Online Appendix to

"CONSERVATIVE ACCOUNTING AND THE PRICING OF RISK: THE CASE OF RESEARCH AND DEVELOPMENT"

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1 Introduction

This Online Appendix provides details of the procedures used to estimate equity duration, news in the VAR system, the bootstrapped standard errors and the robustness checks in Andronoudis et al. (2019). Section 2 outlines the empirical approach for obtaining an accounting measure of implied equity duration and excess duration. Section 3 presents and discusses the results from the first-order vector autoregressive [VAR(1)] process used to estimate discount rate news (NDR) and cash flow news (NCF). Section 4 summarizes the steps of the bootstrap simulation used to estimate standard errors for the betas, critical values for the CPE evaluation metric and bias estimates for all of our analyses. Section 5 provides the details of the robustness checks. Section 6 shows the workings for obtaining the formulas of excess duration provided in Appendix A of the main paper.

2 Estimating Excess Equity Duration

We define an excess duration variable to capture the "time-gap" implied by conservative R&D accounting. Empirically, we first estimate the equity duration measure developed by Dechow et al. (2004). Then, we adjust for the the effects of R&D-related conservatism in the observed fundamentals that feed into duration's estimation. With the adjusted variables we re-estimate duration, which now is a "pseudo-duration" reflecting that R&D expenses are imminently recoverable and the timing of the R&D-related future cash flows is certain. The difference between the duration and the pseudo-duration is the measure of excess duration.

2.1 Measuring Equity Duration

We follow Dechow et al. (2004) to estimate equity duration (DUR). DUR captures the weighted average time to maturity of cash flows where the weights are determined by dividing the sum of discounted cash flows with market equity. Given that the cash flows of stocks do not have a pre-determined maturity and are not known in advance, we forecast cash flows over a finite horizon T and then assume they are distributed as perpetuity. That is, we estimate DUR for each firm i and (calendar) year t:

$$DUR_{i,t} = \underbrace{\frac{1}{ME_{i,t}} \sum_{s=1}^{T} \frac{s\widehat{CF}_{i,t+s}}{(1+r)^s}}_{\text{Finite-period component}} + \overbrace{\left(T + \frac{1+r}{r}\right)\left(1 - \frac{1}{ME_{i,t}} \sum_{s=1}^{T} \frac{\widehat{CF}_{i,t+s}}{(1+r)^s}\right)}^{\text{Terminal-period component}} \quad \text{(OA.1)}$$

where $T = 15$ (in years) is the finite period over which we forecast cash flows; CF is the forecasted cash flows; and ME is the market value of equity.

To forecast CF we use the clean surplus relation:

$$CF_{i,t} = E_{i,t} + BE_{i,t-1} - BE_{i,t} = BE_{i,t-1}\left(ROE_{i,t} - \frac{BE_{i,t} - BE_{i,t-1}}{BE_{i,t-1}}\right) \quad \text{(OA.2)}$$

where E_t denotes the earnings in year t, BE_t is the book value of equity at the end of year t, and $ROE_t = \frac{E_t}{BE_{t-1}}$ is the return on equity in year t. We are forecasting the two right-hand-side variables of equation (OA.2), namely BE and ROE, as follows.

For BE, we forecast growth in BE via forecasting growth in sales. Sales have been found to better predict future BE (Nissim and Penman 2001), and we take advantage of that feature. Growth in sales follows an autoregressive process with speed of mean reversion 0.24 and long-run mean equal to 0.06, which is the long-run nominal growth rate for the economy. Each finite period year, we apply the expected growth rate to the opening BE and forecast BE. In turn, ROE follows an autoregressive process with speed of mean reversion 0.57 and long-run mean that is equal to 0.12, which is the steady-state historical cost of equity capital. The initial values to forecast BE and ROE are the observed BE, growth in sales and ROE at calendar year t.

With the forecasts for ROE, BE we obtain CF forecasts with the clean surplus relation of equation (OA.2). We then estimate the sum of the present values of the CF forecasts ($PVCF$). As a discount factor (r) we use the steady state cost of equity capital 0.12. The sum of the time-weighted $PVCF$ divided by $PVCF$ is the finite period duration. Then, terminal duration is assumed to be the same for all firm-years [i.e., $T + (1+r)/r \approx 24.33$]. Finally, the total duration is the weighted sum of the finite and terminal durations, and the weights are determined by the $PVCF/ME$ ratio. The $PVCF/ME$ captures the value that is expected to be materialized by the end of the finite period; the remaining value is expected to materialize during the terminal period.

2.2 Measuring Excess Duration

Having obtained $DUR_{i,t}$, we then adjust the fundamental variables feeding into duration for the booking of an R&D asset. Following Lev and Sougiannis (1996), we estimate the R&D asset (RDA) by summing up the current and past R&D expenditures that would have been in the balance sheet for an accounting period, k. That is:

$$RDA_{i,t} = \sum_{k=0}^{N-1} RD_{i,t-k}(1 - \sum_{j=0}^{k} \delta_j) \quad \text{(OA.3)}$$

Which incorporates that the amortization of the R&D asset is:

$$A_{i,t} = \sum_{j=0}^{k} \delta_j RD_{i,t-k} \quad \text{(OA.4)}$$

Where: N is the length of the asset's useful life; RD is the annual R&D expenditure; and δ_j is the amortization rate for year j of the asset's useful life. Following Lev et al. (2005)'s advice, we employ an industry-specific amortisation schedule to more reliably reflect industry patterns on R&D expenditures and useful lives (e.g., Shi 2003). We obtain the industry-specific amortisation rates and R&D assets useful lives from Amir et al. (2007, Table 4, pg. 236).[1] We have also employed a uniform 20% amortization schedule which produces qualitatively similar results.

With these estimates, we adjust earnings and one-year-lagged BE (to get adjusted ROE) as well as current BE. Earnings are now the observed earnings plus the R&D expenditure minus A obtained from (OA.4). We also add to the observed BE(one-year-lagged BE), the RDA(one-year-lagged RDA) obtained from (OA.3). Using the adjusted inputs, we repeat the estimation for duration, described above, and obtain a pseudo-duration (DUR^{pseudo}), i.e., a duration adjusted for the capitalization and amortization of R&D duration. The difference

[1]We use the amortization rates and useful lives estimated by Amir et al. (2007) for the full sample.

between the initial duration and the pseudo-duration is the excess duration:

$$Excess^{DUR}_{i,t} = DUR_{i,t} - DUR^{pseudo}_{i,t} \quad \text{(OA.5)}$$

3 Methodology: ICAPM and Betas

We posit that accounting conservatism communicates information on the distance to the resolution of uncertainty as summarized in our excess duration measure. We then examine whether this information articulates the market's assessment of risk within an ICAPM framework that allows for priced duration risk through discount rate betas.

3.1 The ICAPM Model

Merton (1973)'s ICAPM reflects that multi-period investors hedge against shocks to total market wealth and to shocks in the investment opportunity set. This setting manifests itself in the Campbell (1991) return decomposition:

$$r_{M,t+1} - E_t[r_{M,t+1}] = NCF_{t+1} - NDR_{t+1} \quad \text{(OA.6)}$$

where $r_{M,t+1}$ is the market return between t and $t+1$, $E_t[.]$ is the time-conditional expectation, and NCF_{t+1} and NDR_{t+1} are the cash flows news and discount rate news components of unexpected market return. The two news components are defined as follows:

$$NCF_{t+1} = (E_{t+1} - E_t)\sum_{j=0}^{\infty}\rho^j \Delta d_{t+1+j} \quad \text{(OA.7)}$$

$$NDR_{t+1} = (E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r_{t+1+j} \quad \text{(OA.8)}$$

where ρ is the log-linear discount factor. In ICAPM terms, a risk-averse investor is more concerned about NCF than NDR. This is because NCF has a permanent wealth effect, while NDR has a wealth effect and an offsetting investment opportunities effect. Positive (negative) NDR decreases (increases) wealth today but promises better (worse) future investment opportunities, because less (more) needs to be saved today to earn a dollar in the future. In contrast, negative (positive) NCF decreases (increases) the value of wealth permanently without a corresponding offsetting change in the investment opportunities.

Based on the return decomposition of equation (OA.6), Campbell (1993) derives a two-factor discrete-time ICAPM version. Campbell and Vuolteenaho (2004) extend Campbell (1993)'s ICAPM and re-formulate it in a beta form:

$$E_t[r_{i,t+1}] - r_{f,t+1} + \sigma^2_{i,t}/2 = \sigma^2_{M,t}\beta^{DR}_{i,t} + \gamma\sigma^2_{M,t}\beta^{CF}_{i,t} \qquad \text{(OA.9)}$$

where $\sigma^2_{i,t}/2$ adjusts for Jensen's Inequality, $\sigma^2_{i,t}$ is the return variance of test asset i, $\sigma^2_{M,t}$ is the market return variance, γ is the coefficient of relative risk aversion, and $\beta^{DR}_{i,t}$ and $\beta^{CF}_{i,t}$ are the discount rate and cash flow beta for the $i - th$ test asset, respectively. The discount rate and cash flow betas are defined as follows:[2]

$$\beta^{DR}_{i,t} \equiv \frac{Cov_t(r_{i,t+1}, -NDR_{t+1})}{Var_t(r^e_{M,t+1} - E_t[r^e_{M,t+1}])} \qquad \text{(OA.10)}$$

$$\beta^{CF}_{i,t} \equiv \frac{Cov_t(r_{i,t+1}, NCF_{t+1})}{Var_t(r^e_{M,t+1} - E_t[r^e_{M,t+1}])} \qquad \text{(OA.11)}$$

is the cash flow beta. To follow convention in the related literature, we define the discount rate beta as the covariance of an asset's return with the negative of NDR, i.e., "good" discount rate news. Equation (OA.9) states that the risk price of the cash flow beta is γ times greater than the risk price of the discount rate beta. The discount rate beta premium is restricted to equal the variance of the market portfolio.

