Resurrecting the Value Factor from its Redundancy*

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Abstract

The value factor has no incremental pricing power in the Fama-French (2015) five-factor model. Its pricing power is thereby primarily subsumed by the investment factor. We show that the strong relationship between the two factors arises because their sorting variables - book-to-market and investment - are both driven by shocks to expected cash flows and discount rates. We document that only stocks that are driven by shocks to discount rates contain the factors' cross-sectional pricing information. The value and investment premia based on these stocks are roughly 50% higher than the usual value and investment premia. Importantly, adjusted versions of the value and investment factors that use only such discount rate shock-driven stocks cannot subsume each other and improve the five-factor model's pricing power. Thus, the value factor captures incremental pricing information and is no longer redundant if it is built only from stocks for which book-to-market is actually a good indicator of expected returns.

Keywords: Fama-French five-factor model, value factor, investment factor, cash flow shocks, discount rate shocks

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1. Introduction

The value factor of Fama and French (1993, 1996) is arguably the main source of their three-factor model's explanatory power for the cross-section of expected stock returns. Therefore, the finding of Fama and French (2015) that the value factor loses its explanatory power when the three-factor model is extended with profitability and investment factors, meaning that the value factor is redundant, came as a surprise. Fama and French (2015) motivate these additional factors as well as the value factor itself by showing that each of book-to-market, profitability, and investment is, in theory, related to expected returns. Yet, empirically, the value factor is subsumed by the other factors, in particular by the investment factor.

The contrast between the theoretical motivation for the value factor and its empirical redundancy as well as Fama and French (2015)'s decision to keep it in their five-factor model[1] have sparked controversy about the value factor. On the one hand, the value factor had been considered to be the most important factor for explaining the cross-section of stock returns for a long time. The value premium is an established empirical finding and Fama and French (2015) provide a profound theoretical motivation for the value factor. Additionally, other recently proposed factor models also comprise value factors (e.g. Barillas and Shanken (2018), Daniel et al. (2020), and Fama and French (2020)). On the other hand, the value factor seems to have no incremental explanatory power in the presence of an investment factor. Moreover, Hou et al. (2015) derive an economic model that is able to theoretically motivate the profitability and investment factors but not the value factor. They postulate a widely recognized four-factor model that does not contain a value factor but performs similarly, if not better, than the five-factor model of Fama and French (2015). Consequently, the theoretical motivation as well as the empirical usefulness of the value factor are both called into question.

Our goal is to resolve this recent controversy about the value factor. More specifically, we aim to answer the question of whether a value factor should still be part of a multifactor model that includes an investment factor. To this end, we investigate the reasons for the value factor's close relation with the investment factor and assess whether a value factor can capture incremental pricing information beyond an investment factor. Shedding light on these issues is important for at least three reasons. First, the Fama-French (2015) five-factor model has established itself as the leading factor model for the determination of risk-adjusted returns, for the estimation of capital costs, and for the evaluation of investment performance. Hence, the inclusion or exclusion of the value factor has potentially huge implications for both academia and practice. Second, factor models are the workhorse approach in empirical asset pricing. The questions of how to select and combine factors and of how to construct them such that they capture the intended effects are critical. Beyond the assessment of whether a value factor should be included in a multifactor model, investigating the value factor's redundancy is also likely to yield guidelines on how to construct theoretically motivated factors effectively. Third,

[1] Fama and French (2015) further rationalize this decision by arguing that the value factor's documented redundancy "may be specific to this sample" (p. 2).

investment strategies based on factors are widely employed in the investment management industry, and the value factor is one of the most targeted factors. Examining the value factor's redundancy can deliver insights on how to implement a value factor strategy effectively as well as on whether an investment factor strategy has an added value beyond a value factor strategy.

In order to uncover the reasons for the value factor's close relation with the investment factor, we propose and evaluate a simple and intuitive explanation for the association between their sorting variables - book-to-market and investment. Based on the dividend discount model and the net present value rule, we argue that both variables are driven by cash flow and discount rate shocks: negative cash flow shocks as well as positive discount rate shocks lead investors to lower their valuation of a given firm, implying an increase in the firm's book-to-market, while these shocks also prompt the firm's manager to decrease investment[2]. This mechanism generates a negative relation between book-to-market and investment. Since the value factor is long in high book-to-market stocks and the investment factor is long in low investment stocks, this negative relation implies that both factors are likely to select similar stocks. This should in turn drive their positive comovement.

