 0.14% and a higher number of GRS rejections of 26. However, its number of significant high-minus-low alphas with $|t| \geq 1.96$ is slightly lower at 10.

Value-versus-growth Panel C of of Table 6 shows that among the 15 value-versus-growth anomalies, the role of the expected growth factor is limited. The q-factor model leaves 1 high-minus-low alphas with $|t| \geq 1.96$ (3 in the q^5 model) and 0 with $|t| \geq 3$ (0 in the q^5 model). The average magnitude of the high-minus-low alphas is 0.21% per month, the mean absolute alpha 0.11%, and the number of GRS rejections 8, in contrast to 0.22%, 0.13% and 7 in the q^5 model, respectively.

The Fama-French 5-factor model performs very well in this category. The average magnitude of the high-minus-low alphas is 0.15% per month, the number of high-minus-low alphas with $|t| \geq 1.96$ is only 2 (0 with $|t| \geq 3$), the mean absolute alpha 0.1%, and the number of GRS rejections 7. This performance benefits from having both CMA and HML, while giving up on momentum. Including UMD per the 6-factor model raises the average magnitude of the high-minus-low alphas to 0.19%, the number of alphas with $|t| \geq 1.96$ to 4, and the number of GRS rejections to 9. Adopting RMWc in the 6-factor model improves these metrics slightly to 0.17%, 3, and 6, respectively.

The Barillas-Shanken 6-factor model performs poorly. The average magnitude of high-minus-low alphas is 0.23% per month, the numbers of the alphas with $|t| \geq 1.96$ and $|t| \geq 3$ are 6 and 2, respectively, and the mean absolute alpha 0.13%. More important, the number of GRS rejections is 14 (out of 15 anomalies). Relative to the q-factor model, the Stambaugh-Yuan 4-factor model yields higher numbers of significant high-minus-low alphas, 4 with $|t| \geq 1.96$ and 1 with $|t| \geq 3$ (1 and 0 in the q-factor model), and a higher number of GRS rejections, 9 (8 in the q-factor model).

Finally, the Daniel-Hirshleifer-Sun 3-factor model performs very poorly. The high-minus-low absolute alpha is the highest among all the models, 0.78% per month. All the 15 high-minus-low alphas are significant with $|t| \geq 1.96$ (13 with $|t| \geq 3$). All the 15 sets of deciles yield rejections in the GRS test. The mean absolute alpha of 0.23% is also the highest among all the models. Intuitively, the value-minus-growth deciles tend to have large and negative PEAD factor loadings, going in the wrong direction in explaining average returns, as well as positive but smaller FIN factor loadings, going in the right direction (untabulated). Because the PEAD premium is larger than the FIN premium, the Daniel-Hirshleifer-Sun model exacerbates the value-versus-growth anomalies.

Investment Panel D of Table 6 shows that the q^5 model is the best performer in the investment category. All but one of the 26 high-minus-low alphas have $|t| \geq 1.96$, and none have $|t| \geq 3$. The number of GRS rejections is 6. The average magnitude of high-minus-low alphas is 0.1% per month, and the mean absolute alpha 0.08%. This performance improves substantially on the q-factor model, which leaves 9 high-minus-low alphas with $|t| \geq 1.96$ and 4 with $|t| \geq 3$, as well as 19 GRS rejections.

The Fama-French 6-factor model is largely comparable with the q-factor model. While outperforming the q-factor model, the alternative 6-factor model with RMWc underperforms the q^5

model, leaving 8 high-minus-low alphas with $|t| \geq 1.96$ (1 in q^5) and 2 with $|t| \geq 3$ (0 in q^5) as well as 7 GRS rejections (6 in q^5). The average magnitude of high-minus-low alphas is 0.18% (0.1% in q^5).

The Barillas-Shanken 6-factor model is comparable with the q-factor model, with a slightly lower number of high-minus-low alphas with $|t| \geq 1.96$ (8 versus 9), but a higher number of GRS rejections (24 versus 19). The Stambaugh-Yuan 4-factor model outperforms the q-factor model slightly but underperforms the q^5 model substantially. The average absolute high-minus-low alphas is 0.19% (0.1% in q^5), the number of high-minus-low alphas with $|t| \geq 1.96$ is 8 (1 in q^5), and the number of GRS rejections is 17 (6 in q^5). Finally, the Daniel-Hirshleifer-Sun 3-factor model performs the worst, with the highest average magnitude of the high-minus-low alphas, 0.34%, the highest number of high-minus-low alphas with $|t| \geq 1.96$, 20, and the second highest number of GRS rejections, 22.

Profitability From Panel E of Table 6, the q^5 model is the best performer in the profitability category. The model leaves 5 high-minus-low alphas with $|t| \geq 1.96$ (16 in the q-factor model) and 1 with $|t| \geq 3$ (6 in q). The average absolute high-minus-low alphas is 0.14% per month (0.25% in q), the mean absolute alpha 0.09% (0.10% in q), and the number of GRS rejections 14 (28 in q).

The other factor models underperform the q^5 model, often substantially. The Fama-French alternative 6-factor model with RMWc has a higher number of GRS rejections, 21, a higher average absolute high-minus-low alphas, 0.26%, as well as higher numbers of high-minus-low alphas with $|t| \geq 1.96$, 18, and with $|t| \geq 3$, 7, than the q^5 model. The 6-factor model with RMW performs worse than the alternative 6-factor model. The Barillas-Shanken 6-factor model underperforms the q-factor model in all the metrics. Also, other than fewer GRS rejections (24 versus 28), the Stambaugh-Yuan 4-factor model also underperforms the q-factor model. The Daniel-Hirshleifer-Sun model 3-factor outperforms the q-factor model, with a lower magnitude of high-minus-low alphas, 0.18%, a lower number of high-minus-low alphas with $|t| \geq 1.96$, 6, and a lower number of GRS rejections, 13. However, even this performance is mostly weaker than that of the q^5 model.

Intangibles and Trading Frictions Panel F shows that the q^5 model is the best performer in the intangibles category. Out of 27, the model leaves 8 high-minus-low alphas with $|t| \geq 1.96$ (4 with $|t| \geq 3$). The average magnitude of high-minus-low alphas is 0.36% per month, the mean absolute alpha 0.15%, and the number of GRS rejections 13. The second best performer is the Stambaugh-Yuan model, with only slightly worse metrics than the q^5 model. The q-factor model leaves 13 high-minus-low alphas with $|t| \geq 1.96$ and 11 with $|t| \geq 3$. The average magnitude of high-minus-low alphas is 0.47%, the mean absolute alpha 0.18%, and the number of GRS rejections 19. The Fama-French and Barillas-Shanken models deliver largely similar performance as the q-factor model. The Daniel-Hirshleifer-Sun model again performs poorly, with the highest average absolute high-minus-low alphas, 0.6%, and the second highest number of high-minus-low alphas with $|t| \geq 1.96$, 16.

From Panel G, with only 3 trading frictions anomalies, the performance of all the models is largely similar, except for the Daniel-Hirshleifer-Sun model, with the highest average magnitude of high-minus-low alphas, 0.5% per month, and the highest mean absolute alpha, 0.18%. The q^5 model leaves 2 high-minus-low alphas with $|t| \geq 1.96$ but 0 with $|t| \geq 3$. The average magnitude of high-minus-low alphas is 0.19%, the mean absolute alpha 0.08%, and the number of GRS rejections 2.

4.2.3 Testing Deciles Formed on Composite Scores

As an alternative way to summarize the overall performance of the factor models, we form composite scores across all the 150 anomalies as well as across each of the 6 categories of anomalies. We then use deciles formed on the composite scores as testing portfolios in factor regressions. Although containing less disaggregated information than Table 6, this approach directly quantifies to what extent a given category (as well as all) of the anomalies can be explained by a given factor model.

For a given set of anomalies, we construct its composite score for a stock by equal-weighting the stock's percentile rankings for the anomalies in question. Because anomalies forecast returns with different signs, we realign the anomalies to yield positive slopes in forecasting returns before forming the composite score. At the beginning of month t, we split stocks into deciles based on the

NYSE breakpoints of the composite score that aggregates a given set of anomalies.[10] We calculate value-weighted decile returns for month t and rebalance the deciles at the beginning of month $t+1$.

Table 7 details the factor regressions. The q^5 model is the overall best performer. With the composite score that aggregates all the 150 anomalies, the high-minus-low decile earns on average 1.69% per month ($t = 9.62$). The high-minus-low alpha is the lowest in the q^5 model, 0.37%, albeit still significant ($t = 2.62$). The high-minus-low decile has economically large and significantly positive loadings on the investment, Roe, and expected growth factors in the q^5 model, 0.57, 0.81, and 0.74 ($t = 6.28$, 8.48, and 7.81), respectively. The mean absolute alpha across all the deciles is also the lowest in the q^5 model, 0.1%, but the model is still rejected by the GRS test ($p = 0.01$). For the q-factor model, the high-minus-low alpha is 0.86% ($t = 5.64$), and the mean absolute alpha 0.16%.

For comparison, the Fama-French 6-factor alpha for the high-minus-low decile is 0.94% per month ($t = 7.46$), and the alternative 6-factor alpha with RMWc is 0.82% ($t = 6.77$). The mean absolute alphas are 0.16% and 0.14%, respectively. Both are rejected by the GRS test ($p = 0.00$).

The high-minus-low composite momentum decile earns on average 1.09% per month ($t = 4.21$). The q^5 model yields a high-minus-low alpha of -0.25% ($t = -0.85$). Both the Roe and expected growth factors contribute to this performance, with economically large and significantly positive loadings of 1.16 and 0.9 ($t = 5.44$ and 4.49), respectively. The mean absolute alpha is 0.1%, and the q^5 model is not rejected by the GRS test ($p = 0.35$). The q-factor model yields a high-minus-low alpha of 0.35% ($t = 1.04$), the mean absolute alpha of 0.1%, and a GRS p-value of 0.08. For comparison, the Fama-French 6-factor model yields a high-minus-low alpha of 0.33% ($t = 2.08$), a mean absolute alpha of 0.09%, and a GRS p-value of 0.06. The alternative 6-factor model with RMWc yields a high-minus-low alpha of 0.29% ($t = 1.82$), a mean absolute alpha of 0.1, and a GRS p-value of 0.04.

The Fama-French 6-factor model does a better job than the q^5 model in explaining the com-

[10] As detailed in the Internet Appendix, some individual anomaly deciles are formed monthly, whereas others are formed annually. When calculating the percentile rankings for a given anomaly at the beginning of month t, we adopt the same sorting frequency as in individual anomaly deciles. The percentile rankings for monthly sorted anomalies are recalculated monthly, and those for annually sorted anomalies are recalculated at the end of each June.

posite value-minus-growth premium, which is on average 0.7% per month ($t = 3.47$). The q^5 model yields a high-minus-low alpha of 0.38% ($t = 2.14$), a mean absolute alpha of 0.16%, and a GRS p-value of 0.00. The q-factor model produces a high-minus-low alpha of 0.28% ($t = 1.48$), a mean absolute alpha of 0.13%, and a GRS p-value of 0.00. For comparison, the 6-factor model produces a high-minus-low alpha of 0.19% ($t = 1.58$) and a mean absolute alpha of 0.1%, but their model is also rejected by the GRS test ($p = 0.00$). The performance of the alternative 6-factor model with RMWc is largely similar. The Fama-French 5-factor model is the best performer in this category, with a tiny high-minus-low alpha of 0.04% ($t = 0.3$), albeit still rejected by the GRS test ($p = 0.00$).

The high-minus-low composite investment decile earns on average 0.66% per month ($t = 4.44$). The q^5 model is the best performer, yielding a tiny high-minus-low alpha of 0.06% ($t = 0.54$), a mean absolute alpha of 0.06%, and a GRS p-value of 0.15. The q-factor model yields a high-minus-low alpha of 0.25% ($t = 2.61$), a mean absolute alpha of 0.1%, and a GRS p-value of 0.00. For comparison, the Fama-French 6-factor model produces a high-minus-low alpha of 0.27% ($t = 2.84$), a mean absolute alpha of 0.07%, and a GRS p-value of 0.01. The performance of the alternative 6-factor model with RMWc is largely similar, except for a GRS p-value of 0.06.

The high-minus-low composite profitability decile earns on average 0.8% per month ($t = 4.64$). The q^5 model performs very well, with a high-minus-low alpha of -0.14% ($t = -1.21$), a mean absolute alpha of 0.08%, and a GRS p-value of 0.09. The q-factor model yields a high-minus-low alpha of 0.28% ($t = 2.31$), a mean absolute alpha of 0.07%, and a GRS p-value of 0.01. For comparison, the Fama-French 6-factor model produces a high-minus-low alpha of 0.43% ($t = 3.94$), a mean absolute alpha of 0.09%, and a GRS p-value of 0.00. The alternative 6-factor model with RMWc improves the high-minus-low alpha to 0.3% ($t = 2.3$), the mean absolute alpha to 0.07%, and the GRS p-value to 0.09. Finally, the Daniel-Hirshleifer-Sun model is comparable with the q^5 model in this category.

The high-minus-low composite intangibles decile earns on average 0.94% per month ($t = 5.27$). The q^5 model yields a high-minus-low alpha of 0.5% ($t = 3.19$), a mean absolute alpha of 0.19%, and a GRS p-value of 0.00. The q-factor model has a slightly lower high-minus-low alpha of 0.42% ($t = 2.62$). The Fama-French 6-factor model has a somewhat larger high-minus-low alpha, 0.54% ($t = 4.25$), but is otherwise comparable with the q^5 model. Finally, the high-minus-low composite frictions decile only earns an insignificant average return of 0.23% ($t = 1.77$).

4.3 Individual Factor Regressions

To dig deeper, we detail individual factor regressions of all the 150 anomalies. Table 8 reports the average return and alphas from different models as well as their t-values adjusted for heteroscedasticity and autocorrelations for each high-minus-low decile. We also tabulate the mean absolute alpha and the GRS p-value testing that the alphas are jointly zero across a given set of deciles for a given factor model. To save space, Table 9 only details the factor loadings for the q^5 model.

4.3.1 Momentum

Columns 1–39 in Table 8 detail the alphas for the 39 momentum anomalies. The high-minus-low deciles on earnings surprises (Sue1), revenue surprises (Rs1), and the number of consecutive quarters with earnings increases (Nei1), all at the 1-month horizon, earn average returns of 0.45%, 0.36%, and 0.33% per month (t = 3.5, 2.64, and 3.07), respectively. Their q-factor alphas are 0.05%, 0.28%, and 0.11% ($t = 0.39, 2.04$, and 1.15), and the q^5 alphas $-0.07\%, 0.12\%$, and -0.01% (t = -0.52, 0.9, and -0.05), respectively. The q-factor model is rejected by the GRS test across any of the three sets of deciles, but the q^5 model is not rejected across any set.

The Fama-French 6-factor alphas for the high-minus-low Sue1, Rs1, and Nei1 deciles are 0.26%, 0.44%, and 0.24% per month ($t = 2.23, 3.34$, and 2.56), and the alternative 6-factor alphas with RMWc 0.22%, 0.41%, and 0.21% (t = 1.84, 3.09, and 2.09), respectively. The Stambaugh-Yuan 4-factor model performs similarly, but the Barillas-Shanken 6-factor model yields somewhat smaller and less significant alphas. However, all these models are rejected by the GRS test.

However, all models including the q and q^5 models fail to explain the anomaly formed on cumulative abnormal returns around earnings announcements, Abr, especially at the 1-month horizon. The high-minus-low decile earns on average 0.73% per month ($t = 5.74$). The q-factor alpha is 0.65% ($t = 4.52$), and the q^5 alpha 0.52% ($t = 3.8$). Similarly, the Fama-French 6-factor alpha is 0.64% ($t = 4.88$), and the alternative 6-factor alpha 0.65% ($t = 4.71$). Because Abr is part of the PEAD factor, the Daniel-Hirshleifer-Sun alpha is the smallest, 0.29% ($t = 2.32$).

Except for the Fama-French 5-factor model, all the models can explain price momentum formed on prior 6-month returns (R^6), prior 11-month returns (R^{11}), prior industry returns (Im), prior 6-month residual returns (ϵ^6), and prior 11-month residual returns (ϵ^{11}). In particular, the Jegadeesh-Titman (1993) high-minus-low decile on prior 6-month returns at the 6-month horizon ($R^6$6) earns on average 0.83% per month ($t = 3.66$). The q-factor alpha is 0.3% ($t = 1.04$), and the q^5 alpha −0.16% ($t = -0.64$). Similarly, the 6-factor alpha is 0.19% ($t = 1.92$), and the alternative 6-factor alpha 0.16% ($t = 1.57$). However, all the models are still rejected by the GRS test across the deciles.

Columns 1–39 in Table 9 detail the factor loadings from the q^5 factor regressions of the 39 winner-minus-loser deciles. The loadings on the expected growth factor, R_{Eg}, are universally positive, and 25 of them are significant with $t \geq 1.96$. Intuitively, winners have higher expected growth rates and earn higher expected returns than losers (Johnson 2001; Liu and Zhang 2008, 2014).

4.3.2 Value-versus-growth

Columns 40–54 in Table 8 detail the alphas for the 15 value-minus-growth anomalies. Surprisingly, the Barillas-Shanken 6-factor model fails to explain several classic value-minus-growth anomalies, including book-to-market (Bm), earnings-to-price (Ep$^{\mathrm{q}}$12), and sales-to-price (Sp). The Barillas-Shanken alphas for these high-minus-low deciles are −0.31%, −0.44%, and −0.46% per month ($t = -2.39$, -3.6, and -3.11), respectively. In contrast, their Fama-French 6-factor alphas are −0.09%, −0.03%, and −0.18% ($t = -0.82$, -0.26, and -1.38), respectively. The q-factor alphas of the high-minus-low Bm, Ep$^{\mathrm{q}}$12, and Sp deciles are 0.11%, −0.07%, and −0.09% ($t = 0.71, -0.44$, and -0.48), and their q^5 alphas 0.05%, −0.04%, and 0.02% ($t = 0.32$, -0.28, and 0.1), respectively.

We find that the UMD loadings in the Barillas-Shanken 6-factor model are large, 0.41, 0.19, and 0.19 (t = 6.84, 3.08, and 3.83), respectively (untabulated). In contrast, the UMD loadings in the Fama-French 6-factor model are small, −0.03, −0.07, and −0.13 ($t = -0.71, -1.71$, and −4.19), respectively. We verify that the correlation between the monthly formed HML^{m} and UMD is high, −0.65, but that between the annually formed HML and UMD is low, only −0.19. The high HML^{m}-UMD correlation pushes up the UMD loadings with HML^{m} in the Barillas-Shanken model, causing it to overshoot the average returns to yield economically large but negative alphas.

Columns 40–54 in Table 9 report the q^5-factor loadings for the 15 value-minus-growth deciles. The expected growth factor loadings are all insignificant except for net payout yield (Nop). For the high-minus-low Nop decile, the q-factor alpha is 0.34% per month ($t = 2.5$), and the q^5 model reduces the alpha to 0.18% ($t = 1.25$). The high-minus-low decile has an expected growth factor loading of 0.24 ($t = 2.32$). As such, high net payout yields signal high expected growth going forward.

Most strikingly, the Daniel-Hirshleifer-Sun 3-factor model fails to explain any of the value-minus-growth anomalies. The high-minus-low Bm decile earns on average 0.43% per month ($t = 2.14$). However, its Daniel-Hirshleifer-Sun alpha is 0.76% ($t = 3.7$). In untabulated results, the FIN factor loading for the high-minus-low decile is positive, 0.53 ($t = 4.34$), going in the right direction in explaining the average return. However, this loading is dominated by the PEAD factor loading of −0.75 ($t = -7.87$), which goes in the wrong direction. Because the PEAD premium is more than twice as large as the FIN premium, their model makes the Bm anomaly worse.[11]

4.3.3 Investment

Columns 55–80 in Table 8 detail the alphas for the 26 investment anomalies. The q^5 model shines in this category, leaving only 1 high-minus-low alpha with $|t| \geq 1.96$. The high-minus-low decile on net operating assets (Noa) has a q-factor alpha of −0.5% per month ($t = -3$). The q^5 alpha

[11] Forming the PEAD factor on Abr only from July 1972 onward does not materially change the results (the Internet Appendix). The Daniel-Hirshleifer-Sun model still fails to explain all of the value-minus-growth anomalies, except for book-to-market. Its high-minus-low decile has a marginally significant alpha of 0.44% per month ($t = 1.96$).

is only -0.15% ($t = -1$). In contrast, all the other models except for the Stambaugh-Yuan model fail to explain the Noa anomaly. The Fama-French 6-factor alpha for the high-minus-low decile is -0.48% ($t = -3.44$), and the Barillas-Shanken alpha -0.63% ($t = -4.43$).

