Where is the risk in value? Evidence from a market-to-book decomposition

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Abstract

We study the value premium using a multiples-based market-to-book decomposition of Rhodes-Kropf, Robinson and Viswanathan (2005). The market-to-value component drives *all* of the value strategy return, while the value-to-book component exhibits no return predictability in either portfolio sorts or firm-level regressions. Existing results linking market-to-book to operating leverage, duration, exposure to investment-specific technology shocks, and analysts' risk ratings derive from the unpriced value-to-book component. In contrast, results on expectation errors, limits to arbitrage, and certain types of cash flow risk and consumption risk exposure are due to the market-to-value component. Overall, our evidence casts doubt on several value premium theories.

JEL classification: G12; G14

Keywords: Value Premium, Market-to-Book Decomposition, Risk Exposure, Expectation Errors, Limits to Arbitrage

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The positive return differential between high book-to-market (value) and low book-to-market (growth) stocks is one of the most pervasive phenomena in the behavior of stock prices, having been documented in many markets around the world (e.g., Fama and French (1998), Fama and French (2012), Asness, Moskowitz, and Pedersen (2013)). Naturally, a substantial stream of asset pricing research is concerned with the economic origins of the book-to-market effect. Multiple theories attempt to reconcile the value premium with models of investor and firm behavior, and many of these theories have found empirical support. There is still considerable debate, however, about the exact mechanism giving rise to the value premium and whether some of the proposed theories are more consistent with the data than others.[1]

In this paper we show that a number of prominent theories related to the value premium are actually at odds with the data, and the few stories that withstand our tests face other challenges. We dissect the various theories using a market-to-book decomposition introduced by Rhodes–Kropf, Robinson, and Viswanathan (2005) in their study of merger waves (RRV hereafter). In particular, we decompose market-to-book into market-to-*value* and *value*-to-book components, where *value* is an estimate of fundamental value based on industry valuations and a set of observable characteristics. The market-to-value component represents stock price deviation from valuation implied by long-run industry multiples (total error hereafter). This is further decomposed into stock price deviation from *contemporaneous* peer-implied valuation (firm-specific error hereafter) and the deviation of the latter from valuation implied by long-run industry multiples (sector error hereafter).[2]

Our baseline results show that the entire value premium is concentrated in the market-to-value component. Over the 1975-2013 period, a long-short portfolio strategy based on the conventional market-to-book ratio produces an average return of 0.75% per month in return-

[1] Another possibility is that return predictability in general is an artefact of data snooping (e.g. Lo and MacKinlay (1990), Fama (1991, 1998), Conrad, Cooper, and Kaul (2003)). This is an unlikely explanation for the value premium however, as it has been documented in several time periods, asset classes, and markets (see, e.g., Barber and Lyon (1997), Fama and French (1998), Davis, Fama, and French (2000), Asness, Moskowitz, and Pedersen (2013)). Further, Harvey, Liu, and Zhu (2016) show that the *t*-statistic of the HML factor is comfortably above the critical *t*-value adjusted for publication bias.

[2] We recognize that any estimate of *value* likely deviates from "true" fundamental value. We therefore use the term "error" loosely.

weighted (RW) portfolios and 0.59% in value-weighted (VW) portfolios. The same strategy based on market-to-value produces an average RW return of 0.75% (0.43% VW), while the return spread between low and high value-to-book portfolios is about 10 basis points per month and statistically insignificant regardless of the weighting. Further decomposition of market-to-value shows that return predictability is driven by firm-specific error, whereas sector error exhibits no significant association with future stock returns. Firm-level stock return regressions controlling for numerous other firm-level characteristics produce consistent results: the market-to-value component, and in particular, firm-specific error, subsumes *all* of the value premium.

Conceptually, deviations of market value from our estimates of fundamental value can arise due to the following. First, industry-year multiples may fail to fully capture cross-sectional differences in value-relevant attributes, leading to biased estimates of fundamental value. If these differences represent priced sources of risk, subsequent returns represent compensation for unmodelled risk factors.[3] Second, deviations can be due to relative over/undervaluation, suggesting that subsequent returns represent corrections of prices towards fundamental value. The latter would also require mechanisms by which stock prices become and remain dislocated for a prolonged period of time (De Long et al. (1990), Shleifer and Vishny (1997)).

We examine whether existing results in the value premium literature continue to hold for the component of market-to-book that is actually priced. Recent evidence suggests that market-to-book captures exposure to investment-specific technology shocks. Kogan and Papanikolaou (2014) find that growth stocks are more sensitive to changes in prices of investment goods compared to value stocks, and that this exposure earns a negative risk premium. Technological shocks tend to lower the cost of investment goods and value stocks miss out on those benefits. We find that the value strategy does capture exposure to investment-specific technology shocks, but this is largely due to the value-to-book component. Therefore, exposure to investment-specific technology shocks is an unlikely explanation for the value premium.

We further explore operating leverage – a focal feature of production-based models that potentially gives rise to the value premium (Carlson, Fisher, and Giammarino (2004), Zhang

[3] To illustrate this point, assume that we attempt to value a firm that is riskier than its industry-year peers. In this case, we would be using valuation multiples that are too high (discount rates that are too low), resulting in an inflated estimate of fundamental value. This, in turn, would lead to a lower estimate of market-to-value. Consequently, the higher returns earned by firms with lower market-to-value are consistent with risk-based pricing.

(2005), Novy-Marx (2011)). Operating leverage, in the form of fixed costs of production, makes assets-in-place riskier than growth options, and market-to-book is commonly believed to capture variation in the mix of assets-in-place versus growth options. Using a variety of proxies, we show that differences in the mix of assets-in-place versus growth options across market-to-book portfolios are due to value-to-book. There are no differences in assets-in-place intensity across market-to-value portfolios. Therefore, even if operating leverage is a priced source of risk, it is unlikely to be the mechanism behind the value premium.

Cash flow duration is another firm characteristic that has been linked to market-to-book (Lettau and Wachter (2007)). Several studies show empirically that value stocks have shorter cash flow durations than growth stocks (Dechow, Sloan, and Soliman (2004), Da (2009), Chen (2017)). Once again we show that differences in cash flow duration are due to the unpriced value-to-book. That is, duration cannot explain the value premium.

In the accounting literature, Lui, Markov, and Tamayo (2007) show that equity analysts perceive value stocks to be riskier than growth stocks. While we confirm a negative association of analysts' risk ratings with market-to-book, this correlation is once again driven by the unpriced value-to-book. We emphasize that we do not take a stance on whether operating leverage, duration, exposure to investment-specific technology shocks, or analysts' risk ratings represent priced sources of risk – we only examine their relationship with the value premium.[4]

The literature also shows that the value premium may represent compensation for aggregate cash flow risk (Campbell and Vuolteenaho (2004), Da and Warachka (2009)). While we confirm that the conventional value strategy is exposed to aggregate cash flow shocks, this is not always the case for market-to-value. Using the Da and Warachka (2009) approach, we find that cash flow risk is associated with value-to-book only – the part of market-to-book that earns no premium. However, using the VAR-based return decomposition of Campbell and Vuolteenaho (2004), we find significant cash flow beta spreads across both market-to-value and value-to-book portfolios.[5] Collectively, the evidence on cash flow risk as an explanation for the value premium is mixed.

[4] The value premium has also been linked to distress risk (e.g., Fama and French (1992)). However, this theory has found little empirical support, hence we do not re-examine it. See Griffin and Lemmon (2002), Campbell, Hilscher, and Szilagyi (2008), and Da and Gao (2010).

[5] Chen and Zhao (2009) show that reasonable variations in the set of state variables in the VAR return decomposition model can reverse the beta spread between value and growth stocks. We do not take a stance on this debate.

We further examine long-run consumption risk as an explanation for the value premium. Parker and Julliard (2005) show that ultimate consumption risk, defined as the covariance between stock returns and *future* consumption growth, explains largely the variation in returns across market-to-book portfolios. Bansal, Dittmar, and Lundblad (2005) further show that covariances between cash flow growth rates and *past* consumption growth are also successful in explaining the value premium. We replicate both studies and show that the association between market-to-book and ultimate consumption risk is mainly driven by market-to-value, whereas past consumption risk embedded in cash flows exhibits insignificant associations with both market-to-book and its components. In order to reconcile these findings, we re-estimate *ultimate* consumption risk after replacing stock returns with proxies for cash flow news. While value-to-book exhibits some weak association with ultimate consumption risk embedded in cash flows, such association does not exist for market-to-value. Overall, our results suggest that consumption risk in cash flows cannot explain the value premium, while ultimate consumption risk in returns potentially can.[6]

We perform formal pricing tests of the two models that are not formally rejected in the first-pass analysis of beta spreads, namely the two-beta ICAPM of Campbell and Vuolteenaho (2004) and the ultimate consumption risk model of Parker and Julliard (2005). We ask whether these models can explain the cross-section of returns on market-to-value (firm-specific error) and value-to-book portfolios jointly, given that both sets of assets exhibit significant beta spreads but only the former is characterized by a return premium. While the ultimate consumption risk model of Parker and Julliard (2005) fully explains the cross-section of returns on our test assets (both RW and VW), the Campbell and Vuolteenaho (2004) model fails to do so when confronted with RW test assets. The explanatory power of both models is low when evaluated on the basis of GLS R^2.

In the final part of the paper we revisit the explanations that appeal to expectation errors and limits to arbitrage. Previous research suggests that prices of growth and value firms may reflect systematically optimistic and pessimistic expectations, respectively. Under this view, the

[6] The use of cash flows to measure risk exposures in earlier studies was partly motivated by the possibility that resolution of mispricing (if any) can bias the measured covariances between realized returns and risk factors in favor of finding a beta spread between undervalued and overvalued assets (see Cohen, Polk, and Vuolteenaho (2009) for a formal argument). The idea that surprises affect realized returns and thus the outcome of the related asset pricing tests has also been pointed out by Elton (1999). Our subsequent tests show that market-to-value is associated with surprises both pre- and post- portfolio formation.

value/growth effect represents reversals of expectation errors, which occur largely around earnings announcement dates following portfolio formation. If the value premium is indeed due to irrational expectations, we should find negative (positive) earnings announcement returns for high (low) market-to-value firms in the year *post* portfolio formation. This is exactly what we find. Moreover, the pattern of surprises is reversed when looking at earnings announcement dates in the year *prior* to portfolio formation. This latter result is new to the literature and is consistent with investors overextrapolating news about fundamentals. The same patterns are not there for the unpriced value-to-book.

Prior research also highlights that the value premium is coming largely from stocks characterized by limits to arbitrage, such as short sale constraints and noise trader risk – forces that can sustain deviations of stock prices from intrinsic value ((Nagel (2005), Ali, Hwang, and Trombley (2003), Pontiff (2006)). We find that these results are, indeed, due to market-to-value. Finally, we conduct a novel time-series test utilizing changes in the availability of arbitrage capital, which has been shown to improve stock market efficiency (Kokkonen and Suominen (2015)). Consistent with the value effect emanating from stock price dislocations, market-to-book and market-to-value strategies are profitable only when arbitrage capital at the time of portfolio formation is low.

Overall, our results challenge the empirical validity of several theories related to the value premium. Specifically, we find that the priced component of market-to-book is unrelated to operating leverage, duration, exposure to investment-specific technology shocks, analysts' risk ratings, and some (but not all) types of exposure to cash flow and consumption shocks. We recognize that our tests rely on properly estimating the relevant covariances or characteristics. Therefore, rejection of the associated theories should be viewed as rejection of the joint hypothesis that the model is true *and* the corresponding quantities of interest are estimated with precision. In addition, many of the theories that we test derive from reduced-form pricing kernel models that do not specify investors' preferences and beliefs. As a consequence, tests of these models' predictions do not comprise tests of rational pricing of value and growth stocks (see Kozak, Nagel, and Santosh (2018)). Our evidence, however, does suggest that a valid theory of the value premium would have to offer nuanced predictions that reconcile the entirety of our results, including those on limits to arbitrage and predictable surprises around earnings announcements dates.

The rest of the paper is organized as follows. Section I discusses the market-to-book decomposition and related studies. Section II describes our data. We present the main empirical results in Sections III, IV, and V. Finally, Section VI concludes the paper.

I. RRV Market-to-Book Decomposition and Related Literature

We use the market-to-book decomposition that was introduced by RRV in their study of merger waves. Conceptually, the market-to-book ratio can be decomposed as follows:

$$\textit{Market-to-Book} = \textit{Market-to-Value} \times \textit{Value-to-Book} \tag{1}$$

where *Value* is an estimate of fundamental value. Using lower-case letters to denote values expressed in logs, we can rewrite the above identity as:

$$m - b = (m - v) + (v - b) \tag{2}$$

The expression $(m - v)$ denotes stock price deviation from fundamental value, whereas $(v - b)$ is the difference between fundamental value and book value. If stock prices accurately reflect fundamentals, then $(m - v)$ equals zero and $(m - b)$ equals $(v - b)$. If for whatever reason stock prices deviate from fundamental values, then $(m - v)$ is different from zero.

Following RRV, we estimate v using annual industry-specific cross-sectional regressions of equity values on firm fundamentals. The obtained coefficients represent valuation multiples that account for variation in investors' expectations of returns and growth over time and across different sectors. These valuation multiples are averaged across time and are applied to current firm-specific fundamentals to generate estimates of v.

The time-varying nature of the industry-level multiples allows further breaking down stock price deviations from fundamental value (total error) into stock price deviations from contemporaneous peer-implied valuations (firm-specific error) and deviations of the latter from valuations implied by long-run industry multiples (sector error):

$$m_{it} - b_{it} = \underbrace{m_{it} - v(\theta_{it}; \alpha_{jt})}_{\textit{firm-specific error}} + \underbrace{v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)}_{\textit{sector error}} + \underbrace{v(\theta_{it}; \alpha_j) - b_{it},}_{\textit{value-to-book}} \tag{3}$$

where subscrpipt i denotes firm, subscript t denotes time, and subscript j denotes industry. $v(\theta_{it}; \alpha_{jt})$ is the fitted value from cross-sectional regressions of equity values on firm fundamentals, whereas $v(\theta_{it}; \alpha_j)$ is the predicted fundamental value using multiples averaged across time. Firm-specific error and sector error add up to total error, $m_{it} - v(\theta_{it}; \alpha_j)$.

While, to the best of our knowledge, we are the first to introduce this market-to-book decomposition to the asset pricing literature, industry-specific estimation of fundamental value *v* results in an implicit industry-adjustment of the market-to-book ratio. In results reported in the Internet Appendix we show that there is considerable overlap in the composition and performance of market-to-value (firm-specific error) and industry-adjusted market-to-book portfolios (Tables AII-AIV). Thus, our paper is related to the literature on industry-relative market-to-book (e.g. Cohen and Polk (1996), Lewellen (1999), Asness, Porter, and Stevens (2000), Cohen, Polk, and Vuolteenaho (2003), Novy-Marx (2011)), but takes this approach one step further by testing existing explanations for the value premium. Our work is also related to that of Daniel and Titman (2006), Fama and French (2008), and Gerakos and Linnainmaa (2018) who use a returns-based book-to-market decomposition and show that the return predictability of book-to-market is driven by the change in market value of equity.

II. Sample and Data

Our main data source is the intersection of CRSP and Compustat databases over the period 1970-2013, though our tests start from 1975 as we require 5 years of prior data for the market-to-book decomposition. The estimation sample for the valuation model begins in 1970 and not earlier to allow for a sufficient number of firms (minimum of 30) to enter the industry-specific cross-sectional regressions. For the same reason, we use the fairly broad 12 Fama-French industry classification, though we consider alternatives for robustness.

We keep only common stocks (CRSP share codes 10 and 11) listed on NYSE, Amex, or NASDAQ (CRSP exchange codes 1, 2 and 3). We exclude firm-year observations with SIC codes in the range 6000–6999 (financial firms) because the behavior of earnings and other financial statement numbers for these firms is different. Following RRV, we also exclude stocks with market value of equity below $10 million. Finally, we eliminate potential data errors by requiring market-to-book ratios to lie between 0.01 and 100, return on equity to fall between -1 and 1, and leverage to be between 0 and 1. Table AI of the Internet Appendix presents details of sample construction, industry composition using the 12 Fama-French industry classification excluding financials, and descriptive statistics of the variables entering the decomposition analysis.

In later analysis we supplement the main dataset with additional variables from Thomson Reuters 13f Holdings (institutional ownership), I/B/E/S (earnings forecasts), HFR and Lipper (arbitrage capital availability) and a proprietary dataset of monthly equity risk ratings reported by financial analysts in a large securities firm. Consumption data are obtained from the Bureau of Economic Analysis of the U.S. Department of Commerce. Detailed definitions of all variables are provided in Appendix.

Panel A of Table I presents results from estimating the valuation model for each of the 12 Fama-French industries (excluding financials). We use the most comprehensive specification of the valuation model from RRV:

$$m_{it} = \alpha_{0jt} + \alpha_{1jt}b_{it} + \alpha_{2jt}ni^{+}_{it} + \alpha_{3jt}I_{(<0)}(ni^{+}_{it}) + \alpha_{4jt}LEV_{it} + \varepsilon_{it}, \quad (4)$$

where m_{it} is the log of market value of equity, b_{it} is the log of book value of common equity, ni^{+} is the log of the absolute value of net income, LEV_{it} is book leverage, and ε_{it} is an error term. An indicator variable $I_{(<0)}$ is interacted with the log of absolute net income (ni^{+}) to separately estimate the earnings multiple for firms with negative net income.

We estimate the valuation model yearly using market values as of June 30. To eliminate look-ahead bias, we require a 3 months' lag at a minimum for the accounting information to become publicly available (Hou, van Dijk, and Zhang (2012), Li and Mohanram (2014)). Specifically, in estimating the valuation model in June of year *t*, we only use financials of firms with fiscal year-end from April of year *t*-1 until March of year *t*. To obtain long-run industry valuation multiples, we adapt the RRV approach to the asset pricing setting and compute time-series averages of industry-year multiples over the *past* 5 years including the current year (as opposed to the whole sample in RRV). As a result, the first portfolio formation date is June 1975 and the last one is June 2012; return tracking ends in June 2013, which allows us to perform virtually all of our tests on a constant sample. In consistency with our fundamental value estimation, market-to-book is defined yearly as market value of equity on June 30 divided by the book value of equity that goes into the valuation model.

The R^2s reported in the table indicate that our valuation model explains between 80-95% of the variation in market values. The book value of equity (α_1) and net income (α_2, $\alpha_2 + \alpha_3$) are consistently relevant in explaining market value across all industries, while leverage (α_4) is incrementally relevant for nine out of eleven industries. The incremental coefficient on negative net income realizations is negative, consistent with the transitory nature of negative earnings.

Panel B of Table I reports descriptive statistics for market-to-book and its components. The two-part decomposition produces a mean total error ($m_{it} - v(\theta_{it};\ \alpha_j)$) of 0.021 with a standard deviation of 0.698, and a mean value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) of 0.583 with a standard deviation of 0.532; both components exhibit meaningful variation. By construction, the two means add up to the mean of ($m_{it} - b_{it}$) equal to 0.604. The three-part decomposition further decomposes total error into firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$) and sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$). Firm-specific error exhibits greater variation than sector error, and has a mean value of zero by construction, as it is the OLS residual from (4).

[Please Insert Table I about Here]

III. Return Predictability Tests

III.A Portfolio Sorts

We begin our analysis with the usual portfolio sort tests for market-to-book and its components. Consistent with earlier studies, we use NYSE breakpoints to form our portfolios every June 30. Following Asparouhova, Bessembinder, and Kalcheva (2013), we use prior-period gross return-weighted (RW) and value-weighted (VW) portfolio returns. Both weighting schemes address return measurement biases arising from microstructure noise in equal-weighted portfolios. Since value-weighting deprioritizes small stocks, where the value premium is known to be larger, we use both types of portfolios.[7] We also examine sorts on market-to-book and its components conditional on size. When a firm delists, we use the delisting return in the delisting month. If a delisting is due to liquidation (delisting codes 500 or between 520 and 584) and the delisting return is missing, the delisting return is set to -30% for NYSE/AMEX firms (Shumway (1997)) and -55% for NASDAQ firms (Shumway and Warther (1999)). Table II presents the results.

[7] The widely used HML factor *equally*-weights the *value*-weighted hedge return of value-minus-growth strategies within small stocks and large stocks. See Professor Kenneth French's website: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html

Panel A reports average monthly returns of 10 RW portfolios, sorted on market-to-book or its components, over the 12 months after portfolio formation. The results show a monotonic decline in returns moving from low to high market-to-book deciles. The long-short strategy generates a return of 0.75% per month, highly statistically significant, and an annualized Sharpe ratio of 0.59. The same pattern is mimicked by total error, which produces a hedge portfolio return of 0.75% per month but with lower volatility, resulting in a Sharpe ratio of 0.71. Firm-specific error increases the hedge portfolio return to 0.85% per month and reduces volatility further, resulting in a Sharpe ratio of 0.90. Finally, portfolio strategies based on sector error or value-to-book result in a hedge return of about 0.12% per month, both statistically insignificant.

Panel B reports the same tests using VW portfolio returns. The first column reveals the familiar value premium, which is equal to 0.59% per month and has a Sharpe ratio of 0.45. The second column uses total error as the sorting variable and shows a somewhat lower long-short strategy return of 0.43% per month; the volatility is also reduced resulting in a Sharpe ratio of 0.36. The firm-specific error strategy produces a similar hedge return of 0.41% but further reduces volatility, leading to a Sharpe ratio of 0.39. The last two columns repeat the sorts using sector error and value-to-book and reveal economically and statistically insignificant long-short strategy returns. Overall, the results suggest that the value premium is driven by market-to-value and specifically, by firm-specific error.

Figure 1 plots the cumulative performance of market-to-book, total error, firm-specific error, sector error, and value-to-book strategies over the sample period. Panel A illustrates the RW strategies. It is evident that firm-specific error is solely responsible for the performance of the market-to-book strategy. In fact, firm-specific error achieves a slightly higher terminal wealth with lower volatility; it largely avoids the well-known crash of the value strategy during the dotcom period and significantly reduces the drawdown in 1980. The sector error and value-to-book strategies exhibit little in the form of wealth accumulation but do show relatively high volatility. Panel B illustrates the VW strategies. Here again, the firm-specific error strategy largely mimics market-to-book until the year 2002, although overall it results in a slightly lower terminal wealth than the market-to-book strategy. Finally, sector error and value-to-book produce volatile hedge portfolio returns and result in no wealth accumulation.

We further examine portfolio sorts on market-to-book and its components conditional on size, using both 5×5 and 3×2 sorts. For brevity, these results are reported in Tables AV-AVIII of the Internet Appendix. Consistent with the literature, we find that the value premium is larger among small stocks. The same holds for long/short strategies based on total error and firm-specific error. Sector error and value-to-book do not exhibit return predictability in any size category irrespective of the weighting.

We also experiment with (i) estimating the valuation model using per share values, (ii) alternative industry definitions, and (iii) augmenting the valuation model with a measure of growth. In all cases, we continue to find that the return predictability of market-to-book is driven by firm-specific error and the magnitudes of the hedge returns are similar to those in our baseline results (see Section A.1 of the Internet Appendix, Tables AXXIV-AXXVIII).

Overall, the results in this section show that all of the return predictability of market-to-book comes from the market-to-value component, i.e. stocks whose market values are low relative to their estimated fundamental values exhibit high subsequent returns, and vice versa. The value-to-book component, which captures book value deviations from estimated fundamental values, exhibits no association with future stock returns. In the next section we study whether these patterns continue to hold after considering other firm-level determinants of stock returns.

[Please Insert Table II and Figure 1 about Here]

III.B Firm-level Return Regressions

We perform Fama-MacBeth regressions of monthly individual stock returns on market-to-book or its components, and a set of other firm characteristics known to predict stock returns. The typical OLS estimation of Fama-MacBeth regressions implies equal weighting of stocks within a period. Asparouhova, Bessembinder, and Kalcheva (2010) show that slope coefficients in these regressions can be biased in the presence of microstructure noise and recommend weighting the estimation by prior period gross return (RW), which is what we report in Table III.[8]

In Column (1) we show results from regressing future stock returns on the conventional market-to-book ratio, confirming the familiar negative association. In Column (2) we replace market-to-book with its components obtained from the two-step decomposition: total error and value-to-book. Consistent with the portfolio sort results, we find that total error has a strong

[8] None of our inferences change if we employ the commonly used equal-weighted Fama-MacBeth regressions. Value-weighted Fama-MacBeth regressions do not appear to be standard in the literature; nevertheless, we perform them for completeness and find consistent results (reported in Table AIX of the Internet Appendix).

negative association with subsequent stock returns, while value-to-book obtains a statistically insignificant coefficient. In Column (3) we further decompose total error into firm-specific error and sector error. We find that firm-specific error has a strong negative association with subsequent stock returns, sector error obtains a negative coefficient but statistically insignificant and value-to-book has a coefficient close to zero.

Columns (4), (5), and (6) repeat the previous specifications but this time controlling for additional firm-level characteristics, namely, market value (*Size*), upside and downside beta (β^+ and β^-), idiosyncratic return volatility (*IVol*), illiquidity (*Illiquidity*), momentum ($Ret^{-2\text{-}12}$), reversal (Ret^{-1}), operating profitability (*OP*), and investment (*Inv*). Our inferences remain unchanged. The market-to-book effect in Column (4) is statistically significant, and the decomposition results in Columns (5) and (6) continue to indicate that firm-specific error is the driver of the value premium. The newly added characteristics show associations consistent with existing literature: firms with high market capitalizations (Banz (1981)), high idiosyncratic volatility (Ang et al. (2006)), high prior-month returns (Jegadeesh (1990)), and high asset growth (Titman, Wei, and Xie (2004), Cooper, Gulen, and Schill (2008)) earn lower returns in the future; in contrast, firms with high downside beta (Ang, Chen, and Xing (2006)), high illiquidity (Amihud (2002)), high momentum (Jegadeesh and Titman (1993)), and high profitability experience higher returns in the future.

[Please Insert Table III about Here]

Overall, our evidence thus far indicates that stocks whose market values are above (below) our estimated fundamental values exhibit relatively low (high) subsequent stock returns. What can this pattern represent? Stock price deviations from estimates of fundamental value can reflect errors in our valuation model (e.g., unmodelled risk factors) and/or errors on behalf of investors (over/undervaluation). We now address these possibilities through the lens of our decomposition.

IV. Exposure to Aggregate Risks and Production-Based Models

IV.A Cash Flow Risk

If a theory is to explain the market-to-book effect, it should also explain the market-to-value effect, which is what drives return predictability. Campbell and Vuolteenaho (2004) argue that value stocks have higher cash flow betas than growth stocks and that this can explain the value premium. The authors estimate cash flow betas as the sensitivity of portfolio-level returns to market-level cash flow news, where news is extracted from a vector autoregression (VAR) decomposition of the market return. Da and Warachka (2009) provide further evidence that value stocks have higher cash flow betas than growth stocks. In their approach, cash flow betas are defined as covariances between portfolio-level and market-level cash flow news, where cash flow news is proxied by revisions in analysts' earnings forecasts. We explore the cash flow risk explanation for the value premium using our decomposition. The results are reported in Table IV. To conserve space, we present results using only RW portfolio returns hereafter (risk factor returns on the right hand-side are always VW). None of our inferences change when we use VW portfolios and we always point out any sizable quantitative differences. VW results can be found in the Internet Appendix.

