Investment-based Costs of Equity

Andrei S. Gonçalves*
The Ohio State University

Yicheng Liu†
The Ohio State University

Chen Xue‡
University of Cincinnati

Lu Zhang§
The Ohio State University and NBER

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Abstract

This paper develops the q^5-characteristics model for estimating costs of equity as out-of-sample forecasts from cross-sectional regressions. The q^5-characteristics model is competitive in evaluation tests, outperforming the accounting-based implied cost of equity in predicting cross-sectional returns. The q^5-characteristics cost of equity is precise at the industry level, aligned with average factor premiums, and its equity term structure is flat. Its firm-level distribution is weakly left-skewed, whereas the accounting-based cost of equity is weakly right-skewed. However, the accounting cost of equity outperforms in time series predictability. Factor models perform poorly.

*Fisher College of Business, The Ohio State University, 2100 Neil Avenue, Columbus OH 43210. E-mail: goncalves.11@osu.edu.

†Fisher College of Business, The Ohio State University, 2100 Neil Avenue, Columbus OH 43210. E-mail: liu.9716@buckeyemail.osu.edu.

‡Lindner College of Business, University of Cincinnati, 2338 Lindner Hall, Cincinnati OH 45221. E-mail: xuecx@ucmail.uc.edu.

§Fisher College of Business, The Ohio State University, 2100 Neil Avenue, Columbus OH 43210; and NBER. E-mail: zhanglu@fisher.osu.edu.

1 Introduction

The cost of equity problem is one of the most essential problems in finance. Most practical applications hinge on a high quality cost of equity estimate, such as investment management, business valuation, and capital budgeting, with literally trillions of dollars involved (Pratt and Grabowski 2014).

However, in the academic literature, how to measure a firm's cost of equity is a largely open question. Despite its popularity, factor models give rise to costs of equity that are "distressingly imprecise" even at the industry level (Fama and French 1997, p. 178). A prominent literature has developed over the past two decades that estimates costs of equity from accounting-based valuation models (Gebhardt, Lee, and Swaminathan 2001). Alas, these implied costs of equity exhibit only weak associations with realized returns (Easton and Monahan 2005). In the cross section, the implied factor premiums often have the opposite signs to realized premiums (Tang, Wu, and Zhang 2014).

This paper develops firm-specific q-theory based costs of equity, denoted QCE, from the q^5-characteristics model. Specifically, we calculate QCE as the out-of-sample forecast from Fama-MacBeth (1973) cross-sectional regressions by combining slopes from prior 120-month rolling windows with the latest known q^5-characteristics. These characteristics underlie the q^5-factor model, including size, investment-to-assets, return on equity, and expected growth (Hou et al. 2021).

Through a battery of evaluation tests, we establish the q^5-characteristics model as a competitive model for estimating costs of equity. Sorting on a given cost of equity measure is the simplest way to test its association with future returns. QCE outperforms the accounting implied cost of equity (ICE) in this test. The high-minus-low QCE decile earns on average 1.53%, 0.62%, and 0.4% per month ($t = 6.45$, 2.27, and 1.77), whereas the high-minus-low ICE decile earns 0.14%, 0.37%, and 0.22% ($t = 0.34$, 1.01, and 0.76) at the 1-, 12-, and 36-month horizons post formation, respectively.

We also perform the Lewellen (2015) test on whether the predictive slope equals one in cross-sectional regressions of subsequent returns on a given cost of equity proxy. If the average return is an unbiased proxy for the true expected return, this test checks whether the expected return

proxy is unbiased. QCE again outperforms ICE in this test. The QCE slopes are 0.83, 0.57, and 0.66, whereas the ICE slopes are 0.49, 0.54, and 0.35 at the 1-, 12-, and 36-month horizons, respectively. All the QCE slopes are insignificant from one, whereas the 1- and 36-month ICE slopes are significant from one (and the 12-month slope marginally significant).

We also use time series and cross-section measurement error variance (MEV) to evaluate costs of equity. Lee, So, and Wang (2021) argue that for treatment effects (how differences in firm policies and characteristics are related to differences in costs of equity), the bias in a given cost of equity proxy is less important than the MEVs. We find that QCE underperforms ICE in time series MEV. The QCE-minus-ICE differentials are positive up to the 36-month, albeit turning negative at the 60-month, and all are highly significant. However, QCE shows a small edge over ICE in cross-section MEV. The differentials are negative for four out of six horizons, albeit insignificant.

We use the q^5-characteristics model to study firm-level costs of equity, industry costs of equity, expected factor premiums, and the equity premium. At the firm level, the term structure of the QCE mean is surprisingly flat in the January 1977–December 2022 sample. The 1-month QCE is on average 14.31% per annum, which is close to 14.08% at the 12-month and 13.77% at the 36-month. In contrast, the term structure of the QCE volatility is downward sloping: 10.74%, 6.91%, and 4.33% at the 1-, 12-, and 36-month, respectively. Also, the firm-level QCE distributions are weakly left-skewed across all horizons, while the firm-level ICE distribution is weakly right-skewed. Finally, microcaps reduce the QCE volatilities but leave other moments largely unchanged.

The q^5-characteristics model largely resolves the Fama-French (1997) imprecision problem. Averaged across 57 nonfinancial industries per North American Industry Classification System (NAICS), the return volatility is 27.13% per annum (relative to the average return of 13.17%). The volatility of the q^5-factor costs of equity is 9.66%, which implies a standard error of 1.42% given a sample length of 46 years (relative to its average of 9.7%). In contrast, the volatility of the 12-month QCE is only 4.47%, which implies a standard error of 0.66% (relative to its average of 10.02%).

The q^5-characteristics model also goes a long way in resolving the weak association problem with realized returns (Tang, Wu, and Zhang 2014). The high-minus-low deciles on momentum (prior 11-month return) and return on equity earn large and significant average realized returns in short horizons, and the high-minus-low expected growth decile does so across all horizons. The QCE premiums are largely aligned with average returns, but the ICE premiums are significantly negative across all horizons. For example, the high-minus-low expected growth decile earns average realized holding period returns of 0.65%, 6.78%, and 23.2% (t = 3.06, 2.16, and 3.07) at the 1-, 12-, and 36-month, the QCE premiums of 1.27%, 6.96%, and 13.97% (t = 10.05, 4.88, and 5.22), but the ICE premiums of $-0.23\%, -3\%$, and -10.55% ($t = -6.6, -6.63$, and -6.64), respectively.

We also find that the ICE performance is remarkable in time series predictive regressions of selective factor premiums, especially the equity premium. The ICE slopes are positive and mostly significant across horizons, with R^2 up to 37.2% for momentum, 13.5% for the ROE factor, and 15.5% for the expected growth factor. For the equity premium, the ICE slopes are again positive and often significant, with R^2 up to 29.7%. The QCE performance is fair, but much weaker.

Our costs of equity estimation follows Lewellen (2015). Lewellen shows that out-of-sample forecasts from cross-sectional regressions provide a simple, yet surprisingly effective, way to form a composite trading strategy on predicted returns. This approach is attractive because the forecasts mimic how an investor could, in real time, combine many firm characteristics to form a stock's expected return. Lewellen examines up to 15 characteristics. We instead focus on the q^5 characteristics. We provide a comprehensive comparison with the accounting-based ICE. Also, we study in detail the properties of the q^5 characteristics-based QCE at the firm-, industry-, factor-, and aggregate-level.

Our work complements the implied costs of equity literature (Lee, So, and Wang 2021). The q^5-characteristics model shares its focus on firms. However, the q^5 characteristics are motivated from an economic model. Relative to the accounting ICE, the q^5-characteristics QCE is relatively unbiased. Bias in a given cost of equity proxy is clearly of first-order importance in business valuation

and capital budgeting. In addition, QCE is strongly associated with subsequent returns in the cross section, whereas ICE is strongly associated with subsequent returns in the time series. As such, we echo Lee et al. that time series and cross-sectional predictability entail different pricing information.

Our work expands the investment CAPM literature. The q^5-characteristics model is built on the q^5-factors (Hou, Xue, and Zhang 2015; Hou et al. 2021). Prior work has also studied the in-sample fit via structural estimation (Liu, Whited, and Zhang 2009; Goncalves, Xue, and Zhang 2020). We instead examine its out-of-sample performance and show that it falls short of the q^5-characteristics model. The economy is a complex adaptive system, in which explanation differs from prediction. The structural model explains better the underlying mechanisms, while the q^5-characteristics model better predicts returns. Our evidence supports this systems view of the world (Laszlo 1996).

The rest of the article is organized as follows. Section 2 describes the different models of estimating costs of equity. Section 3 presents the evaluation methods and a battery of evaluation results. Section 4 documents extensively the properties of investment-based costs of equity. Finally, Section 5 concludes. A separate Internet Appendix furnishes supplementary results.

2 Estimating Costs of Equity

We study the relative performance of four classes of cost-of-equity models: (i) factor models (Section 2.1); (ii) accounting-based implied costs of equity (Section 2.2); (iii) characteristics-based cross-sectional forecasts (Section 2.3); and (iv) the structural investment model (Section 2.4).

2.1 Factor Models

We study the costs of equity from the Hou et al. (2021) q^5 model and the Fama-French (2018) 6-factor model. At the beginning of month t, we estimate betas from prior 60-month rolling window (30 months minimum) and combine the betas with factor premiums averaged over the expanding window from January 1967 to month $t-1$ to compute a stock's expected risk premium. We add back the riskless interest rate at the beginning of month t to obtain its cost of equity.

The estimation is for 1-month forecasts. For longer horizons, because the factor models are unconditional in nature, the implied term structure of equity is flat. For example, for 12-month ahead costs of equity, we raise the 1-month forecasts to the power of 12. It is possible to reestimate factor loadings with annual returns data. However, we opt to keep the monthly frequency to ease comparison with other cost-of-equity estimates (all monthly available) over longer horizons.

2.2 Accounting-based Implied Costs of Equity

In the dividend discounting model, the market value of firm i, P_{it}, is the present value of its expected dividends, $P_{it} = \sum_{\tau=1}^{\infty} E[D_{it+\tau}]/(1+er_i)^{\tau}$, in which $D_{it+\tau}$ is dividends, and er_i is the firm's long-term expected stock return. The clean surplus relation says that dividends equal earnings, $Y_{it+\tau}$, minus the change in book equity, $D_{it+\tau} = Y_{it+\tau} - \triangle B_{it+\tau}$, in which $\triangle B_{it+\tau} \equiv B_{it+\tau} - B_{it+\tau-1}$. The valuation equation then becomes $P_{it}/B_{it} = (1/B_{it})\sum_{\tau=1}^{\infty} E[Y_{it+\tau} - \triangle B_{it+\tau}]/(1+er_i)^{\tau}$.

Following Lee, So, and Wang (2021), we examine the implied costs of equity (ICE) proposed by Claus and Thomas (2001), Gebhardt, Lee, and Swaminathan (2001), Easton (2004), and Ohlson and Juettner-Nauroth (2005). Although differing in details, these models all share the basic idea of backing out the costs of equity from the valuation equation. We work with the ICE composite, which is the equal-weighted average of the four ICE variants. Because analyst forecasts are limited to (relatively) small samples and are likely biased, we follow Hou, van Dijk, and Zhang (2012) to estimate regression-based earnings forecasts. The ICE estimates (in annual magnitude) are updated monthly because earnings forecasts and the market equity vary monthly. Appendix A details the estimation.

Because the ICE estimates are the internal rates of returns with a flat term structure going forward, it is straightforward to adjust the (annual) ICEs for different horizons. For example, for 1-month ahead costs of equity, we raise the ICEs to the power of 1/12, and for 3-year ahead costs of equity, we raise the ICEs to the power of three, before using them in forecast evaluation.

2.3 Out-of-sample Forecasts from Cross-sectional Regressions

Lewellen (2015) shows that out-of-sample forecasts from Fama-MacBeth (1973) cross-sectional regressions provide a simple yet effective measure of expected returns, by combining slopes from the prior 120-month rolling window with the latest known characteristics at the beginning of month t.

Lewellen (2015) studies three specifications of cross-sectional regressions. The first one contains size, book-to-market, and momentum. The second adds accruals, prior 36-month stock issuance, annual return on assets, and asset growth (seven variables in total). Finally, the third one further adds dividend yield, long-term reversal, prior 12-month stock issuance, 36-month rolling market beta, stock volatility, turnover, market leverage, and sales-to-price (15 in total). We implement all three specifications. Appendix B.1 details the exact variable definitions in our implementation.

We construct investment-based cross-sectional forecasts based on the Hou et al. (2021) q^5 model. The q^5 model contains size, investment-to-assets, return on equity (ROE), and expected growth, EG, which is from cross-sectional forecasts of changes in investment-to-assets on the log of Tobin's q, cash-based operating cash flow, and changes in ROE. Appendix B.2 details the measurement.

At the beginning of each month t, we construct 1-month ahead costs of equity via cross-sectional regressions of 1-month ahead returns on a given set of characteristics from prior 120-month rolling windows (30 months minimum). We combine the average regression coefficients with the latest available winsorized predictors. The most recent predictors are from the fiscal year (quarter) ending at least four months ago as of month t. We use the latest announced quarterly earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago.

Timing-wise, at the beginning of month t, the latest returns in the rolling window regressions run at most up to month $t-1$, and the predictors are further lagged accordingly. When performing the cross-sectional forecasting regressions, we winsorize all the unbounded regressors at the 2.5 and 97.5 percentiles and bounded regressors (below from zero) at the 0 and 97.5 percentiles at their respective cross-sectional distributions each month. The only exception is expected growth, EG,

which is formed from already winsorized predictors. We do not winsorize returns (Appendix B.2).

The estimation is for 1-month ahead forecasts. We adapt the procedure for other horizons. For example, for 12-month forecasts, at the beginning of month t, we perform cross-sectional forecasting regressions of returns from month $t-12$ to $t-1$ on a given set of characteristics from prior 120-month rolling windows (with overlapping observations). In the latest rolling window, the returns run at most up to month $t-1$, and the predictors are from the fiscal period ending at least four months prior to month $t-12$. To calculate 12-month costs of capital, we combine the average slopes with the most recent winsorized predictors from the fiscal period ending at least four months prior to month t.

2.4 The Structural q-Model

We adopt the Goncalves-Xue-Zhang (2020) 2-capital model:

$$r_{it+1} = \frac{w_{it}^K r_{it+1}^K + (1 - w_{it}^K) r_{it+1}^W - w_{it}^B r_{it+1}^{Ba}}{1 - w_{it}^B}, \tag{1}$$

in which r_{it+1} is stock i's return in month t; $r_{it+1}^{Ba} \equiv r_{it+1}^B - (r_{it+1}^B - 1)\tau_{t+1}$ after-tax cost of debt; r_{it+1}^B pre-tax cost of debt; τ_{t+1} corporate tax rate; $w_{it}^K \equiv q_{it}K_{it+1}/(q_{it}K_{it+1} + W_{it+1})$ the weight of the market equity due to physical capital; K_{it+1} physical capital; W_{it+1} working capital; $q_{it} = 1 + (1 - \tau_t)a(I_{it}/K_{it})$ the marginal q of physical capital with $a > 0$; I_{it} physical capital investment; $w_{it}^B \equiv B_{it+1}/(P_{it} + B_{it+1})$ the market leverage; B_{it+1} debt; and P_{it} the market equity.

The physical investment return is denoted r_{it+1}^K:

$$r_{it+1}^K \equiv \frac{(1 - \tau_{t+1}) \left[\gamma_K \frac{Y_{it+1}}{K_{it+1}} + \frac{a}{2} \left(\frac{I_{it+1}}{K_{it+1}} \right)^2 \right] + \tau_{t+1}\delta_{it+1} + (1 - \delta_{it+1}) \left[1 + (1 - \tau_{t+1}) a \left(\frac{I_{it+1}}{K_{it+1}} \right) \right]}{1 + (1 - \tau_t) a \left(\frac{I_{it}}{K_{it}} \right)}; \tag{2}$$

r_{it+1}^W is the working capital investment return:

$$r_{it+1}^W \equiv 1 + (1 - \tau_{t+1}) \gamma_W \frac{Y_{it+1}}{W_{it+1}}; \tag{3}$$

Y_{it+1} sales; δ_{it+1} physical capital depreciation rate; and $\gamma_K, \gamma_W > 0$ are technological parameters.

Appendix C details our measurement of variables in equation (1) in Compustat.

To form costs of capital from equation (1), we need to form several auxiliary expectations. Because the after-tax cost of debt and sales are relatively persistent in the data, to reduce estimation errors, we set $E_t[r^{Ba}_{it+1}]$ and $E_t[Y_{it+1}]$ to their respective values from the most recent fiscal year ending at least four months ago. Analogously, we set the future tax rate, τ_{t+1}, to its most recent value. The physical investment rate is less persistent. Following Goncalves, Xue, and Zhang (2020), we forecast I_{it+1}/K_{it+1} on the log of Tobin's q_{it}, sales-to-total capital, $Y_{it}/(K_{it}+W_{it})$, and lagged physical investment rate, I_{it}/K_{it}. Tobin's q is the market equity from CRSP plus total debt (item DLTT plus item DLC, zero if missing) scaled by book assets (item AT).

At the beginning of each month t, we use the prior 120-month rolling window to estimate cross-sectional forecasting regressions. We winsorize I_{it+1}/K_{it+1}, the log of Tobin's q_{it}, and I_{it}/K_{it} at the 2.5 and 97.5 percentiles of their respective cross-sectional distributions each month. We winsorize $Y_{it}/(K_{it}+W_{it})$ (bounded below at zero) at the 0 and 97.5 percentiles each month. The I_{it+1} data are from the most recent fiscal year ending at least four months ago as of month t, and the predictors are further lagged accordingly. Because of time-to-build in the model, although dated $t+1$, K_{it+1} and W_{it+1} are one-year-lagged relative to I_{it+1}. We then combine the average slopes with the latest known predictors from at least four months ago to calculate $E_t[I_{it+1}/K_{it+1}]$.

With the auxiliary expectations in hand, plugging them into the right-hand side of equation (1) yields the cost-of-equity function, denoted $er(\mathcal{I}_{it};\gamma,a)$, in which $\mathcal{I}_{it}$ is the conditioning information as of month t, and $\gamma=\gamma_K+\gamma_W$ and a are two structural parameters.[1] Equation (1) becomes:

$$r_{it+1}=er(\mathcal{I}_{it};\gamma,a)+\epsilon_{it+1}, \tag{4}$$

[1] In equation (1), γ_K and γ_W enter only in the form of $\gamma_K+\gamma_W$. From equations (2) and (3):

$$\begin{aligned} w^K_{it}r^K_{it+1}+(1-w^K_{it})r^W_{it+1} &= \frac{(1-\tau_{t+1})(\gamma_K+\gamma_W)Y_{it+1}/(K_{it+1}+W_{it+1})}{q_{it}K_{it+1}/(K_{it+1}+W_{it+1})+W_{it+1}/(K_{it+1}+W_{it+1})}+ \\ & w^K_{it}\frac{(1-\tau_{t+1})(a/2)\left(I_{it+1}/K_{it+1}\right)^2+\tau_{t+1}\delta_{it+1}+(1-\delta_{it+1})q_{it+1}}{q_{it}}+(1-w^K_{it}). \end{aligned}$$

As such, the structural model contains only two parameters, γ and a (Goncalves, Xue, and Zhang 2020).

in which $E_t[\epsilon_{it+1}] = 0$. At the beginning of month t, we align firm i's annual stock returns from t to $t + 11$, which corresponds to the left-hand side of equation (4). In the right-hand side, $er(\mathcal{I}_{it}; \gamma, a)$ is based on the latest available $\mathcal{I}_{it}$ (lagged by at least four months prior to month t).

We estimate γ and a from equation (4) via nonlinear least squares (nonlinear cross-sectional regressions). At the beginning of each month from January 1977 to December 2022, we recursively estimate γ and a using the expanding window that starts in January 1967. The starting point means that the conditioning information, $\mathcal{I}_{it}$, for January 1967 can come from as early as July 1965. However, the endpoint of the first recursive window, January 1977, means that the annual window of stock returns runs up to December 1976 and the $\mathcal{I}_{it}$ in the forecasting regression is further lagged accordingly. We expand the recursive window one month at a time until December 2022 to yield the time series of structural parameters. We obtain the cost of equity for each stock i at the beginning of month t, $er(\mathcal{I}_{it}; \widehat{\gamma}_t, \widehat{a}_t)$, by combining the latest recursive parameters with the latest $\mathcal{I}_{it}$ (from the fiscal year ending at least four months prior to month t).

The benchmark estimation above is for 12-month forecasts, which match the annual accounting variables contained in $\mathcal{I}_{it}$. We adapt the procedure for other forecasting horizons. For 1-month forecasts, the returns in the left-hand side of equation (4) are 1-month ahead, but the cost-of-equity function in the right-hand side becomes $er(\mathcal{I}_{it}; \gamma, a)^{1/12}$. Analogously, for 60-month forecasts, the returns in the left-hand side are 60-month ahead (with overlapping monthly observations), but the right-hand side becomes $er(\mathcal{I}_{it}; \gamma, a)^5$. As such, we allow γ and a to vary with horizons. While often labeled "structural" parameters, their estimates do vary in practice because the data generating process is vastly more complex than our economic model, which is inevitably misspecified.

3 Evaluating Costs of Equity

We evaluate the relative performance of the four classes of costs of equity described in Section 2. We present evaluation methods in Section 3.1 and detail evaluation results in Section 3.2.

3.1 Evaluation Methods

We adopt three groups of evaluation methods: (i) portfolio sorts; (ii) cross-sectional predictive regressions (Lewellen 2015); and (iii) measurement error variances (Lee, So, and Wang 2021).

3.1.1 Portfolio Sorts

In portfolio sorts, with each cost of equity at the beginning of month t (the end of month $t-1$), we split the NYSE, Amex, and NASDAQ stocks into deciles. We calculate the monthly value-weighted decile returns for three holding periods (1-, 3-, and 12-month), over month t, from month t to $t+2$, and from month t to $t+11$. The 3-month horizon means that for a given decile in each month, there exist 3 subdeciles, each initiated in a different month in the prior 3 months. We take the simple average of the subdecile returns as the monthly return for the decile.

We align the holding period with the forecast horizon. For example, we use the 12-month holding period when forecasting returns with 12-month ahead costs of equity. To ease comparison with Lewellen (2015), we use NYSE-Amex-NASDAQ breakpoints in sorts but present evidence in the full, all-but-micro, and big-firm samples to gauge the impact of microcaps. Value-weighting rather than equal-weighting returns is essential for mitigating microcaps, while adopting NYSE-Amex-NASDAQ rather than NYSE breakpoints is secondary (Hou, Xue, and Zhang 2020).

We perform three sets of pairwise comparison tests: (i) the q^5 characteristics model vs. the Lewellen 3-, 7-, and 15-variable models; (ii) the q^5 characteristics model vs. the implied cost of equity; and (iii) the q^5 characteristics model vs. the structural q-model. For each pairwise comparison, we test whether the difference between the two high-minus-low decile returns in question equals zero.

3.1.2 Cross-sectional Predictive Regressions

Following Lewellen (2015), we also perform cross-sectional regressions of subsequent returns on the beginning-of-month costs of equity. We test if the predictive slope equals one. If the average ex post return is an unbiased proxy for the true expected return, this test checks whether a given ex

ante expected return proxy is unbiased. We again align the horizon of subsequent returns with the forecast horizon in costs of equity. For example, when evaluating 12-month ahead costs of equity, we use subsequent 12-month returns as the dependent variable in cross-sectional regressions. To ease comparison with Lewellen, we use ordinary least squares but present the evidence in the full, all-but-micro, and big-firm samples to gauge the impact of microcaps.

For each pairwise comparison, we test whether the difference between the two slopes from cross-sectional regressions equals zero. We use time series tests with Newey-West standard errors.

3.1.3 Measurement Error Variances

Lee, So, and Wang (2021) argue that if the goal is to study how differences in corporate policies or firm characteristics are related to differences in costs of equity (treatment effects), the bias in costs of equity is largely irrelevant. Intuitively, if the bias is unrelated to the variable in question, taking the difference in costs of equity eliminates the impact of bias. As such, measurement error variances (MEV) emerge as the most relevant criteria of costs of equity for treatment effects.

Let er_{it}^h be firm i's true (but unobservable) h-month ahead expected return at the beginning of month t and $\widehat{er}_{it}^h$ be an empirical proxy of er_{it}^h. The measurement error is defined as $\omega_{it} = \widehat{er}_{it}^h - er_{it}^h$. The measurement error should be distinguished from the forecast error, $\widehat{e}_{it+h} \equiv r_{it+h} - \widehat{er}_{it}^h$, for $t = 1, 2, \ldots, T_i^P - h$, in which $T_i^P - h$ is stock i's length of the predictive window (the overall sample minus the initial expanding window, adjusted for the forecast horizon, h). Define $T^P \equiv \max_i\{T_i^P\}$.

Lee, So, and Wang (2021) define the scaled time series variance of an expected return proxy as:

$$\text{SVar}_i^{\text{TS}} = \text{Var}_i\left(\widehat{er}_{it}^h\right) - 2\text{Cov}_i\left(\widehat{er}_{it}^h, r_{it+h}\right), \tag{5}$$

in which $\text{Var}_i(\widehat{er}_{it}^h)$ is time series variance of $\widehat{er}_{it}^h$, and $\text{Cov}_i\left(\widehat{er}_{it}^h, r_{it+h}\right)$ time series covariance between $\widehat{er}_{it}^h$ and r_{it+h}. Time series MEV is the average $\text{SVar}_i^{\text{TS}}$ across all N firms in the sample:

$$\overline{\text{SVar}}^{\text{TS}} = \frac{1}{N}\sum_i \text{SVar}_i^{\text{TS}}. \tag{6}$$

Analogously, Lee, So, and Wang (2021) define the scaled cross-sectional variance as:

$$\text{SVar}_t^{\text{CX}} = \text{Var}_t\left(\widehat{er}_{it}^h\right) - 2\text{Cov}_t\left(\widehat{er}_{it}^h, r_{it+h}\right), \tag{7}$$

in which $\text{Var}_t(\widehat{er}_{it}^h)$ is cross-sectional variance of $\widehat{er}_{it}^h$, and $\text{Cov}_t\left(\widehat{er}_{it}^h, r_{it+h}\right)$ cross-sectional covariance between $\widehat{er}_{it}^h$ and r_{it+h}. The cross-section MEV for a given measure is the time series average of $\text{SVar}_t^{\text{CX}}$ across all the periods, $T^P - h$ (the number of cross-sections):

$$\overline{\text{SVar}}^{\text{CX}} = \frac{1}{T^P - h}\sum_t \text{SVar}_t^{\text{CX}}. \tag{8}$$

We perform two pairwise comparison tests. First, the time series test checks if the time series MEV differential has a mean of zero across the N firms in the sample, using the White (1980) heteroscedasticity-consistent standard errors. Second, the cross-section test checks if the cross-section MEV differential has a mean of zero in the predictive window (with $T^P - h$ months), using the Newey-West (1987) standard errors. This test is equivalent to the Fama-MacBeth cross-sectional regression of differentials on an intercept and calculate its Newey-West t-value.

3.2 Evaluation Results

3.2.1 Portfolio Sorts

From Panel A of Table 1, sorting on the expected return estimated from the q^5-characteristics cost of equity model, denoted QCE, yields a reliable high-minus-low spread in average 1-month ahead return of 1.53% per month ($t = 6.45$) in the full sample. Deciles 1 and 2 earn average excess returns of 0.19% and 0.52%, while deciles 9 and 10 earn 1.39% and 1.71%, respectively. The high-minus-low spread falls to 1.2% ($t = 5.4$) at the 3-month horizon and further to 0.62% ($t = 2.27$) at the 12-month, while still remaining at 0.56% ($t = 2.29$) at the 24-month horizon. The average return spread falls further to 0.4% ($t = 1.77$) at the 36-month and to 0.27% ($t = 1.42$) at the 60-month horizon.

Among the three Lewellen specifications, the 7-variable model performs the best, with an average return spread of 1.18% per month ($t = 3.33$) at the 1-month horizon. The spread falls to 0.99%

($t = 3.15$) at the 3-month and further to 0.5% ($t = 1.45$) at the 12-month, before rebounding to 0.73% ($t = 2.08$) at the 24-month and remaining at 0.51% ($t = 1.56$) at the 60-month horizon.

Factor models perform very poorly, echoing Fama and French (1997). The average return spread sorted on the q^5-factor based cost of equity yields only 0.19% per month ($t = 0.82$) at the 1-month horizon and remains economically small and statistically insignificant across all horizons. Analogously, the average return spread sorted on the Fama-French 6-factor based cost of equity yields -0.24% ($t = -0.98$) and remains all negative and mostly insignificant across all the horizons.

The accounting-based implied cost of equity, denoted ICE, also performs poorly. The high-minus-low ICE decile earns on average only 0.14%, 0.12%, and 0.37% per month ($t = 0.34, 0.32,$ and 1.01) at the 1-, 3-, and 12-month horizons, respectively. At the longer 24-, 36-, and 60-month, the average return spreads are 0.29%, 0.22%, and 0.26% ($t = 0.89$, 0.76, and 0.96), respectively.