[2]Following standard practice (e.g., Dimson 1979; Lo and MacKinlay 1990; Kothari et al. 1995; Campbell and Vuolteenaho 2004), we estimate the discount rate and cash flow betas by adding one lag of each news component in the beta numerators:

$$\beta^{DR}_{i,t} \equiv \frac{Cov_t(r_{i,t+1}, -NDR_{t+1})}{Var_t(r^e_{M,t+1} - E_t[r^e_{M,t+1}])} + \frac{Cov_t(r_{i,t+1}, -NDR_t)}{Var_t(r^e_{M,t+1} - E_t[r^e_{M,t+1}])}$$

$$\beta^{CF}_{i,t} \equiv \frac{Cov_t(r_{i,t+1}, NCF_{t+1})}{Var_t(r^e_{M,t+1} - E_t[r^e_{M,t+1}])} + \frac{Cov_t(r_{i,t+1}, NCF_t)}{Var_t(r^e_{M,t+1} - E_t[r^e_{M,t+1}])}$$

This alleviates concerns related to infrequent and/or non-synchronous trading of stocks (Dimson 1979; Lo and MacKinlay 1990).

3.2 Estimating Cash Flow and Discount Rate News

We obtain NDR and NCF following Campbell (1991). Data are generated by a set of state variables modeled as a first-order vector autoregressive [VAR(1)] process:

$$z_{t+1} = c + \Gamma z_t + u_{t+1} \quad \text{(OA.12)}$$

where z_t is the $(k \times 1)$ vector of the k state variables with the excess market return as its first element, c is the $(k \times 1)$ vector of intercepts, Γ is the $(k \times k)$ matrix of coefficients, and u_{t+1} is the $(k \times 1)$ vector of the i.i.d. disturbance terms. Based on equation (OA.12), we express NCF and NDR as a linear function of the disturbance terms:

$$NDR_{t+1} = e1'\lambda u_{t+1} \quad \text{(OA.13)}$$

$$NCF_{t+1} = (e1' + e1'\lambda)u_{t+1} \quad \text{(OA.14)}$$

where $e1$ is a vector with one as first element and zero in the remaining, $\lambda \equiv \rho\Gamma(I - \rho\Gamma)^{-1}$ maps the state variables shocks into the two market-wide news components, and ρ is the log-linearization discount factor [see equations (OA.7) and (OA.8)]. We set $\rho = 0.95$, implying a constant 5% annual average consumption-to-wealth ratio (Campbell 1993).

We employ a commonly-used VAR(1) (Campbell et al. 2010, 2013, 2018; Chin and Polk 2015) which includes the following state variables: excess log market return (r^e_M), smoothed price-to-earnings ratio (PE), term yield (TY), small stocks value spread (VS) and default spread (DEF). We choose these variables because: (1) there is a fundamentals-against-price indicator, PE, which ensures the correct allocation of the disturbance terms, u_{t+1}, to NDR and NCF; and (2) they have been found to explain long-term variation in market returns (Campbell and Vuolteenaho 2004; Campbell et al. 2010, 2013). We discuss the criticism of the VAR-based aggregate return decomposition, and how we address its implications on our inferences in Section 5.3.

We collect the state variables from January 1929 to June 2013. $r^e_{M,t}$ is the log value-weighted stock market return in excess of the log one-month Treasury bill rate (r_f), obtained from CRSP. PE is the log-transformed ratio of the S&P 500 price over the ten-year moving average of the aggregate S&P 500 earnings, both obtained from Professor Robert J. Shiller's webpage.[3] TY is the difference between the log-yield on the ten-year Treasury bond, obtained from Professor Robert J. Shiller's webpage, and the three-month Treasury bill from CRSP. VS is the spread between the log-BE/ME of the small value portfolio and the log-BE/ME of the small growth portfolio at the end of June t. For the remaining months, VS is constructed by adding the cumulative log returns of the small growth portfolio and subtracting the cumulative log returns of the small value portfolio realized over the last year (Campbell and Vuolteenaho 2004). To construct VS, we obtain data from Professor Kenneth R. French's webpage.[4] Finally, DEF is the difference between the log-yields on Moody's BAA and AAA corporate bonds, both obtained from the Federal Reserve Bank of St. Louis (FRED).

[Insert Table OA1 here.]

Table OA1 shows the VAR-based coefficients, Newey-West t-statistics in parentheses, adjusted R^2 and F-statistics. We observe that the PE is a significant predictor and increases in PE forecast lower excess market returns. That ensures the validity of the VAR-based decomposition; with high prices relative to fundamentals, returns tend to be low subsequently and *vice-versa*. R_M^e positively predicts returns consistent with a short-term return momentum effect. VS is negative and significant return predictor. However, TY (positive coefficient) and DEF (negative coefficient) are insignificant. The statistics may be affected by the multicollinearity among the persistent state variables (e.g., VS–DEF correlation: 0.68). However in the return-prediction regression all five state variables are jointly significant, which suffices for the estimation of the NCF and the NDR (Campbell et al. 2010, 2013).

Using the VAR(1) disturbance terms, we construct the NDR and NCF time series [equations (OA.13) and (OA.14), respectively]. Figure OA1 shows the evolution of (the negative of) NDR and NCF across time.

[Insert Figure OA1 here.]

[3]See: http://www.econ.yale.edu/~shiller/data.htm.

[4]See: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

The NDR and NCF estimates are consistent with those reported by Campbell (1991) and Campbell and Vuolteenaho (2004). Specifically, the NDR series is more volatile than NCF, suggesting that, overall, NDR dominates the time variation of returns. Also the two news series are uncorrelated (0.02; insignificant) and hence, they capture separate sources of risk.

4 The Bootstrap Simulation

The cash flow and discount rate betas are not time-series regression coefficients. To obtain standard errors, also accounting for the inherent NCF –NDR estimation bias, we use a bootstrap simulation approach under the assumption that the VAR is not misspecified (Berkowitz and Kilian 2000). We employ Runkle (1987)'s approach and we follow the steps:

1. Estimate the VAR(1) given in equation (OA.12) and save the coefficient matrix, Γ, as well as the residuals matrix, υ_{t+1}; where t takes values from 1 to $1,014$.

2. Draw with replacement a sample, ${\upsilon_{t+1}}^{\star}$, from the estimated residuals in step 1. The new and the original samples have the same size. We partition ${\upsilon_{t+1}}^{\star}$ with the test portfolios returns in two groups; January 1929 to June 1976; and July 1976 to June 2013. This ensures that the simulated data are observable during our sample period (Campbell and Vuolteenaho 2004).

3. Recursively estimate the new state variables series, ${z_{t+1}}^{\star}$, by adding the product ${z_t}^{\star}\times\Gamma$ with ${\upsilon_{t+1}}^{\star}$ from step 2. To initialise the process we use the December 1928 values.

4. Repeat steps 1 to 3 a total of $2,500$ times.

We use the 2,500 bootstrap samples to obtain new NCF and NDR estimates by repeating the estimation approach described in Subsection 3.2 of the paper. Then, we compute 2,500 cash flow and discount rate betas for the ICAPM along with the $H-N$ differences. The standard deviation of the series of betas and beta differences are the standard errors, and these are used in computing the t-statistics in Table 3 of the paper. Finally, we estimate the pricing models and, in turn, the corresponding CPE metrics.[5] As in Campbell and

[5]For the FF model, we partition its risk factors with ${\upsilon_{t+1}}^{\star}$ as in step 2.

Vuolteenaho (2004), for each model in consideration, the 5^{th} percentile value of the $2,500$ CPE realizations is the critical value to reject the zero pricing errors hypothesis. The 5% critical values are reported in Panel B of Table 4 in the paper and robustness Tables OA10 and OA7 here.

5 Robustness Checks

We perform a number of exercises to examine the robustness of our results. Full details are reported in this section.

5.1 Missing R&D Analysis

Koh and Reeb (2015) examine COMPUSTAT-covered firms for which the R&D figures are missing. They uncover that some of the blank R&D firms file for patents and hence, Koh and Reeb (2015) argue, there is an R&D engagement that is "hidden". However, there is literature supporting that patent-filing is not strongly linked to R&D productivity (e.g., Mansfield 1986). Relatedly, Hall et al. (2014)'s survey of economic literature suggests that most innovative firms do avoid patents, relying instead on lead-time and secrecy to protect R&D outcomes. Collectively, the studies above suggest that there is a proportion of pseudo-blank R&D firms in COMPUSTAT. Patenting activity is a way to tease these firms out, but it is not a clear-cut one. Using patents may systematically flag the low innovative firms (low R&D and R&D growth), while it may disregard the truly innovative firms (high R&D and R&D growth).

The missing R&D cases are important to our analysis because they affect the portfolio compositions. The pseudo-blank R&D firms end-up in the No-$Excess^{DUR}$ portfolios affecting our stylized results on excess R&D duration, returns and discount rate betas. However, this miss-classification goes against our findings; it allocates seemingly similar firms to different portfolios which we then compare. So, missing R&D cases that are included in our No-$Excess^{DUR}$ portfolios downwardly bias the differences on excess R&D duration, returns and discount rate betas.

A potential way to improve our results is to create a portfolio of pseudo-blank R&D firms based on firms that have patents but do not report R&D. But patents may systematically bias the firms we are picking and/or missing. In that case, we are unsure of the way with which this bias is affecting our results.

To track the way Koh and Reeb (2015)'s missing R&D problem affects our results, we keep the same classification approach and provide statistics that help us assessing the pervasiveness of the bias. That is, we have estimated the number of years firms were reporting missing R&D expenditure before switching to reporting R&D expenditure. The table also shows the proportion those firm-yeas represent in terms of our COMPUSTAT sample of 98,413 firm-years from 1975 to 2011.

[Insert Table OA2 here.]