More important, the q^5 model helps explain the accruals anomaly. The high-minus-low decile on operating accruals (Oa) has a large q-factor alpha of -0.57% per month ($t = -4.25$). The q^5 model reduces the alpha to -0.2% ($t = -1.3$). A more challenging anomaly for the q-factor model is discretionary accruals (Dac). The high-minus-low Dac decile has a large q-factor alpha of -0.74% ($t = -5.33$), and the q^5 model shrinks the alpha to -0.31%, albeit still significant ($t = -2.16$). In contrast, the other models all fail to explain the Oa and Dac anomalies. The Fama-French 6-factor alphas for the high-minus-low Oa and Dac deciles are -0.48% ($t = -3.49$) and -0.69% ($t = -5.08$), and the alternative 6-factor alphas -0.32% ($t = -2.13$) and -0.59% ($t = -4.12$), respectively.

The q^5 model also improves on the q-factor model in explaining the dWc (change in net non-cash working capital) and dFin (change in net financial assets) anomalies. The high-minus-low dWc and dFin deciles have significant q-factor alphas of -0.58% per month ($t = -4.38$) and 0.41% ($t = 2.97$), but insignificant q^5 alphas of -0.23% ($t = -1.77$) and 0.14% ($t = 0.97$), respectively. For comparison, the Fama-French 6-factor alphas are -0.51% ($t = -3.93$) and 0.46% ($t = 3.81$), and the alternative 6-factor alphas -0.36% ($t = -2.6$) and 0.34% ($t = 2.63$), respectively.

Columns 55–80 in Table 9 report the q^5 factor loadings for the 26 investment anomalies. The high-minus-low Noa decile has a large loading of -0.53 ($t = -5.1$) on the expected growth factor, R_{Eg}, in the q^5 model. The high-minus-low Oa and Dac deciles have large R_{Eg}-loadings of -0.56 ($t = -5.58$) and -0.64 ($t = -6.02$), respectively. As such, high operating and discretionary accruals indicate low expected growth. Intuitively, given the level of earnings, high accruals mean low cash flows available for financing investments, giving rise to low expected growth. Similarly, the high-minus-low dWc decile has a large R_{Eg}-loading of -0.52 ($t = -5.45$). Intuitively, increases in net noncash working capital signal high past growth but low expected growth. Finally, the high-minus-low dFin decile has a large R_{Eg}-loading of 0.4 ($t = 3.66$). Intuitively, increases in net financial assets provide more internal funds available for investments, stimulating expected growth going forward.

4.3.4 Profitability

Columns 81–120 in Table 8 detail the alphas for the 40 anomalies in the profitability category. The q^5 model again shines, leaving only 5 high-minus-low alphas with $|t| \geq 1.96$ and 1 with $|t| \geq 3$.

The high-minus-low deciles on asset turnover, Ato$^{\text{q}}$, have q-factor alphas of 0.42%, 0.41%, and 0.39% per month, with t-values at least 2.5, across the 1-, 6-, and 12-month horizons, respectively. The q^5 model reduces all the alphas to about 0.15%, with t-values below 0.9. For comparison, the Fama-French 6-factor alphas are 0.44%, 0.42%, and 0.38% ($t = 2.97, 3.08$, and 2.88), and the alternative 6-factor alphas with RMWc 0.4%, 0.37%, and 0.32% ($t = 2.57, 2.51$, and 2.3), respectively.

The high-minus-low deciles on operating profits-to-lagged assets, Ola$^{\text{q}}$, have q-factor alphas of 0.43%, 0.28%, and 0.35% per month ($t = 2.93, 2.11$, and 2.82), but q^5 alphas of $-0.11\%, -0.23\%$, and -0.11% ($t = -0.84, -2.11$, and -1.07) across the 1-, 6-, and 12-month horizons, respectively. All the other models except for the Daniel-Hirshleifer-Sun model fail to explain the Ola$^{\text{q}}$ anomaly. The Fama-French 6-factor alphas are 0.56%, 0.39%, and 0.42% ($t = 3.94, 3.24$, and 3.84), and the alternative 6-factor alphas 0.5%, 0.32%, and 0.35% ($t = 3.05, 2.23$, and 2.69), respectively.

However, we should point out that in two cases, return on equity (Roe) and operating profits-to-lagged book equity (Ole$^{\text{q}}$), at the 6-month horizon, the q^5 model overshoots, yields significantly negative alphas, and underperforms the q-factor model and most of the other models. The high-minus-low Roe6 and Ole$^{\text{q}}$6 deciles have q-factor alphas of -0.18% per month ($t = -1.54$) and -0.17% ($t = -1.21$), but q^5 alphas of -0.33% ($t = -2.93$) and -0.37% ($t = -2.72$), respectively. For comparison, the Fama-French 6-factor alphas are 0.1% ($t = 0.88$) and -0.05% ($t = -0.48$), and the alternative 6-factor alphas 0.02% ($t = 0.14$) and -0.18% ($t = -1.19$), respectively.

Columns 81–120 in Table 9 report the q^5 factor loadings for the 40 profitability anomalies. Most expected growth factor loadings indicate that, sensibly, high profitability firms have higher expected growth than low profitability firms. Out of the 40 loadings, 31 are significant at the 5% level. The high-minus-low Ato^{q} deciles have economically large R_{Eg}-loadings of 0.4, 0.38, and 0.36 ($t = 3.49$, 3.49, and 3.35) across the 1-, 6-, and 12-month horizons, and the high-minus-low Ola^{q} deciles also have large R_{Eg}-loadings of 0.84, 0.79, and 0.72 ($t = 9.14$, 10.39, and 8.73), respectively. These loadings propel the q^5 model to become the best performer in the profitability category.

4.3.5 Intangibles and Trading Frictions

Columns 121–147 in Table 8 detail the alphas for the 27 anomalies in the intangibles category, and the same columns in Table 9 report their high-minus-low loadings in the q^5 model. The q^5 model helps explain the R&D-to-market (Rdm) anomaly. The high-minus-low decile earns a q-factor alpha of 0.81% per month ($t = 3.64$). The q^5 model reduces the alpha to 0.27% ($t = 1.24$) via a large R_{Eg}-loading of 0.84 ($t = 5.37$). Similarly, in monthly sorts, at the 1-, 6-, and 12-month horizons, the high-minus-low Rdm^{q} deciles have q-alphas of 1.41%, 1.02%, and 0.92% ($t = 3.33$, 3.25, and 3.55), but smaller q^5 alphas of 1.05%, 0.58%, and 0.43% ($t = 2.37$, 1.79, and 1.6), respectively. The corresponding R_{Eg}-loadings are 0.55, 0.67, and 0.75 ($t = 2.45, 3.5$, and 4.61), respectively. Intuitively, R&D expenses depress current earnings due to the accounting standards but raise intangible capital that induces future growth opportunities. While the q-factor model misses this economic mechanism, the q^5 model with the expected growth factor incorporates it.

The other models mostly fail to explain the R&D-to-market anomaly. In annual sorts, the high-minus-low Rdm decile has a Fama-French 6-factor alpha of 0.68% per month ($t = 3.24$), an alternative 6-factor alpha of 0.79% ($t = 3.64$), but a Stambaugh-Yuan alpha of 0.39% ($t = 1.79$). In monthly sorts, the high-minus-low Rdm^{q} deciles have 6-factor alphas of 1.36%, 1.01%, and 0.88% ($t = 3.9$, 3.48, and 3.56), alternative 6-factor alphas of 1.37%, 1.06%, and 0.96% ($t = 3.93, 3.71$, and 3.98), and Stambaugh-Yuan alphas of 1.2%, 0.72%, and 0.58% ($t = 3.17, 2.53$, and 2.37).

We should acknowledge that the q^5 model, despite improving on the q-factor model substantially, still leaves 8 high-minus-low alphas with $|t| \geq 1.96$, including 4 with $|t| \geq 3$, in the intangibles category. In particular, three Heston-Sadka (2008) seasonality variables, $R_{\mathrm{a}}^{[2,5]}$, $R_{\mathrm{a}}^{[6,10]}$, and $R_{\mathrm{a}}^{[11,15]}$, have high-minus-low q^5 alphas of 0.84%, 0.91%, and 0.56% per month ($t = 4.11, 4.62$, and 3.27), respectively. The R_{Eg}-loadings of these high-minus-low deciles are all economically small and insignificant. All the other factor models also fail to explain these seasonality anomalies.

Finally, the last 3 columns in Table 8 report the alphas for the anomalies in the trading frictions category, and the same columns in Table 9 show their high-minus-low loadings in the q^5 model. The q^5 model yields an insignificant high-minus-low alpha of 0.18% per month ($t = 1.71$) for the idiosyncratic skewness per the q-factor model (Isq1), whereas all the other models produce significant alphas. However, the q^5 model produces a marginally significant alpha for dollar trading volume (Dtv12), −0.16% ($t = -2.06$), whereas most other models have insignificant alphas.

5 Conclusion

In the multiperiod investment framework, firms with high expected investment growth should earn higher expected returns than firms with low expected investment growth, holding current investment and expected profitability constant. Motivated by this economic insight, we form cross-sectional forecasts and construct an expected growth factor, which yields an average return of 0.84% per month ($t = 10.27$). We augment the q-factor model with the expected growth factor to form the q^5 model. In a largest-to-date set of testing deciles on 150 significant anomalies, the q^5 model is the overall best performing model, improving on the q-factor model substantially. In addition, the q-factor model already compares well with the Fama-French 6-factor model. Finally, the Barillas-Shanken 6-factor model and the Daniel-Hirshleifer-Sun 3-factor model both perform poorly.

We interpret the investment, profitability, and expected growth factors as common factors that summarize a large amount of the cross-sectional variation in average stock returns. On the one hand, we differ from Stambaugh and Yuan (2017) and Daniel, Hirshleifer, and Sun (2019), who view their factors as driven by mispricing. After all, our factors are formed on economic fundamentals motivated from the neoclassical theory of investment, which does not contain any mispricing. On the other hand, our interpretation is weaker than the risk factors interpretation in Fama and French (1993, 1996). We are keenly aware that our empirical results are not inconsistent with mispricing. In particular, Lee and Li (2017) argue that high-investment-low-profitability firms earn abnormally low returns because of their overpricing, not low risks. Future work can shed further light on the economic forces driving the investment, profitability, and expected growth factor premiums.

References

Abarbanell, Jeffery S., and Brian J. Bushee, 1998, Abnormal returns to a fundamental analysis strategy, *The Accounting Review* 73, 19-45.

Abel, Andrew B., and Janice C. Eberly, 2011, How Q and cash flow affect investment without frictions: An analytical explanation, *Review of Economic Studies* 78, 1179–1200.

Alti, Aydogan, 2003, How sensitive is investment to cash flow when financing is frictionless? *Journal of Finance* 58, 707–722.

Anderson, Christopher W., and Luis Garcia-Feijoo, 2006, Empirical evidence on capital investment, growth options, and security returns, *Journal of Finance* 61, 171–194.

Asness, Clifford, and Andrea Frazzini, 2013, The devil in HML's details, *Journal of Portfolio Management* 39, 49–68.

Balakrishnan, Karthik, Eli Bartov, and Lucile Faurel, 2010, Post loss/profit announcement drift, *Journal of Accounting and Economics* 50, 20–41.

Ball, Ray, Joseph Gerakos, Juhani Linnainmaa, and Valeri Nikolaev, 2015, Deflating profitability, *Journal of Financial Economics* 117, 225–248.

Ball, Ray, Joseph Gerakos, Juhani Linnainmaa, and Valeri Nikolaev, 2016, Accruals, cash flows, and operating profitability in the cross section of stock returns, *Journal of Financial Economics* 121, 28–45.

Barbee, William C., Jr., Sandip Mukherji, and Gary A. Raines, 1996, Do sales-price and debt-equity explain stock returns better than book-market and firm size? *Financial Analysts Journal* 52, 56-60.

Barillas, Francisco, and Jay Shanken, 2018, Comparing asset pricing models, *Journal of Finance* 73, 715–754.

Belo, Frederico, and Xiaoji Lin, 2011, The inventory growth spread, *Review of Financial Studies* 25, 278–313.

Blitz, David, Joop Huij, and Martin Martens, 2011, Residual momentum, *Journal of Empirical Finance* 18, 506–521.

Boudoukh, Jacob, Roni Michaely, Matthew Richardson, and Michael R. Roberts, 2007, On the importance of measuring payout yield: Implications for empirical asset pricing, *Journal of Finance* 62, 877–915.

Campbell, John Y., Jens Hilscher, and Jan Szilagyi, 2008, In search of distress risk, *Journal of Finance* 63, 2899–2939.

Carhart, Mark M. 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57–82.

Chan, Louis K. C., Jason Karceski, and Josef Lakonishok, 2003, The level and persistence of growth rates, *Journal of Finance* 58, 643-684.

Chan, Louis K. C., Narasimhan Jegadeesh, and Josef Lakonishok, 1996, Momentum strategies, *Journal of Finance* 51, 1681–1713.

Chan, Louis K. C., Josef Lakonishok, and Theodore Sougiannis, 2001, The stock market valuation of research and development expenditures, *Journal of Finance* 56, 2431–2456.

Cochrane, John H., 1991, Production-based asset pricing and the link between stock returns and economic fluctuations, *Journal of Finance* 46, 209–237.

Cochrane, John H., 2011, Presidential address: Discount rates, *Journal of Finance* 66, 1047–1108.

Cohen, Lauren, and Andrea Frazzini, 2008, Economic links and predictable returns, *Journal of Finance* 63, 1977–2011.

Cohen, Lauren, and Dong Lou, 2012, Complicated firms, *Journal of Financial Economics* 104, 383–400.

Cooper, Michael J., Huseyin Gulen, and Michael J. Schill, 2008, Asset growth and the cross-section of stock returns, *Journal of Finance* 63, 1609–1652.

Daniel, Kent D., David Hirshleifer, and Lin Sun, 2019, Short- and long-horizon behavioral factors, forthcoming, *Review of Financial Studies.*

Desai, Hemang, Shivaram Rajgopal, and Mohan Venkatachalam, 2004, Value-glamour and accruals mispricing: One anomaly or two? *The Accounting Review* 79, 355–385.

Eisfeldt, Andrea L., and Dimitris Papanikolaou, 2013, Organizational capital and the cross-section of expected returns, *Journal of Finance* 68, 1365–1406.

Erickson, Timothy, and Toni M. Whited, 2000, Measurement error and the relationship between investment and q, *Journal of Political Economy* 108, 1027–1057.

Fairfield, Patricia M., J. Scott Whisenant, and Teri Lombardi Yohn, 2003, Accrued earnings and growth: Implications for future profitability and market mispricing, *The Accounting Review* 78, 353–371.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

Fama, Eugene F., and Kenneth R. French, 1996, Multifactor explanation of asset pricing anomalies, *Journal of Finance* 51, 55–84.

Fama, Eugene F., and Kenneth R. French, 2015, A five-factor asset pricing model, *Journal of Financial Economics* 116, 1–22.

Fama, Eugene F., and Kenneth R. French, 2018, Choosing factors, *Journal of Financial Economics* 128, 234–252.

Fama, Eugene F., and James D. MacBeth, 1973, Risk return, and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607–636.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers of Economic Activity* 1, 141–195.

Foster, George, Chris Olsen, and Terry Shevlin, 1984, Earnings releases, anomalies, and the behavior of security returns, *The Accounting Review* 59, 574–603.

George, Thomas J., and Chuan-Yang Hwang, 2004, The 52-week high and momentum investing, *Journal of Finance* 58, 2145–2176.

George, Thomas J., Chuan-Yang Hwang, and Yuan Li, 2018, The 52-week high, q-theory, and the cross section of stock returns, *Journal of Financial Economics* 128, 148–163.

Gibbons, Michael R., Stephen A. Ross, and Jay Shanken, 1989, A test of the efficiency of a given portfolio, *Econometrica* 57, 1121–1152.

Gilchrist, Simon, and Charles P. Himmelberg, 1995, Evidence on the role of cash flow for investment, *Journal of Monetary Economics* 36, 541-572.

Gomes, Joao F., 2001, Financing investment, *American Economic Review* 91, 1263–1285.

Goncalves, Andrei S., Chen Xue, and Lu Zhang, 2019, Aggregation, capital heterogeneity, and the investment CAPM, working paper, The Ohio State University.

Hafzalla, Nader, Russell Lundholm, and E. Matthew Van Winkle, 2011, Percent accruals, *The Accounting Review* 86, 209–236.

Hastie, Trevor, Robert Tibshirani, and Jerome Friedman, 2009, *The Elements of Statistical Learning: Data Mining, Inference, and Prediction* 2nd Ed., Springer.

Hawkins, Eugene H., Stanley C. Chamberlin, and Wayne E. Daniel, 1984, Earnings expectations and security prices, *Financial Analysts Journal* 40, 24–38.

Hayashi, Fumio, 1982, Tobin's marginal q and average q: A neoclassical interpretation, *Econometrica* 50, 213–224.

Heston Steven L., and Ronnie Sadka, 2008, Seasonality in the cross-section of stock returns, *Journal of Financial Economics* 87, 418–445.

Hirshleifer, David, Kewei Hou, Siew Hong Teoh, and Yinglei Zhang, 2004, Do investors overvalue firms with bloated balance sheets? *Journal of Accounting and Economics* 38, 297–331.

Hou, Kewei, 2007, Industry information diffusion and the lead-lag effect in stock returns, *Review of Financial Studies* 20, 1113–1138.

Hou, Kewei, Haitao Mo, Chen Xue, and Lu Zhang, 2019, Which factors? *Review of Finance* 23, 1–35.

Hou, Kewei, and David T. Robinson, 2006, Industry concentration and average stock returns, *Journal of Finance* 61, 1927–1956.

Hou, Kewei, Chen Xue, and Lu Zhang, 2015, Digesting anomalies: An investment approach, *Review of Financial Studies* 28, 650–705.

Hou, Kewei, Chen Xue, and Lu Zhang, 2019, Replicating anomalies, forthcoming, *Review of Financial Studies*.

Jegadeesh, Narasimhan and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65–91.

Jegadeesh, Narasimhan, and Joshua Livnat, 2006, Revenue surprises and stock returns, *Journal of Accounting and Economics* 41, 147–171.

Johnson, Timothy C., 2001, Rational momentum effects, *Journal of Finance* 57, 585–608.

Kaplan, Steven N., and Luigi Zingales, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints? *Quarterly Journal of Economics* 112, 169-215.

Keynes, John Maynard, 1936, *The General Theory of Employment, Interest, and Money*, New York: Harcourt Brace Jovanovich.

Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny, 1994, Contrarian investment, extrapolation, and risk, *Journal of Finance* 49, 1541–1578.

Lee, Charles M. C., and Ken Li, 2017, Salient or safe: Why do predicted stock issuers earn low returns? working paper, Stanford University.

Lev, Baruch, and Feng Gu, 2016, *The End of Accounting and the Path Forward for Investors and Managers*, John Wiley & Sons, Inc., Hoboken, New Jersey.

Li, Jun, and Huijun Wang, 2017, Expected investment growth and the cross section of stock returns, working paper, University of Texas at Dallas.

Liu, Laura Xiaolei, Toni M. Whited, and Lu Zhang, 2009, Investment-based expected stock returns, *Journal of Political Economy* 117, 1105–1139.

Liu, Laura Xiaolei, and Lu Zhang, 2008, Momentum profits, factor pricing, and macroeconomic risk, *Review of Financial Studies* 21, 2417–2448.

Liu, Laura Xiaolei, and Lu Zhang, 2014, A neoclassical interpretation of momentum, *Journal of Monetary Economics* 67, 109–128.

Loughran, Tim, and Jay W. Wellman, 2011, New evidence on the relation between the enterprise multiple and average stock returns, *Journal of Financial and Quantitative Analysis* 46, 1629–1650.

Lucas, Robert E., Jr., and Edward C. Prescott, 1971, Investment under uncertainty, *Econometrica* 39, 659–681.

Lyandres, Evgeny, Le Sun, and Lu Zhang, 2008, The new issues puzzle: Testing the investment-based explanation, *Review of Financial Studies* 21, 2825–2855.

MacKinlay, A. Craig, 1995, Multifactor models do not explain deviations from the CAPM, *Journal of Financial Economics* 38, 3–28.

Menzly, Lior, and Oguzhan Ozbas, 2010, Market segmentation and cross-predictability of returns, *Journal of Finance* 65, 1555–1580.

Moskowitz, Tobias J., and Mark Grinblatt, 1999, Do industries explain momentum? *Journal of Finance* 54 1249–1290.