Finally, the structural q-model delivers a fair performance. The high-minus-low decile earns on average 0.64%, 0.76%, and 0.74% per month ($t = 2.64, 3.28,$ and 3.26) at the 1-, 3-, and 12-month horizons, respectively. At the longer 24-, 36-, and 60-month, the average return spreads are 0.46%, 0.32%, and 0.21% ($t = 2.11$, 1.5, and 1.04), respectively. Although large and reliable, especially in short horizons, these estimates are smaller than those from the q^5-characteristics model.

From the pairwise comparison tests in Panel B, QCE produces mostly higher average return spreads than the other characteristics models (26 out of 30 differences are positive). Alas, because average returns are noisy, the differences are mostly insignificant, although some are large. For instance, the QCE-minus-ICE difference yields 1.35% per month ($t = 3.19$) at the 1-month but falls to 1.07% ($t = 2.62$) at the 3-month and further to 0.28% ($t = 1.02$) at the 12-month horizon.

We should clarify that the differences between a pair of models in Panel B are not identical (albeit close) to the differences between their estimates in Panel A. The reason is that we maximize sample coverage by using all available data for a given model in Panel A. However, in pairwise comparisons, we must impose a common sample between a given pair of models. This observation

applies to all the pairwise comparison tests, including those reported in subsequent tables.

Table 2 shows the sorts in the all-but-micro sample. Microcaps show nontrivial impact, but the basic inferences are unchanged. First, the q^5-characteristics model remains the best model, but the QCE return spread has declined across all horizons. For instance, the 1-month ahead average return spread is 0.95% per month ($t = 4.8$) in contrast to 1.53% ($t = 6.45$) with microcaps. The reason is that decile 10 earns an average excess return of 1.14%, which falls from 1.71% with microcaps.

Second, the 7-variable version is still the best Lewellen model. Its 1-month average return spread is 0.88% per month ($t = 3.6$), which falls from 1.18% ($t = 3.33$) with microcaps. Third, the factor models still perform poorly. The average return spread from the Fama-French 6-factor cost of equity remains mostly negative and insignificant. However, excluding microcaps helps the q^5-factor cost of equity. Its average return spread is 0.4% ($t = 1.97$), which rises from 0.19% ($t = 0.82$) with microcaps. Across four out of six horizons, the average return spreads are significant, with magnitude from 0.38% to 0.46%, while none are significant with microcaps.

Fourth, the implied cost of equity continues to perform poorly. The magnitude of the average return spread ranges from 0.04% to 0.19% per month, with the t-value all below 0.85. Finally, microcaps have little impact on the performance of the structural q-model.[2]

3.2.2 Cross-sectional Predictive Regressions

Table 3 shows cross-sectional predictive regressions of h-month subsequent returns on a given h-month ahead cost of equity at the beginning of month t. From Panel A, QCE performs well. All but one of the slopes are significant from zero across all horizons, and all are insignificant from one. For instance, at the 1-month horizon, the slope is 0.83, which is insignificant from one (absolute

[2]In the Internet Appendix, Table A1 reports the portfolio sorts in the big-firm sample, which includes only stocks with market equity above the NYSE median. The high-minus-low QCE decile earns on average 0.77%, 0.57%, and 0.3% per month ($t = 4.2, 3.17$, and 2.16) at the 1-, 3-, and 12-month horizon, respectively, and insignificant average returns in subsequent horizons. For the Lewellen 7-variable model, the high-minus-low decile earns on average 0.9%, 0.72%, and 0.3% ($t = 3.53, 3$, and 1.41) at the 1-, 3-, and 12-month horizon, respectively, and remains insignificant in subsequent horizons. Finally, the high-minus-low ICE decile earns on average 0.04%, −0.08%, and 0.04% ($t = 0.16, -0.33$, and 0.18) at the 1-, 3-, and 12-month horizon, respectively. The average return remains economically small and statistically insignificant in subsequent horizons.

t-value $|t| = 1.43$), with a standard error of 0.12. Even at the 36-month horizon, the slope is 0.66, with a standard error of 0.29 and an absolute t-value of 1.17 that tests the slope equals one.

The Lewellen models also perform well. For instance, at the 1-month horizon, the slope of the 7-variable specification is 0.77, with a standard error of 0.11, but is significant from one ($|t| = 2.2$). At the 36-month horizon, the slope is 0.74, which is even higher than 0.66 for QCE and insignificant from one ($|t| = 0.78$). More generally, however, across three specifications and six horizons, although the slopes are all positive, six are insignificant from zero, and nine are significant from one.

The factor models perform very poorly. For both the q^5-factor and 6-factor models, the slopes are basically zero, both economically and statistically. The null that a given slope equals one is strongly rejected across all horizons. Clearly, although extremely informative for style analysis and performance attribution, factor models are simply not built for estimating ex ante costs of equity.

The performance of the implied cost of equity is fair. For instance, at the 1-month horizon, the slope is 0.49, with a standard error of 0.18, but is significant from one ($|t| = 2.88$). More generally, across the six horizons, all slopes are positive, all but one significant from zero. However, all but one of the slopes are reliably different from one. For instance, at the 36-month horizon, the slope is 0.35 (0.66 for QCE), with a standard error of 0.13, and is significant from one ($|t| = 4.86$).

The structural q-model performs poorly. Although the slopes are all positive and mostly significant from zero, their magnitudes are (relatively) small. The null that the slope equals one is strongly rejected across all horizons. At the 1-month horizon, the slope is only 0.07, with a standard error of 0.03, and is significant from one ($|t| = 36$). The largest slope, 0.35, appears at the 36-month horizon, with a standard error of 0.11, but is again reliably below one ($|t| = 6.22$).

From pairwise comparisons in Panel B, the differences in slope are mostly positive (the QCE slopes are higher than those from alternative models). Some differences are economically large, but most are insignificant. For instance, the QCE-minus-ICE slope yields 0.34 ($t = 1.5$) at the 1-month horizon and remains at 0.35 ($t = 1.49$) at the 60-month horizon. The largest slope difference are

against the structural q-model. The QCE-minus-structural-q slope yields 0.76 ($t = 6.38$) at the 1-month and remains at 0.32 ($t = 1$) at the 36-month horizon.

Table 4 shows that microcaps are important for costs of equity via cross-sectional forecasts, especially for long-horizon forecasts. At the 1-month horizon, without microcaps, the QCE slope is 0.69, with a standard error of 0.27, and is insignificant from one ($|t| = 1.17$). The evidence at the 3-month horizon is largely similar. However, at the 12-month horizon, the slope is only 0.25 (contra 0.57 with microcaps) and is significant from one ($|t| = 3.34$). The evidence remains similar at the 24-month but deteriorates at longer horizons. At the 60-month, the slope is negative, -0.32, with a standard error of 0.25, and is highly significant from one ($|t| = 5.29$).

The Lewellen 7-variable model shows the same pattern. At the 1-month horizon, the slope is 0.57, with a standard error of 0.11, which gives rise to an absolute t-value of 3.97 for testing the slope equals one. The 3-month horizon is largely similar. At the 12-month, the slope is only 0.24 (contra 0.66 with microcaps) and significant from one ($|t| = 4.77$). At the 60-month, the slope is negative, -0.16, with a standard error of 0.13, and is highly significant from one ($|t| = 8.96$).

Excluding microcaps has also affected the ICE performance. All the slopes become only weakly positive, and their magnitude varies from 0.04 to 0.13 (contra the 0.27–0.54 range with microcaps). None of the slopes are significant from zero, and all are significant from one.[3]

3.2.3 Measurement Error Variances

Table 5 shows measurement error variances and their variance and covariance components in the full sample. Table 6 shows the evidence in the all-but-micro sample. Several patterns emerge.

First, factor models perform poorly. Their MEVs, both time series and cross-section, are often an order of magnitude larger than those of characteristics-based models. Both the large variance and small (even sometimes negative) covariance components contribute to this problem. Excluding

[3]Without going through the details, we can report that the cross-sectional predictive regression results are quantitatively similar in the big-firm sample (Table A2 in the Internet Appendix).

microcaps mitigates the problem somewhat, but the underperformance remains substantial. Once again, factor models are simply not built for estimating ex ante costs of equity.

Second, for time series MEV, ICE is the best performer (Lee, So, and Wang 2021). This outperformance is due to small variance and large covariance component. For instance, at the 1-month horizon, ICE has a time series MEV of -0.0176, which arises from a small variance of 0.0031 but a large covariance of 0.0207 (Panel A, Table 5). For comparison, QCE's time series MEV is 0.0031, with a large variance of 0.0081 and a small covariance of 0.005. The equal MEV on their common sample is strongly rejected. The ICE outperformance is mostly robust across horizons, against diverse models, with and without microcaps. The QCE is largely comparable with the Lewellen models in time series MEV, especially without microcaps. The structural q-model underperforms QCE with microcaps but outperforms QCE without microcaps.

Third, for cross-section MEV, the structural q-model substantially underperforms QCE, with and without microcaps, especially in short horizons (within 12 months). When comparing with other characteristics-based models, QCE shows a small edge, especially in short horizons, as shown in negative differentials in cross-section MEV. However, the differentials are mostly insignificant. For instance, at the 1-month horizon, the QCE-minus-ICE differential is -0.0018 ($t = -0.61$) with microcaps and -0.0013 ($t = -1.66$) without microcaps. At the longer horizons, the differentials are frequently positive but mostly insignificant. In the Internet Appendix, Table A3 shows the evidence in the big-firm sample, which is largely similar to that in the all-but-micro sample.

3.2.4 Why Not Mean Squared (Forecast) Errors?

In the forecasting literature, the mean squared error is the most popular loss function (Elliott and Timmermann 2016). However, although related, the forecast error, $\widehat{e}_{it+h} = r_{it+h} - \widehat{er}^h_{it}$, and the measurement error in the expected return, $\omega_{it} = \widehat{er}^h_{it} - er^h_{it}$, are two different objects. Swamped by the variances of the abnormal return, $e_{it+h} \equiv r_{it+h} - er^h_{it}$, forecast error variances are largely

uninformative about the quality of expected return measures, with very low signal-to-noise ratios.[4]

For completeness, we calculate mean squared (forecast) errors, MSE. Imitating Lee, So, and Wang's (2021) MEV, we separate time series from cross-section MSE. Define for stock i:

$$\text{MSE}_i^{\text{TS}} \equiv \frac{1}{T_i^P - h} \sum_{t=1}^{T_i^P - h} \widehat{e}_{it+h}^2. \tag{9}$$

Time series MSE is the average MSE_i^{TS} across all N firms in the sample, $\overline{\text{MSE}}^{\text{TS}} = \left(\sum_i \text{MSE}_i^{\text{TS}}\right)/N$. Analogously, we calculate cross-section MSE at time t as:

$$\text{MSE}_t^{\text{CX}} \equiv \frac{1}{N_t} \sum_{i=1}^{N_t} \widehat{e}_{it+h}^2. \tag{10}$$

Cross-section MSE is its time series average, $\overline{\text{MSE}}^{\text{CX}} = \left(\sum_t \text{MSE}_t^{\text{CX}}\right)/(T^P - h)$.

Table 7 furnishes the evidence. Without going through the details, we emphasize three salient results. First, forecast error variances can be an order of magnitude larger than measurement error variances. For instance, at the 1-month horizon, the time series MSE of QCE is 0.071, which is about 23 times of its (scaled) time series MEV, 0.0031. The cross section MSE is 0.0339, which is about 11 times in magnitude of its (scaled) cross section MEV, -0.0031.

Second, factor models and characteristics models produce comparable MSEs. At the 1-month horizon, the time series MSE of QCE is 0.071, which is even higher than that of the q^5-factor model, 0.059. At the 12-month horizon, the contrast is between 0.976 and 0.997. The similar MSE magnitude is mostly robust across different models, over different horizons, with and without microcaps. Because factor models substantially underperform characteristics models per all other evaluation metrics, the evidence clearly indicates the low signal-to-noise nature of forecast error variances.

The QCE-minus-ICE differences in MSEs are mostly insignificant. For time series MSE, ICE outperforms QCE significantly at the 3- and 12-month but underperforms at the 60-month. For cross section MSE, QCE outperforms ICE significantly at the 1- and 3-month, but the differences

[4]Lee, So, and Wang (2021, p. 1915, footnote 4) define the mean squared (measurement) error as $E[(\widehat{er}_{it}^h - er_{it}^h)^2]$. Alas, this error cannot be estimated because the true expected return, er_{it}^h, is unobservable.

are insignificant over longer horizons. Without microcaps, only one QCE-minus-ICE difference is significant (time series MSE at the 60-month), although the differences are mostly positive.

3.2.5 Summary and Interpretation

Our extensive evidence on evaluating costs of equity establishes the q^5-characteristics model as competitive. It is the best performer in portfolio sorts and cross-sectional predictive regressions. Although underperforming the implied cost of equity in time series MEV, the q^5-characteristics model is at least comparable with all other characteristics-based models in cross-section MEV. Across all evaluation metrics for costs of equity, factor models perform poorly, including the q^5-factor model. This evidence highlights the importance of developing the q^5-characteristics model.

We should acknowledge the role of microcaps in forming the q^5-characteristics based cost of equity, QCE, via cross-sectional forecasts, especially at long horizons (Table 4). Microcaps are plentiful, consisting of about 60% of stocks, but tiny, accounting for only about 3.5% of total market equity (Hou, Xue, and Zhang 2020). It is likely that microcaps contain important information on the relation between q^5-characteristics and expected returns, information that transcends their tiny size.

While we value-weight returns in sorts to mitigate microcaps, we follow Lewellen (2015) in using ordinary least squares in cross-sectional forecasts. We do so to ease comparison because the q^5-characteristics model follows the Lewellen methodology. In addition, in the ICE construction, the Hou-van Dijk-Zhang (2012) regression-based earnings forecasts also use ordinary least squares. Finally, time series and cross-section MEVs in Lee, So, and Wang (2021) implicitly treat all stocks as equal. We stick with the same practice, while leaving the exploration of weighted least squares in cross-sectional return and earnings forecasts as well as value-weighted MEVs to future work.[5]

The q^5-characteristics model has reliably outperformed the structural q-model. The economy

[5]The expected growth (EG) factor is largely robust when changing from weighted least squares (WLS) to ordinary least squares (OLS) in forming expected growth (untabulated). In the January 1967–December 2022 sample, the EG factor earns on average 0.7% per month ($t = 5.96$) with OLS and 0.81% ($t = 8.67$) with WLS. The q-factor alpha of the EG factor is 0.7% ($t = 7.37$) with OLS vs. 0.62% ($t = 8.63$) with WLS. The correlation between the two versions of the EG factor is 0.81. The correlations of the EG factor with the market, size, investment, and ROE factors in the q-factor model are −0.37, −0.38, −0.05, and 0.53 with OLS and −0.42, −0.38, 0.25, and 0.61 with WLS, respectively.

is not a machine, in which explanation is equivalent to prediction. In Newtonian mechanics, explaining the orbit of Halley's comet amounts to predicting its future orbit. Alas, the economy is a complex adaptive system, in which a given empirical pattern is caused by multiple, unobservable, causal mechanisms. Their relative strength also varies across space and over time (Wimsatt 2007).

According to this systems view of the world, explanation differs from prediction. To explain is to build a model, in which one makes (false) assumptions to isolate the targeted causal mechanism from interfering ones (Mäki 2005). The structural q-model explains the investment-based mechanisms underlying the investment, return-on-equity, and expected growth factors. However, the long list of specific assumptions of the structural model stands in the way of predicting returns. Following the flexible Lewellen methododogy, the q^5-characteristics model drops these assumptions but still combines the information contained in the key variables identified in the structural model.

4 Investment-based Costs of Equity

After establishing the q^5-characteristics model as competitive, we study in depth the properties of QCE for firms (Section 4.1), industries (Section 4.2), factor premiums (Section 4.3), and the equity premium (Section 4.4). We also show the properties of the accounting-based ICE for comparison.

4.1 Firm-level Costs of Equity

Table 8 shows the firm-level properties of costs of equity in the January 1977–December 2022 sample. Because ICE is the internal rate of return, its term structure is flat. As such, we only show (the 12-month ahead) ICE based on annual accounting data. To ease comparison across horizons, we annualize all QCE estimates to align with the unit of (the 12-month ahead) QCE_{12}. For example, annualizing QCE_1 means $(1+\text{QCE}_1)^{12}-1$, and annualizing QCE_{60} means $(1+\text{QCE}_{60})^{1/5}-1$. We annualize each firm-month before calculating time series averages of cross-sectional moments.

Several insights emerge from Table 8. First, the term structure of QCE is surprisingly flat. The 1-month ahead QCE is on average 14.31% per annum, which is close to the 12-month average of

14.08%, which is in turn close to the 36-month average of 13.77%. The median QCEs show a similar pattern across horizons. The mean QCEs estimates are also close to the mean ICE of 13.18%.

Second, the volatility of the QCE estimates declines with horizon. The 1-month ahead QCE volatility is 10.74% per annum, which drops to 6.91% at the 12-month and further to 4.33% at the 36-month horizon. For comparison, the 12-month ICE volatility is 9.29%. Relatedly, the (monthly) autocorrelation of QCEs varies from 0.723 to 0.779, an interval that encompasses 0.755 for the ICE.

Third, the QCE distributions are weakly left-skewed across all horizons, with the skewness ranging from -0.6 to -0.83. In contrast, the ICE distribution is right-skewed, with a skewness of 1.89. Relatedly, the excess kurtosis (in excess of three for the normal distribution) is weakly negative for QCEs across all horizons, but the excess kurtosis for ICE is weakly positive. The distributional differences between QCE and ICE are clearly visible in the histograms of costs of equity in Figure 1.

Microcaps impact on the costs of equity volatilities but leave other patterns largely unchanged. From Table 9, the QCE volatility starts at 6.25% per annum at the 1-month, falls to 3.74% at the 12-month, and further to 2.87% at the 36-month horizon. The cross-sectional dispersion falls accordingly. The 5–95 percentiles dispersion is 12.26% for the 12-month QCE, which is about one half of 22.4% with microcaps. Also, the mean 12-month QCE is 12.75%, which is higher than 8.99% for the mean ICE. As such, excluding microcaps enlarges the mean QCE–ICE difference, 3.76% vs. 0.9%. The ICE skewness falls from 1.89 to 0.9, which is also shown in the histograms in Figure 2.

Panel B of Table 8 shows the average slopes and their t-values in cross-sectional return regressions underlying the QCEs in the full sample, while Figure 3 shows the time series of 120-month rolling window slopes that we use to calculate the QCEs. The average slopes all have expected signs. The only exception is ROE, which has a slope of -0.284 ($t = -0.79$) at the 60-month horizon. More important, the expected growth slopes increase monotonically with horizon, 0.034 ($t = 3.35$) at the 1-month, 0.266 ($t = 1.6$) at the 12-month, 1.005 ($t = 5.04$) at the 36-month, and 2.017 ($t = 3.49$) at the 60-month horizon. The investment-to-assets slopes also largely increase in magnitude except

for the 60-month. However, the ROE slopes revert in magnitude after the 12-month. These slope patterns largely persist in the all-but-microcap and big-firm samples (the Internet Appendix).

4.2 Industry Costs of Equity

Fama and French (1997) show that factor-based industry costs of equity are "distressingly imprecise" (p. 178). We show that the q^5 characteristics-based QCE goes a long way in meeting this challenge. We use North American Industry Classification System (NAICS) to define sectors and industries. Prior to June 1985, we convert different versions of Standard Industry Classification (SIC) codes into NAICS codes using the meticulous mapping developed by Bai et al. (2022).

Table 10 shows sector and industry costs of equity for 18 nonfinancial NAICS sectors and 57 nonfinancial NAICS industries. For each sector and each industry, we show the times series means and standard deviations of different costs of equity, including the q^5-factor model (Q5F), QCE_1, QCE_3, QCE_{12}, QCE_{24}, QCE_{36}, QCE_{60}, and ICE, as well as average returns, AR.

To estimate an industry's Q5F, at the beginning of month t, we estimate an industry's factor loadings from the prior 60-month rolling window (30 months minimum) and combine the factor loadings with factor premiums averaged over the expanding window from January 1967 to month $t-1$ to compute the stock's expected excess return. We use value-weighted industry returns in the left-hand side of the q^5-factor regression. We add back the riskless interest rate at the beginning of month t to obtain the industry's cost of equity. For all the other costs of equity, we value-weight the stock-level costs of equity across all the stocks within a given industry or sector.

The characteristics-based costs of equity are more precise than Q5F, which is in turn more precise than average returns. From Panel A of Table 10, averaged across 18 sectors, the AR volatility is 21.95% per annum, relative to its mean of only 12.38%. By retaining only common factor variations, Q5F reduces the volatility to 7.53%, relative to a mean of 9.76%. The QCE estimates improve the precision further. At the 12-month horizon, for instance, the QCE volatility is only 4.2%, which drops further to 3.04% at the 60-month. The ICE volatility is 2.85%. Across the 18 sectors, the

12-month ahead QCE volatility ranges from 3.16% to 5.79%, while the Q5F volatility from 3.15% to 10.92%. The ICE volatility varies from 1.94% to 3.88%. Also, the term structure of mean sector cost of equity is largely flat. However, the term structure of its volatility is downward sloping: 4.53% on average at the 1-month, 4.2% at the 12-month, and 3.29% at the 36-month horizon.

From Panel B, the characteristics models are again more precise than the q^5-factor model, which is in turn more precise than average returns. Averaged across 57 nonfinancial industries, the AR volatility is 27.13% per annum, which is more than twice the mean of 13.17%. The Q5F volatility is 9.66%, which is close to its mean of 9.7%. The QCE estimates are again more precise. At the 12-month horizon, the QCE volatility is 4.47%, which is less than one half of its mean of 10.02%. The ICE volatility is 3.31%, relative to its mean of 9.05%. Again, the term structure of mean QCE industry cost of equity is largely flat: 10.34% at the 1-month, 10.02% at the 12-month, and 10.31% at the 36-month horizon. However, the term structure of its volatility is again downward sloping: 5.29% at the 1-month, 4.47% at the 12-month, and 3.41% at the 36-month horizon.

The volatility of industry cost of equity also varies across the 57 industries. The lowest volatility is 2.75% per annum for industry 3270 (nonmetallic mineral products), followed by the second lowest of 2.77% for industry 3260 (plastics and rubber products). On the other extreme, the highest volatility is 7.93% for industry 4930 (warehousing and storage), followed by the second highest of 7.42% for industry 5411 (legal services). For the mean cost of equity, it varies from 6.77% (industry 5130, broadcasting and telecommunications) and 6.8% (industry 5140, information and data processing services) to 13.02% (industry 5310, real estate) and 13.12% (industry 6240, social assistance).

4.3 Factor Premiums

Tang, Wu, and Zhang (2014) show that expected return estimates (ICEs) differ drastically from average realized returns for many factors. We show that the q^5 characteristics-based QCE goes a long way in reconciling this difference. We study size, value, momentum (prior 11-month return, skipping 1 month), investment-to-assets, ROE, and expected growth. To simplify calculation, we

use one-way deciles with annual sorts on size, value, and investment-to-assets and monthly sorts on momentum, ROE, and expected growth (Hou, Xue, and Zhang 2020).

Table 11 shows the factor premiums in the January 1977–December 2022 sample. For the small-minus-big decile, the holding period returns are all insignificant from zero, with the average returns positive up to 12-month but negative afterward. The QCE expected premiums with matching horizons are largely in line with average returns. Although all positive, none are significant. The ICE premiums are also all positive but are significant up to 24 months.

For the value-minus-growth decile, the holding period returns are all positive but insignificant. For instance, the 1-month ahead average return is 0.29% per month ($t = 1.18$). The QCE premiums are negative up to 3-month but turn significantly positive afterward. The ICE premiums are all positive and highly significant. For the low-minus-high investment decile, the average returns are positive up to 12 months but negative afterward. All are insignificant. The 1-month ahead average return is 0.33% ($t = 1.74$). Both QCE and ICE premiums are significantly positive across all horizons.

Prior 11-month returns and ROE yield significantly positive premiums in short horizons. At the 1-month, their average returns are 0.96% ($t = 3.03$) and 0.82% ($t = 3.18$), respectively. Expected growth yields significantly positive premiums across all horizons, 0.65%, 6.78%, and 23.2% ($t = 3.06$, 2.16, and 3.07) at the 1-, 12-, and 36-month, respectively.

The QCE premiums are mostly aligned with average returns of the momentum and ROE factors, significantly positive in short horizons but insignificant in long horizons. In particular, the 1-month ahead QCE premiums are 0.33% ($t = 5.92$) for momentum and 1.14% per month ($t = 8.33$) for ROE. The QCE premiums for expected growth are significantly positive across all horizons, 1.27%, 6.96%, and 13.97% ($t = 10.05$, 4.88, and 5.22) at the 1-, 12-, and 36-month, respectively.

ICE performs poorly in aligning with average returns of the momentum, ROE, and expected growth factors. The ICE premiums are significantly negative across all horizons. For instance, the 1-month ICE premium for momentum is -0.35% ($t = -5.82$), and the 1-month ICE premium for

ROE is -0.27% ($t = -7.42$). For the expected growth factor, the ICE premiums are $-0.23\%, -3\%$, and -10.55% ($t = -6.6, -6.63$, and -6.64) at the 1-, 12-, and 36-month, respectively.

Table 12 shows time series predictive regressions of realized factor premiums over subsequent h months on the h-month ahead expected premiums. Consistent with Lee, So, and Wang (2021), ICE performs well in the time series. For the size premium, the ICE slopes are all positive, and the ICE R^2 increases with horizon, reaching 45.2% at the 60-month. In contrast, although positive up to 36-month, the QCE slope is negative at the 60-month, albeit all insignificant. The R^2s are all tiny.

For the value premium, QCE shows predictive power up to 36 months, with often significant slopes and R^2s up to 22.5%. ICE again performs better with significant slopes up to 60 months and R^2s up to 26.4%. QCE performs better than ICE in predicting the investment premium. The QCE slopes are positive and occasionally significant up to 36 months, with R^2s up to 9.4%. In contrast, the ICE slopes are all insignificant, albeit mostly positive, and the R^2s are all tiny.

Most impressively, ICE outperforms QCE substantially in predicting momentum, ROE, and expected growth premiums in the time series. For momentum, the ICE slopes are all significantly positive, with R^2s up to 37.2%. In contrast, the QCE slopes are all insignificant, albeit mostly positive, and the R^2s are at most 6.4%. For the ROE premium, the ICE slopes are all positive and mostly significant in long horizons. The QCE slopes are all insignificant. Finally, for the EG factor, the ICE slopes are again all significantly positive, with R^2s up to 15.5%. In contrast, the QCE slopes are all insignificant, even with mixed signs in long horizons, and the R^ss are all tiny.

4.4 The Equity Premium

We value-weight firm-level costs of equity to obtain the aggregate cost of equity over different horizons. We then subtract the risk-free interest rates with matching maturities to obtain the equity premium. The riskfree rates data are from Federal Reserve Economic Data at St. Louis Fed.

From Panel A of Table 13, the term structure of interest rates in the January 1977–December 2022 sample is upward sloping, 4.25%, 4.72%, and 5.48% per annum at the 1-, 12-, and 60-month

horizons, respectively. For comparison, the QCE equity premium has a largely flat term structure, 4.78%, 3.92%, and 4.72% at the 1-, 12-, and 60-month, respectively. The ICE equity premium has a downward sloping term structure, which results from the upward sloping term structure of interest rates. The term structure of the ICE aggregate cost of equity is flat by construction.

The equity premium estimates are precise. The 1-month QCE equity premium, 4.78% per annum, has an annual volatility of 5.31%, which implies a standard error of only 0.783%, given the sample length of 46 years. Similarly, the 12-month QCE equity premium, 3.92%, has a volatility of 4.47%, which implies a standard error of 0.659%. The ICE estimates are also all precise.

For completeness, we also show expanding window average returns, denoted EAR, over different horizons, with the expanding window starts in January 1967. We use the EAR series later to calculate out-of-sample R^2s from predictive regressions. For 1-month, EAR is expanding window average monthly returns. For 12-month, EAR is the expanding window series of the average prior 12-month returns (with overlapping monthly observations). The EAR estimates have a largely downward sloping term structure. However, this evidence is due to low realized equity premiums in early decades of our sample. From 1967 to 1976, the equity premium is only 2.04% per annum. From 1977 to 1986, it goes up to 6.36%, which is still lower than 8.29% in the 1977–2022 sample.

From Panel B, the QCE equity premiums across different horizons are all highly correlated. The ICE equity premium is positively correlated with the QCE estimates, with the correlations ranging from 0.1 to 0.28, except at the 60-month, which has a correlation of -0.18. The EAR estimates are positively correlated with the QCE estimates but negatively correlated with the ICE estimate. Figure 4 plots the time series of different equity premiums over different horizons.