Our empirical evidence supports this explanation. Specifically, we document a negative relation between book-to-market and investment that is only driven by stocks whose variation in book-to-market is due to market equity rather than book equity changes. This result is in line with our thesis that cash flow and discount rate shocks drive the relation since only market equity changes reflect these shocks. Further corroborating our conjecture, we demonstrate that mispricing or financial constraints are unlikely to cause these findings. As expected, the negative relation between book-to-market and investment leads to a substantial overlap between the value and investment factors' portfolios. This overlap is again only due to market equity-driven stocks, and it is in turn the primary reason for the factors' strong comovement.

In theory, only differences in discount rates are associated with differences in expected returns. Thus, high book-to-market and low investment should be associated with higher future returns only if they are high respectively low because of discount rate shocks rather than cash flow shocks. Consequently, only those stocks whose variation in book-to-market and investment is due to discount rate shocks, and thus due to differences in expected returns, should contain the value and investment factors' pricing information for the cross-section of stock returns.

In order to evaluate this conjecture, we construct proxies for firms' cash flow and discount rate shocks. Following Hou and van Dijk (2019), our proxy for firms' cash flow shocks is the profitability shock as estimated from a cross-sectional profitability model. Moreover, we obtain a proxy for firms' discount rate shocks as the residual return from a cross-sectional regression of firms' contemporaneous stock returns on their estimated profitability shocks.

Our proxies are successful in identifying the variation in book-to-market and investment that is informative about expected returns. Specifically, we show that only stocks whose book-to-market and investment are more likely to be driven by discount rate shocks than by cash flow

[2]The same reasoning applies analogously to positive cash flow shocks and negative discount rate shocks.

shocks earn the value and investment premia. By contrast, the value and investment premia are weak to non-existent for stocks whose book-to-market and investment are driven by cash flow shocks. The value and investment premia of discount rate shock-driven stocks are around 6.0% and 3.6% p.a., respectively, which correspond to an increase of 50% compared to the standard value and investment premia documented in the literature. Moreover, contrary to the standard premia, the discount rate shock-driven value and investment premia represent largely independent sources of excess returns.

The differences between the discount rate shock- and cash flow shock-driven value and investment premia are arguably due to differences in expected returns. Yet, the Fama-French (2015) five-factor model fails to explain why only discount rate shock-driven stocks earn value and investment premia while cash flow shock-driven stocks do not. This result implies that the Fama-French (2015) model cannot distinguish whether book-to-market is high respectively investment is low because of high expected returns or because of low expected profitability.

Motivated by our findings, we construct adjusted versions of the value and investment factors that employ only stocks whose book-to-market and investment are driven by discount rate shocks. We find that these discount rate shock-driven value and investment factors cannot subsume each other in spanning regressions. Thus, they are not redundant with respect to each other and capture incremental pricing information. The value factor's incremental pricing information is hidden in the standard version of the value factor because of its cash flow shock-driven part: it contains hardly any pricing information but strongly contributes to the comovement with the investment factor.

We further show that our discount rate shock-driven value and investment factors are able to capture the entire pricing information of the standard value and investment factors, but not vice versa. Consequently, an adjusted five-factor model that uses the factors' adjusted versions exhibits a better pricing performance than the standard five-factor model. In particular, the adjusted five-factor model can explain why discount rate shock-driven stocks earn value and investment premia while cash flow shock-driven stocks do not.

Furthermore, we evaluate why the value factor rather than the investment factor is the redundant one in the first place. We find that the value factor is the redundant one for three reasons. First, it comprises the noisy book equity-driven part that reflects other effects than its market equity-driven part or the investment factor. Second, the value factor captures the effects with more noise than the investment factor, especially during periods of market-wide distortions. Third, the value factor is a worse hedge for the three remaining factors of the five-factor model (i.e., market, size, and profitability) than the investment factor. We present indicative evidence that the later two reasons may be specific to our sample period from 1963 to 2019, suggesting that even the standard value factor may be non-redundant going forward.

Finally, we use the disconnect between our discount rate shock- and cash flow shock-driven value and investment premia as a laboratory to evaluate the three-beta ICAPM of Campbell et al. (2018) as a potential explanation for the value and investment effects. We find that our discount rate shock-driven value and investment factors have similar exposures to the model's factors as their cash flow shock-driven counterparts, meaning that the three-beta ICAPM cannot explain their disconnect. Contrary to earlier evidence, this finding implies that differential exposures to the three factors of this model cannot rationalize the value and investment effects.