Mussa, Michael L., 1977, External and internal adjustment costs and the theory of aggregate and firm investment, *Economica* 44, 163-178.

Novy-Marx, Robert, 2011, Operating leverage, *Review of Finance* 15, 103–134.

Novy-Marx, Robert, 2013, The other side of value: The gross profitability premium, *Journal of Financial Economics* 108, 1–28.

Novy-Marx, Robert, 2015, How can a q-theoretic model price momentum? NBER working paper no. 20985.

Penman, Stephen H., Scott A. Richardson, and Irem Tuna, 2007, The book-to-price effect in stock returns: Accounting for leverage, *Journal of Accounting Research* 45, 427–467.

Penman, Stephen H., and Julie Lei Zhu, 2014, Accounting anomalies, risk, and return, *The Accounting Review* 89, 1835–1866.

Pontiff, Jeffrey, and Artemiza Woodgate, 2008, Share issuance and cross-sectional returns, *Journal of Finance* 63, 921–945.

Restoy, Fernando, and G. Michael Rockinger, 1994, On stock market returns and returns on investment, *Journal of Finance* 49, 543–556.

Richardson, Scott A., Richard G. Sloan, Mark T. Soliman, and Irem Tuna, 2005, Accrual reliability, earnings persistence and stock prices, *Journal of Accounting and Economics* 39, 437–485.

Rosenberg, Barr, Kenneth Reid, and Ronald Lanstein, 1985, Persuasive evidence of market inefficiency, *Journal of Portfolio Management* 11, 9–16.

Sloan, Richard G., 1996, Do stock prices fully reflect information in accruals and cash flows about future earnings? *The Accounting Review* 71, 289–315.

Stambaugh, Robert F., and Yu Yuan, 2017, Mispricing factors, *Review of Financial Studies* 30, 1270–1315.

Thomas, Jacob K., and Huai Zhang, 2002, Inventory changes and future returns, *Review of Accounting Studies* 7, 163–187.

Tobin, James, 1969, A general equilibrium approach to monetary theory, *Journal of Money, Credit, and Banking* 1, 15–29.

Tuzel, Selale, 2010, Corporate real estate holdings and the cross-section of stock returns, *Review of Financial Studies* 23, 2268–2302.

Watts, Ross L., 2003a, Conservatism in accounting Part I: Explanations and implications, *Accounting Horizons* 17, 207–221.

Watts, Ross L., 2003b, Conservatism in accounting Part II: Evidence and research opportunities, *Accounting Horizons* 17, 287–301.

Xie, Hong, 2001, The mispricing of abnormal accruals, *The Accounting Review* 76, 357–373.

Xing, Yuhang, 2008, Interpreting the value effect through the Q-theory: An empirical investigation, *Review of Financial Studies* 21, 1767–1795.

Table 1 : Monthly Cross-sectional Regressions of Future Investment-to-assets Changes, July 1963–December 2018, 666 Months

For each month, we perform cross-sectional regressions of future τ-year-ahead investment-to-assets changes, $\mathrm{d}^\tau\mathrm{I/A}$, in which $\tau = 1, 2, 3$, on the log of Tobin's q, $\log(q)$, cash flows, Cop, the change in return on equity, dRoe, as well as on all the three regressors. Current investment-to-assets is from the most recent fiscal year ending at least four months ago, and $\mathrm{d}^\tau\mathrm{I/A}$ is investment-to-assets from the subsequent τ-year-ahead fiscal year end minus the current investment-to-assets. The cross-sectional regressions are estimated via weighted least squares with the market equity as weights. We winsorize each variable each month at the 1–99% level. We report the average slopes, the t-values adjusted for heteroscedasticity and autocorrelations (in parentheses), and goodness-of-fit coefficients (R^2, in percent). At the beginning of each month t, we calculate the expected I/A changes, $E_t[\mathrm{d}^\tau\mathrm{I/A}]$, by combining the most recent winsorized predictors with the average cross-sectional slopes. The most recent predictors, $\log(q)$ and Cop, are from the most recent fiscal year ending at least four months ago as of month t, and dRoe is based on the latest announced earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago. The average slopes in calculating $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ are from the prior 120-month rolling window (30 months minimum), in which the dependent variable, $\mathrm{d}^\tau\mathrm{I/A}$, uses data from the fiscal year ending at least four months ago as of month t, and the regressors are further lagged accordingly. For instance, for $\tau = 1$, the regressors used in the latest monthly cross-sectional regression are further lagged by 12 months relative to the most recent predictors used in calculating $E_t[\mathrm{d}^1\mathrm{I/A}]$. We report time-series averages of cross-sectional Pearson and rank correlations between $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ calculated at the beginning of month t and the realized τ-year-ahead investment-to-assets changes. The p-values testing that a given correlation is zero are in brackets.

	Panel A: $\log(q)$				Panel B: Cop			
τ	$\log(q)$	R^2	Pearson	Rank	Cop	R^2	Pearson	Rank
1	0.021	1.00	0.016	0.004	0.418	3.04	0.138	0.176
	(5.12)		[0.00]	[0.33]	(13.38)		[0.00]	[0.00]
2	−0.005	1.09	0.027	0.037	0.457	3.99	0.127	0.153
	(−0.95)		[0.00]	[0.00]	(12.09)		[0.00]	[0.00]
3	−0.019	1.14	0.085	0.098	0.436	3.88	0.115	0.131
	(−3.81)		[0.00]	[0.00]	(10.49)		[0.00]	[0.00]

	Panel C: dRoe				Panel D: $\log(q)$, Cop, and dRoe					
τ	dRoe	R^2	Pearson	Rank	$\log(q)$	Cop	dRoe	R^2	Pearson	Rank
1	0.795	2.18	0.068	0.131	−0.029	0.516	0.771	6.42	0.135	0.208
	(7.85)		[0.00]	[0.00]	(−5.63)	(12.75)	(7.62)		[0.00]	[0.00]
2	0.949	1.97	0.068	0.155	−0.073	0.699	0.907	8.61	0.148	0.220
	(9.82)		[0.00]	[0.00]	(−9.76)	(12.34)	(10.07)		[0.00]	[0.00]
3	0.746	1.54	0.055	0.130	−0.093	0.745	0.717	8.98	0.154	0.218
	(8.50)		[0.00]	[0.00]	(−12.39)	(12.17)	(8.60)		[0.00]	[0.00]

Table 2 : Properties of the Expected Growth Deciles, January 1967–December 2018, 624 Months

We use the log of Tobin's q, $\log(q)$, cash flow, Cop, and the change in return on equity, dRoe, to form the expected investment-to-assets changes, $E_t[\mathrm{d}^\tau\mathrm{I/A}]$, with τ ranging from 1 to 3 years. At the beginning of each month t, we calculate $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ by combining the three most recent predictors (winsorized at the 1–99% level) with the average slopes. The most recent predictors, $\log(q)$ and Cop, are from the most recent fiscal year ending at least four months ago as of month t, and dRoe uses the latest announced earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago. The average slopes in calculating $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ are from the prior 120-month rolling window (30 months minimum), in which the dependent variable, $\mathrm{d}^\tau\mathrm{I/A}$, uses data from the fiscal year ending at least four months ago as of month t, and the regressors are further lagged accordingly. For instance, for $\tau = 1$, the regressors used in the latest monthly cross-sectional regression are further lagged by 12 months relative to the most recent predictors used in calculating $E_t[\mathrm{d}^1\mathrm{I/A}]$. Cross-sectional regressions are estimated via weighted least squares with the market equity as weights. At the beginning of each month t, we sort all stocks into deciles based on the NYSE breakpoints of the ranked $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ values, and compute value-weighted decile returns for the current month t. The deciles are rebalanced at the beginning of month $t+1$. For each decile and the high-minus-low decile, we report the average excess return, $\overline{R}$, the q-factor alpha, α_q, the expected investment-to-assets changes, $E_t[\mathrm{d}^\tau\mathrm{I/A}]$, and the average future realized changes, $\mathrm{d}^\tau\mathrm{I/A}$, and their heteroscedasticity-and-autocorrelation-adjusted t-statistics (beneath the corresponding estimates). $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ and $\mathrm{d}^\tau\mathrm{I/A}$ are value-weighted.

τ	Low	2	3	4	5	6	7	8	9	High	H−L
					Panel A: Average excess returns, $\overline{R}$						
1	−0.12	0.20	0.28	0.42	0.45	0.49	0.56	0.64	0.77	0.95	1.07
	−0.40	0.84	1.21	2.00	2.36	2.61	3.00	3.54	4.17	4.69	6.48
2	−0.09	0.23	0.23	0.37	0.44	0.60	0.62	0.80	0.70	1.08	1.17
	−0.33	0.98	1.07	1.79	2.29	3.36	3.50	4.23	3.61	5.10	7.14
3	−0.08	0.20	0.30	0.39	0.53	0.51	0.74	0.68	0.81	1.11	1.19
	−0.29	0.90	1.41	1.92	2.82	2.79	3.86	3.39	4.19	5.20	7.13
					Panel B: The q-factor alphas, α_q						
1	−0.42	−0.35	−0.23	−0.14	−0.15	−0.02	0.08	0.17	0.29	0.43	0.86
	−4.09	−3.45	−2.28	−1.58	−1.80	−0.28	1.05	1.64	3.54	4.31	6.19
2	−0.36	−0.19	−0.17	−0.19	−0.13	0.06	0.01	0.17	0.29	0.58	0.93
	−3.78	−2.43	−1.81	−2.88	−1.81	0.68	0.19	1.88	3.02	4.16	5.53
3	−0.40	−0.16	−0.21	−0.23	−0.02	−0.11	0.17	0.19	0.30	0.61	1.01
	−4.14	−1.84	−2.49	−3.00	−0.21	−1.21	1.88	1.98	3.02	4.40	6.01
					Panel C: The expected growth, $E_t[\mathrm{d}^\tau\mathrm{I/A}]$						
1	−15.21	−7.67	−5.61	−4.20	−3.03	−1.97	−0.86	0.47	2.52	7.65	22.87
	−36.75	−31.37	−25.19	−20.56	−15.96	−11.01	−5.08	3.01	16.53	37.98	45.21
2	−19.87	−10.18	−7.38	−5.52	−4.03	−2.67	−1.23	0.51	3.13	9.44	29.31
	−34.26	−26.34	−21.16	−16.88	−12.97	−8.94	−4.22	1.81	11.30	29.57	45.51
3	−20.42	−11.16	−8.26	−6.33	−4.75	−3.31	−1.77	0.03	2.66	9.06	29.48
	−30.59	−23.07	−18.58	−15.04	−11.80	−8.51	−4.70	0.10	7.67	24.92	44.17
					Panel D: Average future realized growth, $\mathrm{d}^\tau\mathrm{I/A}$						
1	−16.69	−12.30	−4.11	−3.56	−1.10	−0.43	−0.32	0.64	1.57	5.96	22.65
	−11.71	−8.36	−7.15	−5.22	−2.24	−0.90	−0.71	1.18	3.59	9.07	14.72
2	−23.68	−12.64	−6.45	−3.74	−2.25	−1.44	0.10	1.47	1.25	3.14	26.82
	−14.38	−12.42	−8.44	−4.60	−3.86	−2.43	0.22	2.72	2.33	4.93	16.10
3	−23.10	−12.91	−7.00	−3.20	−2.29	−2.90	−1.44	−0.50	0.46	1.31	24.41
	−14.70	−13.87	−9.51	−4.72	−3.79	−4.68	−2.96	−0.91	0.76	1.85	15.18

Table 3 : Properties of the Expected Growth Factor, R_{Eg}, January 1967–December 2018, 624 Months

The log of Tobin's q, $\log(q)$, cash flows, Cop, and change in return on equity, dRoe, are used to form the expected 1-year-ahead investment-to-assets changes, $E_t[\mathrm{d}^1\mathrm{I/A}]$. At the beginning of month t, $E_t[\mathrm{d}^1\mathrm{I/A}]$ combines the most recent predictors (winsorized at the 1–99% level) with average Fama-MacBeth slopes. The most recent $\log(q)$ and Cop are from the most recent fiscal year ending at least four months ago as of month t, and dRoe uses the latest announced earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago. The average slopes in calculating $E_t[\mathrm{d}^\tau\mathrm{I/A}]$ are from the prior 120-month rolling window (30 months minimum), in which the dependent variable, $\mathrm{d}^1\mathrm{I/A}$, uses data from the fiscal year ending at least four months ago as of month t, and the regressors are further lagged. The regressions are estimated via weighted least squares with the market equity as weights. At the beginning of each month t, we use the median NYSE market equity to split stocks into two groups, small and big, based on the beginning-of-month market equity. Independently, we sort all stocks into three $E_t[\mathrm{d}^1\mathrm{I/A}]$ groups, low, median, and high, based on the NYSE breakpoints for the low 30%, middle 40%, and high 30% of its ranked values at the beginning of month t. Taking the intersections, we form six portfolios. We calculate value-weighted portfolio returns for the current month t, and rebalance the portfolios at the beginning of month $t+1$. The expected growth factor, R_{Eg}, is the difference (high-minus-low), each month, between the simple average of the returns on the two high $E_t[\mathrm{d}^1\mathrm{I/A}]$ portfolios and the simple average of the returns on the two low $E_t[\mathrm{d}^1\mathrm{I/A}]$ portfolios. Panel A reports properties of the six size-$E_t[\mathrm{d}^1\mathrm{I/A}]$ portfolios, including value-weighted average excess returns, $\overline{R}$, their t-values, $t_{\overline{R}}$, the volatilities of portfolio excess returns, σ_R, the simple average of the beginning-of-month market equity in billions of dollars, the average number of stocks, the average beginning-of-month market equity as a percentage of total market equity, as well as the value-weighted averages of the expected 1-year-ahead investment-to-assets change, $E_t[\mathrm{d}^1\mathrm{I/A}]$, the realized 1-year-ahead investment-to-assets change, $\mathrm{d}^1\mathrm{I/A}$, the log of Tobin's q, $\log(q)$, and operating cash flows-to-assets, Cop, from the fiscal year ending at least four months ago as of month t, and the change in return on equity, dRoe, calculated with the latest announced earnings, and if not available, earnings from the fiscal quarter ending at least four months ago. Panel B reports for the expected growth factor, R_{Eg}, its average return, $\overline{R}_{\mathrm{Eg}}$, and alphas, factor loadings, and R^2s from the q-factor model, and the q-factor model augmented with an $\log(q)$ factor, a Cop factor, and a dRoe factor, separately or jointly. The t-values adjusted for heteroscedasticity and autocorrelations are in parentheses. To form the $\log(q)$ and Cop factors, at the end of June of year t, we use the median NYSE market equity to split stocks into two groups, small and big. Independently, we split stocks into three $\log(q)$ groups, low, median, and high, based on the NYSE breakpoints for the low 30%, middle 40%, and high 30% of its ranked values from the fiscal year ending in calendar year $t-1$. Taking the intersections, we form six portfolios. We calculate monthly value-weighted portfolio returns from July of year t to June of $t+1$, and rebalance the portfolios at the end of June of year $t+1$. The $\log(q)$ factor, $R_{\log(q)}$, is the difference (low-minus-high), each month, between the simple average of the returns on the two low $\log(q)$ portfolios and the simple average of the returns on the two high $\log(q)$ portfolios. The (high-minus-low) Cop factor, R_{Cop}, is constructed analogously. To form the dRoe factor, at the beginning of each month t, we use the median NYSE market equity to split stocks into two groups, small and big, based on the beginning-of-month market equity. Independently, we sort stocks into three dRoe groups, low, median, and high, based on the NYSE breakpoints for the low 30%, middle 40%, and high 30% of its ranked values at the beginning of month t. dRoe is calculated with the latest announced earnings, and if not available, with the earnings from the fiscal quarter ending at least four months ago. Taking the intersections, we form six portfolios. We calculate monthly value-weighted portfolio returns for the current month t, and rebalance the portfolios monthly. The dRoe factor, R_{dRoe}, is the difference (high-minus-low), each month, between the simple average of the returns on the two high dRoe portfolios and the simple average of the returns on the two low dRoe portfolios. Finally, Panel C reports the correlations of the expected growth factor, R_{Eg}, with the q-factors, as well as the $\log(q)$, Cop, and dRoe factors.

Panel A: Properties of the six size-expected growth benchmark portfolios

	Low	Median	High	Low	Median	High	Low	Median	High
	$\overline{R}$			$t_{\overline{R}}$			σ_R		
Small	0.22	0.90	1.31	0.71	3.42	4.94	7.04	6.01	6.17
Big	0.17	0.43	0.75	0.72	2.42	4.17	5.51	4.41	4.49
	Average size			# Stocks on average			% Total market cap		
Small	0.15	0.24	0.24	968	618	572	2.51	2.42	2.09
Big	5.05	7.03	10.01	141	233	206	12.19	28.35	33.91
	$E_t[\text{d}^1\text{I/A}]$			$\text{d}^1\text{I/A}$			$\log(q)$		
Small	−11.36	−2.57	4.35	−11.24	0.11	5.51	0.23	0.08	0.24
Big	−8.51	−2.31	3.85	−10.23	−1.44	2.73	0.34	0.33	0.62
	Cop			dRoe					
Small	4.26	14.57	24.33	−2.43	−0.14	1.26			
Big	9.74	17.32	28.14	−2.07	−0.21	0.75			

Panel B: Properties of the expected growth factor, R_{Eg}

$\overline{R}_{\text{Eg}}$	α	β_{Mkt}	β_{Me}	$\beta_{\text{I/A}}$	β_{Roe}	R^2			
0.84	0.67	−0.11	−0.09	0.21	0.30	0.44			
(10.27)	(9.75)	(−6.38)	(−3.56)	(4.86)	(9.13)				
	α	β_{Mkt}	β_{Me}	$\beta_{\text{I/A}}$	β_{Roe}	$\beta_{\log(q)}$	R^2		
	0.67	−0.11	−0.09	0.23	0.30	−0.02	0.44		
	(9.80)	(−6.40)	(−3.61)	(4.72)	(8.83)	(−0.48)			
	α	β_{Mkt}	β_{Me}	$\beta_{\text{I/A}}$	β_{Roe}	β_{Cop}	R^2		
	0.37	−0.02	−0.02	0.31	0.14	0.60	0.65		
	(6.35)	(−1.66)	(−0.54)	(9.51)	(4.37)	(10.63)			
	α	β_{Mkt}	β_{Me}	$\beta_{\text{I/A}}$	β_{Roe}	β_{dRoe}	R^2		
	0.63	−0.11	−0.10	0.18	0.23	0.16	0.46		
	(8.56)	(−6.62)	(−3.93)	(3.57)	(5.00)	(2.41)			
	α	β_{Mkt}	β_{Me}	$\beta_{\text{I/A}}$	β_{Roe}	β_{Cop}	β_{dRoe}	R^2	
	0.33	−0.03	−0.02	0.28	0.07	0.60	0.15	0.66	
	(5.20)	(−1.88)	(−0.72)	(6.73)	(1.72)	(10.02)	(2.33)		
	α	β_{Mkt}	β_{Me}	$\beta_{\text{I/A}}$	β_{Roe}	$\beta_{\log(q)}$	β_{Cop}	β_{dRoe}	R^2
	0.25	−0.01	−0.01	0.06	0.04	0.22	0.72	0.21	0.70
	(4.04)	(−0.86)	(−0.35)	(1.31)	(1.27)	(8.36)	(14.61)	(3.19)	

Panel C: Correlations of R_{Eg} with other factors

R_{Mkt}	R_{Me}	$R_{\text{I/A}}$	R_{Roe}	$R_{\log(q)}$	R_{Cop}	R_{dRoe}
−0.458	−0.367	0.342	0.506	0.188	0.710	0.423

Table 4 : The List of Significant Anomalies To Be Explained

The 150 anomalies (significant with NYSE breakpoints and value-weighted returns) are grouped into six categories: (i) momentum; (ii) value-versus-growth; (iii) investment; (iv) profitability; (v) intangibles; and (vi) trading frictions. The number in parenthesis in the title of a panel is the number of anomalies in that category. For each anomaly variable, we list its symbol, brief description, and its academic source.