Panel C of Table 13 performs long-horizon regressions of subsequent h-month ahead realized equity premiums on the h-month ahead expected equity premiums. In addition to horizon, we align the units between the left- and right-hand sides of the regressions. For $h = 60$, for example, we convert the ICE aggregate cost of equity from annual to 5-year unit, $(1 + \text{ICE})^5 - 1$, and then

subtract the 5-year Treasury bond rate. We use overlapping monthly observations.

ICE shows remarkable performance. Its slopes are all positive and significant up to the 12-month horizon. More important, the in-sample R^2 increases with horizon and reaches 29.7% at the 60-month. More impressively, the out-of-sample R^2 of ICE shows a similar pattern, increasing mostly with horizon and reaches the highest, 26.1%, at the 60-month. We calculate the out-of-sample R^2 per Welch and Goyal (2008), $1 - \text{MSE}_i/\text{MSE}_i^A$, in which MSE_i^A is the MSE of the EAR estimate. The time series MEV is also large and negative, meaning that ICE substantially outperforms EAR. For comparison, although fair, the QCE performance falls far short of ICE's. The in-sample R^2 is at most 9.1%, the out-of-sample R^2 is occasionally negative, and time series MEV occasionally positive.

5 Conclusion

This paper develops the q^5-characteristics model for estimating costs of equity as out-of-sample forecasts from cross-sectional predictive regressions by combining slopes from prior 120-month rolling windows with the latest available q^5-characteristics. The q^5-characteristics model is competitive in a battery of evaluation tests, outperforming the accounting-based implied cost of equity in associating with returns in the cross section but underperforming in the time series. The q^5 cost of equity is precise at the industry level and aligned with future realized factor premiums. Its firm-level distribution is weakly left-skewed, whereas the accounting cost of equity is weakly right-skewed. However, the accounting cost of equity substantially outperforms in time series predictability of the equity premium.

Our work has broad, practical implications. In their impressive 1,345-page treatise, Pratt and Grabowski (2014) propose a build-up method of estimating a company's cost of equity, which includes the risk-free rate, equity risk premium, size premium, and company-specific risk premium. The company-specific premium is in turn driven by exceptionally small size, industry, return volatility, leverage, and other specific factors, such as dependence on key personnel and pending litigation. This build-up approach balances the CAPM with practical considerations. Alas, because the CAPM is still front and center in their approach, their costs of equity estimates are likely subject to the im-

precision and weak association problems that plague the prior academic estimates of costs of equity.

More generally, the q^5-characteristics model represents a fundamental departure from the CAPM. The academic literature is also a complex adaptive system, which shows path-dependence. While Fama and French (1992) reject the CAPM, Fama and French (1993) retain the factor model form by adding the size and value factors into the CAPM. The q^5-factor model further maintains the factor model form. Motivated by the investment CAPM, which is a purely characteristics-based economic theory, the q^5-characteristics model breaks away from the factor-model tradition altogether. Fully developing its meta-theoretical foundation, however, is left to future work.

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A Estimating Implied Costs of Equity

A.1 The Gebhardt-Lee-Swaminathan (2001, GLS) Model

We skip the firm index i in subscript for notational simplicity. At the beginning of each month t, we estimate firm i's cost of equity as the internal rate of return (IRR) from the nonlinear equation:

$$P_t = B_{y(t)} + \sum_{\tau=1}^{11} \frac{(E_t[\text{ROE}_{y(t)+\tau}] - \text{IRR}) \times B_{y(t)+\tau-1}}{(1+\text{IRR})^{\tau}} + \frac{(E_t[\text{ROE}_{y(t)+12}] - \text{IRR}) \times B_{y(t)+11}}{\text{IRR} \times (1+\text{IRR})^{11}}, \quad \text{(A1)}$$

in which P_t is the market equity at the beginning of month t, $y(t)$ is the firm's latest fiscal year ending at least four months prior to month t. $B_{y(t)}$ is the latest available book equity. $E_t[\text{ROE}_{y(t)+\tau}]$ is the expected return on equity (ROE) for fiscal year $y(t)+\tau$ based on information as of month t.

Current book equity, $B_{y(t)}$, uses the latest accounting data from the fiscal year ending at least four months prior to the beginning of month t.[6] We apply clean surplus accounting to construct future book equity as $B_{y(t)+\tau} = B_{y(t)+\tau-1} + B_{y(t)+\tau-1}E_t[\text{ROE}_{y(t)+\tau}](1-k), 1 \leq \tau \leq 11$, in which k is the dividend payout ratio for fiscal year $y(t)$. We calculate k as dividends (item DVC) divided by earnings (item IB) for profitable firms, or dividends divided by 6% of total assets (item AT) for firms with zero or negative earnings. We drop a firm if its book equity is zero or negative.

We construct the expected ROE for the first three years ahead ($\tau \leq 3$) via regression-based earnings forecasts. After fiscal year $y(t)+3$, we assume that the expected firm-level ROE mean-reverts linearly to the historical industry median ROE by year $y(t)+12$ and becomes a perpetuity afterwards. As in GLS, we use the Fama-French (1997) 48-industry classification. We use at least five and up to ten years of past ROE data from non-loss firms to compute the industry median ROE.

Following Hou, van Dijk, and Zhang (2012), we estimate costs of equity at the firm level via regression-based earnings forecasts from the pooled cross-sectional regressions, for $1 \leq \tau \leq 3$,

$$Y_{s+\tau} = a + b_1 A_s + b_2 D_s + b_3 DD_s + b_4 Y_s + b_5 Y_s^- + b_6 AC_s + \epsilon_{s+\tau}, \quad \text{(A2)}$$

in which Y_s is earnings (item IB) fiscal year s, A_s is total assets (item AT), D_s is dividends (item DVC), and DD_s is a dummy variable that equals one for dividend payers, and zero otherwise. Y_s^- is a dummy that equals one for negative earnings, and zero otherwise, and AC_s is operating accruals.[7]

[6] Following Davis, Fama, and French (2000), we measure book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock.

[7] Following Hou, Xue, and Zhang (2020), prior to 1988, we use the balance-sheet approach of Sloan (1996) to measure operating accruals as changes in noncash working capital minus depreciation, in which the noncash working capital is changes in noncash current assets minus changes in current liabilities less short-term debt and taxes

To mitigate the impact of outliers, we winsorize the unbounded level variables ($Y_{s+\tau}$, Y_s, and AC_s) in equation (A2) at the 2.5 and 97.5 percentiles of their cross-sectional distributions each month. We winsorize the bounded (from below at zero) variables (A_s and D_s) at the 0 and 97.5 percentiles. At the beginning of month t, we estimate the forecasting regressions using the pooled panel data from the prior 120-month rolling window. The latest $Y_{s+\tau}$ data in equation (A2) are from fiscal year $y(t)$ ending at least four months prior to month t, and the right-hand side variables are further lagged accordingly. We form the expected earnings, $E_t[Y_{y(t)+\tau}]$, by combining the estimated regression coefficients with the latest values of the winsorized predictors from the fiscal year $y(t)$. We then construct expected ROE recursively as $E_t[\text{ROE}_{y(t)+\tau}] = E_t[Y_{y(t)+\tau}]/B_{y(t)+\tau-1}$.

A.2 The Claus-Thomas (2001, CT) Model

At the beginning of each month t, we estimate the internal rate of returns (IRR) from:

$$P_t = B_{y(t)} + \sum_{\tau=1}^{5} \frac{(E_t[\text{ROE}_{y(t)+\tau}] - \text{IRR}) \times B_{y(t)+\tau-1}}{(1+\text{IRR})^{\tau}} + \frac{(E_t[\text{ROE}_{y(t)+5}] - \text{IRR}) \times B_{y(t)+4} \times (1+g)}{(\text{IRR}-g) \times (1+\text{IRR})^5}, \tag{A3}$$

in which P_t is the market equity of month t, $y(t)$ is a firm's latest fiscal year ending at least four months prior to month t. $B_{y(t)+\tau}$ is the book equity for fiscal year $y(t)+\tau$, $E_t[\text{ROE}_{y(t)+\tau}]$ is the expected ROE for fiscal year $y(t)+\tau$ based on information as of month t, and g is the long-term growth rate of abnormal earnings. Abnormal earnings are defined as $(E_t[\text{ROE}_{y(t)+\tau}] - \text{IRR}) \times B_{y(t)+\tau-1}$.

We construct future book equity as $B_{y(t)+\tau} = B_{y(t)+\tau-1} + B_{y(t)+\tau-1} E_t[\text{ROE}_{y(t)+\tau}](1-k), 1 \le \tau \le 4$, in which k is the dividend payout ratio for fiscal year $y(t)$. We calculate k as dividends (item DVC) divided by earnings (item IB) for profitable firms, or dividends divided by 6% of total assets (item AT) for firms with zero or negative earnings. We drop a firm if its book equity is zero or negative. We construct the expected ROE, $E_t[\text{ROE}_{y(t)+\tau}]$, for up to five years ahead, using regression-based earnings forecasts. Following CT, we set g to the ten-year Treasury bond rate minus 3%.

A.3 The Ohlson-Juettner-Nauroth (2005, OJ) Model

At the beginning of each month t, we construct the internal rate of returns (IRR) as:

$$\text{IRR} = A_t + \sqrt{A^2 + \frac{E_t[Y_{y(t)+1}]}{P_t} \times (g_t - (\gamma - 1))}, \tag{A4}$$

in which

$$A_t \equiv \frac{1}{2}\left((\gamma - 1) + \frac{E_t[D_{y(t)+1}]}{P_t}\right), \tag{A5}$$

$$g_t \equiv \frac{1}{2}\left(\frac{E_t[Y_{y(t)+3}] - E_t[Y_{y(t)+2}]}{E_t[Y_{y(t)+2}]} + \frac{E_t[Y_{y(t)+5}] - E_t[Y_{y(t)+4}]}{E_t[Y_{y(t)+4}]}\right). \tag{A6}$$

payable. In particular, $AC = (\triangle CA - \triangle CASH) - (\triangle CL - \triangle STD - \triangle TP) - DP$, in which $\triangle CA$ is the change in current assets (Compustat annual item ACT), $\triangle CASH$ is the change in cash or cash equivalents (item CHE), $\triangle CL$ is the change in current liabilities (item LCT), $\triangle STD$ is the change in debt included in current liabilities (item DLC, zero if missing), $\triangle TP$ is the change in income taxes payable (item TXP, zero if missing), and DP is depreciation and amortization (item DP, zero if missing). Starting from 1988, we follow Hribar and Collins (2002) to measure AC using the statement of cash flows as net income (item NI) minus net cash flow from operations (item OANCF).

P_t is the market equity of month t, $y(t)$ is a firm's latest fiscal year ending at least four months prior to month t. $E_t[Y_{t+\tau}]$ is the expected earnings for fiscal year $y(t)+\tau$ based on information as of month t, and $E_t[D_{y(t)+1}]$ is the expected dividends for fiscal year $y(t)+1$. Expected earnings are from regression-based earnings forecasts. Expected dividends are expected earnings times the current dividend payout ratio, which is computed as dividends (item DVC) divided by earnings (item IB) for profitable firms, or dividends divided by 6% of total assets (item AT) for firms with zero or negative earnings. We use the average of predicted near-term growth rate and five-year growth rate to estimate g_t. We require $E_t[Y_{y(t)+2}]$ and $E_t[Y_{y(t)+4}]$ to be positive so that g_t is well defined. The perpetual growth rate of abnormal earnings, $\gamma - 1$, is the ten-year Treasury bond rate minus 3%.

A.4 The MPEG Model from Easton (2004)

At the beginning of month t, we estimate the internal rate of returns (IRR) from:

$$P_t = \frac{E_t[Y_{y(t)+2}] + \text{IRR} \times E_t[D_{y(t)+1}] - E_t[Y_{y(t)+1}]}{\text{IRR}^2}, \tag{A7}$$

in which P_t is the market equity of month t, $y(t)$ is a firm's latest fiscal year ending at least four months prior to month t, $E_t[Y_{y(t)+\tau}]$ is the expected earnings for fiscal year $y(t)+\tau$ based on information as of month t, and $E_t[D_{y(t)+1}]$ is the expected dividends for fiscal year $y(t)+1$. Expected dividends are expected earnings times the current dividend payout ratio, which is computed as dividends (item DVC) divided by earnings (item IB) for profitable firms, or dividends divided by 6% of total assets (item AT) for firms with zero or negative earnings. When equation (A7) has two positive roots (in very few cases), we use the average as the IRR estimate.

B Variable Definitions in Cross-sectional Forecasts

B.1 The Lewellen (2015) Specifications

We implement Lewellen's (2015) three specifications. Lewellen is brief about variable definitions. This appendix provides the exact measurement of all the variables in our implementation.

LogME, log of market equity Market equity, ME, is price per share (CRSP item PRC) times shares outstanding (item SHROUT). At the beginning of each month t, we measure logME as the logarithm of market equity at the end of month $t-1$.

LogB/M, log of book-to-market At the beginning of each month t, book-to-market, B/M, is the book equity for the latest fiscal year ending at least four months ago divided by the market equity (from CRSP) at the end of month $t-1$. For firms with more than one share class, we merge the market equity for all share classes before computing B/M. Following Davis, Fama, and French (2000), we measure book equity as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (Compustat annual item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (item CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock.

R11, prior 11-month return At the beginning of each month t, we skip month $t-1$ and calculate the prior 11-month return from month $t-12$ to $t-2$.

LogR24, log of 24-month return from $t-36$ to $t-13$ We calculate the sum of log returns from month $t-36$ to $t-13$ as the prior 24-month return at the beginning of month t.

LogIssue12 and LogIssue36, growth in shares outstanding At the beginning of each month t, we calculate the log growth of split-adjusted shares outstanding from month $t-12$ to $t-1$ (LogIssue12) and from month $t-36$ to month $t-1$ (LogIssue36). Split-adjusted shares outstanding equal shares outstanding (CRSP item SHROUT) time the adjustment factor (item CFACSHR).

Acc/A, accrual-to-assets Following Sloan (1996), we measure operating accruals, Acc, as changes in noncash working capital minus depreciation, in which the noncash working capital is changes in noncash current assets minus changes in current liabilities less short-term debt and taxes payable: Acc = (dCA−dCASH)−(dCL−dSTD−dTP)−DP, in which dCA is the change in current assets (item ACT), dCASH is the change in cash or cash equivalents (item CHE), dCL is the change in current liabilities (item LCT), dSTD is the change in debt included in current liabilities (item DLC), dTP is the change in income taxes payable (item TXP), and DP is depreciation and amortization (item DP). Missing changes in income taxes payable are set to zero. At the beginning of each month t, we calculate Acc/A with accruals from the most recent fiscal year ending at least four months ago divided by the average of total assets (item AT) and one-year-lagged total assets.

ROA, return on assets Return on assets, ROA, is income before extraordinary items (item IB) for the most recent fiscal year ending at least four months ago divided by the average of total assets (item AT) and one-year-lagged total assets.

LogAG, log growth of assets At the beginning of each month t, log asset growth, LogAG, is the logarithm of total assets (item AT) from the latest fiscal year ending at least four months ago divided by one-year-lagged total assets.

DY, dividend yield Dividend yield, DY, is the sum of dividends per share (CRSP item DIVAMT, adjusted for stock splits using CFACSHR) from month $t-12$ to $t-1$ divided by price (CRSP item PRC) adjusted for stock splits at the end of month $t-1$, i.e., $[\sum_{s=t-12}^{t-1}(\text{DIVAMT}_s/\text{CFACSHR}_s)]/[\text{PRC}_{t-1}/\text{CFACSHR}_{t-1}]$.

Beta36, market beta Market beta is estimated with weekly returns from month $t-36$ to $t-1$. We calculate weekly returns from daily returns during each calendar week (from Friday market close to next Friday market close) and then estimate the market beta using 156 weekly returns, in which the last return comes from the latest week ending before the beginning of month t.

StdDev, monthly standard deviation Monthly standard deviation, StdDev, is calculated with daily returns from month $t-12$ to month $t-1$, i.e., $\text{StdDev}_t = \sqrt{(21/N-1)\sum_{d\in[t-12,\ t-1]} r_d^2}$, in which d is the index of trading days from month $t-12$ to $t-1$, r_d is the daily return, and N is the total number of trading days in the prior 12-month period.

Turnover, average monthly turnover Turnover is the average monthly turnover from month $t-12$ to month $t-1$. Monthly turnover is the shares traded during a given month (CRSP item VOL) divided by total shares outstanding (item SHROUT) at the end of that month.

D/P, debt-to-price At the beginning of each month t, debt-to-price, D/P, is the ratio of total debt (item DLC plus item DLTT, zero if missing) for the latest fiscal year ending at least four months ago divided by the market equity at the end of month $t-1$ from CRSP. For firms with more than one share class, we merge the market equity for all share classes.

S/P, sales-to-price At the beginning of each month t, sales-to-price, S/P, is the ratio of sales (item SALE) from the latest fiscal year ending at least four months ago divided by the market equity at the end of month $t-1$ from CRSP. For firms with more than one share class, we merge the market equity for all share classes.

Winsorization In cross-sectional forecasting regressions of returns, we winsorize logME, logB/M, LogIssue12, LogIssue36, Acc/A, ROA, LogAG, and Beta36 at the 2.5 and 97.5 percentiles at their respective cross-sectional distributions each month. We winsorize DY, StdDev, Turnover, D/P, and S/P at the 0 and 97.5 percentiles because these variables are bounded from below at zero. Finally, we do not winsorize R11 and LogR24, both of which are returns.

B.2 The q^5 Characteristics

The q^5 characteristics include size, investment-to-assets, return on equity, and expected growth. We follow Hou, Xue, and Zhang (2020) in variable definitions.

Size, ME Size (market equity, ME) is price per share (CRSP item PRC) times shares outstanding (item SHROUT). At the beginning of each month t, ME is measured at the end of month $t-1$. We further take logarithm of ME when using it in cross-sectional regressions.

Investment-to-assets, I/A At the beginning of each month t, I/A is total assets (item AT) from the fiscal year ending at least four months ago divided by one-year-lagged total assets minus one.

Return on equity, ROE Return on equity, ROE, is income before extraordinary items (item IBQ) divided by one-quarter-lagged book equity. Book equity is shareholders' equity, plus balance sheet deferred taxes and investment tax credit (item TXDITCQ) if available, minus the book value of preferred stock (item PSTKQ). Depending on availability, we use stockholders' equity (item SEQQ), or common equity (item CEQQ) plus the book value of preferred stock, or total assets (item ATQ) minus total liabilities (item LTQ) in that order as shareholders' equity.

Before 1972, the sample coverage is limited for quarterly book equity in Compustat quarterly files. We expand the coverage with book equity from Compustat annual files as well as by imputing quarterly book equity with clean surplus accounting. Whenever available, we first use quarterly book equity from Compustat quarterly files. We then supplement the coverage for fiscal quarter four with annual book equity from Compustat annual files. Annual book equity is stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (item TXDITC) if available, minus the book value of preferred stock. Stockholders' equity is the value reported by Compustat (item SEQ), if available. If not, stockholders' equity is the book value of common equity (item

CEQ) plus the par value of preferred stock (item PSTK), or the book value of assets (item AT) minus total liabilities (item LT). Depending on availability, we use redemption (item PSTKRV), liquidating (item PSTKL), or par value (item PSTK) for the book value of preferred stock.

If both are unavailable, we apply the clean surplus relation to impute the book equity. First, if available, we backward impute the beginning-of-quarter book equity as the end-of-quarter book equity minus quarterly earnings plus quarterly dividends. Quarterly earnings are income before extraordinary items (item IBQ). Quarterly dividends are zero if dividends per share (item DVPSXQ) are zero. Otherwise, dividends are dividends per share times beginning-of-quarter shares outstanding adjusted for stock splits during the quarter. Shares outstanding are from Compustat (item CSHOQ supplemented with annual item CSHO for fiscal quarter four) or CRSP (item SHROUT), and the share adjustment factor is from Compustat (item AJEXQ supplemented with annual item AJEX for fiscal quarter four) or CRSP (item CFACSHR).

If data are unavailable for the backward imputation, we impute the book equity for quarter t forward based on book equity from prior quarters. Let BEQ_{t-j}, $1 \leq j \leq 4$ denote the latest available quarterly book equity as of quarter t, and $\text{IBQ}_{t-j+1,t}$ and $\text{DVQ}_{t-j+1,t}$ be the sum of quarterly earnings and quarterly dividends from quarter $t-j+1$ to t, respectively. BEQ_t can then be imputed as $\text{BEQ}_{t-j} + \text{IBQ}_{t-j+1,t} - \text{DVQ}_{t-j+1,t}$. We do not use prior book equity from more than four quarters ago (i.e., $1 \leq j \leq 4$) to reduce imputation errors.

At the beginning of each month t, we use the most recent available ROE. Before 1972, we use the most recent ROE computed with quarterly earnings from fiscal quarters ending at least four months ago. Starting from 1972, we use ROE computed with quarterly earnings from the most recent quarterly earnings announcements (item RDQ). We require the end of the fiscal quarter corresponding to its most recent ROE to be within prior six months. To avoid potentially erroneous records, we also require the earnings announcement date to be after the corresponding fiscal quarter end.

Expected growth, EG We estimate monthly cross-sectional forecasting regressions of one-year-ahead investment-to-assets change, $\text{d}^1\text{I/A}$, on the log of Tobin'q, $\log(q)$, operating cash flows, Cop, and the change in return on equity, dROE. At the beginning of each month t, we measure current investment-to-assets as total assets (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 one-year-prior total assets. The one-year ahead investment-to-assets change, $\text{d}^1\text{I/A}$, is the investment-to-assets from the first year after the most recent fiscal year end minus the current investment-to-assets.

At the beginning of each month t, Tobin's q is the market equity (from CRSP) plus total debt (item DLTT plus item DLC, zero if missing) 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 measure operating cash flows, Cop, as total revenue (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. dROE is ROE minus the four-quarter-lagged ROE. Missing dROE values are set to zero in cross-sectional growth forecasting regressions. We winsorize all the variables on both sides of the regressions at the 2.5 and 97.5 percentiles of their cross-sectional distributions each month.

At the beginning of each month t, we construct expected one-year-ahead investment-to-assets changes, denoted $E_t[\mathrm{d}^1\mathrm{I/A}]$, by combining the most recent winsorized predictors with the average slopes estimated from the prior 120-month rolling window (36 months minimum). 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. dROE is computed using the latest announced quarterly earnings, and if not available, the earnings from the most recent fiscal quarter ending at least four months ago. To avoid look-ahead bias, the average slopes in calculating $E_t[\mathrm{d}^1\mathrm{I/A}]$ are estimated from the prior rolling window regressions, in which $\mathrm{d}^1\mathrm{I/A}$ is from the most recent fiscal year ending at least four months ago as of month t, and the predictors are further lagged by 12 months.

Winsorization In cross-sectional forecasting regressions of returns, we winsorize the log market equity, investment-to-assets, and return on equity at the 2.5 and 97.5 percentiles at their respective cross-sectional distributions each month. Because expected growth, EG, is calculated on already winsorized predictors, we do not winsorize EG further before using it to forecast returns.

C Measurement in the Structural q-Model

Data are from Center for Research in Security Prices (CRSP) monthly stock files and annual Compustat industrial files. We exclude firms with gross property, plant, and equipment or sales either zero or negative. Both are necessary to calculate the right-hand side of equation (1).

In the model, time-t stock variables are at the beginning of period t, and time-t flow variables are over the course of period t. In Compustat both stock and flow variables are recorded at the end of period t. As such, for the year 2010, for example, we take time-t stock variables from the 2009 balance sheet, and time-t flow variables from the 2010 income or cash flow statement.

Output, Y_{it}, is sales (item SALE), working capital is current assets (item ACT). Debt, B_{it+1}, is long-term debt (item DLTT) plus short-term debt (item DLC). Missing values are set to zero. The market leverage, w_{it}^B, is the ratio of debt to the sum of debt and market equity. The tax rate, τ_t, is the statutory corporate income tax rate from the Commerce Clearing House's annual publications. The pre-tax cost of debt, r_{it+1}^B, is total interest and related expenses (item XINT) scaled by debt.

We measure investment as change in net property, plant, and equipment (item PPENT) plus depreciation and amortization (item DP) minus amortization (item AM, zero if missing). However, we measure physical capital, K_{it}, as gross property, plant, and equipment (item PPEGT) and set the depreciate rate of physical capital, δ_{it}, to zero. Ideally, in a perfect world, we ought to use the replacement cost of capital as K_{it} and the economic depreciation rate as δ_{it}. Integrating national accounting in Bureau of Economic Analysis (BEA) with financial accounting in Compustat, Bai et al. (2022) construct firm-specific replacement costs of capital and economic depreciation rates for the entire Compustat universe.

However, the Bai et al. (2022) data cannot be used to forecast returns. The capital and investment price deflators and industry-specific economic depreciation rates are from the BEA data for calendar years, but the fiscal years of firms in Compustat do not always end in December. To deal with this misalignment, Bai et al. use linear interpolation to impute the price deflators and depreciation rates for all possible fiscal year ending months. Doing so involves future information.

More important, for our purpose, Bai et al. (2022) show that gross PPE is much closer to the replacement cost of capital than net PPE. The ratio of the replacement cost to gross PPE is on average

0.98, but the ratio to net PPE is 2.11. Intuitively, gross PPE ignores both depreciation and price inflation. Ignoring the former induces an upward bias, but ignoring the latter induces a downward bias. The two largely offset each other on average. In contrast, net PPE uses aggressive (accounting) depreciation and ignores price inflation. Both induce downward biases. As such, although both are free of look-ahead bias, gross PPE is a better proxy for the replacement cost than net PPE.

Table 1 : Portfolio Sorts, January 1977–December 2022

In Panel A, with each cost of equity at the beginning of month t, we split the NYSE, Amex, and NASDAQ stocks into deciles. We calculate the monthly value-weighted decile returns for different holding periods, h (in months). For instance, the 3-month horizon means that for a given decile in each month, there exist 3 subdeciles, each initiated in a different month in the prior 3 months. We take the simple average of the subdecile returns as the monthly return for the decile. We align the holding period with the forecast horizon in costs of equity. For instance, we use the 12-month holding period when forecasting returns with 12-month ahead costs of equity. We use NYSE-Amex-NASDAQ breakpoints and value-weighted returns. Each individual decile return is in excess of the 1-month Treasury bill rate. Beneath each row of average return estimates, we show the corresponding Newey-West t-statistics adjust for 12 lags. Panel B shows pairwise comparison tests of the q^5-characteristics model versus the Lewellen 3-, 7-, and 15-variable models; the implied cost of equity (ICE); and the structural q-model. For each pairwise comparison, we test whether the difference between the two high-minus-low (H−L) decile returns is on average zero.