Using the exact VAR specification as in Campbell and Vuolteenaho (2004), we confirm that the sensitivity of portfolio-level returns to market-level cash flow shocks is greater for value stocks compared to growth stocks (Table IV Panel A). The cash flow beta spread between the extreme market-to-book portfolios is 0.139 and significant at the 1% level. Turning to the components, we find that both total error and firm-specific error exhibit a statistically significant cash flow beta spread, although somewhat smaller in magnitude (0.113 and 0.108, respectively). Sector error produces a spread of half size (0.044), but statistically insignificant. Similar to the market-to-value components, value-to-book exhibits a significant cash flow beta spread of almost the same magnitude (0.079), despite the fact that value-to-book does not predict returns. Results based on VW portfolios yield the same inferences (see Table AX of the Internet Appendix). Overall, while we confirm that market-to-book captures variation in cash flow risk, such risk is associated with both priced market-to-value and unpriced value-to-book.

The return decomposition approach of Campbell and Vuolteenaho (2004) has been shown to be sensitive to the choice of state variables included in the VAR model (Chen and Zhao (2009)). Yet, Da and Warachka (2009) confirm that value stocks are more exposed to aggregate cash flow shocks than growth stocks using an approach that is immune to expected return model misspecification. Specifically, Da and Warachka (2009) define cash flow news as revisions in the discounted sum of analysts' earnings forecasts.

We follow Da and Warachka (2009) and compute cash flow betas for portfolios sorted on market-to-book and its components. Analysts' earnings forecasts are obtained from I/B/E/S, which naturally reduces the sample size for this test. Panel B of Table IV reports the results.[9] Consistent with earlier findings, Column (1) shows that cash flow betas are monotonically decreasing with market-to-book. The difference in the betas between the extreme deciles is 0.242 and highly statistically significant. As for the components, total error, firm-specific error and sector error produce no significant cash flow beta spreads. In fact, all of the difference in cash flow betas across market-to-book portfolios is coming from value-to-book. That is, while the value strategy loads on cash flow risk, the component of the value strategy that is responsible for the return premium does not.

Finally, as a robustness check on the Da and Warachka (2009) approach, we re-estimate cash flow betas after replacing their cash flow news proxy with changes in the discounted sum of future annual earnings realizations (ROEs) over a 5-year horizon (see, e.g., Vuolteenaho (2002)). Results reported in Panel C of Table IV show that market-to-book portfolios exhibit a positive but insignificant beta spread, which is once again driven by the significant beta spread between the extreme value-to-book portfolios. Total error and firm-specific error exhibit beta spreads of the wrong sign (low *m–v* firms have lower cash flow betas than high *m–v* stocks) and sector error shows no particular pattern.

Overall, only when we use the VAR methodology of Campbell and Vuoltenaaho (2004) to extract cash flow news, we find that market-to-value is inversely associated with exposures to cash flow risk. Under the same approach however, unpriced value-to-book appears almost as risky. Cash flow-based approaches designed to address some of the limitations of the VAR-based return decomposition approach reject the cash flow risk explanation for the value premium when confronted with our decomposition.

[Please Insert Table IV about Here]

IV.B Long-Run Consumption Risk

We further examine long-run consumption risk as an explanation for the value premium. Parker and Julliard (2005) show that ultimate consumption risk, measured as the covariance

[9] Da and Warachka (2009) deflate earnings and book values with stock price, prior to aggregating them within portfolios. We intentionally skip this step in order to exclude price from the construction of the measure and avoid mispricing effects (if any) affecting the results. Also, as fundamentals (earnings and book values) are aggregated within portfolios, there is no distinction between RW and VW tests.

between asset returns and consumption growth *over the subsequent three years*, explains largely the variation in returns across market-to-book portfolios. Bansal, Dittmar and Lundblad (2005) further show that past consumption risk, measured as the covariance between cash flows and consumption growth *over the past two years*, is also successful in explaining the value premium. We replicate both studies and estimate consumption betas for our portfolios. The results are reported in Table V.

Following Parker and Julliard (2005), we first estimate sensitivities of portfolio returns to ultimate consumption growth (Panel A). Specifically, we regress quarterly portfolio returns (obtained by cumulating monthly returns within a quarter) on the 11-quarter ahead log growth rate in real per capita consumption of non-durable goods. The results confirm that value stocks have higher sensitivity to ultimate consumption growth than growth stocks, and the difference in betas is large (0.688) and statistically significant. Turning to the components, both total error and firm-specific error exhibit significant beta spreads, albeit somewhat smaller in magnitude (0.558 and 0.527, respectively). Value-to-book produces a marginally significant beta spread (0.269), while sector error does not show any pattern in ultimate consumption betas. Results using VW portfolios are somewhat different: the beta spreads in total error, firm-specific error and sector error miss the conventional significance levels, and the beta spread in value-to-book is no longer significant (see Table AXI of the Internet Appendix). Despite a more mixed picture from VW portfolios, on balance there is some evidence that market-to-value is associated with ultimate consumption risk.

We now turn to Bansal, Dittmar and Lundblad (2005) and estimate the sensitivity of portfolio-level cash flows to average consumption growth over the past 2 years (γ from equation (7) and Table III of Bansal, Dittmar and Lundblad (2005)). Specifically, we regress, at the quarterly frequency, the seasonally-adjusted (4-quarter moving average) log growth rate in portfolio dividends on smoothed (8-quarter moving average) log growth rate in real per capita consumption of non-durables plus services (Panel B). We find no evidence that dividends of value stocks are more sensitive to past consumption growth than growth stocks.[10] The same is true for all of the components of market-to-book. While the beta spreads are positive for market-to-book, total error and firm-specific error, they are all far from the conventional significance levels. Inferences from

[10] Bansal, Dittmar and Lundblad (2005) use sample formation criteria that are different from ours, and they do not report the standard errors of their beta spread estimates.

tests using VW portfolios are the same (Table AXI of Internet Appendix). Neither market-to-book nor firm-specific error exhibit statistically significant beta spreads. Thus, the cash flows of value stocks, as measured by the dividend streams of managed portfolios, are not more sensitive to past consumption growth compared to growth stocks.

The approaches to estimating consumption risk in Parker and Julliard (2005) and Bansal, Dittmar and Lundblad (2005) differ both in terms of the outcome variable (realized returns vs. dividends) and in terms of the measure of consumption growth (future vs. past).[11] In order to reconcile the two approaches, we estimate the sensitivity of portfolio dividends as in Bansal, Dittmar and Lundblad (2005) to ultimate consumption growth of Parker and Julliard (2005) (Panel C). We continue to find no beta spread across value and growth portfolios when using ultimate consumption growth on the right-hand side. Therefore, the use of portfolio returns appears important. To further investigate this issue, we employ two additional measures of portfolio-level fundamentals. The first one is the Da and Warachka (2009) cash flow news measure, which is based on revisions in analysts' earnings forecasts. In order to match the quarterly frequency of the consumption growth series, we add up the monthly forecast revisions for each quarter (Panel D). The second measure that we use is our alternative proxy for cash flow news, equal to the change in the sum of discounted future ROEs over a 5-year horizon (Panel E). Both cash flow news proxies are regressed on ultimate consumption growth.

Using the Da and Warachka (2009) cash flow news measure, we find that value stocks have higher sensitivity to ultimate consumption growth than growth stocks, although the difference in betas (0.142) is statistically insignificant. This effect appears to be coming from value-to-book, where the beta spread (0.315) is significant, albeit not monotonic. Other components do not show significant beta spreads. Using the change in future earnings realizations as a cash flow news proxy paints a similar picture. Market-to-book exhibits a small positive beta spread (0.064) albeit statistically insignificant, and it appears to be driven by value-to-book (spread of 0.477). Total error, firm-specific error, and sector error exhibit negative beta spreads and they are all insignificant.

[11] Another minor difference between the two approaches is that Parker and Julliard (2005) use consumption of non-durable goods only, whereas Bansal, Dittmar, and Lundblad (2005) use consumption of non-durables plus services.

Overall, the returns of the market-to-book and market-to-value strategies are sensitive to future consumption growth, but their cash flows are not.

[Please Insert Table V about Here]

IV.C Investment-Specific Technology Shocks

Kogan and Papanikolaou (2014) argue that firms with higher market-to-book earn lower returns because they are more exposed to investment-specific technology (IST) shocks that carry a negative risk premium. In their model, firms with a higher fraction of growth opportunities in their market value (high market-to-book firms) need to invest more in order to realize this growth. Therefore when a positive IST shock hits, growth firms benefit more, giving rise to differences in risk premia across value and growth stocks. Empirically, the exposure to IST shocks is captured by the covariance between asset returns and the returns on a factor mimicking portfolio going long investment goods producers and short consumer goods producers (IMC). Kogan and Papanikolaou (2014) show that portfolios formed on the basis of IMC beta exhibit a significant return spread (i.e. exposure to IST shocks is priced) as well as a monotonic relation with the HML beta.

We examine the IST exposure explanation for the value premium through the lens of our market-to-book decomposition. We measure IMC betas for our market-to-book portfolios, as well as for portfolios formed on the basis of our decomposition. Table VI presents the results. Consistent with the results in Kogan and Papanikolaou (2014), we find that market-to-book portfolios exhibit a monotonic pattern in their exposure to IST shocks – value firms are less exposed and growth firms are more exposed. The difference between the extreme portfolios' exposures is -0.269 and highly statistically significant. The total error sort reveals an IMC beta spread of -0.140, half the size of the spread across market-to-book portfolios, and the firm-specific error sort exhibits an IMC beta spread that is only a third (-0.095). The latter is only marginally statistically significant. At the same time, the beta spread between extreme value-to-book portfolios is even more pronounced (-0.452) than that in market-to-book and highly statistically significant. The sector error sort reveals no pattern in the IMC beta.

Overall, the results suggest that market-to-book is positively associated with IST exposures, but this association is largely driven by value-to-book. Results based on VW portfolios are even less supportive of the idea that the value premium represents compensation for exposure to IST shocks (Table AXII of the Internet Appendix). The IMC beta spread across market-to-book portfolios is negative as predicted, but not statistically significant.[12] Total error and firm-specific error exhibit beta spreads of the opposite sign to that predicted by the theory. Interestingly, value-to-book continues to exhibit a statistically significant negative IMC beta spread. Yet, value-to-book is not priced in the cross-section in either RW or VW portfolios. Hence, differential exposure to investment-specific technology shocks cannot be responsible for the value premium. This is not to say that exposure to such shocks is not a priced risk factor.

[Please Insert Table VI about Here]

IV.D Operating Leverage

Several prominent production-based models generate the value premium via an operating inflexibility/operating leverage channel (Carlson, Fisher, and Giammarino (2004), Zhang (2005), Novy-Marx (2011)). Specifically, when capital is costly to adjust, operating inflexibility in the form of fixed costs of production makes less efficient (low market-to-book) producers more exposed to economic downturns. Zhang (2005, p. 68) writes: "In bad times, value firms are burdened with more unproductive capital, finding it more difficult to reduce their capital stocks than growth firms do. The dividends and returns of value stocks will hence covary more with economic downturns."[13] More generally, operating inflexibility makes assets-in-place riskier than growth options.

In both Novy-Marx (2011) and Zhang (2005) models, firm-level productivity is the only source of firm heterogeneity, and thus the only source of differences in market-to-book and expected returns. Novy-Marx (2011) relates capital productivity to an empirical measure of operating leverage (operating costs divided total assets) and argues that a return spread arises between high cost producers (value firms) and low cost producers (growth firms). He shows that high operating leverage relates to higher returns, but it does not detract from the market-to-book effect. Moreover, in Novy-Marx (2013), more profitable firms (efficient producers) exhibit higher rather than lower returns, and controlling for profitability improves rather than eliminates the

[12] Note that Kogan and Papanikolau (2014) report equal-weighted averages of HML betas across IMC beta-sorted portfolios. Hence, their results are more directly comparable to our RW portfolios.

[13] Note however that the market-to-book and market-to-value effects survive controls for downside beta in our firm-level return regressions in Table III.

market-to-book effect.[14] In results reported in the Internet Appendix (Table AXIII), we find that controlling for operating leverage leaves the association between future returns and market-to-value essentially unchanged, and neither market-to-book nor any of the components are significantly exposed to a long-short operating leverage strategy.

Nevertheless, in the presence of operating leverage, market-to-book may have a further role in determining asset prices if it reliably picks up variation in assets-in-place versus growth options, beyond differences in productivity. As operating inflexibility makes assets-in-place risker than growth options, high market-to-book firms should earn lower expected returns if they have fewer assets-in-place (holding firm productivity/operating leverage constant). This logic is alluded to in both Novy-Marx (2011) and Zhang (2005), although not formally modelled.

The intuition behind market-to-book capturing variation in assets-in-place versus growth options is straightforward: the value of growth options should be reflected in market value of equity, but not in book value. Numerous studies document relationships that are consistent with market-to-book capturing growth option intensity. Work in corporate finance shows that market-to-book is negatively related to financial leverage, consistent with growth options having lower (or even negative) debt capacity (see e.g. Rajan and Zingales (1995), Hovakimian, Opler, and Titman (2001), Barclay, Smith, and Morellec (2006)). In addition, Ai, Croce, and Li (2013) show that book-to-market sorts reveal differences in firm age, with growth firms being younger.[15] Further, Ai and Kiku (2016) show that return sensitivity to idiosyncratic volatility is positively associated with Tobin's Q, consistent with high Q firms being more growth option intensive. Lastly, Kogan and Papanikolaou (2014) show a negative association between HML betas and IMC betas, consistent with growth option value responding positively to IST shocks. In light of these associations, the operating inflexibility mechanism in Novy-Marx (2011) and Zhang (2005) may, indeed, account for the value premium.

Since market-to-value is responsible for the market-to-book effect, a test of the operating inflexibility/operating leverage story boils down to a test of whether market-to-value continues to

[14] Notice that market-to-value is orthogonal to profitability by construction (net income is in the valuation model and market-to-value is the residual). A further control for operating profitability is included in firm-level regressions in Table III.

[15] Grullon, Lyandres, and Zhdanov (2012) further show that younger firms exhibit greater sensitivity to volatility, consistent with younger firms having more growth option value.

proxy for the mix of assets-in-place versus growth options, or whether this variation is passed on to the unpriced components. We have already shown that the association between market-to-book and exposure to IST shocks of Kogan and Papanikolau (2014) stems from the unpriced value-to-book. We explore the other proxies in Table VII. Confirming the studies cited above, market-to-book sorts uncover strong and monotonic patterns in firm age (Panel A), leverage (Panel B), and sensitivity to idiosyncratic volatility (Panel C). Differences between value and growth portfolios are economically large (e.g. 6.2 years for age) and highly statistically significant. However, all of these relations are driven entirely by value-to-book, where differences are further magnified. Sorting on the priced firm-specific error does not reveal patterns in any of the measures, except for an economically small difference in age of 1.03 years (compared to 10.89 years for value-to-book). Absent differences in growth option intensity across market-to-value portfolios, theories relying on growth option intensity cannot explain the value premium.[16]

We employ a fourth proxy to test the operating inflexibility channel, namely fixed asset tangibility (property, plant, and equipment divided by total assets). While this measure does not proxy for the mix of assets-in-place vs. growth options, it does increase with the amount of productive capital that is subject to both i) fixed operating costs and ii) costly adjustment. In other words, this measure captures the portion of firms' assets affected by operating leverage, as predicted by theories of Zhang (2005) and Novy-Marx (2011).[17] Panel D presents the results. We find that market-to-book sorts uncover large differences in the amount of capital affected by operating leverage. Tangible fixed assets represent 36% of total assets for value firms and 26% for growth firms. The difference of almost 10 percentage points is economically large, but once again

[16] We do not use investment variables (e.g. capital or R&D expenditure) as a proxy for growth option intensity, because investment can relate to price-scaled variables in the presence of mispricing. The RRV market-to-book decomposition was developed specifically to study the link between misvaluation and investment in the form of acquisitions. More generally, Binsbergen and Opp (2017) provide evidence of "real" anomalies whereby inefficient prices, reflecting biased expectations about future cash flows or discount rates, affect the investment behavior of value-maximizing firms. In addition, financially constrained firms may decrease investment to avoid issuing undervalued equity (Baker, Stein, and Wurgler (2003)). See also Chirinko and Schaller (2001), Gilchrist, Himmelberg, and Huberman (2005), and Polk and Sapienza (2009).

[17] Current assets (such as cash, inventories, and accounts receivable) are easily adjusted to changes in demand. Intangible assets such as patents, copyrights, trademarks, distribution rights, and software licenses might be costly to adjust but do not entail fixed operating costs.

it is driven by value-to-book. In fact, the spread in asset tangibility across value-to-book portfolios widens to 16.5 percentage points. Total error and firm-specific error exhibit U-shaped patterns in fixed asset tangibility with virtually zero differences between the extreme portfolios. Asset tangibility across sector error portfolios is virtually constant. Once again, differences in the amount of capital affected by operating leverage are not associated with the component of market-to-book that earns a premium.

[Please Insert Table VII about Here]

Finally, note that the findings in this section pose a challenge to duration-based explanations for the value premium (e.g., Lettau and Wachter (2007)). Since assets-in-place produce cash flows today, while growth options only produce cash flows in the future, variation in the timing of cash flows should be associated with variation in the mix of assets-in-place versus growth options. Our results show that there is no such variation across market-to-value portfolios. We provide more direct tests of the duration-based explanation in the following section.

IV.E Duration

The duration-based explanation for the value premium appeals to the differential timing of cash flows among value and growth firms; cash flows of growth firms are realized in the more distant future than cash flows of value firms. Lettau and Wachter (2007) argue that long-horizon equity is less risky than short-horizon equity, and that this can potentially explain the value premium. Dechow, Sloan, and Soliman (2004) develop an empirical measure of equity duration implied by stock prices and show that growth firms, indeed, have longer cash flow durations than value firms. They further show that a low-minus-high duration factor exhibits a significant positive return.

One limitation of the implied equity duration measure of Dechow, Sloan, and Soliman (2004) is that it uses stock price as an input and therefore mechanically correlates with market-to-book and market-to-value. Moreover, duration metrics that rely on stock prices are influenced by possible mispricing, and therefore cannot uniquely identify duration as the mechanism behind the value premium.[18] Da (2009) proposes a portfolio-level measure of duration based solely on

[18] Indeed, Weber (2018) shows that the return predictability of implied equity duration comes from stocks that are difficult to arbitrage, is concentrated in periods following high investor sentiment, and is associated with analysts' forecast errors – evidence that makes him lean towards a mispricing-based explanation for the duration effect.

accounting fundamentals, and continues to find that cash flows of growth portfolios have longer duration than those of value portfolios. Chen (2017) further shows that dividends of growth stocks in buy-and-hold portfolios grow faster than those of value stocks in the modern sample period, albeit the difference is not large enough to fully explain the value premium.

We employ our decomposition to shed light on the association between market-to-book and cash flow duration. Since our decomposition offers an alternative valuation for the stock (i.e. our estimate of fundamental value *v*), it is natural to examine a measure of duration implied by this alternative price. We follow the exact methodology of Dechow, Sloan, and Soliman (2004) to compute implied equity duration, after replacing stock price with our measure of intrinsic value *v*. Although this new measure has the benefit of being independent of the stock price, it does require our model to properly value future cash flow growth. The results are reported in Panel A of Table VIII. Consistent with existing literature, we find that value and growth stocks exhibit large and significant differences in duration. As is the case with most of our tests, value-to-book is responsible for the entire duration spread in market-to-book portfolios, which is further magnified. Extreme portfolios formed on the basis of total error and firm-specific error exhibit differences in cash flow duration of the opposite sign, i.e. low market-to-value stocks have somewhat *longer* cash flow durations than high market-to-value stocks. Sector error follows the same pattern.

We now resort to portfolio-level measures of duration, relying only on accounting fundamentals. Da (2009) defines duration as an infinite sum of discounted dividend growth rates making use of a log-linear approximation of the accounting clean surplus identity. We follow the same definition after accounting for two biases pointed out by Chen (2017). First, Chen (2017) recommends omitting the first-year (look-back) growth rate from the infinite sum, since the concept of cash flow duration pertains only to the timing of *future* cash flows.[19] Second, Da (2009) assumes that, beyond year 7, the ROE of value and growth stocks is equal to the average ROE over the first 7 years. It turns out that this assumption overestimates (underestimates) the steady-

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Nevertheless, including implied equity duration as an additional control in firm-level regressions does not subsume the return predictability of either total error or firm-specific error (Table AXIV of the Internet Appendix).

[19] Consider two firms with cash flows of 5, 10, 15, 20, 25, 30 and 10, 10, 15, 20, 25, 30, paid out during years 0, 1, 2, 3, 4, 5, respectively. At the end of year 0 (portfolio formation date), these two firms have identical future cash flows (years 1-5) and thus identical cash flow durations. Inclusion of the first (look-back) growth rate would result in a higher duration measure for the first firm, which is counterfactual.

state ROE for growth (value) stocks, biasing towards finding longer cash flow durations for growth stocks: Chen (2017) shows that ROEs of value and growth stocks diverge significantly around portfolio formation before converging and stabilizing by year 7. To account for this bias, we re-define the terminal ROE as ROE in year 7, when convergence has occurred. Panel B of Table VIII reports the results.

Consistent with Da (2009), we confirm that value portfolios have significantly shorter cash flow duration than growth portfolios. However, once we decompose market-to-book into the various components, we find that value-to-book is solely responsible for this association, and the spread across low and high value-to-book portfolios is further strengthened. Extreme portfolios formed on the basis of total error and firm-specific error exhibit no significant differences in cash flow duration. Thus, while the cash flows of value stocks have shorter duration than growth stocks according to the modified Da (2009) measure, this is not the case for the component of market-to-book that drives return predictability.

Finally, we re-examine the results in Chen (2017) using our decomposition. Panel C of Table VIII reports Chen's baseline results, namely, the geometric average growth rate in dividends of buy-and-hold portfolios over the 10 years following portfolio formation. We find a statistically significant difference in the average dividend growth rate between value and growth portfolios (-2.4%), similar to the magnitude reported by Chen (2017). That is, dividends of growth stocks grow somewhat faster than those of value stocks, implying longer cash flow durations. As for the components, this difference is virtually zero for total error and firm-specific error. Sector error exhibits a small positive but statistically insignificant difference. Value-to-book, however, exhibits a sizable difference in the average growth rate in dividends of -4.55% and highly statistically significant. These results do not change when using VW portfolios (Table AXIV of Internet Appendix). Therefore, even the modest difference in growth rates between value and growth stocks found by Chen (2017) is driven by value-to-book and not by the component that is responsible for the return premium.

[Please Insert Table VIII about Here]

Overall, our results show no differences in duration across portfolios sorted on the component of market-to-book that exhibits return predictability. Therefore, duration is unlikely to be the reason behind the value premium. Once again, we do not take a stance on whether duration itself – independently of the value premium – is a priced source of risk. Our conclusions are only with respect to its ability to explain the value premium.

IV.F Analyst Risk Ratings

There is evidence that equity research analysts perceive value stocks to be risky. Lui, Markov, and Tamayo (2007) show that analysts' risk ratings correlate negatively with market-to-book, while Lui, Markov, and Tamayo (2012) further show that changes in analysts' risk ratings move stock prices and are followed by changes in HML factor loadings. In order to speak to this type of evidence, we obtain analysts' risk ratings data from a major equity research provider. Equity analysts assign stocks a rating of "Low Risk", "Medium Risk", "High Risk", and "Speculative Risk", which we convert to numerical ranks 1, 2, 3, and 4, respectively. The ratings are assigned monthly but contain very little variation during the year; hence we convert the data to stock-year observations and use the ratings in June consistent with portfolio formation. The sample period is from 2003 to 2010. We regress analysts' risk ratings on market-to-book or its components, as well as other characteristics shown to affect these risk ratings. We follow Lui, Markov, and Tamayo (2007) and estimate pooled ordered logit regressions with year fixed effects. Standard errors are clustered at the firm level. The results are reported in Table IX.

Column (1) uses the conventional market-to-book as the sole explanatory variable. Consistent with Lui, Markov, and Tamayo (2007), we find that analysts' risk ratings correlate negatively with market-to-book. Columns (2) and (3) use the two-part and three-part decompositions, respectively. The correlation of analysts' risk ratings with market-to-book is driven entirely by value-to-book. Analysts do not perceive market-to-value to be risky – yet this is the priced part of market-to-book. Whatever risk analysts have in mind with respect to market-to-book, this risk does not earn a return premium. Columns (4), (5), and (6) include other determinants of analysts' risk ratings, namely size, market beta, illiquidity, idiosyncratic volatility, and leverage. The conventional market-to-book remains significant after adding controls (albeit only marginally). Once again, this relation is driven entirely by value-to-book. Overall, the evidence in this section shows that the risk in value stocks as perceived by equity research analysts is concentrated in the part of market-to-book that is not associated with a return premium.

[Please Insert Table IX about Here]

IV.G Formal Pricing Tests

So far, only the Campbell and Vuolteenaho (2004) and Parker and Julliard (2005) models have the potential to explain the value premium, as evidenced by significant cash flow beta and ultimate consumption beta spreads across firm-specific error. We therefore proceed to formal pricing tests and perform second-pass cross-sectional regressions of average excess portfolio returns on the estimated betas. We ask whether the two models can explain the cross-section of returns when portfolios are sorted on both components of market-to-book, while only one of them is associated with a return premium. Specifically, our test assets include 10 portfolios sorted on the basis of firm-specific error and 10 portfolios sorted on value-to-book. We report the estimated zero-beta rate, the risk premia, the associated *t*-statistics (corrected for estimation error in betas), OLS R^2 and GLS R^2, a T^2 statistic for a test that all pricing errors are jointly zero, and the mean absolute pricing error (MAPE).[20] Table X presents the results.

We begin with the Campbell and Vuolteenaho (2004) two-beta model and estimate its unrestricted version, whereby the price of discount rate risk is not restricted to the variance of the market return (Panel A). Using RW portfolios as test assets, we estimate a statistically significant cash flow risk premium, equal to 3% per month. The estimated zero-beta rate is 0.6% per month and marginally significant, implying that a riskless asset would earn an annualized return that is 7.2% higher than a risk-free rate. The model explains about half of the variation in average returns while the GLS R^2 is only 12% – consistent with the evidence in Lewellen, Nagel and Shanken (2010) that the GLS R^2 appears to be a more stringent hurdle. The mean absolute pricing error of 0.11% per month is economically significant. Most importantly, the T^2 statistic rejects the null hypothesis that all pricing errors are jointly zero, implying that the two-beta model does not fully explain the cross-section of returns on our 20 portfolios. The model is somewhat more successful when we use 20 VW portfolios as test assets. While the estimated price of cash flow risk is reduced to 2.5%

[20] Note that the standard Shanken (1992) adjustment is not directly applicable to the analysis of Campbell and Vuolteenaho (2004) model because their betas are not standard regression betas: covariances are scaled by the variance of the unexpected market return, as opposed to the variance of the factor. In this case we make use of results in Kan, Robotti, and Shanken (2013) on the asymptotic variance of the estimated price of *covariance* risk, generalized to the case of scaled covariances. Details are provided in Section A.2 of the Internet Appendix. We are grateful to Raymond Kan for suggesting this solution.

per month,[21] we can no longer reject the null hypothesis that all pricing errors are jointly zero; the estimated zero-beta rate is also indistinguishable from zero at conventional levels of significance. This result is not surprising given the smaller cash flow beta spread across value-to-book portfolios when using VW as opposed to RW portfolios. Nevertheless, the GLS R^2 of 17% in the VW case is still low.