Panel A: Momentum (39)			
Sue1	Earnings surprise (1-month period), Foster, Olsen, and Shevlin (1984)	Abr1	Cumulative abnormal returns around earnings announcements (1-month period), Chan, Jegadeesh, and Lakonishok (1996)
Abr6	Cumulative abnormal returns around earnings announcements (6-month period), Chan, Jegadeesh, and Lakonishok (1996)	Abr12	Cumulative abnormal returns around earnings announcements (12-month period), Chan, Jegadeesh, and Lakonishok (1996)
Re1	Revisions in analysts' forecasts (1-month period), Chan, Jegadeesh, and Lakonishok (1996)	Re6	Revisions in analysts' forecasts (6-month period), Chan, Jegadeesh, and Lakonishok (1996)
$R^6 1$	Price momentum (6-month prior returns, 1-month period), Jegadeesh and Titman (1993)	$R^6 6$	Price momentum (6-month prior returns, 6-month period), Jegadeesh and Titman (1993)
$R^6 12$	Price momentum (6-month prior returns, 12-month period), Jegadeesh and Titman (1993)	$R^{11} 1$	Price momentum (11-month prior returns, 1-month period), Fama and French (1996)
$R^{11} 6$	Price momentum, (11-month prior returns, 6-month period), Fama and French (1996)	$R^{11} 12$	Price momentum, (11-month prior returns, 12-month period), Fama and French (1996)
Im1	Industry momentum (1-month period), Moskowitz and Grinblatt (1999)	Im6	Industry momentum (6-month period), Moskowitz and Grinblatt (1999)
Im12	Industry momentum (12-month period), Moskowitz and Grinblatt (1999)	Rs1	Revenue surprise (1-month period), Jegadeesh and Livnat (2006)
dEf1	Analysts' forecast change (1-month period), Hawkins, Chamberlin, and Daniel (1984)	dEf6	Analysts' forecast change (6-month period), Hawkins, Chamberlin, and Daniel (1984)
dEf12	Analysts' forecast change (12-month period), Hawkins, Chamberlin, and Daniel (1984)	Nei1	# of consecutive quarters with earnings increases (1-month period), Barth, Elliott, and Finn (1999)
52w6	52-week high (6-month period), George and Hwang (2004)	52w12	52-week high (12-month period), George and Hwang (2004)
$\epsilon^6 6$	6-month residual momentum (6-month period), Blitz, Huij, and Martens (2011)	$\epsilon^6 12$	6-month residual momentum (12-month period), Blitz, Huij, and Martens (2011)
$\epsilon^{11} 1$	11-month residual momentum (1-month period), Blitz, Huij, and Martens (2011)	$\epsilon^{11} 6$	11-month residual momentum (6-month period), Blitz, Huij, and Martens (2011)
$\epsilon^{11} 12$	11-month residual momentum (12-month period), Blitz, Huij, and Martens (2011)	Sm1	Segment momentum (1-month period), Cohen and Lou (2012)
Sm12	Segment momentum (12-month period), Cohen and Lou (2012)	Ilr1	Industry lead-lag effect in prior returns (1-month period), Hou (2007)

Ilr6	Industry lead-lag effect in prior returns (6-month period), Hou (2007)	Ilr12	Industry lead-lag effect in prior returns (12-month period), Hou (2007)
Ile1	Industry lead-lag effect in earnings news (1-month period), Hou (2007)	Cm1	Customer momentum (1-month period), Cohen and Frazzini (2008)
Cm12	Customer momentum (12-month period), Cohen and Frazzini (2008)	Sim1	Supplier industries momentum (1-month period), Menzly and Ozbas (2010)
Cim1	Customer industries momentum (1-month period), Menzly and Ozbas (2010)	Cim6	Customer industries momentum (6-month period), Menzly and Ozbas (2010)
Cim12	Customer industries momentum (12-month period), Menzly and Ozbas (2010)		

Panel B: Value-versus-growth (15)

Bm	Book-to-market equity, Rosenberg, Reid, and Lanstein (1985)	$\text{Ep}^{q}1$	Quarterly earnings-to-price (1-month period)
$\text{Ep}^{q}6$	Quarterly earnings-to-price (6-month period)	$\text{Ep}^{q}12$	Quarterly earnings-to-price (12-month period)
$\text{Cp}^{q}1$	Quarterly Cash flow-to-price (1-month period)	$\text{Cp}^{q}6$	Quarterly Cash flow-to-price (6-month period)
Nop	Net payout yield, Boudoukh et al. (2007)	Em	Enterprise multiple, Loughran and Wellman (2011)
$\text{Em}^{q}1$	Quarterly enterprise multiple (1-month period)	Sp	Sales-to-price, Barbee, Mukherji, and Raines (1996)
$\text{Sp}^{q}1$	Quarterly sales-to-price (1-month period)	$\text{Sp}^{q}6$	Quarterly sales-to-price (6-month period)
$\text{Sp}^{q}12$	Quarterly sales-to-price (12-month period)	Ocp	Operating cash flow-to-price, Desai, Rajgopal, and Venkatachalam (2004)
$\text{Ocp}^{q}1$	Quarterly operating cash flow-to-price (1-month period)		

Panel C: Investment (26)

Ia	Investment-to-assets, Cooper, Gulen, and Schill (2008)	$\text{Ia}^{q}6$	Quarterly investment-to-assets (6-month period)
$\text{Ia}^{q}12$	Quarterly investment-to-assets (12-month period)	dPia	(Changes in PPE and inventory)/assets, Lyandres, Sun, and Zhang (2008)
Noa	Net operating assets, Hirshleifer et al. (2004)	dNoa	Changes in net operating assets, Hirshleifer et al. (2004)
dLno	Change in long-term net operating assets, Fairfield, Whisenant, and Yohn (2003)	Ig	Investment growth, Xing (2008)
2Ig	Two-year investment growth, Anderson and Garcia-Feijoo (2006)	Nsi	Net stock issues, Pontiff and Woodgate (2008)
dIi	% change in investment−% change in industry investment, Abarbanell and Bushee (1998)	Cei	Composite equity issuance, Daniel and Titman (2006)
Ivg	Inventory growth, Belo and Lin (2011)	Ivc	Inventory changes, Thomas and Zhang (2002)
Oa	Operating accruals, Sloan (1996)	dWc	Change in net non-cash working capital, Richardson et al. (2005)
dCoa	Change in current operating assets, Richardson et al. (2005)	dNco	Change in net non-current operating assets, Richardson et al. (2005)
dNca	Change in non-current operating assets, Richardson et al. (2005)	dFin	Change in net financial assets, Richardson et al. (2005)
dFnl	Change in financial liabilities, Richardson et al. (2005)	dBe	Change in common equity, Richardson et al. (2005)

Dac	Discretionary accruals, Xie (2001)	Poa	Percent operating accruals, Hafzalla, Lundholm, and Van Winkle (2011)
Pta	Percent total accruals, Hafzalla, Lundholm, and Van Winkle (2011)	Pda	Percent discretionary accruals

Panel D: Profitability (40)

Roe1	Return on equity (1-month period), Hou, Xue, and Zhang (2015)	Roe6	Return on equity (6-month period), Hou, Xue, and Zhang (2015)
dRoe1	Change in Roe (1-month period)	dRoe6	Change in Roe (6-month period)
dRoe12	Change in Roe (12-month period),	Roa1	Return on assets (1-month period), Balakrishnan, Bartov, and Faurel (2010)
dRoa1	Change in Roa (1-month period)	dRoa6	Change in Roa (6-month period)
Ato	Asset turnover, Soliman (2008)	Cto	Capital turnover, Haugen and Baker (1996)
Rna^{q}1	Quarterly return on net operating assets (1-month period)	Rna^{q}6	Quarterly return on net operating assets (6-month period)
Ato^{q}1	Quarterly asset turnover (1-month period)	Ato^{q}6	Quarterly asset turnover (6-month period)
Ato^{q}12	Quarterly asset turnover (12-month period)	Cto^{q}1	Quarterly capital turnover (1-month period)
Cto^{q}6	Quarterly capital turnover (6-month period)	Cto^{q}12	Quarterly capital turnover (12-month period)
Gpa	Gross profits-to-assets, Novy-Marx (2013)	Gla^{q}1	Gross profits-to-lagged assets (1-month period)
Gla^{q}6	Gross profits-to-lagged assets (6-month period)	Gla^{q}12	Gross profits-to-lagged assets (12-month period)
Ole^{q}1	Operating profits-to-lagged equity (1-month period)	Ole^{q}6	Operating profits-to-lagged equity (6-month period)
Opa	Operating profits-to-assets, Ball et al. (2015)	Ola^{q}1	Operating profits-to-lagged assets (1-month period)
Ola^{q}6	Operating profits-to-lagged assets (6-month period)	Ola^{q}12	Operating profits-to-lagged assets (12-month period)
Cop	Cash-based operating profitability, Ball et al. (2016)	Cla	Cash-based operating profits-to-lagged assets
Cla^{q}1	Cash-based operating profits-to-lagged assets (1-month period)	Cla^{q}6	Cash-based operating profits-to-lagged assets (6-month period)
Cla^{q}12	Cash-based operating profits-to-lagged assets (12-month period)	F^{q}1	Quarterly F-score (1-month period)
F^{q}6	Quarterly F-score (6-month period)	F^{q}12	Quarterly F-score (12-month period)
Fp^{q}6	Failure probability (6-month period), Campbell, Hilscher, and Szilagyi (2008)	O^{q}1	Quarterly O-score (1-month period)
Tbi^{q}12	Quarterly taxable income-to-book income (12-month period)	Sg^{q}1	Quarterly sales growth (1-month period)

Panel E: Intangibles (27)

Oca	Organizational capital/assets, Eisfeldt and Papanikolaou (2013)	Ioca	Industry-adjusted organizational capital /assets, Eisfeldt and Papanikolaou (2013)
Adm	Advertising expense-to-market, Chan, Lakonishok, and Sougiannis (2001)	Rdm	R&D-to-market, Chan, Lakonishok, and Sougiannis (2001)
Rdm^{q}1	Quarterly R&D-to-market (1-month period)	Rdm^{q}6	Quarterly R&D-to-market (6-month period)

$\text{Rdm}^q 12$	Quarterly R&D-to-market (12-month period)	$\text{Rds}^q 6$	Quarterly R&D-to-sales (6-month period)
$\text{Rds}^q 12$	Quarterly R&D-to-sales (12-month period)	Ol	Operating leverage, Novy-Marx (2011)
$\text{Ol}^q 1$	Quarterly operating leverage (1-month period)	$\text{Ol}^q 6$	Quarterly operating leverage (6-month period)
$\text{Ol}^q 12$	Quarterly operating leverage (12-month period)	Hs	Industry concentration (sales), Hou and Robinson (2006)
Rer	Real estate ratio, Tuzel (2010)	Eprd	Earnings predictability, Francis et al. (2004)
Etl	Earnings timeliness, Francis et al. (2004)	$\text{Alm}^q 1$	Quarterly market assets liquidity (1-month period)
$\text{Alm}^q 6$	Quarterly market assets liquidity (6-month period)	$\text{Alm}^q 12$	Quarterly market assets liquidity (12-month period)
R_{a}^{1}	Year 1-lagged return, annual Heston and Sadka (2008)	R_{n}^{1}	Year 1-lagged return, nonannual Heston and Sadka (2008)
$R_{\text{a}}^{[2,5]}$	Years 2–5 lagged returns, annual Heston and Sadka (2008)	$R_{\text{a}}^{[6,10]}$	Years 6–10 lagged returns, annual Heston and Sadka (2008)
$R_{\text{n}}^{[6,10]}$	Years 6–10 lagged returns, nonannual Heston and Sadka (2008)	$R_{\text{a}}^{[11,15]}$	Years 11–15 lagged returns, annual Heston and Sadka (2008)
$R_{\text{a}}^{[16,20]}$	Years 16–20 lagged returns, annual Heston and Sadka (2008)		
		Panel F: Trading frictions (3)	
Dtv12	Dollar trading volume (12-month period), Brennan, Chordia, and Subrahmanyam (1998)	Isff1	Idiosyncratic skewness per the 3-factor model (1-month period)
Isq1	Idiosyncratic skewness per the q-factor model (1-month period)		

Table 5 : Monthly Sharpe Ratios, January 1967–December 2018, 624 Months

Panel A reports Sharpe ratios for the market, size, investment, and Roe factors in the Hou, Xue, and Zhang (2015) q-factor model (q), R_{Mkt}, R_{Me}, $R_{\mathrm{I/A}}$, and R_{Roe}, respectively; the expected growth factor, R_{Eg}, in the q^5 model (q^5); the size, value, investment, and profitability factors in the Fama-French (2015) 5-factor model (FF5), SMB, HML, CMA, and RMW, respectively; the momentum factor, UMD, in the Fama-French (2018) 6-factor model (FF6); the cash-based profitability factor, RMWc, in the Fama-French (2018) alternative 6-factor model; the monthly formed value factor, $\mathrm{HML}^{\mathrm{m}}$, in the Barillas-Shanken (2018) 6-factor model (BS6); the management (MGMT) and performance (PERF) factors in the Stambaugh-Yuan (2017) 4-factor model (SY4); and the financing (FIN) and post-earnings-announcement-drift (PEAD) factors in the Daniel-Hirshleifer-Sun 3-factor model (DHS). Panel B reports the maximum Sharpe ratios for each factor model, calculated as $\sqrt{\mu_f' V_f^{-1} \mu_f}$, in which μ_f is the vector of mean factor returns in the factor model, and V_f is the variance-covariance matrix for the vector of factor returns.

Panel A: Sharpe ratios for individual factors							
R_{Mkt}	R_{Me}	$R_{\mathrm{I/A}}$	R_{Roe}	R_{Eg}	SMB	HML	CMA
0.112	0.094	0.200	0.218	0.444	0.074	0.112	0.149
RMW	RMWc	UMD	$\mathrm{HML}^{\mathrm{m}}$	MGMT	PERF	FIN	PEAD
0.125	0.186	0.151	0.083	0.195	0.163	0.104	0.320
Panel B: Maximum Sharpe ratios for factor models							
q	q^5	FF5	FF6	FF6c	BS6	SY4	DHS
0.416	0.634	0.322	0.365	0.434	0.475	0.412	0.416

Table 6 : Overall Performance of Factor Models, January 1967–December 2018, 624 Months

For each model, $\overline{|\alpha_{\text{H-L}}|}$ is the average magnitude of the high-minus-low alphas, $\#_{|t|\geq 1.96}$ the number of the high-minus-low alphas with $|t| \geq 1.96$, $\#_{|t|\geq 3}$ the number of the high-minus-low alphas with $|t| \geq 3$, $\overline{|\alpha|}$ the mean absolute alpha across the anomaly deciles in a given category, and $\#_{p<5\%}$ the number of sets of deciles within a given category, with which the factor model is rejected by the GRS test at the 5% level. We report the results for the q-factor model (q), the q^5 model (q^5), the Fama-French (2015) 5-factor model (FF5), the Fama-French (2018) 6-factor model with RMW (FF6), the Fama-French alternative 6-factor model with RMWc (FF6c), the Barillas-Shanken (2018) 6-factor model (BS6), the Stambaugh-Yuan (2017) 4-factor model (SY4), and the Daniel-Hirshleifer-Sun (2018) 3-factor model (DHS).

	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq 1.96}$	$\#_{\lvert t\rvert\geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#_{p<5\%}$	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq 1.96}$	$\#_{\lvert t\rvert\geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#_{p<5\%}$	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq 1.96}$	$\#_{\lvert t\rvert\geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#_{p<5\%}$	$\overline{\lvert\alpha_{\text{H-L}}\rvert}$	$\#_{\lvert t\rvert\geq 1.96}$	$\#_{\lvert t\rvert\geq 3}$	$\overline{\lvert\alpha\rvert}$	$\#_{p<5\%}$
	Panel A: All (150)					Panel B: Momentum (39)					Panel C: Value-versus-growth (15)					Panel D: Investment (26)				
q	0.28	52	25	0.11	101	0.25	11	3	0.10	24	0.21	1	0	0.11	8	0.22	9	4	0.10	19
q^5	0.19	23	6	0.10	57	0.17	4	1	0.09	15	0.22	3	0	0.13	7	0.10	1	0	0.08	6
FF5	0.43	100	69	0.13	112	0.62	37	29	0.15	36	0.15	2	0	0.10	7	0.24	10	7	0.09	17
FF6	0.30	74	37	0.11	91	0.27	19	6	0.10	21	0.19	4	0	0.10	9	0.22	10	6	0.09	16
FF6c	0.27	59	25	0.11	71	0.24	14	5	0.09	18	0.17	3	0	0.10	6	0.18	8	2	0.08	7
BS6	0.29	63	37	0.13	132	0.23	12	4	0.12	33	0.23	6	2	0.13	14	0.22	8	6	0.11	24
SY4	0.29	64	25	0.11	87	0.32	19	6	0.10	23	0.24	4	1	0.12	9	0.19	8	3	0.09	17
DHS	0.37	70	33	0.14	97	0.25	10	3	0.14	26	0.78	15	13	0.23	15	0.34	20	4	0.10	22
						Panel E: Profitability (40)					Panel F: Intangibles (27)					Panel G: Trading frictions (3)				
q						0.25	16	6	0.10	28	0.47	13	11	0.18	19	0.24	2	1	0.10	3
q^5						0.14	5	1	0.09	14	0.36	8	4	0.15	13	0.19	2	0	0.08	2
FF5						0.43	32	23	0.12	32	0.50	17	9	0.16	18	0.22	2	1	0.07	2
FF6						0.31	26	13	0.10	25	0.48	13	11	0.17	18	0.20	2	1	0.07	2
FF6c						0.26	18	7	0.10	21	0.50	14	11	0.17	18	0.20	2	0	0.07	1
BS6						0.31	20	12	0.12	37	0.49	15	11	0.20	21	0.23	2	2	0.09	3
SY4						0.29	20	9	0.10	24	0.38	11	6	0.15	12	0.18	2	0	0.09	2
DHS						0.18	6	1	0.09	13	0.60	16	10	0.19	18	0.50	3	2	0.18	3

Table 7 : Explaining Composite Anomalies, January 1967–December 2018, 624 Months

We form composite scores across all the 150 anomalies (All) and across each category of anomalies, including momentum (Mom), value-versus-growth (VvG), investment (Inv), profitability (Prof), intangibles (Intan), and trading frictions (Fric). For a given set of anomalies, we construct the composite score by equal-weighting a stock's percentile ranking for each anomaly (realigned to yield a positive slope in forecasting returns). At the beginning of each month t, we split stocks into deciles based on the NYSE breakpoints of the composite scores, and calculate value-weighted returns for month t. The deciles are rebalanced at the beginning of month $t+1$. For each model and each set of deciles, we report the high-minus-low alpha (Panel A), its t-value (Panel B), the mean absolute alpha (Panel C), and the GRS p-value (Panel D). We report the results for the q-factor model (q), the q^5 model (q^5), the Fama-French (2015) 5-factor model (FF5), the Fama-French (2018) 6-factor model (FF6), the Fama-French alternative 6-factor model with RMWc (FF6c), the Barillas-Shanken (2018) 6-factor model (BS6), the Stambaugh-Yuan (2017) model (SY4), and the Daniel-Hirshleifer-Sun (2018) model (DHS). For the q^5 model, Panel E shows the loadings on the market, size, investment, Roe, and expected growth factors ($\beta_{\mathrm{Mkt}}, \beta_{\mathrm{Me}}, \beta_{\mathrm{I/A}}, \beta_{\mathrm{Roe}}$, and β_{Eg}, respectively) and their t-values. The t-values are adjusted for heteroscedasticity and autocorrelations.