Panel A: Portfolio sorts

h	1	2	3	4	5	6	7	8	9	10	H−L
					The q^5 characteristics-based QCE						
1	0.19	0.52	0.86	0.81	0.80	0.97	0.83	1.18	1.39	1.71	1.53
	0.68	2.49	4.38	4.22	4.02	5.23	3.62	5.07	5.77	5.78	6.45
3	0.27	0.61	0.72	0.84	0.95	0.99	0.96	0.94	1.26	1.46	1.20
	0.95	2.83	3.51	4.15	4.73	5.02	4.86	3.92	5.49	5.62	5.40
12	0.51	0.76	0.83	0.89	0.86	0.90	0.94	0.98	1.06	1.13	0.62
	2.06	3.65	4.07	4.35	4.03	4.19	4.03	3.78	3.80	3.31	2.27
24	0.52	0.70	0.80	0.84	0.89	0.90	0.91	0.96	1.02	1.08	0.56
	2.19	3.25	3.81	3.97	4.04	3.78	3.61	3.50	3.37	3.17	2.29
36	0.68	0.80	0.89	0.89	0.95	0.97	0.94	0.95	1.03	1.08	0.40
	3.17	3.90	4.27	4.20	4.26	4.14	3.77	3.55	3.66	3.34	1.77
60	0.75	0.83	0.81	0.82	0.90	0.91	0.96	0.96	1.06	1.02	0.27
	3.54	3.89	3.49	3.39	3.69	3.54	3.65	3.46	3.55	3.16	1.42
					The Lewellen 3-variable model						
1	0.78	0.80	0.84	0.77	0.83	0.84	0.97	1.02	1.18	1.49	0.71
	2.64	3.44	4.00	3.68	4.25	4.13	4.74	3.96	4.03	3.29	1.58
3	0.89	0.84	0.98	0.84	0.83	0.86	0.95	0.88	1.09	1.24	0.35
	2.67	3.19	4.39	3.93	4.09	4.16	4.22	3.39	3.46	3.10	0.82
12	0.84	0.92	0.90	0.85	0.84	0.87	0.88	0.84	0.88	0.73	−0.11
	3.30	4.29	4.41	4.02	4.01	3.92	3.66	2.98	2.63	1.74	−0.29
24	0.72	0.72	0.80	0.81	0.83	0.83	0.93	0.94	0.98	0.84	0.13
	3.12	3.55	3.95	3.94	3.86	3.55	3.74	3.30	2.83	1.90	0.33
36	0.76	0.78	0.85	0.90	0.83	0.84	0.90	0.92	0.98	0.92	0.16
	3.31	3.82	4.39	4.45	3.91	3.71	3.73	3.42	2.96	2.27	0.44
60	0.77	0.84	0.82	0.85	0.81	0.89	0.88	0.94	1.01	1.02	0.25
	3.36	3.97	3.81	3.79	3.49	3.66	3.49	3.31	3.05	2.50	0.73

h	1	2	3	4	5	6	7	8	9	10	H−L
					The Lewellen 7-variable model						
1	0.35	0.66	0.79	0.79	0.80	0.90	0.98	1.11	1.30	1.53	1.18
	1.43	3.44	4.23	4.48	4.34	4.83	4.60	4.65	4.32	3.75	3.33
3	0.32	0.65	0.73	0.84	0.88	0.96	0.92	1.13	1.11	1.31	0.99
	1.34	3.13	3.95	4.73	4.58	4.95	4.44	4.51	3.93	3.42	3.15
12	0.52	0.80	0.86	0.92	0.93	0.88	0.99	1.00	1.04	1.01	0.50
	2.03	4.20	4.76	4.81	4.84	4.25	4.43	3.93	3.26	2.63	1.45
24	0.46	0.78	0.84	0.88	0.82	0.88	0.94	1.03	1.05	1.18	0.73
	1.62	3.94	4.44	4.62	3.98	3.99	3.96	3.69	3.20	2.96	2.08
36	0.60	0.81	0.89	0.96	0.92	0.93	0.98	0.99	1.07	1.14	0.54
	2.25	4.11	4.86	4.95	4.53	4.37	4.29	3.90	3.53	3.14	1.64
60	0.64	0.80	0.88	0.89	0.89	0.91	0.93	0.98	1.03	1.15	0.51
	2.69	3.89	4.20	4.10	3.98	3.90	3.71	3.44	3.12	2.87	1.56
					The Lewellen 15-variable model						
1	0.54	0.70	0.74	0.73	0.76	0.81	0.86	0.94	1.26	1.51	0.96
	1.71	2.70	3.79	3.82	4.09	3.52	3.69	3.77	4.35	4.03	2.49
3	0.59	0.66	0.73	0.73	0.72	0.77	0.84	1.00	1.14	1.31	0.72
	1.48	3.02	3.81	3.98	3.73	3.48	3.68	4.00	3.97	3.57	1.77
12	0.68	0.85	0.77	0.73	0.81	0.87	0.89	0.95	1.01	1.19	0.51
	2.05	4.26	3.92	3.68	3.81	4.14	3.85	3.60	3.39	3.04	1.30
24	0.59	0.76	0.79	0.80	0.83	0.80	0.83	0.92	0.94	1.00	0.41
	1.90	3.47	4.08	4.09	3.98	3.80	3.51	3.51	3.19	2.63	1.15
36	0.69	0.83	0.89	0.90	0.90	0.85	0.84	0.88	0.88	0.92	0.22
	2.44	3.85	4.52	4.89	4.55	4.04	3.61	3.65	3.18	2.76	0.69
60	0.81	0.82	0.84	0.88	0.89	0.88	0.84	0.83	0.86	0.91	0.10
	3.05	3.81	3.97	4.13	4.15	3.84	3.61	3.48	3.23	3.02	0.39
					The q^5-factor model						
1	0.64	0.59	0.62	0.65	0.64	0.61	0.79	0.73	0.86	0.83	0.19
	1.80	2.16	2.80	3.11	3.64	3.53	4.28	3.44	4.45	2.96	0.82
3	0.61	0.67	0.60	0.66	0.63	0.70	0.80	0.75	0.82	0.83	0.22
	1.70	2.40	2.67	3.36	3.57	4.12	4.36	3.81	3.90	2.94	0.91
12	0.57	0.67	0.58	0.66	0.65	0.74	0.80	0.79	0.90	0.91	0.34
	1.55	2.43	2.53	3.47	3.61	4.38	4.44	4.19	4.09	3.31	1.39
24	0.64	0.66	0.59	0.68	0.69	0.73	0.81	0.78	0.92	1.03	0.39
	1.80	2.58	2.67	3.56	3.91	4.36	4.52	4.07	4.08	3.70	1.66
36	0.76	0.64	0.62	0.70	0.73	0.76	0.81	0.76	0.90	1.00	0.23
	2.24	2.48	2.81	3.69	4.23	4.48	4.56	3.96	3.95	3.55	1.12
60	0.94	0.73	0.70	0.73	0.78	0.80	0.82	0.79	0.90	0.98	0.04
	2.96	2.89	3.27	3.91	4.64	4.84	4.88	4.27	3.93	3.54	0.22

h	1	2	3	4	5	6	7	8	9	10	H−L
						The Fama-French 6-factor model					
1	0.79	0.78	0.67	0.74	0.73	0.69	0.75	0.70	0.70	0.55	−0.24
	2.65	3.22	3.19	3.56	3.77	3.64	4.39	3.52	3.00	1.75	−0.98
3	0.82	0.78	0.69	0.78	0.70	0.74	0.71	0.72	0.73	0.58	−0.24
	2.69	3.26	3.13	3.97	3.67	4.17	4.12	3.65	2.91	1.85	−0.91
12	0.86	0.72	0.69	0.83	0.69	0.77	0.72	0.75	0.72	0.58	−0.28
	2.80	2.83	3.14	4.37	3.71	4.26	4.06	3.80	2.83	1.84	−1.14
24	0.91	0.72	0.73	0.83	0.73	0.78	0.69	0.76	0.72	0.63	−0.28
	2.96	2.80	3.40	4.46	4.00	4.30	3.88	3.84	2.92	2.08	−1.22
36	0.98	0.75	0.75	0.82	0.74	0.78	0.71	0.75	0.78	0.66	−0.32
	3.22	2.92	3.58	4.42	4.07	4.29	3.97	3.69	3.25	2.18	−1.53
60	1.10	0.86	0.79	0.85	0.79	0.79	0.75	0.79	0.78	0.73	−0.38
	3.71	3.53	3.94	4.83	4.67	4.56	4.26	4.03	3.38	2.45	−2.03
						The accounting-based ICE					
1	0.69	0.57	0.67	0.74	0.73	0.68	0.71	0.76	0.79	0.84	0.14
	2.40	2.86	3.73	4.33	4.33	3.97	3.57	3.18	2.60	1.69	0.34
3	0.72	0.62	0.66	0.73	0.74	0.67	0.72	0.78	0.86	0.85	0.12
	2.58	3.17	3.61	4.22	4.55	3.76	3.65	3.31	3.09	1.83	0.32
12	0.65	0.64	0.75	0.75	0.81	0.80	0.75	0.80	0.94	1.02	0.37
	2.36	3.32	4.25	4.26	4.86	4.53	3.91	3.31	3.48	2.45	1.01
24	0.64	0.69	0.81	0.81	0.86	0.85	0.85	0.84	0.93	0.93	0.29
	2.39	3.57	4.49	4.66	5.10	4.77	4.55	3.72	3.61	2.38	0.89
36	0.70	0.73	0.81	0.82	0.87	0.88	0.86	0.82	0.92	0.92	0.22
	2.66	3.73	4.41	4.66	5.10	4.88	4.67	3.76	3.51	2.47	0.76
60	0.81	0.80	0.84	0.85	0.90	0.92	0.89	0.85	0.89	1.07	0.26
	3.16	4.22	4.78	4.96	5.19	4.91	4.73	4.06	3.33	2.90	0.96
						The structural q-model					
1	0.34	0.61	0.68	0.70	0.64	0.83	0.78	0.82	0.86	0.98	0.64
	1.30	2.52	3.28	3.21	3.65	4.76	4.44	4.18	5.00	4.46	2.64
3	0.20	0.64	0.66	0.70	0.65	0.86	0.90	0.79	0.87	0.96	0.76
	0.71	3.31	3.08	3.53	3.40	4.84	4.73	4.18	4.58	4.55	3.28
12	0.35	0.57	0.70	0.75	0.68	0.81	0.87	0.79	0.80	1.10	0.74
	1.30	3.05	3.29	3.65	3.31	4.24	4.53	3.85	3.99	5.49	3.26
24	0.47	0.62	0.68	0.69	0.75	0.76	0.84	0.74	0.87	0.92	0.46
	1.76	3.23	3.12	3.22	3.54	3.82	4.34	3.54	4.10	4.75	2.11
36	0.56	0.73	0.81	0.79	0.81	0.81	0.85	0.82	0.85	0.88	0.32
	2.09	3.94	4.20	3.81	4.04	4.35	4.39	4.20	4.12	4.80	1.50
60	0.62	0.76	0.78	0.82	0.78	0.79	0.83	0.84	0.81	0.83	0.21
	2.36	3.91	3.68	3.83	3.89	3.96	4.28	4.13	3.71	4.30	1.04

	Panel B: Pairwise comparison tests with QCE					
	h	Diff	t	h	Diff	t
Lewellen-3	1	0.82	1.98	24	0.43	1.82
Lewellen-7	1	0.35	1.20	24	−0.17	−0.81
Lewellen-15	1	0.56	1.74	24	0.15	0.64
ICE	1	1.38	3.23	24	0.24	0.85
Structural-q	1	0.89	3.58	24	0.10	0.29
Lewellen-3	3	0.84	2.00	36	0.24	0.96
Lewellen-7	3	0.21	0.67	36	−0.14	−0.60
Lewellen-15	3	0.48	1.30	36	0.17	0.75
ICE	3	1.08	2.64	36	0.23	0.80
Structural-q	3	0.44	1.76	36	0.09	0.28
Lewellen-3	12	0.73	2.90	60	0.02	0.09
Lewellen-7	12	0.12	0.62	60	−0.23	−0.94
Lewellen-15	12	0.11	0.37	60	0.18	0.72
ICE	12	0.29	1.02	60	0.13	0.56
Structural-q	12	−0.12	−0.37	60	0.06	0.20

Table 2 : Portfolio Sorts, the All-but-micro Sample, January 1977–December 2022

Starting from the full NYSE-Amex-NASDAQ sample, we exclude microcaps (stocks with the market equity below the NYSE 20 percentile). In Panel A, with each cost of equity at the beginning of month t, we split all remaining stocks into deciles. We calculate the monthly value-weighted decile returns for different holding periods, h (in months). For instance, the 3-month horizon means that for a given decile in each month, there exist 3 subdeciles, each initiated in a different month in the prior 3 months. We take the simple average of the subdecile returns as the monthly return for the decile. We align the holding period with the forecast horizon in costs of equity. For instance, we use the 12-month holding period when forecasting returns with 12-month ahead costs of equity. We use all-but-micro breakpoints and value-weighted returns. Each individual decile return is in excess of the 1-month Treasury bill rate. Beneath each row of average return estimates, we show the corresponding Newey-West t-statistics adjust for 12 lags. Panel B shows pairwise comparison tests of the q^5-characteristics model versus the Lewellen 3-, 7-, and 15-variable models; the implied cost of equity (ICE); and the structural q-model. For each pairwise comparison, we test whether the difference between the two high-minus-low (H−L) decile returns is on average zero.

Panel A: Portfolio sorts

h	1	2	3	4	5	6	7	8	9	10	H−L
					The q^5 characteristics-based QCE						
1	0.18	0.57	0.69	0.63	0.76	0.67	0.87	0.90	0.96	1.14	0.95
	0.65	2.57	3.51	3.04	3.75	3.11	4.15	4.59	4.28	5.03	4.80
3	0.36	0.56	0.69	0.73	0.79	0.80	0.87	0.88	0.94	1.08	0.72
	1.24	2.40	3.41	3.61	4.04	3.84	4.15	4.27	4.35	4.76	3.50
12	0.41	0.65	0.72	0.78	0.80	0.81	0.80	0.88	0.87	0.89	0.48
	1.42	2.79	3.48	4.02	4.22	4.07	3.91	4.14	4.07	3.84	2.64
24	0.38	0.59	0.64	0.68	0.75	0.83	0.79	0.77	0.81	0.78	0.40
	1.32	2.52	2.91	3.37	3.75	4.43	4.06	3.79	3.79	3.22	2.37
36	0.64	0.78	0.80	0.83	0.81	0.85	0.81	0.78	0.87	0.77	0.13
	2.60	3.84	4.15	4.53	4.49	4.68	4.35	4.28	4.37	3.22	0.93
60	0.75	0.85	0.81	0.83	0.86	0.82	0.82	0.80	0.79	0.79	0.04
	3.01	3.63	3.71	3.82	4.19	4.10	4.18	4.12	3.81	3.25	0.32
					The Lewellen 3-variable model						
1	0.37	0.52	0.64	0.54	0.68	0.67	0.70	0.87	0.85	0.99	0.62
	1.62	2.65	3.17	2.81	3.42	3.39	3.36	4.24	3.74	3.16	2.48
3	0.51	0.60	0.61	0.67	0.71	0.71	0.75	0.82	0.85	0.91	0.41
	2.26	3.17	3.20	3.72	3.69	3.73	3.94	3.93	3.58	2.91	1.78
12	0.75	0.76	0.76	0.77	0.83	0.80	0.82	0.78	0.68	0.75	0.00
	3.21	3.81	4.14	4.24	4.58	4.33	4.32	3.82	2.74	2.49	0.01
24	0.75	0.75	0.77	0.76	0.77	0.79	0.80	0.79	0.80	0.78	0.02
	3.23	3.97	4.25	4.31	4.23	4.27	4.14	3.81	3.77	2.91	0.11
36	0.89	0.87	0.92	0.88	0.86	0.84	0.81	0.80	0.83	0.79	−0.09
	3.65	4.52	5.04	5.03	4.71	4.65	4.08	4.01	4.09	3.40	−0.49
60	0.95	0.97	0.90	0.87	0.87	0.85	0.78	0.81	0.73	0.65	−0.30
	3.75	4.37	4.28	4.23	4.30	4.18	3.78	4.08	3.52	2.82	−1.91

h	1	2	3	4	5	6	7	8	9	10	H−L
					The Lewellen 7-variable model						
1	0.23	0.39	0.51	0.70	0.71	0.71	0.79	0.91	1.02	1.11	0.88
	0.89	1.94	2.67	3.68	3.69	3.76	4.16	4.27	5.04	3.89	3.60
3	0.26	0.47	0.63	0.64	0.70	0.78	0.84	0.87	0.95	1.03	0.76
	1.07	2.47	3.39	3.59	3.63	4.04	4.40	4.43	4.34	3.57	3.41
12	0.40	0.63	0.67	0.81	0.81	0.83	0.82	0.80	0.75	0.82	0.41
	1.74	3.31	3.74	4.59	4.52	4.41	4.18	3.93	3.11	2.93	2.31
24	0.49	0.58	0.64	0.71	0.80	0.83	0.82	0.74	0.84	0.81	0.32
	2.25	3.01	3.01	3.71	4.45	4.48	4.26	3.45	3.82	3.07	1.79
36	0.63	0.69	0.80	0.80	0.85	0.87	0.85	0.83	0.83	0.84	0.21
	2.99	3.38	4.37	4.07	4.64	4.94	4.78	4.44	4.31	3.53	1.42
60	0.81	0.81	0.81	0.84	0.84	0.84	0.83	0.80	0.76	0.73	−0.07
	3.34	3.82	3.81	4.15	4.39	4.34	4.32	4.21	3.84	3.06	−0.54
					The Lewellen 15-variable model						
1	0.38	0.56	0.55	0.58	0.67	0.62	0.62	0.81	0.86	1.17	0.79
	1.48	2.86	2.88	3.18	3.30	3.27	2.98	3.78	3.87	4.04	2.89
3	0.47	0.62	0.49	0.57	0.71	0.68	0.71	0.82	0.92	1.02	0.55
	1.89	3.29	2.75	3.06	3.76	3.64	3.46	3.73	3.70	3.45	2.08
12	0.61	0.69	0.72	0.74	0.74	0.75	0.81	0.71	0.81	0.82	0.22
	2.69	3.77	4.24	4.02	3.89	3.93	3.89	2.83	2.98	2.66	0.86
24	0.51	0.63	0.63	0.74	0.76	0.77	0.78	0.80	0.74	0.78	0.28
	2.40	3.38	3.16	3.91	3.84	3.90	3.77	3.62	2.86	2.55	1.14
36	0.61	0.69	0.72	0.77	0.85	0.82	0.83	0.86	0.85	0.86	0.25
	2.76	3.52	4.18	4.42	4.69	4.30	4.26	4.24	3.56	2.86	1.06
60	0.80	0.83	0.79	0.77	0.79	0.79	0.80	0.79	0.76	0.83	0.03
	3.42	4.43	4.36	4.17	4.02	3.91	3.85	3.74	3.23	3.01	0.20
					The q^5-factor model						
1	0.54	0.64	0.70	0.56	0.77	0.68	0.70	0.74	0.76	0.94	0.40
	1.82	2.99	3.16	3.13	4.44	4.10	4.11	3.78	3.66	3.90	1.97
3	0.59	0.61	0.71	0.66	0.75	0.68	0.77	0.76	0.75	0.90	0.32
	1.91	2.78	3.42	3.90	4.35	4.02	4.65	3.97	3.61	3.62	1.60
12	0.57	0.61	0.67	0.64	0.72	0.71	0.79	0.79	0.81	0.96	0.38
	1.89	2.68	3.31	3.63	4.16	4.34	4.79	4.39	3.97	3.92	2.05
24	0.61	0.60	0.67	0.67	0.72	0.74	0.80	0.79	0.85	1.07	0.46
	2.11	2.72	3.40	3.75	4.22	4.51	4.65	4.37	4.09	4.27	2.48
36	0.64	0.61	0.69	0.71	0.76	0.77	0.80	0.77	0.86	1.02	0.38
	2.29	2.75	3.59	4.09	4.47	4.63	4.64	4.22	4.18	4.01	2.33
60	0.80	0.68	0.74	0.76	0.82	0.83	0.82	0.77	0.89	0.98	0.19
	2.97	3.18	3.95	4.44	4.93	5.20	4.98	4.28	4.50	3.90	1.30

h	1	2	3	4	5	6	7	8	9	10	H−L
						The Fama-French 6-factor model					
1	0.73	0.77	0.64	0.63	0.67	0.75	0.80	0.66	0.76	0.65	−0.08
	2.73	3.72	3.21	3.20	3.72	3.98	4.45	3.41	3.52	2.48	−0.39
3	0.74	0.78	0.72	0.62	0.69	0.74	0.79	0.72	0.74	0.68	−0.06
	2.79	3.68	3.62	3.34	3.85	4.27	4.35	3.77	3.41	2.54	−0.26
12	0.77	0.70	0.76	0.67	0.70	0.75	0.80	0.75	0.67	0.77	0.00
	2.87	3.24	3.89	3.69	3.85	4.23	4.55	4.05	3.02	2.87	0.00
24	0.84	0.69	0.77	0.72	0.73	0.75	0.77	0.74	0.70	0.80	−0.04
	3.11	3.24	4.01	4.04	4.05	4.27	4.43	3.88	3.24	3.01	−0.19
36	0.85	0.69	0.80	0.76	0.75	0.75	0.74	0.75	0.75	0.85	−0.01
	3.24	3.28	4.28	4.40	4.13	4.30	4.13	3.87	3.45	3.30	−0.03
60	0.97	0.75	0.87	0.82	0.78	0.78	0.77	0.75	0.81	0.84	−0.13
	3.84	3.68	4.79	4.89	4.56	4.62	4.41	3.99	3.86	3.30	−0.85
						The accounting-based ICE					
1	0.74	0.63	0.51	0.69	0.73	0.74	0.64	0.77	0.79	0.78	0.04
	2.48	3.11	2.60	3.90	4.21	4.02	3.66	4.42	4.38	3.13	0.15
3	0.78	0.61	0.61	0.70	0.70	0.75	0.70	0.77	0.69	0.83	0.05
	2.67	2.93	3.19	3.97	4.05	4.18	4.00	4.38	3.86	3.46	0.20
12	0.73	0.61	0.63	0.76	0.75	0.83	0.83	0.80	0.69	0.86	0.13
	2.56	2.97	3.40	4.28	4.25	4.90	4.78	4.51	3.84	3.74	0.54
24	0.68	0.61	0.70	0.82	0.82	0.87	0.85	0.86	0.80	0.87	0.19
	2.53	2.95	3.80	4.62	4.69	5.24	4.83	4.75	4.34	3.99	0.84
36	0.70	0.67	0.74	0.82	0.82	0.86	0.85	0.87	0.84	0.83	0.13
	2.63	3.25	3.92	4.59	4.69	5.11	4.73	4.68	4.63	3.88	0.65
60	0.78	0.74	0.80	0.85	0.86	0.89	0.90	0.91	0.84	0.85	0.06
	3.12	3.75	4.38	4.89	4.86	5.23	5.04	4.92	4.58	3.94	0.32
						The structural q-model					
1	0.20	0.63	0.66	0.65	0.62	0.81	0.84	0.81	0.72	0.92	0.72
	0.78	3.14	3.15	3.14	3.32	4.01	4.53	4.21	3.80	4.71	3.20
3	0.28	0.61	0.69	0.67	0.63	0.83	0.81	0.82	0.79	0.89	0.61
	1.08	3.16	3.17	3.12	3.29	4.17	4.51	4.13	4.10	4.63	2.78
12	0.36	0.61	0.73	0.68	0.72	0.78	0.84	0.85	0.78	0.91	0.55
	1.36	3.25	3.45	3.09	3.97	3.76	4.35	4.58	3.68	4.58	2.40
24	0.47	0.65	0.69	0.67	0.70	0.79	0.79	0.83	0.76	0.87	0.41
	1.81	3.35	3.25	2.99	3.54	3.93	3.80	4.27	3.57	4.45	1.91
36	0.55	0.75	0.77	0.80	0.78	0.83	0.87	0.87	0.79	0.87	0.32
	2.12	3.94	4.05	3.84	3.86	4.48	4.44	4.65	3.87	4.79	1.51
60	0.60	0.74	0.80	0.75	0.78	0.84	0.82	0.88	0.77	0.82	0.21
	2.35	3.65	4.04	3.37	3.83	4.35	4.18	4.37	3.66	4.31	1.03

	Panel B: Pairwise comparison tests with QCE					
	h	Diff	t	h	Diff	t
Lewellen-3	1	0.33	1.06	24	0.38	1.48
Lewellen-7	1	0.08	0.27	24	0.08	0.37
Lewellen-15	1	0.17	0.54	24	0.13	0.44
ICE	1	0.91	2.88	24	0.11	0.41
Structural-q	1	0.24	1.06	24	−0.01	−0.03
Lewellen-3	3	0.31	0.99	36	0.22	1.09
Lewellen-7	3	−0.04	−0.16	36	−0.08	−0.55
Lewellen-15	3	0.17	0.53	36	−0.12	−0.53
ICE	3	0.68	2.21	36	0.02	0.06
Structural-q	3	0.10	0.50	36	−0.17	−0.74
Lewellen-3	12	0.48	1.56	60	0.34	2.54
Lewellen-7	12	0.07	0.29	60	0.12	0.95
Lewellen-15	12	0.27	0.85	60	0.01	0.03
ICE	12	0.34	1.18	60	0.13	0.50
Structural-q	12	−0.07	−0.37	60	−0.17	−0.69

Table 3 : Cross-sectional Predictive Regressions, January 1977–December 2022

In Panel A, we perform cross-sectional regressions of subsequent h-month returns on a given h-month ahead cost of equity at the beginning of month t. s is the average slope, Ste its Newey-West standard error adjust for 12 lags, and $|t_{s=1}|$ the absolute t-value that tests the slope equals one. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5 factor model (Q5F), the Fama-French 6-factor model (FF6), the accounting-based implied cost of equity (ICE), and the structural q-model. Panel B shows pairwise comparison tests of the q^5-characteristics model versus the other 5 characteristics-based models. For each pairwise comparison, we test whether the slope difference is on average zero. We use time series tests with Newey-West t-values.

Panel A: Cross-sectional predictive regressions

	h	s	Ste	$\lvert t_{s=1}\rvert$	h	s	Ste	$\lvert t_{s=1}\rvert$	h	s	Ste	$\lvert t_{s=1}\rvert$
QCE	1	0.83	0.12	1.43	12	0.57	0.33	1.32	36	0.66	0.29	1.17
Lewellen-3	1	0.66	0.20	1.72	12	0.15	0.39	2.19	36	0.67	0.49	0.68
Lewellen-7	1	0.77	0.11	2.20	12	0.66	0.23	1.49	36	0.74	0.34	0.78
Lewellen-15	1	0.68	0.10	3.34	12	0.57	0.22	1.92	36	0.50	0.19	2.69
Q5F	1	0.03	0.03	35.00	12	0.01	0.04	23.89	36	0.01	0.02	57.99
FF6	1	0.02	0.04	22.63	12	0.01	0.09	10.59	36	−0.01	0.03	33.78
ICE	1	0.49	0.18	2.88	12	0.54	0.24	1.93	36	0.35	0.13	4.86
Structural-q	1	0.07	0.03	36.03	12	0.24	0.14	5.50	36	0.35	0.11	6.22
QCE	3	0.76	0.15	1.60	24	0.72	0.22	1.30	60	0.56	0.26	1.67
Lewellen-3	3	0.38	0.27	2.27	24	0.75	0.34	0.72	60	0.60	0.46	0.86
Lewellen-7	3	0.73	0.13	2.09	24	0.74	0.23	1.12	60	0.62	0.40	0.96
Lewellen-15	3	0.65	0.12	2.86	24	0.56	0.16	2.81	60	0.28	0.15	4.76
Q5F	3	0.02	0.03	29.10	24	0.02	0.02	44.74	60	0.00	0.01	169.36
FF6	3	0.02	0.05	18.49	24	0.00	0.04	22.62	60	−0.03	0.02	51.80
ICE	3	0.38	0.18	3.47	24	0.49	0.15	3.36	60	0.27	0.15	4.85
Structural-q	3	0.14	0.06	15.53	24	0.31	0.13	5.40	60	0.30	0.09	7.40

Panel B: Pairwise comparison tests with QCE

	h	Diff	t	h	Diff	t	h	Diff	t
Lewellen-3	1	0.17	1.11	12	0.41	1.86	36	−0.00	−0.04
Lewellen-7	1	0.06	0.57	12	−0.10	−0.52	36	−0.07	−0.88
Lewellen-15	1	0.15	1.76	12	−0.01	−0.04	36	0.17	0.92
ICE	1	0.34	1.50	12	0.03	0.11	36	0.31	1.42
Structural-q	1	0.76	6.38	12	0.32	0.88	36	0.32	1.00
Lewellen-3	3	0.38	1.84	24	−0.04	−0.19	60	−0.04	−0.26
Lewellen-7	3	0.03	0.27	24	−0.03	−0.19	60	−0.06	−0.34
Lewellen-15	3	0.11	1.01	24	0.16	0.88	60	0.28	1.04
ICE	3	0.38	1.51	24	0.22	1.34	60	0.35	1.49
Structural-q	3	0.62	3.76	24	0.40	1.95	60	0.26	0.76

Table 4 : Cross-sectional Predictive Regressions, the All-but-micro Sample, January 1977–December 2022

In Panel A, we perform cross-sectional regressions of subsequent h-month returns on a given h-month ahead cost of equity at the beginning of month t. s is the average slope, Ste its Newey-West standard error adjust for 12 lags, and $|t_{s=1}|$ the absolute t-value that tests the slope equals one. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model, the accounting-based implied cost of equity (ICE), and the structural q-model. Panel B shows pairwise comparison tests of the q^5-characteristics model versus the other 5 characteristics-based models. For each pairwise comparison, we test whether the slope difference is on average zero. We use time series tests with Newey-West t-values.