Panel A of Figure 2 presents a graphical view of the results by plotting average realized returns of RW portfolios against model-fitted values. While the market-to-value portfolios line-up well along the 45-degree line, meaning that their returns are well-explained by the model, the value-to-book portfolios are scattered across the middle of the plot – their fitted returns exhibit meaningful variation, while their realized returns do not. The plot using VW test assets looks similar and is reported in the Internet Appendix (Figure A1, Panel A). Overall, including RW value-to-book portfolios to the set of test assets poses a challenge to the performance of the Campbell and Vuolteenaho (2004) pricing model. This echoes Phalippou (2007) and Daniel and Titman (2012) who also show that expanding the set of test portfolios can lead to a rejection of this model.[22]

Panel B of Table X presents the results for the Parker and Julliard (2005) ultimate consumption model. Using RW portfolios as test assets, we estimate a statistically significant ultimate consumption risk premium of 3.8% per quarter and an insignificant zero-beta rate. The OLS R^2 of the model is high and equal to 75%, but once again the GLS R^2 is only 22%. The mean absolute pricing error is 0.21% (quarterly) and we cannot reject the null that all pricing errors are jointly zero. That is, the model appears to fully explain the cross-section of returns on our 20 portfolios. Model performance is less impressive when using VW portfolios as test assets: the estimated risk premium is reduced to 2.6% per quarter, while the estimated zero-beta rate is 1.6%

[21] Using 25 Fama-French size/book-to-market portfolios, Campbell and Vuolteenaho (2004) estimate that the price of cash flow risk is 5.3% per month in the modern sample.

[22] We also assess the performance of the three-beta model of Campbell et al. (2018), which includes a beta with respect to volatility news. Similar to our findings for the two-beta model, we find significant spreads in volatility betas for both firm-specific error and value-to-book. Second-pass pricing regressions show some evidence of a significant volatility risk premium, but the Shanken T^2 statistic rejects the null hypothesis of zero pricing errors when the model is confronted with RW test assets. These results are reported in Tables AXV-AXVII of the Internet Appendix.

per quarter – both marginally statistically significant. The OLS (GLS) R^2 is reduced to 41% (11%), although we still cannot reject that all pricing errors are jointly zero.

Panel B of Figure 2 presents a graphical summary of the results by plotting average realized returns of RW portfolios against model-fitted values. The plot using VW portfolios looks similar and can be found in the Internet Appendix (Figure A1, Panel B). Once again we find that market-to-value portfolios line-up along the 45-degree line, whereas the best-fit line drawn through value-to-book portfolios alone would be closer to a flat one.

[Please Insert Table X and Figure 2 about Here]

Overall, while we cannot formally reject the ultimate consumption risk model (low GLS R^2 notwithstanding), the results in this section indicate that the use of market-to-value and value-to-book portfolios as test assets appears to raise the bar for models attempting to explain the value premium.[23] We now turn to theories that link the value premium to expectation errors and limits to arbitrage and revisit some of the early evidence through our decomposition.

V. Expectation Errors and Limits to Arbitrage

V.A Expectation Errors and Overextrapolation

In this part of the paper we examine whether the results in prior literature linking value/growth to expectation errors are, indeed, due to market-to-value – the component of market-to-book exhibiting return predictability. Specifically, we test whether investors are negatively (positively) surprised by the realization of fundamentals of high (low) market-to-value firms following portfolio formation. The same test is performed by La Porta et al. (1997) for the conventional market-to-book ratio.

We measure excess returns based on the market model over the window (–5, +5) centered on the firms' quarterly earnings announcement dates, and then aggregate these abnormal returns over the 4 quarters *following* portfolio formation. This task is slightly complicated by the fact that firms have different fiscal year ends. Since we form our portfolios on June 30, the actual quarters entering the calculation differ depending on the first reporting quarter on or after June 30.[24] Panel

[23] The returns on our portfolios can be downloaded from the journal's webpage and are also available from the authors.

[24] For a firm with fiscal year end in December 2000, we look at earnings announcement dates that relate to quarters 06/01, 09/01, 12/01 and 03/02. Correspondingly, for a firm with fiscal year end in March 2000, we look at earnings

A of Table XI reports the results. We find that value stocks exhibit positive excess returns around earnings announcements in the year following portfolio formation, while growth stocks exhibit negative excess returns. The difference in earnings announcement returns between value and growth stocks is economically large and highly statistically significant. These results are consistent with the findings of La Porta et al. (1997). When we break up market-to-book into its components, we find that virtually all of this result is driven by market-to-value, and, in particular, by firm-specific error.

Our evidence indicates that investors are negatively surprised by the realization of fundamentals of high market-to-value firms and positively surprised by the news of low market-to-value firms. These effects are consistent with the behavioral explanations for the value premium. However, for these explanations to be complete, one needs to establish i) a mechanism by which stocks become over/undervalued, and ii) the market friction(s) that allows such stock price dislocations to persist for prolonged periods of time. This is what we attempt to do next.

One potential mechanism behind relative over/undervaluation is investors' overextrapolation of recent good or bad news. To test this conjecture, we repeat our earnings announcements tests but this time looking at four quarters *prior to* portfolio formation. Panel B of Table XI presents the results. Indeed, we find that the post-portfolio-formation pattern is reversed: low market-to-book stocks exhibit negative excess returns around earnings announcements, while high market-to-book stocks exhibit positive excess returns. Once again, this pattern is driven by market-to-value and not by value-to-book. That is, stocks whose prices are above fundamental values report good news in the quarters prior to portfolio formation, and vice versa. This suggests that a potential mechanism by which growth (value) stocks become overvalued (undervalued) is investors' overextrapolation of recent good (bad) news. This is in the spirit of Lakonishok, Shleifer, and Vishny (1994) who show that value firms tend to exhibit lower prior growth in accounting fundamentals than growth stocks.

[Please Insert Table XI about Here]

A remaining question, however, is why mispricing (if any) is not corrected by arbitrageurs. After all, our market-to-book decomposition relies on information that is publicly available to

announcement dates for the quarters 06/00, 09/00, 12/00 and 03/01. Similarly, for all other fiscal year end firms we look at the announcement dates that follow portfolio formation.

investors at the time of portfolio formation. Typical explanations for the persistence of mispricing in financial markets revolve around limits to arbitrage (Shleifer and Vishny (1997)). In fact, existing studies show that the value strategy return is largely due to stocks characterized by limits to arbitrage, such as short sale constraints and noise trader risk. In the next section we explore whether these results arise due to the market-to-value component.

V.B Limits to Arbitrage

Short sale constraints limit arbitrageurs' ability to profit from security overvaluation. To test this proposition, we use institutional ownership as our proxy for short sale constraints. Nagel (2005) argues that institutional ownership enables short selling by increasing the supply of lendable shares, and shows that the market-to-book effect is stronger among stocks with low institutional ownership. We implement two-way sorts based on market-to-book or its components and the level of (residual) institutional ownership, resulting in 25 portfolios. Table XII reports the results using RW portfolios. For the remainder of our tests, we report the results for market-to-book, firm-specific error, and value-to-book only. Total error always mimics firm-specific error, and sector error exhibits no particular patterns; these results can be found in the Internet Appendix (Table AXVIII).

Panel A refers to market-to-book. Conditional on low institutional ownership, the long-short return of the market-to-book strategy produces a monthly hedge return of 0.80%. The same long-short strategy for stocks with high institutional ownership produces a hedge return of only about half the size: 0.44% per month. Importantly, this difference arises largely due to *high* market-to-book stocks – those that would be considered overpriced and thus affected by short sale constraints. In Panels B and C we repeat these tests on firm-specific error and value-to-book and find that the above pattern is entirely due to firm-specific error. Again, this result is driven by high market-to-value stocks – the ones that need to be sold short and thus most affected by short sale constraints. The above patterns are not there for value-to-book.

When using VW portfolios, we further split the universe into small and big stocks: Nagel (2005) shows that institutional ownership does not affect the value premium for large stocks, because large stocks tend to be available for shorting regardless of institutional ownership. This means that VW portfolios will tend to work against finding this interaction effect. As expected, the differential market-to-book and market-to-value effects across institutional ownership quintiles are detectable in small but not in large stocks when portfolios are value-weighted (Table AXIX of the Internet Appendix). Overall, there is evidence that the value premium is concentrated in stocks with relatively high short sale constraints, and this finding is due to market-to-value. We now turn to the noise trader risk proposition as an additional limit to arbitrage.

[Please Insert Table XII about Here]

Noise trader risk is the possibility that, in the short run, stock prices may deviate even further from fundamental value and move against the arbitrageur, causing arbitrageurs' capital providers – who are unable to tell noise from actual mistakes – to withdraw capital at the time when it is needed the most. Ali, Hwang, and Trombley (2003) use idiosyncratic stock return volatility as a proxy for arbitrage risk and show that the market-to-book strategy return is greater for the set of stocks with high idiosyncratic return volatility.

We replicate these tests on the conventional market-to-book and then on our components. Table XIII presents the results for market-to-book, firm-specific error and value-to-book using RW portfolios (results for total error and sector error can be found in Table AXX of the Internet Appendix). Panel A shows that the long-short return of the market-to-book strategy is appreciably greater for the high idiosyncratic volatility stocks than for the low idiosyncratic volatility stocks (0.69% per month versus only 0.24% per month). Panel B shows that these differences are even more pronounced when the stocks are sorted on the basis of firm-specific error. Finally, the results in Panel C show no such difference when stocks are sorted on the basis of value-to-book. In VW portfolios we continue to find that the market to-book and market-to-value effects are concentrated in high idiosyncratic volatility stocks, and that this holds for small but not for large stocks (Table AXXI of the Internet Appendix). These results suggest that the value premium is concentrated in stocks characterised by significant noise trader risk.

[Please Insert Table XIII about Here]

Overall, the results reported in this section provide evidence that the market-to-book effect – driven entirely by the market-to-value component – is concentrated in the set of stocks characterized by limits to arbitrage. This is consistent with the proposition that the value/growth dimension captures stock price deviations from fundamental value that cannot be immediately arbitraged away.

V.C A New Time-Series Test: Arbitrage Capital Availability

Finally, we conduct a novel time-series test of the limits to arbitrage story. If the value premium arises due to market inefficiencies, we should find that the return predictability of market-to-book (as driven by market-to-value) decreases with the level of arbitrage capital. Kokkonen and Suominen (2015) show that hedge fund assets under management (HF AUM) serve as a good proxy for arbitrage capital availability. They present evidence that market-level misvaluation is decreasing with the level of HF AUM. Jylhä and Suominen (2011) further study currency speculation by hedge funds, and show that HF AUM relate to currency carry trade returns.

We follow Jylhä and Suominen (2011) and Kokkonen and Suominen (2015) and proxy for arbitrage capital availability with HF AUM, scaled by the average CRSP market capitalization over the previous 12 months.[25] These data are available to us monthly from January 1990 to December 2011. HF AUM exhibits an upward trend over time, starting at around 1.5% in January 1990 and increasing to about 15.0% at the end of 2011, with meaningful variation in between. We divide the 22 sample years for which we have data – corresponding to 22 portfolio formations – into three periods based on HF AUM in June: low (84 months), medium (96 months), and high (84 months).[26] We then examine the performance of our strategies conditional on arbitrage capital availability. Table XIV presents the results for market-to-book, firm-specific error and value-to-book using RW portfolios (results for total error and sector error are in Table AXXII of the Internet Appendix).

The magnitude of value strategy return (Panel A) during the period of low arbitrage capital availability is higher than that during the period of high arbitrage capital availability, although the difference is not statistically significant at conventional levels. Moving to the strategy based on firm-specific error (Panel B), the above pattern becomes more pronounced: firm-specific error yields a significant hedge return of 1.34% conditional on low arbitrage capital, and only a hedge return of 0.40% – statistically insignificant – conditional on high arbitrage capital. The difference in the hedge returns between low and high arbitrage capital periods is 0.94% and is marginally statistically significant (*p*-value of 0.105). Strategy on the basis of value-to-book does not exhibit any patterns. Tests using VW portfolios yield very similar results (Table AXXIII of the Internet

[25] We thank Petri Jylha and Joni Kokkonen for sharing these data with us.

[26] The years of low HF AUM are 1990-1993 and 1999-2001; the years of medium HF AUM are 1994-1998 and 2002-2004, and the years of high HF AUM are 2005-2011.

Appendix). Overall, the return predictability of the conventional value strategy is driven by market-to-value and is concentrated in periods of low arbitrage capital availability. These results are consistent with the proposition that the value effect arises from stock price deviations from fundamental value and subsequent corrections.

[Please Insert Table XIV about Here]

VI. Conclusion

Using the market-to-book decomposition of Rhodes–Kropf, Robinson, and Viswanathan (2005) we show that all of the value premium is driven by market-to-value, whereas value-to-book exhibits no return predictability in either portfolio sorts or firm-level regressions. While prior literature finds that market-to-book is related to operating leverage, duration, exposure to investment-specific technology shocks and analysts' risk ratings, we show that these associations derive from the unpriced value-to-book. Existing results on cash flow and consumption risk exposure are due to the priced component of market-to-book only under certain approaches.

We also find that high (low) market-to-value stocks are characterized by positive (negative) surprises in the quarters prior to portfolio formation, and negative (positive) surprises in the quarters following portfolio formation. This pattern is consistent with investors extrapolating good (bad) news of high (low) market-to-value stocks, leading to temporary mispricing that is subsequently corrected. We also show that the value premium (as driven by market-to-value) is concentrated in stocks characterized by limits to arbitrage – short sale constraints and noise trader risk – and in periods when arbitrage capital availability is low. None of the above patterns hold for value-to-book.

Overall, our evidence casts doubt on several theories associating the value premium with exposure to aggregate risks and on production-based models linking market-to-book to focal firm characteristics. This conclusion is subject to the usual joint hypothesis problem that the model is true and the relevant covariances or characteristics are estimated with precision. At the very least, a valid theory of the value premium would have to offer nuanced predictions that can reconcile the entirety of our results.

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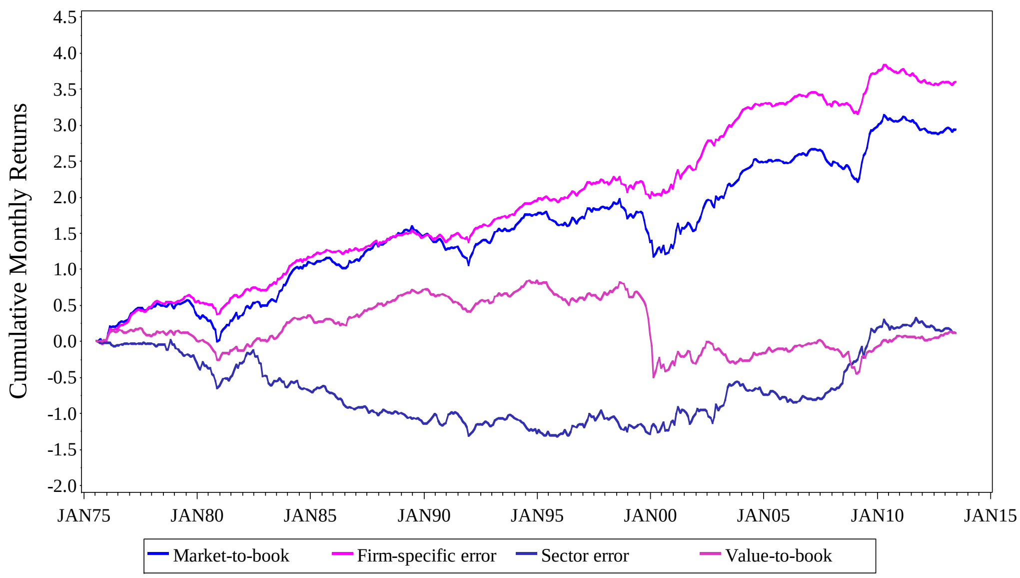
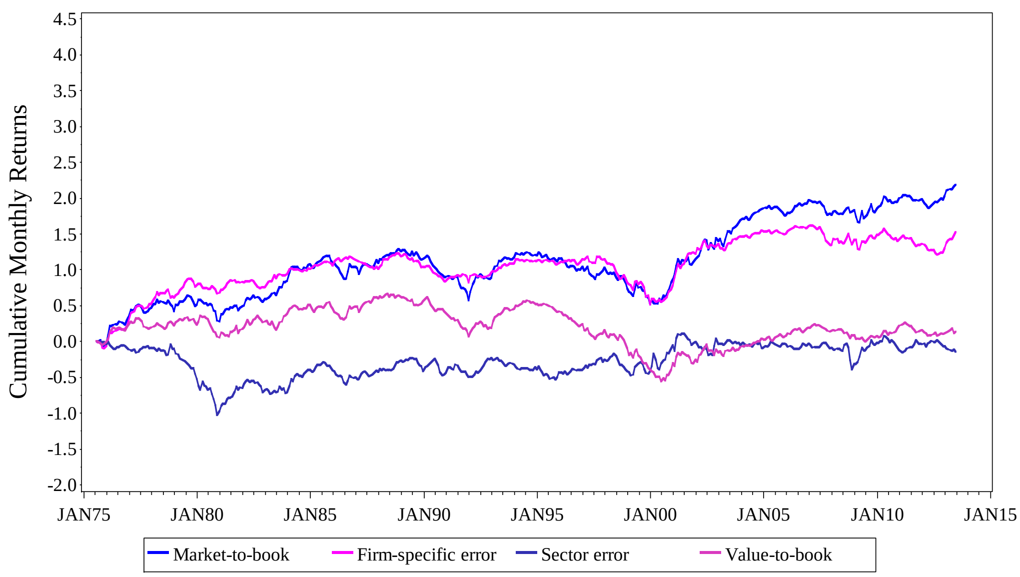
Figure 1
Calendar-time cumulative monthly returns of long/short strategies

Panel A: RW Portfolios



Panel B: VW Portfolios

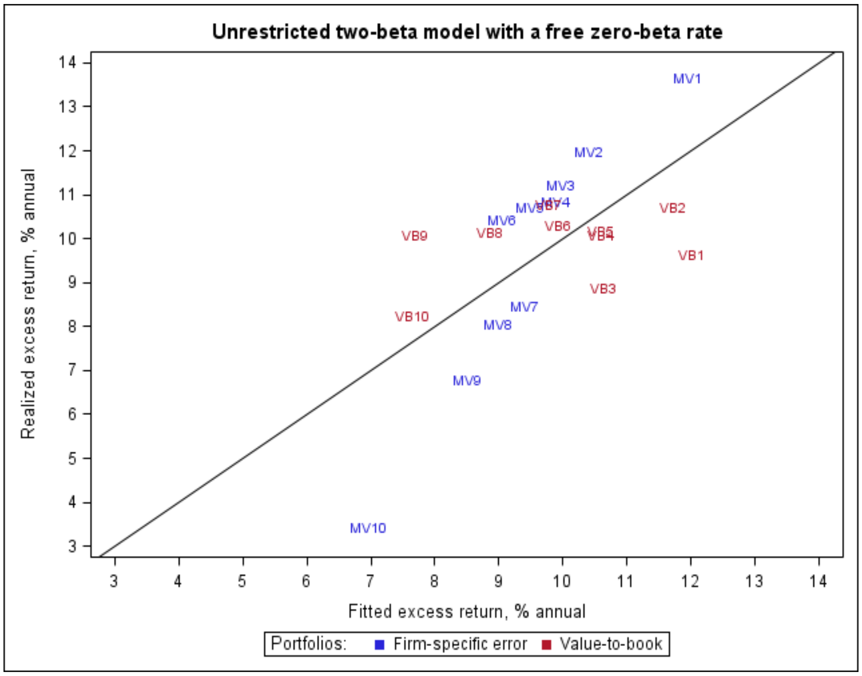


The figure plots the cumulative performance of long-short strategies formed on the basis of log market-to-book ($m_{it} - b_{it}$) and its components: total error ($m_{it} - v(\theta_{it};\ \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$), sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$), and value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$) for the period from July 1975 to June 2013. See Appendix for detailed definitions. Following Asparouhova, Bessembinder, and Kalcheva (2013), two portfolio weighting schemes are used. Panel A shows the performance of gross return-weighted (RW) hedge portfolio strategies. Panel B shows the performance of value-weighted (VW) hedge portfolio strategies. The series illustrate the monthly log of one plus cumulative buy-and-hold return of the corresponding long-short position. Firms are sorted into 10 portfolios every June using NYSE breakpoints.

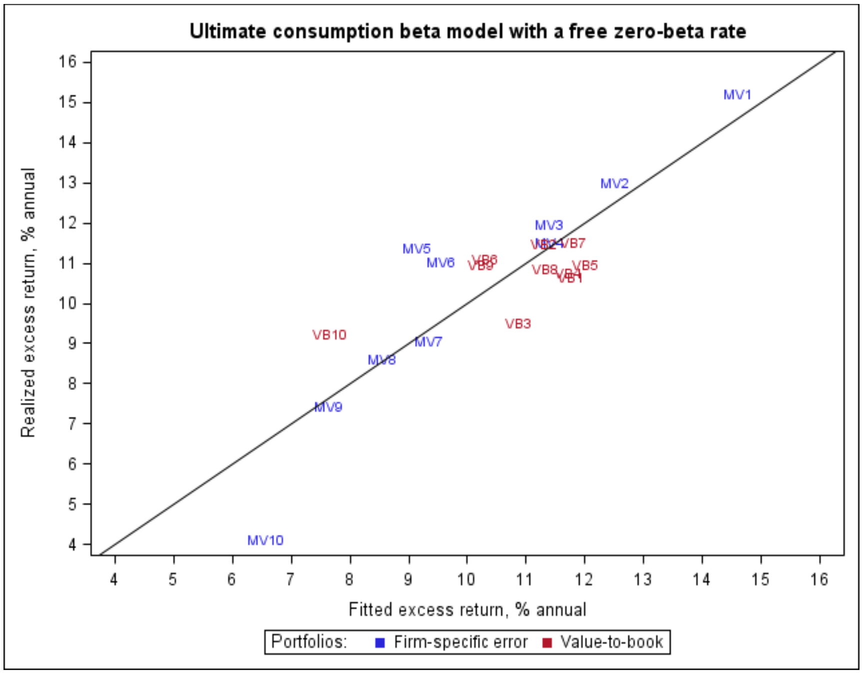
Figure 2

Average realized returns against model-predicted values

Panel A: Campbell and Vuolteenaho (2004) two-beta model



Panel B: Parker and Julliard (2005) ultimate consumption beta model



The figure plots average realized excess returns on test assets against model-predicted values. Panel A refers to the Campbell and Vuolteenaho (2004) model, and Panel B refers to the Parker and Julliard (2005) model. The vertical (horizontal) axis corresponds to realized (fitted) annualized excess returns in percent. Blue "MV" symbols represent firm-specific error portfolios and red "VB" symbols represent value-to-book portfolios (e.g. "MV1" is the lowest firm-specific error portfolio). Portfolio returns are gross-return weighted (RW).

Table I

Market-to-book decomposition

Panel A: Valuation model: $m_{it} = \alpha_{0jt} + \alpha_{1jt}b_{it} + \alpha_{2jt}ni^{+}_{it} + \alpha_{3jt}I_{(<0)}(ni^{+}_{it}) + \alpha_{4jt}LEV_{it} + \varepsilon_{it}$

	Fama-French 12 Industry Classification										
	1	2	3	4	5	6	7	8	9	10	12
α_0	1.493	1.622	1.354	1.613	1.814	1.816	1.744	1.294	1.725	2.251	1.863
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
α_1	0.554	0.558	0.628	(0.671	0.512	0.602	0.606	0.585	0.522	0.549	0.556
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
α_2	0.455	0.391	0.346	0.225	0.469	0.356	0.296	0.371	0.455	0.385	0.348
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
α_3	-0.246	-0.158	-0.174	-0.190	-0.181	-0.247	-0.118	-0.051	-0.289	-0.289	-0.201
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.052)	(0.000)	(0.000)	(0.000)
α_4	-0.246	-0.234	-0.221	0.038	-0.356	-0.273	0.255	-0.137	-0.533	-0.484	-0.434
	(0.000)	(0.025)	(0.001)	(0.588)	(0.010)	(0.000)	(0.002)	(0.190)	(0.000)	(0.000)	(0.000)
R^2	0.871	0.870	0.869	0.901	0.900	0.824	0.876	0.956	0.843	0.847	0.803

Panel B: Decomposition output

	N	Mean	St. Dev	1%	5%	10%	25%	Median	75%	90%	95%	99%
Market-to-book	113,663	0.604	0.856	-3.566	-1.209	-0.649	0.025	0.534	1.117	2.105	2.967	4.592
Total error	113,663	0.021	0.698	-4.157	-1.661	-1.063	-0.410	-0.003	0.421	1.210	1.899	4.921
Firm-specific error	113,663	0.000	0.663	-4.131	-1.565	-1.027	-0.413	-0.027	0.376	1.143	1.809	4.361
Sector error	113,663	0.021	0.219	-1.894	-0.566	-0.326	-0.096	0.021	0.137	0.379	0.604	2.050
Value-to-book	113,663	0.583	0.532	-2.951	-0.840	-0.291	0.243	0.630	0.935	1.377	1.747	3.411

The table presents details of the market-to-book decomposition. Panel A reports the estimation results of the valuation model (Eq. 4) based on a sample of 120,558 firm-year observations over the period 1970–2012. Cross-sectional regressions are run for each Fama-French industry group every year (industry codes are reported across the top). The reported coefficients are time-series averages of the estimated coefficients. Fama-MacBeth *p*-values are reported in parentheses. Time-series averages of adjusted R^2s for each industry are also reported. Panel B reports descriptive statistics for log market-to-book ($m_{it} - b_{it}$) and its components: total error ($m_{it} - v(\theta_{it};\ \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$), sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$), and value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$) for a sample of 113,663 firm-year observations over the period 1975–2012. Subscripts *i*, *j*, and *t* denote firm, industry, and year, respectively. See Appendix for detailed definitions.

Table II

Portfolio sorts on market-to-book and its components

Panel A: RW portfolio returns

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.522	1.496	1.554	1.158	1.220
2	1.533	1.455	1.415	1.295	1.308
3	1.399	1.418	1.350	1.253	1.156
4	1.344	1.317	1.321	1.328	1.258
5	1.254	1.269	1.310	1.286	1.265
6	1.302	1.194	1.285	1.320	1.276
7	1.261	1.103	1.122	1.230	1.316
8	1.189	1.129	1.087	1.222	1.263
9	1.084	0.948	0.982	1.212	1.257
High	0.769	0.743	0.701	1.043	1.104
Low – High	0.754	0.754	0.852	0.115	0.116
t-stat	3.660	4.370	5.554	0.569	0.625
p-value	(0.000)	(0.000)	(0.000)	(0.570)	(0.532)
Sharpe Ratio	0.594	0.709	0.901	0.092	0.101
N	456	456	456	456	456

Panel B: VW portfolio returns

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.494	1.333	1.285	1.057	1.065
2	1.221	1.329	1.109	1.081	1.033
3	1.186	1.273	1.308	1.159	0.914
4	0.954	1.141	1.235	1.129	0.928
5	1.157	1.153	1.288	0.904	1.098
6	1.122	1.014	0.969	0.966	1.070
7	1.043	1.068	1.013	1.069	1.070
8	1.092	1.016	0.965	1.011	1.020
9	0.983	0.863	0.999	1.049	1.120
High	0.907	0.900	0.873	1.018	0.958
Low – High	0.588	0.433	0.411	0.039	0.107
t-stat	2.773	2.215	2.406	0.195	0.627
p-value	(0.006)	(0.027)	(0.017)	(0.846)	(0.531)
Sharpe Ratio	0.450	0.359	0.390	0.032	0.102
N	456	456	456	456	456

The table presents average monthly returns (in percent) of 10 portfolios formed on the basis of log market-to-book ($m_{it} – b_{it}$), total error ($m_{it} – v(\theta_{it}; \alpha_j)$), firm-specific error ($m_{it} – v(\theta_{it}; \alpha_{jt})$), sector error ($v(\theta_{it}; \alpha_{jt}) – v(\theta_{it}; \alpha_j)$), and value-to-book ($v(\theta_{it}; \alpha_j) – b_{it}$) over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2013), two portfolio weighting schemes are used. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High) and the associated *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown. See Appendix for detailed definitions.