	All	Mom	VvG	Inv	Prof	Intan	Fric		All	Mom	VvG	Inv	Prof	Intan	Fric
$\overline{R}$	1.69	1.09	0.70	0.66	0.80	0.94	0.23	$t_{\overline{R}}$	9.62	4.21	3.47	4.44	4.64	5.27	1.77
	Panel A: The high-minus-low alpha, $\alpha_{\mathrm{H-L}}$								Panel B: $t_{\mathrm{H-L}}$						
q	0.86	0.35	0.28	0.25	0.28	0.42	0.16		5.64	1.04	1.48	2.61	2.31	2.62	1.80
q^5	0.37	−0.25	0.38	0.06	−0.14	0.50	0.15		2.62	−0.85	2.14	0.54	−1.21	3.19	1.60
FF5	1.33	1.21	0.04	0.29	0.60	0.43	0.14		7.94	3.74	0.30	3.11	5.35	3.24	1.80
FF6	0.94	0.33	0.19	0.27	0.43	0.54	0.12		7.46	2.08	1.58	2.84	3.94	4.25	1.53
FF6c	0.82	0.29	0.12	0.27	0.30	0.57	0.12		6.77	1.82	1.05	2.62	2.30	4.17	1.34
BS6	0.68	0.21	−0.16	0.18	0.34	0.26	0.14		4.85	1.26	−1.17	1.73	2.61	1.85	1.60
SY4	0.90	0.43	0.34	0.10	0.37	0.46	0.13		7.61	1.93	2.20	1.00	2.86	3.16	1.50
DHS	0.74	−0.36	0.98	0.55	−0.09	0.89	0.57		4.98	−1.49	5.34	3.83	−0.56	5.24	4.29
	Panel C: The mean absolute alpha, $\overline{\lvert\alpha\rvert}$								Panel D: The GRS p-value, p_{GRS}						
q	0.16	0.10	0.13	0.10	0.07	0.18	0.10		0.00	0.08	0.00	0.00	0.01	0.00	0.00
q^5	0.10	0.10	0.16	0.06	0.08	0.19	0.08		0.01	0.35	0.00	0.15	0.09	0.00	0.06
FF5	0.25	0.27	0.11	0.08	0.12	0.18	0.08		0.00	0.00	0.00	0.00	0.00	0.00	0.05
FF6	0.16	0.09	0.10	0.07	0.09	0.20	0.07		0.00	0.06	0.00	0.01	0.00	0.00	0.07
FF6c	0.14	0.10	0.10	0.06	0.07	0.21	0.06		0.00	0.04	0.00	0.06	0.09	0.00	0.28
BS6	0.13	0.09	0.12	0.09	0.09	0.15	0.11		0.00	0.07	0.00	0.00	0.00	0.00	0.00
SY4	0.16	0.10	0.14	0.07	0.09	0.18	0.09		0.00	0.01	0.00	0.01	0.00	0.00	0.01
DHS	0.14	0.16	0.31	0.12	0.07	0.28	0.13		0.00	0.00	0.00	0.00	0.35	0.00	0.00
	Panel E: The q^5 factor loadings														
β_{Mkt}	−0.03	−0.10	0.06	−0.03	0.03	−0.04	−0.05	t_{Mkt}	−0.63	−1.24	1.16	−1.04	0.93	−0.83	−2.17
β_{Me}	0.21	0.29	0.30	−0.01	−0.03	0.39	0.77	t_{Me}	3.56	1.49	2.27	−0.28	−0.59	3.33	24.50
$\beta_{\mathrm{I/A}}$	0.57	−0.19	1.31	1.24	−0.43	0.69	−0.04	$t_{\mathrm{I/A}}$	6.28	−0.74	9.51	20.32	−5.34	5.13	−0.73
β_{Roe}	0.81	1.16	−0.30	−0.17	1.05	0.35	−0.21	t_{Roe}	8.48	5.44	−2.48	−2.57	15.42	3.17	−5.00
β_{Eg}	0.74	0.90	−0.15	0.29	0.63	−0.11	0.02	t_{Eg}	7.81	4.49	−1.08	4.15	7.63	−0.93	0.28

Table 8 : Explaining the 150 Individual Anomalies, January 1967–December 2018, 624 Months

For each high-minus-low decile, we report the average return, $\overline{R}$, the q-factor alpha, α_q, the q^5 alpha, α_{q^5}, the Fama-French (2015) 5-factor alpha, α_{FF5}, the Fama-French (2018) 6-factor alpha, α_{FF6}, the alpha from the alternative 6-factor model with RMW replaced by RMWc, α_{FF6c}, the Barillas-Shanken (2018) 6-factor alpha, α_{BS6}, the Stambaugh-Yuan (2017) alpha, α_{SY4}, and the Daniel-Hirshleifer-Sun (2018) alpha, α_{DHS}, as well as their heteroscedasticity-and-autocorrelation-consistent t-statistics, denoted by $t_{\overline{R}}$, t_q, t_{q^5}, t_{FF5}, t_{FF6}, t_{FF6c}, t_{BS6}, t_{SY4}, and t_{DHS}, respectively. Also, for all the ten deciles formed on a given anomaly variable, we report the mean absolute alphas from the q-factor model, $\overline{|\alpha_q|}$, the q^5 model, $\overline{|\alpha_{q^5}|}$, the 5-factor model, $\overline{|\alpha_{\mathrm{FF5}}|}$, the 6-factor model, $\overline{|\alpha_{\mathrm{FF6}}|}$, the alternative 6-factor model, $\overline{|\alpha_{\mathrm{FF6c}}|}$, the Barillas-Shanken 6-factor model, $\overline{|\alpha_{\mathrm{BS6}}|}$, the Stambaugh-Yuan model, $\overline{|\alpha_{\mathrm{SY4}}|}$, and the Daniel-Hirshleifer-Sun model, $\overline{|\alpha_{\mathrm{DHS}}|}$, as well as the p-values from the GRS test on the null hypothesis that all the alphas across a given set of deciles are jointly zero. The p-values are denoted by p_q, p_{q^5}, p_{FF5}, p_{FF6}, p_{FF6c}, p_{BS6}, p_{SY4}, and p_{DHS}, respectively. Table 4 describes the anomaly symbols, and the Internet Appendix details variable definitions and portfolio construction.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Sue1	Abr1	Abr6	Abr12	Re1	Re6	$R^6 1$	$R^6 6$	$R^6 12$	$R^{11} 1$	$R^{11} 6$	$R^{11} 12$	Im1	Im6	Im12	Rs1	dEf1	dEf6	dEf12	Nei1
$\overline{R}$	0.45	0.73	0.36	0.25	0.78	0.48	0.66	0.83	0.55	1.18	0.80	0.45	0.66	0.60	0.61	0.36	0.94	0.56	0.33	0.33
$t_{\overline{R}}$	3.50	5.74	3.80	3.23	3.40	2.38	2.38	3.66	3.04	4.20	3.26	2.12	2.87	3.13	3.55	2.64	4.55	3.33	2.47	3.07
α_q	0.05	0.65	0.34	0.26	0.14	0.00	0.10	0.30	0.18	0.38	0.17	0.05	0.27	0.10	0.29	0.28	0.56	0.17	0.06	0.11
α_{q^5}	−0.07	0.52	0.24	0.18	0.10	−0.08	−0.38	−0.16	−0.10	−0.19	−0.20	−0.13	−0.11	−0.32	0.00	0.12	0.50	0.17	0.04	−0.01
α_{FF5}	0.48	0.84	0.50	0.41	0.79	0.57	0.81	1.00	0.78	1.30	1.03	0.76	0.71	0.66	0.79	0.56	1.05	0.69	0.47	0.38
α_{FF6}	0.26	0.64	0.32	0.26	0.38	0.20	−0.13	0.19	0.19	0.24	0.18	0.18	0.06	−0.01	0.26	0.44	0.73	0.38	0.23	0.24
α_{FF6c}	0.22	0.65	0.32	0.25	0.40	0.20	−0.10	0.16	0.12	0.22	0.11	0.07	0.06	−0.05	0.18	0.41	0.63	0.35	0.20	0.21
α_{BS6}	0.12	0.68	0.33	0.26	0.12	0.00	−0.06	0.14	0.12	0.17	0.08	0.06	0.17	−0.06	0.19	0.42	0.54	0.17	0.08	0.14
α_{SY4}	0.27	0.72	0.39	0.32	0.58	0.33	0.02	0.29	0.31	0.31	0.30	0.32	0.13	0.07	0.33	0.39	0.87	0.46	0.30	0.27
α_{DHS}	−0.35	0.29	0.10	0.05	−0.33	−0.45	−0.59	−0.22	−0.30	−0.27	−0.42	−0.54	−0.19	−0.27	−0.08	−0.20	0.21	−0.19	−0.25	−0.29
t_q	0.39	4.52	3.07	3.08	0.61	0.00	0.25	1.04	0.92	1.03	0.61	0.27	0.94	0.43	1.39	2.04	2.62	1.08	0.51	1.15
t_{q^5}	−0.52	3.80	2.21	1.94	0.44	−0.42	−1.13	−0.64	−0.48	−0.58	−0.77	−0.58	−0.39	−1.36	0.01	0.90	2.22	0.99	0.36	−0.05
t_{FF5}	3.70	6.07	4.99	5.53	3.33	2.75	2.47	3.75	4.15	3.87	3.88	3.92	2.64	2.89	4.16	4.18	4.79	4.06	3.75	3.99
t_{FF6}	2.23	4.88	3.70	4.21	2.05	1.24	−0.68	1.92	1.76	2.01	1.51	1.27	0.34	−0.05	1.79	3.34	3.88	3.07	2.38	2.56
t_{FF6c}	1.84	4.71	3.48	3.74	2.17	1.28	−0.52	1.57	1.13	1.85	0.94	0.50	0.32	−0.33	1.24	3.09	3.20	2.76	1.98	2.09
t_{BS6}	1.05	4.67	3.35	3.44	0.68	−0.01	−0.31	1.23	0.88	1.40	0.54	0.32	0.81	−0.39	1.12	3.30	2.91	1.41	0.83	1.55
t_{SY4}	2.28	5.30	3.99	4.40	2.67	1.85	0.07	1.44	2.06	1.30	1.48	1.90	0.57	0.39	1.90	3.07	4.44	3.20	2.93	2.57
t_{DHS}	−3.19	2.32	1.14	0.76	−1.77	−2.71	−1.74	−0.94	−2.02	−0.90	−1.80	−3.06	−0.75	−1.37	−0.49	−1.41	1.17	−1.56	−2.57	−2.14
$\overline{\lvert\alpha_q\rvert}$	0.09	0.12	0.08	0.07	0.10	0.11	0.15	0.07	0.05	0.11	0.08	0.08	0.12	0.11	0.12	0.07	0.15	0.11	0.10	0.09
$\overline{\lvert\alpha_{q^5}\rvert}$	0.08	0.11	0.06	0.05	0.09	0.10	0.21	0.13	0.09	0.17	0.14	0.11	0.07	0.09	0.07	0.07	0.16	0.13	0.10	0.08
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.19	0.15	0.09	0.08	0.18	0.16	0.14	0.17	0.15	0.24	0.21	0.15	0.22	0.21	0.21	0.15	0.26	0.16	0.14	0.14
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.12	0.12	0.06	0.05	0.08	0.07	0.19	0.09	0.06	0.13	0.08	0.06	0.11	0.11	0.11	0.11	0.18	0.10	0.07	0.09
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.11	0.12	0.06	0.05	0.08	0.06	0.19	0.10	0.07	0.13	0.10	0.08	0.10	0.10	0.10	0.11	0.17	0.09	0.06	0.08
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.11	0.13	0.08	0.08	0.09	0.09	0.19	0.11	0.08	0.16	0.12	0.10	0.15	0.15	0.14	0.11	0.15	0.12	0.11	0.09
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.11	0.13	0.08	0.07	0.10	0.09	0.17	0.09	0.06	0.12	0.08	0.07	0.07	0.08	0.09	0.09	0.20	0.12	0.09	0.12
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.12	0.12	0.09	0.07	0.21	0.20	0.30	0.18	0.15	0.24	0.20	0.20	0.12	0.13	0.12	0.12	0.18	0.17	0.15	0.12
p_q	0.02	0.00	0.00	0.00	0.09	0.01	0.00	0.00	0.03	0.00	0.01	0.01	0.56	0.05	0.09	0.01	0.00	0.00	0.01	0.04
p_{q^5}	0.26	0.00	0.00	0.01	0.39	0.07	0.00	0.00	0.07	0.01	0.01	0.01	0.82	0.12	0.21	0.05	0.01	0.00	0.02	0.22
p_{FF5}	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p_{FF6}	0.00	0.00	0.00	0.00	0.18	0.07	0.00	0.00	0.01	0.00	0.00	0.01	0.31	0.02	0.01	0.00	0.00	0.00	0.01	0.01
p_{FF6c}	0.03	0.00	0.00	0.01	0.33	0.30	0.00	0.00	0.00	0.00	0.00	0.01	0.49	0.10	0.07	0.03	0.01	0.00	0.04	0.11
p_{BS6}	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.01	0.00	0.00	0.00	0.00	0.01
p_{SY4}	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.14	0.07	0.00	0.00	0.00	0.00	0.00
p_{DHS}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.02	0.01	0.01	0.00	0.00	0.00	0.02

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	52w6	52w12	$\epsilon^6 6$	$\epsilon^6 12$	$\epsilon^{11} 1$	$\epsilon^{11} 6$	$\epsilon^{11} 12$	Sm1	Sm12	Ilr1	Ilr6	Ilr12	Ile1	Cm1	Cm12	Sim1	Cim1	Cim6	Cim12	Bm
$\overline{R}$	0.59	0.47	0.46	0.37	0.61	0.49	0.33	0.50	0.15	0.61	0.33	0.33	0.56	0.71	0.13	0.78	0.75	0.32	0.29	0.43
$t_{\overline{R}}$	2.19	2.02	4.03	4.05	3.90	3.80	2.96	2.26	2.08	3.02	3.33	4.24	3.50	3.65	2.03	3.68	3.46	3.09	3.72	2.14
α_q	0.08	0.10	0.29	0.22	0.27	0.21	0.13	0.53	−0.03	0.65	0.18	0.18	0.30	0.64	0.04	0.59	0.66	0.12	0.12	0.11
α_{q^5}	−0.33	−0.15	0.08	0.04	0.01	0.02	0.00	0.38	−0.13	0.41	0.00	0.01	0.09	0.60	−0.03	0.22	0.39	−0.13	−0.11	0.05
α_{FF5}	0.78	0.70	0.50	0.44	0.56	0.54	0.42	0.60	0.11	0.71	0.35	0.37	0.66	0.69	0.11	0.76	0.74	0.29	0.31	−0.11
α_{FF6}	0.05	0.15	0.24	0.20	0.20	0.21	0.15	0.52	−0.03	0.57	0.09	0.11	0.45	0.67	0.01	0.61	0.63	0.04	0.07	−0.09
α_{FF6c}	0.04	0.08	0.22	0.17	0.22	0.20	0.13	0.49	−0.07	0.55	0.07	0.08	0.39	0.64	0.00	0.57	0.56	0.06	0.05	−0.09
α_{BS6}	−0.09	−0.02	0.21	0.18	0.15	0.14	0.11	0.58	−0.06	0.67	0.13	0.11	0.39	0.68	0.01	0.59	0.68	0.07	0.06	−0.31
α_{SY4}	0.09	0.22	0.29	0.24	0.26	0.26	0.19	0.58	−0.01	0.59	0.14	0.14	0.41	0.66	0.01	0.58	0.60	0.05	0.07	−0.01
α_{DHS}	−0.67	−0.59	0.10	0.00	0.07	0.00	−0.08	0.50	−0.07	0.42	−0.01	−0.01	0.00	0.69	0.00	0.47	0.43	0.00	−0.01	0.76
t_q	0.30	0.60	1.99	1.76	1.40	1.29	0.90	2.02	−0.38	2.68	1.42	1.77	1.76	2.72	0.41	2.01	2.56	0.75	1.02	0.71
t_{q^5}	−1.48	−0.92	0.53	0.30	0.07	0.10	−0.02	1.34	−1.58	1.67	−0.02	0.11	0.48	2.52	−0.29	0.73	1.38	−0.79	−0.94	0.32
t_{FF5}	3.21	4.03	3.83	3.98	3.12	3.60	3.25	2.59	1.32	3.09	3.03	3.75	4.04	3.24	1.33	2.85	3.14	2.09	2.78	−0.99
t_{FF6}	0.47	1.40	2.12	2.34	1.36	1.83	1.56	2.25	−0.46	2.66	1.05	1.85	2.74	2.85	0.07	2.43	2.78	0.37	0.93	−0.82
t_{FF6c}	0.37	0.75	1.90	1.92	1.43	1.67	1.32	1.93	−1.03	2.36	0.83	1.34	2.37	2.65	−0.03	2.19	2.49	0.61	0.68	−0.74
t_{BS6}	−0.70	−0.21	1.68	2.01	0.92	1.13	1.11	2.41	−0.99	2.94	1.43	1.82	2.24	2.96	0.15	2.26	2.87	0.63	0.76	−2.39
t_{SY4}	0.53	1.67	2.16	2.30	1.48	1.86	1.69	2.26	−0.09	2.66	1.43	1.82	2.48	2.79	0.16	2.14	2.55	0.37	0.74	−0.05
t_{DHS}	−2.84	−3.44	0.69	0.04	0.39	0.03	−0.71	1.85	−0.91	1.82	−0.06	−0.06	0.03	2.75	0.04	1.52	1.77	−0.03	−0.15	3.70
$\overline{\lvert\alpha_q\rvert}$	0.06	0.04	0.07	0.06	0.08	0.06	0.06	0.12	0.10	0.18	0.09	0.08	0.11	0.19	0.11	0.14	0.19	0.06	0.06	0.08
$\overline{\lvert\alpha_{q^5}\rvert}$	0.13	0.08	0.06	0.06	0.06	0.04	0.04	0.11	0.09	0.10	0.04	0.03	0.06	0.16	0.09	0.07	0.13	0.06	0.05	0.09
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.16	0.15	0.08	0.07	0.15	0.12	0.08	0.16	0.16	0.21	0.15	0.14	0.19	0.19	0.08	0.18	0.21	0.07	0.08	0.05
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.07	0.04	0.05	0.05	0.06	0.05	0.04	0.14	0.12	0.17	0.09	0.09	0.13	0.19	0.09	0.14	0.19	0.05	0.05	0.05
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.06	0.04	0.04	0.04	0.06	0.03	0.03	0.15	0.15	0.17	0.09	0.09	0.12	0.18	0.09	0.14	0.18	0.05	0.05	0.06
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.07	0.05	0.06	0.07	0.08	0.06	0.06	0.14	0.13	0.20	0.13	0.13	0.14	0.24	0.16	0.15	0.19	0.07	0.06	0.11
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.08	0.06	0.06	0.06	0.08	0.07	0.05	0.12	0.08	0.15	0.05	0.06	0.10	0.17	0.07	0.14	0.18	0.06	0.05	0.06
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.22	0.19	0.04	0.05	0.06	0.05	0.06	0.10	0.04	0.14	0.13	0.13	0.13	0.22	0.11	0.13	0.17	0.10	0.08	0.19
p_q	0.32	0.01	0.00	0.00	0.02	0.02	0.05	0.30	0.31	0.07	0.35	0.11	0.16	0.09	0.06	0.46	0.00	0.06	0.01	0.12
p_{q^5}	0.15	0.00	0.02	0.00	0.73	0.40	0.30	0.58	0.04	0.73	0.25	0.35	0.86	0.11	0.19	0.99	0.14	0.27	0.18	0.31
p_{FF5}	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.00	0.00	0.07	0.03	0.08	0.00	0.06	0.00	0.53
p_{FF6}	0.15	0.05	0.00	0.00	0.21	0.17	0.22	0.09	0.07	0.05	0.31	0.07	0.02	0.07	0.14	0.41	0.01	0.26	0.14	0.48
p_{FF6c}	0.26	0.25	0.01	0.00	0.57	0.39	0.31	0.05	0.02	0.07	0.44	0.14	0.10	0.10	0.05	0.42	0.02	0.32	0.16	0.62
p_{BS6}	0.12	0.01	0.00	0.00	0.02	0.02	0.03	0.10	0.07	0.01	0.05	0.01	0.03	0.02	0.03	0.37	0.00	0.02	0.01	0.00
p_{SY4}	0.16	0.01	0.00	0.00	0.04	0.05	0.06	0.39	0.43	0.26	0.29	0.14	0.14	0.07	0.29	0.41	0.01	0.13	0.06	0.59
p_{DHS}	0.00	0.00	0.17	0.01	0.45	0.12	0.10	0.54	0.80	0.08	0.20	0.10	0.09	0.03	0.05	0.27	0.00	0.00	0.00	0.01