Panel A: Cross-sectional predictive regressions

	h	s	Ste	$\lvert t_{s=1}\rvert$	h	s	Ste	$\lvert t_{s=1}\rvert$	h	s	Ste	$\lvert t_{s=1}\rvert$
QCE	1	0.69	0.27	1.17	12	0.25	0.22	3.34	36	0.17	0.14	5.96
Lewellen-3	1	0.54	0.23	2.04	12	0.10	0.22	4.16	36	−0.14	0.32	3.55
Lewellen-7	1	0.57	0.11	3.97	12	0.24	0.16	4.77	36	0.20	0.15	5.48
Lewellen-15	1	0.38	0.13	4.88	12	0.18	0.17	4.95	36	0.23	0.11	7.11
Q5F	1	0.05	0.04	27.09	12	0.06	0.03	30.36	36	0.06	0.02	39.16
FF6	1	0.04	0.06	17.08	12	0.04	0.07	12.84	36	0.00	0.04	25.66
ICE	1	0.13	0.27	3.24	12	0.11	0.31	2.85	36	0.04	0.19	5.03
Structural-q	1	0.07	0.03	27.30	12	0.13	0.10	8.28	36	0.21	0.08	10.43
QCE	3	0.61	0.24	1.58	24	0.28	0.14	5.19	60	−0.32	0.25	5.29
Lewellen-3	3	0.42	0.18	3.24	24	0.16	0.32	2.66	60	−0.64	0.28	5.91
Lewellen-7	3	0.46	0.12	4.64	24	0.23	0.20	3.94	60	−0.16	0.13	8.96
Lewellen-15	3	0.30	0.15	4.73	24	0.18	0.13	6.27	60	−0.02	0.09	11.45
Q5F	3	0.05	0.04	26.90	24	0.08	0.03	30.91	60	0.03	0.01	92.79
FF6	3	0.04	0.06	16.12	24	0.03	0.05	18.42	60	−0.03	0.04	26.35
ICE	3	0.04	0.29	3.34	24	0.11	0.24	3.71	60	0.06	0.17	5.39
Structural-q	3	0.11	0.06	16.17	24	0.17	0.08	10.78	60	0.15	0.06	13.59

Panel B: Pairwise comparison tests with QCE

	h	Diff	t	h	Diff	t	h	Diff	t
Lewellen-3	1	0.15	0.45	12	0.15	0.68	36	0.30	0.86
Lewellen-7	1	0.12	0.44	12	0.01	0.06	36	−0.04	−0.26
Lewellen-15	1	0.31	1.19	12	0.07	0.32	36	−0.07	−0.41
ICE	1	0.55	1.36	12	0.13	0.29	36	0.07	0.23
Structural-q	1	0.62	2.29	12	0.12	0.49	36	−0.04	−0.27
Lewellen-3	3	0.20	0.64	24	0.12	0.29	60	0.32	1.13
Lewellen-7	3	0.15	0.57	24	0.05	0.20	60	−0.16	−0.72
Lewellen-15	3	0.31	1.18	24	0.10	0.53	60	−0.31	−0.86
ICE	3	0.58	1.38	24	0.12	0.40	60	−0.33	−1.13
Structural-q	3	0.50	1.91	24	0.10	0.69	60	−0.47	−1.77

Table 5 : Measurement Error Variances, January 1977–December 2022

In Panel A, $\overline{\text{SVar}}^{\text{TS}} = (1/N)\sum_i \left(\text{Var}_i\left(\widehat{er}^h_{it}\right) - 2\text{Cov}_i\left(\widehat{er}^h_{it}, r_{it+h}\right)\right)$ is the time series measurement error variance (MEV) of a given expected return proxy, $\widehat{er}^h_{it}$, $\text{Var}^{\text{TS}} = (1/N)\sum_i \text{Var}_i\left(\widehat{er}^h_{it}\right)$ the variance component, and $\text{Cov}^{\text{TS}} = (1/N)\sum_i \text{Cov}_i\left(\widehat{er}^h_{it}, r_{it+h}\right)$ the covariance component. $\overline{\text{SVar}}^{\text{CX}} = (1/(T^p-h))\sum_t \left(\text{Var}_t\left(\widehat{er}^h_{it}\right) - 2\text{Cov}_t\left(\widehat{er}^h_{it}, r_{it+h}\right)\right)$ is the cross-section MEV of $\widehat{er}^h_{it}$, in which $T^p - h$ is the number of cross-sections in the predictive window. $\text{Var}^{\text{CX}} = (1/(T^p-h))\sum_t \text{Var}_t\left(\widehat{er}^h_{it}\right)$ is the variance component, and $\text{Cov}^{\text{CX}} = (1/(T^p-h))\sum_t \text{Cov}_t\left(\widehat{er}^h_{it}, r_{it+h}\right)$ the covariance component. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model (FF6), the accounting-based implied cost of equity (ICE), and the structural q-model. Panel B shows pairwise comparison tests with QCE. Diff^{TS} is the time series MEV differential, and t_{TS} its White heteroscedasticity-adjusted t-value. Diff^{CX} is the cross-section MEV differential, and t_{CX} its Newey-West t-value adjusted for 12 lags.

Panel A: Measurement error variances

	h	$\overline{\text{SVar}}^{\text{TS}}$	Var^{TS}	Cov^{TS}	$\overline{\text{SVar}}^{\text{CX}}$	Var^{CX}	Cov^{CX}	h	$\overline{\text{SVar}}^{\text{TS}}$	Var^{TS}	Cov^{TS}	$\overline{\text{SVar}}^{\text{CX}}$	Var^{CX}	Cov^{CX}
QCE	1	0.0031	0.0081	0.0050	−0.0031	0.0080	0.0111	24	−1.6930	1.2691	2.9621	−0.4540	1.6201	2.0741
Lewellen-3	1	−0.0002	0.0047	0.0049	−0.0024	0.0051	0.0075	24	−3.6076	1.1705	4.7781	−0.8658	1.6309	2.4967
Lewellen-7	1	0.0002	0.0051	0.0049	−0.0034	0.0062	0.0095	24	−3.4147	1.6007	5.0155	−1.1854	2.1065	3.2919
Lewellen-15	1	0.0063	0.0067	0.0004	−0.0009	0.0078	0.0087	24	−3.2863	2.1242	5.4104	−0.9875	2.4519	3.4394
Q5F	1	0.0234	0.0195	−0.0039	0.0302	0.0312	0.0010	24	21.84	20.85	−0.9881	29.49	30.58	1.0922
FF6	1	0.0127	0.0089	−0.0039	0.0135	0.0134	−0.0001	24	9.6957	8.5497	−1.1459	12.79	12.74	−0.0552
ICE	1	−0.0176	0.0031	0.0207	−0.0013	0.0045	0.0058	24	−8.0229	3.3824	11.41	−0.3978	4.6689	5.0667
Structural-q	1	0.0171	0.0275	0.0104	0.0558	0.0670	0.0112	24	−0.0003	0.6621	0.6624	0.7641	2.0340	1.2699
QCE	3	0.0327	0.0596	0.0269	−0.0225	0.0574	0.0799	36	−1.7692	2.2386	4.0079	−0.0685	3.1506	3.2191
Lewellen-3	3	0.0470	0.0371	−0.0099	−0.0046	0.0352	0.0398	36	−5.1279	2.4925	7.6204	−1.1186	3.5377	4.6563
Lewellen-7	3	0.0385	0.0436	0.0051	−0.0179	0.0472	0.0650	36	−4.7497	3.1905	7.9403	−1.8243	4.4311	6.2554
Lewellen-15	3	0.0669	0.0576	−0.0093	−0.0053	0.0618	0.0671	36	−4.0968	4.5021	8.5988	−0.6044	5.4031	6.0075
Q5F	3	0.2276	0.1793	−0.0483	0.2840	0.2861	0.0021	36	86.68	86.84	0.1576	114.69	117.87	3.1812
FF6	3	0.1202	0.0818	−0.0384	0.1258	0.1242	−0.0016	36	32.15	29.36	−2.7929	43.07	42.31	−0.7531
ICE	3	−0.1539	0.0286	0.1825	−0.0113	0.0416	0.0529	36	−10.85	12.31	23.15	5.03	15.16	10.13
Structural-q	3	−0.0025	0.0499	0.0524	0.1243	0.1790	0.0547	36	1.0065	1.1265	0.1200	1.0279	3.2928	2.2648
QCE	12	−0.1782	0.4756	0.6538	−0.1755	0.5288	0.7043	60	−8.6963	6.5921	15.29	3.8038	10.09	6.2831
Lewellen-3	12	−0.1199	0.3234	0.4434	−0.0536	0.4133	0.4669	60	−18.69	7.7616	26.45	0.8077	12.02	11.21
Lewellen-7	12	−0.4804	0.4666	0.9470	−0.2158	0.5878	0.8036	60	−15.83	9.6940	25.52	0.4323	14.37	13.93
Lewellen-15	12	−0.5622	0.6280	1.1902	−0.1531	0.7296	0.8827	60	−3.1844	17.56	20.74	10.37	21.19	10.82
Q5F	12	4.1936	3.4265	−0.7671	5.3185	5.3230	0.0045	60	1319.81	1318.50	−1.3115	1530.08	1523.23	−6.8501
FF6	12	2.2135	1.5588	−0.6547	2.3996	2.3562	−0.0434	60	247.32	240.24	−7.0811	332.02	320.75	−11.26
ICE	12	−2.6801	0.5375	3.2176	−0.5684	0.7965	1.3649	60	26.71	105.86	79.15	63.91	108.54	44.62
Structural-q	12	−0.0350	0.2432	0.2782	0.4365	0.8645	0.4280	60	2.6223	2.7788	0.1565	3.0476	8.6056	5.5580

Panel B: Pairwise comparison tests with QCE

	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}
Lewellen-3	1	0.0032	4.10	−0.0007	−0.51	12	−0.0241	−0.49	−0.1219	−0.95	36	3.7749	15.85	1.0501	1.22
Lewellen-7	1	0.0027	3.56	0.0003	0.26	12	0.2765	3.83	0.0403	0.28	36	3.0256	11.54	1.7558	2.38
Lewellen-15	1	−0.0036	−4.06	−0.0021	−1.09	12	0.3499	3.62	−0.0224	−0.06	36	2.2739	5.46	0.5359	0.49
ICE	1	0.0188	21.06	−0.0018	−0.61	12	2.5781	17.02	0.3892	0.65	36	9.7580	9.77	−5.2155	−0.33
Structural-q	1	−0.0138	−10.77	−0.0588	−15.48	12	−0.1421	−2.84	−0.6122	−1.43	36	−2.6984	−9.99	−1.1016	−0.47
Lewellen-3	3	−0.0113	−2.04	−0.0179	−1.67	24	2.0138	13.34	0.4118	0.73	60	11.87	16.44	2.9961	0.91
Lewellen-7	3	−0.0066	−1.24	−0.0046	−0.46	24	1.7201	11.26	0.7315	1.27	60	7.7978	8.45	3.3715	0.75
Lewellen-15	3	−0.0377	−5.52	−0.0172	−0.91	24	1.5817	7.09	0.5335	0.66	60	−5.0106	−3.12	−6.5677	−0.93
ICE	3	0.1753	25.61	−0.0113	−0.36	24	6.7189	15.22	0.0110	0.01	60	−38.12	−4.23	−71.07	−1.55
Structural-q	3	0.0362	6.10	−0.1464	−6.33	24	−1.7531	−10.61	−1.2057	−1.33	60	−11.49	−13.75	0.7536	0.11

Table 6 : Measurement Error Variances, the All-but-micro Sample, January 1977–December 2022

In Panel A, $\overline{\text{SVar}}^{\text{TS}} = (1/N)\sum_i \left(\text{Var}_i\left(\widehat{er}_{it}^h\right) - 2\text{Cov}_i\left(\widehat{er}_{it}^h, r_{it+h}\right)\right)$ is the time series measurement error variance (MEV) of a given expected return proxy, $\widehat{er}_{it}^h$, $\text{Var}^{\text{TS}} = (1/N)\sum_i \text{Var}_i\left(\widehat{er}_{it}^h\right)$ the variance component, and $\text{Cov}^{\text{TS}} = (1/N)\sum_i \text{Cov}_i\left(\widehat{er}_{it}^h, r_{it+h}\right)$ the covariance component. $\overline{\text{SVar}}^{\text{CX}} = (1/(T^p-h))\sum_t \left(\text{Var}_t\left(\widehat{er}_{it}^h\right) - 2\text{Cov}_t\left(\widehat{er}_{it}^h, r_{it+h}\right)\right)$ is the cross-section MEV of $\widehat{er}_{it}^h$, in which $T^p - h$ is the number of cross-sections in the predictive window. $\text{Var}^{\text{CX}} = (1/(T^p-h))\sum_t \text{Var}_t\left(\widehat{er}_{it}^h\right)$ is the variance component, and $\text{Cov}^{\text{CX}} = (1/(T^p-h))\sum_t \text{Cov}_t\left(\widehat{er}_{it}^h, r_{it+h}\right)$ the covariance component. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model (FF6), the accounting-based implied cost of equity (ICE), and the structural q-model. Panel B shows pairwise comparison tests with QCE. Diff^{TS} is the time series MEV differential, and t_{TS} its White heteroscedasticity-adjusted t-value. Diff^{CX} is the cross-section MEV differential, and t_{CX} its Newey-West t-value adjusted for 12 lags.

Panel A: Measurement error variances

	h	$\overline{\text{SVar}}^{\text{TS}}$	Var^{TS}	Cov^{TS}	$\overline{\text{SVar}}^{\text{CX}}$	Var^{CX}	Cov^{CX}	h	$\overline{\text{SVar}}^{\text{TS}}$	Var^{TS}	Cov^{TS}	$\overline{\text{SVar}}^{\text{CX}}$	Var^{CX}	Cov^{CX}
QCE	1	0.0024	0.0026	0.0002	−0.0013	0.0028	0.0042	24	0.5951	0.5919	−0.0032	0.1509	0.5863	0.4354
Lewellen-3	1	0.0061	0.0049	−0.0012	0.0007	0.0028	0.0021	24	0.6690	0.5046	−0.1644	0.3275	0.3189	−0.0086
Lewellen-7	1	0.0042	0.0043	0.0001	0.0001	0.0031	0.0030	24	0.6339	0.6709	0.0370	0.2747	0.5966	0.3220
Lewellen-15	1	0.0089	0.0056	−0.0033	0.0018	0.0040	0.0023	24	1.7581	1.2193	−0.5388	1.1902	1.1959	0.0057
Q5F	1	0.0113	0.0091	−0.0022	0.0131	0.0142	0.0012	24	7.4443	8.5957	1.1514	11.25	12.95	1.6995
FF6	1	0.0066	0.0039	−0.0027	0.0060	0.0061	0.0001	24	3.7373	3.5605	−0.1768	5.4522	5.4770	0.0247
ICE	1	−0.0038	0.0004	0.0042	0.0000	0.0006	0.0006	24	−1.5802	0.3537	1.9339	0.1525	0.5216	0.3691
Structural-q	1	0.0012	0.0065	0.0052	0.0298	0.0350	0.0052	24	0.1769	0.4723	0.2954	1.5134	2.1354	0.6220
QCE	3	0.0184	0.0198	0.0014	−0.0094	0.0206	0.0299	36	2.4239	1.5167	−0.9073	1.0340	1.4173	0.3834
Lewellen-3	3	0.0593	0.0388	−0.0204	0.0121	0.0220	0.0099	36	1.3053	0.8616	−0.4438	0.4831	0.6037	0.1206
Lewellen-7	3	0.0390	0.0353	−0.0036	0.0050	0.0242	0.0192	36	1.8209	1.3475	−0.4734	0.5530	1.3048	0.7518
Lewellen-15	3	0.0793	0.0468	−0.0325	0.0186	0.0331	0.0145	36	3.9344	2.8530	−1.0814	2.5978	2.9800	0.3822
Q5F	3	0.0985	0.0844	−0.0141	0.1215	0.1316	0.0102	36	26.34	28.46	2.1125	37.30	41.31	4.0196
FF6	3	0.0558	0.0365	−0.0193	0.0565	0.0570	0.0005	36	11.92	10.89	−1.0261	16.44	16.30	−0.1418
ICE	3	−0.0343	0.0039	0.0382	0.0012	0.0057	0.0045	36	−2.8429	0.9626	3.8054	0.7301	1.4347	0.7046
Structural-q	3	0.0028	0.0246	0.0218	0.0976	0.1281	0.0305	36	1.1032	1.0024	−0.1008	2.8097	4.2021	1.3924
QCE	12	0.2240	0.1790	−0.0450	−0.0198	0.1744	0.1942	60	9.7945	8.5020	−1.2926	9.1482	6.8230	−2.3252
Lewellen-3	12	0.7327	0.2828	−0.4499	0.2235	0.1657	−0.0578	60	2.5837	3.5857	1.0021	4.8884	2.6665	−2.2220
Lewellen-7	12	0.6663	0.2797	−0.3866	0.1563	0.2120	0.0558	60	5.5482	5.6486	0.1004	6.7562	5.2775	−1.4788
Lewellen-15	12	1.1538	0.4098	−0.7440	0.3904	0.3359	−0.0545	60	22.74	16.71	−6.0246	22.42	16.38	−6.0378
Q5F	12	1.5550	1.5990	0.0439	2.2175	2.4649	0.2475	60	203.63	210.36	6.7305	273.39	282.19	8.8045
FF6	12	0.8361	0.6912	−0.1448	1.0560	1.0725	0.0165	60	64.09	62.10	−1.9855	91.63	86.92	−4.7073
ICE	12	−0.5137	0.0722	0.5859	0.0236	0.1064	0.0828	60	−9.5787	4.2605	13.84	2.8797	6.4220	3.5423
Structural-q	12	0.0441	0.1456	0.1015	0.5474	0.7398	0.1924	60	2.6960	2.7177	0.0217	8.5331	11.51	2.9817

Panel B: Pairwise comparison tests with QCE

	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}
Lewellen-3	1	−0.0031	−5.12	−0.0021	−1.44	12	−0.4695	−12.01	−0.2432	−1.43	36	1.2368	9.58	0.5509	1.50
Lewellen-7	1	−0.0027	−5.07	−0.0014	−1.14	12	−0.445	−9.96	−0.176	−1.35	36	0.8927	5.64	0.481	1.01
Lewellen-15	1	−0.0073	−11.16	−0.0031	−1.92	12	−0.9567	−14.26	−0.4101	−1.29	36	−1.2697	−4.11	−1.5638	−1.49
ICE	1	0.0058	13.52	−0.0013	−1.66	12	0.7393	21.14	−0.0415	−0.41	36	5.4118	25.74	0.5684	0.61
Structural-q	1	0.0008	1.33	−0.0311	−12.67	12	0.2001	6.74	−0.5679	−2.28	36	1.4123	7.51	−1.787	−1.23
Lewellen-3	3	−0.0372	−8.02	−0.0214	−1.49	24	−0.0604	−0.84	−0.1766	−0.84	60	7.6677	11.75	4.2597	1.18
Lewellen-7	3	−0.0283	−7.74	−0.0143	−1.24	24	0.0776	0.97	−0.1238	−0.62	60	5.3586	8.80	2.3919	0.67
Lewellen-15	3	−0.0682	−15.16	−0.0279	−1.59	24	−1.0284	−6.73	−1.0393	−1.58	60	−12.7665	−7.88	−13.2741	−1.79
ICE	3	0.0499	14.77	−0.0106	−1.43	24	2.1888	25.15	0.0603	0.19	60	20.20	20.73	5.6333	0.96
Structural-q	3	0.0149	4.03	−0.1068	−6.74	24	0.4931	5.97	−1.3588	−1.71	60	7.3434	9.10	0.585	0.08

Table 7 : Mean Squared (Forecast) Errors, January 1977–December 2022

$\overline{\text{MSE}}^{\text{TS}}$ is the time series mean squared (forecast) errors (MSE), and $\overline{\text{MSE}}^{\text{CX}}$ the cross-section MSE. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model (FF6), the accounting-based implied cost of equity (ICE), and the structural q-model. Panel A shows the full-sample evidence, and Panel B the all-but-micro evidence. Panel C shows pairwise comparison tests between QCE and ICE.

	h	$\overline{\text{MSE}}^{\text{TS}}$	$\overline{\text{MSE}}^{\text{CX}}$	h	$\overline{\text{MSE}}^{\text{TS}}$	$\overline{\text{MSE}}^{\text{CX}}$	h	$\overline{\text{MSE}}^{\text{TS}}$	$\overline{\text{MSE}}^{\text{CX}}$
Panel A: The full sample									
QCE	1	0.0710	0.0339	3	0.1775	0.1090	12	0.9756	0.6978
Lewellen-3	1	0.0622	0.0362	3	0.1768	0.1173	12	0.9035	0.7164
Lewellen-7	1	0.0566	0.0330	3	0.1781	0.1067	12	0.9319	0.6735
Lewellen-15	1	0.0578	0.0322	3	0.1684	0.1041	12	0.9333	0.6591
Q5F	1	0.0587	0.0343	3	0.1739	0.1127	12	0.9974	0.7332
FF6	1	0.0585	0.0341	3	0.1715	0.1110	12	0.9521	0.7013
ICE	1	0.0602	0.0357	3	0.1726	0.1143	12	0.8637	0.6850
Structural-q	1	0.0675	0.0341	3	0.1726	0.1081	12	0.9195	0.6775
QCE	24	2.3296	1.6566	36	3.5459	2.7543	60	7.3638	6.8629
Lewellen-3	24	2.2069	1.6931	36	3.3324	2.7563	60	7.7872	7.4532
Lewellen-7	24	2.1772	1.5405	36	3.2836	2.5755	60	7.3242	6.4216
Lewellen-15	24	2.1488	1.4949	36	3.0215	2.4803	60	6.9739	6.4203
Q5F	24	2.6665	1.8815	36	5.6509	3.8896	60	39.82	23.04
FF6	24	2.3877	1.7041	36	4.2967	3.1337	60	13.65	10.25
ICE	24	2.2019	1.6457	36	3.3920	2.7711	60	8.8410	8.1240
Structural-q	24	2.1391	1.5858	36	3.4150	2.6823	60	7.5810	6.9717
Panel B: The all-but-micro sample									
QCE	1	0.0285	0.0156	3	0.0857	0.0489	12	0.3783	0.2484
Lewellen-3	1	0.0325	0.0158	3	0.0999	0.0501	12	0.4227	0.2519
Lewellen-7	1	0.0279	0.0147	3	0.0866	0.0463	12	0.3869	0.2315
Lewellen-15	1	0.0279	0.0146	3	0.0871	0.0463	12	0.3900	0.2336
Q5F	1	0.0221	0.0138	3	0.0727	0.0441	12	0.3809	0.2340
FF6	1	0.0220	0.0137	3	0.0716	0.0434	12	0.3593	0.2217
ICE	1	0.0324	0.0158	3	0.0976	0.0496	12	0.3912	0.2432
Structural-q	1	0.0298	0.0156	3	0.0875	0.0480	12	0.3709	0.2394
QCE	24	1.0421	0.6687	36	1.9260	1.1958	60	3.5527	3.9777
Lewellen-3	24	0.9689	0.6569	36	1.6518	1.1819	60	3.4138	3.6014
Lewellen-7	24	1.0825	0.6048	36	1.3218	1.0520	60	3.0694	3.2583
Lewellen-15	24	1.1269	0.6145	36	1.2229	1.0831	60	3.4989	3.5614
Q5F	24	1.3046	0.6758	36	1.8038	1.3632	60	8.4716	5.8897
FF6	24	1.1998	0.6138	36	1.3851	1.1395	60	4.3901	3.9228
ICE	24	0.9462	0.6530	36	1.5229	1.1451	60	3.0502	3.4634
Structural-q	24	1.0110	0.6525	36	1.9042	1.1826	60	3.2341	3.6663

Panel C: Pairwise comparison tests between QCE and ICE

h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}
	The full sample				The all-but-micro sample			
1	0.0142	1.7918	−0.0018	−3.8724	0.0002	0.7581	−0.0002	−0.7460
3	0.0114	1.9914	−0.0056	−3.0059	−0.0003	−0.2727	−0.0008	−0.7751
12	0.0559	1.9995	0.0046	0.2354	0.0061	1.0420	0.0027	0.7593
24	0.0481	0.5622	−0.0131	−0.3869	0.0832	0.9519	0.0103	0.7675
36	0.0177	0.1048	−0.0058	−0.0775	0.4411	0.9095	0.0474	1.7579
60	−1.9941	−2.9775	−1.3381	−0.8546	0.2001	2.0740	0.4120	1.9001

Table 8 : Firm-level Properties of Costs of Equity, January 1977–December 2022

In Panel A, #Obs. is the number of firm-month observations. The summary statistics are time series averages of cross-sectional moments, including mean, standard deviation (Std), skewness (Skew), excess kurtosis (Kurt), autocorrelation (ρ), and 1, 5, 25, 50, 75, 95, and 99 percentiles. QCE is the cost of equity from the q^5-characteristics model, ICE is the accounting-based implied cost of equity, and QCE_{12} minus ICE is the difference between 12-month ahead QCE and ICE. Panel B shows the average slopes and their t-values in cross-sectional return regressions in forming QCE. The panel uses the full sample to illustrate the slopes, while the QCE estimates uses latest available 120-month rolling window slopes (Figure 3).

Panel A: Firm-level properties of QCE, ICE, and their differences

h	#Obs.	Mean	Std	Skew	Kurt	ρ	p1	p5	p25	p50	p75	p95	p99
						QCE							
1	1,503,852	14.31	10.74	−0.63	−0.87	0.723	−18.13	−5.55	9.37	15.09	20.52	29.85	39.32
3	1,500,343	14.15	9.50	−0.77	−0.77	0.742	−15.34	−3.94	10.06	15.07	19.65	27.49	35.14
12	1,484,234	14.08	6.91	−0.77	−0.99	0.775	−7.05	1.58	10.66	14.62	18.42	23.98	28.25
24	1,463,349	13.86	5.39	−0.83	−0.83	0.776	−2.24	4.24	11.01	14.29	17.35	21.61	24.64
36	1,442,954	13.77	4.33	−0.80	−1.03	0.779	1.66	6.01	11.33	14.10	16.66	20.11	22.44
60	1,404,074	14.01	3.28	−0.60	−1.65	0.775	5.4	8.02	12.09	14.26	16.25	18.88	20.57
						ICE							
12	1,923,741	13.18	9.29	1.89	0.61	0.755	4.12	4.79	7.39	10.16	15.08	35.15	46.36
						QCE_{12} minus ICE							
12	1,435,671	1.53	10.17	−1.45	0.44	0.765	−34.22	−19.80	−1.59	3.85	7.66	12.83	17.04

Panel B: Average slopes and their t-values in cross-sectional return regressions

	Slopes				t-values			
h	logME	ROE	I/A	EG	logME	ROE	I/A	EG
1	−0.002	0.058	−0.011	0.034	−4.63	5.35	−7.52	3.35
3	−0.005	0.142	−0.033	0.090	−3.42	4.05	−7.36	2.95
12	−0.020	0.166	−0.109	0.266	−1.88	1.06	−4.90	1.60
24	−0.038	0.131	−0.165	0.540	−2.39	0.68	−3.21	1.45
36	−0.051	0.033	−0.198	1.005	−1.40	0.16	−3.43	5.04
60	−0.097	−0.284	−0.168	2.017	−1.36	−0.79	−1.10	3.49

Table 9 : Firm-level Properties of Costs of Equity, the All-but-micro Sample, January 1977–December 2022

In Panel A, #Obs. is the number of firm-month observations. The summary statistics are time series averages of cross-sectional moments, including mean, standard deviation (Std), skewness (Skew), excess kurtosis (Kurt), autocorrelation (ρ), and 1, 5, 25, 50, 75, 95, and 99 percentiles. QCE is the cost of equity from the q^5-characteristics model, ICE is the accounting-based implied cost of equity, and QCE_{12} minus ICE is the difference between 12-month ahead QCE and ICE. Panel B shows the average slopes and their t-values in cross-sectional return regressions in QCE. The panel uses the full sample to illustrate the slopes, while the QCE estimates uses latest available 120-month rolling window slopes (Figure A2).