Table III

Fama-MacBeth regressions of firm-level returns on market-to-book and its components

	1	2	3	4	5	6
Intercept	1.369	1.229	1.162	3.080	2.832	2.766
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	-0.292			-0.266		
	(0.000)			(0.000)		
First decomposition						
Total error		-0.357			-0.382	
		(0.000)			(0.000)	
Value-to-book		-0.111			-0.055	
		(0.374)			(0.473)	
Comprehensive decomposition						
Firm-specific error			-0.375			-0.394
			(0.000)			(0.000)
Sector error			-0.127			-0.374
			(0.720)			(0.161)
Value-to-book			-0.041			-0.023
			(0.737)			(0.778)
Controls						
m				-0.256	-0.234	-0.230
				(0.000)	(0.000)	(0.000)
β^{+}_{post}				0.084	0.092	0.094
				(0.398)	(0.357)	(0.345)
β^{-}_{post}				0.834	0.827	0.828
				(0.000)	(0.000)	(0.000)
$IVol_{post}$				-42.519	-42.706	-42.178
				(0.000)	(0.000)	(0.000)
Illiquidity				0.010	0.010	0.010
				(0.000)	(0.000)	(0.000)
Ret^{-2-12}				0.383	0.401	0.395
				(0.001)	(0.000)	(0.000)
Ret^{-1}				-0.051	-0.051	-0.052
				(0.000)	(0.000)	(0.000)
OP				0.585	0.560	0.591
				(0.000)	(0.000)	(0.000)
Inv				-0.720	-0.697	-0.685
				(0.000)	(0.000)	(0.000)
Adj. R^2	0.008	0.011	0.016	0.078	0.079	0.081
N	456	456	456	456	456	456

The table reports estimation results obtained from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on log market-to-book, its components, and control variables over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix for detailed definitions of all variables.

Table IV

Cash flow risk

Panel A: Campbell and Vuolteenaho (2004) cash flow beta (N = 456 months)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.351	0.329	0.326	0.280	0.313
2	0.264	0.266	0.267	0.251	0.269
3	0.251	0.245	0.250	0.244	0.238
4	0.253	0.235	0.245	0.250	0.252
5	0.241	0.234	0.227	0.232	0.259
6	0.247	0.235	0.222	0.230	0.254
7	0.229	0.230	0.235	0.237	0.246
8	0.224	0.231	0.233	0.249	0.233
9	0.219	0.226	0.239	0.236	0.218
High	0.211	0.217	0.218	0.236	0.234
Low – High	0.139	0.113	0.108	0.044	0.079
t-stat (lag 1)	3.237	3.088	3.211	1.183	2.348
p-value	(0.001)	(0.002)	(0.001)	(0.237)	(0.019)

Panel B: Da and Warachka (2009) analyst earnings beta (N = 378 months)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.146	1.088	1.129	1.063	1.233
2	1.077	1.045	1.087	1.047	0.956
3	1.077	0.964	1.038	0.867	0.997
4	1.037	1.005	1.014	0.987	1.086
5	1.003	0.998	0.954	1.013	0.987
6	1.017	1.024	0.980	0.953	1.008
7	0.997	0.991	0.975	0.940	0.903
8	1.026	0.944	1.081	0.971	0.871
9	0.877	0.952	0.922	0.857	0.967
High	0.904	1.185	1.067	1.255	0.921
Low – High	0.242	-0.097	0.063	-0.192	0.312
t-stat (lag 12)	2.690	-0.571	0.867	-1.414	3.478
p-value	(0.007)	(0.568)	(0.386)	(0.158)	(0.001)

Panel C: Cash flow beta using earnings realizations (N = 38 years)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.027	1.125	1.023	0.995	1.527
2	1.044	0.907	0.943	1.380	1.053
3	1.079	0.849	0.836	0.567	0.962
4	1.076	0.737	0.814	0.656	1.307
5	1.313	0.661	0.677	0.689	1.518
6	0.867	0.714	0.743	0.726	0.777
7	1.111	0.815	0.932	0.677	0.657
8	0.959	1.136	0.931	0.808	0.924
9	0.776	0.873	0.865	1.000	0.560
High	0.648	1.587	1.758	1.202	0.552
Low – High	0.378	-0.462	-0.735	-0.208	0.975
t-stat (lag 1)	0.778	-1.068	-2.559	-0.363	2.876
p-value	(0.442)	(0.293)	(0.015)	(0.719)	(0.007)

Table IV (*Continued*)

The table presents cash flow betas for portfolios sorted on log market-to-book and its components. Panel A reports sensitivities of monthly portfolio-level log returns to market-level cash flow shocks as in Campbell and Vuolteenaho (2004). Cash flow shocks are obtained from a VAR-based decomposition of the log market excess return, implemented over the period from January 1929 to June 2013. Portfolio returns are gross return-weighted (RW). The sample period for beta estimation runs from July 1975 to June 2013. Panel B reports sensitivities of monthly portfolio-level cash flow news to market-level cash flow news as in Da and Warachka (2009). Cash flow news is defined as the revision in the infinite sum of discounted analysts' earnings forecasts. The sample period is from January 1982 to June 2013. Panel C reports sensitivities of annual portfolio-level cash flow news to market-level cash flows news. Cash flow news is defined as the revision in the sum of discounted future ROEs over a 5-year horizon. The sample period is from June 1975 to June 2012. In all panels, portfolios are formed every June using NYSE breakpoints. See Appendix for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table V

Long-run consumption risk

Panel A: Ultimate consumption risk in returns (Parker and Julliard (2005)) (N = 152 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.707	0.599	0.586	0.266	0.400
2	0.531	0.455	0.449	0.428	0.369
3	0.463	0.385	0.376	0.384	0.341
4	0.399	0.370	0.375	0.386	0.397
5	0.372	0.292	0.227	0.244	0.416
6	0.304	0.257	0.255	0.295	0.304
7	0.224	0.229	0.241	0.339	0.403
8	0.230	0.112	0.188	0.326	0.370
9	0.152	0.150	0.129	0.292	0.299
High	0.019	0.041	0.059	0.259	0.131
Low – High	0.688	0.558	0.527	0.007	0.269
t-stat (lag 1)	3.208	3.246	3.300	0.029	1.665
p-value	(0.002)	(0.001)	(0.001)	(0.977)	(0.098)

Panel B: Consumption risk in cash flows (dividends) (Bansal, Dittmar and Lundblad (2005)) (N = 148 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	-0.108	1.769	1.212	-5.618	0.072
2	-3.025	-3.532	0.455	-6.310	2.219
3	0.595	-2.013	-1.600	-4.533	-3.385
4	0.669	1.177	0.718	-1.684	-5.751
5	1.053	1.747	-1.020	2.280	-4.009
6	0.760	1.249	0.232	4.459	0.820
7	-1.337	-0.031	-0.751	4.941	0.131
8	-3.043	-0.526	-2.918	7.143	2.445
9	-0.556	-1.140	-1.406	0.777	-1.700
High	-1.553	-4.706	-3.444	-0.259	1.131
Low – High	1.445	6.475	4.656	-5.358	-1.060
t-stat (lag 4)	0.215	1.061	0.815	-0.514	-0.224
p-value	(0.830)	(0.290)	(0.416)	(0.608)	(0.823)

Panel C: Ultimate consumption risk in cash flows (dividends) (N = 148 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.068	-0.202	-0.075	-0.609	-0.230
2	-0.137	0.045	-0.060	-0.406	-0.333
3	0.004	-0.278	-0.401	-0.192	-0.214
4	-0.255	-0.360	-0.363	0.037	0.169
5	-0.241	-0.283	-0.094	-0.292	0.049
6	-0.314	-0.337	-0.390	-0.137	-0.402
7	-0.353	-0.175	-0.159	-0.223	-0.067
8	-0.146	-0.389	-0.320	-0.349	-0.164
9	-0.556	-0.192	-0.191	0.092	-0.216
High	-0.155	0.126	-0.078	0.277	-0.669
Low – High	0.223	-0.327	0.003	-0.885	0.439
t-stat (lag 1)	0.494	-0.485	0.006	-0.812	1.272
p-value	(0.622)	(0.629)	(0.996)	(0.418)	(0.205)

Table V (*Continued*)

Panel D: Ultimate consumption risk in cash flows (analysts' earnings forecasts) (N = 126 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.206	0.196	0.192	0.069	0.229
2	0.151	0.123	0.187	0.068	-0.015
3	0.182	0.168	0.118	0.063	0.122
4	0.178	-0.038	0.078	0.130	0.127
5	0.040	0.246	0.129	0.163	0.172
6	0.075	0.076	0.047	0.082	0.222
7	0.069	0.124	0.057	0.047	0.185
8	0.038	0.013	0.134	0.086	0.021
9	0.091	0.089	0.101	0.190	0.041
High	0.064	0.266	0.066	0.384	-0.086
Low – High	0.142	-0.070	0.126	-0.315	0.315
t-stat (lag 12)	0.828	-0.260	0.748	-1.399	2.780
p-value	(0.409)	(0.795)	(0.456)	(0.164)	(0.006)

Panel E: Ultimate consumption risk in cash flows (future earnings realizations) (N = 38 years)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	-0.060	-0.059	0.066	-0.261	0.363
2	0.001	-0.136	0.141	0.261	0.297
3	0.207	-0.092	0.042	-0.099	0.231
4	0.297	0.047	0.142	0.109	0.654
5	0.279	0.204	-0.017	0.059	0.273
6	0.452	0.033	0.162	0.264	0.324
7	0.477	0.350	0.365	0.141	0.186
8	0.430	0.392	0.384	0.396	0.184
9	0.392	0.433	0.242	0.169	-0.061
High	-0.124	0.329	0.248	0.683	-0.114
Low – High	0.064	-0.388	-0.182	-0.944	0.477
t-stat (lag 1)	0.211	-0.988	-0.609	-1.378	1.473
p-value	(0.834)	(0.330)	(0.546)	(0.177)	(0.150)

The table presents consumption betas for portfolios sorted on log market-to-book and its components. Panel A reports sensitivities of quarterly portfolio-level returns to ultimate consumption growth as in Parker and Julliard (2005). Quarterly portfolio returns (obtained by cumulating monthly returns within a quarter) are regressed on the 11-quarter ahead log growth rate in real per capita consumption of non-durable goods. Portfolio returns are gross return-weighted (RW) and converted to real using the PCE deflator. The sample period runs from 1975:Q3 to 2013:Q2. Panel B reports sensitivities of quarterly portfolio-level dividend growth to past consumption growth, as in Bansal, Dittmar and Lundblad (2005). The demeaned seasonally adjusted (4-quarter moving average) log growth rate in portfolio dividends is regressed on the demeaned smoothed (8-quarter moving average) log growth rate in real per capita consumption of non-durables plus services. Portfolio-level monthly dividends are extracted from CRSP using (gross return-weighted) returns with and without dividends. These are subsequently aggregated at the quarterly frequency and converted to real using the PCE deflator. The sample period runs from 1976:Q3 to 2013:Q2. Panel C reports sensitivities of quarterly portfolio-level dividends as in Bansal, Dittmar and Lundblad (2005) to ultimate consumption growth as in Parker and Julliard (2005). Panel D reports sensitivities of quarterly portfolio-level cash flow news, proxied by revisions in the sum of discounted analysts' earnings forecasts, to ultimate consumption growth of Parker and Julliard (2005). Monthly revisions are aggregated to quarterly. The sample period runs from 1982:Q1 to 2013:Q2. Panel E reports sensitivities of annual portfolio-level cash flow news, proxied by revisions in the sum of discounted future ROEs over a 5-year horizon, to annual ultimate consumption growth of Parker and Julliard (2005) as of quarter 4. The sample period runs from 1975 to 2012. In all panels, portfolios are formed every June using NYSE breakpoints. See Appendix for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table VI

Exposure to investment-specific technology shocks (Kogan and Papanikolau (2014)) (N = 456 months)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.747	0.847	0.885	0.816	0.602
2	0.624	0.746	0.716	0.769	0.477
3	0.577	0.663	0.665	0.675	0.524
4	0.593	0.632	0.655	0.614	0.600
5	0.642	0.607	0.611	0.594	0.655
6	0.679	0.636	0.642	0.671	0.689
7	0.740	0.639	0.668	0.636	0.654
8	0.768	0.699	0.716	0.588	0.744
9	0.858	0.800	0.794	0.636	0.884
High	1.016	0.987	0.980	0.875	1.054
Low – High	-0.269	-0.140	-0.095	-0.060	-0.452
t-stat (lag 1)	-3.241	-2.080	-1.881	-0.689	-4.570
p-value	(0.001)	(0.038)	(0.061)	(0.491)	(0.000)

The table presents sensitivities of portfolio-level returns to investment-specific technology shocks (IST) for portfolios sorted on log market-to-book and its components. Following Kogan and Papanikolau (2014), IST shocks are captured by the returns on a factor mimicking portfolio going long investment goods producers and short consumer goods producers (IMC). Portfolio returns are gross return-weighted (RW) and the IMC factor return is value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. After portfolios are formed, investment good producers and services firms are excluded from the sample. Industry classifications are from Gomes, Kogan, and Yogo (2009). The sample period runs from July 1975 to June 2013. See Appendix for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table VII

Operating leverage

Panel A: Firm age (number of years on CRSP)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	17.905	14.197	14.136	17.215	22.915
2	19.140	15.834	16.020	17.858	23.984
3	19.843	17.519	17.166	17.376	21.877
4	19.422	18.224	18.634	16.695	19.785
5	18.354	18.918	19.032	16.838	18.132
6	17.671	19.011	19.091	16.811	17.509
7	16.716	18.341	18.233	17.693	16.313
8	15.570	17.378	17.260	18.823	15.127
9	14.570	16.278	16.024	19.510	14.064
High	11.686	13.514	13.104	19.659	12.022
Low – High	6.220	0.682	1.031	-2.444	10.893
t-stat (lag 3)	3.938	1.002	3.799	-0.844	5.390
p-value	(0.000)	(0.323)	(0.001)	(0.404)	(0.000)

Panel B: Book leverage

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.273	0.217	0.219	0.233	0.310
2	0.251	0.215	0.214	0.219	0.303
3	0.247	0.221	0.223	0.218	0.298
4	0.241	0.226	0.230	0.217	0.274
5	0.234	0.231	0.231	0.213	0.244
6	0.223	0.229	0.235	0.214	0.223
7	0.210	0.227	0.226	0.219	0.206
8	0.201	0.219	0.219	0.235	0.189
9	0.190	0.216	0.211	0.247	0.174
High	0.188	0.227	0.219	0.273	0.172
Low – High	0.084	-0.010	0.000	-0.040	0.138
t-stat (lag 2)	15.252	-1.825	-0.309	-1.749	14.477
p-value	(0.000)	(0.076)	(0.759)	(0.089)	(0.000)

Panel C: Sensitivity to idiosyncratic volatility (Ai and Kiku (2016))

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.019	0.026	0.027	0.022	0.017
2	0.020	0.025	0.025	0.021	0.015
3	0.021	0.022	0.024	0.021	0.015
4	0.021	0.021	0.021	0.021	0.019
5	0.021	0.020	0.019	0.021	0.020
6	0.023	0.019	0.020	0.022	0.023
7	0.024	0.021	0.022	0.022	0.024
8	0.024	0.022	0.022	0.022	0.026
9	0.026	0.025	0.024	0.023	0.027
High	0.033	0.030	0.030	0.026	0.033
Low – High	-0.014	-0.004	-0.003	-0.004	-0.015
t-stat (lag 2)	-3.775	-1.164	-0.935	-0.763	-4.997
p-value	(0.001)	(0.252)	(0.356)	(0.450)	(0.000)

Table VII (*Continued*)

Panel D: Fixed asset tangibility

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.361	0.296	0.294	0.344	0.405
2	0.369	0.313	0.310	0.334	0.454
3	0.380	0.332	0.334	0.324	0.452
4	0.373	0.352	0.357	0.323	0.415
5	0.359	0.363	0.369	0.327	0.368
6	0.336	0.358	0.365	0.333	0.333
7	0.314	0.352	0.350	0.342	0.312
8	0.298	0.328	0.332	0.348	0.288
9	0.282	0.317	0.309	0.357	0.264
High	0.263	0.298	0.294	0.362	0.240
Low – High	0.097	-0.002	0.000	-0.018	0.165
t-stat (lag 2)	7.967	-0.241	-0.066	-0.536	12.054
p-value	(0.000)	(0.811)	(0.947)	(0.595)	(0.000)

The table presents characteristics pertaining to operating inflexibility for portfolios sorted on log market-to-book and its components. Panel A reports average firm age, equal to the number of years between portfolio formation date and the first date the stock appears in CRSP. Panel B reports average book leverage (*LEV*). Panel C reports average firm-level return sensitivity to idiosyncratic volatility shocks following Ai and Kiku (2016), where sensitivities and innovations for each firm are obtained using monthly data over the past 5 years. Panel D reports average fixed asset tangibility, measured as property, plant, and equipment (net) divided by total assets. In all panels, time-series averages of portfolio means across 38 portfolio formation years (1975–2012) are reported. Portfolios are formed every June using NYSE breakpoints. See Appendix for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table VIII

Duration

Panel A: Dechow, Sloan, and Soliman (2004) equity duration implied by v

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	15.498	16.686	16.616	16.640	13.193
2	15.442	16.197	16.173	16.035	14.777
3	15.524	15.976	15.987	15.899	15.235
4	15.586	15.821	15.786	15.839	15.597
5	15.774	15.751	15.696	15.819	15.803
6	15.890	15.716	15.727	15.770	15.957
7	16.056	15.757	15.817	15.751	16.075
8	16.211	15.852	15.879	15.687	16.243
9	16.418	15.900	15.983	15.671	16.528
High	17.062	16.099	16.241	15.696	17.326
Low – High	-1.564	0.587	0.375	0.944	-4.133
t-stat (lag 3)	-4.888	4.234	4.865	2.321	-9.636
p-value	(0.000)	(0.000)	(0.000)	(0.026)	(0.000)

Panel B: Modified Da (2009) portfolio-level cash flow duration

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.459	0.348	0.359	0.320	0.194
2	0.097	0.135	0.222	0.305	0.096
3	-0.016	-0.026	0.119	0.480	0.247
4	0.196	0.107	0.098	0.334	0.395
5	0.159	0.332	0.168	0.274	0.338
6	0.275	0.245	0.185	0.302	0.423
7	0.431	0.292	0.418	0.405	0.502
8	0.493	0.478	0.417	0.349	0.500
9	0.577	0.615	0.618	0.438	0.726
High	0.830	0.522	0.527	0.362	0.667
Low – High	-0.371	-0.173	-0.168	-0.041	-0.473
t-stat (lag 1)	-2.743	-1.552	-1.416	-0.253	-3.969
p-value	(0.010)	(0.130)	(0.165)	(0.801)	(0.000)

Panel C: Chen (2017) buy-and-hold portfolio dividend growth rates (geometric average of years 1-10)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	10.074	10.644	10.594	9.657	7.783
2	7.824	9.336	8.711	9.948	6.408
3	9.073	9.470	9.181	8.965	7.495
4	9.259	9.316	9.254	9.942	9.296
5	9.309	8.708	8.694	9.208	9.478
6	10.288	9.254	8.494	9.349	9.756
7	10.281	9.227	9.680	9.079	8.850
8	11.067	10.072	11.431	7.611	9.774
9	12.612	10.500	10.290	8.339	12.480
High	12.456	10.490	10.982	7.828	12.333
Low – High	-2.382	0.154	-0.388	1.829	-4.550
t-stat (lag 1)	-2.369	0.149	-0.377	1.415	-2.996
p-value	(0.025)	(0.882)	(0.709)	(0.168)	(0.006)

Table VIII (*Continued*)

The table presents measures of duration for portfolios sorted on log market-to-book and its components. Panel A reports means of firm-level implied equity duration as defined in Dechow, Sloan, and Soliman (2004), except that market capitalization is replaced by our estimate of intrinsic value v. Time-series averages of portfolio-level means are taken across 38 portfolio formations (1975–2012). Panel B reports portfolio-level cash flow duration as defined in Da (2009) with two modifications: In computing the infinite sum of discounted dividend growth rates, the first year (look-back) ROE is skipped, and the terminal ROE is set equal to ROE in year 7 instead of the average of ROEs in years 1–7. Time-series averages of portfolio-level duration measures are taken across 36 portfolio formations (1975–2010). Panel C reports buy-and-hold portfolio-level dividend growth rates (in percent) following Chen (2017). For the ten years following each portfolio formation, annual portfolio-level dividends are extracted from monthly CRSP data using RW returns with and without dividends (added up from July to June). The geometric average of dividend growth rates over the years 1–10 is then computed as $(\text{Dividend}_{10}/\text{Dividend}_{1})^{1/9}-1$ at each portfolio formation date. Dividend series are converted to real using the PCE deflator. Time-series averages of portfolio-level dividend growth rates are taken across 29 portfolio formations (1975–2003). In all panels, portfolios are formed every June using NYSE breakpoints. See Appendix for detailed definitions. *t*-statistics and *p*-values (in parentheses) are based on Newey-West adjusted standard errors with the indicated number of lags.

Table IX

Analysts' risk ratings

	1	2	3	4	5	6
Market-to-book	-0.287			-0.195		
	(0.008)			(0.089)		
First decomposition						
Total error		-0.046			-0.099	
		(0.680)			(0.461)	
Value-to-book		-0.739			-0.371	
		(0.000)			(0.021)	
Comprehensive decomposition						
Firm-specific error			-0.070			-0.179
			(0.544)			(0.205)
Sector error			0.358			1.028
			(0.220)			(0.002)
Value-to-book			-0.704			-0.285
			(0.000)			(0.080)
m				-0.615	-0.615	-0.596
				(0.000)	(0.000)	(0.000)
β_{pre}				1.097	1.076	1.058
				(0.000)	(0.000)	(0.000)
$IVol_{pre}$				168.229	166.612	172.706
				(0.000)	(0.000)	(0.000)
Illiquidity				-0.465	-0.450	-0.539
				(0.652)	(0.669)	(0.601)
LEV				0.087	-0.058	-0.087
				(0.872)	(0.911)	(0.868)
R^2	0.011	0.019	0.020	0.296	0.297	0.300
N	2,190	2,190	2,190	2,190	2,190	2,190

The table reports estimation results obtained from pooled ordered logit regressions of analysts' risk ratings on log market-to-book, its components, and control variables. Year fixed effects are included in all regressions. The sample consists of 2,190 stock-year observations covering the period from 2003 to 2010. *p*-values in parentheses are based on heteroscedasticity-robust standard errors clustered by firm. See Appendix for detailed definitions.

Table X

Pricing tests with market-to-value (firm-specific error) and value-to-book portfolios as test assets

Panel A: Campbell and Vuolteenaho (2004) two-beta model

	20 RW portfolios	20 VW portfolios
Intercept (Zero-beta rate)	0.006	0.003
t-stat (EIV)	1.776	0.926
	(0.076)	(0.355)
Cash flow beta	0.030	0.025
t-stat (EIV)	2.673	2.326
	(0.008)	(0.020)
Discount rate beta	-0.005	-0.001
t- stat (EIV)	-1.204	-0.256
	(0.229)	(0.798)
OLS R^2	0.435	0.449
GLS R^2	0.119	0.168
Shanken T^2	48.959	23.804
p-value (χ^2)	(0.000)	(0.162)
p-value (*F*)	(0.001)	(0.305)
MAPE (% per month)	0.112	0.071

Panel B: Parker and Julliard (2005) ultimate consumption beta model

	20 RW portfolios	20 VW portfolios
Intercept (Zero-beta rate)	0.015	0.016
t-stat (EIV)	0.997	1.869
	(0.320)	(0.064)
Ultimate consumption beta	0.038	0.026
t-stat (EIV)	2.306	1.749
	(0.022)	(0.082)
OLS R^2	0.752	0.405
GLS R^2	0.218	0.110
Shanken T^2	24.083	14.876
p-value (χ^2)	(0.193)	(0.730)
p-value (*F*)	(0.408)	(0.868)
MAPE (% per quarter)	0.212	0.259

The table presents results obtained from second-pass cross-sectional OLS regressions of average excess returns on 20 test asset portfolios on the estimated betas and a constant (free zero-beta rate). Betas are re-estimated using portfolio returns in excess of the risk-free rate for consistency with the second-pass regressions. Decile portfolios formed on the basis of firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$) and value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) are used as test assets. In Panel A, cash flow and discount rate betas of Campbell and Vuolteenaho (2004) are used to explain the cross-section of average monthly excess returns (unconstrained version of the two-beta model). *t*-statistics (EIV) incorporate an errors-in-variables correction based on an extension of Kan, Robotti, and Shanken (2011) described in Section A.2 of the Internet Appendix. In Panel B, the ultimate consumption beta of Parker and Julliard (2005) is used to explain the cross-section of average quarterly excess returns. *t*-statistics (EIV) incorporate an errors-in-variables correction following Shanken (1992). *p*-values associated with the *t*-statistics (EIV) are in parentheses. OLS R^2 and GLS R^2 are defined as in Kandel and Stambaugh (1995). Shanken's T^2 statistic testing that all pricing errors are jointly zero (with the associated *p*-values based on χ^2 and *F* distributions), and the mean absolute pricing error (MAPE) are also reported.