Table OA2 shows that from 1975 to 2011 there are 4,242 "suspicious" firm-years of our sample that firms were reporting missing R&D before switching to reporting R&D (zero and positive expenditure). That represents 4.31% of our final COMPUSTAT sample. However, there are only 2,859 "truly" suspicious firm-years that firms were reporting missing R&D before switching to reporting positive R&D expenditure (2.91% of our final sample). Assuming that pseudo-blank firms will eventually report their R&D, Table OA2 suggests that the potentially pseudo-blank firm-years are not enough to significantly weaken our main results.

5.2 Financial Constraints

Li (2011) argues that financial constraints prevent firms from raising the required funds to ensure the continuation of R&D projects, leading to premature project suspension, delaying the resolution of technical uncertainty and hence increasing expected returns. The role of uncertainly resolution in expected returns is relevant in both our explanation and in Li (2011)'s arguments. Therefore, it is possible that the higher risk of High-$Excess^{DUR}$ portfolios may be driven by financial constraints.

To investigate the extent to which financial constraints affect our findings, we examine whether our High-$Excess^{DUR}$ portfolios are more constrained than No-$Excess^{DUR}$ portfolios. We also examine the proportion of firm-years classified as financially constrained within each test portfolio. Our empirical proxy of financial constraints is based on the Hadlock and Pierce

(2010) index (HPI). The HPI score is a function of size and age; financial constraints decrease sharply as small and young firms start to grow and mature. We calculate the HPI score as: $HPI = -(0.737 \times Size) + (0.043 \times Size^2) - (0.040 \times Age)$; where $Size$ is the log inflation-adjusted total assets;[6] and Age is the number of years the firm is listed with a non-missing stock price on COMPUSTAT.[7] We follow Hadlock and Pierce (2010) and winsorize (the log of) $Size$ at \$4.5 billion and Age at 37 years.

[Insert Table OA3 here.]

We first estimate the HPI score for each firm-year. Then, we estimate the annual value weighted averages for the firms in each portfolio, using the portfolio weights. Table OA3 Panel A (Panel B) reports the sample means (medians) of the 37 annual HPI values of each test portfolio. The larger the HPI value, the more financially constrained a test portfolio. We observe negligible variation in the HPI scores across our test portfolios; mean and median HPI values do not change substantially from No-$Excess^{DUR}$ to High-$Excess^{DUR}$ portfolios. Table OA3 Panel B reports the proportion of firm-years in each portfolio that are classified as financially constrained based on their HPI score at $t-1$. Following convention, firm-year observations above the 70^{th} percentile are characterised as financially constrained (see Farre-Mensa and Ljungqvist 2016, and references therein). The results of this exercise suggest that the proportion of firm-years classified as constrained is larger among the Small and High-$Excess^{DUR}$ portfolios. However, the firm-level effect in Panel B appears to be diversified at the portfolio-level, as indicated by Panels A and B.

Table OA3 suggests that the HPI approximates relatively high financial stress on small-size High-$Excess^{DUR}$ young portfolios. The ability of widely-used proxies of financial constraints to identify firms facing difficulties in raising external funding have been questioned recently. Farre-Mensa and Ljungqvist (2016) demonstrate that firms that are classified as financially constrained actually have ready access to both the equity market and bank lending. Additionally, Farre-Mensa and Ljungqvist (2016) find that firms classified as financially constrained tend to be smaller, younger, and less profitable, to have fewer tangible assets and

[6] Assets are inflation-adjusted in 2004 dollars with Consumer Price Index (CPI) data from FRED.
[7] Less than 1% of the initial firm-years is excluded due to missing price figures on COMPUSTAT.

lower leverage than "unconstrained" firms, but also to grow faster and invest more, particularly in R&D. That is, rather than identifying financial constraints, these measures appear to capture characteristics associated with the early stage in the firm's life cycle. Farre-Mensa and Ljungqvist (2016)'s findings call for caution in interpreting the empirical evidence in Li (2011).[8] It could be the case that the delay in the uncertainty resolution, that can be an indication of financial constraints based on Li (2011), may in fact reflect our small-size High-$Excess^{DUR}$.

5.3 Alternative VAR Specifications

So far, we have followed convention and used a VAR model, decomposing return news to discount rate news and treating cash flow news as the residual product. Chen and Zhao (2009) argue that this return decomposition approach has two caveats. First, they argue that the VAR-based decomposition results are sensitive to the decision to obtain discount rates directly and cash flows residually. Campbell et al. (2010) and Engsted et al. (2012) demonstrate that this argument is not valid. The return decomposition is a tautology that relies on the log-linearization of the (log) dividend yield (DY). If the DY, or a highly correlated price-defined variable, is in the VAR along with the same other state variables, it does not matter whether cash flows news or discount rate news are computed residually.

Following the related literature, we use the smoothed price-to-earnings ratio (PE) instead of the dividend yield. The swap is valid since the PE incorporates price and is highly correlated with the dividend yield and, moreover, it better predicts returns (Campbell and Vuolteenaho 2004; Campbell et al. 2010). To confirm that omitting DY did not affect our

[8]As in Li (2011), we also estimate the Lamont et al. (2001) version of the Kaplan-Zingales (1997) financial constraints index (KZ). It is not our principal choice, because we want to avoid selection bias and ensure the representativeness of our test portfolios, i.e., estimate the financial constraint characteristics with all, or at least most, underlying firms. With the KZ we lose many firm-years; KZ requires non-missing values for all annual COMPUSTAT items used in the calculation. Overall, the KZ estimation suggests excess duration is associated with lower financial constraints. Within each size and BE/ME subset, High-$Excess^{DUR}$ portfolios have lower KZ characteristics than No-$Excess^{DUR}$ portfolios. These results are inconsistent with Li (2011), but they are consistent with (Farre-Mensa and Ljungqvist 2016). Farre-Mensa and Ljungqvist (2016, pg. 279) report that KZ-coded constrained firms "...spend considerably less on R&D". Moreover, KZ "...stands out as an outlier" (Farre-Mensa and Ljungqvist 2016, pg. 277); its association with firm characteristics, such as R&D activity, is different than other financial constraints measures. Recall, we do not dismiss the financial constraints story; we highlight that our robustness checks and Li (2011)'s conclusions come from less than perfect measures of financial constraints.

inferences, we re-run the VAR(1) by including it, and not PE, along with the initial state variables (see section 3.2). Table OA4 shows the VAR(1) results with the DY. Consistent with the literature cited above, DY predicts market returns, albeit the regression has lower explanatory power than with the PE. The correlation between PE and DY is high (-0.91), suggesting that using PE instead of DY cannot have a substantial impact on the dynamics of discount rate news and cash flow news. Indeed, we observe that the discount rate and cash flow news extracted with the DY VAR are highly correlated to discount rate and cash flow news extracted with the PE VAR (0.89 and 0.81, respectively).

[Insert Table OA4 here.]

We further attempt to show that the patterns in our portfolio betas persist even by reversing the estimation to directly estimating cash flow news and treating discount rate news as the residual terms. Following Botshekan et al. (2012), we define an additional VAR(1) which includes the log dividend growth (GD) and the excess market return (r_M^e) and directly obtaining cash flows as: $NCF^{dir} = e1\Gamma^{dir}[I - \rho\Gamma^{dir}]^{-1}u_{t+1}$, where $e1$ is a vector with one as first element and zero as second, I is the identity vector, Γ^{dir} is the square matrix of coefficients and u_{t+1}^{dir} is the vector of residuals. Then, we back out the discount rate (NDR^{res}) by subtracting NCF^{dir} from the unexpected market return of the initial VAR(1), reported in Table OA1.

[Insert Table OA5 here.]

Table OA5 reports the results of the additional VAR(1) showing that GD is highly persistent (first column), while r_M^e exhibits short-term momentum (second column). With Table OA5's VAR(1), we estimate: NCF^{dir} and NDR^{res}. The untabulated correlation between NCF^{dir} and the initially backed-out cash flow news is mediocre (0.062), probably because the additional VAR(1) has relatively the low power (Botshekan et al. 2012). However, the correlation between the NDR^{res} and the directly-estimated discount rate news is high (0.76), suggesting that discount rate news are estimated robustly.

[Insert Table OA6 here.]

Using NCF^{dir} and NDR^{res} in obtaining the 18 portfolio betas suggests that our initial beta inferences are robust. Table OA6 re-produces the same pattern in the discount rate betas, in that betas increase across the excess duration dimension. Although directly-estimated, cash flow betas still do not resemble any excess duration effect. That is, the High-$Excess^{DUR}$ minus No-$Excess^{DUR}$ differences on NCF^{dir} beta are all insignificant. The direct and indirect estimations of cash flow and discount rate news, respectively, underscore the link between our excess duration measure and discount rate risk.

Chen and Zhao (2009) also argue that the VAR-based return decomposition is sensitive to the choice of state variables. This concern is alleviated by the inclusion of the dividend yield, or a highly correlated price-defined variable. However, the choice of the other state variables may also have an effect on the decomposition. We use the state variables the have been identified by prior research to have return predictability. This initial set of state variables allocates 79% of the return news variation to discount rate news. Expanding the set of state variables in a way that improves the VAR's return predictability, will increase the dominance of discount rate news. In practice however, expanding the set of state variables is a highly subjective of choosing additional variables, raising over-fitting concerns.

5.4 Additional Benchmark Models and Specifications

To test ICAPM's relative ability in capturing the excess duration effect on returns, we also consider additional benchmark models. Moreover, we test the performance of all models by imposing the Black (1972) zero beta rate constraint. An asset pricing model must imply a risk free rate which is identical to the observed risk free rate, i.e., fit the equity premium. This is captured by the constant in the Fama and MacBeth (1973) cross-sectional regression, which must be zero. We now specify regressions without constants for every model, testing whether they produce qualitatively results with the free-constant versions. Finally, we also consider additional evaluation metrics, namely, the Campbell and Vuolteenaho (2004) composite pricing error (CPE), the average pricing error magnitude (PEM) and the Hansen and Jagannathan (1997) distance (HJ). Similar to the Fama and MacBeth (1973) *alpha* statistic, CPE assesses the null hypothesis of zero pricing errors.[9] The critical values for each CPE comes from the 5^{th} percentile of its bootstrap distribution. PEM is the square root of CPE and reflects the average magnitude of the Fama and MacBeth (1973) pricing errors. The HJ captures the maximum pricing error per unit of payoff norm.