Panel A: Firm-level properties of QCE, ICE, and their differences

h	#Obs.	Mean	Std	Skew	Kurt	ρ	p1	p5	p25	p50	p75	p95	p99
						QCE							
1	648,265	13.53	6.25	−0.43	−1.42	0.633	−4.20	2.20	10.43	13.92	17.13	23.00	28.66
3	646,491	13.40	5.54	−0.61	−1.24	0.662	−2.81	3.11	10.76	13.87	16.65	21.52	26.14
12	638,242	12.75	3.74	−0.73	−1.11	0.682	1.51	5.81	10.97	13.13	15.01	18.07	20.78
24	627,273	12.45	3.09	−0.73	−1.10	0.675	3.27	6.77	10.92	12.77	14.36	16.88	19.00
36	616,252	12.27	2.87	−0.68	−0.89	0.677	3.84	7.13	10.83	12.53	14.04	16.39	18.38
60	594,257	12.54	2.71	−0.66	−0.44	0.678	4.89	7.84	11.17	12.74	14.17	16.49	18.40
						ICE							
12	816,956	8.99	3.22	0.90	−2.35	0.640	4.14	4.70	6.67	8.42	10.68	15.53	17.99
						QCE_{12} minus ICE							
12	623,280	4.19	4.91	−0.80	−1.53	0.673	−10.67	−4.94	1.67	4.81	7.39	11.03	13.90

Panel B: Average slopes and their t-values in cross-sectional return regressions

	Slopes				t-values			
h	logME	ROE	I/A	Eg	logME	ROE	I/A	Eg
1	−0.001	0.044	−0.006	0.037	−2.42	3.10	−3.74	5.35
3	−0.003	0.110	−0.020	0.097	−2.06	2.37	−3.62	4.43
12	−0.007	0.108	−0.058	0.309	−0.88	0.46	−2.32	3.34
24	−0.012	0.060	−0.098	0.590	−0.77	0.15	−2.11	3.08
36	−0.015	−0.112	−0.105	0.993	−0.51	−0.24	−1.33	4.44
60	−0.036	−0.725	−0.025	1.952	−0.48	−1.08	−0.10	3.62

Table 10 : Industry Costs of Equity, January 1977–December 2022

For each nonfinancial NAICS sector or industry, we calculate its sector- or industry-level cost of equity by value-weighting the costs of equity across all the firms within the sector or industry. There are 19 nonfinancial sectors and 58 industries. However, one industry (sector) "Management of companies and enterprises" drops out because it contains only a few firms in each cross section, firms that do not survive our sample criteria. In addition to the average realized return (AR), we report the cost of equity from the q^5-factor model (Q5F); 1-, 3-, 12-, 24-, 36-, and 60-month ahead QCEs; as well as ICE. We value-weight firm-month costs of equity across all the firms within a given industry to obtain industry costs of equity. We then annualize each industry-month before taking the time series means and standard deviations for industry costs of equity. The only exception is AR, which renders our annualization procedure infeasible because of outliers even at the industry level. Instead, after we value-weight firm-level AR to obtain industry AR, we take time series means and standard deviations of (monthly) industry ARs first before annualizing them. Annualized mean equals $(1+\text{monthly mean})^{12}-1$, and annualized standard deviation equals monthly standard deviation times $\sqrt{12}$. The sector code is as follows: 11 Agriculture, forestry, fishing, and hunting; 21 Mining; 22 Utilities; 23 Construction; 31ND Nondurable goods; 33DG Durable goods; 42 Wholesale trade; 44 Retail trade; 48TW Transportation and warehousing; 51 Information; 53 Real estate and rental and leasing; 54 Professional, scientific, and technical services; 56 Administrative and waste management services; 61 Educational services; 62 Health care and social assistance; 71 Arts, entertainment, and recreation; 72 Accommodation and food services; 81 Other services, except government. The industry code is as follows: 110C Farms; 113F Forestry, fishing, and related activities; 2110 Oil and gas extraction; 2120 Mining, except oil and gas; 2130 Support activities for mining; 2200 Utilities; 2300 Construction; 311A Food and beverage and tobacco products; 313T Textile mills and textile product mills; 315A Apparel and leather and allied products; 3210 Wood products; 3220 Paper products; 3230 Printing and related support activities; 3240 Petroleum and coal products; 3250 Chemical products; 3260 Plastics and rubber products; 3270 Nonmetallic mineral products; 3310 Primary metals; 3320 Fabricated metal products; 3330 Machinery; 3340 Computer and electronic products; 3350 Electrical equipment, appliances, and components; 336M Motor vehicles, bodies and trailers, and parts; 336O Other transportation equipment; 3370 Furniture and related products; 338A Miscellaneous manufacturing; 4200 Wholesale trade; 44RT Retail trade; 4810 Air transportation; 4820 Railroad transportation; 4830 Water transportation; 4840 Truck transportation; 4850 Transit and ground passenger transportation; 4860 Pipeline transportation; 487S Other transportation and support activities; 4930 Warehousing and storage; 5110 Publishing industries (includes software); 5120 Motion picture and sound recording industries; 5130 Broadcasting and telecommunications; 5140 Information and data processing services; 5310 Real estate; 5320 Rental and leasing services and lessors of intangible assets; 5411 Legal services; 5412 Miscellaneous professional, scientific, and technical services; 5415 Computer systems design and related services; 5610 Administrative and support services; 5620 Waste management and remediation services; 6100 Educational services; 6210 Ambulatory health care services; 622H Hospitals; 6230 Nursing and residential care facilities; 6240 Social assistance; 711A Performing arts, spectator sports, museums, and related activities; 7130 Amusements, gambling, and recreation industries; 7210 Accommodation; 7220 Food services and drinking places; 8100 Other services, except government.

Panel A: Sector-level costs of equity

	Time series mean									Time series standard deviation								
Sector	Q5F	QCE_1	QCE_3	QCE_{12}	QCE_{24}	QCE_{36}	QCE_{60}	ICE	AR	Q5F	QCE_1	QCE_3	QCE_{12}	QCE_{24}	QCE_{36}	QCE_{60}	ICE	AR
11	13.14	10.44	11.21	10.07	9.96	9.97	10.24	7.75	14.29	7.85	5.49	5.12	4.90	4.52	4.36	4.32	3.03	21.26
21	5.61	7.39	8.51	8.20	8.55	9.10	9.90	9.29	11.81	10.92	4.21	4.05	4.20	3.89	3.70	3.57	2.56	25.91
22	9.27	7.61	8.68	8.50	8.65	9.38	10.44	12.96	10.72	4.81	7.06	6.44	5.79	5.07	4.00	3.36	3.88	14.44
23	7.91	8.94	9.82	9.48	9.56	10.01	10.68	8.97	14.03	8.26	4.49	4.22	4.07	3.54	3.00	2.30	2.70	25.44
31ND	10.97	9.69	10.80	8.90	8.71	8.97	9.43	8.46	12.59	4.40	4.25	4.36	4.56	4.11	3.80	3.72	2.89	14.09
33DG	10.43	9.38	10.35	8.86	8.89	9.31	9.96	8.20	12.41	3.15	4.09	3.87	4.02	3.65	3.34	3.31	2.89	20.34
42	10.16	9.06	9.87	9.08	9.17	9.60	10.47	8.62	12.49	5.22	4.16	3.73	3.62	3.28	2.96	2.69	2.66	19.87
44	8.09	8.13	9.17	7.94	8.07	8.57	9.29	7.67	13.86	8.69	4.57	4.18	4.28	3.85	3.43	3.29	2.93	19.30
48TW	8.84	8.81	9.87	9.37	9.43	9.74	10.20	9.46	11.82	4.73	3.45	3.33	3.37	3.18	3.09	2.96	2.98	19.42
51	7.85	7.17	8.42	7.40	7.67	8.35	9.20	8.79	12.38	6.27	5.09	4.79	4.84	4.31	3.69	3.53	3.78	17.55
53	6.98	9.71	10.31	9.62	9.95	10.51	11.39	9.67	13.18	10.09	5.17	4.77	4.68	4.20	3.45	3.09	3.23	26.78
54	8.75	10.42	10.95	9.32	9.42	9.95	10.87	7.96	10.64	5.70	4.05	3.63	4.24	3.98	3.60	3.38	2.91	20.89
56	10.71	10.10	10.75	9.48	9.48	9.85	10.60	7.68	11.65	6.33	4.72	4.19	3.94	3.37	2.57	2.19	2.31	21.65
61	13.61	12.91	12.98	11.21	11.13	11.38	12.27	7.50	11.56	9.99	4.50	4.21	4.06	3.26	2.61	2.08	2.71	26.83
62	13.32	10.05	10.43	9.68	9.97	10.50	11.54	8.19	10.11	10.90	3.70	3.39	3.46	3.14	2.69	2.67	1.94	27.15
71	9.28	10.50	10.94	10.39	10.56	11.03	11.80	8.02	13.33	10.27	4.69	4.52	4.17	3.53	2.99	2.78	2.31	26.50
72	8.79	10.47	11.12	9.41	9.37	9.75	10.32	7.31	15.67	8.03	4.10	3.98	4.31	3.95	3.57	3.37	2.29	23.23
81	12.05	11.87	12.31	11.61	11.49	11.71	12.25	9.19	10.30	9.93	3.83	3.28	3.16	2.84	2.38	2.08	3.24	24.47
Average	9.76	9.59	10.36	9.36	9.45	9.87	10.60	8.65	12.38	7.53	4.53	4.23	4.20	3.76	3.29	3.04	2.85	21.95
Industry	Panel B: Industry-level costs of equity																	
110C	12.58	10.63	11.35	10.07	9.92	9.90	10.13	7.68	14.30	8.74	5.69	5.28	4.94	4.54	4.38	4.36	3.05	21.68
113F	29.59	11.03	11.67	12.85	13.35	13.77	14.33	12.15	19.55	17.86	10.75	9.54	6.11	4.04	3.14	2.66	6.31	44.91
2110	7.74	7.34	8.45	8.04	8.34	8.90	9.60	10.07	12.75	10.57	4.53	4.44	4.38	4.07	3.82	3.72	2.65	27.96
2120	2.72	7.94	8.93	8.47	8.75	9.20	9.94	8.45	11.14	14.05	5.32	4.99	4.68	4.16	3.82	3.47	2.52	26.81
2130	3.11	7.89	8.85	8.60	8.98	9.66	10.51	8.88	14.26	10.66	3.96	3.62	3.99	3.92	3.90	3.76	3.40	34.13
2200	9.27	7.78	8.79	8.50	8.59	9.31	10.36	12.96	10.72	4.81	6.98	6.38	5.79	5.12	4.03	3.42	3.88	14.44
2300	7.91	9.19	9.99	9.48	9.47	9.92	10.57	8.97	14.03	8.26	4.40	4.17	4.07	3.57	3.02	2.29	2.70	25.44
311A	11.02	10.24	11.23	8.96	8.62	8.85	9.28	8.10	14.46	7.06	4.27	4.44	4.64	4.11	3.73	3.57	2.62	15.04
313T	11.87	12.07	12.53	11.73	11.50	11.54	11.90	9.55	10.62	7.31	4.23	4.05	3.64	3.18	2.89	2.77	3.41	26.70
315A	10.56	12.03	12.34	10.48	10.33	10.51	11.00	8.06	14.12	7.81	4.04	3.88	3.94	3.53	3.24	3.13	3.16	23.09
3210	11.83	9.95	11.08	10.73	10.55	10.81	11.51	8.89	13.82	8.74	5.14	4.44	3.89	3.46	2.98	2.39	3.04	28.15
3220	14.27	10.30	11.26	9.35	9.15	9.35	9.74	8.63	11.13	8.43	4.15	3.83	3.90	3.62	3.38	3.36	2.22	18.23
3230	10.27	13.96	14.33	12.69	12.08	11.86	12.09	10.06	8.07	8.78	4.53	4.38	3.49	2.75	2.27	2.03	2.59	23.48
3240	11.11	7.64	9.07	7.89	7.79	8.15	8.59	10.41	14.05	6.46	4.37	4.39	4.80	4.37	3.97	3.86	3.28	19.64
3250	9.96	10.35	11.36	9.10	8.83	9.07	9.52	7.73	12.25	3.84	4.69	4.84	4.78	4.27	3.96	3.93	2.59	15.46
3260	9.10	12.20	12.92	11.45	11.03	11.05	11.32	8.77	11.37	4.94	3.25	3.04	2.77	2.48	2.27	2.33	2.57	20.85
3270	7.06	11.86	12.72	11.66	11.27	11.25	11.44	9.51	13.42	10.38	3.65	3.40	2.75	2.46	2.31	2.24	2.89	24.38
3310	9.02	8.69	9.84	9.48	9.53	9.88	10.40	10.28	10.58	9.48	4.94	4.50	3.85	3.36	2.91	2.57	3.20	27.06

	Time series mean									Time series standard deviation								
Industry	Q5F	QCE_1	QCE_3	QCE_{12}	QCE_{24}	QCE_{36}	QCE_{60}	ICE	AR	Q5F	QCE_1	QCE_3	QCE_{12}	QCE_{24}	QCE_{36}	QCE_{60}	ICE	AR
3320	9.56	11.44	12.20	10.71	10.44	10.68	11.20	8.22	13.03	5.06	3.92	3.72	3.73	3.34	2.87	2.42	2.85	19.67
3330	7.84	9.63	10.53	9.19	9.10	9.44	9.92	8.35	12.42	5.16	3.79	3.60	3.74	3.44	3.17	3.03	2.83	21.84
3340	12.72	9.76	10.63	8.68	8.68	9.11	9.79	7.24	13.11	4.29	4.64	4.39	4.43	4.03	3.71	3.71	2.58	23.40
3350	9.01	9.78	10.67	9.39	9.18	9.30	9.79	8.58	13.47	4.89	4.18	4.00	3.50	3.11	3.02	3.14	2.66	22.13
336M	6.91	8.63	9.79	8.90	8.73	8.97	9.40	12.94	13.35	6.17	4.90	4.53	3.80	3.46	3.27	3.22	4.22	26.88
336O	11.52	8.91	10.01	8.39	8.27	8.62	9.15	9.04	13.08	8.01	4.59	4.39	4.57	4.14	3.73	3.52	3.40	19.82
3370	12.94	12.49	13.02	11.56	11.16	11.25	11.71	8.61	11.83	6.99	3.40	2.99	2.92	2.53	2.09	1.76	2.90	23.75
338A	8.74	10.03	10.89	9.56	9.52	9.82	10.55	7.14	11.83	4.40	3.56	3.47	3.46	3.16	3.00	3.03	2.72	18.25
4200	10.16	9.27	10.02	9.08	9.08	9.48	10.34	8.62	12.49	5.22	4.11	3.70	3.62	3.31	2.99	2.72	2.66	19.87
44RT	8.09	8.27	9.26	7.94	8.02	8.49	9.18	7.67	13.86	8.69	4.56	4.17	4.28	3.87	3.44	3.34	2.93	19.30
4810	12.76	9.08	9.75	9.57	9.92	10.34	10.92	10.90	7.79	11.32	6.35	5.50	4.12	3.68	3.60	3.66	3.25	31.60
4820	8.55	9.01	10.66	10.62	10.35	10.61	11.13	10.22	16.76	6.54	5.81	5.48	5.43	4.45	3.65	2.97	3.38	22.10
4830	6.55	11.86	12.43	11.91	11.65	11.57	11.82	10.07	10.16	10.83	3.91	3.68	3.08	2.58	2.39	2.12	2.58	26.27
4840	10.72	13.78	13.78	12.14	11.93	11.84	11.87	8.43	13.98	7.01	4.50	4.23	3.47	2.87	2.67	2.69	3.09	24.06
4850	10.16	13.12	12.88	12.34	12.17	11.96	12.59	10.58	17.05	10.03	8.02	7.40	5.21	3.81	3.06	2.32	8.18	36.93
4860	2.97	7.56	8.56	8.72	9.05	9.52	10.29	11.11	14.06	10.94	6.42	5.97	4.73	4.52	4.61	4.87	3.46	23.77
487S	11.41	9.91	10.58	9.63	9.73	10.10	10.70	8.23	9.86	7.51	4.40	4.23	4.36	4.28	4.26	4.06	2.68	24.78
4930	9.40	12.30	12.36	11.01	10.81	11.31	12.04	10.45	19.07	15.27	9.98	9.00	7.93	7.00	5.95	4.64	4.80	36.99
5110	9.69	9.60	10.39	8.33	8.35	8.86	9.68	6.64	15.11	7.49	4.34	4.10	4.32	3.91	3.46	3.62	2.57	23.04
5120	6.50	9.51	10.38	9.72	9.74	10.01	10.83	8.86	10.58	9.48	5.56	4.72	4.17	3.80	3.34	3.36	3.19	27.58
5130	7.33	5.87	7.37	6.77	6.94	7.70	8.52	10.88	10.49	6.66	5.94	5.64	5.40	4.88	3.93	3.56	4.31	16.67
5140	6.68	7.42	8.19	6.80	7.32	8.33	9.50	6.39	16.49	11.00	7.69	7.33	7.12	6.17	4.69	3.88	2.49	26.28
5310	-7.94	13.31	13.03	13.02	12.79	12.97	13.73	11.75	24.16	23.90	7.38	7.05	6.16	5.49	4.35	3.38	6.43	78.18
5320	7.16	9.90	10.41	9.51	9.75	10.30	11.17	9.67	13.30	10.25	5.01	4.67	4.72	4.43	3.59	3.15	3.23	26.91
5411	8.27	11.14	10.93	11.70	12.00	12.31	13.31	10.34	8.59	23.73	11.08	10.60	7.42	5.36	3.62	2.67	5.97	48.58
5412	9.24	10.77	11.18	9.99	10.03	10.59	11.56	7.92	11.10	4.89	4.95	4.49	4.33	3.97	3.28	3.02	3.00	20.95
5415	11.35	11.20	11.39	9.23	9.45	9.98	10.89	7.85	10.37	11.65	5.27	4.57	4.72	4.33	3.78	3.42	2.85	28.68
5610	9.93	12.45	12.67	11.01	10.77	11.02	11.65	7.83	11.97	4.85	4.42	4.02	3.82	3.35	2.81	2.42	2.57	21.83
5620	11.46	8.16	9.12	7.96	8.00	8.56	9.50	7.83	14.97	9.02	5.96	5.46	5.21	4.54	3.27	2.70	2.14	30.88
6100	13.61	13.10	13.10	11.21	11.08	11.33	12.21	7.50	11.56	9.99	4.51	4.21	4.06	3.28	2.61	2.07	2.71	26.83
6210	14.21	9.32	9.72	9.47	10.08	10.77	11.85	7.92	7.49	9.95	4.28	3.89	3.82	3.80	3.38	3.38	2.52	30.39
622H	12.30	11.32	11.62	10.79	10.61	10.66	11.33	9.14	15.26	14.82	4.98	4.67	3.85	3.18	2.66	2.16	2.49	32.46
6230	11.10	11.75	12.12	11.34	11.11	11.32	12.04	8.97	9.44	12.68	6.52	5.94	4.95	3.88	2.95	2.38	2.14	34.80
6240	12.44	13.59	13.23	13.12	13.25	13.59	14.17	9.15	20.46	26.24	8.78	7.98	5.38	3.80	3.37	3.39	8.72	52.77
711A	13.65	11.28	11.60	11.29	11.32	11.74	12.48	8.92	12.67	15.63	5.84	5.43	5.21	4.76	3.94	3.67	3.06	27.88
7130	8.62	10.71	10.99	10.30	10.49	10.98	11.80	8.33	14.05	10.45	5.26	5.04	4.48	3.83	3.24	2.67	2.75	32.73
7210	4.70	9.97	10.52	9.29	9.31	9.95	10.67	8.14	18.28	13.62	6.60	6.30	5.90	5.31	4.59	3.98	2.69	33.40
7220	11.36	11.04	11.59	9.55	9.42	9.69	10.17	7.01	16.01	7.93	3.66	3.52	4.00	3.72	3.40	3.32	2.29	22.17
8100	12.05	12.06	12.43	11.61	11.43	11.64	12.15	9.19	10.30	9.93	3.81	3.27	3.16	2.85	2.36	2.05	3.24	24.47
Average	9.70	10.34	10.99	10.02	9.98	10.31	10.94	9.05	13.17	9.66	5.29	4.93	4.47	3.92	3.41	3.11	3.31	27.13

Table 11 : Factor Premiums, January 1977–December 2022

This table forms one-way deciles with annual sorts on size (ME), book-to-market (BM), and investment-to-assets (I/A) as well as monthly sorts on prior 11-month returns (R^{11}), return on equity (ROE), and expected growth (EG). For each decile, we calculate subsequently realized holding period returns over 1-, 3-, 12-, 24-, 36-, and 60-month horizons as well as ex ante expected returns measured by QCE and ICE over the horizons. We report the differences between the extreme deciles and their Newey-West t-values (adjusted for 12 lags).

	1m	3m	12m	24m	36m	60m	1m	3m	12m	24m	36m	60m
	Average realized returns						t-values of average realized returns					
ME, 1−10	0.03	0.33	1.18	−1.53	−6.12	−17.19	0.11	0.35	0.21	−0.18	−0.35	−0.63
BM, 10−1	0.29	0.97	4.05	6.74	6.43	10.19	1.18	1.13	0.80	0.58	0.35	0.30
I/A, 1−10	0.33	1.02	2.69	−0.13	−6.05	−19.12	1.74	1.55	0.69	−0.02	−0.56	−0.66
R^{11}, 10−1	0.96	2.48	2.86	0.43	7.16	9.95	3.03	2.31	0.67	0.05	0.97	0.62
ROE, 10−1	0.82	1.89	3.85	6.44	10.09	18.26	3.18	2.20	1.08	1.38	1.69	2.01
EG, 10−1	0.65	1.81	6.78	14.43	23.20	39.70	3.06	2.61	2.16	2.52	3.07	2.52
	Average QCEs						t-values of average QCEs					
ME, 1−10	0.56	1.37	8.28	17.66	26.58	51.33	1.48	0.84	0.63	0.30	0.24	0.19
BM, 10−1	−0.14	−0.31	1.54	3.46	4.82	7.25	−2.03	−1.71	2.03	2.80	2.65	2.48
I/A, 1−10	0.77	2.32	8.26	13.32	16.62	18.59	13.39	14.42	13.78	12.30	13.88	10.23
R^{11}, 10−1	0.33	0.86	0.85	0.00	−1.25	−5.72	5.92	5.63	1.67	0.00	−1.00	−1.86
ROE, 10−1	1.14	2.86	3.44	3.43	2.59	0.44	8.33	6.50	2.03	1.61	1.17	0.19
EG, 10−1	1.27	3.41	6.96	10.92	13.97	17.89	10.05	7.94	4.88	5.55	5.22	3.60
	Average ICEs						t-values of average ICEs					
ME, 1−10	0.34	1.04	4.49	9.96	16.60	34.26	2.02	2.03	2.10	2.20	2.30	2.50
BM, 10−1	0.61	1.86	8.01	17.72	29.44	60.34	15.84	15.72	15.15	14.31	13.41	11.63
I/A, 1−10	0.25	0.76	3.26	7.12	11.66	23.25	9.59	9.56	9.43	9.24	9.04	8.61
R^{11}, 10−1	−0.35	−1.07	−4.58	−10.06	−16.62	−33.69	−5.82	−5.81	−5.74	−5.64	−5.53	−5.31
ROE, 10−1	−0.27	−0.83	−3.55	−7.81	−12.90	−26.14	−7.42	−7.38	−7.21	−6.97	−6.73	−6.25
EG, 10−1	−0.23	−0.71	−3.00	−6.50	−10.55	−20.69	−6.60	−6.61	−6.63	−6.64	−6.64	−6.61

Table 12 : Predicting Factor Premiums, January 1977–December 2022

Factors are the differences between the extreme deciles from one-way annual sorts on size (ME), book-to-market (BM), and investment-to-assets (I/A), as well as monthly sorts on prior 11-month returns (R^{11}), return on equity (ROE), and expected growth (EG). We align the factors to yield positive average premiums. We perform predictive regressions of realized factor premiums over subsequent h months on h-month ahead expected premiums. We use overlapping monthly observations, in which $h = 1, 3, 12, 24, 36$, and 60 months. We show the slopes, Newey-West t-values (adjusted for 12 lags), and R^2s. QCE is from the q^5-characteristics model, and ICE is from the accounting models.

h	Slope	t-value	R^2	Slope	t-value	R^2	Slope	t-value	R^2	Slope	t-value	R^2
	QCE			ICE			QCE			ICE		
	Panel A: ME						Panel B: BM					
1	0.842	1.508	0.007	1.352	1.275	0.006	1.214	1.849	0.009	0.491	0.366	0.000
3	0.595	0.877	0.007	1.979	1.357	0.030	1.572	2.295	0.029	1.142	0.686	0.004
12	0.277	0.344	0.007	2.104	1.268	0.123	1.368	1.841	0.058	2.075	1.739	0.047
24	0.385	0.565	0.023	1.620	0.503	0.183	2.396	3.048	0.146	2.894	2.613	0.165
36	0.212	0.268	0.009	2.041	1.611	0.286	3.365	4.474	0.225	2.667	2.622	0.222
60	−0.249	−0.265	0.021	1.886	4.226	0.452	−0.411	−0.459	0.003	1.909	2.685	0.264
	Panel C: I/A						Panel D: R^{11}					
1	1.033	2.271	0.014	1.400	1.341	0.003	−0.356	−0.426	0.000	4.396	2.515	0.025
3	0.875	1.758	0.027	1.348	1.153	0.009	0.841	1.141	0.004	5.329	2.401	0.108
12	0.720	1.109	0.049	1.122	0.682	0.024	2.078	1.431	0.060	4.708	4.152	0.361
24	0.760	1.360	0.061	0.188	0.404	0.001	2.094	1.401	0.064	3.361	3.475	0.372
36	1.278	2.437	0.094	0.109	0.319	0.001	0.926	1.180	0.024	1.863	4.306	0.245
60	−0.274	−0.331	0.002	0.027	0.087	0.000	0.325	0.486	0.005	1.333	3.708	0.206
	Panel E: ROE						Panel F: EG					
1	0.350	0.903	0.002	2.609	1.385	0.008	0.178	0.485	0.001	3.972	3.107	0.028
3	0.446	1.082	0.007	2.948	1.552	0.026	0.232	0.732	0.003	3.625	2.984	0.066
12	0.766	1.899	0.055	2.266	1.937	0.071	0.385	0.685	0.015	2.729	3.383	0.132
24	0.746	1.588	0.054	1.717	2.991	0.108	0.194	0.419	0.003	2.288	3.209	0.155
36	0.379	0.632	0.011	1.497	2.808	0.135	−0.112	−0.272	0.001	1.887	2.955	0.143
60	−0.330	−0.929	0.007	0.856	2.646	0.086	−0.346	−0.651	0.010	1.457	2.465	0.124

Table 13 : The Equity Premium, January 1977–December 2022

Panel A shows the (annualized) means and volatilities of the QCE equity premium across horizons, including the 1-, 3-, 12-, 24-, 36-, and 60-month. Rf is the risk-free rate. The panel also reports the ICE equity premium and the average realized return from an expanding window, denoted EAR. For 1-month (1m), EAR is the average of the expanding window series of the average monthly returns. The expanding window starts in January 1967. For 12-monnth (12m), EAR is the average of the expanding window series of the average prior 12-month returns (with overlapping monthly observations). Panel B shows the correlation matrix of the equity premium estimates. The upper triangular shows the Pearson correlations, and the lower triangular the Spearman correlations. ICE_{12} is the 12-month ICE equity premium, and EAR_1 is the 1-month EAR equity premium. Panel C show the predictive regressions of subsequent h-month realized equity premium on the ex ante h-month ahead equity premium. For the ICE equity premium, we align the units between the left- and right-hand sides of the regression. For the 1-month regression, for instance, we convert the ICE aggregate cost of equity from annual to monthly unit, i.e., $(1 + \text{ICE})^{1/12} - 1$, then subtract the 1-month treasury bill rate. For the 60-month regression, we convert the ICE aggregate cost of equity from annual to 5-year unit, i.e., $(1 + \text{ICE})^5 - 1$, then subtract the 5-year treasury bond rate. We use overlapping monthly observations. The t-values are Newey-West (1987) t-values adjusted for 12 lags. Oos-R^2 is the Welch-Goyal (2008) out-of-sample R^2, calculated as $1 - \text{MSE}_h/\text{MSE}_h^A$, in which MSE_h is the mean squared forecast error (MSE) at the h-month horizon, and MSE_h^A is the MSE of the expanding window average return. We align the EAR horizon with the horizon, h, in the left-hand side. For the 12-month, for instance, EAR is the time series of prior 12-month returns averaged from the expanding window. $\overline{\text{SVar}}^{\text{TS}}$ is time series MEV.

Panel A: Means and volatilities of the equity premium and risk-free rates

		1m	3m	12m	24m	36m	60m
QCE	Mean	4.78	5.87	3.92	3.71	4.05	4.72
	Std	5.31	4.66	4.47	4.38	4.35	4.07
ICE	Mean	4.34	4.37	3.88	3.60	3.43	3.12
	Std	2.46	2.33	2.37	2.28	2.17	1.97
EAR	Mean	5.26	5.15	4.13	5.97	3.10	3.05
	Std	1.75	1.82	1.94	1.54	2.14	2.03
Rf	Mean	4.25	4.22	4.72	5.00	5.17	5.48
	Std	3.77	3.59	3.84	3.81	3.72	3.58

Panel B: Correlation matrix of the equity premium estimates

QCE	1m	3m	12m	24m	36m	60m	ICE_{12}	EAR_1
1m	1	0.964	0.925	0.908	0.815	0.480	0.289	0.537
3m	0.958	1	0.959	0.925	0.852	0.535	0.207	0.544
12m	0.917	0.954	1	0.968	0.864	0.508	0.218	0.469
24m	0.885	0.915	0.966	1	0.945	0.646	0.245	0.559
36m	0.740	0.805	0.845	0.929	1	0.863	0.153	0.694
60m	0.340	0.431	0.438	0.574	0.820	1	−0.151	0.759
ICE_{12}	0.282	0.168	0.218	0.243	0.095	−0.179	1	−0.027
EAR_1	0.408	0.398	0.350	0.410	0.509	0.575	−0.095	1

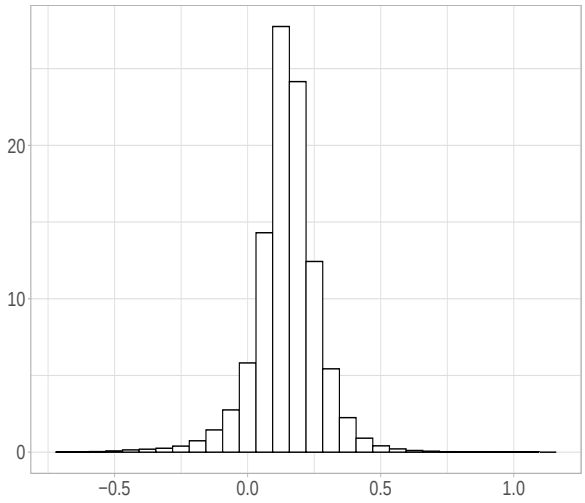
Panel C: Predictive regressions of subsequent h-month realized equity premiums

	QCE					ICE				
h	Slope	t-value	R^2	Oos-R^2	$\overline{\text{SVar}}^{\text{TS}}$	Slope	t-value	R^2	Oos-R^2	$\overline{\text{SVar}}^{\text{TS}}$
1	0.535	1.074	0.002	0.002	0.000	3.203	3.072	0.019	0.011	−0.002
3	0.472	0.724	0.004	0.011	0.001	2.726	2.343	0.038	0.026	−0.014
12	0.763	0.597	0.042	0.047	−0.103	2.188	1.982	0.099	0.080	−0.190
24	0.816	1.250	0.091	−0.007	−0.484	1.856	1.305	0.148	0.049	−0.631
36	0.514	1.323	0.051	0.046	−0.049	1.822	1.162	0.200	0.207	−1.415
60	−0.021	−0.027	0.000	−0.130	7.311	1.965	1.700	0.297	0.261	−4.796

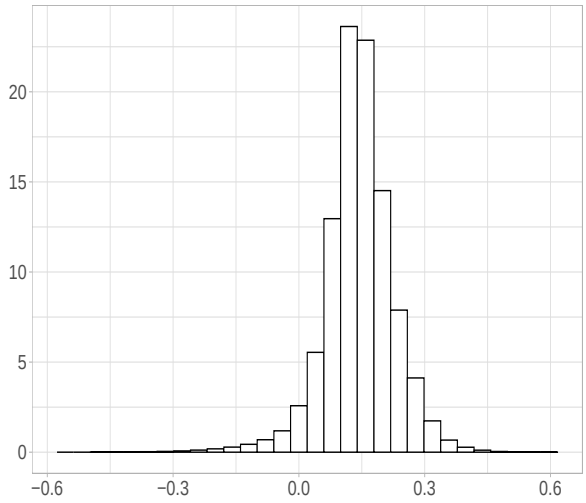
Figure 1 : The Firm-level Cost of Equity Distribution, QCE vs. ICE, 1977–2022

This figure shows the histograms of firm-level costs of equity based on the samples in Table 8. We show the distributions of 1-, 12-, and 36-month ahead QCEs as well as the (12-month) ICE.