Table XI

Evidence on expectation errors: excess returns around earnings announcements

	Low	2	3	4	5	6	7	8	9	High	Low-High
Panel A: Post-portfolio formation											
Market-to-book	0.036	0.021	0.013	0.004	0.003	-0.001	-0.004	-0.013	-0.023	-0.047	0.084
	(0.001)	(0.001)	(0.017)	(0.401)	(0.555)	(0.772)	(0.309)	(0.005)	(0.000)	(0.000)	(0.000)
Total error	0.028	0.012	0.010	0.001	0.001	-0.002	-0.013	-0.016	-0.022	-0.048	0.076
	(0.004)	(0.025)	(0.057)	(0.799)	(0.893)	(0.641)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Firm-specific error	0.028	0.009	0.005	0.005	0.001	-0.002	-0.010	-0.014	-0.020	-0.046	0.074
	(0.005)	(0.131)	(0.322)	(0.343)	(0.746)	(0.721)	(0.005)	(0.003)	(0.000)	(0.000)	(0.000)
Sector error	0.008	0.004	0.001	0.008	0.001	-0.003	-0.008	-0.007	-0.015	-0.023	0.031
	(0.229)	(0.486)	(0.833)	(0.120)	(0.790)	(0.548)	(0.119)	(0.099)	(0.004)	(0.000)	(0.001)
Value-to-book	0.007	0.006	0.010	0.003	0.001	-0.002	-0.001	-0.007	-0.007	-0.022	0.029
	(0.230)	(0.141)	(0.060)	(0.530)	(0.762)	(0.688)	(0.861)	(0.153)	(0.190)	(0.003)	(0.000)
Panel B: Pre-portfolio formation											
Market-to-book	-0.044	-0.018	-0.007	-0.005	0.000	0.006	0.011	0.015	0.020	0.025	-0.069
	(0.000)	(0.000)	(0.179)	(0.293)	(0.915)	(0.231)	(0.017)	(0.011)	(0.003)	(0.001)	(0.000)
Total error	-0.044	-0.017	-0.009	0.005	0.003	0.013	0.012	0.017	0.030	0.033	-0.077
	(0.000)	(0.006)	(0.040)	(0.305)	(0.492)	(0.014)	(0.015)	(0.002)	(0.000)	(0.000)	(0.000)
Firm-specific error	-0.043	-0.017	-0.008	0.000	0.006	0.011	0.013	0.017	0.025	0.035	-0.077
	(0.000)	(0.006)	(0.110)	(0.942)	(0.157)	(0.031)	(0.007)	(0.001)	(0.000)	(0.000)	(0.000)
Sector error	-0.015	-0.003	0.005	-0.003	0.007	0.007	0.009	0.009	0.005	0.003	-0.017
	(0.008)	(0.584)	(0.523)	(0.594)	(0.180)	(0.207)	(0.096)	(0.099)	(0.310)	(0.653)	(0.034)
Value-to-book	0.005	0.005	0.002	0.002	0.002	0.003	0.008	0.006	-0.001	-0.008	0.012
	(0.406)	(0.235)	(0.664)	(0.718)	(0.670)	(0.550)	(0.132)	(0.259)	(0.910)	(0.288)	(0.107)

The table presents average excess earnings announcement returns across portfolios sorted on log market-to-book and its components. For each firm in a portfolio, we calculate buy-and-hold excess returns in the [-5, +5] event window centered on the quarterly earnings announcement date reported by Compustat. We then aggregate these returns over the four quarters following portfolio formation (Panel A) or prior to portfolio formation (Panel B). Excess returns are calculated using the market model with parameters estimated over the period starting 240 days and ending 41 days prior to the announcement date. Portfolios are formed every June using NYSE breakpoints. See Appendix for detailed definitions.

Table XII

Limits to arbitrage: short-sale constraints proxied by institutional ownership

Panel A: Double sort with log market-to-book ($m_{it} – b_{it}$)

	Residual Institutional Ownership						
	Low	2	3	4	High	High–Low	*p*-value
Market-to-book							
Low	1.091	1.383	1.566	1.235	1.485	0.394	(0.049)
2	1.223	1.188	1.263	1.270	1.297	0.074	(0.597)
3	0.937	1.148	1.295	1.213	1.265	0.328	(0.020)
4	0.827	1.054	1.172	1.048	1.273	0.445	(0.002)
High	0.287	0.863	0.895	0.936	1.042	0.755	(0.000)
Low – High	0.804	0.520	0.671	0.299	0.443	-0.360	(0.125)
p-value	(0.000)	(0.009)	(0.001)	(0.143)	(0.065)		

Panel B: Double sort with firm-specific error ($m_{it} – v(\theta_{it}; \alpha_{jt})$)

	Residual Institutional Ownership						
	Low	2	3	4	High	High–Low	*p*-value
Firm-specific error							
Low	1.164	1.218	1.404	1.228	1.478	0.314	(0.100)
2	1.036	1.234	1.332	1.258	1.214	0.178	(0.198)
3	1.044	1.210	1.307	1.086	1.305	0.262	(0.100)
4	0.678	0.944	1.086	1.073	1.071	0.394	(0.008)
High	0.243	0.854	0.896	0.948	1.057	0.814	(0.000)
Low – High	0.921	0.364	0.508	0.279	0.421	-0.500	(0.014)
p-value	(0.000)	(0.041)	(0.002)	(0.099)	(0.031)		

Panel C: Double sort with value-to-book ($v(\theta_{it}; \alpha_j) – b_{it}$)

	Residual Institutional Ownership						
	Low	2	3	4	High	High–Low	*p*-value
Value-to-book							
Low	0.947	1.131	1.281	1.010	1.294	0.347	(0.066)
2	0.822	1.127	1.286	1.055	1.293	0.471	(0.013)
3	0.792	1.147	1.152	1.223	1.278	0.486	(0.001)
4	0.855	1.148	1.213	1.248	1.245	0.390	(0.001)
High	0.620	0.938	1.144	1.087	1.279	0.658	(0.000)
Low – High	0.327	0.193	0.137	-0.077	0.015	-0.311	(0.166)
p-value	(0.202)	(0.293)	(0.456)	(0.681)	(0.938)		

The table presents average monthly returns (in percent) of portfolios sorted independently on log market-to-book (or firm-specific error or value-to-book) and residual institutional ownership following Nagel (2005). Residual institutional ownership is obtained two quarters prior to portfolio formation (i.e. end of December) and is orthogonalized with respect to size and size-squared. See Appendix for detailed definitions. Portfolio returns are gross return-weighted (RW). The time period runs from July 1981 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table XIII

Limits to arbitrage: noise trader risk proxied by idiosyncratic volatility

Panel A: Double sort with log market-to-book ($m_{it} – b_{it}$)

	Idiosyncratic Volatility						
	Low	2	3	4	High	High–Low	*p*-value
Market-to-book							
Low	1.432	1.557	1.372	1.458	1.428	-0.003	(0.991)
2	1.174	1.313	1.443	1.313	1.381	0.207	(0.433)
3	1.223	1.259	1.311	1.403	1.246	0.023	(0.925)
4	1.196	1.206	1.355	1.406	1.101	-0.095	(0.703)
High	1.188	1.178	1.236	1.152	0.740	-0.449	(0.131)
Low – High	0.243	0.379	0.136	0.306	0.689	0.446	(0.022)
p-value	(0.063)	(0.004)	(0.371)	(0.058)	(0.000)		

Panel B: Double sort with firm-specific error ($m_{it} – v(\theta_{it}; \alpha_{jt})$)

	Idiosyncratic Volatility						
	Low	2	3	4	High	High–Low	*p*-value
Firm-specific error							
Low	1.359	1.447	1.338	1.466	1.469	0.109	(0.660)
2	1.308	1.377	1.507	1.468	1.201	-0.107	(0.685)
3	1.201	1.299	1.399	1.365	1.257	0.057	(0.840)
4	1.195	1.144	1.266	1.160	0.998	-0.198	(0.455)
High	1.076	1.142	1.148	1.159	0.613	-0.462	(0.105)
Low – High	0.284	0.305	0.191	0.307	0.855	0.571	(0.000)
p-value	(0.025)	(0.013)	(0.121)	(0.019)	(0.000)		

Panel C: Double sort with value-to-book ($v(\theta_{it}; \alpha_j) – b_{it}$)

	Idiosyncratic Volatility						
	Low	2	3	4	High	High–Low	*p*-value
Value-to-book							
Low	1.185	1.251	1.239	1.203	1.223	0.038	(0.895)
2	1.111	1.214	1.361	1.289	1.173	0.062	(0.812)
3	1.332	1.345	1.338	1.395	1.200	-0.132	(0.573)
4	1.277	1.309	1.313	1.385	1.149	-0.129	(0.572)
High	1.281	1.299	1.377	1.322	1.061	-0.220	(0.459)
Low – High	-0.096	-0.048	-0.138	-0.119	0.162	0.258	(0.227)
p-value	(0.454)	(0.663)	(0.264)	(0.398)	(0.377)		

The table presents average monthly returns (in percent) of portfolios sorted independently on log market-to-book (or firm-specific error or value-to-book) and idiosyncratic return volatility ($IVOL_{pre}$) following Ali, Hwang, and Trombley (2003). Idiosyncratic volatility is calculated as the standard deviation of residuals obtained from a regression of daily stock returns on the CRSP value-weighted market return over the 12 months prior to portfolio formation. See Appendix for detailed definitions. Portfolio returns are gross return-weighted (RW). The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table XIV

Limits to arbitrage: time-series test using hedge funds assets under management

Panel A: Sort on log market-to-book ($m_{it} - b_{it}$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Market-to-book					
Low	1.206	1.856	1.028	-0.178	(0.878)
2	1.084	1.759	1.187	0.103	(0.910)
3	1.216	1.671	0.811	-0.405	(0.642)
4	1.100	1.464	0.821	-0.279	(0.748)
5	1.121	1.387	0.666	-0.455	(0.599)
6	1.172	1.432	0.780	-0.392	(0.657)
7	1.027	1.386	0.692	-0.334	(0.715)
8	1.058	1.351	0.647	-0.411	(0.656)
9	0.644	1.265	0.656	0.012	(0.990)
High	0.372	1.179	0.456	0.084	(0.939)
Low – High	0.833	0.677	0.572	-0.262	(0.734)
p-value	(0.127)	(0.185)	(0.295)		
N	84	96	84		

Panel B: Sort on firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Firm-specific error					
Low	1.434	1.954	0.943	-0.491	(0.665)
2	1.228	1.675	0.762	-0.466	(0.624)
3	1.027	1.413	0.914	-0.112	(0.900)
4	0.911	1.548	0.796	-0.115	(0.896)
5	1.078	1.384	0.858	-0.220	(0.792)
6	1.178	1.465	0.939	-0.239	(0.782)
7	0.885	1.235	0.621	-0.264	(0.762)
8	0.679	1.360	0.733	0.053	(0.952)
9	0.802	1.222	0.610	-0.192	(0.843)
High	0.097	1.061	0.542	0.445	(0.683)
Low – High	1.338	0.893	0.401	-0.936	(0.105)
p-value	(0.001)	(0.020)	(0.325)		
N	84	96	84		

Table XIV (Continued)

Panel C: Sort on value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Value-to-book					
Low	0.688	1.299	0.857	0.169	(0.864)
2	0.902	1.455	0.960	0.058	(0.944)
3	0.564	1.277	0.874	0.310	(0.711)
4	0.790	1.392	0.907	0.117	(0.899)
5	1.019	1.313	0.934	-0.084	(0.926)
6	0.908	1.223	0.911	0.003	(0.997)
7	1.066	1.411	0.726	-0.340	(0.698)
8	0.929	1.604	0.622	-0.307	(0.744)
9	0.987	1.667	0.550	-0.436	(0.670)
High	1.036	1.494	0.600	-0.436	(0.697)
Low – High	-0.348	-0.195	0.258	0.606	(0.410)
p-value	(0.503)	(0.688)	(0.620)		
N	84	96	84		

The table presents average monthly returns (in percent) of portfolios sorted on log market-to-book (Panel A), firm-specific error (Panel B) and value-to-book (Panel C) conditional on arbitrage capital availability. Following Jylha and Suominen (2011) and Kokkonen and Suominen (2015), we capture arbitrage capital availability using hedge fund assets under management (HF AUM). HF AUM is obtained at portfolio formation and is scaled by the average CRSP market capitalization over the previous 12 months. HF AUM is available to us from 1990 to 2011. We classify each of the 22 portfolio formations into low, medium, or high arbitrage capital availability environment based on low, medium or high HF AUM. This leads to three (approximately) equal-sized periods: low (84 months), medium (96 months) and high (84 months). See Appendix for detailed definitions. Portfolio returns are gross return-weighted (RW). The time period runs from July 1990 to June 2012. Portfolios are formed every June using NYSE breakpoints.

Appendix. Definitions of variables

Market-to-book ($m_{it} - b_{it}$)	Natural logarithm of the market-to-book ratio for firm *i* at time *t*.
Total error ($m_{it} - v(\theta_{it};\ \alpha_j)$)	Total error, i.e. the component of $m_{it} - b_{it}$ resulting from stock price deviations from fundamental value implied by long-run industry valuation multiples.
Firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$)	Firm-specific error, i.e. the component of $m_{it} - b_{it}$ resulting from stock price deviations from fundamental value implied by industry-year valuation multiples.
Sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$)	Sector error, i.e. the component of $m_{it} - b_{it}$ resulting from valuations implied by industry-year multiples deviating from valuations implied by long-run multiples.
Value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$)	Long-run value-to-book, i.e. the component of $m_{it} - b_{it}$ resulting from differences between valuations implied by long-run industry multiples and current book values.
m	Natural logarithm of market value of equity as of June 30 from CRSP.
b	Natural logarithm of book value of common equity (CEQ) plus balance sheet deferred taxes (TXDB) as of fiscal year-end from Compustat. Observations with negative book values are excluded.
ni^{+}	Natural logarithm of the absolute value of net income (NI) as of fiscal year-end from Compustat.
$I_{<0}$	Indicator variable equal to one if net income (NI) is negative and zero otherwise.
LEV	Book leverage, defined as long-term debt (DLTT) plus debt in short-term liabilities (DLC) divided by total assets (AT) as of fiscal year-end from Compustat
Growth (robustness checks)	Past growth in sales (SALE) over the years *t* to *t-3*.
β^{+}_{post}	Upside beta, estimated by regressing firm-level daily stock returns on the value-weighted CRSP market index, conditional on market returns being higher than the sample average. The estimation is done over a window of 12 months starting July *t* until June *t+1*. A minimum of 60 daily return observations is required.
β^{-}_{post}	Downside beta, estimated by regressing firm-level daily stock returns on the value-weighted CRSP market index, conditional on market returns being lower than the sample average. The estimation is done over a window of 12 months starting July *t* until June *t+1*. A minimum of 60 daily return observations is required.
$IVol_{post}$	Idiosyncratic volatility of a stock, i.e. the portion of total stock return volatility unexplained by the market. It is calculated as the standard deviation of residuals obtained from a regression of firm-level daily stock returns on the value-weighted CRSP market index. The estimation is done over a window of 12 months starting July *t* until June *t+1*, with a minimum of 60 daily return observations.

β_{pre}	Market beta, estimated by regressing firm-level daily stock returns on the value-weighted CRSP market index. The estimation is done over a window of 12 months starting July *t-1* until June *t*. A minimum of 60 daily return observations is required.
$IVol_{pre}$	The idiosyncratic volatility of a stock, i.e. the portion of total stock return volatility unexplained by the market. It is calculated as the standard deviation of residuals obtained from a regression of firm-level daily stock returns on the value-weighted CRSP market index. The estimation is done over a window of 12 months starting July *t-1* until June *t*, with a minimum of 60 daily return observations.
Illiquidity	The daily ratio of a stock's absolute return to its dollar volume, averaged over a window of 12 months starting July *t-1* until June *t* (Amihud (2002)).
Ret^{-2-12}	Prior buy-and-hold 11-month stock return skipping one month (-2; -12).
Ret^{-1}	Prior one month stock return.
OP	Operating profitability defined as gross profitability (REVT – COGS – XSGA - XINT) divided by book value of common equity (CEQ) as of fiscal year end from Compustat (Fama and French (2015)).
Inv	Investment, defined as the annual percentage change in total assets (AT) from Compustat (Fama and French (2015)).
OLEV	Operating leverage, defined as cost of goods sold (COGS), plus selling, general and administrative expenses (XSGA) divided by total assets (AT) as of fiscal year end from Compustat (Novy-Marx (2011)).
Duration	Implied equity duration following Dechow, Sloan, and Soliman (2004).
Firm age	Number of years between portfolio formation date and the date when the stock first appeared in CRSP.
Sensitivity to idiosyncratic volatility	Sensitivity of monthly firm-level stock returns to innovations in idiosyncratic volatility following Ai and Kiku (2016) estimated over a 5-year period prior to portfolio formation.
Fixed asset tangibility	Net property plant and equipment (PPENT) divided by total assets (AT) as of fiscal year-end from Compustat.
RRating	A discrete variable taking the values 1, 2, 3, 4 for low risk, medium risk, high risk, and speculative risk, respectively. These risk ratings are assigned by equity research analysts of a major financial institution.
RI	Residual institutional ownership 2 quarters prior to portfolio formation, defined as the residual from the following regression model estimated quarterly: $\log(INST_{it}/(1\text{-}INST_{it})) = \alpha + \beta LogSZ_{it} + \gamma(LogSZ_{it})^2$, where INST is institutional ownership and LogSZ is the logarithm of market value of equity. Values of INST below 0.0001 and above 0.9999 are replaced with 0.0001 and 0.9999 respectively (Nagel (2005)). Data are from Thomson 13f Holdings.
HF AUM	Hedge funds assets under management scaled by the average CRSP market capitalization over the previous 12 months. Data are from Jylha and Suominen (2011) and Kokkonen and Suominen (2015).

Internet Appendix to

"Where is the risk in value? Evidence from a market-to-book decomposition"

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A.I Robustness Tests

In this section we briefly describe our robustness checks, which corroborate our main return predictability results, i.e. results obtained from portfolio sorts and firm-level regressions. Our findings are reported in Tables AXXIV-AXXVIII of this Internet Appendix.

First, we estimate the valuation model in equation (4) of the paper using per share values (i.e. scaling market value of equity, book value of equity, and net income by the number of shares outstanding). The R^2 of this alternative specification (not reported) ranges between 57% and 73% depending on the industry. We continue to find that market-to-value (specifically firm-specific error) drives the entire value premium (see Table AXXIV).

Second, we experiment with alternative industry definitions when estimating our valuation model. We consider the Campbell (1996) 12 industry classification, as well as finer Fama-French 30 and Fama-French 38 industry classifications at the expense of having to drop industries that do not contain at least 30 firms in each year. The results show that firm-specific error continues to drive all of the value premium in both portfolio sorts and firm-level regressions (see Tables AXXV-AXXVII).

Finally, we experiment with augmenting the valuation model with a firm-level proxy for growth:

$$m_{it} = \alpha_{0jt} + \alpha_{1jt}b_{it} + \alpha_{2jt}ni^{+}_{it} + \alpha_{3jt}I_{(<0)}(ni^{+}_{it}) + \alpha_{4jt}LEV_{it} + \alpha_{5jt}Growth_{it} + \varepsilon_{it},$$

where $Growth_{it}$ is defined as growth in revenue from year t–3 to year t. The coefficient α_5 in the valuation model is consistently positive across industries, suggesting that firms on faster growth trajectories have higher valuations. Interestingly, the addition of the growth variable contributes very little to the overall explanatory power of the model (the R^2s improve only by up to 1%), suggesting that other aspects of the model are already capturing certain dimensions of growth. Overall, the results do not change any of our conclusions – it is firm-specific error that continues to drive the entire market-to-book return predictability (Table AXXVIII).

A.II Asymptotic Variance of Estimated Risk Premia on Scaled Covariances

In this section we describe the errors-in-variables adjustment for second-pass pricing regressions that utilize scaled covariances as regressors (i.e. Campbell and Vuolteenaho (2004) and Campbell et al. (2018) models). In what follows we use the results in Kan, Robotti, and Shanken (2013) as well as their notation. In particular, Proposition A.3 of their Internet Appendix shows that the asymptotic variance of the estimated prices of covariance risk ($\hat{\lambda}$) is

$$\sqrt{T}\left(\hat{\lambda} - \lambda\right) \sim^{A} N(0_{K+1}, V(\hat{\lambda})), \tag{A1}$$

where

$$V\left(\hat{\lambda}\right) = \sum_{j=-\infty}^{\infty} E[\tilde{h}_t \tilde{h}'_{t+j}]. \tag{A2}$$

With the assumption that h_t is uncorrelated over time, $V\left(\hat{\lambda}\right) = E[h_t h'_t]$ and its consistent estimator is $V\left(\hat{\lambda}\right) = \frac{1}{T}\sum_{t=1}^{T} \tilde{h}_t \tilde{h}'_t$.

Under a correctly specified model, Kan, Robotti and Shanken (2013) show that $\tilde{h}_t$ in the OLS case is given by

$$\tilde{h}_t = (\lambda_t - \lambda) - \tilde{A}\tilde{G}_t\lambda_1, \tag{A3}$$

where λ_1 denotes the last K elements of λ, $\tilde{G}_t = (R_t - \mu_R)\left(f_t - \mu_f\right)' - V_{Rf}$, $\tilde{H} = (C'C)^{-1}$, $\tilde{A} = \tilde{H}C'$, $\lambda_t = \tilde{A}R_t$.

Instead of using covariances V_{Rf} as regressors in the cross-sectional regression, one can use scaled covariances

$$B = \frac{1}{\sigma_Z^2} V_{Rf} \tag{A4}$$

as regressors, where σ_Z^2 is the variance of a random variable Z_t. The sample estimate of B is given by

$$\hat{B} = \frac{1}{\hat{\sigma}_Z^2} \hat{V}_{Rf}. \tag{A5}$$

Let

$$D = [1_N, B], \tag{A6}$$

$$\widehat{D} = \left[1_N, \hat{B}\right], \tag{A7}$$

and

$$\eta = (D'D)^{-1}(D'\mu_R), \tag{A8}$$

$$\hat{\eta} = \left(\widehat{D}'\widehat{D}\right)^{-1}(\widehat{D}'\hat{\mu}_R). \tag{A9}$$

It can be easily shown that

$$\eta_0 = \lambda_0, \tag{A10}$$

$$\eta_1 = \sigma_z^2\lambda_1, \tag{A11}$$

$$\hat{\eta}_0 = \hat{\lambda}_0, \tag{A12}$$

$$\hat{\eta}_1 = \hat{\sigma}_z^2\hat{\lambda}_1. \tag{A13}$$

Using the delta method, it can be shown that

$$\sqrt{T}(\hat{\eta} - \eta) \sim^A N(0_{K+1}, \sum_{j=-\infty}^{\infty} E[\, g_t {g'}_{t+j}]), \tag{A14}$$

Where $g_t = [g_{0,t}, {g'}_{1,t}]'$, with

$$g_{0,t} = \tilde{h}_{0,t}, \tag{A15}$$

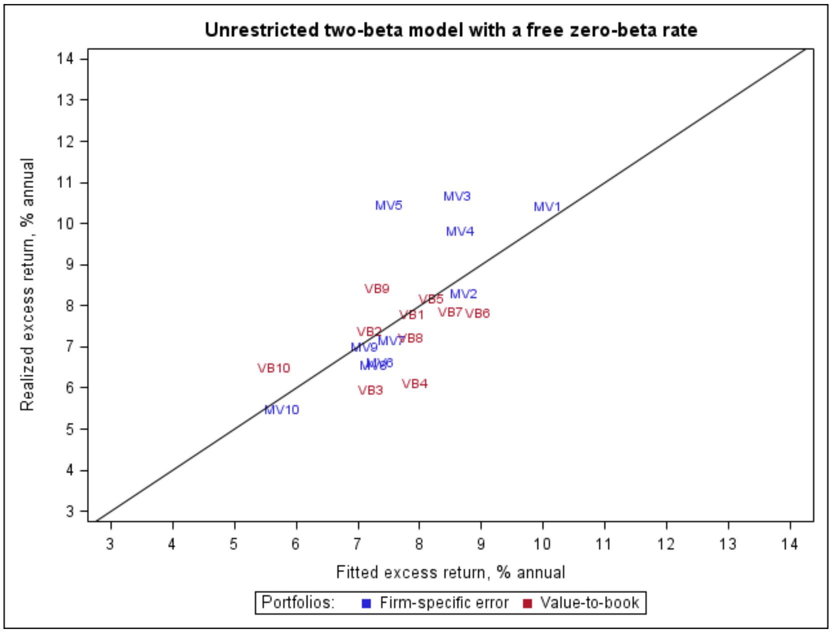
$$g_{1,t} = \sigma_z^2\tilde{h}_{1,t} + \lambda_1((Z_t - \mu_z)^2 - \sigma_z^2). \tag{A16}$$

A.III Additional Figures and Tables

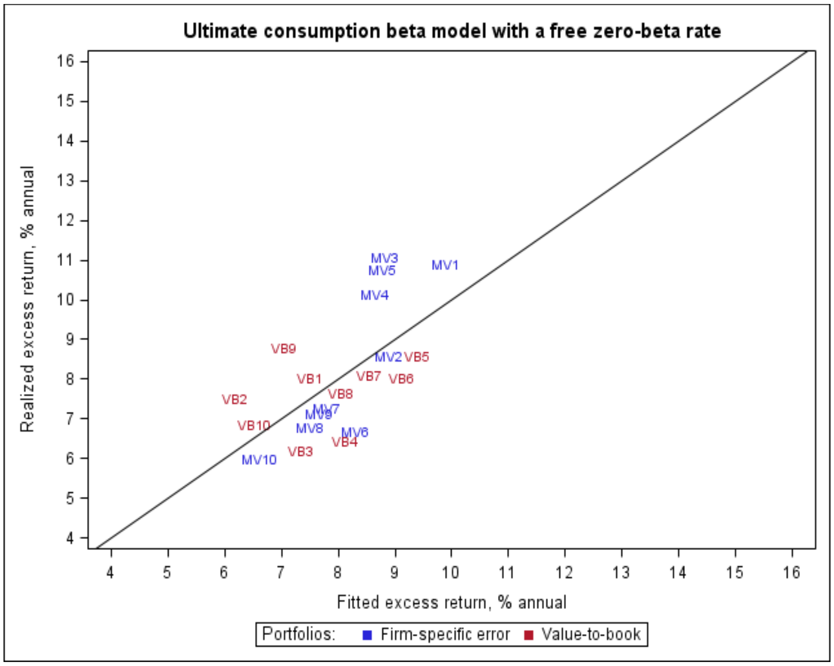
Figure A1

Average realized returns against model-predicted values (VW)

Panel A: Campbell and Vuolteenaho (2004) two-beta model



Panel B: Parker and Julliard (2005) ultimate consumption beta model



The figure plots average realized excess returns on test assets against model-predicted values. Panel A refers to the Campbell and Vuolteenaho (2004) model, and Panel B refers to the Parker and Julliard (2005) model. The vertical (horizontal) axis corresponds to realized (fitted) annualized excess returns in percent. Blue "MV" symbols represent firm-specific error portfolios and red "VB" symbols represent value-to-book portfolios (e.g. "MV1" is the lowest firm-specific error portfolio). Portfolio returns are value-weighted (VW).

Table AI

Sample formation and descriptive statistics

Panel A: Data selection

	Firm-years	**Firms**
Matched Compustat/CRSP for the period 1970 – 2012	224,614	21,802
less stocks other than NYSE, AMEX or Nasdaq stocks	*-5,844*	*-655*
Stocks listed on NYSE, AMEX or Nasdaq	218,770	21,147
less stocks other than ordinary common stocks	*-22,024*	*-2,353*
Ordinary common stocks listed on NYSE, AMEX or Nasdaq	196,746	18,794
less financial firms	*-32,892*	*-3,053*
Non-financial firms with ordinary common stocks listed on NYSE, AMEX or Nasdaq	163,854	15,741
less stocks with market value of equity below $10 million on June 30	*-28,207*	*-1,896*
Sample after excluding microcap stocks	135,647	13,845
less observations with missing b, m, ni, LEV, and ROE	*-37,969*	*-2,684*
Sample with non-missing *b, m, ni, LEV* and *ROE*	125,885	13,057
less observations with BP outside [0.01, 100], LEV outside [0, 1], ROE outside [-1, 1]	*-5,327*	*-527*
Final sample	**120,558**	**12,530**

Panel B: Industry composition

FF code	**Industry**	**Firm-years**	**% of obs.**
1	Consumer Non-Durables	10,061	8.35
2	Consumer Durables	4,333	3.59
3	Manufacturing	19,774	16.40
4	Energy	5,776	4.79
5	Chemicals and Allied Products	3,919	3.25
6	Business Equipment	22,407	18.59
7	Telephone and TV Transmission	2,997	2.49
8	Utilities	6,583	5.46
9	Wholesale	16,193	13.43
10	Medical	11,129	9.23
12	Everything else (except finance)	17,386	14.42
Total		**120,558**	**100.00**

Table AI (*Continued*)

Panel C: Descriptive statistics

	N	Mean	St. Dev	1%	5%	25%	Median	75%	95%	99%
ME	120,558	1,736	10,717	10.665	13.597	39.192	139.4	632.0	5,612	28,367
BE	120,558	735.9	3,921	2.268	6.58	26.73	83.3	329.5	2,574	11,705
NI	120,558	76.01	715.4	-222	-31.346	0.466	5.323	28.88	296.82	1,513.4
ROE	120,558	0.074	0.245	-0.800	-0.428	0.017	0.108	0.184	0.389	0.704
LEV	120,558	0.223	0.181	0.000	0.000	0.055	0.208	0.349	0.548	0.694
m	120,558	5.189	1.891	2.367	2.610	3.668	4.937	6.449	8.633	10.253
b	120,558	4.606	1.845	0.819	1.883	3.286	4.422	5.798	7.853	9.368
ni^+	120,558	2.431	1.989	-2.146	-0.587	1.078	2.305	3.710	5.850	7.435
$I_{<0}$	120,558	0.222	0.415	0.000	0.000	0.000	0.000	0.000	1.000	1.000

The table reports sample formation, sample industry composition and sample descriptive statistics. Panel A details the sample selection criteria leading to a final sample of 120,558 firm-year observations for the period 1970–2012, which forms the basis for the valuation model estimation. Panel B reports industry composition of this sample using the Fama-French 12 industry classification (financials excluded). Panel C reports the descriptive statistics of the main variables. *ME* is market value of equity as of June 30 (in US$ mil.). *BE* is book value of common equity plus balance sheet deferred taxes (in US$ mil.). *NI* is net income (in US$ mil.). $I_{<0}$ is an indicator variable taking the value of one when net income is negative and zero otherwise. *ROE* is return on equity defined as net income divided by beginning of period *BE*. *LEV* is book leverage defined as long-term debt plus debt in short-term liabilities divided by total assets. Lowercase letters are used for variables expressed in natural logs: *m* is natural logarithm of *ME*, *b* is natural logarithm of *BE*, and ni^+ is natural logarithm of the absolute value of *NI*.