Table OA7 presents the risk prices and the evaluation metrics for all asset pricing models under consideration. Apart from the main paper models (ICAPM, Two-Factor, FF), we also test the Carhart (1997) four-factor model (FF4); the Khan (2008) four factor model (Kahn-F4); and the Hou et al. (2015) Q-factor model (Q-FM). The first column for each model is the constrained constant specification while the second is the unconstraint. Table OA8 presents the hedge portfolio returns.

[Insert Table OA7 here.]

[Insert Table OA8 here.]

In terms of the main paper models, Tables OA7 and OA8 suggest that the ICAPM produces similar risk prices, evaluation metrics and hedge portfolio returns both without and with constant. Interestingly, the zero pricing error hypothesis cannot be rejected under the CPE in the no-constant ICAPM. The Two-Factor is unstable since its performance notably alters from the no-constant to constant specification. The FF is unstable as the variation captured by its factors in the no-constant specification is attributed to the constant in the free-constant specification. This is the unwelcoming result of having risk factors (SMB, HML) defined similarly to the test assets (recall, we also sort on size and BE/ME).

In terms of the additional benchmark models, Table OA7 suggests that incorporating the Carhart (1997) momentum factor in the FF model (i.e., FF4) improves the goodness of firm marginally. However, the momentum price of risk is statistically insignificant, and the model violates the null hypothesis of zero pricing errors. The FF4 model also indicates a statistically significant excess zero-beta rate and, hence, fails to fit the equity premium. The trading strategy in Table OA8 implies statistical significant abnormal returns within the subset of all Small firms and the Big/Growth firms.

[9] CPE weights test-assets based on the variances of their returns. That is, the higher the return variance of an asset, the lower its influence on the statistic.

The Khan (2008) four-factor model replaces the market factor in the FF model with the cash flow and discount rate news factors. Table OA7 suggests that the Khan (2008) four-factor model is rejected under both the alpha and the CPE statistics. The model fails in the estimation of the equity premium since it implies an unreasonably high excess zero-beta rate (the constant is 23.7% annually). The trading strategy results of Table OA8 also indicate that the model fails to explain the excess duration relation with returns as risk premium, implying profitable R&D-$Excess^{DUR}$ mispricing in Small firms.

The Hou et al. (2015) Q-Factor model expresses expected returns as a function of assets' betas relative to the market portfolio, a size factor, a profitability factor and an investment factor.[10] The Q-FM performs well. However, Tables OA7 and OA8 indicate that it has four shortcomings. The Q-FM does not explain the equity premium, since it indicates a statistically significant excess zero-beta rate. One of Q-FM's risk factors, namely profitability, is not relevant in the cross-section of our 18 test portfolios, with its price of risk being statistically insignificant under both zero-beta rate versions of the model. The Q-FM is rejected because it violates the zero pricing errors hypothesis under both the *alpha* and the CPE test criteria. Finally, the trading strategy in Table OA7 implies statistically significant abnormal returns within the small-size subset.

We conclude with a comment. We do not seek to identify the best performing model, but instead we assess the performance of the ICAPM in explaining the relation between excess duration and returns relative to other benchmark models. To that end, the ICAPM needs to perform relatively well to support the connection of conservative R&D accounting with priced discount rate risk through duration. Through that lens, our comparative analysis suggests that the ICAPM has relatively good pricing ability and supports our risk-based explanation.

[10]Each quarter, the profitability factor is defined as the return on a portfolio of firms that have high return on (one-quarter-lagged) book value of equity over the return of a portfolio of firms that have low return on (one-quarter-lagged) book value of equity. The investment factor is defined as the return on a portfolio of low investment firms (small change in assets, scaled by one-year-lagged assets) over the return of a portfolio of high investment firms (large change in assets, scaled by one-year-lagged assets). Unlike the FF factors, Q-FM's size, profitability and investment factors are rebalanced monthly.

5.5 Further Robustness Tests

5.5.1 Quarterly Observations

By sampling data at monthly frequency there is still a risk that stale prices bias our beta estimates, even-though we include the coefficients on one-month lags of market news in the numerators of our betas as Campbell and Vuolteenaho (2004). An alternative is to use lower frequency observations (e.g., Kothari et al. 1995, and references therein). Under this alternative, we no longer need to add lags of market-wide news to estimate the betas.

[Insert Table OA9 here.]

[Insert Table OA10 here.]

[Insert Table OA11 here.]

Table OA9 tabulates the discount rate and cash flow betas obtained from quarterly observations. Table OA9's betas are consistent with the monthly betas in that the discount rate betas are higher for High-$Excess^{DUR}$ portfolios as opposed to No-$Excess^{DUR}$ portfolios, while there is no variation in cash flow betas. The magnitudes of the portfolio betas are smaller, sign that risk is lower as the investment horizon elongates. Reassuringly for the robustness of our inferences, the magnitudes of the High-minus-No-$Excess^{DUR}$ differences are similar. Table OA10 shows the prices of risk and the evaluation metrics for any given model, when models are estimated using quarterly-sampled observations. Table OA11 shows the corresponding hedge portfolio annualized abnormal returns. All point estimates are comparable to those reported in our main analysis. Sampling frequency does not appear to affect our main inferences.

5.5.2 Alternative Breakpoints and Portfolio Definitions

We consider two alternative sets of R&D excess duration breakpoints in forming our test portfolios, using as cutoff points (i) the 30^{th} and the 70^{th} NYSE percentiles; and (ii) the 40^{th} and 60^{th} NYSE percentiles. We discuss results for alternative (i) in this section. Using alternative (ii) produces identical results.

We define 24 value-weighted test portfolios, constructed as the intersection of two size, three BE/ME and four R&D excess duration portfolios. The size and BE/ME classifications are those used in our main empirical analysis. We then assign firm-years with missing R&D expenditures to the No-$Excess^{DUR}$ portfolio. Firm-years with R&D excess duration below the 30^{th} NYSE percentile are assigned to the Low-$Excess^{DUR}$ portfolio; firm-years with R&D excess duration between the 30^{th} and 70^{th} NYSE percentiles are assigned to the Medium-$Excess^{DUR}$ portfolio; and the remaining firm-years are assigned to the High-$Excess^{DUR}$ portfolio. Using these alternative breakpoints there are some months when the Big/Value portfolios are thinly populated (less than nine firms). This may undermine the benefits of diversification by introducing idiosyncratic noise in the results of this exercise.

[Insert Table OA12 here.]

Table OA12 presents the annual excess returns on the 24 portfolios (Panel A); and the differences in discount rate and cash betas between the High-$Excess^{DUR}$ and the No-$Excess^{DUR}$ portfolios within each size and BE/ME subset (Panel B). The findings are qualitatively similar to those discussed in our main empirical analysis. Panel A confirms the positive relation between excess duration and future returns, especially among Small stocks. In the case of the Small stocks subset, we observe statistically significant increasing returns along the excess duration dimension within each BE/ME subset. Panel B confirms that excess duration stocks have higher discount rate betas than No-$Excess^{DUR}$ stocks. Panel B re-affirms the lack of an excess duration effect on cash flow betas. The differences between cash flow betas and discount rate betas are also similar in magnitude and statistical significance to those reported in Table 4 in the paper.

6 Proofs: Excess Duration and R&D Investment

In this section, we show full workings for obtaining the formulas of excess duration provided in Appendix A of the main paper. The equation numbers in this section refer all to the equation numbers in the main paper.

6.1 Equation (A8)

Using $Ex\widehat{ce}ss^{CF}_{t+s} = \widehat{CF}_{t+s} - \widehat{CF}^{pseudo}_{t+s}$, we can write pseudo duration as follows:

$$
\begin{aligned}
DUR^{pseudo}_t &= \frac{1}{ME_t}\sum_{s=1}^{T}\frac{s\widehat{CF}^{pseudo}_{t+s}}{(1+r)^s} + \left(T+\frac{1+r}{r}\right)\left(1-\frac{1}{ME_t}\sum_{s=1}^{T}\frac{\widehat{CF}^{pseudo}_{t+s}}{(1+r)^s}\right) \\
&= \frac{1}{ME_t}\sum_{s=1}^{T}\frac{s(\widehat{CF}_{t+s} - Ex\widehat{ce}ss^{CF}_{t+s})}{(1+r)^s} + \left(T+\frac{1+r}{r}\right)\left(1-\frac{1}{ME_t}\sum_{s=1}^{T}\frac{\widehat{CF}_{t+s} - Ex\widehat{ce}ss^{CF}_{t+s}}{(1+r)^s}\right) \\
&= \frac{1}{ME_t}\sum_{s=1}^{T}\frac{s\widehat{CF}_{t+s}}{(1+r)^s} - \frac{1}{ME_t}\sum_{s=1}^{T}\frac{sEx\widehat{ce}ss^{CF}_{t+s}}{(1+r)^s} \\
&\quad + \left(T+\frac{1+r}{r}\right)\left(1-\frac{1}{ME_t}\sum_{s=1}^{T}\frac{\widehat{CF}_{t+s}}{(1+r)^s}\right) + \left(T+\frac{1+r}{r}\right)\frac{1}{ME_t}\sum_{s=1}^{T}\frac{Ex\widehat{ce}ss^{CF}_{t+s}}{(1+r)^s} \\
&= DUR_t - \frac{1}{ME_t}\sum_{s=1}^{T}\frac{Ex\widehat{ce}ss^{CF}_{t+s}}{(1+r)^s}(s-T-\frac{1+r}{r})
\end{aligned}
$$