	41 Ep^{q1}	42 Ep^{q6}	43 Ep^{q12}	44 Cp^{q1}	45 Cp^{q6}	46 Nop	47 Em	48 Em^{q1}	49 Sp	50 Sp^{q1}	51 Sp^{q6}	52 Sp^{q12}	53 Ocp	54 Ocp^{q1}	55 Ia	56 Ia^{q6}	57 Ia^{q12}	58 dPia	59 Noa	60 dNoa
$\overline{R}$	0.83	0.53	0.37	0.53	0.40	0.60	−0.44	−0.59	0.42	0.52	0.49	0.46	0.59	0.55	−0.37	−0.41	−0.38	−0.44	−0.47	−0.49
$t_{\overline{R}}$	4.47	3.08	2.30	2.58	2.10	3.30	−2.34	−2.72	2.05	2.16	2.17	2.18	2.73	2.04	−2.46	−2.45	−2.48	−3.40	−3.59	−3.74
α_q	0.33	0.04	−0.07	0.34	0.25	0.34	−0.15	−0.35	−0.09	0.16	0.10	0.01	0.31	0.44	0.10	−0.07	0.05	−0.16	−0.50	−0.11
α_{q^5}	0.46	0.09	−0.04	0.50	0.34	0.18	0.00	−0.37	0.02	0.32	0.24	0.15	0.21	0.35	0.07	0.01	0.10	−0.17	−0.15	−0.09
α_{FF5}	0.36	0.06	−0.08	0.01	−0.06	0.21	0.02	−0.22	−0.27	−0.22	−0.24	−0.25	−0.03	0.12	0.05	0.04	0.08	−0.27	−0.56	−0.22
α_{FF6}	0.49	0.15	−0.03	0.37	0.21	0.22	0.05	−0.35	−0.18	0.12	0.04	−0.06	0.06	0.41	0.05	−0.02	0.06	−0.25	−0.48	−0.19
α_{FF6c}	0.44	0.10	−0.07	0.34	0.18	0.16	0.17	−0.25	−0.19	0.11	0.03	−0.06	0.01	0.40	0.02	−0.08	0.01	−0.27	−0.45	−0.18
α_{BS6}	−0.07	−0.32	−0.44	−0.02	−0.10	0.13	0.22	−0.08	−0.46	−0.24	−0.27	−0.35	−0.16	0.31	0.16	0.03	0.13	−0.15	−0.63	−0.04
α_{SY4}	0.62	0.27	0.09	0.42	0.28	0.17	−0.08	−0.44	−0.12	0.14	0.08	−0.01	0.25	0.56	0.19	0.17	0.24	−0.04	−0.22	−0.06
α_{DHS}	0.85	0.50	0.37	1.09	0.92	0.37	−0.60	−0.74	0.64	1.07	0.98	0.83	0.90	1.01	−0.37	−0.58	−0.44	−0.41	−0.35	−0.37
t_q	1.42	0.23	−0.44	1.61	1.37	2.50	−0.88	−1.49	−0.48	0.60	0.45	0.07	1.74	1.55	0.89	−0.69	0.51	−1.32	−3.00	−0.83
t_{q^5}	2.05	0.50	−0.28	2.56	2.02	1.25	−0.02	−1.61	0.10	1.32	1.17	0.84	1.18	1.42	0.55	0.05	0.91	−1.36	−1.00	−0.63
t_{FF5}	2.12	0.41	−0.67	0.07	−0.41	1.80	0.16	−1.20	−1.98	−1.11	−1.49	−1.74	−0.19	0.59	0.42	0.47	0.90	−2.48	−3.66	−1.57
t_{FF6}	2.99	1.12	−0.26	2.73	1.74	1.89	0.38	−2.05	−1.38	0.66	0.25	−0.44	0.42	2.69	0.44	−0.25	0.63	−2.16	−3.44	−1.40
t_{FF6c}	2.74	0.74	−0.57	2.59	1.52	1.33	1.24	−1.45	−1.43	0.60	0.22	−0.50	0.05	2.61	0.20	−0.87	0.06	−2.23	−3.07	−1.41
t_{BS6}	−0.43	−2.30	−3.60	−0.14	−0.79	0.94	1.41	−0.50	−3.11	−1.23	−1.71	−2.42	−1.01	1.97	1.45	0.22	1.24	−1.23	−4.43	−0.33
t_{SY4}	3.37	1.72	0.67	2.69	1.95	1.34	−0.46	−2.30	−0.81	0.67	0.45	−0.06	1.48	2.96	1.58	1.67	2.29	−0.33	−1.57	−0.43
t_{DHS}	4.01	2.86	2.43	5.52	5.40	3.18	−3.51	−3.63	3.17	3.84	4.14	3.94	4.57	4.10	−2.20	−3.32	−2.51	−2.68	−2.49	−2.63
$\overline{\lvert\alpha_q\rvert}$	0.16	0.12	0.10	0.16	0.14	0.12	0.11	0.17	0.06	0.07	0.07	0.07	0.10	0.18	0.08	0.07	0.07	0.10	0.12	0.09
$\overline{\lvert\alpha_{q^5}\rvert}$	0.19	0.15	0.13	0.22	0.18	0.11	0.11	0.20	0.07	0.10	0.07	0.06	0.11	0.16	0.09	0.05	0.05	0.11	0.09	0.06
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.13	0.09	0.07	0.09	0.10	0.10	0.09	0.15	0.10	0.10	0.11	0.11	0.05	0.10	0.10	0.06	0.05	0.09	0.11	0.08
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.17	0.11	0.08	0.15	0.10	0.09	0.08	0.16	0.08	0.06	0.06	0.07	0.07	0.16	0.08	0.05	0.05	0.09	0.11	0.08
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.16	0.10	0.07	0.16	0.12	0.09	0.08	0.15	0.09	0.07	0.07	0.07	0.08	0.16	0.09	0.05	0.05	0.07	0.10	0.06
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.12	0.13	0.12	0.12	0.14	0.13	0.12	0.15	0.16	0.10	0.12	0.15	0.12	0.14	0.10	0.08	0.08	0.12	0.14	0.08
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.20	0.15	0.11	0.18	0.14	0.12	0.10	0.18	0.06	0.05	0.04	0.05	0.10	0.22	0.09	0.08	0.07	0.10	0.08	0.07
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.28	0.20	0.16	0.30	0.24	0.12	0.17	0.25	0.20	0.29	0.25	0.21	0.18	0.32	0.10	0.17	0.14	0.08	0.11	0.10
p_q	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.30	0.40	0.35	0.17	0.05	0.20	0.00	0.04	0.06	0.00	0.00	0.05
p_{q^5}	0.00	0.00	0.00	0.00	0.00	0.15	0.03	0.00	0.43	0.37	0.57	0.47	0.13	0.15	0.01	0.33	0.52	0.00	0.01	0.38
p_{FF5}	0.01	0.00	0.06	0.05	0.04	0.01	0.01	0.00	0.04	0.46	0.21	0.07	0.41	0.57	0.00	0.14	0.14	0.01	0.00	0.02
p_{FF6}	0.00	0.00	0.03	0.00	0.01	0.02	0.02	0.00	0.09	0.69	0.53	0.19	0.38	0.04	0.01	0.10	0.10	0.02	0.00	0.05
p_{FF6c}	0.00	0.00	0.13	0.00	0.01	0.06	0.04	0.00	0.23	0.70	0.65	0.47	0.28	0.05	0.03	0.28	0.35	0.13	0.03	0.23
p_{BS6}	0.02	0.00	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.15	0.00	0.01	0.01	0.00	0.00	0.05
p_{SY4}	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.44	0.75	0.76	0.32	0.13	0.04	0.01	0.01	0.01	0.01	0.01	0.17
p_{DHS}	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.00	0.01

	61 dLno	62 Ig	63 2Ig	64 Nsi	65 dIi	66 Cei	67 Ivg	68 Ivc	69 Oa	70 dWc	71 dCoa	72 dNco	73 dNca	74 dFin	75 dFnl	76 dBe	77 Dac	78 Poa	79 Pta	80 Pda
$\overline{R}$	−0.32	−0.42	−0.32	−0.67	−0.29	−0.57	−0.31	−0.41	−0.29	−0.47	−0.28	−0.39	−0.37	0.27	−0.26	−0.31	−0.45	−0.43	−0.43	−0.56
$t_{\overline{R}}$	−2.41	−3.44	−2.41	−4.74	−2.71	−3.42	−2.40	−3.17	−2.36	−3.70	−2.14	−3.39	−3.16	2.43	−2.53	−1.99	−3.47	−3.29	−3.31	−4.54
α_q	0.07	−0.03	0.07	−0.36	0.08	−0.31	−0.02	−0.26	−0.57	−0.58	0.07	−0.06	0.00	0.41	−0.01	0.08	−0.74	−0.22	−0.23	−0.52
α_{q^5}	0.11	−0.13	0.01	−0.15	0.06	−0.03	0.09	−0.02	−0.20	−0.23	0.14	0.00	0.00	0.14	0.02	0.13	−0.31	−0.05	−0.07	−0.18
α_{FF5}	−0.04	−0.15	−0.06	−0.33	−0.02	−0.31	−0.09	−0.34	−0.54	−0.57	0.04	−0.19	−0.12	0.48	−0.11	0.09	−0.71	−0.21	−0.19	−0.53
α_{FF6}	0.00	−0.12	0.01	−0.31	0.06	−0.27	−0.04	−0.28	−0.48	−0.51	0.04	−0.16	−0.11	0.46	−0.09	0.09	−0.69	−0.18	−0.19	−0.48
α_{FF6c}	−0.07	−0.16	−0.02	−0.25	0.06	−0.19	−0.02	−0.23	−0.32	−0.36	0.06	−0.17	−0.14	0.34	−0.08	0.04	−0.59	−0.08	−0.16	−0.45
α_{BS6}	0.05	0.01	0.10	−0.29	0.23	−0.12	0.05	−0.23	−0.55	−0.47	0.15	−0.08	−0.02	0.50	−0.06	0.13	−0.79	−0.14	−0.12	−0.53
α_{SY4}	0.22	−0.02	0.09	−0.20	0.08	−0.23	0.02	−0.17	−0.46	−0.49	0.12	0.00	0.03	0.37	−0.01	0.24	−0.57	−0.22	−0.11	−0.37
α_{DHS}	−0.17	−0.34	−0.29	−0.34	−0.15	−0.31	−0.21	−0.45	−0.34	−0.33	−0.32	−0.32	−0.32	0.25	−0.18	−0.32	−0.49	−0.33	−0.31	−0.50
t_q	0.43	−0.30	0.61	−2.83	0.82	−2.49	−0.14	−1.99	−4.25	−4.38	0.65	−0.52	−0.01	2.97	−0.05	0.64	−5.33	−1.73	−1.75	−3.40
t_{q^5}	0.68	−1.01	0.11	−1.12	0.52	−0.20	0.73	−0.17	−1.30	−1.77	1.18	0.01	0.01	0.97	0.16	0.94	−2.16	−0.38	−0.60	−1.22
t_{FF5}	−0.27	−1.35	−0.55	−2.91	−0.24	−3.04	−0.78	−2.85	−4.31	−4.40	0.39	−1.62	−1.03	4.08	−1.04	0.83	−5.47	−1.86	−1.60	−3.77
t_{FF6}	0.02	−1.11	0.08	−2.70	0.62	−2.46	−0.36	−2.35	−3.49	−3.93	0.37	−1.40	−0.97	3.81	−0.87	0.84	−5.08	−1.60	−1.58	−3.28
t_{FF6c}	−0.50	−1.35	−0.20	−2.07	0.60	−1.78	−0.14	−1.84	−2.13	−2.60	0.53	−1.42	−1.18	2.63	−0.72	0.33	−4.12	−0.71	−1.35	−2.99
t_{BS6}	0.34	0.07	0.77	−2.19	2.11	−0.90	0.45	−1.72	−3.79	−3.28	1.31	−0.74	−0.20	3.64	−0.56	1.05	−5.52	−1.11	−0.87	−3.34
t_{SY4}	1.56	−0.15	0.77	−1.78	0.78	−2.02	0.18	−1.37	−3.39	−3.88	1.05	−0.03	0.24	2.93	−0.09	2.00	−3.95	−1.82	−0.95	−2.68
t_{DHS}	−0.96	−2.87	−1.67	−3.01	−1.19	−2.79	−1.60	−2.86	−2.36	−2.13	−2.12	−2.31	−2.28	2.15	−1.43	−1.76	−3.45	−2.53	−2.55	−3.37
$\overline{\lvert\alpha_q\rvert}$	0.05	0.09	0.08	0.13	0.07	0.12	0.10	0.07	0.14	0.13	0.08	0.10	0.10	0.08	0.08	0.08	0.15	0.11	0.09	0.18
$\overline{\lvert\alpha_{q^5}\rvert}$	0.07	0.11	0.08	0.10	0.06	0.07	0.09	0.09	0.06	0.10	0.08	0.07	0.05	0.06	0.05	0.06	0.06	0.07	0.10	0.09
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.05	0.07	0.05	0.12	0.05	0.10	0.10	0.07	0.12	0.12	0.05	0.08	0.09	0.09	0.09	0.06	0.14	0.09	0.07	0.17
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.06	0.08	0.06	0.12	0.04	0.11	0.09	0.07	0.12	0.12	0.05	0.08	0.09	0.09	0.09	0.06	0.14	0.09	0.07	0.16
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.06	0.07	0.05	0.11	0.04	0.08	0.10	0.07	0.07	0.09	0.07	0.06	0.06	0.08	0.07	0.06	0.12	0.06	0.06	0.13
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.06	0.10	0.10	0.14	0.08	0.13	0.13	0.10	0.14	0.15	0.10	0.10	0.12	0.09	0.09	0.12	0.17	0.10	0.09	0.19
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.07	0.08	0.07	0.13	0.05	0.11	0.10	0.05	0.11	0.12	0.07	0.08	0.07	0.08	0.06	0.07	0.11	0.09	0.08	0.13
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.07	0.11	0.10	0.12	0.08	0.10	0.10	0.09	0.09	0.09	0.10	0.12	0.11	0.07	0.06	0.11	0.11	0.09	0.11	0.13
p_q	0.66	0.00	0.03	0.00	0.29	0.00	0.04	0.42	0.00	0.00	0.06	0.00	0.00	0.02	0.05	0.16	0.00	0.00	0.03	0.00
p_{q^5}	0.53	0.00	0.07	0.06	0.60	0.57	0.02	0.26	0.52	0.10	0.13	0.36	0.81	0.60	0.60	0.74	0.48	0.12	0.01	0.17
p_{FF5}	0.83	0.04	0.43	0.00	0.44	0.00	0.02	0.18	0.00	0.00	0.43	0.02	0.01	0.00	0.05	0.37	0.00	0.02	0.11	0.00
p_{FF6}	0.83	0.04	0.30	0.00	0.67	0.00	0.04	0.22	0.01	0.00	0.44	0.03	0.03	0.01	0.03	0.53	0.00	0.05	0.13	0.00
p_{FF6c}	0.77	0.16	0.54	0.00	0.73	0.04	0.02	0.20	0.29	0.12	0.27	0.19	0.33	0.18	0.38	0.56	0.00	0.40	0.33	0.01
p_{BS6}	0.54	0.00	0.01	0.00	0.02	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00
p_{SY4}	0.53	0.01	0.07	0.00	0.60	0.01	0.01	0.66	0.00	0.00	0.18	0.04	0.07	0.02	0.21	0.30	0.00	0.03	0.01	0.00
p_{DHS}	0.60	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.04	0.04	0.01	0.00	0.02	0.08	0.40	0.02	0.01	0.10	0.00	0.00

	81 Roe1	82 Roe6	83 dRoe1	84 dRoe6	85 dRoe12	86 Roa1	87 dRoa1	88 dRoa6	89 Ato	90 Cto	91 Rna^{q}1	92 Rna^{q}6	93 Ato^{q}1	94 Ato^{q}6	95 Ato^{q}12	96 Cto^{q}1	97 Cto^{q}6	98 Cto^{q}12	99 Gpa	100 Gla^{q}1
$\overline{R}$	0.69	0.41	0.76	0.37	0.25	0.58	0.56	0.29	0.40	0.34	0.65	0.43	0.67	0.59	0.49	0.47	0.45	0.41	0.41	0.56
$t_{\overline{R}}$	3.24	2.03	5.78	3.35	2.59	2.77	3.91	2.17	2.32	2.06	2.92	2.11	3.85	3.49	3.02	2.72	2.69	2.49	2.97	3.86
α_q	−0.04	−0.18	0.36	−0.01	−0.07	0.03	0.09	−0.16	0.43	0.05	0.19	0.09	0.42	0.41	0.39	−0.05	−0.02	0.00	0.21	0.26
α_{q^5}	−0.20	−0.33	0.08	−0.19	−0.17	−0.22	−0.15	−0.25	0.10	0.04	−0.05	−0.17	0.15	0.15	0.14	−0.14	−0.10	−0.09	0.05	0.04
α_{FF5}	0.47	0.25	0.78	0.39	0.26	0.49	0.52	0.26	0.42	0.08	0.52	0.33	0.54	0.53	0.48	0.08	0.09	0.10	0.26	0.41
α_{FF6}	0.30	0.10	0.55	0.21	0.12	0.26	0.30	0.06	0.39	0.06	0.38	0.23	0.44	0.42	0.38	0.04	0.04	0.05	0.23	0.33
α_{FF6c}	0.22	0.02	0.56	0.20	0.10	0.16	0.28	0.06	0.31	0.02	0.29	0.13	0.40	0.37	0.32	−0.05	−0.06	−0.05	0.19	0.27
α_{BS6}	−0.07	−0.21	0.36	−0.03	−0.08	−0.02	0.12	−0.16	0.63	0.13	0.18	0.09	0.56	0.57	0.56	0.00	0.04	0.07	0.33	0.34
α_{SY4}	0.32	0.12	0.56	0.18	0.11	0.28	0.35	0.09	0.23	−0.05	0.41	0.27	0.30	0.28	0.25	−0.09	−0.07	−0.05	0.08	0.26
α_{DHS}	−0.41	−0.60	0.13	−0.16	−0.18	−0.43	−0.04	−0.21	0.24	0.09	−0.20	−0.26	0.39	0.30	0.24	−0.06	−0.04	−0.03	0.12	0.13
t_q	−0.36	−1.54	2.64	−0.13	−0.87	0.28	0.57	−1.18	2.82	0.33	1.47	0.70	2.50	2.53	2.51	−0.33	−0.14	−0.02	1.55	1.94
t_{q^5}	−1.75	−2.93	0.57	−1.68	−1.84	−2.01	−0.82	−1.74	0.63	0.22	−0.36	−1.42	0.88	0.90	0.90	−0.81	−0.63	−0.55	0.36	0.28
t_{FF5}	3.71	2.10	5.67	3.38	2.67	3.65	3.50	1.98	3.15	0.58	3.94	2.76	3.42	3.65	3.49	0.55	0.66	0.73	2.11	3.08
t_{FF6}	2.55	0.88	4.49	2.05	1.36	2.30	2.04	0.51	2.94	0.47	3.05	2.08	2.97	3.08	2.88	0.25	0.29	0.40	1.90	2.55
t_{FF6c}	1.47	0.14	4.36	1.90	1.09	1.15	1.89	0.47	2.23	0.11	2.02	1.02	2.57	2.51	2.30	−0.34	−0.36	−0.35	1.40	1.95
t_{BS6}	−0.58	−1.74	2.84	−0.27	−0.97	−0.20	0.72	−1.26	4.57	0.87	1.43	0.75	3.65	4.03	3.98	−0.03	0.22	0.45	2.39	2.44
t_{SY4}	2.06	0.76	4.13	1.73	1.23	1.88	2.29	0.67	1.60	−0.33	2.48	1.72	2.01	2.03	1.83	−0.56	−0.47	−0.31	0.56	1.91
t_{DHS}	−2.31	−3.31	1.10	−1.61	−2.04	−2.41	−0.28	−1.60	1.39	0.50	−1.08	−1.50	1.99	1.66	1.37	−0.29	−0.20	−0.16	0.78	0.89
$\overline{\lvert\alpha_q\rvert}$	0.09	0.08	0.09	0.07	0.07	0.07	0.10	0.07	0.09	0.08	0.06	0.06	0.11	0.07	0.07	0.08	0.08	0.08	0.13	0.10
$\overline{\lvert\alpha_{q^5}\rvert}$	0.10	0.09	0.06	0.09	0.09	0.08	0.07	0.08	0.12	0.10	0.05	0.06	0.12	0.12	0.12	0.11	0.11	0.11	0.06	0.09
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.11	0.08	0.16	0.09	0.05	0.14	0.16	0.10	0.10	0.06	0.15	0.11	0.15	0.12	0.10	0.06	0.06	0.06	0.11	0.13
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.07	0.04	0.10	0.06	0.04	0.07	0.10	0.05	0.10	0.05	0.11	0.08	0.11	0.08	0.07	0.06	0.06	0.06	0.12	0.12
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.05	0.04	0.09	0.05	0.03	0.07	0.11	0.06	0.11	0.04	0.10	0.08	0.13	0.09	0.09	0.06	0.06	0.06	0.12	0.13
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.09	0.09	0.10	0.08	0.08	0.09	0.12	0.09	0.13	0.10	0.12	0.12	0.12	0.11	0.11	0.09	0.08	0.09	0.19	0.17
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.08	0.05	0.10	0.06	0.05	0.07	0.11	0.05	0.08	0.08	0.10	0.06	0.12	0.09	0.08	0.08	0.08	0.08	0.08	0.08
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.16	0.16	0.08	0.09	0.10	0.14	0.09	0.08	0.08	0.08	0.07	0.07	0.10	0.07	0.05	0.06	0.06	0.06	0.08	0.07
p_q	0.02	0.08	0.03	0.07	0.03	0.70	0.34	0.04	0.00	0.13	0.21	0.36	0.01	0.04	0.03	0.36	0.03	0.01	0.05	0.07
p_{q^5}	0.00	0.01	0.45	0.07	0.06	0.55	0.48	0.09	0.00	0.10	0.70	0.60	0.01	0.01	0.01	0.03	0.01	0.01	0.67	0.20
p_{FF5}	0.01	0.05	0.00	0.01	0.11	0.03	0.00	0.03	0.01	0.74	0.00	0.03	0.00	0.00	0.00	0.62	0.10	0.06	0.02	0.00
p_{FF6}	0.19	0.42	0.00	0.13	0.19	0.52	0.11	0.26	0.00	0.68	0.03	0.10	0.00	0.01	0.01	0.59	0.13	0.12	0.02	0.01
p_{FF6c}	0.79	0.74	0.01	0.22	0.51	0.76	0.08	0.18	0.01	0.88	0.14	0.29	0.00	0.02	0.03	0.66	0.30	0.38	0.07	0.01
p_{BS6}	0.01	0.00	0.03	0.02	0.01	0.05	0.09	0.01	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00
p_{SY4}	0.07	0.28	0.00	0.07	0.12	0.34	0.09	0.18	0.03	0.16	0.05	0.44	0.00	0.02	0.01	0.19	0.03	0.02	0.17	0.11
p_{DHS}	0.00	0.00	0.17	0.02	0.00	0.13	0.24	0.02	0.08	0.20	0.88	0.42	0.00	0.14	0.39	0.49	0.05	0.07	0.45	0.27