Table AII

Portfolio sorts using industry-adjusted market-to-book and industry market-to-book

Panel A: RW portfolios

	Industry-adjusted market-to-book	*Firm-specific error*	*Industry market-to-book*	*Value-to-book*
Low	1.641	1.554	1.122	1.220
2	1.456	1.415	0.766	1.308
3	1.379	1.350	1.363	1.156
4	1.296	1.321	1.488	1.258
5	1.261	1.310	1.151	1.265
6	1.218	1.285	1.282	1.276
7	1.130	1.122	1.278	1.316
8	1.127	1.087	0.992	1.263
9	1.037	0.982	1.333	1.257
High	0.750	0.701	1.363	1.104
Low – High	0.891	0.852	-0.241	0.116
t-stat	5.369	5.554	-0.970	0.625
p-value	(0.000)	(0.000)	(0.332)	(0.532)
Sharpe Ratio	0.871	0.901	-0.157	0.101
N	456	456	456	456

Panel B: VW portfolios

	Industry-adjusted market-to-book	*Firm-specific error*	*Industry market-to-book*	*Value-to-book*
Low	1.460	1.285	1.045	1.065
2	1.384	1.109	0.793	1.033
3	1.130	1.308	1.073	0.914
4	1.212	1.235	1.328	0.928
5	1.056	1.288	0.986	1.098
6	1.126	0.969	1.201	1.070
7	1.069	1.013	1.077	1.070
8	1.094	0.965	0.834	1.020
9	0.898	0.999	1.212	1.120
High	0.883	0.873	0.937	0.958
Low – High	0.577	0.411	0.108	0.107
t-stat	2.909	2.406	0.477	0.627
p-value	(0.004)	(0.017)	(0.633)	(0.531)
Sharpe Ratio	0.472	0.390	0.077	0.102
N	456	456	456	456

The table presents average monthly returns (in percent) of 10 portfolios formed on the basis of industry-adjusted market-to-book, firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$), industry market-to-book, and value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$). Industry-adjusted market-to-book is defined as log market-to-book minus log industry market-to-book. Industry market-to-book is defined as log industry market value minus log industry book value. Fama-French 12 industry classification (excluding financials) is used to define industries for consistency with our decomposition. The sample period runs from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2013), two portfolio weighting schemes are used. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High), the associated *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown.

Table AIII

Variation in firm-specific error and value-to-book explained by industry-adjusted market-to-book and industry market-to-book

Panel A: Firm-specific error

	1	2
Intercept	0.129	0.000
	(0.000)	(0.747)
Industry-adjusted market-to-book	0.662	
	(0.000)	
Industry market-to-book		0.000
		(0.940)
R^2	0.662	0.000
N	38	38

Panel B: Value-to-book

	1	2
Intercept	0.575	0.137
	(0.000)	(0.000)
Industry-adjusted market-to-book	0.254	
	(0.000)	
Industry market-to-book		0.592
		(0.000)
R^2	0.171	0.173
N	38	38

The table reports estimation results obtained from annual Fama-MacBeth regressions of firm-specific error (Panel A) and value-to-book (Panel B) on industry-adjusted market-to-book and industry market-to-book. *Industry-adjusted market-to-book* is defined as log market-to-book minus log industry market-to-book. *Industry market-to-book* is defined as log industry market value minus log industry book value. Fama-French 12 industry classification (excluding financials) is used to define industries, in consistency with our decomposition. Reported R^2s are time-series means of yearly R^2s.

Table AIV

Frequency matrix for firm-specific error/industry-adjusted market-to-book and value-to-book/industry market-to-book

Panel A: Firm-specific error and industry-adjusted market-to-book

	Industry-adjusted market-to-book									
	Low	1	2	3	4	5	6	7	8	High
Firm-specific error										
Low	56.10	22.60	10.54	4.92	2.60	1.34	0.91	0.54	0.29	0.17
1	17.38	27.30	21.97	13.84	8.35	4.60	2.84	2.06	1.10	0.56
2	7.30	16.29	21.31	18.96	13.81	9.23	5.34	4.10	2.27	1.39
3	4.60	9.81	14.27	18.49	17.28	13.73	9.75	6.33	3.93	1.82
4	2.71	6.29	9.14	13.57	17.43	16.74	15.07	10.13	5.73	3.19
5	1.92	3.78	6.19	9.34	14.05	17.06	17.34	14.77	10.31	5.24
6	1.50	3.17	4.82	6.58	9.21	13.07	16.69	19.63	17.01	8.31
7	1.38	2.42	3.40	4.52	6.33	8.83	12.93	19.15	24.62	16.43
8	0.98	1.60	2.56	3.17	4.04	5.28	7.39	13.52	27.20	34.27
High	0.75	0.98	1.40	1.63	2.00	2.53	3.53	4.94	12.10	70.15

Panel B: Value-to-book and industry market-to-book

	Industry market-to-book									
	Low	1	2	3	4	5	6	7	8	High
Value-to-book										
Low	14.89	8.24	10.99	12.24	16.13	11.30	9.57	8.79	4.84	3.01
1	28.79	7.74	9.46	10.06	13.72	8.73	7.08	6.72	5.37	2.34
2	27.52	7.14	11.13	9.70	14.09	8.43	6.74	6.97	5.61	2.66
3	20.08	7.84	12.30	11.11	14.78	8.47	6.98	8.17	7.39	2.89
4	10.34	7.83	13.87	13.96	15.97	9.89	8.07	9.15	7.84	3.08
5	6.41	6.85	12.89	14.81	15.56	10.40	9.19	11.65	8.55	3.67
6	5.25	6.87	12.27	13.98	14.20	10.93	9.78	12.10	10.10	4.53
7	4.29	5.69	11.00	12.02	12.84	10.68	9.88	13.60	13.40	6.60
8	3.10	4.12	7.66	9.63	11.04	10.65	9.67	14.73	17.44	11.96
High	2.20	3.07	5.20	6.03	7.74	7.07	6.93	11.05	21.27	29.45

The table reports decile portfolio frequency matrices for firm-specific error and industry-adjusted market-to-book (Panel A) and for value-to-book and industry market-to-book (Panel B). Values reported across the row represent the fraction of stocks in a given firm-specific error (value-to-book) decile falling into each industry-adjusted market-to-book (industry market-to-book) decile. Values across rows add up to 100. *Industry-adjusted market-to-book* is defined as log market-to-book minus log industry market-to-book. *Industry market-to-book* is the log industry market-to-book, defined as log industry market value minus log industry book value. Fama-French 12 industry classification (excluding financials) is used to define industries, in consistency with our decomposition. Sorts are based on NYSE breakpoints.

Table AV

Sorts on market-to-book and its components within size quintiles (RW)

Panel A: Market-to-book ($m_{it} – b_{it}$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Market-to-book							
Low	1.536	1.421	1.498	1.357	1.169	0.368	(0.167)
2	1.552	1.448	1.261	1.210	1.102	0.450	(0.041)
3	1.461	1.351	1.278	1.215	1.042	0.419	(0.022)
4	1.331	1.399	1.318	1.160	1.016	0.315	(0.094)
High	1.043	1.077	1.103	1.132	0.947	0.095	(0.663)
Low – High	0.493	0.344	0.395	0.225	0.221	0.272	(0.198)
p-value	(0.013)	(0.081)	(0.049)	(0.257)	(0.262)		

Panel B: Total error ($m_{it} – v(\theta_{it}; \alpha_j)$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Total error							
Low	1.568	1.414	1.420	1.449	1.181	0.386	(0.141)
2	1.474	1.451	1.452	1.294	1.089	0.385	(0.068)
3	1.398	1.464	1.263	1.183	1.097	0.301	(0.126)
4	1.305	1.285	1.250	1.131	0.919	0.386	(0.043)
High	0.882	1.007	1.060	1.054	0.990	-0.108	(0.591)
Low – High	0.685	0.407	0.359	0.395	0.191	0.495	(0.010)
p-value	(0.000)	(0.017)	(0.050)	(0.022)	(0.260)		

Panel C: Firm-specific error ($m_{it} – v(\theta_{it}; \alpha_{jt})$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Firm-specific error							
Low	1.594	1.408	1.366	1.394	1.200	0.394	(0.114)
2	1.553	1.464	1.440	1.315	1.020	0.533	(0.015)
3	1.362	1.359	1.253	1.105	1.036	0.326	(0.100)
4	1.322	1.310	1.278	1.170	0.989	0.332	(0.075)
High	0.881	1.043	1.055	1.092	1.004	-0.123	(0.544)
Low – High	0.712	0.365	0.311	0.302	0.195	0.517	(0.004)
p-value	(0.000)	(0.014)	(0.068)	(0.046)	(0.176)		

Panel D: Sector error ($v(\theta_{it}; \alpha_{jt}) – v(\theta_{it}; \alpha_j)$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Sector error							
Low	1.124	1.363	1.367	1.325	1.144	-0.020	(0.931)
2	1.391	1.374	1.289	1.202	1.102	0.288	(0.182)
3	1.329	1.241	1.245	1.244	0.995	0.334	(0.118)
4	1.358	1.341	1.312	1.268	1.135	0.222	(0.281)
High	1.276	1.115	1.159	1.042	0.910	0.367	(0.094)
Low – High	-0.153	0.248	0.208	0.284	0.234	-0.386	(0.041)
p-value	(0.344)	(0.153)	(0.265)	(0.128)	(0.237)		

Table AV (*Continued*)

Panel E: Value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Value-to-book							
Low	1.221	1.222	1.255	1.143	1.134	0.086	(0.691)
2	1.312	1.287	1.295	1.148	0.990	0.322	(0.100)
3	1.268	1.389	1.261	1.207	1.076	0.192	(0.285)
4	1.341	1.383	1.238	1.238	0.943	0.398	(0.030)
High	1.222	1.152	1.228	1.229	1.080	0.142	(0.553)
Low – High	-0.001	0.069	0.027	-0.086	0.054	-0.056	(0.761)
p-value	(0.993)	(0.676)	(0.867)	(0.614)	(0.728)		

The table presents average monthly returns (in percent) of gross return-weighted (RW) portfolios sorted on log market-to-book (or its components) conditional on size. Stocks are first sorted into size quintiles, and then sorted on log market-to-book or its components within each size quintile. See Appendix of the paper for detailed definitions. The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AVI

Sorts on market-to-book and its components within size quintiles (VW)

Panel A: Market-to-book ($m_{it} - b_{it}$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Market-to-book							
Low	1.552	1.359	1.463	1.292	1.019	0.533	(0.040)
2	1.559	1.405	1.226	1.166	1.015	0.543	(0.013)
3	1.483	1.330	1.231	1.170	0.967	0.517	(0.013)
4	1.410	1.391	1.316	1.130	1.014	0.396	(0.056)
High	1.206	1.160	1.123	1.158	0.866	0.340	(0.159)
Low – High	0.346	0.199	0.340	0.134	0.153	0.193	(0.368)
p-value	(0.122)	(0.314)	(0.096)	(0.527)	(0.402)		

Panel B: Total error ($m_{it} - v(\theta_{it}; \alpha_j)$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Total error							
Low	1.594	1.368	1.424	1.386	1.084	0.509	(0.045)
2	1.566	1.466	1.418	1.257	0.953	0.613	(0.008)
3	1.509	1.415	1.213	1.107	1.101	0.408	(0.059)
4	1.451	1.309	1.239	1.123	0.855	0.596	(0.008)
High	1.048	1.077	1.070	1.089	0.861	0.187	(0.407)
Low – High	0.546	0.291	0.354	0.297	0.224	0.322	(0.070)
p-value	(0.001)	(0.094)	(0.064)	(0.109)	(0.174)		

Panel C: Firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Firm-specific error							
Low	1.623	1.367	1.368	1.308	1.095	0.528	(0.026)
2	1.596	1.497	1.377	1.298	1.002	0.593	(0.008)
3	1.508	1.341	1.245	1.058	0.929	0.578	(0.014)
4	1.408	1.318	1.265	1.135	0.961	0.447	(0.040)
High	1.074	1.094	1.063	1.129	0.879	0.194	(0.389)
Low – High	0.549	0.272	0.305	0.179	0.216	0.334	(0.051)
p-value	(0.000)	(0.079)	(0.091)	(0.273)	(0.129)		

Panel D: Sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Sector error							
Low	1.236	1.297	1.344	1.274	1.033	0.202	(0.396)
2	1.459	1.371	1.316	1.178	0.952	0.507	(0.031)
3	1.390	1.288	1.226	1.269	0.837	0.553	(0.014)
4	1.365	1.359	1.291	1.249	1.087	0.278	(0.230)
High	1.370	1.175	1.125	0.989	0.894	0.476	(0.047)
Low – High	-0.135	0.122	0.219	0.285	0.140	-0.274	(0.144)
p-value	(0.425)	(0.475)	(0.214)	(0.119)	(0.427)		

Table AVI (*Continued*)

Panel E: Value to book ($v(\theta_{it};\alpha_j) - b_{it}$) sort conditional on size

	Size						
	Low	2	3	4	High	High–Low	*p*-value
Value-to-book							
Low	1.232	1.191	1.191	1.097	1.018	0.214	(0.344)
2	1.217	1.290	1.311	1.117	0.896	0.320	(0.106)
3	1.350	1.362	1.199	1.144	0.977	0.374	(0.056)
4	1.417	1.412	1.293	1.271	0.892	0.525	(0.007)
High	1.339	1.206	1.229	1.223	1.000	0.339	(0.190)
Low – High	-0.108	-0.015	-0.038	-0.125	0.017	-0.125	(0.574)
p-value	(0.578)	(0.924)	(0.816)	(0.502)	(0.915)		

The table presents average monthly returns (in percent) of value-weighted (VW) portfolios sorted on log market-to-book (or its components) conditional on size. Stocks are first sorted into size quintiles, and then sorted on log market-to-book or its components within each size quintile. See Appendix of the paper for detailed definitions. The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AVII

Unconditional 3x2 sorts – RW portfolios

Panel A: Double sort on market-to-book ($m_{it} - b_{it}$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Market-to-book				
Low	1.494	1.322	0.172	(0.303)
Medium	1.345	1.171	0.174	(0.222)
High	0.980	1.068	-0.088	(0.569)
Low – High	0.514	0.253	0.261	(0.022)
p-value	(0.001)	(0.100)		

Panel B: Double sort on total error ($m_{it} - v(\theta_{it}; \alpha_j)$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Total error				
Low	1.468	1.407	0.061	(0.702)
Medium	1.257	1.185	0.072	(0.620)
High	0.884	1.025	-0.141	(0.326)
Low – High	0.584	0.382	0.202	(0.058)
p-value	(0.000)	(0.003)		

Panel C: Double sort on firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Firm-specific error				
Low	1.473	1.305	0.167	(0.293)
Medium	1.293	1.188	0.105	(0.458)
High	0.854	1.054	-0.200	(0.160)
Low – High	0.618	0.251	0.367	(0.000)
p-value	(0.000)	(0.021)		

Panel D: Double sort on sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$) and size

	Size			
Sector error	Small	Big	Small-Big	*p*-value
Low	1.230	1.234	-0.004	(0.981)
Medium	1.362	1.135	0.227	(0.101)
High	1.155	1.060	0.095	(0.507)
Low – High	0.076	0.174	-0.098	(0.427)
p-value	(0.556)	(0.240)		

Table AVII (Continued)

Panel E: Double sort on value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) and size

	Size			
Value-to-book	Small	Big	Small-Big	*p*-value
Low	1.259	1.102	0.157	(0.295)
Medium	1.332	1.175	0.157	(0.186)
High	1.227	1.137	0.090	(0.598)
Low – High	0.032	-0.035	0.067	(0.597)
p-value	(0.825)	(0.771)		

The table presents average monthly returns (in percent) of gross return-weighted (RW) portfolios sorted on log market-to-book (or its components) and size. Stocks are independently sorted into Small and Big based on the median market capitalization, and into Low, Medium and High based on the 30th and 70th percentiles of market-to-book or its components. See Appendix of the paper for detailed definitions. The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AVIII

Unconditional 3x2 sorts– VW portfolios

Panel A: Double sort on market-to-book ($m_{it} - b_{it}$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Market-to-book				
Low	1.479	1.164	0.315	(0.045)
Medium	1.373	1.012	0.361	(0.017)
High	1.147	0.945	0.203	(0.270)
Low – High	0.332	0.219	0.112	(0.389)
p-value	(0.039)	(0.153)		

Panel B: Double sort on total error ($m_{it} - v(\theta_{it}; \alpha_j)$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Total error				
Low	1.489	1.235	0.254	(0.108)
Medium	1.368	1.054	0.313	(0.042)
High	1.070	0.902	0.168	(0.359)
Low – High	0.419	0.333	0.086	(0.483)
p-value	(0.001)	(0.011)		

Panel C: Double sort on firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Firm-specific error				
Low	1.468	1.110	0.358	(0.022)
Medium	1.373	1.069	0.304	(0.044)
High	1.082	0.935	0.147	(0.423)
Low – High	0.386	0.175	0.211	(0.078)
p-value	(0.001)	(0.114)		

Panel D: Double sort on sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Sector error				
Low	1.289	1.095	0.194	(0.232)
Medium	1.403	0.963	0.440	(0.005)
High	1.210	0.962	0.248	(0.131)
Low – High	0.079	0.133	-0.054	(0.687)
p-value	(0.541)	(0.374)		

Table AVIII (Continued)

Panel E: Double sort on value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) and size

	Size			
	Small	Big	Small-Big	*p*-value
Value-to-book				
Low	1.231	0.964	0.267	(0.079)
Medium	1.364	1.000	0.364	(0.010)
High	1.285	1.018	0.266	(0.148)
Low – High	-0.054	-0.054	0.001	(0.995)
p-value	(0.704)	(0.672)		

The table presents average monthly returns (in percent) of value-weighted (VW) portfolios sorted on log market-to-book (or its components) and size. Stocks are independently sorted into Small and Big based on the median market capitalization, and into Low, Medium and High based on the 30^{th} and 70^{th} percentiles of market-to-book or its components. See Appendix of the paper for detailed definitions. The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AIX

Fama-MacBeth regressions of firm-level returns on log market-to-book and its components (VW)

	1	2	3	4	5	6
Intercept	1.114	1.093	1.114	3.297	3.269	3.352
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	-0.129			-0.146		
	(0.138)			(0.102)		
First decomposition						
Total error		-0.220			-0.163	
		(0.024)			(0.069)	
Value-to-book		-0.002			-0.094	
		(0.986)			(0.423)	
Comprehensive decomposition						
Firm-specific error			-0.212			-0.160
			(0.020)			(0.073)
Sector error			-0.261			-0.173
			(0.437)			(0.546)
Value-to-book			0.053			-0.112
			(0.626)			(0.342)
Controls						
m				-0.211	-0.208	-0.207
				(0.000)	(0.000)	(0.000)
β^{+}_{post}				0.185	0.175	0.168
				(0.222)	(0.246)	(0.258)
β^{-}_{post}				0.513	0.496	0.495
				(0.005)	(0.008)	(0.007)
$IVol_{post}$				-63.692	-63.187	-63.062
				(0.000)	(0.000)	(0.000)
Illiquidity				0.019	0.017	0.017
				(0.001)	(0.003)	(0.002)
$Ret^{-2\text{-}12}$				0.398	0.416	0.408
				(0.020)	(0.012)	(0.012)
Ret^{-1}				-0.039	-0.039	-0.040
				(0.000)	(0.000)	(0.000)
OP				0.591	0.526	0.532
				(0.006)	(0.016)	(0.013)
Inv				-0.248	-0.226	-0.219
				(0.028)	(0.047)	(0.054)
Adj. R^2	0.026	0.035	0.052	0.178	0.185	0.193
N	456	456	456	456	456	456

The table reports estimation results obtained from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on log market-to-book, its components, and control variables over the period from July 1975 to June 2013. Regressions are value-weighted (VW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix of the paper for detailed definitions of all variables.

Table AX

Cash flow risk – Campbell and Vuolteenaho (2004) (VW) (N = 456 months)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.254	0.291	0.270	0.158	0.181
2	0.188	0.208	0.218	0.154	0.155
3	0.191	0.223	0.210	0.140	0.160
4	0.205	0.175	0.209	0.194	0.191
5	0.195	0.192	0.170	0.186	0.201
6	0.208	0.192	0.160	0.221	0.224
7	0.196	0.166	0.170	0.188	0.206
8	0.202	0.175	0.163	0.192	0.190
9	0.170	0.149	0.158	0.171	0.169
High	0.114	0.136	0.124	0.162	0.119
Low – High	0.140	0.155	0.146	-0.004	0.062
t-stat (lag 1)	3.659	4.125	4.272	-0.118	2.155
p-value	(0.000)	(0.000)	(0.000)	(0.906)	(0.032)

The table presents sensitivities of monthly portfolio-level log returns to market-level cash flow shocks as in Campbell and Vuolteenaho (2004). Cash flow shocks are obtained from a VAR-based decomposition of the log market excess return, implemented over the period from January 1929 to June 2013. Portfolio returns are value-weighted (VW). The sample period for beta estimation runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table AXI

Long-run consumption risk (VW)

Panel A: Ultimate consumption risk in returns (Parker and Julliard (2005)) (N = 152 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.543	0.350	0.364	0.267	0.133
2	0.243	0.418	0.267	0.155	0.006
3	0.208	0.338	0.260	0.160	0.119
4	0.146	0.206	0.243	0.083	0.193
5	0.130	0.290	0.255	0.076	0.314
6	0.161	0.152	0.210	0.066	0.289
7	0.222	0.189	0.162	0.132	0.233
8	0.161	0.146	0.133	0.066	0.186
9	0.190	0.043	0.147	0.106	0.089
High	0.076	0.078	0.047	0.015	0.040
Low – High	0.468	0.272	0.317	0.252	0.093
t-stat (lag 1)	2.175	1.492	1.649	1.418	0.556
p-value	(0.031)	(0.138)	(0.101)	(0.158)	(0.579)

Panel B: Consumption risk in cash flows (dividends) (Bansal, Dittmar and Lundblad (2005)) (N = 148 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	4.575	1.548	1.592	2.188	2.241
2	-1.859	1.533	5.609	-3.765	4.052
3	2.499	-1.684	-2.046	-1.138	-1.397
4	2.656	-0.637	0.378	-0.007	-3.230
5	2.402	3.738	1.154	-1.847	-2.033
6	1.965	0.997	-2.421	3.479	1.786
7	-0.799	-0.452	-0.105	1.179	-1.721
8	1.641	1.028	0.008	3.930	1.121
9	0.617	0.688	-0.717	5.191	2.743
High	-1.029	-4.435	-0.626	-3.008	-0.708
Low – High	5.604	5.983	2.218	5.197	2.949
t-stat (lag 4)	0.418	0.818	0.527	0.539	0.434
p-value	(0.677)	(0.415)	(0.599)	(0.591)	(0.665)

Panel C: Ultimate consumption risk in cash flows (dividends) (N = 148 quarters)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.158	-0.461	-0.017	-0.432	-0.332
2	-0.257	-0.177	-0.226	0.107	-0.438
3	-0.415	0.102	-0.265	0.086	-0.165
4	-0.277	0.112	-0.329	0.375	0.294
5	-0.418	-0.332	-0.102	-0.037	0.150
6	-0.416	-0.210	-0.083	-0.342	-0.096
7	0.195	-0.243	-0.281	-0.189	-0.002
8	-0.015	-0.329	0.324	-0.015	-0.058
9	-0.208	-0.042	0.009	-0.620	-0.108
High	0.306	-0.012	-0.099	0.353	-0.192
Low – High	-0.148	-0.449	0.083	-0.785	-0.140
t-stat (lag 2)	-0.297	-0.985	0.205	-1.246	-0.382
p-value	(0.767)	(0.326)	(0.838)	(0.215)	(0.703)

Table AXI *(Continued)*

The table presents consumption betas for portfolios sorted on log market-to-book and its components. Panel A reports sensitivities of quarterly portfolio-level returns to ultimate consumption growth as in Parker and Julliard (2005). Quarterly portfolio returns (obtained by cumulating monthly returns within a quarter) are regressed on the 11-quarter ahead log growth rate in real per capita consumption of non-durable goods. Portfolio returns are value-weighted (RW) and converted to real using the PCE deflator. The sample period runs from 1975:Q3 to 2013:Q2. Panel B reports sensitivities of quarterly portfolio-level dividend growth to past consumption growth, as in Bansal, Dittmar and Lundblad (2005). The demeaned seasonally adjusted (4-quarter moving average) log growth rate in portfolio dividends is regressed on the demeaned smoothed (8-quarter moving average) log growth rate in real per capital consumption of non-durables plus services. Portfolio-level monthly dividends are extracted from CRSP using (value-weighted) returns with and without dividends. These are subsequently aggregated at the quarterly frequency and converted to real using the PCE deflator. The sample period runs from 1976:Q3 to 2013:Q2. Panel C reports sensitivities of quarterly portfolio-level dividends as in Bansal, Dittmar and Lundblad (2005) to ultimate consumption growth as in Parker and Julliard (2005). In all panels, portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions. t-statistics and the associated p-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table AXII

Exposure to investment-specific technology shocks (Kogan and Papanikolau (2014)) (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.417	0.584	0.622	0.527	0.382
2	0.276	0.515	0.403	0.522	0.297
3	0.258	0.397	0.413	0.462	0.426
4	0.326	0.408	0.354	0.331	0.486
5	0.344	0.255	0.375	0.386	0.482
6	0.343	0.321	0.400	0.490	0.450
7	0.409	0.353	0.335	0.458	0.390
8	0.347	0.300	0.328	0.391	0.391
9	0.407	0.345	0.292	0.379	0.333
High	0.476	0.545	0.586	0.500	0.515
Low – High	-0.059	0.039	0.036	0.027	-0.133
t-stat (lag 1)	-0.880	0.544	0.662	0.273	-2.554
p-value	(0.379)	(0.587)	(0.508)	(0.785)	(0.011)