Hence:

$$
Excess^{DUR}_t = \frac{1}{ME_t}\sum_{s=1}^{T}\frac{Ex\widehat{ce}ss^{CF}_{t+s}}{(1+r)^s}(s-T-\frac{1+r}{r})
$$

6.2 Equation (A9)

Substituting equation (A7) into equation (A8) we have:

$$
\begin{aligned}
Excess^{DUR}_t &= \frac{1}{ME_t}\sum_{s=1}^{T}\frac{Ex\widehat{ce}ss^{CF}_{t+s}}{(1+r)^s}(s+T+\frac{1+r}{r}) \\
&= \frac{1}{ME_t}\sum_{s=1}^{T}\frac{\phi^s Excess^{ROE}_t(\widehat{BE}_{t+s}+\widehat{RDA}_{t+s}) - \widehat{RDA}_{t+s}\left[\widehat{G}_{t+s}-\widehat{ROE}_{t+s}\right]}{(1+r)^s}(s-T-\frac{1+r}{r})
\end{aligned}
$$

We define $a_s = \frac{(1+\widehat{G}_{t+1})\dots(1+\widehat{G}_{t+s-1})}{(1+r)^s}(s - T - \frac{1+r}{r})$ and hence:

$$
\begin{aligned}
Excess_t^{DUR} &= \frac{1}{ME_t}\sum_{s=1}^{T}[a_s\phi^s Excess_t^{ROE}(BE_t + RDA_t) \\
&\qquad - a_s RDA_t(\mu_G(1-\phi_G^s) + \phi_G^s G'_t - \mu(1-\phi^s) - \phi^s ROE_t)] \\
&= \frac{1}{ME_t}\sum_{s=1}^{T}[a_s\phi^s \frac{RDA_{t-1}}{BE_{t-1} + RDA_{t-1}}\left[ROE_t - RDG_t\right](BE_t + RDA_t) \\
&\qquad - a_s RDA_t(\mu_G(1-\phi_G^s) + \phi_G^s G'_t - \mu(1-\phi^s) - \phi^s ROE_t)] \\
&= \frac{1}{ME_t}\sum_{s=1}^{T}[a_s\phi^s \frac{RDA_t}{BE_t\frac{1+RDG_t}{1+G_t} + RDA_t}\left[ROE_t - RDG_t\right](BE_t + RDA_t) \\
&\qquad - a_s RDA_t(\mu_G(1-\phi_G^s) + \phi_G^s G'_t - \mu(1-\phi^s) - \phi^s ROE_t)] \\
&= \frac{RDA_t(BE_t + RDA_t)}{ME_t}\frac{ROE_t - RDG_t}{BE_t\frac{1+RDG_t}{1+G_t} + RDA_t}\sum_{s=1}^{T} a_s\phi^s \\
&\qquad - \frac{RDA_t}{ME_t}\sum_{s=1}^{T}[a_s(\mu_G(1-\phi_G^s) + \phi_G^s G'_t - \mu(1-\phi^s) - \phi^s ROE_t)]
\end{aligned}
$$

6.3 Equation (A10)

We take the partial derivative of excess duration with respect to the growth in the R&D asset:

$$
\begin{aligned}
\frac{\partial Excess_t^{DUR}}{\partial RDG_t} &= \frac{RDA_t(BE_t+RDA_t)}{ME_t}\Bigg[\frac{\partial}{\partial RDG_t}\frac{ROE_t}{BE_t\frac{1+RDG_t}{1+G_t}+RDA_t} \\
&\quad -\frac{\partial}{\partial RDG_t}\frac{RDG_t}{BE_t\frac{1+RDG_t}{1+G_t}+RDA_t}\Bigg]\sum_{s=1}^{T}a_s\phi^s \\
&= \frac{RDA_t(BE_t+RDA_t)}{ME_t}\Bigg[\frac{0-\frac{BE_t}{1+G_t}ROE_t}{\left(BE_t\frac{1+RDG_t}{1+G_t}+RDA_t\right)^2} \\
&\quad -\frac{1\times\left(BE_t\frac{1+RDG_t}{1+G_t}+RDA_t\right)-\frac{BE_t}{1+G_t}RDG_t}{\left(BE_t\frac{1+RDG_t}{1+G_t}+RDA_t\right)^2}\Bigg]\sum_{s=1}^{T}a_s\phi^s \\
&= \frac{RDA_t(BE_t+RDA_t)}{ME_t}\frac{-\frac{BE_t}{1+G_t}ROE_t-\frac{BE_t}{1+G_t}-\frac{BE_t}{1+G_t}RDG_t-RDA_t+\frac{BE_t}{1+G_t}RDG_t}{\left(BE_t\frac{1+RDG_t}{1+G_t}+RDA_t\right)^2}\sum_{s=1}^{T}a_s\phi^s \\
&= \frac{RDA_t(BE_t+RDA_t)}{ME_t}\frac{-\frac{BE_t}{1+G_t}ROE_t-\frac{BE_t}{1+G_t}-RDA_t}{\left(BE_t\frac{1+RDG_t}{1+G_t}+RDA_t\right)^2}\sum_{s=1}^{T}a_s\phi^s \\
&= -\frac{RDA_t(BE_t+RDA_t)}{ME_t}\frac{\frac{BE_t}{1+G_t}(1+ROE_t)+RDA_t}{\left(BE_t\frac{1+RDG_t}{1+G_t}+RDA_t\right)^2}\sum_{s=1}^{T}a_s\phi^s
\end{aligned}
$$

We know that: $a_s < 0$. For $ME_t > 0$, $\phi > 0$, $RDA_t > 0$, and $BE_t > 0$, excess duration increases with RDG_t when $ROE_t > -1$.

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Figure OA1: Evolution of cash flow and negative of discount rate news

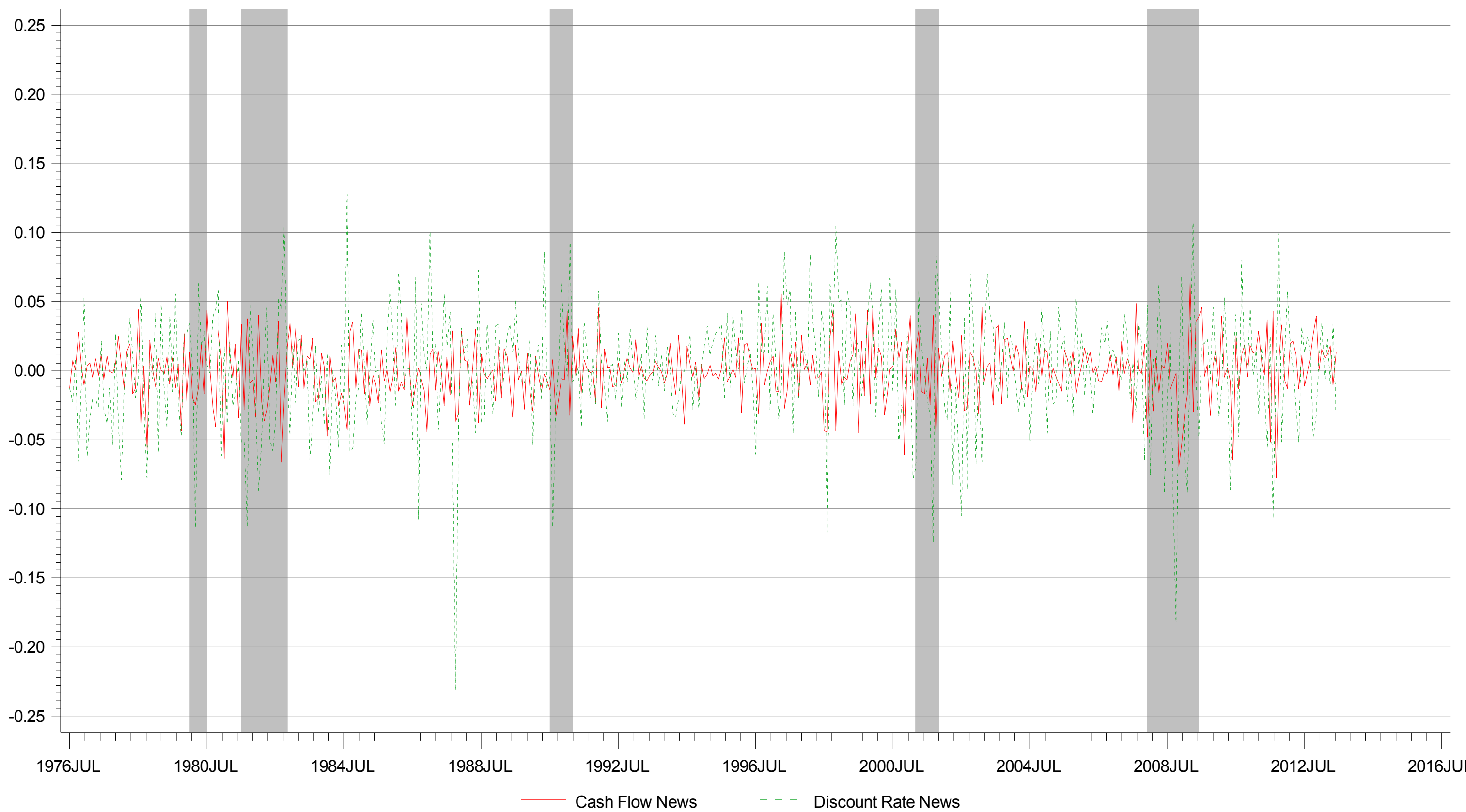

Figure OA1 shows the evolution of NCF (red line) and negative of NDR (green line) across time. The grey shaded area corresponds to NBER recessions. The sample spans the period July 1976 to June 2013.