Our study contributes to four strands of literature. First, it contributes to the resolution of the recent controversy about the inclusion of a value factor in a multifactor model that has been raised by the studies of Fama and French (2015) and Hou et al. (2015). While Fama and French (2015) motivate their factors based on the dividend discount model, Hou et al. (2015) motivate their factors based on an economic model inspired by q-theory and production-based asset pricing. Both approaches agree that discount rates, and therefore expected returns, should be higher for low investment and high profitability firms. However, the model of Hou et al. (2015) does not yield an independent relation between book-to-market and expected returns. Hou et al. (2015) rather argue that the value effect is a manifestation of the investment effect, suggesting that the value factor is not only empirically but also theoretically redundant. In line with the conjectures of Hou et al. (2015), we show that the value and investment factors reflect the same effects, namely cash flow and discount rate shocks. Nevertheless, we reject the conclusion that a value factor is therefore necessarily redundant. On the one hand, our results support the claim of Fama and French (2015) that the redundancy of the standard value factor may be specific to the sample. On the other hand, we find that the value factor contains incremental pricing information beyond the investment factor. This information is hidden in the standard version of the factor because its construction methodology does not take into account whether stocks' book-to-market reflect differences in expected returns or differences in expected profitability. Consequently, we advocate the inclusion of a value factor in a multifactor model even in the presence of an investment factor. Yet, the value factor's construction methodology should be modified such that it captures pricing information more accurately.

Second, this study contributes to the recent literature on improvements to the factors' construction methodologies. Fama and French (2018) show that the pricing performance of their five-factor model is quite sensitive to the factors' construction methodology. Fama and French (2020) construct cross-sectional factors from Fama-MacBeth (1973) regressions and document that they perform somewhat better than the traditional time-series factors. Daniel et al. (2020) propose hedged versions of the five Fama-French (2015) factors that aim to capture priced covariation more accurately. They find that the factors' hedged versions improve upon the pricing performance of their standard versions. In line with these studies, our findings suggest that better versions of existing factors are needed[3]. Thereby, we complement these studies' approaches by suggesting improvements to the factors that are motivated by economic intuition rather than statistical arguments. In particular, we show that factors can be improved if their construction methodologies take into account which stocks should, based on economic intuition, contain their pricing information. Moreover, purging factors of their unpriced parts can even

[3]Constructing better versions of a few existing factors that can be theoretically motivated counteracts the problematic development of an ever-expanding factor zoo outlined by Cochrane (2011).

restore their incremental pricing power as is the case with the value factor.

Third, our paper is related to the extensive literature on the source of book-to-market's predictive power for future returns and on the value premium. Fama and French (2006) aim to isolate book-to-market's information about expected returns by cancelling out its information about expected profitability. Daniel and Titman (2006) split the change in book-to-market into a tangible return, capturing firms' past performance, and an intangible return, capturing news about firms' future performance. They find that only the intangible return predicts future returns. Fama and French (2008) decompose the change in book-to-market into the per-share book equity change, the without-dividend return, and share issues. They document that all three components have predictive power for future returns. Gerakos and Linnainmaa (2018) differentiate between changes in total book equity and total market equity. They show that only stocks whose book-to-market is driven by market equity changes earn the value premium. We extend these studies by differentiating between variation in book-to-market that is informative about expected returns and variation in book-to-market that is informative expected profitability. Our results indicate that our approach improves upon these studies in pinpointing the variation in book-to-market that is informative about expected returns.

Finally, we contribute to the literature on the investment effect and its relation to the value effect. Titman et al. (2004) are among the first to document a negative relation between investment, as measured by capital expenditures to sales, and future returns. Cooper et al. (2008) show that this relation holds also when investment is measured by asset growth, which is the measure of investment used for the construction of the investment factor. Xing (2008) finds that book-to-market and investment capture similar information about future returns. Thereby, the investment effect seems to subsume the value effect, but not vice versa. Our results add to this literature by pinning down the variation in investment that is related to expected returns. Moreover, we work out the reasons for the close relation between book-to-market and investment. Yet, we find that book-to-market and investment capture incremental information about expected returns when their information about expected profitability is discarded.

Our results have also important implications for the investment management industry. While the value factor is one of the most frequently targeted factors in factor investing strategies, the investment factor is as of yet hardly targeted. One major reason may be that targeting the investment factor in addition to the value factor is not perceived to have an added value because of their close relation. Our findings challenge this perception. In particular, they indicate that enhanced value and investment strategies that select only stocks whose book-to-market and investment are good indicators of expected returns represent largely independent sources of excess returns. Thus, it is beneficial for investors to include both - an enhanced value strategy as well as an enhanced investment strategy - in a multifactor investing strategy.