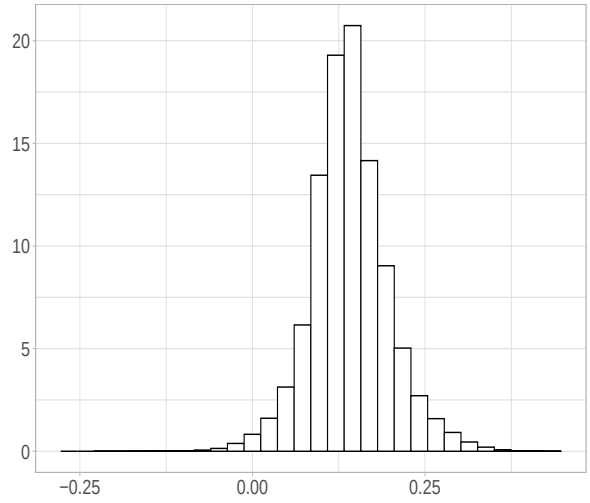
Panel A: 1-month QCE (1,503,852 firm-months)



Panel B: 12-month QCE (1,484,234 firm-months)



Panel C: 36-month QCE (1,442,954 firm-months)



Panel D: ICE (1,923,741 firm-months)

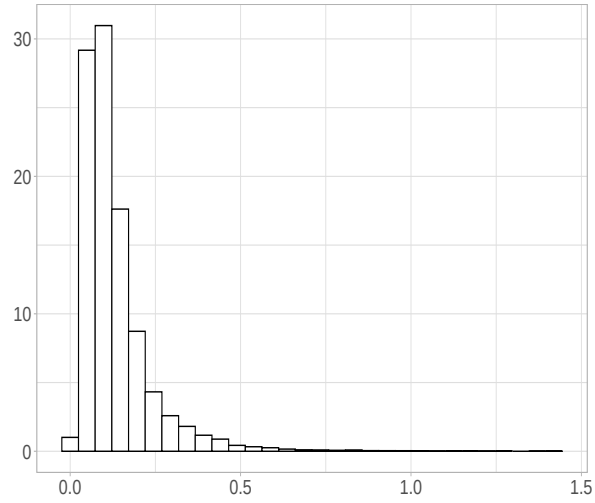
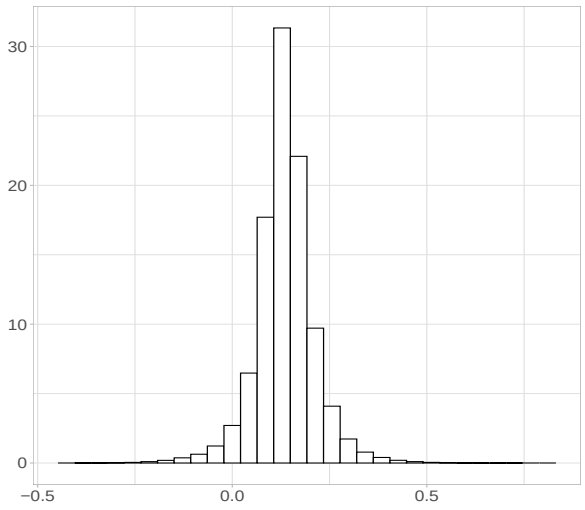


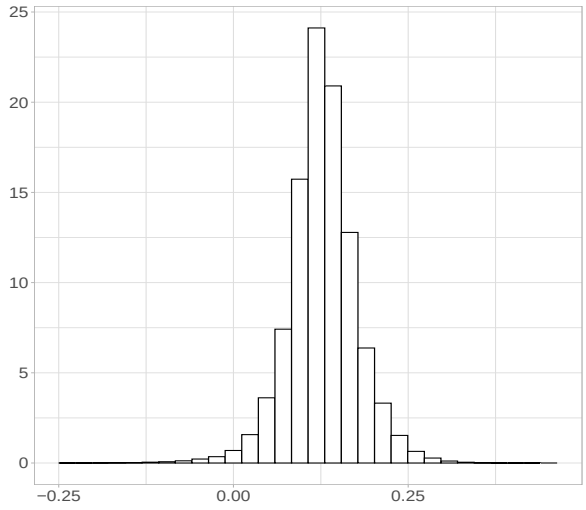
Figure 2 : The Firm-level Cost of Equity Distribution, QCE vs. ICE, the All-but-micro Sample, 1977–2022

This figure shows the histograms of firm-level costs of equity based on the all-but-micro sample. We show the distributions of 1-, 12-, and 36-month ahead QCEs as well as the (12-month) ICE.

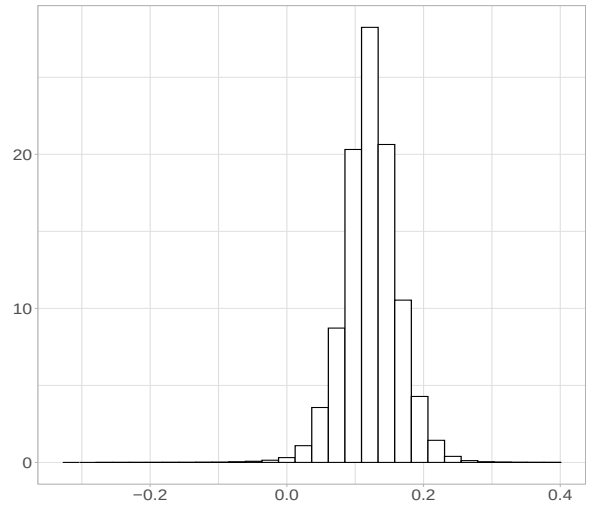
Panel A: 1-month QCE (648,265 firm-months)



Panel B: 12-month QCE (638,242 firm-months)



Panel C: 36-month QCE (616,252 firm-months)



Panel D: ICE (816,956 firm-months)

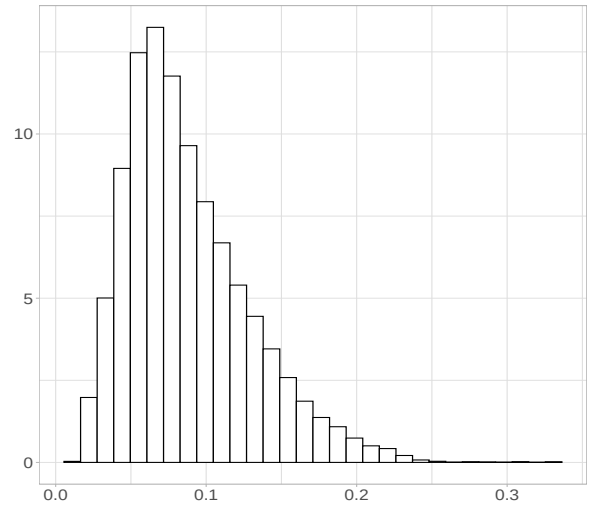


Figure 3 : The 120-month Rolling Window Slopes in Cross-sectional Regressions of 1-, 12-, and 36-month Subsequent Returns Underlying the QCE Estimates, 1977–2022

This figure shows the time series plots of 120-month rolling window slopes in cross-sectional regressions of 1-, 12-, and 36-month subsequent returns on the latest available q^5-characteristics, including the logarithm of size (logME), investment-to-assets (I/A), return on equity (ROE), and expected growth (Eg).

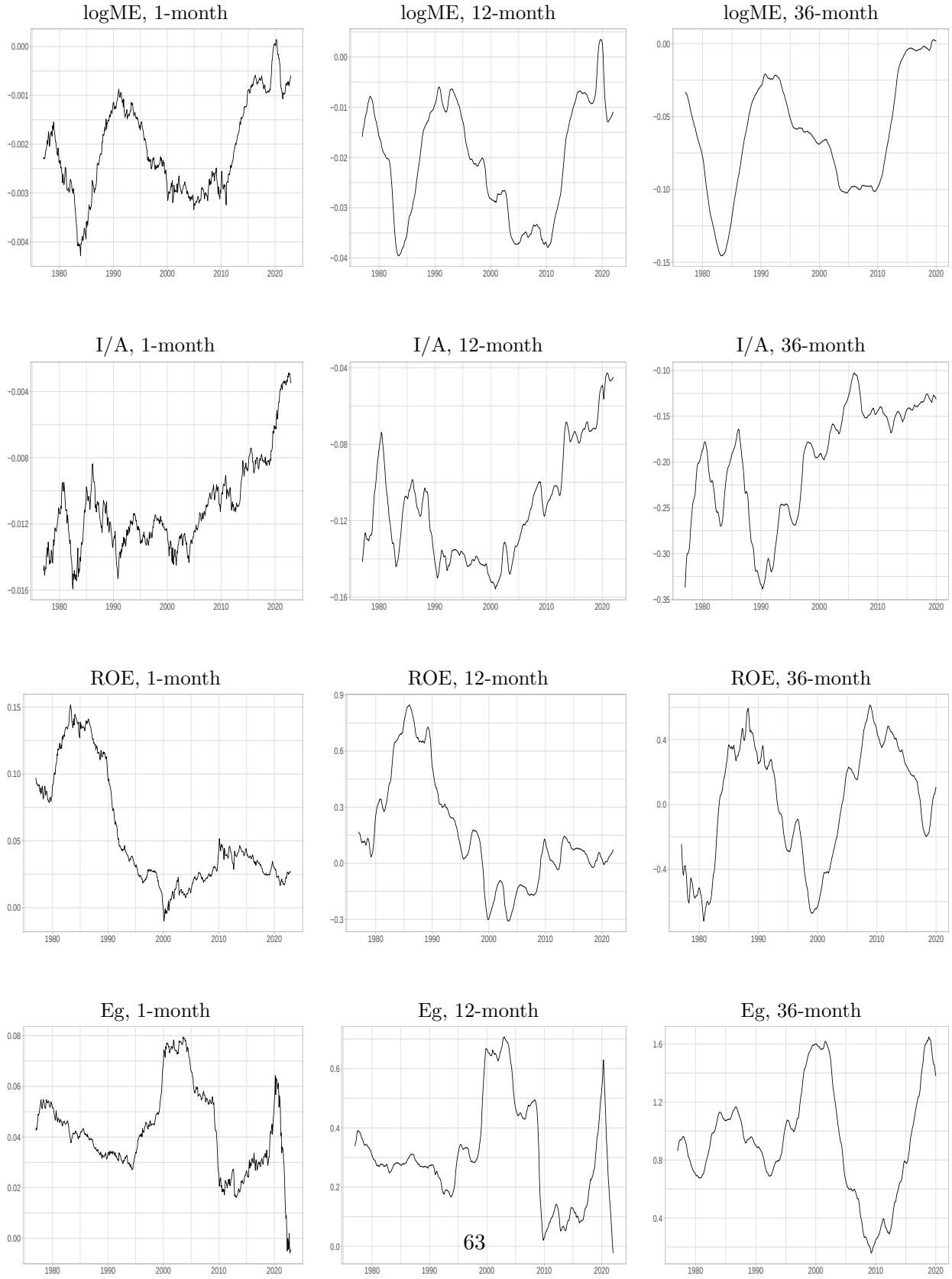
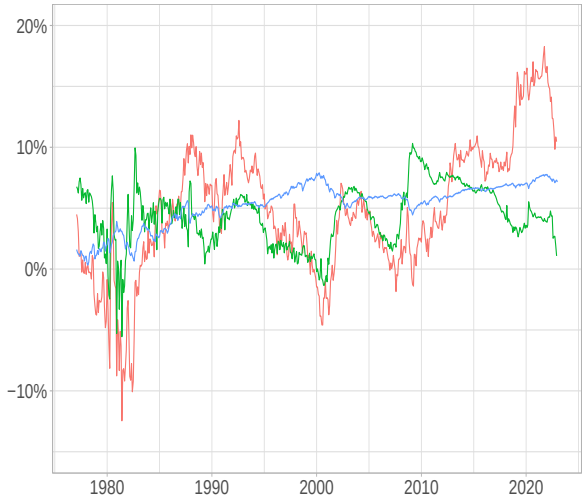


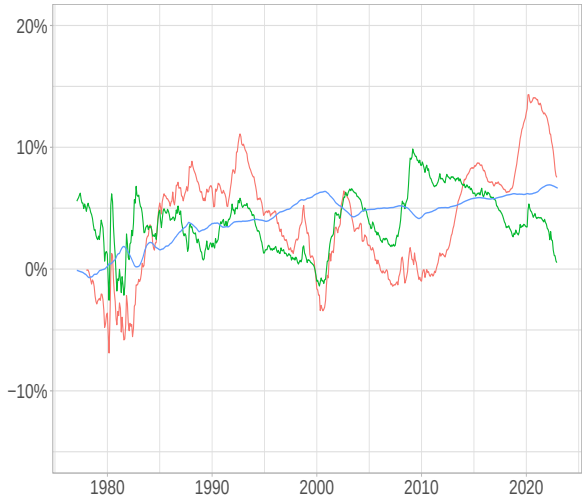
Figure 4 : The Equity Premium, 1977–2022

In each panel, the series in red is the QCE equity premium, the series in green is the ICE equity premium, and the series in blue is the historical average realized returns, denoted EAR, from an expanding window that starts in January 1967. All series are annualized. For 1-month, EAR is the average of the expanding window series of the average monthly returns. For 12-month, EAR is the average of the expanding window series of the average prior 12-month returns (with overlapping monthly observations).

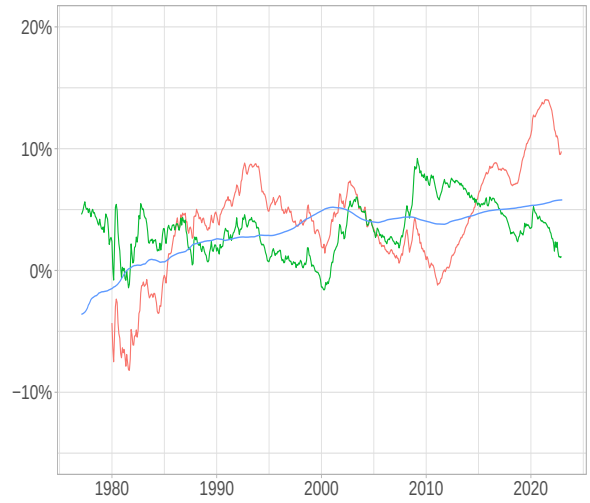
Panel A: 1-month ahead



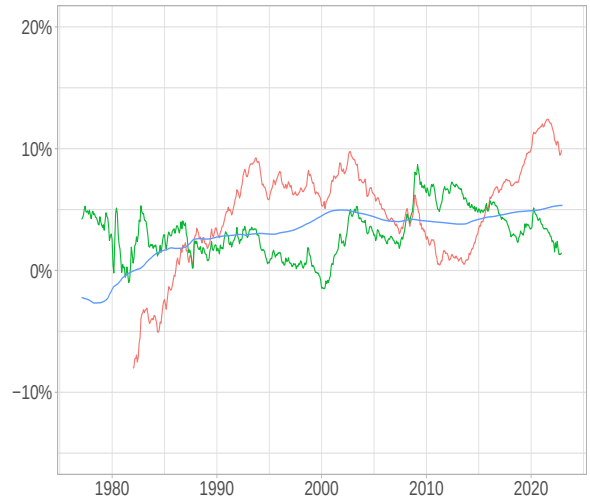
Panel B: 12-month ahead



Panel C: 36-month ahead



Panel D: 60-month ahead



Internet Appendix for "Investment-based Costs of Equity" (for Online Publication Only)

This Internet Appendix furnishes supplementary results for our manuscript.

Table A1 : Portfolio Sorts, the Big-firm Sample, January 1977–December 2022

Starting from the full NYSE-Amex-NASDAQ sample, we include only big firms (stocks with the market equity above the NYSE median). In Panel A, with each cost of equity at the beginning of month t, we split all remaining stocks into deciles. We calculate the monthly value-weighted decile returns for different holding periods, h (in months). For instance, the 3-month horizon means that for a given decile in each month, there exist 3 subdeciles, each initiated in a different month in the prior 3 months. We take the simple average of the subdecile returns as the monthly return for the decile. We align the holding period with the forecast horizon in costs of equity. For instance, we use the 12-month holding period when forecasting returns with 12-month ahead costs of equity. We use all-but-micro breakpoints and value-weighted returns. Each individual decile return is in excess of the 1-month Treasury bill rate. Beneath each row of average return estimates, we show the corresponding Newey-West t-statistics adjust for 12 lags. Panel B shows pairwise comparison tests of the q^5-characteristics model versus the Lewellen 3-, 7-, and 15-variable models; the implied cost of equity (ICE); and the structural q-model. For each pairwise comparison, we test whether the difference between the two high-minus-low (H−L) decile returns is on average zero.

Panel A: Portfolio sorts

h	1	2	3	4	5	6	7	8	9	10	H−L
The q^5 characteristics-based QCE											
1	0.25	0.50	0.62	0.67	0.70	0.68	0.83	0.82	0.90	1.02	0.77
	0.91	2.34	3.15	3.46	3.61	3.42	4.01	4.08	3.80	4.42	4.20
3	0.38	0.58	0.70	0.78	0.71	0.74	0.73	0.84	0.93	0.95	0.57
	1.35	2.75	3.59	4.02	3.67	3.83	3.88	4.18	3.93	4.09	3.17
12	0.50	0.62	0.73	0.80	0.74	0.75	0.82	0.86	0.90	0.80	0.30
	2.12	3.04	3.72	4.22	3.98	4.09	4.17	4.38	4.26	3.25	2.16
24	0.49	0.70	0.71	0.69	0.67	0.75	0.81	0.84	0.79	0.77	0.28
	2.11	3.54	3.63	3.50	3.46	3.87	4.23	4.46	3.98	3.17	1.88
36	0.75	0.79	0.82	0.81	0.80	0.80	0.84	0.85	0.83	0.73	−0.03
	3.43	3.93	4.05	4.19	4.30	4.39	4.42	4.58	4.40	3.04	−0.17
60	0.84	0.85	0.82	0.81	0.81	0.82	0.82	0.79	0.73	0.69	−0.15
	3.57	3.72	3.89	3.77	3.87	3.96	4.07	4.06	3.42	2.82	−1.06
The Lewellen 3-variable model											
1	0.34	0.49	0.66	0.54	0.67	0.69	0.70	0.62	0.89	1.09	0.75
	1.48	2.57	3.61	2.79	3.56	3.72	3.51	3.18	3.97	3.57	2.91
3	0.46	0.56	0.66	0.60	0.67	0.66	0.79	0.74	0.85	0.96	0.50
	2.19	2.96	3.63	3.38	3.70	3.46	4.31	3.65	3.49	3.12	1.92
12	0.73	0.68	0.72	0.76	0.79	0.77	0.71	0.74	0.66	0.78	0.05
	3.26	3.58	3.99	4.27	4.63	4.16	3.70	3.46	2.55	2.50	0.19
24	0.78	0.82	0.76	0.75	0.79	0.77	0.75	0.74	0.67	0.70	−0.09
	3.37	4.27	4.02	3.90	4.18	4.26	3.99	3.80	3.00	2.36	−0.38
36	0.92	0.91	0.83	0.86	0.89	0.85	0.83	0.82	0.72	0.73	−0.19
	4.27	4.63	4.39	4.73	4.73	4.49	4.44	4.44	3.56	2.81	−0.95
60	1.01	0.89	0.86	0.82	0.80	0.81	0.78	0.71	0.65	0.67	−0.34
	4.41	4.19	4.23	4.24	4.10	4.11	4.00	3.63	3.20	2.88	−2.15

h	1	2	3	4	5	6	7	8	9	10	H−L
						The Lewellen 7-variable model					
1	0.21	0.45	0.55	0.58	0.66	0.68	0.63	0.83	0.89	1.11	0.90
	0.81	2.24	3.25	3.18	3.71	3.31	3.19	3.84	4.44	3.78	3.53
3	0.31	0.55	0.50	0.71	0.69	0.74	0.72	0.78	0.89	1.03	0.72
	1.26	2.99	2.91	4.21	3.72	3.97	3.77	3.81	4.06	3.53	3.00
12	0.48	0.70	0.71	0.73	0.72	0.82	0.75	0.73	0.68	0.79	0.30
	2.36	4.03	4.00	4.37	4.20	4.45	3.97	3.41	2.67	2.65	1.41
24	0.43	0.69	0.80	0.79	0.80	0.77	0.72	0.77	0.74	0.75	0.32
	1.96	3.78	4.42	4.33	4.47	4.26	3.80	3.99	3.43	2.77	1.71
36	0.57	0.82	0.87	0.88	0.85	0.84	0.81	0.83	0.78	0.80	0.23
	2.73	4.31	4.51	4.82	4.82	4.82	4.42	4.50	4.10	3.42	1.51
60	0.74	0.85	0.81	0.85	0.79	0.78	0.77	0.73	0.74	0.70	−0.04
	2.93	4.35	4.00	4.62	4.28	4.14	4.12	4.00	3.80	3.07	−0.32
						The Lewellen 15-variable model					
1	0.47	0.57	0.55	0.56	0.62	0.64	0.69	0.68	0.81	1.10	0.63
	2.11	3.24	2.96	3.02	3.34	3.07	3.71	3.17	3.62	3.58	2.26
3	0.57	0.62	0.55	0.62	0.61	0.71	0.70	0.70	0.89	0.98	0.41
	2.55	3.48	3.29	3.51	3.49	3.65	3.56	3.27	3.68	3.17	1.46
12	0.65	0.70	0.71	0.68	0.72	0.74	0.72	0.64	0.71	0.81	0.16
	3.25	4.28	4.28	4.12	4.10	4.11	3.61	2.57	2.63	2.60	0.62
24	0.55	0.66	0.66	0.71	0.74	0.75	0.72	0.74	0.69	0.84	0.29
	2.82	3.77	3.58	3.82	4.17	4.00	3.63	3.40	2.65	2.65	1.08
36	0.68	0.72	0.75	0.78	0.80	0.84	0.82	0.80	0.79	0.89	0.20
	3.60	4.11	4.27	4.37	4.66	4.68	4.44	4.12	3.44	2.88	0.80
60	0.77	0.84	0.75	0.73	0.77	0.79	0.77	0.73	0.75	0.77	0.01
	3.29	4.40	4.16	3.97	4.26	4.04	4.06	3.70	3.31	2.88	0.03
						The q^5-factor model					
1	0.47	0.69	0.59	0.62	0.73	0.68	0.71	0.66	0.75	0.89	0.42
	1.77	3.05	2.61	3.58	4.23	3.95	4.52	3.51	3.53	4.21	2.37
3	0.52	0.64	0.67	0.66	0.70	0.72	0.71	0.79	0.72	0.84	0.33
	1.85	2.78	3.34	3.90	3.98	4.36	4.40	4.30	3.56	3.90	1.79
12	0.53	0.63	0.65	0.64	0.69	0.73	0.74	0.80	0.82	0.85	0.32
	1.88	2.77	3.39	3.60	3.90	4.61	4.49	4.58	4.39	3.74	1.86
24	0.59	0.61	0.66	0.68	0.69	0.72	0.76	0.82	0.78	0.98	0.39
	2.22	2.79	3.50	3.79	3.99	4.50	4.53	4.59	4.13	4.30	2.33
36	0.62	0.62	0.68	0.72	0.75	0.74	0.77	0.81	0.77	0.96	0.34
	2.37	2.81	3.67	4.14	4.39	4.57	4.56	4.54	4.04	4.18	2.32
60	0.74	0.68	0.73	0.77	0.81	0.81	0.82	0.82	0.78	0.95	0.21
	2.91	3.25	4.03	4.50	4.88	5.20	5.02	4.82	4.21	4.16	1.59

h	1	2	3	4	5	6	7	8	9	10	H−L
						The Fama-French 6-factor model					
1	0.74	0.78	0.65	0.63	0.59	0.68	0.78	0.76	0.70	0.63	−0.11
	3.00	3.50	3.44	3.01	3.16	4.01	4.36	3.91	3.54	2.65	−0.53
3	0.78	0.73	0.72	0.65	0.62	0.65	0.81	0.70	0.76	0.63	−0.15
	3.12	3.22	3.84	3.50	3.31	3.90	4.68	3.66	3.90	2.52	−0.70
12	0.80	0.68	0.76	0.68	0.65	0.69	0.79	0.73	0.73	0.67	−0.13
	3.06	3.10	4.05	3.72	3.62	3.94	4.51	4.09	3.77	2.59	−0.59
24	0.83	0.70	0.76	0.70	0.69	0.73	0.77	0.72	0.73	0.71	−0.12
	3.17	3.30	4.14	3.95	3.90	4.13	4.37	3.93	3.69	2.87	−0.61
36	0.82	0.71	0.80	0.74	0.75	0.74	0.75	0.72	0.72	0.78	−0.04
	3.17	3.42	4.34	4.29	4.32	4.15	4.29	3.90	3.58	3.31	−0.24
60	0.93	0.74	0.85	0.82	0.79	0.78	0.77	0.75	0.74	0.81	−0.12
	3.71	3.72	4.81	4.84	4.73	4.51	4.58	4.20	3.83	3.58	−0.84
						The accounting-based ICE					
1	0.73	0.56	0.58	0.72	0.63	0.69	0.7	0.84	0.57	0.77	0.04
	2.37	2.71	2.77	3.86	3.5	3.92	4.38	5.2	3.34	3.64	0.16
3	0.77	0.57	0.63	0.71	0.65	0.69	0.74	0.79	0.62	0.69	−0.08
	2.56	2.76	3.16	3.9	3.66	3.98	4.5	5.18	3.54	3.27	−0.33
12	0.7	0.63	0.65	0.7	0.77	0.74	0.78	0.8	0.69	0.74	0.04
	2.43	3.01	3.43	3.84	4.49	4.36	4.63	5.16	4.07	3.69	0.18
24	0.69	0.59	0.71	0.74	0.81	0.78	0.83	0.81	0.77	0.79	0.09
	2.54	2.87	3.72	4.06	4.73	4.6	4.9	4.87	4.54	4.07	0.43
36	0.72	0.65	0.73	0.74	0.8	0.8	0.82	0.82	0.79	0.79	0.07
	2.74	3.11	3.86	4.05	4.57	4.62	4.72	4.81	4.71	4.1	0.36
60	0.81	0.73	0.77	0.79	0.83	0.83	0.87	0.86	0.8	0.8	−0.01
	3.26	3.65	4.21	4.49	4.76	4.87	5.12	5.11	4.69	4.11	−0.03
						The structural q-model					
1	0.28	0.63	0.61	0.68	0.54	0.81	0.79	0.77	0.78	0.82	0.54
	1.10	3.05	2.78	3.19	2.78	4.27	4.12	3.87	4.19	4.41	2.43
3	0.30	0.62	0.67	0.63	0.66	0.81	0.74	0.84	0.76	0.85	0.55
	1.20	3.04	3.25	3.02	3.16	4.32	3.81	4.37	3.96	4.54	2.61
12	0.36	0.61	0.74	0.64	0.65	0.81	0.82	0.82	0.73	0.86	0.49
	1.34	3.17	3.51	2.95	3.32	4.10	4.28	4.50	3.37	4.52	2.23
24	0.42	0.66	0.67	0.66	0.66	0.78	0.77	0.82	0.78	0.85	0.43
	1.61	3.37	3.23	2.90	3.24	3.88	3.65	4.26	3.78	4.44	2.09
36	0.51	0.75	0.75	0.77	0.77	0.84	0.84	0.89	0.83	0.84	0.33
	1.92	4.01	3.94	3.66	3.84	4.51	4.34	4.75	4.25	4.69	1.60
60	0.55	0.77	0.77	0.72	0.75	0.83	0.78	0.88	0.79	0.78	0.23
	2.13	4.09	3.98	3.19	3.67	4.27	4.06	4.41	3.98	4.24	1.14

	Panel B: Pairwise comparison tests with QCE					
	h	Diff	t	h	Diff	t
Lewellen-3	1	0.03	0.08	24	0.37	1.56
Lewellen-7	1	−0.12	−0.43	24	−0.05	−0.25
Lewellen-15	1	0.15	0.45	24	−0.01	−0.04
ICE	1	0.73	2.32	24	0.06	0.21
Structural-q	1	0.23	1.10	24	−0.15	−0.66
Lewellen-3	3	0.07	0.23	36	0.17	0.85
Lewellen-7	3	−0.15	−0.54	36	−0.26	−1.67
Lewellen-15	3	0.16	0.47	36	−0.23	−0.90
ICE	3	0.67	2.11	36	−0.09	−0.30
Structural-q	3	0.02	0.10	36	−0.34	−1.29
Lewellen-3	12	0.25	0.97	60	0.19	1.44
Lewellen-7	12	0.00	0.00	60	−0.11	−0.78
Lewellen-15	12	0.14	0.55	60	−0.15	−0.67
ICE	12	0.24	0.77	60	−0.00	−0.01
Structural-q	12	−0.20	−0.88	60	−0.38	−1.50

Table A2 : Cross-sectional Predictive Regressions, the Big-firm Sample, January 1977–December 2022

In Panel A, we perform cross-sectional regressions of subsequent h-month returns on a given h-month ahead cost of equity at the beginning of month t. s is the average slope, Ste its Newey-West standard error adjust for 12 lags, and $|t_{s=1}|$ the absolute t-value that tests the slope equals one. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model, the accounting-based implied cost of equity (ICE), and the structural q-model. Panel B shows pairwise comparison tests of the q^5-characteristics model versus the other 5 characteristics-based models. For each pairwise comparison, we test whether the slope difference is on average zero. We use time series tests with Newey-West t-values.