Table OA1: State variables' VAR(1) model

	$\mathbf{r^e_{M,t+1}}$	$\mathbf{PE_{t+1}}$	$\mathbf{TY_{t+1}}$	$\mathbf{VS_{t+1}}$	$\mathbf{DEF_{t+1}}$
c	0.071***	0.027**	0.008	0.040	0.021
	(3.36)	(2.19)	(0.05)	(1.19)	(0.42)
$\mathbf{r^e_{M,t}}$	0.105**	0.514***	−0.214	−0.074	−1.082***
	(1.98)	(13.66)	(−0.79)	(−1.51)	(−5.15)
$\mathbf{PE_t}$	−0.021***	0.991***	0.008	−0.008	−0.001
	(−3.31)	(281.78)	(0.18)	(−0.82)	(−0.08)
$\mathbf{TY_t}$	0.002	0.001	0.936***	−0.002	0.001
	(1.33)	(0.84)	(58.35)	(−0.70)	(0.11)
$\mathbf{VS_t}$	−0.014*	−0.010**	−0.007	0.964***	0.046**
	(−1.63)	(−2.11)	(−0.16)	(76.16)	(2.03)
$\mathbf{DEF_t}$	−0.001	0.004	0.067***	0.012	0.954***
	(−0.08)	(0.85)	(2.58)	(1.32)	(36.31)
Adj. $\mathbf{R^2}$	2.27%	99.08%	90.66%	96.48%	96.03%
F	5.71***	21,736.20***	1,967.36***	5,546.55***	4,905.60***

Table OA1 reports results from the state variables' VAR(1): $z_{t+1} = c + \Gamma z_t + \upsilon_{t+1}$ where z_t is the $k \times 1$ vector of state variables at time $t(k = 1, 2, 3, 4, 5)$, c is the $k \times 1$ vector of constants, Γ is the $k \times k$ matrix of slope coefficients and υ_{t+1} is the $k \times 1$ vector of residuals. Estimated coefficients, Newey-West t-statistics in parentheses, adjusted R^2 and F-statistic are reported. The t-statistic tests the null hypothesis of a zero coefficient and the F-statistic tests the null hypothesis that the coefficients for any given equation within the VAR(1) are jointly equal to zero. One, two and three asterisks denote rejection of the null hypothesis at a 10%, 5% and 1% level, respectively. The sample spans the period from January 1929 to June 2013 (1,014 monthly observations).

Table OA2: Missing R&D examination

	Number of suspicious (in firm-years)	Proportion in COMPUSTAT from 1975 to 2011
Missing to record zero or positive R&D expense	4,243	4.31%
Missing to record positive only R&D expense	2,859	2.91%

Table OA2 reports the number of years firms were reporting missing R&D expenditure before switching to report any (top) or just positive (bottom) R&D expenditure. The table also shows the proportion those firm-yeas represent in terms of our COMPUSTAT sample of 98,413 firm-years from 1975 to 2011.

Table OA3: Financial constraints for the test portfolios

	Size=Small			Size=Big		
	BE/ME			BE/ME		
	G *(Growth)*	M	V *(Value)*	G *(Growth)*	M	V *(Value)*
R&D Excess Duration						
Panel A: Portfolio-level average financial constraints						
N ***(No-***$Excess^{DUR}$***)***	−3.53	−3.87	−3.94	−4.13	−4.17	−4.27
L ***(Low-***$Excess^{DUR}$***)***	−3.52	−3.92	−3.94	−4.27	−4.30	−4.29
H ***(High-***$Excess^{DUR}$***)***	−3.36	−3.74	−3.83	−4.18	−4.27	−4.26
H - N	0.16	0.13	0.10	-0.06^{*}	-0.10^{***}	0.01
	(0.76)	(0.39)	(0.30)	(−1.66)	(−3.70)	(0.66)
Panel B: Portfolio-level median financial constraints						
N ***(No-***$Excess^{DUR}$***)***	−3.55	−3.84	−3.94	−4.16	−4.18	−4.29
L ***(Low-***$Excess^{DUR}$***)***	−3.55	−3.93	−3.93	−4.27	−4.31	−4.33
H ***(High-***$Excess^{DUR}$***)***	−3.38	−3.72	−3.82	−4.23	−4.30	−4.31
H - N	0.17	0.12	0.12	−0.07	−0.11	−0.02
Panel C: Proportion of constrained firm-years in the portfolios						
N ***(No-***$Excess^{DUR}$***)***	50.8%	28.0%	25.0%	4.6%	1.7%	1.5%
L ***(Low-***$Excess^{DUR}$***)***	53.9%	27.1%	22.0%	4.5%	2.2%	0.6%
H ***(High-***$Excess^{DUR}$***)***	63.4%	42.4%	35.1%	6.5%	1.3%	1.8%

Table OA3 shows the financial constraint characteristics of each size, BE/ME and R&D excess test portfolio. Financial constraints are estimated with the Handlock and Pierce (2010) index (HPI) as: $HPI = -(0.737 \times Size) + (0.043 \times Size^2) - (0.040 \times Age)$; where $Size$ is the log inflation-adjusted assets; and Age is the number of years the firm is listed with a non-missing stock price. $Size$ is capped at (the log of) \$4.5 billion, and Age is capped at 37 years. Panel A (Panel B) reports the sample means (medians) of the 37 (1975 to 2011) annual values, where an annual value is the weighted average of the HPI values of the firms in each portfolio, using the portfolio weights. Panel C reports the percentage proportion of firm-years on each test portfolio classified as constrained. Every June of calendar year t firms are coded based on their HPI values in calendar year $t-1$. Firms in the top tercile are considered to be constrained. The sample spans the period from 1975 to June 2011 (37 fiscal years).

Table OA4: State variables' VAR(1) model

	$\mathbf{R^e_{M,t+1}}$	$\mathbf{DY_{t+1}}$	$\mathbf{TY_{t+1}}$	$\mathbf{VS_{t+1}}$	$\mathbf{DEF_{t+1}}$
c	0.041***	−0.019*	−0.020	0.060*	0.015
	(2.63)	(−1.66)	(−0.17)	(1.93)	(0.35)
$\mathbf{R^e_{M,t}}$	0.108**	−0.517***	−0.215	−0.073	0.015
	(2.02)	(−12.81)	(−0.80)	(−1.48)	(0.35)
$\mathbf{DY_t}$	0.010***	0.994***	−0.014	0.012	−0.001
	(2.48)	(346.23)	(−0.48)	(1.58)	(−0.07)
$\mathbf{TY_t}$	0.003*	0.000	0.935***	−0.001	0.001
	(1.62)	(−0.29)	(59.43)	(−0.48)	(0.10)
$\mathbf{VS_t}$	−0.013	0.016***	0.000	0.959***	0.047
	(−1.44)	(2.72)	(−0.01)	(67.63)	(1.88)
$\mathbf{DEF_t}$	0.003	−0.012***	0.067**	0.013	0.954***
	(0.30)	(−2.62)	(2.35)	(1.42)	(36.01)
$\mathbf{Adj.\,R^2}$	1.64%	99.33%	90.66%	96.49%	96.03%
F	4.38**	30034.20***	1967.80***	5564.09***	4905.59***

Table OA4 reports results from an alternative VAR(1) that includes the log dividend yield (DY) instead of the smoothed price/earnings ratio (PE). The VAR(1) is modelled as: $z_{t+1} = c + \Gamma z_t + \upsilon_{t+1}$ where z_t is the $k \times 1$ vector of state variables at time $t(k = 1, 2, 3, 4, 5)$, c is the $k \times 1$ vector of constants, Γ is the $k \times k$ matrix of slope coefficients and υ_{t+1} is the $k \times 1$ vector of residuals. Estimated coefficients, Newey-West t-statistics in parentheses, adjusted R^2 and F-statistic are reported. The t-statistic tests the null hypothesis of a zero coefficient and the F-statistic tests the null hypothesis that the coefficients for any given equation within the VAR(1) are jointly equal to zero. One, two and three asterisks denote rejection of the null hypothesis at a 10%, 5% and 1% level, respectively. The sample spans the period from January 1929 to June 2013 (1,014 monthly observations).

Table OA5: Cash flow news VAR(1) model

	$\mathbf{GD_{t+1}}$	$\mathbf{r^e_{M,t+1}}$
c	0.000	0.003
	(1.36)	(1.53)
$\mathbf{GD_t}$	0.861**	0.136
	(2.02)	(0.57)
$\mathbf{r^e_{M,t}}$	0.003	0.111**
	(0.81)	(2.10)
$\mathbf{Adj. R^2}$	74.0%	1.1%
F	1,443.97***	6.71**

The table reports the estimated coefficients, t-statistics in parentheses, adjusted R^2 and F-statistic for a VAR(1) which is specified for estimating cash flow news directly. The VAR(1) includes log dividend growth (GD) and the excess log market return (r^e_M). We model the two state variable as: $z^{dir}_{t+1} = c + \Gamma^{dir} z^{dir}_t + u^{dir}_{t+1}$, where z^{dir}_t is the $(2x1)$ vector of state variables at time t, c is the $(2x1)$ vector of constants, Γ^{dir} is the $(2x2)$ matrix of slope coefficients and u^{dir}_{t+1}, is the $(2x1)$ vector of residuals. We estimate cash flows as: $NCF^{dir} = e1\Gamma^{dir}[I - \rho\Gamma^{dir}]^{-1}u_{t+1}$, where $e1$ is a vector with one as first element and zero as second element, I is the identity vector. The sample spans the period from January 1929 to June 2013 (1,014 monthly observations).