Moreover, our findings also provide a theoretical underpinning for the infamous value trap that plagues value investing (see e.g. Penman and Reggiani (2018)). The value trap refers to the observation that value stocks with weak profitability do, on average, not outperform. The common practice of avoiding such stocks in value investing strategies resonates well with our results: only value stocks whose book-to-market is high due to positive discount rate shocks earn the value premium. Stocks whose book-to-market is high due to negative cash flow shocks, and thus due to lower profitability, do not earn the value premium.

The remainder of the paper is structured as follows: in Section 2, we discuss our predictions on the close relation between the value and the investment factors and on the factors' pricing information. Section 3 provides details on our data set, reviews the construction of the factors, and introduces our procedure to classify stocks as cash flow shock- versus discount rate shock-driven. Section 4 presents our results on the relation between book-to-market and investment. In Section 5, we investigate the drivers of the value and investment factors' strong comovement. Section 6 examines which parts of the factor portfolios contain the factors' pricing information. In Section 7, we investigate whether the factors' pricing information is redundant and whether adjusted versions of the factors improve the pricing performance. Section 8 examines why the value factor is the redundant one of the two factors in the first place. In Section 9, we evaluate the three-beta ICAPM of Campbell et al. (2018) as a potential explanation for the value and investment effects. Section 10 explores alternative explanations for the relation between book-to-market and investment. Finally, Section 11 concludes.

2. Theoretical Framework

Fama and French (2015) derive the following relation between book-to-market, profitability, investment, and discount rates by manipulating the dividend discount model:

$$\frac{M_0}{B_0} = \sum_{t=1}^{\infty} \frac{\frac{E_0(Y_t)}{B_0} - \frac{E_0(dB_t)}{B_0}}{(1+r)^t} \tag{1}$$

where M_0 (B_0) is the current market (book) value of the firm, Y_t is total earnings in year t, dB_t is the change in book equity in year t, and r is the stock's long-term average expected return. In words, this equation states that, all else equal, a firm's book-to-market ($\frac{B_0}{M_0}$) and its expected profitability ($\frac{E_0(Y_t)}{B_0}$) are positively related to its expected return while the firm's expected investment ($\frac{E_0(dB_t)}{B_0}$) is negatively related to its expected return. Thus, book-to-market, profitability, and investment are indicators for expected returns. Fama and French (2015) motivate their value, profitability, and investment factors based on this insight. The implicit assumption is that the three variables capture sufficiently different information about expected returns, and thus, that the factors reflect at least partly independent priced covariation.

Equation (1) is an identity that has to hold at any point in time. Thus, if one variable changes, one or multiple of the other variables also have to change. Two types of news may trigger changes: cash flow shocks and discount rate shocks. In equation (1), a cash flow shock affects the firm's expected earnings ($E_0(Y_t)$), and a discount rate shock affects its expected return (r). In order for equation (1) to still hold after a cash flow or a discount rate shock, the firm's market value (M_0) and/or the firm's expected investment ($E_0(dB_t)$) need to adjust.

How do these two variables adjust upon cash flow and discount rate shocks, that is, how do investors and firm managers react to these shocks? First, consider a representative investor who values a firm's stock based on the dividend discount model:

$$P_0 = \sum_{t=1}^{\infty} \frac{E_0(D_t)}{(1+r)^t} \tag{2}$$

where P_0 is the fair value of the firm's stock, D_t is the dividend in year t, and r is the required return of the investor.

Second, assume that the firm's manager evaluates projects based on the net present value rule of investment, that is, he continues an existing project or realizes a new project if the project's net present value is greater zero:

$$NPV_0 = -I_0 + \sum_{t=1}^{T} \frac{E_0(CF_t)}{(1+r)^t} \tag{3}$$

where NPV_0 is the project's current net present value, I_0 is the required investment to continue or to realize the project, CF_t is the cash flow from the project in year t, and r is the firm's cost of capital, which is in equilibrium equal to the investor's required return r from equation (2)[4].

Now, consider a discount rate shock. A positive discount rate shock means that the investor's required return for holding the firm's stock increases, and in turn, that the firm's cost of capital increases. Equation (2) shows that an increase in the investor's required return (r) leads him to value the firm's stock at a lower price, implying a decrease in the firm's market value and an increase in its book-to-market. Simultaneously, equation (3) indicates that an increase in the firm's cost of capital (r) implies lower net present values for the firm's projects, prompting the firm's manager to divest from existing projects and to decrease investment in future projects.