The table presents sensitivities of portfolio-level returns to investment-specific technology shocks (IST) for portfolios sorted on log market-to-book and its components. Following Kogan and Papanikolau (2014), IST shocks are captured by the returns on a factor mimicking portfolio going long investment goods producers and short consumer goods producers (IMC). Portfolio returns and the IMC factor return are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. After portfolios are formed, investment good producers and services firms are excluded from the sample. Industry classifications are from Gomes, Kogan, and Yogo (2009). The sample period runs from July 1975 to June 2013. See Appendix of the paper for detailed definitions. t-statistics and the associated p-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table AXIII

Additional results on operating leverage

Panel A: Sensitivity to an operating leverage factor (RW portfolios)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	-0.296	-0.266	-0.292	-0.371	-0.216
2	-0.207	-0.225	-0.201	-0.216	-0.225
3	-0.173	-0.156	-0.180	-0.154	-0.224
4	-0.141	-0.157	-0.151	-0.061	-0.220
5	-0.136	-0.105	-0.145	-0.057	-0.167
6	-0.146	-0.157	-0.175	-0.091	-0.126
7	-0.175	-0.135	-0.167	-0.064	-0.120
8	-0.146	-0.139	-0.155	-0.097	-0.123
9	-0.208	-0.197	-0.221	-0.136	-0.221
High	-0.290	-0.309	-0.285	-0.368	-0.330
Low – High	-0.006	0.043	-0.007	-0.003	0.114
t-stat (lag 1)	-0.052	0.444	-0.089	-0.027	1.300
p-value	(0.958)	(0.657)	(0.929)	(0.978)	(0.194)

Panel B: Sensitivity to an operating leverage factor (VW portfolios)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	-0.271	-0.218	-0.216	-0.382	-0.288
2	-0.257	-0.185	-0.220	-0.246	-0.353
3	-0.198	-0.162	-0.131	-0.079	-0.433
4	-0.234	-0.204	-0.226	-0.018	-0.352
5	-0.270	-0.155	-0.181	-0.154	-0.211
6	-0.174	-0.219	-0.349	-0.160	-0.084
7	-0.191	-0.254	-0.174	-0.045	-0.031
8	-0.127	-0.143	-0.186	-0.147	0.003
9	-0.130	-0.191	-0.152	-0.094	0.003
High	-0.158	-0.214	-0.250	-0.332	-0.229
Low – High	-0.113	-0.005	0.033	-0.049	-0.059
t-stat (lag 1)	-1.025	-0.043	0.428	-0.478	-0.691
p-value	(0.306)	(0.966)	(0.669)	(0.633)	(0.490)

Table AXIII (*Continued*)

Panel C: Firm-level regressions including *OLEV*

	1	2	3
Intercept	2.971	2.715	2.687
	(0.000)	(0.000)	(0.000)
Market-to-book	-0.264		
	(0.000)		
First decomposition			
Total error		-0.383	
		(0.000)	
Value-to-book		-0.052	
		(0.501)	
Comprehensive decomposition			
Firm-specific error			-0.389
			(0.000)
Sector error			-0.415
			(0.107)
Value-to-book			-0.032
			(0.685)
OLEV	0.069	0.073	0.064
	(0.080)	(0.064)	(0.084)
Controls: m, β^{+}_{post}, β^{-}_{post}, $IVol_{post}$, *Illiquidity*, Ret_{-2-12}, Ret_{-1}, *OP*, *Inv*			
Adj. R^2	0.080	0.081	0.082
N	456	456	456

The table presents additional results on operating leverage. Panel A and Panel B report sensitivities of portfolio-level returns to an operating leverage (*OLEV*) factor that is based on the operating leverage measure of Novy-Marx (2011). The *OLEV* factor is the return on a factor mimicking portfolio going long high *OLEV* stocks (top 20%) and short low *OLEV* stocks (bottom 20%) using NYSE breakpoints. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). The *OLEV* factor is always value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. The sample period runs from July 1975 to June 2013. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags. Panel C reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on log market-to-book, its components, and control variables including *OLEV* over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix of the paper for detailed definitions of all variables.

Table AXIV

Additional results on duration

Panel A: Firm-level regressions including *Duration*

	1	2	3
Intercept	2.685	2.381	2.347
	(0.000)	(0.000)	(0.000)
Market-to-book	-0.304		
	(0.000)		
First decomposition			
Total error		-0.432	
		(0.000)	
Value-to-book		-0.092	
		(0.237)	
Comprehensive decomposition			
Firm-specific error			-0.444
			(0.000)
Sector error			-0.364
			(0.179)
Value-to-book			-0.056
			(0.486)
Duration	0.028	0.031	0.029
	(0.003)	(0.001)	(0.002)
Controls: m, β^{+}_{post}, β^{-}_{post}, $IVol_{post}$, *Illiquidity*, $Ret^{-2\text{-}12}$, Ret^{-1}, *OP*, *Inv*			
Adj. R^2	0.079	0.080	0.082
N	456	456	456

Panel B: Chen (2017) buy-and-hold portfolio dividend growth rates (geometric average of years 1-10) (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	4.195	4.284	4.168	2.912	2.503
2	1.346	2.537	2.497	3.370	1.308
3	1.883	2.573	3.116	3.328	2.370
4	1.482	2.766	3.258	2.804	3.053
5	2.870	2.982	2.575	3.459	2.977
6	2.470	2.360	2.633	4.074	5.061
7	3.319	3.100	3.810	4.623	3.794
8	4.631	3.795	4.428	3.551	5.100
9	5.773	5.598	4.651	3.838	6.726
High	6.656	4.875	4.942	4.387	6.554
Low – High	-2.461	-0.591	-0.775	-1.476	-4.052
t-stat (lag 1)	-1.761	-0.428	-0.592	-1.180	-6.388
p-value	(0.089)	(0.672)	(0.559)	(0.248)	(0.000)

Table AXIV (*Continued*)

The table presents additional results on duration. Panel A reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on log market-to-book, its components, and control variables including *Duration* over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix for detailed definitions of all variables. Panel B reports buy-and-hold portfolio-level dividend growth rates (in percent) following Chen (2017). For the ten years following each portfolio formation, annual portfolio-level dividends are extracted from monthly CRSP data using VW returns with and without dividends (added up from July to June). The geometric average of dividend growth rates over the years 1–10 is then computed as $(Dividend_{10}/Dividend_1)^{1/9}-1$ at each portfolio formation date. Dividend series are converted to real using the PCE deflator. Time-series averages of portfolio-level dividend growth rates are taken across 29 portfolio formations (1975–2003). Portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions. *t*-statistics and *p*-values (in parentheses) are based on Newey-West adjusted standard errors with the indicated number of lags.

Table AXV

Campbell et al. (2018) cash flow, discount rate, and volatility betas – unweighted estimates

Panel A: RW portfolios

Cash flow beta	*Market-to-book*	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.198	0.197	0.198	0.154	0.200
2	0.203	0.186	0.190	0.186	0.201
3	0.212	0.192	0.191	0.192	0.209
4	0.203	0.200	0.193	0.202	0.181
5	0.198	0.194	0.192	0.204	0.209
6	0.185	0.187	0.182	0.200	0.183
7	0.182	0.181	0.179	0.202	0.195
8	0.183	0.185	0.178	0.210	0.182
9	0.165	0.179	0.185	0.185	0.176
High	0.155	0.168	0.168	0.162	0.157
Low - High	0.043	0.029	0.030	-0.008	0.043
T-stat (lag of 1)	0.999	0.829	1.011	-0.187	1.241
p-value	(0.319)	(0.408)	(0.314)	(0.852)	(0.216)
Discount rate beta					
Low	0.960	1.011	1.026	1.070	0.920
2	0.833	0.943	0.933	0.964	0.782
3	0.812	0.889	0.870	0.865	0.744
4	0.833	0.835	0.874	0.863	0.823
5	0.843	0.865	0.857	0.836	0.847
6	0.892	0.874	0.885	0.891	0.911
7	0.971	0.890	0.912	0.878	0.894
8	0.986	0.962	0.958	0.880	0.961
9	1.072	1.049	1.050	0.892	1.070
High	1.200	1.179	1.182	1.099	1.168
Low - High	-0.240	-0.169	-0.156	-0.028	-0.248
T-stat (lag of 1)	-1.851	-1.760	-1.715	-0.250	-1.977
p-value	(0.066)	(0.080)	(0.088)	(0.803)	(0.050)
Volatility beta					
Low	-0.115	-0.074	-0.074	-0.043	-0.083
2	-0.053	-0.041	-0.033	-0.031	-0.058
3	-0.048	-0.014	-0.017	-0.022	-0.034
4	-0.030	-0.008	-0.009	-0.020	-0.049
5	-0.010	-0.008	0.000	-0.008	-0.031
6	0.005	0.014	0.011	0.015	-0.013
7	0.013	0.015	0.012	0.019	0.000
8	0.038	0.029	0.033	0.008	0.012
9	0.047	0.041	0.037	0.025	0.041
High	0.073	0.064	0.061	-0.016	0.055
Low - High	-0.188	-0.138	-0.135	-0.028	-0.138
T-stat (lag of 1)	-4.400	-4.356	-4.659	-0.772	-3.636
p-value	(0.000)	(0.000)	(0.000)	(0.441)	(0.000)

Table AXV (Continued)

Panel B: VW portfolios

Cash flow beta	*Market-to-book*	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.189	0.233	0.204	0.163	0.168
2	0.180	0.179	0.175	0.159	0.144
3	0.188	0.180	0.174	0.160	0.176
4	0.162	0.167	0.191	0.165	0.148
5	0.171	0.192	0.184	0.147	0.187
6	0.163	0.173	0.152	0.179	0.152
7	0.160	0.144	0.130	0.159	0.170
8	0.154	0.140	0.144	0.145	0.195
9	0.173	0.135	0.131	0.167	0.170
High	0.113	0.132	0.125	0.152	0.106
Low - High	0.076	0.101	0.079	0.010	0.061
T-stat (lag of 1)	1.801	2.244	2.282	0.271	1.694
p-value	(0.074)	(0.026)	(0.024)	(0.787)	(0.092)
Discount rate beta					
Low	0.703	0.875	0.880	0.797	0.659
2	0.603	0.783	0.762	0.736	0.621
3	0.614	0.753	0.752	0.717	0.687
4	0.620	0.701	0.694	0.738	0.809
5	0.657	0.589	0.667	0.800	0.831
6	0.694	0.667	0.630	0.792	0.799
7	0.757	0.635	0.639	0.803	0.770
8	0.727	0.701	0.712	0.787	0.806
9	0.773	0.753	0.714	0.760	0.797
High	0.922	0.922	0.994	0.813	0.925
Low - High	-0.219	-0.047	-0.114	-0.016	-0.266
T-stat (lag of 1)	-1.945	-0.364	-1.119	-0.165	-3.354
p-value	(0.054)	(0.717)	(0.265)	(0.869)	(0.001)
Volatility beta					
Low	-0.024	-0.050	-0.017	-0.034	0.010
2	-0.033	-0.032	0.017	0.042	0.039
3	-0.021	0.016	0.004	0.059	0.054
4	0.008	0.037	0.025	0.018	0.011
5	0.013	0.011	0.021	0.041	0.010
6	0.017	0.006	0.038	0.043	0.036
7	0.038	0.028	0.019	0.056	0.045
8	0.054	0.041	0.055	0.049	0.045
9	0.059	0.048	0.043	0.047	0.037
High	0.074	0.086	0.076	0.074	0.098
Low - High	-0.098	-0.136	-0.093	-0.108	-0.088
T-stat (lag of 1)	-3.185	-3.319	-3.887	-2.263	-3.750
p-value	(0.002)	(0.001)	(0.000)	(0.025)	(0.000)

The table presents cash flow, discount rate, and volatility betas across portfolios sorted on log market-to-book and its components. Panel A reports the results for RW portfolios, and Panel B for VW portfolios. The data on cash flow news, discount rate news, and volatility news are from Campbell et al. (2018). Beta estimation is unweighted. The sample period for beta estimation runs from 1975Q3 to 2011Q4. In all panels, portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table AXVI

Campbell et al. (2018) cash flow, discount rate, and volatility betas – weighted estimates

Panel A: RW portfolios

Cash flow beta	*Market-to-book*	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.191	0.188	0.190	0.134	0.186
2	0.193	0.177	0.178	0.169	0.189
3	0.197	0.180	0.180	0.173	0.200
4	0.192	0.188	0.183	0.187	0.167
5	0.186	0.181	0.180	0.185	0.197
6	0.177	0.172	0.171	0.187	0.168
7	0.165	0.171	0.165	0.190	0.183
8	0.169	0.171	0.164	0.198	0.168
9	0.152	0.161	0.165	0.176	0.163
High	0.137	0.148	0.145	0.153	0.143
Low - High	0.054	0.040	0.045	-0.020	0.043
T-stat (lag of 1)	1.301	1.153	1.441	-0.454	1.334
p-value	(0.195)	(0.251)	(0.152)	(0.650)	(0.184)
Discount rate beta					
Low	0.956	0.994	1.012	1.049	0.921
2	0.825	0.953	0.942	0.952	0.795
3	0.813	0.892	0.881	0.863	0.747
4	0.846	0.836	0.886	0.856	0.814
5	0.840	0.878	0.854	0.839	0.854
6	0.901	0.875	0.879	0.884	0.917
7	0.971	0.887	0.905	0.892	0.901
8	0.985	0.954	0.955	0.894	0.953
9	1.075	1.051	1.047	0.901	1.067
High	1.192	1.176	1.180	1.092	1.163
Low - High	-0.236	-0.182	-0.168	-0.043	-0.242
T-stat (lag of 1)	-1.915	-1.947	-1.797	-0.383	-2.077
p-value	(0.057)	(0.053)	(0.074)	(0.702)	(0.040)
Volatility beta					
Low	-0.097	-0.060	-0.060	-0.027	-0.067
2	-0.041	-0.025	-0.018	-0.016	-0.042
3	-0.033	-0.002	-0.004	-0.008	-0.021
4	-0.015	0.003	0.006	-0.009	-0.034
5	0.001	0.006	0.015	0.005	-0.018
6	0.017	0.030	0.022	0.022	0.001
7	0.025	0.025	0.021	0.031	0.012
8	0.051	0.038	0.041	0.020	0.025
9	0.057	0.051	0.047	0.035	0.051
High	0.082	0.074	0.073	-0.002	0.064
Low - High	-0.179	-0.134	-0.132	-0.025	-0.131
T-stat (lag of 1)	-4.342	-4.353	-4.544	-0.758	-3.636
p-value	(0.000)	(0.000)	(0.000)	(0.450)	(0.000)

Table AXVI (*Continued*)

Panel B: VW portfolios

Cash flow beta	*Market-to-book*	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	0.185	0.220	0.197	0.147	0.157
2	0.172	0.175	0.167	0.148	0.136
3	0.181	0.169	0.168	0.146	0.172
4	0.153	0.155	0.184	0.160	0.138
5	0.164	0.179	0.174	0.129	0.175
6	0.154	0.163	0.144	0.160	0.133
7	0.152	0.137	0.120	0.151	0.157
8	0.145	0.127	0.133	0.140	0.178
9	0.154	0.123	0.121	0.169	0.147
High	0.089	0.110	0.105	0.151	0.087
Low - High	0.096	0.110	0.091	-0.005	0.070
T-stat (lag of 1)	2.174	2.521	2.528	-0.114	1.948
p-value	(0.031)	(0.013)	(0.013)	(0.909)	(0.053)
Discount rate beta					
Low	0.731	0.869	0.876	0.793	0.665
2	0.601	0.795	0.770	0.739	0.631
3	0.624	0.761	0.759	0.737	0.675
4	0.616	0.717	0.714	0.744	0.797
5	0.641	0.606	0.679	0.822	0.824
6	0.707	0.669	0.634	0.807	0.817
7	0.764	0.620	0.650	0.830	0.785
8	0.752	0.714	0.709	0.815	0.827
9	0.794	0.773	0.720	0.786	0.809
High	0.927	0.930	0.992	0.834	0.930
Low - High	-0.196	-0.061	-0.116	-0.040	-0.265
T-stat (lag of 1)	-1.516	-0.461	-0.940	-0.388	-3.275
p-value	(0.132)	(0.646)	(0.349)	(0.698)	(0.001)
Volatility beta					
Low	-0.011	-0.036	-0.007	-0.018	0.017
2	-0.022	-0.017	0.027	0.051	0.046
3	-0.009	0.027	0.015	0.070	0.058
4	0.015	0.048	0.037	0.029	0.022
5	0.018	0.022	0.032	0.056	0.020
6	0.030	0.016	0.045	0.056	0.051
7	0.046	0.032	0.030	0.067	0.057
8	0.066	0.051	0.062	0.061	0.059
9	0.072	0.060	0.052	0.056	0.050
High	0.087	0.097	0.088	0.081	0.108
Low - High	-0.098	-0.133	-0.094	-0.099	-0.090
T-stat (lag of 1)	-3.042	-3.275	-3.280	-2.197	-3.851
p-value	(0.003)	(0.001)	(0.001)	(0.030)	(0.000)

Table AXVI (*Continued*)

The table presents cash flow, discount rate, and volatility betas across portfolios sorted on log market-to-book and its components. Panel A reports the results for RW portfolios, and Panel B for VW portfolios. The data on cash flow news, discount rate news, and volatility news are from Campbell et al. (2018). Beta estimation is weighted by the inverse of the expected market variance, shrunk towards equal weights. The sample period for beta estimation runs from 1975Q3 to 2011Q4. In all panels, portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions. *t*-statistics and the associated *p*-values (in parentheses) are based on Newey-West standard errors with the indicated number of lags.

Table AXVII

Pricing tests of the Campbell et al. (2018) model with market-to-value (firm-specific error) and value-to-book portfolios as test assets

Panel A: Unweighted beta estimates

	20 RW portfolios	20 VW portfolios
Cash flow beta	0.088	0.029
t-stat (EIV)	1.035	0.721
	(0.302)	(0.472)
Discount rate beta	0.013	0.002
t-stat (EIV)	0.685	0.159
	(0.495)	(0.874)
Volatility beta	-0.095	-0.105
t-stat (EIV)	-2.123	-1.681
	(0.035)	(0.095)
OLS R^2	0.407	0.313
GLS R^2	0.153	0.136
Shanken T^2	51.711	20.763
p-value (χ^2)	(0.000)	(0.237)
p-value (*F*)	(0.004)	(0.589)
MAPE (% per quarter)	0.358	0.242

Panel B: Weighted beta estimates

	20 RW portfolios	20 VW portfolios
Cash flow beta	0.166	0.030
t-stat (EIV)	1.794	0.803
	(0.075)	(0.423)
Discount rate beta	0.012	0.006
t-stat (EIV)	0.567	0.399
	(0.572)	(0.690)
Volatility beta	-0.062	-0.102
t-stat (EIV)	-1.349	-1.610
	(0.180)	(0.110)
OLS R^2	0.474	0.284
GLS R^2	0.133	0.185
Shanken T^2	38.575	19.701
p-value (χ^2)	(0.002)	(0.290)
p-value (*F*)	(0.047)	(0.645)
MAPE (% per quarter)	0.341	0.247

The table presents results obtained from second-pass cross-sectional OLS regressions of average excess returns on 20 test asset portfolios on the estimated betas (no intercept). Cash flow, discount rate, and volatility betas are used to explain the cross-section of average excess returns, as in Campbell et al. (2018). Betas are re-estimated using portfolio returns in excess of the market for consistency with the second-pass regressions. Test assets consist of 20 portfolios formed on the basis of firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$) and value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$). In Panel A, betas are obtained using unweighted covariances. In Panel B, betas are obtained using weighted covariances. *t*-statistics (EIV) incorporate an errors-in-variables correction based on the asymptotic variance of the price of covariance risk from Kan, Robotti, and Shaken (2011) generalized to the case of scaled covariances (see Section A.2 of this Internet Appendix for details); the associated *p*-values are in parentheses. OLS R^2 and GLS R^2 are defined as in Kandel and Stambaugh (1995). The Shanken's T^2 statistic testing that all pricing errors are jointly zero (with the associated *p*-values based on χ^2 and *F* distributions), and the mean absolute pricing error (MAPE) are also reported.

Table AXVIII

Limits to arbitrage: short-sale constraints proxied by institutional ownership (RW) – total error and sector error

Panel A: Double sort with total error ($m_{it} - v(\theta_{it};\ \alpha_j)$)

	Residual Institutional Ownership						
	Low	2	3	4	High	High–Low	*p*-value
Total error							
Low	1.143	1.255	1.455	1.197	1.474	0.331	(0.078)
2	1.132	1.257	1.310	1.319	1.246	0.114	(0.425)
3	0.928	1.124	1.168	1.151	1.189	0.261	(0.079)
4	0.609	1.039	1.192	0.996	1.128	0.519	(0.001)
High	0.268	0.820	0.873	0.919	1.044	0.776	(0.000)
Low – High	0.875	0.435	0.583	0.278	0.430	-0.445	(0.032)
p-value	(0.000)	(0.027)	(0.001)	(0.130)	(0.040)		

Panel B: Double sort with sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$)

	Residual Institutional Ownership						
	Low	2	3	4	High	High–Low	*p*-value
Sector error							
Low	0.842	1.030	1.323	1.147	1.383	0.540	(0.002)
2	0.850	1.180	1.256	1.205	1.363	0.513	(0.000)
3	0.888	1.249	1.316	1.254	1.331	0.443	(0.001)
4	0.823	1.138	1.148	1.153	1.226	0.403	(0.004)
High	0.664	0.971	1.029	0.892	1.060	0.397	(0.014)
Low – High	0.179	0.059	0.295	0.255	0.322	0.144	(0.495)
p-value	(0.448)	(0.782)	(0.124)	(0.186)	(0.088)		

The table presents average monthly returns (in percent) of portfolios sorted independently on total error (or sector error) and residual institutional ownership following Nagel (2005). Residual institutional ownership is obtained two quarters prior to portfolio formation (i.e. end of December) and is orthogonalized with respect to size and size-squared. See Appendix of the paper for detailed definitions. Portfolio returns are gross return-weighted (RW). The time period runs from July 1981 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AXIX

Limits to arbitrage: short-sale constraints proxied by institutional ownership (VW)

Panel A: Double sort on log market-to-book ($m_{it} – b_{it}$) conditional on size

Within Small	Residual Institutional Ownership						
Market-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.646	0.409	0.092	0.090	0.389	-0.257	(0.334)
p-value	(0.015)	(0.144)	(0.730)	(0.723)	(0.122)		
Within Big	Residual Institutional Ownership						
Market-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.062	0.210	0.142	0.298	0.095	0.033	(0.926)
p-value	(0.853)	(0.379)	(0.522)	(0.179)	(0.733)		

Panel B: Double sort with total error ($m_{it} – v(\theta_{it}; \alpha_j)$) conditional on size

Within Small	Residual Institutional Ownership						
Total error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.802	0.377	0.159	0.302	0.388	-0.414	(0.093)
p-value	(0.000)	(0.111)	(0.448)	(0.158)	(0.061)		
Within Big	Residual Institutional Ownership						
Total error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.154	0.172	0.248	0.222	0.370	0.216	(0.461)
p-value	(0.571)	(0.448)	(0.228)	(0.334)	(0.138)		

Panel C: Double sort with firm-specific error ($m_{it} – v(\theta_{it}; \alpha_{jt})$) conditional on size

Within Small	Residual Institutional Ownership						
Firm-specific error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.814	0.396	0.105	0.186	0.308	-0.506	(0.033)
p-value	(0.000)	(0.066)	(0.596)	(0.364)	(0.120)		
Within Big	Residual Institutional Ownership						
Firm-specific error	Low	2	3	4	High	High–Low	*p*-value
Low – High	-0.036	0.172	0.238	0.272	0.022	0.059	(0.844)
p-value	(0.891)	(0.419)	(0.207)	(0.177)	(0.924)		

Table AXIX (*Continued*)

Panel D: Double sort with sector error ($v(\theta_{it};\, \alpha_{jt}) - v(\theta_{it};\, \alpha_j)$) conditional on size

Within Small	Residual Institutional Ownership						
Sector error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.164	0.021	0.218	0.140	0.171	0.007	(0.976)
p-value	(0.452)	(0.926)	(0.308)	(0.547)	(0.421)		
Within Big	Residual Institutional Ownership						
Sector error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.556	0.347	0.312	0.178	0.366	-0.190	(0.545)
p-value	(0.044)	(0.132)	(0.149)	(0.471)	(0.142)		

Panel E: Double sort with value-to-book ($v(\theta_{it};\, \alpha_j) - b_{it}$) conditional on size

Within Small	Residual Institutional Ownership						
Value-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.211	0.098	-0.124	-0.360	0.071	-0.140	(0.576)
p-value	(0.377)	(0.628)	(0.576)	(0.131)	(0.745)		
Within Big	Residual Institutional Ownership						
Value-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	-0.086	0.011	-0.124	-0.069	-0.299	-0.213	(0.512)
p-value	(0.777)	(0.961)	(0.558)	(0.765)	(0.245)		

The table presents average returns (in percent) of long-short portfolios formed on the basis of log market-to-book (or its components) conditional on institutional ownership for small and big stocks separately. Stocks are first grouped into small and big based on the median market capitalization of NYSE firms. Within these two groups, stocks are subsequently sorted independently into quintiles based on log market-to-book (or its components) and residual institutional ownership. Residual institutional ownership is obtained two quarters prior to portfolio formation (i.e. end of December) and is orthogonalized with respect to size and size-squared. See Appendix of the paper for detailed definitions. Portfolio returns are value-weighted (VW). The time period runs from July 1981 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AXX

Limits to arbitrage: noise trader risk proxied by idiosyncratic volatility (RW) – total error and sector error

Panel A: Double sort with total error ($m_{it} - v(\theta_{it};\ \alpha_j)$)

	Idiosyncratic Volatility						
	Low	2	3	4	High	High–Low	*p*-value
Total error							
Low	1.383	1.504	1.374	1.455	1.396	0.013	(0.958)
2	1.309	1.382	1.488	1.466	1.268	-0.041	(0.869)
3	1.184	1.261	1.380	1.377	1.139	-0.044	(0.875)
4	1.169	1.172	1.240	1.180	1.070	-0.099	(0.706)
High	1.089	1.102	1.158	1.127	0.622	-0.467	(0.106)
Low – High	0.294	0.401	0.216	0.329	0.774	0.480	(0.007)
p-value	(0.034)	(0.002)	(0.089)	(0.018)	(0.000)		

Panel B: Double sort with sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$)

	Idiosyncratic Volatility						
	Low	2	3	4	High	High–Low	*p*-value
Sector error							
Low	1.218	1.275	1.341	1.162	1.019	-0.199	(0.451)
2	1.217	1.371	1.398	1.328	1.123	-0.094	(0.706)
3	1.166	1.315	1.345	1.462	1.250	0.084	(0.727)
4	1.218	1.210	1.266	1.304	1.156	-0.062	(0.817)
High	1.249	1.231	1.264	1.293	1.003	-0.245	(0.395)
Low – High	-0.030	0.044	0.077	-0.131	0.016	0.046	(0.819)
p-value	(0.822)	(0.708)	(0.589)	(0.396)	(0.932)		

The table presents average monthly returns (in percent) of portfolios sorted independently on total error (or sector error) and idiosyncratic return volatility ($IVOL_{pre}$) following Ali, Hwang, and Trombley (2003). Idiosyncratic volatility is calculated as the standard deviation of residuals obtained from a regression of daily stock returns on the CRSP value-weighted market return over the 12 months prior to portfolio formation. See Appendix of the paper for detailed definitions. Portfolio returns are gross return-weighted (RW). The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AXXI

Limits to arbitrage: noise trader risk proxied by idiosyncratic volatility (VW)

Panel A: Double sort with log market-to-book ($m_{it} – b_{it}$) conditional on size

Within Small	Idiosyncratic Volatility						
Market-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.121	-0.172	-0.024	0.238	0.578	0.457	(0.113)
p-value	(0.557)	(0.336)	(0.906)	(0.278)	(0.022)		
Within Big	Idiosyncratic Volatility						
Market-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.087	0.167	0.117	0.300	0.148	0.061	(0.838)
p-value	(0.662)	(0.411)	(0.580)	(0.194)	(0.630)		

Panel B: Double sort with total error ($m_{it} – v(\theta_{it}; \alpha_j)$) conditional on size

Within Small	Idiosyncratic Volatility						
Total error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.185	-0.016	0.274	0.217	0.584	0.399	(0.092)
p-value	(0.263)	(0.916)	(0.104)	(0.223)	(0.004)		
Within Big	Idiosyncratic Volatility						
Total error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.097	0.337	0.200	0.365	0.344	0.247	(0.357)
p-value	(0.621)	(0.093)	(0.294)	(0.073)	(0.163)		

Panel C: Double sort with firm-specific error ($m_{it} – v(\theta_{it}; \alpha_{jt})$) conditional on size

Within Small	Idiosyncratic Volatility						
Firm-specific error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.159	0.034	0.229	0.229	0.646	0.486	(0.026)
p-value	(0.300)	(0.815)	(0.146)	(0.185)	(0.000)		
Within Big	Idiosyncratic Volatility						
Firm-specific error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.145	0.109	0.261	0.266	0.247	0.102	(0.691)
p-value	(0.442)	(0.563)	(0.179)	(0.134)	(0.263)		

Table AXXI (*Continued*)

Panel D: Double sort with sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$) conditional on size

Within Small	Idiosyncratic Volatility						
Sector error	Low	2	3	4	High	High–Low	*p*-value
Low – High	-0.119	0.005	-0.112	-0.097	0.076	0.194	(0.420)
p-value	(0.461)	(0.976)	(0.533)	(0.623)	(0.715)		
Within Big	Idiosyncratic Volatility						
Sector error	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.059	0.381	-0.036	0.113	0.253	0.194	(0.512)
p-value	(0.766)	(0.072)	(0.870)	(0.622)	(0.298)		

Panel E: Double sort with value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$) conditional on size

Within Small	Idiosyncratic Volatility						
Value-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.057	-0.343	-0.489	-0.084	0.345	0.287	(0.217)
p-value	(0.696)	(0.039)	(0.007)	(0.626)	(0.082)		
Within Big	Idiosyncratic Volatility						
Value-to-book	Low	2	3	4	High	High–Low	*p*-value
Low – High	0.133	-0.087	-0.113	0.006	-0.140	-0.273	(0.323)
p-value	(0.500)	(0.675)	(0.573)	(0.979)	(0.557)		

The table presents average returns (in percent) of long-short portfolios formed on the basis of log market-to-book (or its components) conditional on idiosyncratic volatility for small and big stocks separately. Stocks are first grouped into small and big based on the median market capitalization of NYSE firms. Within these two groups, stocks are subsequently sorted independently into quintiles based on log market-to-book (or its components) and past idiosyncratic volatility. Idiosyncratic volatility is calculated as the standard deviation of residuals obtained from a regression of daily stock returns on the CRSP value-weighted market return over the 12 months prior to portfolio formation. See Appendix of the paper for detailed definitions. Portfolio returns are value-weighted (VW). The time period runs from July 1975 to June 2013. Portfolios are formed every June using NYSE breakpoints.