Table OA6: Robustness analysis for discount rate betas and cash flow betas

	Size=Small			Size=Big		
	BE/ME			BE/ME		
	G	**M**	**V**	**G**	**M**	**V**
	(Growth)		*(Value)*	*(Growth)*		*(Value)*
R&D Excess Duration						
Panel A: Discount rate beta (indirectly-estimated)						
N (***No***-$Excess^{DUR}$)	1.396***	1.118***	1.161***	1.129***	0.945***	0.789***
	(4.48)	(4.86)	(4.60)	(4.81)	(5.05)	(1.78)
L (***Low***-$Excess^{DUR}$)	1.485***	1.170***	1.357***	1.008***	0.807***	1.084***
	(7.00)	(5.55)	(4.19)	(5.51)	(2.87)	(9.82)
H (***High***-$Excess^{DUR}$)	1.720***	1.527***	1.489***	1.174***	1.136***	1.058***
	(8.03)	(10.01)	(7.00)	(3.92)	(5.74)	(5.42)
H - N	0.324***	0.409***	0.328***	0.045	0.190***	0.269***
	(3.35)	(4.28)	(4.40)	(0.88)	(4.09)	(3.18)
Panel B: Cash flow beta (directly-estimated)						
N (***No***-$Excess^{DUR}$)	0.032***	0.028***	0.025***	0.023***	0.010***	0.018**
	(3.95)	(3.50)	(3.08)	(3.29)	(4.32)	(2.20)
L (***Low***-$Excess^{DUR}$)	0.004*	0.037***	0.060***	0.002	0.038***	0.013*
	(1.86)	(4.53)	(4.58)	(1.47)	(3.16)	(1.84)
H (***High***-$Excess^{DUR}$)	0.005***	0.017***	0.019***	0.015*	0.020**	0.018*
	(2.87)	(2.14)	(2.36)	(1.90)	(1.97)	(1.76)
H - N	−0.027	−0.010	−0.006	−0.008	0.010	0.000
	(−0.64)	(−0.30)	(−0.47)	(−0.33)	(0.44)	(0.00)

For each of the 18 portfolios, the table reports the discount rate betas obtained with indirectly-estimated discount rate news (Panel A); and the cash flow betas obtained with directly-estimated cash flow news (Panel B). The t-statistics in parentheses are based on bootstrap standard errors. The last row in each panel reports the difference in betas between High-$Excess^{DUR}$ and No-$Excess^{DUR}$ duration portfolios. One, two and three asterisks denote rejection of the null hypothesis of a zero beta (or a zero beta difference) at a 10%, 5% and 1% significance level. The sample spans the period from July 1976 to June 2011 (444 monthly observations).

Table OA7: The prices of discount rate risk and cash flow risk with the main and the additional benchmark models

	ICAPM		Two-Factor		FF		FF4		Khan-F4		Q-FM	
	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$
Panel A: Prices of risk												
c	0.000	0.002	0.000	0.008**	0.000	0.011***	0.000	0.011***	0.000	0.020***	0.000	0.011**
	-	(0.88)	-	(2.08)	-	(2.50)	-	(2.57)	-	(3.53)	-	(2.19)
	[0.0%]	[2.6%]	[0.0%]	[10.0%]	[0.0%]	[13.4%]	[0.0%]	[13.8%]	[0.0%]	[23.7%]	[0.0%]	[13.0%]
NDR	0.002	0.002	0.001	−0.012*					0.006	−0.030***		
	-	-	(0.16)	(−1.73)					(1.01)	(−2.67)		
	[2.5%]	[2.5%]	[0.8%]	[−14.9%]					[6.9%]	[−35.6%]		
NCF	0.034***	0.022*	0.042*	0.075***					0.004	0.059***		
	(2.60)	(1.74)	(1.65)	(2.71)					(0.16)	(2.22)		
	[40.3%]	[26.1%]	[50.3%]	[90.2%]					[4.6%]	[71.3%]		
$\mathbf{R^e_M}$					0.006***	−0.005	0.006***	−0.006			0.006***	−0.005
					(2.89)	(−0.92)	(2.65)	(−1.05)			(2.95)	(−0.84)
					[7.3%]	[−5.6%]	[7.1%]	[−6.6%]			[7.4%]	[−5.5%]
SMB					0.003	0.004**	0.002	0.004*	0.002	0.005***		
					(1.52)	(2.19)	(1.23)	(1.78)	(1.49)	(2.65)		
					[3.0%]	[4.9%]	[2.8%]	[4.4%]	[3.0%]	[5.9%]		
HML					0.003	0.002	0.003	0.002	0.003	0.002		
					(1.38)	(0.92)	(1.37)	(0.98)	(1.47)	(1.03)		
					[3.1%]	[2.1%]	[3.1%]	[2.2%]	[3.1%]	[2.2%]		
UMD							−0.004	−0.005				
							(−0.36)	(−0.45)				
							[4.4%]	[−5.6%]				
ME											0.003*	0.004*
											(1.75)	(1.91)
											[4.0%]	[4.4%]
I/A											0.003*	0.002
											(1.89)	(1.10)
											[3.5%]	[2.3%]
ROE											−0.002	−0.004
											(−0.52)	(−1.24)
											[−1.9%]	[−5.0%]

(continued on next page)

Table OA7: The prices of discount rate risk and cash flow risk with the main and the additional benchmark models *(continued from previous page)*

	ICAPM		Two-Factor		FF		FF4		Khan-F4		Q-FM	
	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$
Panel B: Evaluation metrics												
Adj. $\mathbf{R^2}$	20.9%	28.3%	16.5%	55.0%	45.2%	59.0%	41.9%	56.5%	43.3%	65.2%	54.7%	64.5%
alpha	46.35**	39.23**	46.24**	35.48**	39.62**	29.95**	39.27**	29.84**	38.06**	26.96**	31.97**	25.39**
	>27.59	>26.30	>26.30	>25.00	>25.00	>23.69	>23.69	>22.36	>23.69	>22.36	>23.69	>22.36
CPE	0.020	0.018**	0.022**	0.010	0.012**	0.008**	0.012**	0.007**	0.011**	0.007**	0.009**	0.007**
	<0.020	>0.013	>0.014	<0.011	>0.009	>0.006	>0.008	>0.005	>0.007	>0.005	>0.006	>0.005
PEM	0.146	0.135	0.147	0.100	0.108	0.087	0.108	0.086	0.106	0.082	0.096	0.081
HJ	0.055	0.047	0.055	0.030	0.034	0.025	0.034	0.025	0.032	0.020	0.026	0.020

Table OA7 presents the results from the second step of the Fama and MacBeth (1973) framework for the asset pricing models under consideration. R^e_M is the excess value-weighted market return. SMB and HML are the small-minus-big and high-minus-low size and BE/ME Fama-French (1993) factors. UMD is the Carhart (1997) momentum factor. I/A and ROE are the investment and profitability Hou et al. (2015) factors. The first column for any model restricts the zero-beta rate to equal the risk-free rate ($R_{rf} = R_{zb}$), i.e., the model is run without constant. The second column for any model allows $R_{rf} \neq R_{zb}$, i.e., the model is run with constant. Panel A tabulates the prices of risk; the Newey-West t-statistics, in parenthesis; and the annualized prices of risk, in square brackets. Panel B tabulates the $Adj. R^2$, *alpha*, *CPE*, *PEM*, and *HJ* evaluation metrics. One, two and three asterisks denote rejection of the null hypothesis at a 10%, 5% and 1% level, respectively. In the case of the t-statistic the null hypothesis is that the price of risk is equal to zero, while in the cases of *alpha* and CPE the null hypothesis is that the pricing errors are, on average, equal to zero. For *alpha* and CPE two asterisks denote rejection of the zero-pricing errors hypothesis since the statistic exceeds the 5% critical value shown below each statistic. The 5% critical value for *alpha* is obtained from the chi-squared distribution, while for CPE is obtained from a bootstrap distribution. The asset pricing models are estimated using monthly observations over the period from July 1976 to June 2013.

Table OA8: Hedge portfolios with the main and the additional benchmark models

	BE/ME	Hedge	ICAPM		Two-Factor		FF		FF4		Khan-F4		Q-FM	
Size		Portfolios	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$	$R_{rf} = R_{zb}$	$R_{rf} \neq R_{zb}$
	G	HP_1	−1.7%	−0.8%	−2.0%	−0.9%*	1.8%	1.7%*	1.8%	1.8%*	1.7%*	0.9%	0.8%*	0.3%
			(−0.75)	(−0.31)	(−0.74)	(−1.67)	(0.96)	(1.92)	(1.10)	(1.91)	(1.91)	(0.59)	(1.62)	(0.23)
Small	**M**	HP_2	−0.2%	0.9%	−0.5%	1.6%*	2.7%**	3.8%***	2.7%***	3.9%***	2.7%***	2.9%***	2.4%***	2.9%***
			(−0.13)	(0.57)	(−0.25)	(1.79)	(2.10)	(3.30)	(2.48)	(3.23)	(2.59)	(3.02)	(2.65)	(3.24)
	V	HP_3	−0.6%	0.3%	−0.7%	1.0%	1.4%	2.8%**	1.4%	2.7%**	1.4%	3.1%**	1.5%*	2.0%*
			(−0.39)	(0.17)	(−0.46)	(0.80)	(0.95)	(2.35)	(0.99)	(2.20)	(1.10)	(2.33)	(1.91)	(1.80)
	G	HP_4	2.2%	2.3%	2.2%	2.5%	3.5%**	3.0%*	3.4%**	2.8%*	3.4%**	2.5%*	3.3%**	1.8%
			(1.32)	(1.24)	(1.13)	(1.43)	(2.16)	(1.86)	(2.22)	(1.81)	(2.31)	(1.67)	(2.35)	(1.57)
Big	**M**	HP_5	−1.7%	−1.1%	−1.8%	−0.9%	−0.7%	1.0%	−0.8%	0.7%	−0.7%	0.8%	−0.8%	0.7%
			(−1.20)	(−0.77)	(−1.29)	(−0.71)	(−0.53)	(0.91)	(−0.73)	(0.68)	(−0.55)	(0.66)	(−0.59)	(0.54)
	V	HP_6	−3.9%***	−3.2%**	−4.1%**	−2.9%*	−2.6%	−0.3%	−2.8%*	−0.7%	−2.5%	−1.9%	−2.5%*	−0.5%
			(−2.53)	(−2.01)	(−2.21)	(−1.72)	(−1.34)	(−0.16)	(−1.70)	(−0.68)	(−1.53)	(−1.26)	(−1.65)	(−1.01)

Table OA8 shows annualized average abnormal returns, in percentages, and their Newey-West t-statistics, in parentheses, of the hedge portfolios under consideration. The risk-adjustment is from the model identified at the top of each column. We form six hedge portfolios (HP_1, HP_2, HP_3, HP_4, HP_5 and HP_6) by going long on the High-$Excess^{DUR}$ portfolios and short on the No-$Excess^{DUR}$ portfolios within each size and BE/ME bucket. Table 5, in the main body of the paper, contains the details of hedge portfolio formation. The sample spans the period from July 1976 to July 2013 (444 monthly observations).