Next, suppose the firm experiences a cash flow shock. A negative cash flow shock implies lower expected cash flows from projects, and in turn, lower expected dividends. Equation (2) shows that lower expected dividends ($E_0(D_t)$) lead the investor to value the firm's stock at a lower price, implying again a decrease in the firm's market value and an increase in its book-to-market. Simultaneously, equation (3) indicates that lower expected cash flows ($E_0(CF_t)$) result in lower net present values for the firm's projects, prompting the firm's manager to divest from existing projects and to invest less in future projects.

In both cases - a positive discount rate shock and a negative cash flow shock - the firm's book-to-market increases and its investment decreases. Based on the analogous reasoning, firm's book-to-market decreases and its investment increases upon a negative discount rate shock or a positive cash flow shock. Thus, discount rate and cash flow shocks give rise to a negative relation between book-to-market and investment. Importantly, the negative relation of book-to-market

[4] For simplicity, we assume that the firm's assets are homogeneous and that the firm is all-equity-financed, meaning that the discount rate for each project is the same and equal to the investor's required return.

with investment is for both types of shocks associated with a change in market equity (i.e., a change in the denominator of book-to-market; hf. market-channel) rather than with a change in book equity (i.e., a change in the numerator of book-to-market; hf. book-channel).

The value factor is long in high book-to-market stocks (hf. value stocks) and short in low book-to-market stocks (hf. growth stocks). The investment factor is long in low investment stocks (hf. conservative stocks) and short in high investment stocks (hf. aggressive stocks). Given the predicted negative relation between book-to-market and investment, value stocks should therefore frequently also be conservative stocks. Analogously, growth stocks should frequently also be aggressive stocks. Thus, the factors are likely to select similar stocks in their long legs and their short legs. The factors' long legs and the factors' short legs should therefore strongly comove, causing in turn the factors themselves to comove. Figure 1 summarizes our theses on how discount rate and cash flow shocks give rise to the value and investment factors' comovement.

[Insert Figure 1 near here.]

Discount rate shocks and cash flow shocks both contribute to the negative relation between book-to-market and investment. However, only discount rate shocks reflect changes in investors' required returns, and thus, changes in stocks' expected returns. By contrast, cash flow shocks reflect changes in firms' expected profitability. While cash flow shocks therefore affect stocks' prices immediately, they do not give rise to changes in stocks' expected returns. Differences in expected returns across stocks are only due to differences in their past discount rate shocks.

For this reason, only value and conservative stocks whose book-to-market is high respectively whose investment is low because of positive discount rate shocks should, all else equal, have higher expected returns. By contrast, value and conservative stocks whose book-to-market is high respectively whose investment is low because of negative cash flow shocks should, all else equal, not have higher expected returns but rather lower expected profitability. In both cases, the opposite applies to growth and aggressive stocks. Thus, book-to-market and investment are good indicators for expected returns only if they are driven by discount rate shocks. Consequently, only those stocks whose variation in book-to-market and investment is due to discount rate shocks should contain the factors' pricing information for the cross-section of expected stock returns.

Although our theoretical framework is based on rationality, it can also accommodate irrationalities. In particular, the representative investor's required return in the dividend discount model in equation (2), and thus the stock's expected return, may be determined by the stock's systematic risk as well as by the investor's behavioural biases. Like rational changes in expected returns, irrational changes in expected returns should also spill over to the firm's cost of capital in equation (3), and thus, affect firm's investment[5]. It is therefore not necessary to assume that changes in expected returns are rational.

[5]This conjecture is supported by the findings of, among others, Polk and Sapienza (2009) and Dessaint et al. (2019). Their evidence suggests that mispricing affects firms' investment decisions.

3. Data and Methodology

3.1. Data Sample

Our sample period spans the time from July 1963 to December 2019. We obtain stock data from CRSP and firm fundamentals data from Compustat. We supplement the Compustat fundamentals data with Davis et al. (2000)'s hand-collected book equity data from Kenneth French's website[6]. Our sample includes all stocks that are traded on the NYSE, AMEX, or NASDAQ and that have a CRSP share code of 10 or 11. We adjust monthly holding period returns for potential delisting returns. Following Shumway (1997) and Shumway and Warther (1999), we additionally set missing delisting returns for NYSE and AMEX stocks to -30% and for NASDAQ stocks to -55% in case the delisting was performance-related. Finally, we use the one-month T-bill rate retrieved from Kenneth French's website as a proxy for the risk-free rate. The construction of our key variables is described in detail in Appendix A.