	101 Gla^{q}6	102 Gla^{q}12	103 Ole^{q}1	104 Ole^{q}6	105 Opa	106 Ola^{q}1	107 Ola^{q}6	108 Ola^{q}12	109 Cop	110 Cla	111 Cla^{q}1	112 Cla^{q}6	113 Cla^{q}12	114 F^{q}1	115 F^{q}6	116 F^{q}12	117 Fp^{q}6	118 O^{q}1	119 Tbi^{q}12	120 Sg^{q}1
$\overline{R}$	0.38	0.34	0.67	0.43	0.47	0.78	0.55	0.51	0.68	0.61	0.52	0.49	0.48	0.53	0.49	0.38	−0.67	−0.43	0.21	0.34
$t_{\overline{R}}$	2.83	2.58	3.31	2.23	2.44	3.84	2.85	2.78	3.94	3.65	3.43	3.75	3.88	2.47	2.55	2.16	−2.24	−1.97	2.02	2.01
α_q	0.15	0.18	−0.02	−0.17	0.52	0.43	0.28	0.35	0.75	0.81	0.46	0.41	0.46	0.15	0.15	0.06	−0.24	−0.38	0.32	0.14
α_{q^5}	−0.05	−0.01	−0.23	−0.37	−0.04	−0.11	−0.23	−0.11	0.11	0.18	−0.04	−0.06	0.03	0.25	0.28	0.17	0.30	−0.06	0.36	0.00
α_{FF5}	0.28	0.27	0.24	0.04	0.59	0.72	0.52	0.53	0.84	0.88	0.60	0.55	0.58	0.39	0.38	0.26	−0.86	−0.58	0.23	0.57
α_{FF6}	0.22	0.23	0.11	−0.05	0.54	0.56	0.39	0.42	0.75	0.80	0.50	0.44	0.49	0.25	0.26	0.17	−0.36	−0.48	0.22	0.37
α_{FF6c}	0.14	0.14	0.01	−0.18	0.44	0.50	0.32	0.35	0.55	0.60	0.43	0.35	0.39	0.28	0.26	0.14	−0.34	−0.34	0.15	0.39
α_{BS6}	0.22	0.25	−0.23	−0.33	0.63	0.50	0.35	0.41	0.86	0.93	0.51	0.45	0.51	0.08	0.11	0.02	−0.28	−0.40	0.27	0.31
α_{SY4}	0.16	0.19	0.14	−0.01	0.43	0.55	0.40	0.46	0.62	0.70	0.41	0.39	0.43	0.35	0.38	0.27	−0.28	−0.41	0.36	0.47
α_{DHS}	0.01	0.03	−0.28	−0.39	0.07	0.06	−0.08	−0.02	0.26	0.26	0.12	0.12	0.17	0.08	0.07	−0.02	0.45	0.16	0.19	−0.27
t_q	1.25	1.49	−0.15	−1.21	3.41	2.93	2.11	2.82	5.57	5.78	3.17	3.13	3.83	0.70	0.93	0.43	−0.97	−2.65	2.94	0.85
t_{q^5}	−0.36	−0.07	−1.59	−2.72	−0.25	−0.84	−2.11	−1.07	0.96	1.57	−0.28	−0.51	0.28	1.27	1.66	1.21	1.30	−0.42	3.01	0.01
t_{FF5}	2.38	2.33	1.87	0.33	3.79	4.54	3.88	4.33	6.80	7.18	4.20	4.29	5.08	1.92	2.26	1.93	−3.31	−4.13	2.25	3.71
t_{FF6}	1.92	2.02	0.84	−0.48	3.86	3.94	3.24	3.84	6.44	6.71	3.79	3.96	4.79	1.28	1.57	1.30	−2.26	−3.26	1.98	2.37
t_{FF6c}	1.19	1.20	0.04	−1.19	2.87	3.05	2.23	2.69	4.75	5.16	3.17	3.01	3.76	1.39	1.47	0.98	−2.05	−2.36	1.34	2.50
t_{BS6}	1.84	2.01	−1.57	−2.43	4.04	3.53	2.74	3.36	6.47	6.77	3.74	3.77	4.74	0.43	0.69	0.18	−1.70	−2.70	2.39	1.92
t_{SY4}	1.33	1.52	0.87	−0.06	2.75	3.71	2.94	3.57	4.88	5.28	3.07	3.50	4.36	1.74	2.26	1.86	−2.05	−2.52	3.33	2.83
t_{DHS}	0.04	0.22	−1.73	−2.46	0.38	0.35	−0.46	−0.11	1.61	1.59	0.81	0.95	1.49	0.38	0.37	−0.10	1.88	0.80	1.52	−1.45
$\overline{\lvert\alpha_q\rvert}$	0.11	0.10	0.07	0.08	0.14	0.13	0.09	0.09	0.18	0.15	0.20	0.12	0.13	0.10	0.14	0.10	0.11	0.08	0.10	0.09
$\overline{\lvert\alpha_{q^5}\rvert}$	0.09	0.06	0.10	0.12	0.07	0.07	0.07	0.05	0.07	0.07	0.07	0.05	0.04	0.09	0.11	0.09	0.16	0.08	0.08	0.10
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.12	0.11	0.09	0.06	0.17	0.23	0.17	0.16	0.21	0.19	0.22	0.15	0.17	0.13	0.11	0.07	0.13	0.12	0.10	0.17
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.12	0.11	0.07	0.05	0.14	0.18	0.13	0.12	0.18	0.15	0.20	0.12	0.13	0.11	0.10	0.08	0.10	0.10	0.09	0.12
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.14	0.13	0.06	0.05	0.14	0.18	0.13	0.12	0.15	0.14	0.18	0.11	0.13	0.11	0.10	0.06	0.10	0.10	0.09	0.11
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.17	0.16	0.09	0.11	0.18	0.16	0.12	0.13	0.21	0.19	0.21	0.13	0.15	0.09	0.14	0.10	0.09	0.09	0.11	0.11
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.08	0.06	0.08	0.07	0.12	0.16	0.11	0.10	0.14	0.12	0.19	0.11	0.12	0.13	0.12	0.10	0.11	0.09	0.08	0.14
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.07	0.05	0.12	0.13	0.05	0.06	0.05	0.04	0.09	0.07	0.14	0.05	0.06	0.07	0.10	0.06	0.21	0.14	0.06	0.11
p_q	0.07	0.16	0.04	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.04
p_{q^5}	0.07	0.23	0.29	0.01	0.08	0.52	0.14	0.38	0.25	0.40	0.49	0.93	0.51	0.22	0.00	0.01	0.02	0.25	0.01	0.09
p_{FF5}	0.01	0.04	0.09	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
p_{FF6}	0.01	0.05	0.19	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.01	0.01	0.01	0.00	0.00
p_{FF6c}	0.01	0.03	0.41	0.43	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.08	0.00	0.10	0.00	0.05	0.00	0.05	0.00	0.02
p_{BS6}	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.02	0.00	0.00
p_{SY4}	0.08	0.22	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
p_{DHS}	0.40	0.61	0.01	0.00	0.40	0.71	0.48	0.50	0.06	0.26	0.01	0.68	0.34	0.27	0.02	0.08	0.00	0.03	0.12	0.01

	121 Oca	122 Ioca	123 Adm	124 Rdm	125 Rdm^{q}1	126 Rdm^{q}6	127 Rdm^{q}12	128 Rds^{q}6	129 Rds^{q}12	130 Ol	131 Ol^{q}1	132 Ol^{q}6	133 Ol^{q}12	134 Hs	135 Rer	136 Eprd	137 Etl	138 Alm^{q}1	139 Alm^{q}6	140 Alm^{q}12
$\overline{R}$	0.57	0.51	0.62	0.73	1.09	0.80	0.83	0.50	0.51	0.44	0.49	0.48	0.49	−0.28	0.39	−0.59	0.32	0.53	0.54	0.48
$t_{\overline{R}}$	2.91	4.20	2.60	2.96	3.04	2.31	2.62	2.00	2.01	2.75	2.71	2.73	2.94	−2.00	2.85	−3.38	2.70	2.59	2.84	2.58
α_q	0.21	0.07	0.11	0.81	1.41	1.02	0.92	0.90	0.93	0.03	0.09	0.11	0.15	−0.25	0.40	−0.58	0.24	0.25	0.23	0.12
α_{q^5}	−0.11	−0.02	0.06	0.27	1.05	0.58	0.43	0.64	0.65	0.06	0.10	0.03	0.05	−0.12	0.23	−0.48	0.18	0.26	0.23	0.16
α_{FF5}	0.37	0.27	−0.07	0.66	0.95	0.74	0.72	0.95	1.00	0.13	0.24	0.24	0.28	−0.36	0.34	−0.89	0.33	0.07	0.12	0.07
α_{FF6}	0.35	0.13	0.07	0.68	1.36	1.01	0.88	0.88	0.93	0.12	0.24	0.23	0.26	−0.30	0.32	−0.79	0.23	0.13	0.13	0.05
α_{FF6c}	0.43	0.12	0.06	0.79	1.37	1.06	0.96	0.98	1.01	0.13	0.23	0.23	0.26	−0.28	0.30	−0.84	0.29	0.13	0.13	0.04
α_{BS6}	0.33	0.05	−0.20	0.81	1.43	1.04	0.91	1.00	1.04	0.00	0.11	0.10	0.13	−0.40	0.39	−0.80	0.30	0.00	−0.02	−0.11
α_{SY4}	0.05	0.07	0.09	0.39	1.20	0.72	0.58	0.59	0.65	0.02	0.14	0.13	0.15	−0.22	0.24	−0.61	0.16	0.16	0.17	0.10
α_{DHS}	0.24	0.17	0.88	1.12	1.74	1.43	1.33	0.60	0.61	0.15	0.16	0.19	0.20	−0.14	0.20	−0.09	0.35	0.88	0.82	0.69
t_q	1.14	0.58	0.43	3.64	3.33	3.25	3.55	3.27	3.36	0.16	0.56	0.71	0.95	−1.36	2.51	−3.32	1.45	1.72	1.74	0.91
t_{q^5}	−0.56	−0.14	0.25	1.24	2.37	1.79	1.60	2.31	2.35	0.35	0.56	0.19	0.29	−0.59	1.46	−2.83	1.13	1.75	1.70	1.19
t_{FF5}	1.93	2.30	−0.37	3.06	2.60	2.43	2.81	4.25	4.41	0.87	1.47	1.52	1.86	−2.29	2.30	−5.62	2.31	0.54	1.07	0.66
t_{FF6}	1.79	1.16	0.34	3.24	3.90	3.48	3.56	3.91	4.10	0.81	1.50	1.52	1.74	−1.78	2.12	−5.04	1.74	1.05	1.21	0.46
t_{FF6c}	1.99	0.98	0.27	3.64	3.93	3.71	3.98	4.44	4.54	0.84	1.30	1.37	1.60	−1.69	1.99	−5.23	2.21	1.05	1.16	0.38
t_{BS6}	1.71	0.40	−0.92	3.58	3.73	3.28	3.36	4.73	4.93	−0.01	0.67	0.60	0.81	−2.23	2.50	−4.79	2.04	0.03	−0.14	−0.89
t_{SY4}	0.27	0.60	0.40	1.79	3.17	2.53	2.37	2.37	2.65	0.14	0.89	0.84	1.02	−1.29	1.58	−3.96	1.15	1.18	1.29	0.81
t_{DHS}	1.12	1.22	2.99	4.48	3.99	3.47	3.53	2.41	2.46	0.88	0.91	1.02	1.14	−0.91	1.14	−0.43	2.29	4.50	4.21	3.60
$\overline{\lvert\alpha_q\rvert}$	0.13	0.09	0.07	0.28	0.53	0.47	0.46	0.30	0.30	0.09	0.08	0.08	0.09	0.14	0.13	0.15	0.07	0.09	0.09	0.07
$\overline{\lvert\alpha_{q^5}\rvert}$	0.09	0.07	0.09	0.12	0.36	0.27	0.24	0.23	0.21	0.11	0.10	0.11	0.10	0.13	0.12	0.16	0.08	0.09	0.07	0.06
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.13	0.08	0.06	0.22	0.38	0.36	0.37	0.26	0.27	0.07	0.08	0.08	0.08	0.15	0.11	0.22	0.08	0.06	0.06	0.05
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.13	0.07	0.07	0.24	0.48	0.41	0.40	0.28	0.28	0.07	0.08	0.08	0.08	0.13	0.11	0.19	0.07	0.07	0.06	0.04
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.16	0.05	0.06	0.24	0.46	0.40	0.39	0.26	0.26	0.06	0.09	0.08	0.08	0.13	0.11	0.21	0.08	0.08	0.06	0.06
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.18	0.12	0.10	0.34	0.56	0.51	0.49	0.32	0.32	0.10	0.11	0.11	0.10	0.18	0.18	0.22	0.09	0.07	0.06	0.06
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.08	0.07	0.06	0.18	0.45	0.35	0.33	0.26	0.25	0.07	0.06	0.07	0.07	0.11	0.09	0.15	0.07	0.08	0.08	0.06
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.10	0.06	0.17	0.29	0.54	0.47	0.46	0.23	0.22	0.10	0.10	0.11	0.11	0.10	0.09	0.07	0.08	0.23	0.24	0.20
p_q	0.03	0.06	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.18	0.02	0.01	0.02	0.01	0.01	0.19	0.06	0.06	0.38
p_{q^5}	0.16	0.53	0.38	0.25	0.00	0.02	0.03	0.00	0.00	0.09	0.08	0.04	0.02	0.13	0.05	0.01	0.17	0.07	0.14	0.31
p_{FF5}	0.05	0.06	0.83	0.00	0.01	0.01	0.00	0.00	0.00	0.10	0.22	0.05	0.01	0.00	0.01	0.00	0.06	0.20	0.16	0.36
p_{FF6}	0.05	0.19	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.18	0.04	0.03	0.01	0.01	0.00	0.30	0.11	0.15	0.42
p_{FF6c}	0.03	0.51	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.09	0.04	0.02	0.04	0.01	0.00	0.21	0.17	0.22	0.49
p_{BS6}	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.08	0.05	0.06	0.18
p_{SY4}	0.24	0.31	0.69	0.06	0.00	0.01	0.02	0.00	0.00	0.32	0.62	0.12	0.08	0.17	0.18	0.00	0.36	0.17	0.21	0.31
p_{DHS}	0.28	0.26	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.07	0.01	0.01	0.21	0.25	0.55	0.12	0.00	0.00	0.00

	141	142	143	144	145	146	147	148	149	150
	R_a^1	R_n^1	$R_a^{[2,5]}$	$R_a^{[6,10]}$	$R_n^{[6,10]}$	$R_a^{[11,15]}$	$R_a^{[16,20]}$	Dtv12	Isff1	Isq1
$\overline{R}$	0.63	0.59	0.71	0.81	−0.44	0.63	0.57	−0.36	0.30	0.22
$t_{\overline{R}}$	3.31	1.97	4.31	5.09	−2.34	4.65	3.53	−2.05	3.41	2.59
α_q	0.53	−0.06	0.83	1.08	0.02	0.61	0.65	−0.13	0.31	0.28
α_{q^5}	0.43	−0.67	0.84	0.91	0.04	0.56	0.63	−0.16	0.23	0.18
α_{FF5}	0.61	0.81	0.74	1.02	−0.10	0.69	0.62	−0.07	0.33	0.26
α_{FF6}	0.42	−0.27	0.76	1.08	−0.02	0.66	0.62	−0.08	0.29	0.23
α_{FF6c}	0.34	−0.24	0.69	1.06	−0.06	0.67	0.65	−0.10	0.28	0.21
α_{BS6}	0.41	−0.20	0.80	1.07	0.29	0.59	0.61	−0.02	0.35	0.31
α_{SY4}	0.53	−0.19	0.85	0.98	−0.09	0.59	0.58	−0.03	0.27	0.23
α_{DHS}	0.27	−0.76	0.60	1.09	−0.36	0.53	0.62	−0.88	0.28	0.34
t_q	2.57	−0.15	4.28	5.13	0.09	3.68	3.48	−1.69	3.05	2.84
t_{q^5}	1.94	−1.83	4.11	4.62	0.21	3.27	3.06	−2.06	2.07	1.71
t_{FF5}	3.36	2.20	4.22	5.32	−0.59	4.08	3.93	−1.03	3.55	2.80
t_{FF6}	2.39	−1.75	4.00	5.61	−0.12	4.28	3.62	−1.02	3.17	2.45
t_{FF6c}	1.84	−1.55	3.49	5.14	−0.34	4.00	3.49	−1.24	2.93	2.16
t_{BS6}	2.03	−1.24	3.95	4.82	1.54	3.40	3.52	−0.23	3.62	3.12
t_{SY4}	2.89	−0.66	4.44	4.97	−0.49	3.99	3.23	−0.34	2.81	2.31
t_{DHS}	1.14	−2.20	2.75	5.38	−1.75	3.23	3.32	−4.20	2.84	3.00
$\overline{\lvert\alpha_q\rvert}$	0.14	0.18	0.17	0.24	0.15	0.17	0.16	0.09	0.09	0.11
$\overline{\lvert\alpha_{q^5}\rvert}$	0.12	0.24	0.17	0.20	0.10	0.17	0.16	0.09	0.08	0.09
$\overline{\lvert\alpha_{\mathrm{FF5}}\rvert}$	0.16	0.17	0.15	0.23	0.15	0.19	0.16	0.05	0.08	0.09
$\overline{\lvert\alpha_{\mathrm{FF6}}\rvert}$	0.12	0.20	0.15	0.24	0.14	0.18	0.16	0.05	0.08	0.08
$\overline{\lvert\alpha_{\mathrm{FF6c}}\rvert}$	0.11	0.21	0.14	0.24	0.15	0.19	0.18	0.05	0.08	0.07
$\overline{\lvert\alpha_{\mathrm{BS6}}\rvert}$	0.12	0.22	0.16	0.24	0.15	0.18	0.16	0.06	0.10	0.12
$\overline{\lvert\alpha_{\mathrm{SY4}}\rvert}$	0.13	0.18	0.16	0.22	0.13	0.16	0.14	0.07	0.09	0.10
$\overline{\lvert\alpha_{\mathrm{DHS}}\rvert}$	0.10	0.32	0.11	0.24	0.15	0.15	0.15	0.37	0.08	0.09
p_q	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p_{q^5}	0.53	0.00	0.00	0.00	0.15	0.00	0.02	0.05	0.02	0.06
p_{FF5}	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00
p_{FF6}	0.29	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.01	0.01
p_{FF6c}	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.02	0.08
p_{BS6}	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
p_{SY4}	0.20	0.00	0.00	0.00	0.02	0.00	0.03	0.18	0.00	0.00
p_{DHS}	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00

Table 9 : The q^5-factor Loadings for the 150 Individual Anomalies, January 1967–December 2018, 624 Months