Panel A: Cross-sectional predictive regressions

	h	s	Ste	$\|t_{s=1}\|$	h	s	Ste	$\|t_{s=1}\|$	h	s	Ste	$\|t_{s=1}\|$
QCE	1	0.68	0.15	2.11	12	0.37	0.19	3.41	36	0.13	0.18	4.71
Lewellen-3	1	0.44	0.22	2.61	12	0.24	0.26	2.92	36	−0.01	0.33	3.02
Lewellen-7	1	0.55	0.12	3.66	12	0.24	0.17	4.46	36	0.21	0.16	5.09
Lewellen-15	1	0.34	0.12	5.29	12	0.23	0.15	5.32	36	0.30	0.19	3.78
Q5F	1	0.06	0.04	22.98	12	0.07	0.05	18.65	36	0.09	0.03	28.13
FF6	1	0.00	0.07	13.69	12	0.00	0.12	8.64	36	−0.01	0.07	15.43
ICE	1	0.02	0.24	4.03	12	0.00	0.26	3.88	36	−0.06	0.21	5.03
Structural-q	1	0.06	0.03	29.84	12	0.11	0.12	7.31	36	0.18	0.10	8.22
QCE	3	0.61	0.14	2.78	24	0.33	0.16	4.14	60	−0.43	0.14	9.96
Lewellen-3	3	0.40	0.23	2.59	24	0.13	0.28	3.06	60	−0.91	0.39	4.92
Lewellen-7	3	0.47	0.15	3.45	24	0.24	0.16	4.74	60	−0.28	0.18	7.23
Lewellen-15	3	0.31	0.14	5.09	24	0.29	0.15	4.61	60	−0.13	0.23	5.02
Q5F	3	0.06	0.04	21.06	24	0.09	0.05	18.10	60	0.03	0.02	44.98
FF6	3	0.01	0.08	12.42	24	0.00	0.10	9.80	60	−0.04	0.07	15.20
ICE	3	−0.06	0.27	3.99	24	0.06	0.21	4.40	60	−0.09	0.23	4.81
Structural-q	3	0.10	0.06	16.30	24	0.15	0.12	7.35	60	0.16	0.09	9.05

Panel B: Pairwise comparison tests with QCE

	h	Diff	t	h	Diff	t	h	Diff	t
Lewellen-3	1	0.24	0.83	12	0.13	0.50	36	0.14	0.50
Lewellen-7	1	0.13	0.73	12	0.13	0.68	36	−0.07	−0.45
Lewellen-15	1	0.34	1.78	12	0.14	0.55	36	−0.17	−0.88
ICE	1	0.66	2.21	12	0.35	0.89	36	0.14	0.46
Structural-q	1	0.62	4.28	12	0.26	1.02	36	−0.05	−0.26
Lewellen-3	3	0.21	0.71	24	0.21	0.87	60	0.48	1.61
Lewellen-7	3	0.14	0.73	24	0.09	0.62	60	−0.15	−1.48
Lewellen-15	3	0.30	1.48	24	0.05	0.25	60	−0.30	−2.46
ICE	3	0.68	1.99	24	0.23	0.68	60	−0.29	−2.10
Structural-q	3	0.51	3.47	24	0.18	0.99	60	−0.59	−4.22

Table A3 : Measurement Error Variances, the Big-firm Sample, January 1977–December 2022

In Panel A, $\overline{\text{SVar}}^{\text{TS}} = (1/N)\sum_i \left(\text{Var}_i\left(\widehat{er}_{it}^{h}\right) - 2\text{Cov}_i\left(\widehat{er}_{it}^{h}, r_{it+h}\right)\right)$ is the time series measurement error variance (MEV) of a given expected return proxy, $\widehat{er}_{it}^{h}$, $\text{Var}^{\text{TS}} = (1/N)\sum_i \text{Var}_i\left(\widehat{er}_{it}^{h}\right)$ the variance component, and $\text{Cov}^{\text{TS}} = (1/N)\sum_i \text{Cov}_i\left(\widehat{er}_{it}^{h}, r_{it+h}\right)$ the covariance component. $\overline{\text{SVar}}^{\text{CX}} = (1/(T^p-h))\sum_t \left(\text{Var}_t\left(\widehat{er}_{it}^{h}\right) - 2\text{Cov}_t\left(\widehat{er}_{it}^{h}, r_{it+h}\right)\right)$ is the cross-section MEV of $\widehat{er}_{it}^{h}$, in which $T^p - h$ is the number of cross-sections in the predictive window. $\text{Var}^{\text{CX}} = (1/(T^p-h))\sum_t \text{Var}_t\left(\widehat{er}_{it}^{h}\right)$ is the variance component, and $\text{Cov}^{\text{CX}} = (1/(T^p-h))\sum_t \text{Cov}_t\left(\widehat{er}_{it}^{h}, r_{it+h}\right)$ the covariance component. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model (FF6), the accounting-based implied cost of equity (ICE), and the structural q-model. Panel B shows pairwise comparison tests with QCE. Diff^{TS} is the time series MEV differential, and t_{TS} its White heteroscedasticity-adjusted t-value. Diff^{CX} is the cross-section MEV differential, and t_{CX} its Newey-West t-value adjusted for 12 lags.

Panel A: Measurement error variances

	h	$\overline{\text{SVar}}^{\text{TS}}$	Var^{TS}	Cov^{TS}	$\overline{\text{SVar}}^{\text{CX}}$	Var^{CX}	Cov^{CX}	h	$\overline{\text{SVar}}^{\text{TS}}$	Var^{TS}	Cov^{TS}	$\overline{\text{SVar}}^{\text{CX}}$	Var^{CX}	Cov^{CX}
QCE	1	0.0018	0.0015	−0.0004	−0.0005	0.0015	0.0020	24	1.0140	0.5071	−0.5069	0.2852	0.3860	0.1008
Lewellen-3	1	0.0014	0.0045	0.0031	0.0007	0.0024	0.0017	24	1.5929	0.8172	−0.7757	0.6496	0.3799	−0.2697
Lewellen-7	1	0.0018	0.0041	0.0023	0.0006	0.0028	0.0022	24	1.4178	0.8445	−0.5732	0.6017	0.5654	−0.0363
Lewellen-15	1	0.0043	0.0052	0.0009	0.0022	0.0039	0.0016	24	3.0890	1.8343	−1.2547	1.9920	1.7738	−0.2182
Q5F	1	0.0081	0.0067	−0.0014	0.0086	0.0100	0.0013	24	5.3109	5.8743	0.5634	7.0296	8.5363	1.5067
FF6	1	0.0048	0.0029	−0.0019	0.0046	0.0044	−0.0002	24	2.7093	2.5260	−0.1833	3.8755	3.7442	−0.1313
ICE	1	−0.0025	0.0003	0.0029	0.0003	0.0005	0.0002	24	−1.0773	0.2886	1.3659	0.2501	0.4441	0.1940
Structural-q	1	0.0012	0.0048	0.0036	0.0252	0.0290	0.0039	24	0.1753	0.4728	0.2975	1.7101	2.2929	0.5829
QCE	3	0.0153	0.0107	−0.0046	−0.0027	0.0103	0.0130	36	3.5471	1.7404	−1.8067	1.5293	1.1872	−0.3421
Lewellen-3	3	0.0229	0.0427	0.0198	0.0119	0.0228	0.0109	36	3.0577	1.2387	−1.8190	0.8575	0.5353	−0.3222
Lewellen-7	3	0.0217	0.0395	0.0178	0.0103	0.0258	0.0155	36	3.2304	1.5594	−1.6710	1.0713	1.0856	0.0143
Lewellen-15	3	0.0492	0.0509	0.0017	0.0271	0.0372	0.0101	36	6.3264	3.9464	−2.3800	4.1433	4.1019	−0.0414
Q5F	3	0.0689	0.0616	−0.0073	0.0809	0.0921	0.0112	36	16.97	18.23	1.2544	21.64	25.63	3.9917
FF6	3	0.0390	0.0272	−0.0118	0.0426	0.0407	−0.0019	36	7.8727	7.3893	−0.4834	10.74	10.72	−0.0225
ICE	3	−0.0226	0.0031	0.0257	0.0037	0.0047	0.0010	36	−1.8306	0.8110	2.6416	0.8988	1.2469	0.3481
Structural-q	3	0.0037	0.0188	0.0151	0.0865	0.1086	0.0221	36	1.3186	1.0466	−0.2720	3.2820	4.6535	1.3715
QCE	12	0.2908	0.1196	−0.1713	0.0393	0.0984	0.0592	60	25.09	17.14	−7.9516	17.74	11.16	−6.5828
Lewellen-3	12	0.7959	0.4346	−0.3613	0.3122	0.2310	−0.0813	60	8.6017	4.8212	−3.7806	5.1307	2.0970	−3.0337
Lewellen-7	12	0.7453	0.4114	−0.3339	0.3028	0.2727	−0.0301	60	14.01	8.8288	−5.1855	9.9133	5.7889	−4.1244
Lewellen-15	12	1.2323	0.5832	−0.6491	0.6222	0.4883	−0.1339	60	38.50	26.87	−11.63	32.47	24.52	−7.9510
Q5F	12	1.2163	1.1467	−0.0697	1.4993	1.6921	0.1928	60	113.82	113.63	−0.1934	141.29	148.89	7.6058
FF6	12	0.6189	0.5034	−0.1155	0.7936	0.7539	−0.0397	60	37.25	37.56	0.3089	54.07	51.75	−2.3219
ICE	12	−0.3514	0.0579	0.4093	0.0621	0.0891	0.0270	60	−7.0451	3.5961	10.64	3.8455	5.6256	1.7801
Structural-q	12	0.0443	0.1321	0.0878	0.5790	0.7266	0.1477	60	4.1514	3.0331	−1.1183	9.7275	13.29	3.5623

Panel B: Pairwise comparison tests with QCE

	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}	h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}
Lewellen-3	1	0.0001	0.17	−0.0012	−0.74	12	−0.4565	−7.58	−0.2730	−0.87	36	0.5592	3.04	0.6719	0.97
Lewellen-7	1	0.0002	0.27	−0.0011	−0.70	12	−0.4262	−7.76	−0.2635	−0.85	36	0.5468	2.85	0.4580	0.82
Lewellen-15	1	−0.0023	−2.39	−0.0027	−1.28	12	−0.9285	−12.21	−0.5830	−1.06	36	−2.6420	−6.72	−2.6139	−1.25
ICE	1	0.0041	11.05	−0.0008	−1.47	12	0.6339	17.79	−0.0184	−0.25	36	5.4230	19.92	0.9203	0.59
Structural-q	1	0.0009	1.50	−0.0257	−12.70	12	0.2634	8.99	−0.5403	−2.03	36	2.3918	9.55	−1.7641	−0.78
Lewellen-3	3	−0.0095	−1.65	−0.0146	−0.79	24	−0.5284	−5.32	−0.3644	−0.72	60	16.39	9.10	12.61	1.05
Lewellen-7	3	−0.0066	−1.18	−0.0130	−0.71	24	−0.3190	−2.94	−0.3165	−0.67	60	11.60	7.83	7.8255	0.91
Lewellen-15	3	−0.0353	−5.47	−0.0297	−1.06	24	−2.0018	−8.49	−1.7068	−1.12	60	−15.08	−5.15	−14.73	−1.66
ICE	3	0.0356	12.38	−0.0065	−1.23	24	2.0947	15.84	0.1085	0.39	60	32.58	13.91	13.56	0.76
Structural-q	3	0.0130	3.66	−0.0891	−6.83	24	0.9101	7.66	−1.4237	−1.69	60	20.82	10.71	7.9773	0.46

Table A4 : Mean Squared (Forecast) Errors, The Big-firm Sample, January 1977–December 2022

$\overline{\text{MSE}}^{\text{TS}}$ is the time series mean squared (forecast) errors (MSE), and $\overline{\text{MSE}}^{\text{CX}}$ the cross-section MSE. We examine 8 cost of equity measures, including the q^5-characteristics model (QCE); the Lewellen 3-, 7-, and 15-variable models; the q^5-factor model (Q5F), the Fama-French 6-factor model (FF6), the accounting-based implied cost of equity (ICE), and the structural q-model.

	h	$\overline{\text{MSE}}^{\text{TS}}$	$\overline{\text{MSE}}^{\text{CX}}$	h	$\overline{\text{MSE}}^{\text{TS}}$	$\overline{\text{MSE}}^{\text{CX}}$	h	$\overline{\text{MSE}}^{\text{TS}}$	$\overline{\text{MSE}}^{\text{CX}}$
Panel A: MSEs									
QCE	1	0.0228	0.0115	3	0.0708	0.0353	12	0.3203	0.1875
Lewellen-3	1	0.0268	0.0112	3	0.0872	0.0347	12	0.3900	0.1857
Lewellen-7	1	0.0224	0.0106	3	0.0761	0.0327	12	0.3318	0.1709
Lewellen-15	1	0.0225	0.0105	3	0.0779	0.0328	12	0.3536	0.1748
Q5F	1	0.0145	0.0096	3	0.0438	0.0298	12	0.2183	0.1615
FF6	1	0.0145	0.0096	3	0.0434	0.0293	12	0.2093	0.1531
ICE	1	0.0272	0.0112	3	0.0834	0.0345	12	0.3285	0.1770
Structural-q	1	0.0230	0.0114	3	0.0703	0.0338	12	0.2979	0.1754
QCE	24	0.6812	0.5037	36	1.0175	0.9204	60	3.3684	3.6441
Lewellen-3	24	0.7866	0.4926	36	1.1232	0.8729	60	2.9625	3.0450
Lewellen-7	24	0.6793	0.4486	36	1.0143	0.8462	60	3.0122	3.0972
Lewellen-15	24	0.7634	0.4710	36	1.1511	0.9031	60	3.9707	3.6036
Q5F	24	0.5565	0.4603	36	1.2079	0.9818	60	4.9407	4.0849
FF6	24	0.4996	0.4221	36	1.0213	0.8528	60	3.5004	3.0876
ICE	24	0.7008	0.4797	36	0.9715	0.8345	60	2.3007	2.8052
Structural-q	24	0.6277	0.4742	36	0.8671	0.8884	60	2.6011	3.3234

Panel B: Pairwise comparison tests between QCE and ICE

h	Diff^{TS}	t_{TS}	Diff^{CX}	t_{CX}
1	0.0000	0.1182	0.0003	1.6818
3	0.0007	0.8075	0.0007	0.9836
12	0.0036	0.7186	0.0082	2.6560
24	0.0064	0.4899	0.0196	1.1278
36	0.0424	1.2500	0.0797	1.9718
60	0.8073	7.2385	0.6970	2.9627

Table A5 : Firm-level Properties of Costs of Equity, the Big-firm Sample, January 1977–December 2022

In Panel A, #Obs. is the number of firm-month observations. The summary statistics are time series averages of cross-sectional moments, including mean, standard deviation (Std), skewness (Skew), excess kurtosis (Kurt), autocorrelation (ρ), and 1, 5, 25, 50, 75, 95, and 99 percentiles. QCE is the cost of equity from the q^5-characteristics model, ICE is the accounting-based implied cost of equity, and QCE_{12} minus ICE is the difference between 12-month ahead QCE and ICE. Panel B shows the average slopes and their t-values in cross-sectional return regressions in QCE. The panel uses the full sample to illustrate the slopes, while the QCE estimates uses latest available 120-month rolling window slopes (Figure A3).

Panel A: Firm-level properties of QCE, ICE, and their differences

h	#Obs.	Mean	Std	Skew	Kurt	ρ	p1	p5	p25	p50	p75	p95	p99
						QCE							
1	329,529	13.16	4.84	−0.13	−1.69	0.62	0.36	4.97	10.51	13.21	15.87	20.94	25.44
3	328,560	13.03	4.14	−0.18	−1.78	0.65	1.93	5.93	10.78	13.15	15.40	19.59	23.27
12	324,027	12.66	2.93	−0.24	−2.00	0.67	4.92	7.68	11.02	12.76	14.43	17.30	19.45
24	318,036	12.41	2.61	−0.29	−1.90	0.66	5.51	7.95	10.94	12.48	14.01	16.51	18.41
36	312,022	12.23	2.49	−0.37	−1.47	0.67	5.83	8.13	10.82	12.26	13.73	16.19	18.06
60	299,877	12.38	2.71	−0.37	−1.14	0.67	5.64	8.13	10.85	12.37	13.90	16.87	18.97
						ICE							
12	418099	8.72	2.90	0.80	−2.69	0.62	4.26	4.77	6.60	8.23	10.33	14.57	16.36
						QCE_{12} minus ICE							
12	318028	4.49	4.06	−0.49	−2.20	0.66	−6.62	−2.75	2.18	4.81	7.12	10.60	13.09

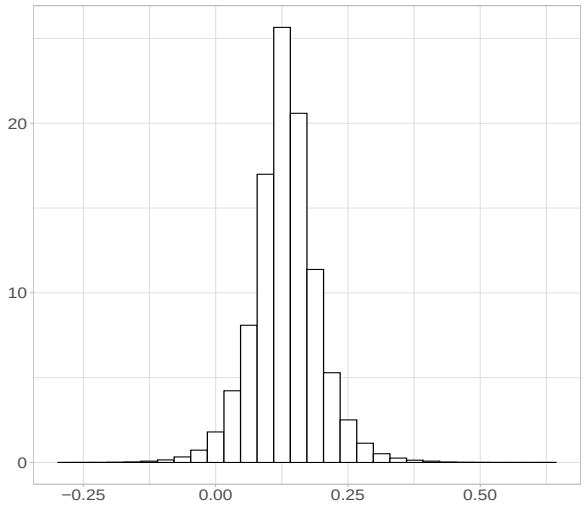
Panel B: Average slopes and their t-values in cross-sectional return regressions

	Slopes				t-values			
h	logME	ROE	I/A	Eg	logME	ROE	I/A	Eg
1	−0.001	0.035	−0.005	0.040	−1.95	2.21	−2.33	5.62
3	−0.002	0.082	−0.015	0.103	−1.66	1.62	−2.00	4.56
12	−0.005	0.039	−0.042	0.355	−0.53	0.15	−1.32	3.91
24	−0.006	−0.045	−0.071	0.700	−0.31	−0.09	−1.30	3.67
36	−0.003	−0.255	−0.065	1.051	−0.08	−0.42	−0.71	3.81
60	−0.015	−0.524	0.106	1.829	−0.25	−0.71	0.38	3.22

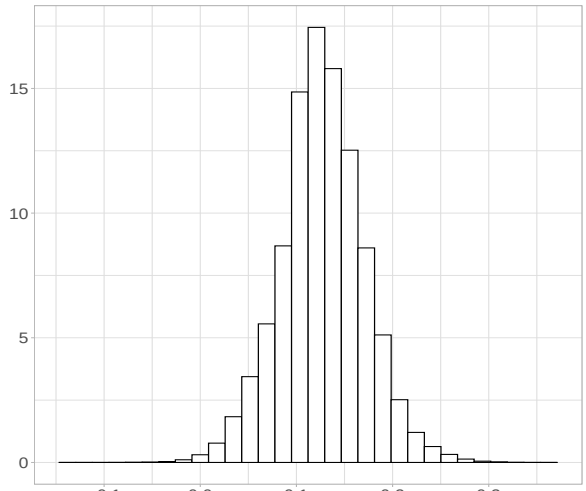
Figure A1 : The Firm-level Cost of Equity Distribution, QCE vs. ICE, the Big-firm Sample, 1977–2022

This figure shows the histograms of firm-level costs of equity based on the big-firm sample. We show the distributions of 1-, 12-, and 36-month ahead QCEs as well as the (12-month) ICE.

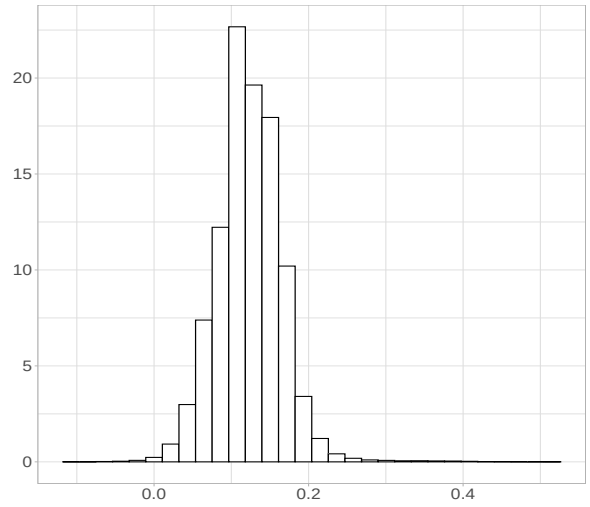
Panel A: 1-month QCE (648,265 firm-months)



Panel B: 12-month QCE (638,242 firm-months)



Panel C: 36-month QCE (616,252 firm-months)



Panel D: ICE (816,956 firm-months)

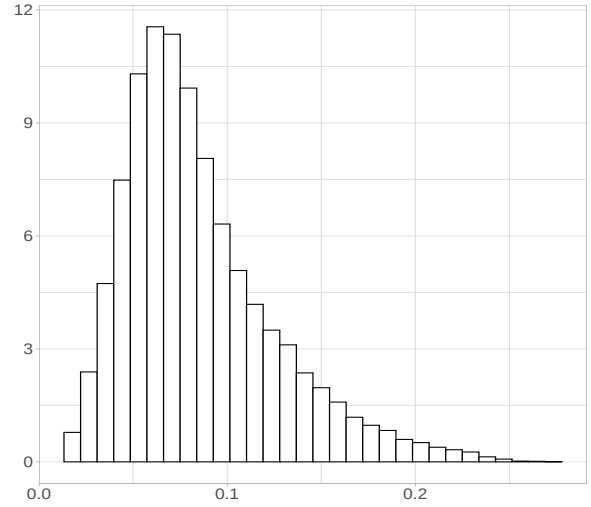


Figure A2 : The 120-month Rolling Window Slopes in Cross-sectional Regressions of 1-, 12-, and 36-month Subsequent Returns, the All-but-micro Sample, 1977–2022

This figure shows the time series plots of 120-month rolling window slopes in cross-sectional regressions of 1-, 12-, and 36-month subsequent returns on the latest available q^5-characteristics, including the logarithm of size (logME), investment-to-assets (I/A), return on equity (ROE), and expected growth (Eg).

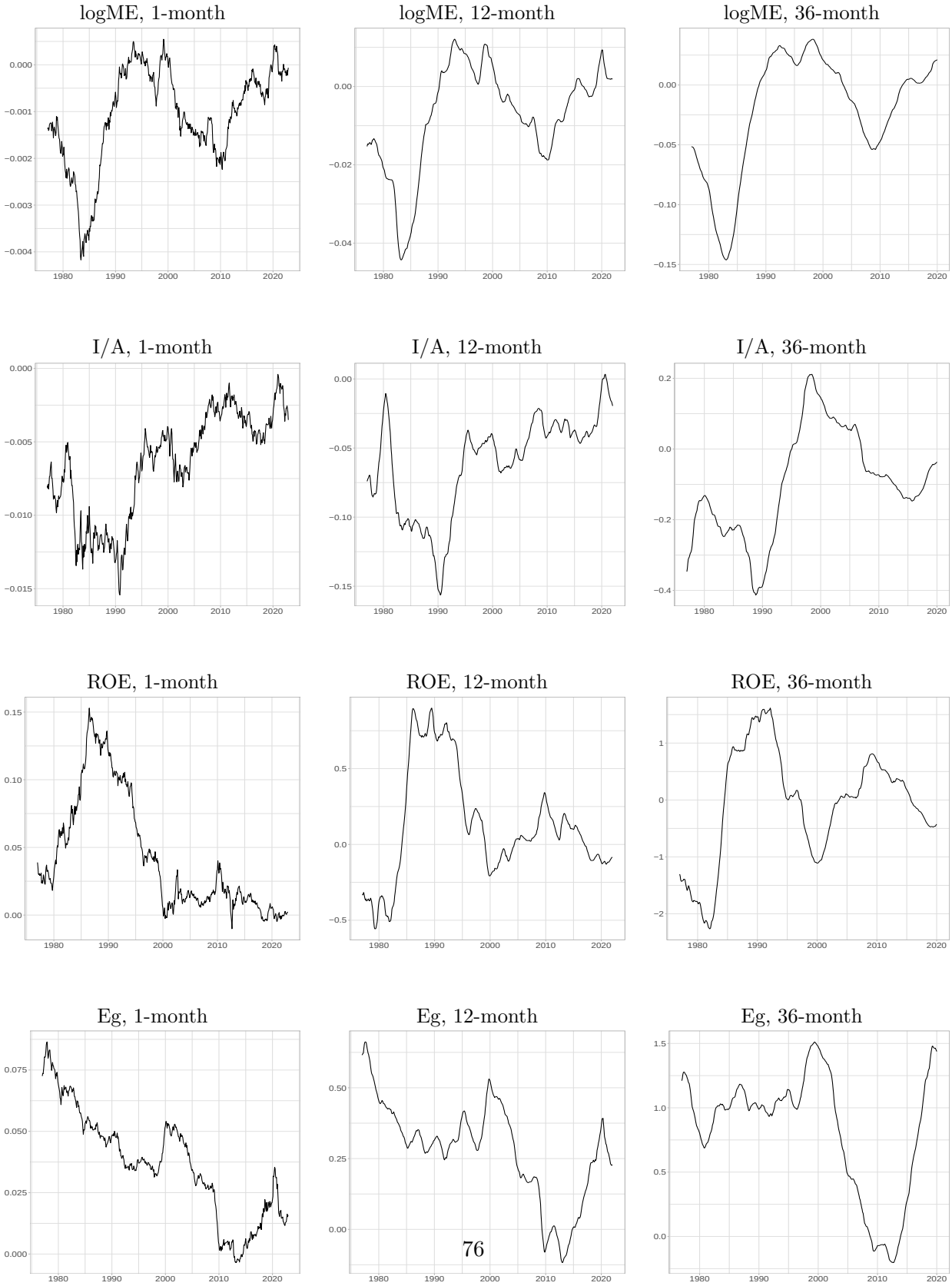


Figure A3 : The 120-month Rolling Window Slopes in Cross-sectional Regressions of 1-, 12-, and 36-month Subsequent Returns, the Big-firm Sample, 1977–2022

This figure shows the time series plots of 120-month rolling window slopes in cross-sectional regressions of 1-, 12-, and 36-month subsequent returns on the latest available q^5-characteristics, including the logarithm of size (logME), investment-to-assets (I/A), return on equity (ROE), and expected growth (Eg).