3.2. Factor Portfolios

We construct the value factor and the investment factor as described in Fama and French (2015). In particular, for the construction of the value factor, we sort stocks at the end of each June into two groups according to their market equity at the end of June and into three groups according to their book-to-market from the last fiscal year ending in the prior year[7]. The breakpoints of the sorts are the median market equity and the 30th and 70th book-to-market percentiles of all NYSE stocks. Taking the intersections of the two market equity groups and the three book-to-market groups yields six portfolios. The return on the value factor (HML) is the average of the value-weighted returns on the two high book-to-market portfolios minus the average of the value-weighted returns on the two low book-to-market portfolios.

The investment factor is constructed in the same way, only that the second sort is with respect to investment as measured by asset growth from the last fiscal year ending. The return on the investment factor (CMA) is the average of the value-weighted returns on the two low investment portfolios minus the average of the value-weighted returns on the two high investment portfolios. The correlation of the investment factor with the value factor is 0.66.

For both factors, we form an aggregate long (short) portfolio as the equal-weighted combination of the small long (short) and the big long (short) portfolio. Thereby, each stock receives the same weight in the aggregate portfolios as it has in the calculation of the factors' returns. We refer to the long (short) portfolio of the value factor as the value (growth) portfolio and

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

[7] We measure book-to-market slightly differently than Fama and French (2015): we take the market equity at the fiscal year ending rather than at the calendar year ending. We make this adjustment in order to align the market equity changes with our cash flow and discount rate shock proxies introduced in Section 3.4.

to the long (short) portfolio of the investment factor as the conservative (aggressive) portfolio. The long-short combinations of the aggregate factor portfolios are denoted as HML portfolio and CMA portfolio, respectively.

Additionally, we construct subsets of the aggregate portfolios that consist, in each year, only of those stocks that newly enter the portfolios. More precisely, we classify the portfolios' stocks at each rebalancing date (i.e., at the end of each June) as incoming stocks if they were not part of the respective portfolio in the previous year[8]. The stocks' weights in the incoming subsets are proportionally the same as in the complete portfolios.

3.3. Book-to-Market Decomposition

Next, we decompose firms' book-to-market following Gerakos and Linnainmaa (2018):

$$bm_{i,t} = bm_{i,t-k} + \sum_{s=0}^{k-1} dbe_{i,t-s} - \sum_{s=0}^{k-1} dme_{i,t-s} \tag{4}$$

where $bm_{i,t}$ is firm i's log-book-to-market in year t and $dbe_{i,t}$ ($dme_{i,t}$) is the log-change in the firm's book (market) equity from year $t-1$ to year t. t-variables are measured at the end of June of year t based on the firm's last fiscal year ending in year $t-1$. The equation states that a firm's log-book-to-market is equal to its lagged log-book-to-market plus the annual log-changes in its book equity minus the annual log-changes in its market equity.

[Insert Table 1 near here.]

Table 1 presents the average contributions of lagged book-to-market, book equity changes, and market equity changes to the total cross-sectional variation in book-to-market for one- to five-year decompositions of book-to-market. The results for the full sample in Panel A show that book equity changes contribute virtually nothing to book-to-market's variation in the one-year decomposition while they contribute even negatively for the two- to five-year decompositions. By contrast, market equity changes contribute 18.3% to book-to-market's variation in the one-year decomposition, further increasing up to 52.6% in the five-year decomposition. The contributions of lagged book-to-market decrease in parallel from 81.5% to 53.1%. Overall, book-to-market changes are, in the full sample, thus primarily driven by market equity changes rather than book equity changes. These results are in line with those of Gerakos and Linnainmaa (2018).

Panel B of Table 1 presents the same results for the sample of stocks that are newly entering the value and growth portfolios. Contrary to the full sample, the contribution of lagged book-to-market to book-to-market's cross-sectional variation is rather small. Across all decompositions, market equity changes account for the majority of the variation. This result implies

[8]We classify only stocks that could have been but have not been in the previous year's portfolios as incoming stocks. This filter excludes stocks that were not yet in the sample or that did not have valid book-to-market respectively investment data in the previous year.

that the market-channel is the primary channel for stocks to become value and growth stocks. Nevertheless, book equity changes contribute also considerably to book-to-market's variation (between 24.0% and 33.1%) in this sample. Thus, book equity changes are a non-negligible driver for stocks to become value and growth stocks.