Table AXXII

Limits to arbitrage: time-series test using hedge funds assets under management (RW) – total error and sector error

Panel A: Sort on total error ($m_{it} - v(\theta_{it}; \alpha_j)$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Total error					
Low	1.377	1.947	0.980	-0.397	(0.728)
2	1.157	1.717	0.886	-0.272	(0.778)
3	1.204	1.601	0.854	-0.350	(0.700)
4	1.075	1.326	0.773	-0.302	(0.723)
5	1.221	1.360	0.810	-0.411	(0.632)
6	0.891	1.385	0.771	-0.120	(0.888)
7	0.925	1.150	0.646	-0.279	(0.737)
8	0.802	1.327	0.807	0.004	(0.996)
9	0.592	1.161	0.557	-0.035	(0.972)
High	0.167	1.075	0.482	0.315	(0.772)
Low – High	1.209	0.872	0.497	-0.712	(0.264)
p-value	(0.008)	(0.039)	(0.270)		
N	84	96	84		

Panel B: Sort on sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Sector error					
Low	0.676	1.744	1.269	0.594	(0.596)
2	1.062	1.568	0.871	-0.191	(0.847)
3	1.134	1.427	0.824	-0.310	(0.735)
4	1.274	1.403	0.838	-0.435	(0.612)
5	1.102	1.259	0.926	-0.176	(0.835)
6	1.222	1.384	0.799	-0.423	(0.639)
7	1.240	1.350	0.516	-0.724	(0.403)
8	1.015	1.375	0.685	-0.331	(0.695)
9	0.879	1.416	0.612	-0.267	(0.753)
High	0.524	1.351	0.086	-0.437	(0.689)
Low – High	0.152	0.393	1.183	1.031	(0.166)
p-value	(0.772)	(0.424)	(0.025)		
N	84	96	84		

The table presents average monthly returns (in percent) of portfolios sorted on total error (Panel A) or sector error (Panel B) conditional on arbitrage capital availability. Following Jylha and Suominen (2011) and Kokkonen and Suominen (2015), we capture arbitrage capital availability using hedge fund assets under management (HF AUM). HF AUM is obtained at portfolio formation and is scaled by the average CRSP market capitalization over the previous 12 months. HF AUM is available to us from 1990 to 2011. We classify each of the 22 portfolio formations into low, medium, or high arbitrage capital availability environment based on low, medium or high HF AUM. This leads to three (approximately) equal-sized periods: low (84 months), medium (96 months) and high (84 months). Portfolio returns are gross return-weighted (RW). The time period runs from July 1990 to June 2012. Portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions.

Table AXXIII

Limits to arbitrage: time-series test using hedge funds assets under management (VW)

Panel A: Sort on market-to-book ($m_{it} - b_{it}$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Market-to-book					
Low	1.138	1.712	0.867	-0.271	(0.756)
2	0.420	1.262	0.874	0.455	(0.529)
3	0.662	1.397	0.911	0.248	(0.726)
4	0.092	1.162	0.698	0.607	(0.369)
5	0.503	1.535	0.928	0.425	(0.533)
6	0.670	1.441	0.574	-0.096	(0.892)
7	0.431	1.397	0.528	0.097	(0.889)
8	0.570	1.401	0.627	0.057	(0.932)
9	0.170	1.756	0.557	0.386	(0.587)
High	-0.027	1.623	0.717	0.744	(0.324)
Low – High	1.165	0.089	0.150	-1.016	(0.163)
p-value	(0.024)	(0.853)	(0.771)		
N	84	96	84		

Panel B: Sort on total error ($m_{it} - v(\theta_{it}; \alpha_j)$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Total error					
Low	0.820	1.725	1.048	0.228	(0.815)
2	0.691	1.612	0.531	-0.160	(0.846)
3	0.665	1.602	0.388	-0.277	(0.722)
4	0.208	1.210	1.033	0.825	(0.267)
5	0.788	1.482	0.586	-0.203	(0.748)
6	0.564	1.212	0.583	0.018	(0.978)
7	0.001	1.684	0.823	0.823	(0.203)
8	0.418	1.473	0.646	0.227	(0.718)
9	-0.016	1.467	0.618	0.634	(0.343)
High	0.072	1.552	0.754	0.681	(0.395)
Low – High	0.748	0.173	0.294	-0.454	(0.527)
p-value	(0.141)	(0.716)	(0.562)		
N	84	96	84		

Table AXXIII (*Continued*)

Panel C: Sort on firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Firm-specific error					
Low	0.828	1.520	0.608	-0.220	(0.810)
2	0.218	1.433	0.349	0.131	(0.867)
3	0.661	1.545	0.779	0.118	(0.870)
4	0.471	1.517	0.712	0.242	(0.739)
5	1.119	1.537	0.700	-0.419	(0.555)
6	0.074	1.497	0.721	0.647	(0.355)
7	0.118	1.373	0.564	0.446	(0.484)
8	-0.159	1.530	0.501	0.660	(0.304)
9	0.371	1.594	0.725	0.354	(0.584)
High	-0.127	1.611	0.845	0.972	(0.255)
Low – High	0.955	-0.091	-0.237	-1.192	(0.044)
p-value	(0.022)	(0.815)	(0.569)		
N	84	96	84		

Panel D: Sort on sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Sector error					
Low	0.315	1.671	0.644	0.329	(0.713)
2	0.330	1.451	0.923	0.593	(0.446)
3	0.627	1.575	0.779	0.152	(0.841)
4	0.795	1.235	0.804	0.009	(0.990)
5	-0.091	1.442	0.550	0.641	(0.398)
6	0.061	1.481	0.776	0.714	(0.368)
7	0.481	1.398	0.724	0.243	(0.743)
8	0.389	1.393	0.581	0.193	(0.781)
9	0.546	1.391	0.598	0.052	(0.941)
High	0.099	1.464	0.522	0.423	(0.581)
Low – High	0.216	0.207	0.122	-0.094	(0.891)
p-value	(0.655)	(0.647)	(0.800)		
N	84	96	84		

Table AXXIII (Continued)

Panel E: Sort on value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$)

	Arbitrage Capital				
	Low	Medium	High	High–Low	*p*-value
Value-to-book					
Low	0.419	1.235	0.726	0.307	(0.671)
2	0.437	1.197	0.919	0.482	(0.466)
3	-0.237	1.373	0.638	0.875	(0.224)
4	0.201	1.191	0.415	0.214	(0.794)
5	0.147	1.948	0.704	0.558	(0.482)
6	0.109	1.615	0.738	0.629	(0.419)
7	0.549	1.420	0.686	0.137	(0.849)
8	0.416	1.398	0.719	0.302	(0.682)
9	0.289	1.658	0.691	0.402	(0.575)
High	-0.018	1.846	0.640	0.658	(0.383)
Low – High	0.437	-0.611	0.086	-0.351	(0.529)
p-value	(0.268)	(0.098)	(0.827)		
N	84	96	84		

The table presents average monthly returns (in percent) of portfolios sorted on log market-to-book (or its components) conditional on arbitrage capital availability. Following Jylha and Suominen (2011) and Kokkonen and Suominen (2015), we capture arbitrage capital availability using hedge fund assets under management (HF AUM). HF AUM is obtained at portfolio formation and is scaled by the average CRSP market capitalization over the previous 12 months. HF AUM is available to us from 1990 to 2011. We classify each of the 22 portfolio formations into low, medium, or high arbitrage capital availability environment based on low, medium or high HF AUM. This leads to three (approximately) equal-sized periods: low (84 months), medium (96 months) and high (84 months). Portfolio returns are value-weighted (VW). The time period runs from July 1990 to June 2012. Portfolios are formed every June using NYSE breakpoints. See Appendix of the paper for detailed definitions.

Table AXXIV

Valuation model estimated using per share values

Panel A: Portfolio sorts (RW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.527	1.366	1.442	1.202	1.196
2	1.522	1.402	1.377	1.278	1.351
3	1.398	1.363	1.276	1.129	1.349
4	1.341	1.241	1.260	1.204	1.323
5	1.202	1.216	1.215	1.258	1.377
6	1.210	1.138	1.196	1.243	1.375
7	1.259	1.158	1.136	1.396	1.254
8	1.117	1.098	1.081	1.304	1.247
9	1.026	1.017	1.071	1.295	1.187
High	0.842	0.961	0.883	1.121	1.019
Low – High	0.685	0.404	0.559	0.081	0.176
t-stat	3.084	1.991	2.972	0.376	0.855
p-value	(0.002)	(0.047)	(0.003)	(0.707)	(0.393)
Sharpe Ratio	0.500	0.323	0.482	0.061	0.139
N	456	456	456	456	456

Panel B: Portfolio sorts (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.455	1.249	1.351	1.174	1.125
2	1.227	1.325	1.202	1.158	1.003
3	1.179	1.281	1.271	1.096	1.030
4	0.941	1.126	1.157	0.975	0.974
5	1.155	1.215	1.153	1.033	1.096
6	1.101	1.017	1.065	0.979	1.196
7	1.028	1.028	1.041	1.101	1.078
8	1.079	0.945	0.972	0.989	0.910
9	0.975	0.992	1.032	1.081	0.945
High	0.905	0.914	0.870	0.854	0.968
Low – High	0.550	0.335	0.481	0.321	0.157
t-stat	2.649	1.707	2.753	1.499	0.925
p-value	(0.008)	(0.089)	(0.006)	(0.135)	(0.355)
Sharpe Ratio	0.430	0.277	0.447	0.243	0.150
N	456	456	456	456	456

Table AXXIV (*Continued*)

Panel C: Firm-level regressions

	1	2
Intercept	3.088	3.062
	(0.000)	(0.000)
First decomposition		
Total error	-0.479	
	(0.000)	
Value-to-book	-0.091	
	(0.313)	
Comprehensive decomposition		
Firm-specific error		-0.506
		(0.000)
Sector error		-0.537
		(0.103)
Value-to-book		-0.096
		(0.289)
Controls: $m, \beta^{+}_{post}, \beta^{-}_{post}, IVol_{post}, Illiquidity, Ret^{-2\text{-}12}, Ret^{-1}, OP, Inv$		
Adj. R^2	0.080	0.082
N	456	456

The table reports return predictability results when the valuation model in equation (4) of the paper is estimated using per share values of market value of equity, book value of equity, and net income. To prevent influential log transformations of values close to zero, we use log of (1 + share price), log of (1 + book value per share), and log of (1 + abs (earnings per share)) when estimating the valuation model. Panels A and B present average monthly returns (in percent) of 10 portfolios formed on the basis of log market-to-book ($m_{it} - b_{it}$), total error ($m_{it} - v(\theta_{it};\ \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$), sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$), and value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$) over the period from July 1975 to June 2013. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High), *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown. Panel C reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on the components of log market-to-book and control variables over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix of the paper for detailed definitions.

Table AXXV

Fama-French 30 industry classification (21 industries remain)

Panel A: Portfolio sorts (RW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.522	1.525	1.580	1.080	1.262
2	1.554	1.444	1.415	1.393	1.224
3	1.413	1.436	1.450	1.295	1.241
4	1.377	1.353	1.306	1.319	1.232
5	1.266	1.232	1.219	1.250	1.268
6	1.271	1.191	1.237	1.231	1.309
7	1.289	1.097	1.184	1.220	1.311
8	1.181	1.095	1.094	1.253	1.301
9	1.116	0.979	0.941	1.261	1.269
High	0.781	0.803	0.755	1.029	1.078
Low – High	0.741	0.722	0.825	0.051	0.184
t-stat	3.539	4.111	5.413	0.275	1.050
p-value	(0.000)	(0.000)	(0.000)	(0.784)	(0.294)
Sharpe Ratio	0.574	0.667	0.878	0.045	0.170
N	456	456	456	456	456

Panel B: Portfolio sorts (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.456	1.367	1.323	1.163	1.043
2	1.259	1.212	1.188	1.037	1.081
3	1.169	1.321	1.263	1.131	1.033
4	0.954	1.201	1.186	1.158	0.878
5	1.153	1.054	1.222	1.003	1.123
6	1.085	1.046	0.980	0.943	0.998
7	0.999	0.913	0.950	1.191	1.119
8	1.037	0.978	1.033	0.899	1.064
9	0.999	0.911	0.969	1.024	1.145
High	0.907	0.911	0.850	1.080	0.911
Low – High	0.549	0.456	0.472	0.084	0.131
t-stat	2.556	2.260	2.714	0.410	0.764
p-value	(0.011)	(0.024)	(0.007)	(0.682)	(0.445)
Sharpe Ratio	0.415	0.367	0.440	0.066	0.124
N	456	456	456	456	456

Table AXXV (*Continued*)

Panel C: Firm-level regressions

	1	2
Intercept	2.912	2.813
	(0.000)	(0.000)
First decomposition		
Total error	-0.392	
	(0.000)	
Value-to-book	-0.087	
	(0.236)	
Comprehensive decomposition		
Firm-specific error		-0.414
		(0.000)
Sector error		-0.326
		(0.067)
Value-to-book		-0.048
		(0.524)
Controls: $m, \beta^{+}_{post}, \beta^{-}_{post}, IVol_{post}, Illiquidity, Ret^{-2\text{-}12}, Ret^{-1}, OP, Inv$		
Adj. R^2	0.079	0.081
N	456	456

The table reports return predictability results when the valuation model in equation (4) of the paper is estimated using the Fama-French 30 industry classification (21 industries have a sufficient number of firms in each year). Panels A and B present average monthly returns (in percent) of 10 portfolios formed on the basis of log market-to-book ($m_{it} - b_{it}$), total error ($m_{it} - v(\theta_{it}; \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$), sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$), and value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) over the period from July 1975 to June 2013. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High), *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown. Panel C reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on the components of log market-to-book and control variables over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix of the paper for detailed definitions.

Table AXXVI

Fama-French 38 industry classification (14 industries remain)

Panel A: Portfolio sorts (RW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.625	1.523	1.576	1.092	1.347
2	1.504	1.544	1.487	1.343	1.299
3	1.389	1.448	1.462	1.420	1.150
4	1.380	1.384	1.283	1.374	1.224
5	1.265	1.209	1.324	1.308	1.326
6	1.336	1.164	1.157	1.240	1.325
7	1.258	1.075	1.135	1.175	1.296
8	1.257	1.093	1.087	1.167	1.280
9	1.114	1.004	1.026	1.235	1.283
High	0.764	0.825	0.775	0.956	1.106
Low – High	0.861	0.698	0.801	0.136	0.240
t-stat	4.062	3.878	5.015	0.708	1.322
p-value	(0.000)	(0.000)	(0.000)	(0.479)	(0.187)
Sharpe Ratio	0.659	0.629	0.813	0.115	0.214
N	456	456	456	456	456

Panel B: Portfolio sorts (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.562	1.254	1.430	0.974	1.115
2	1.221	1.481	1.142	1.275	1.107
3	1.198	1.293	1.225	1.263	0.906
4	1.085	1.272	1.326	1.247	0.825
5	1.141	1.106	1.144	1.117	1.029
6	1.105	0.995	0.990	1.015	1.207
7	1.071	1.011	0.984	1.032	1.180
8	1.130	1.055	0.964	1.071	1.103
9	1.019	0.884	0.941	1.070	1.133
High	0.913	0.950	0.965	0.919	0.905
Low – High	0.649	0.304	0.465	0.055	0.210
t-stat	2.878	1.510	2.674	0.238	1.253
p-value	(0.004)	(0.132)	(0.008)	(0.812)	(0.211)
Sharpe Ratio	0.467	0.245	0.434	0.039	0.203
N	456	456	456	456	456

Table AXXVI (*Continued*)

Panel C: Firm-level return regressions

	1	2
Intercept	2.951	2.838
	(0.000)	(0.000)
First decomposition		
Total error	-0.377	
	(0.000)	
Value-to-book	-0.153	
	(0.042)	
Comprehensive decomposition		
Firm-specific error		-0.387
		(0.000)
Sector error		-0.702
		(0.002)
Value-to-book		-0.118
		(0.132)
Controls: $m, \beta^{+}_{post}, \beta^{-}_{post}, IVol_{post}, Illiquidity, Ret^{-2\text{-}12}, Ret^{-1}, OP, Inv$		
Adj. R^2	0.082	0.084
N	456	456

The table reports return predictability results when the valuation model in equation (4) of the paper is estimated using the Fama-French 38 industry classification (14 industries have a sufficient number of firms in each year). Panels A and B present average monthly returns (in percent) of 10 portfolios formed on the basis of log market-to-book ($m_{it} - b_{it}$), total error ($m_{it} - v(\theta_{it}; \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$), sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$), and value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) over the period from July 1975 to June 2013. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High), *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown. Panel C reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on the components of log market-to-book and control variables over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix of the paper for detailed definitions.

Table AXXVII

Campbell (1996) 12 industry classification (11 industries after excluding finance)

Panel A: Portfolio sorts (RW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.541	1.519	1.548	1.093	1.277
2	1.532	1.489	1.501	1.414	1.204
3	1.422	1.476	1.429	1.358	1.250
4	1.357	1.328	1.300	1.217	1.280
5	1.274	1.297	1.268	1.336	1.315
6	1.304	1.115	1.204	1.375	1.332
7	1.290	1.156	1.155	1.205	1.288
8	1.183	1.077	1.074	1.194	1.244
9	1.108	1.009	1.029	1.178	1.292
High	0.789	0.817	0.779	0.976	1.122
Low – High	0.752	0.702	0.770	0.117	0.155
t-stat	3.601	3.762	4.480	0.616	0.956
p-value	(0.000)	(0.000)	(0.000)	(0.538)	(0.340)
Sharpe Ratio	0.584	0.610	0.727	0.100	0.155
N	456	456	456	456	456

Panel B: Portfolio sorts (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.482	1.287	1.305	1.059	1.064
2	1.251	1.415	1.309	1.142	1.026
3	1.183	1.419	1.268	1.189	0.910
4	0.955	1.213	1.186	1.158	0.987
5	1.147	1.193	1.150	1.173	1.205
6	1.139	0.979	1.097	1.116	1.147
7	1.060	1.084	1.072	0.994	1.154
8	1.098	0.949	1.060	1.038	1.086
9	0.964	0.987	0.994	0.976	1.082
High	0.918	0.881	0.869	1.041	0.949
Low – High	0.564	0.405	0.436	0.018	0.115
t-stat	2.628	1.909	2.422	0.088	0.732
p-value	(0.009)	(0.057)	(0.016)	(0.930)	(0.464)
Sharpe Ratio	0.426	0.310	0.393	0.014	0.119
N	456	456	456	456	456

Table AXXVII (*Continued*)

Panel C: Firm-level regressions

	1	2
Intercept	2.895	2.803
	(0.000)	(0.000)
First decomposition		
Total error	-0.329	
	(0.000)	
Value-to-book	-0.140	
	(0.047)	
Comprehensive decomposition		
Firm-specific error		-0.338
		(0.000)
Sector error		-0.348
		(0.149)
Value-to-book		-0.102
		(0.165)
Controls: $m, \beta^{+}_{post}, \beta^{-}_{post}, IVol_{post}, Illiquidity, Ret^{-2\text{-}12}, Ret^{-1}, OP, Inv$		
Adj. R^2	0.080	0.082
N	456	456

The table reports return predictability results when the valuation model in equation (4) of the paper is estimated using the Campbell (1996) 12 industry classification (11 industries after excluding finance). Panels A and B present average monthly returns (in percent) of 10 portfolios formed on the basis of log market-to-book ($m_{it} - b_{it}$), total error ($m_{it} - v(\theta_{it}; \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it}; \alpha_{jt})$), sector error ($v(\theta_{it}; \alpha_{jt}) - v(\theta_{it}; \alpha_j)$), and value-to-book ($v(\theta_{it}; \alpha_j) - b_{it}$) over the period from July 1975 to June 2013. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High), *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown. Panel C reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on the components of log market-to-book and control variables over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix of the paper for detailed definitions.

Table AXXVIII

Augmenting the valuation model with growth

Panel A: Portfolio sorts (RW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.579	1.504	1.548	1.218	1.329
2	1.547	1.496	1.500	1.302	1.344
3	1.434	1.504	1.402	1.358	1.274
4	1.421	1.355	1.419	1.288	1.293
5	1.300	1.391	1.349	1.346	1.410
6	1.346	1.206	1.288	1.358	1.325
7	1.318	1.179	1.261	1.353	1.311
8	1.219	1.211	1.125	1.343	1.363
9	1.155	1.113	1.095	1.216	1.307
High	0.878	0.873	0.847	1.133	1.123
Low – High	0.701	0.630	0.701	0.085	0.206
t-stat	3.353	3.782	4.794	0.448	1.147
p-value	(0.001)	(0.000)	(0.000)	(0.654)	(0.252)
Sharpe Ratio	0.544	0.614	0.778	0.073	0.186
N	456	456	456	456	456

Panel B: Portfolio sorts (VW)

	Market-to-book	*Total error*	*Firm-specific error*	*Sector error*	*Value-to-book*
Low	1.457	1.320	1.263	0.993	1.119
2	1.247	1.316	1.160	1.073	1.059
3	1.195	1.218	1.201	1.087	0.975
4	0.966	1.219	1.303	1.006	0.982
5	1.168	1.078	1.168	1.064	1.058
6	1.101	0.989	1.000	1.170	1.071
7	1.047	1.035	1.076	1.222	1.020
8	1.078	1.010	0.935	1.042	1.106
9	1.005	0.943	0.964	1.036	1.008
High	0.903	0.921	0.934	1.001	0.987
Low – High	0.554	0.398	0.328	-0.008	0.131
t-stat	2.633	1.992	1.979	-0.042	0.757
p-value	(0.009)	(0.047)	(0.048)	(0.966)	(0.449)
Sharpe Ratio	0.427	0.323	0.321	-0.007	0.123
N	456	456	456	456	456

Table AXVIII (*Continued*)

Panel C: Firm-level regressions

	1	2
Intercept	2.626	2.605
	(0.000)	(0.000)
First decomposition		
Total error	-0.353	
	(0.000)	
Value-to-book	-0.093	
	(0.247)	
Comprehensive decomposition		
Firm-specific error		-0.360
		(0.000)
Sector error		-0.186
		(0.403)
Value-to-book		-0.049
		(0.552)
Controls: $m, \beta^{+}_{post}, \beta^{-}_{post}, IVol_{post}, Illiquidity, Ret^{-2-12}, Ret^{-1}, OP, Inv$		
Adj. R^2	0.080	0.081
N	456	456

The table reports return predictability results when the valuation model in equation (4) of the paper is augmented with a firm-level measure of *growth*, computed as the percentage change in sales over the years *t* and *t*-3. Panels A and B present average monthly returns (in percent) of 10 portfolios formed on the basis of log market-to-book ($m_{it} - b_{it}$), total error ($m_{it} - v(\theta_{it};\ \alpha_j)$), firm-specific error ($m_{it} - v(\theta_{it};\ \alpha_{jt})$), sector error ($v(\theta_{it};\ \alpha_{jt}) - v(\theta_{it};\ \alpha_j)$), and value-to-book ($v(\theta_{it};\ \alpha_j) - b_{it}$) over the period from July 1975 to June 2013. In Panel A, portfolio returns are gross return-weighted (RW). In Panel B, portfolio returns are value-weighted (VW). Portfolios are formed every June using NYSE breakpoints. Long/short hedge portfolio returns (Low – High), *t*-statistics, *p*-values (in parentheses), and annualized Sharpe ratios are also shown. Panel C reports estimation results from Fama-MacBeth regressions of monthly firm-level stock returns (in percent) on the components of log market-to-book and control variables over the period from July 1975 to June 2013. Following Asparouhova, Bessembinder, and Kalcheva (2010), regressions are weighted by prior period gross returns (RW). Reported R^2s are time-series means of monthly adjusted R^2s. See Appendix for detailed definitions.