Table OA9: Discount rate betas and cash flow betas using quarterly data

	Size=Small			Size=Big		
	BE/ME			BE/ME		
	G *(Growth)*	M	V *(Value)*	G *(Growth)*	M	V *(Value)*
R&D Excess Duration						
Panel A: Discount rate beta						
N ***(No-***$Excess^{DUR}$***)***	0.886***	0.714***	0.727***	0.840***	0.706***	0.572***
	(7.55)	(7.09)	(6.82)	(9.09)	(8.10)	(6.74)
L ***(Low-***$Excess^{DUR}$***)***	0.951***	0.724***	0.900***	0.816***	0.663***	0.737***
	(7.86)	(6.77)	(7.25)	(9.84)	(8.21)	(7.12)
H ***(High-***$Excess^{DUR}$***)***	1.120***	0.998***	1.056***	0.952***	0.834***	0.795***
	(7.94)	(7.98)	(8.32)	(9.53)	(8.52)	(8.34)
H - N	0.234***	0.284***	0.329***	0.112	0.128***	0.223***
	(3.51)	(5.19)	(7.33)	(1.58)	(2.82)	(4.88)
Panel B: Cash flow beta						
N ***(No-***$Excess^{DUR}$***)***	0.143***	0.112***	0.122***	0.078***	0.087***	0.066***
	(4.57)	(4.30)	(4.53)	(3.02)	(3.83)	(3.25)
L ***(Low-***$Excess^{DUR}$***)***	0.161***	0.133***	0.155***	0.044*	0.040*	0.050**
	(4.74)	(4.97)	(4.92)	(1.84)	(1.86)	(1.94)
H ***(High-***$Excess^{DUR}$***)***	0.192***	0.167***	0.193***	0.076***	0.087***	0.080***
	(4.80)	(4.93)	(5.88)	(2.66)	(3.18)	(3.30)
H - N	0.049	0.054	0.071**	−0.002	0.000	0.014
	(1.19)	(1.56)	(2.39)	(−0.08)	(0.00)	(0.53)

Table OA9 reports the estimated discount rate (Panel A) and cash flow (Panel B) betas, as well as their t-statistics in parentheses for each one of the 18 test portfolios. The t-statistics are based on bootstrap standard errors. The last row in each panel reports the difference in betas between High-$Excess^{DUR}$ and No-$Excess^{DUR}$ for each size and BE/ME bucket. One, two and three asterisks denote rejection of the null hypothesis of a zero beta (or a zero beta difference) at a 10%, 5% and 1% significance level, respectively. The betas are estimated using quarterly observations over the period from September 1976 to June 2013 (148 quarterly observations).

Table OA10: The prices of discount rate risk and cash flow risk using quarterly data

	ICAPM	Two-Factor	FF
Panel A: Prices of risk			
c	0.009	0.025*	0.011
	(1.38)	(1.88)	(0.95)
	[3.6%]	[10.1%]	[4.4%]
NDR	0.007	−0.020	
	-	(−0.92)	
	[2.9%]	[−7.9%]	
NCF	0.092*	0.149***	
	(1.73)	(2.24)	
	[37.0%]	[59.5%]	
$\mathbf{R^e_M}$			0.008
			(0.58)
			[3.4%]
SMB			0.009*
			(1.85)
			[3.6%]
HML			0.007
			(1.23)
			[2.9%]
Panel B: Evaluation metrics			
$\mathbf{Adj.\,R^2}$	39.2%	49.3%	58.0%
alpha	48.64**	47.81**	40.75**
	>26.30	>25.00	>23.69
CPE	0.043**	0.030**	0.026**
	>0.036	>0.030	>0.022
PEM	0.208	0.174	0.161
HJ	0.044	0.036	0.028

Table OA10 presents the results from the second step of the Fama and MacBeth (1973) framework for the asset pricing models under consideration. The models are not restricted to have zero-beta rate (R_{zb}) equal to the risk-free rate (R_{rf}), i.e., we consider intercepts in our Fama-MacBeth regressions. Panel A reports the price of risk, the Newey-West t-statistics (in parentheses) and the annualized prices of risk (in square brackets). The t-statistic tests the null hypothesis is that the price of risk is equal to zero. Panel B reports the $Adj.\,R^2$, the Fama-MacBeth *alpha*, *CPE*, *PEM* and *HJ*, *alpha* evaluation metrics. The 5% critical value for *alpha* is obtained from the chi-squared distribution, while for CPE is obtained from a bootstrap distribution. One, two and three asterisks denote rejection of the null hypothesis at a 10%, 5% and 1% level, respectively. All asset pricing models are estimated using quarterly observations over the period from September 1976 to June 2013 (148 quarterly observations).

Table OA11: Hedge portfolios at a quarterly frequency

Size	BE/ME	Hedge Portfolios	ICAPM	Two-Factor	FF
Small	**G**	HP_1	−0.8%	0.6%	2.2%*
			(−0.34)	(0.34)	(1.82)
	M	HP_2	1.2%	3.1%***	3.2%**
			(0.77)	(3.03)	(2.61)
	V	HP_3	−0.7%	1.3%	1.9%*
			(−0.45)	(1.05)	(1.69)
Big	**G**	HP_4	2.3%	3.6%**	3.5%**
			(1.36)	(2.36)	(2.27)
	M	HP_5	−0.1%	1.3%	−0.4%
			(−0.05)	(0.83)	(−0.29)
	V	HP_6	−2.3%	−0.3%	−2.3%
			(−1.36)	(−0.13)	(−1.53)

Table OA11 shows annualized average abnormal returns, in percentages, and their Newey-West t-statistics, in parentheses, of the hedge portfolios under consideration. The risk-adjustment is from the model identified at the top of each column. We form six hedge portfolios (HP_1, HP_2, HP_3, HP_4, HP_5 and HP_6) by going long on the R&D High-$Excess^{DUR}$ portfolios and short on the No-$Excess^{DUR}$ portfolios within each size and BE/ME bucket. Table 5, in the main body of the paper, contains the details of hedge portfolio formation. The sample spans the period from September 1976 to June 2013 (148 quarterly observations).

Table OA12: Alternative definitions – 24 size, BE/ME and R&D excess duration portfolios

	Size=Small			Size=Big		
	BE/ME			BE/ME		
	G *(Growth)*	**M**	**V** *(Value)*	**G** *(Growth)*	**M**	**V** *(Value)*
R&D Excess Duration						
Panel A: Annualized average excess returns						
N ***(No-*** $Excess^{DUR}$***)***	8.5%**	11.5%***	13.5%***	6.9%**	8.5%***	10.0%***
L ***(Low-*** $Excess^{DUR}$***)***	5.7%	12.2%***	13.8%**	5.0%*	6.8%***	4.5%
M ***(Medium-*** $Excess^{DUR}$***)***	9.2%**	14.1%***	12.6%***	9.0%**	8.5%**	7.6%**
H ***(High-*** $Excess^{DUR}$***)***	10.0%*	16.2%***	17.3%***	6.9%**	10.0%***	8.8%**
H - N	1.5%*	4.5%*	3.8%*	0.0%	1.5%	−1.3%
Panel B: H - N differences in discount rate and cash flow betas						
Discount rate	0.292***	0.390***	0.311***	0.053	0.232***	0.309***
Cash flow	0.079	0.080	0.063*	0.021	0.074*	0.079**

Table OA12 Panel A shows the annualized average excess returns of the 24 test portfolios, in percentages. Panel B displays the differences in discount rate and cash flow betas between High-$Excess^{DUR}$ and No-$Excess^{DUR}$ portfolios. The portfolios are constructed at the end of June of year t as the intersections of 2 portfolios formed on size, 3 portfolios formed on the ratio of book value of equity to market value of equity (BE/ME) and 4 portfolios formed on excess duration. The size for June of year t is the market value of equity at the end of June of year t. The BE/ME for June of year t is the book value of equity for the fiscal year ending in $t-1$ calendar year, divided by the ME for December of $t-1$ calendar year. The R&D excess duration for June of calendar year t is the Dechow et al. (2004) duration minus the duration estimated with capitalized and amortized R&D expenses. The size cut-off point for year t is the median NYSE size. The BE/ME cut-off points are the 30^{th} and 70^{th} NYSE BE/ME percentiles. The No-$Excess^{DUR}$ portfolios include all firm-years with zero or missing R&D expenses, R&D asset and R&D amortization. For firm-years with R&D records the cut-off points for year t are the 30^{th} and 70^{th} NYSE R&D excess duration percentiles. ("Low-$Excess^{DUR}$", "Medium-$Excess^{DUR}$", "High-$Excess^{DUR}$"). "$H-N$" is the difference between High-$Excess^{DUR}$ and No-$Excess^{DUR}$ duration portfolios within each size and BE/ME subset. One, two and three asterisks indicate significance levels of 10%, 5% and 1%, respectively. The sample spans the period from July 1976 to June 2013 (444 monthly observations).