3.4. Determination of Cash Flow and Discount Rate Shocks

As we need to determine whether stocks' book-to-market and investment are driven by cash flow shocks or by discount rate shocks to investigate our predictions, we construct proxies for these shocks. We follow Hou and van Dijk (2019) and use firms' estimated profitability shocks as proxy for their cash flow shocks. In a first step, we implement the cross-sectional profitability model of Hou and van Dijk (2019) that yields estimates for firms' expected profitability. Specifically, we run the following cross-sectional regression at the end of each June from 1963 to 2019[9]:

$$\frac{E_{i,t}}{A_{i,t-1}} = b_{0,t} + b_{1,t}\frac{A_{i,t-1} + ME_{i,t-1} - BE_{i,t-1}}{A_{i,t-1}} + b_{2,t}DD_{i,t-1} + b_{3,t}\frac{D_{i,t-1}}{BE_{i,t-1}} + b_{4,t}\frac{E_{i,t-1}}{A_{i,t-2}} + \epsilon_{i,t} \quad (5)$$

where $E_{i,t}$ is firm i's operating income after depreciation, $A_{i,t}$ are total assets, $ME_{i,t}$ is market equity (from Compustat), $BE_{i,t}$ is book equity (calculated as described in Appendix A), $D_{i,t}$ are dividend payments, and $DD_{i,t}$ is a dummy variable that equals one if the firm does not pay dividends. t-variables are measured at the end of June of year t based on the firm's last fiscal year ending in year $t-1$.

The average coefficients from the annual regressions are presented in Panel A of Table 2. Their signs are identical and their magnitudes are similar to those reported by Hou and van Dijk (2019). In line with intuition, the coefficients indicate that expected profitability is higher for firms with higher firm valuations, higher dividend payments, and higher past profitability.

[Insert Table 2 near here.]

Like Hou and van Dijk (2019), we use the annual regression coefficients from the profitability model in (5) to calculate firms' profitability shocks. In particular, we forecast firm i's profitability for year t by multiplying the estimated coefficients from the regression in year $t-1$ with the firm's values for the predictor variables in year $t-1$. The firm's profitability shock in year t, $PS_{i,t}$, is then its realized profitability in year t minus its forecasted profitability, that is:

$$PS_{i,t} = \frac{E_{i,t}}{A_{i,t-1}} - E_{t-1}\left(\frac{E_{i,t}}{A_{i,t-1}}\right) = \frac{E_{i,t}}{A_{i,t-1}} - X_{i,t-1}\hat{b}'_{t-1} \quad (6)$$

where $X_{i,t-1}$ is a vector that contains firm i's values for the predictors as of year $t-1$ and $\hat{b}_{t-1}$

[9]Following Hou and van Dijk (2019), we exclude firms with total assets of less than $10 million and book equity of less than $5 million for the estimation of the model.

is the vector of coefficients that are estimated from regression (5) in year $t-1$. We employ $PS_{i,t}$ as a proxy for firm i's cash flow shock across the fiscal year that ended in year $t-1$.

In order to construct a proxy for firms' discount rate shocks, we regress firms' annual returns on their estimated profitability shocks. Specifically, we estimate at the end of each June from 1964 to 2019 the following cross-sectional regression[10]:

$$\overline{R}_{i,t} = c_{1,t}\overline{PS}_{i,t} + RR_{i,t} \tag{7}$$

where $\overline{R}_{i,t}$ is the cross-sectionally demeaned return of firm i across the fiscal year that ended in year $t-1$, $\overline{PS}_{i,t}$ is the firm's cross-sectionally demeaned profitability shock across the fiscal year that ended in year $t-1$, and $RR_{i,t}$ is the regression's error term which captures the firm's return across the fiscal year that is unexplained by its profitability shock[11].

Panel B of Table 2 presents the regression results, showing that the average coefficient on the profitability shock is positive and highly significant. Thus, a positive profitability shock is associated with a positive contemporaneous return. This is consistent with the notion that the estimated profitability shock captures cash flow shocks.