For each of the 150 high-minus-low deciles, we show the loadings on the market, size, investment-to-assets, Roe, and expected growth factors (β_{Mkt}, β_{Me}, $\beta_{\mathrm{I/A}}$, β_{Roe}, and β_{Eg}, respectively) in the q^5 model, as well as their heteroscedasticity-and-autocorrelation-adjusted t-values (denoted t_{Mkt}, t_{Me}, $t_{\mathrm{I/A}}$, t_{Roe}, and t_{Eg}, respectively). Table 4 describes the anomalies, and the Internet Appendix details variable definitions and portfolio construction.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Sue1	Abr1	Abr6	Abr12	Re1	Re6	R^61	R^66	R^612	$R^{11}1$	$R^{11}6$	$R^{11}12$	Im1	Im6	Im12	Rs1	dEf1	dEf6	dEf12	Nei1
β_{Mkt}	−0.02	−0.04	−0.02	0.00	−0.06	−0.06	−0.15	−0.02	0.02	−0.05	0.00	0.02	−0.13	−0.01	0.00	−0.02	0.02	0.06	0.03	0.03
β_{Me}	0.00	0.06	0.09	0.08	−0.17	−0.14	0.27	0.27	0.09	0.37	0.18	−0.07	0.18	0.28	0.17	−0.10	−0.05	−0.02	−0.07	−0.04
$\beta_{\mathrm{I/A}}$	−0.14	−0.19	−0.24	−0.31	0.02	−0.15	−0.19	−0.25	−0.35	−0.20	−0.34	−0.49	−0.07	−0.10	−0.29	−0.51	−0.17	−0.31	−0.34	−0.35
β_{Roe}	0.79	0.21	0.13	0.12	1.22	1.01	0.95	0.80	0.73	1.19	1.13	1.00	0.60	0.64	0.56	0.49	0.74	0.77	0.66	0.58
β_{Eg}	0.18	0.19	0.15	0.12	0.06	0.13	0.71	0.69	0.41	0.85	0.56	0.27	0.57	0.63	0.43	0.24	0.08	0.01	0.02	0.17
t_{Mkt}	−0.42	−0.83	−0.59	−0.13	−1.08	−1.10	−1.62	−0.27	0.34	−0.56	0.02	0.39	−1.71	−0.12	0.08	−0.40	0.37	1.43	0.85	1.26
t_{Me}	0.04	0.66	1.86	2.07	−2.04	−1.70	1.38	1.64	0.68	1.80	1.05	−0.52	1.00	1.91	1.31	−1.99	−0.54	−0.23	−1.17	−1.03
$t_{\mathrm{I/A}}$	−1.56	−1.89	−3.50	−5.58	0.13	−1.09	−0.63	−1.24	−2.21	−0.70	−1.63	−2.82	−0.26	−0.53	−1.67	−6.51	−1.26	−2.74	−4.06	−5.27
t_{Roe}	10.18	2.14	1.84	2.60	8.66	7.84	2.98	3.88	5.09	4.23	5.41	6.86	2.76	3.55	3.72	5.90	6.95	7.83	8.96	9.28
t_{Eg}	1.83	1.63	1.64	1.70	0.38	0.96	2.82	3.51	2.51	3.33	2.58	1.47	2.86	3.68	2.69	2.56	0.55	0.12	0.21	2.47

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	52w6	52w12	ϵ^66	ϵ^612	$\epsilon^{11}1$	$\epsilon^{11}6$	$\epsilon^{11}12$	Sm1	Sm12	Ilr1	Ilr6	Ilr12	Ile1	Cm1	Cm12	Sim1	Cim1	Cim6	Cim12	Bm
β_{Mkt}	−0.38	−0.33	0.00	0.01	0.05	0.03	0.02	0.02	0.03	−0.14	−0.08	−0.03	−0.01	0.08	0.03	0.08	0.02	−0.03	0.00	0.01
β_{Me}	−0.33	−0.46	0.11	0.06	0.16	0.13	0.05	−0.18	0.12	−0.06	0.09	0.09	0.05	−0.16	0.10	0.10	−0.16	0.14	0.12	0.42
$\beta_{\mathrm{I/A}}$	0.26	0.16	0.02	−0.05	0.14	0.03	−0.02	0.17	0.01	0.03	−0.05	−0.09	−0.22	0.24	−0.02	0.11	0.07	0.02	−0.09	1.34
β_{Roe}	1.10	1.00	0.14	0.20	0.28	0.29	0.28	−0.17	0.18	−0.04	0.25	0.25	0.53	−0.06	0.09	−0.04	0.05	0.18	0.18	−0.58
β_{Eg}	0.60	0.38	0.32	0.27	0.39	0.29	0.19	0.24	0.16	0.36	0.27	0.25	0.31	0.06	0.10	0.56	0.40	0.37	0.35	0.09
t_{Mkt}	−5.57	−6.69	0.07	0.17	0.84	0.61	0.52	0.31	1.51	−1.99	−2.38	−1.03	−0.16	1.10	0.95	1.05	0.35	−0.90	0.07	0.27
t_{Me}	−2.09	−4.40	1.78	1.05	2.40	1.67	0.63	−1.98	3.92	−0.67	1.20	1.60	0.53	−1.94	1.64	0.82	−1.71	1.99	2.37	5.27
$t_{\mathrm{I/A}}$	1.33	1.16	0.27	−0.66	1.21	0.29	−0.18	0.98	0.19	0.17	−0.46	−1.23	−1.83	1.47	−0.29	0.51	0.41	0.17	−0.83	13.13
t_{Roe}	5.21	6.81	1.42	2.69	2.09	2.75	3.04	−0.99	3.59	−0.30	2.67	3.45	4.95	−0.35	1.54	−0.21	0.38	1.91	2.51	−6.42
t_{Eg}	3.55	2.70	2.93	2.89	2.50	2.12	1.65	1.36	2.86	2.25	2.83	3.63	2.53	0.35	1.89	3.15	2.43	3.77	4.90	0.78

	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	Ep^{q}1	Ep^{q}6	Ep^{q}12	Cp^{q}1	Cp^{q}6	Nop	Em	Em^{q}1	Sp	Sp^{q}1	Sp^{q}6	Sp^{q}12	Ocp	Ocp^{q}1	Ia	Ia^{q}6	Ia^{q}12	dPia	Noa	dNoa
β_{Mkt}	−0.01	−0.03	−0.06	0.06	0.00	−0.13	0.08	0.05	0.08	0.11	0.07	0.05	0.01	0.13	0.04	0.06	0.04	0.04	−0.06	−0.01
β_{Me}	0.29	0.25	0.26	0.18	0.17	−0.31	−0.20	0.01	0.61	0.57	0.60	0.63	0.17	0.15	−0.13	−0.19	−0.21	−0.11	0.08	0.03
$\beta_{\mathrm{I/A}}$	0.90	0.87	0.85	1.11	1.05	0.99	−0.97	−0.76	1.18	1.14	1.16	1.14	1.41	1.15	−1.41	−1.36	−1.37	−0.88	0.11	−1.04
β_{Roe}	0.23	0.20	0.16	−0.49	−0.49	−0.01	0.22	−0.05	−0.22	−0.45	−0.41	−0.29	−0.57	−0.61	0.13	0.37	0.22	0.09	0.17	0.03
β_{Eg}	−0.20	−0.07	−0.04	−0.25	−0.13	0.24	−0.21	0.03	−0.16	−0.24	−0.21	−0.21	0.14	0.13	0.05	−0.12	−0.07	0.01	−0.53	−0.03
t_{Mkt}	−0.16	−0.60	−1.18	0.98	−0.10	−3.01	1.61	0.93	1.61	1.65	1.25	1.07	0.20	1.54	1.35	1.92	1.19	1.19	−1.62	−0.29
t_{Me}	2.20	2.08	2.39	1.36	1.44	−3.99	−2.51	0.14	4.60	3.43	4.02	4.59	1.55	0.72	−2.34	−3.53	−4.56	−2.11	0.80	0.55
$t_{\mathrm{I/A}}$	5.53	6.55	6.78	7.14	7.48	10.17	−7.89	−5.37	9.88	6.57	7.68	8.61	10.13	5.84	−19.14	−14.29	−15.67	−9.21	0.77	−9.93
t_{Roe}	1.41	1.50	1.36	−3.15	−3.70	−0.13	1.80	−0.43	−1.92	−2.33	−2.48	−2.21	−4.57	−2.80	1.85	4.89	3.26	1.06	1.68	0.47
t_{Eg}	−1.45	−0.54	−0.35	−1.69	−1.02	2.32	−1.78	0.23	−1.36	−1.62	−1.55	−1.75	1.04	0.69	0.56	−1.34	−0.86	0.15	−5.10	−0.49

	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
	dLno	Ig	2Ig	Nsi	dIi	Cei	Ivg	Ivc	Oa	dWc	dCoa	dNco	dNca	dFin	dFnl	dBe	Dac	Poa	Pta	Pda
β_{Mkt}	−0.07	0.00	0.06	0.01	0.03	0.17	−0.04	0.00	0.00	−0.03	0.04	−0.03	−0.05	0.01	0.03	0.03	−0.05	−0.03	0.04	−0.03
β_{Me}	−0.15	−0.15	−0.28	0.14	−0.16	0.24	0.06	−0.03	0.25	0.33	−0.04	−0.07	−0.10	−0.08	−0.08	−0.13	0.15	0.14	0.15	0.05
$\beta_{\mathrm{I/A}}$	−0.80	−0.82	−0.80	−0.56	−0.66	−0.89	−0.88	−0.63	0.14	−0.15	−1.13	−0.77	−0.88	−0.36	−0.44	−1.33	0.45	−0.79	−0.79	−0.09
β_{Roe}	0.01	−0.11	−0.09	−0.17	−0.19	0.00	0.10	0.29	0.46	0.32	0.16	0.02	0.02	−0.09	−0.14	0.27	0.38	0.19	0.13	0.14
β_{Eg}	−0.06	0.14	0.08	−0.31	0.03	−0.43	−0.16	−0.36	−0.56	−0.52	−0.11	−0.09	−0.01	0.40	−0.04	−0.08	−0.64	−0.26	−0.23	−0.50
t_{Mkt}	−1.46	0.00	1.83	0.33	0.90	4.94	−1.08	−0.01	−0.02	−0.77	1.35	−0.78	−1.41	0.34	0.98	0.73	−1.62	−1.02	1.05	−0.82
t_{Me}	−2.30	−2.69	−4.41	1.90	−3.43	3.75	1.55	−0.63	4.64	4.03	−0.78	−1.50	−1.99	−1.72	−1.80	−1.98	2.83	3.35	2.39	0.66
$t_{\mathrm{I/A}}$	−7.53	−11.11	−9.71	−6.97	−8.23	−12.29	−12.12	−5.82	1.41	−1.58	−17.87	−11.64	−13.44	−3.03	−6.33	−13.02	4.91	−8.24	−7.71	−0.70
t_{Roe}	0.06	−1.64	−1.16	−2.59	−2.62	−0.05	1.32	3.16	6.43	4.36	2.53	0.20	0.32	−1.05	−1.93	3.05	5.74	2.84	1.45	1.56
t_{Eg}	−0.53	1.60	0.95	−3.83	0.42	−5.04	−1.68	−3.43	−5.58	−5.45	−1.20	−1.10	−0.06	3.66	−0.42	−0.86	−6.02	−2.77	−2.32	−4.78

	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
	Roe1	Roe6	dRoe1	dRoe6	dRoe12	Roa1	dRoa1	dRoa6	Ato	Cto	Rna^{q}1	Rna^{q}6	Ato^{q}1	Ato^{q}6	Ato^{q}12	Cto^{q}1	Cto^{q}6	Cto^{q}12	Gpa	Gla^{q}1
β_{Mkt}	−0.05	−0.09	0.06	0.06	0.02	−0.09	0.13	0.09	0.24	0.17	−0.10	−0.10	0.15	0.13	0.12	0.12	0.13	0.12	0.06	0.03
β_{Me}	−0.34	−0.40	−0.01	0.01	0.00	−0.34	0.14	0.13	0.29	0.36	−0.43	−0.46	0.43	0.38	0.33	0.32	0.31	0.30	0.05	0.14
$\beta_{\mathrm{I/A}}$	0.10	0.01	0.10	0.12	0.09	−0.13	0.12	0.11	−1.08	−0.55	−0.20	−0.27	−0.62	−0.73	−0.80	−0.17	−0.25	−0.31	−0.37	−0.37
β_{Roe}	1.42	1.30	0.48	0.48	0.47	1.25	0.49	0.55	0.16	0.54	1.17	1.03	0.43	0.41	0.36	0.79	0.74	0.68	0.47	0.54
β_{Eg}	0.24	0.22	0.41	0.27	0.14	0.36	0.35	0.14	0.50	0.03	0.36	0.39	0.40	0.38	0.36	0.12	0.12	0.13	0.23	0.35
t_{Mkt}	−1.35	−2.45	1.56	1.62	0.78	−3.01	3.02	2.22	5.53	3.60	−2.60	−3.14	2.66	2.50	2.30	2.38	2.59	2.40	1.59	0.87
t_{Me}	−5.59	−6.27	−0.08	0.13	0.09	−6.14	2.03	1.86	5.05	4.89	−8.86	−10.84	5.54	5.56	5.81	3.03	3.35	3.52	1.10	2.80
$t_{\mathrm{I/A}}$	1.14	0.14	1.22	1.76	1.76	−1.95	1.16	1.41	−9.62	−5.75	−2.26	−3.30	−6.62	−7.92	−8.95	−1.74	−2.62	−3.41	−4.46	−4.50
t_{Roe}	18.88	16.73	5.28	5.53	7.36	16.11	4.47	5.22	2.17	7.00	15.75	13.77	4.30	5.15	4.71	9.36	9.63	9.31	6.33	8.75
t_{Eg}	2.46	2.46	3.61	2.78	2.12	4.23	2.90	1.31	4.59	0.24	4.17	4.91	3.49	3.49	3.35	1.05	1.05	1.19	2.25	3.59

	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
	Gla^{q}6	Gla^{q}12	Ole^{q}1	Ole^{q}6	Opa	Ola^{q}1	Ola^{q}6	Ola^{q}12	Cop	Cla	Cla^{q}1	Cla^{q}6	Cla^{q}12	F^{q}1	F^{q}6	F^{q}12	Fp^{q}6	O^{q}1	Tbi^{q}12	Sg^{q}1
β_{Mkt}	0.05	0.04	−0.01	−0.02	−0.16	−0.03	−0.03	−0.06	−0.13	−0.11	−0.01	0.03	0.00	−0.09	−0.06	−0.06	0.33	0.09	−0.08	0.14
β_{Me}	0.08	0.06	−0.22	−0.28	−0.40	−0.27	−0.32	−0.32	−0.53	−0.55	−0.27	−0.27	−0.27	−0.35	−0.42	−0.43	0.38	0.77	−0.17	0.12
$\beta_{\mathrm{I/A}}$	−0.46	−0.54	0.34	0.29	−0.58	−0.43	−0.48	−0.57	−0.32	−0.56	−0.29	−0.28	−0.32	0.40	0.33	0.31	0.36	0.28	−0.12	−0.79
β_{Roe}	0.50	0.43	1.07	0.97	0.42	0.81	0.73	0.65	0.20	0.12	0.22	0.22	0.18	0.76	0.71	0.68	−1.31	−0.62	0.04	0.66
β_{Eg}	0.30	0.30	0.31	0.29	0.82	0.84	0.79	0.72	0.97	0.93	0.77	0.73	0.66	−0.16	−0.20	−0.17	−0.84	−0.49	−0.05	0.21
t_{Mkt}	1.77	1.22	−0.34	−0.60	−4.36	−0.77	−1.02	−2.37	−3.75	−3.07	−0.26	1.21	−0.20	−1.57	−1.37	−1.47	5.25	2.39	−2.16	3.11
t_{Me}	1.70	1.51	−2.11	−3.25	−4.83	−3.69	−5.72	−5.76	−8.09	−9.19	−4.57	−5.84	−6.20	−3.30	−4.75	−5.28	2.16	14.54	−3.34	1.75
$t_{\mathrm{I/A}}$	−6.15	−6.88	2.74	2.74	−7.09	−4.75	−6.48	−7.94	−4.42	−7.01	−3.19	−3.48	−4.52	2.84	2.92	3.29	1.56	2.78	−1.89	−7.22
t_{Roe}	8.23	6.52	10.12	9.21	6.09	10.71	11.84	9.43	3.59	1.94	3.13	4.28	3.77	6.85	7.65	7.22	−6.95	−8.65	0.58	5.34
t_{Eg}	3.38	3.39	2.66	2.60	8.07	9.14	10.39	8.73	11.84	12.27	7.00	10.18	10.81	−1.18	−1.68	−2.04	−5.50	−5.75	−0.67	1.43

	121 Oca	122 Ioca	123 Adm	124 Rdm	125 Rdm^{q}1	126 Rdm^{q}6	127 Rdm^{q}12	128 Rds^{q}6	129 Rds^{q}12	130 Ol	131 Ol^{q}1	132 Ol^{q}6	133 Ol^{q}12	134 Hs	135 Rer	136 Eprd	137 Etl	138 Alm^{q}1	139 Alm^{q}6	140 Alm^{q}12
β_{Mkt}	−0.12	−0.07	0.07	0.23	0.08	0.00	0.01	−0.08	−0.11	−0.05	−0.10	−0.12	−0.12	−0.18	0.09	0.10	0.03	0.08	0.07	0.07
β_{Me}	0.25	0.28	0.48	0.67	0.21	0.57	0.67	0.20	0.18	0.30	0.27	0.33	0.32	−0.09	−0.11	0.34	0.31	0.67	0.71	0.72
$\beta_{\mathrm{I/A}}$	0.07	0.31	1.31	−0.10	0.47	0.51	0.61	−1.00	−1.01	0.12	0.03	0.00	−0.01	0.29	−0.16	0.47	−0.13	0.87	0.80	0.75
β_{Roe}	0.44	0.47	−0.30	−0.87	−1.15	−1.06	−0.90	−0.41	−0.41	0.58	0.67	0.59	0.56	0.03	−0.02	−0.57	0.02	−0.44	−0.34	−0.23
β_{Eg}	0.49	0.14	0.08	0.84	0.55	0.67	0.75	0.40	0.42	−0.05	0.00	0.12	0.14	−0.20	0.24	−0.14	0.09	−0.01	0.00	−0.06
t_{Mkt}	−1.94	−2.15	0.79	3.93	0.71	0.05	0.15	−1.01	−1.30	−1.02	−1.94	−2.53	−2.64	−3.66	1.69	1.73	0.63	2.17	2.38	2.32
t_{Me}	3.19	6.06	2.84	7.55	1.07	4.24	5.76	1.33	1.15	3.25	3.38	3.75	4.14	−1.11	−1.19	4.45	3.37	7.97	10.97	11.94
$t_{\mathrm{I/A}}$	0.64	3.32	6.18	−0.69	1.65	2.58	3.68	−6.09	−6.55	1.16	0.29	−0.01	−0.14	1.91	−1.36	4.01	−0.88	8.86	9.99	9.44
t_{Roe}	3.62	6.86	−1.35	−5.83	−4.15	−6.22	−6.26	−2.27	−2.42	5.47	6.52	5.50	5.36	0.22	−0.21	−5.13	0.16	−5.17	−4.83	−3.03
t_{Eg}	3.26	1.20	0.42	5.37	2.45	3.50	4.61	2.45	2.67	−0.39	−0.03	0.95	1.23	−1.65	1.98	−1.25	0.82	−0.07	0.01	−0.72

	141 R_{a}^{1}	142 R_{n}^{1}	143 $R_{\mathrm{a}}^{[2,5]}$	144 $R_{\mathrm{a}}^{[6,10]}$	145 $R_{\mathrm{n}}^{[6,10]}$	146 $R_{\mathrm{a}}^{[11,15]}$	147 $R_{\mathrm{a}}^{[16,20]}$	148 Dtv12	149 Isff1	150 Isq1
β_{Mkt}	0.23	−0.13	0.06	0.00	0.15	0.00	−0.06	0.14	−0.01	−0.01
β_{Me}	−0.14	0.44	−0.17	0.04	−0.29	−0.06	−0.08	−1.13	0.14	0.20
$\beta_{\mathrm{I/A}}$	−0.21	−0.32	−0.30	−0.42	−0.81	−0.02	−0.06	−0.36	−0.07	−0.10
β_{Roe}	0.14	1.02	0.04	−0.30	−0.26	0.07	−0.01	0.28	−0.08	−0.16
β_{Eg}	0.15	0.90	−0.02	0.25	−0.04	0.08	0.02	0.04	0.12	0.15
t_{Mkt}	4.34	−1.22	1.01	−0.06	2.82	−0.07	−1.28	5.64	−0.18	−0.28
t_{Me}	−1.23	1.98	−1.67	0.47	−3.32	−0.66	−1.53	−32.45	3.75	2.80
$t_{\mathrm{I/A}}$	−1.46	−0.97	−2.65	−2.62	−6.23	−0.18	−0.48	−7.62	−0.96	−1.42
t_{Roe}	0.99	3.17	0.32	−2.34	−1.95	0.63	−0.13	6.70	−1.40	−2.76
t_{Eg}	1.02	3.44	−0.19	1.88	−0.28	0.66	0.21	0.92	1.81	2.03