Campbell (1991) argues that realized returns are driven by three components: expected returns, cash flow shocks, and discount rate shocks. The results of Hou and van Dijk (2019) as well as the significantly positive coefficient in Panel B of Table 2 indicate that the estimated profitability shocks are a reasonable proxy for firms' cash flow shocks. Therefore, the regression in (7) cancels the part of the realized return that is due to cash flow shocks. Moreover, by demeaning the return cross-sectionally before estimating the regression model in (7), we further cancel the part of the realized return that is due to the expected market return as well as due to *market* cash flow shocks and *market* discount rate shocks. Consequently, the residual return should only capture firm-specific discount rate shocks as well as pre-existing differences in expected returns. Pre-existing differences in expected returns are on average zero, are uncorrelated with subsequent discount rate shocks, and are likely to be small relative to the price effects of discount rate shocks. Therefore, the negative of $RR_{i,t}$ should be a reasonable proxy for firm i's discount rate shock across the fiscal year that ended in year $t-1$[12].

Our attempt to separate the effects of cash flow and discount rate shocks extends Gerakos and Linnainmaa (2018), Daniel and Titman (2006), and Fama and French (2008). In these studies, the authors argue that market equity changes, intangible returns, and without-dividend returns are the source of book-to-market's predictive power for future returns because they capture news about discount rates. However, they neglect that these variables also reflect news

[10]This approach is similar to Hou and van Dijk (2019)'s second return adjustment method. The only difference is that we use stocks' compounded returns across their fiscal years rather than their monthly returns during their fiscal years.

[11]Note that this regression as well as the estimation of the profitability shocks requires only data that is publicly available by the end of June of year t, such that there is no look-ahead bias.

[12]Our discount rate shock proxy may not only capture stock price changes that are due to changes in risk but also those that are due to mispricing. Yet, since changes in risk as well as mispricing are both associated with changes in expected returns, our discount rate shock proxy is still a valid instrument for identifying variation in book-to-market and investment that is due to differences in expected returns.

about cash flows. Based on our cash flow and discount rate shock proxies, we aim to identify the variation in book-to-market that is informative about expected returns more precisely.

3.5. Subsets of the Factor Portfolios

In order to examine our predictions from Section 2 on the relation between the value factor and the investment factor as well as on the source of their pricing information, we dissect the factors' portfolios into several parts. First, we split the value and growth portfolios into market- and book-channel subsets based on the one-year decomposition of book-to-market. Specifically, we classify incoming value (growth) stocks as market-channel stocks if the negative of the cross-sectionally demeaned log-change in their market equity is greater (lower) than the cross-sectionally demeaned log-change in their book equity, and as book-channel stocks in the opposite case. Market-channel incoming stocks are thus stocks whose book-to-market change is, relative to other stocks' book-to-market change, more strongly driven by market rather than book equity changes. Given that lagged book-to-market hardly contributes to the variation of incoming value and growth stocks' book-to-market, considering the one-year decomposition is sufficient to determine whether stocks become value and growths stock primarily because of book equity or market equity changes. We find that, on average, 81.4% (18.6%) of incoming stocks are classified as market-channel (book-channel) stocks. In line with the results from Panel B of Table 1, these numbers imply that stocks become value and growth stocks primarily because of changes in their market equity.

Next, we use the estimated profitability shocks and residual returns to determine whether market-channel incoming value and growth stocks as well as incoming conservative and aggressive stocks are cash flow shock- or discount rate shock-driven. Since the estimated profitability shocks and residual returns have different scales and different cross-sectional dispersions, simply comparing them would be inappropriate for this purpose. Therefore, we rather rank stocks cross-sectionally according to their estimated profitability shocks and residual returns. Comparing a stock's profitability shock rank with its residual return rank indicates whether the stock was, relative to other stocks, more strongly affected by cash flow shocks or by discount rate shocks during the previous year.

In detail, we rank all market-channel incoming value stocks at the end of each June according to the estimated profitability shocks and residual returns from low to high. We do the same for market-channel incoming growth stocks. Market-channel incoming value (growth) stocks are then classified as discount rate shock-driven if their residual return ranks are lower (higher) than their profitability shock ranks, and as cash flow shock-driven in the opposite case. That is, discount rate shock-driven value (growth) stocks are stocks whose positive (negative) discount rate shocks are likely to have been more pronounced than their negative (positive) cash flow shocks. Based on this procedure, on average 40.9% (59.1%) of market-channel incoming value and growth stocks that can be classified are classified as discount rate (cash flow) shock-driven.

Incoming conservative and aggressive stocks are classified analogously. That is, we rank all incoming conservative stocks at the end of each June according to the estimated profitability shocks and residual returns from low to high, and we do the same for incoming aggressive stocks. Incoming conservative (aggressive) stocks are classified as discount rate shock-driven if their residual return ranks are lower (higher) than their profitability shock ranks, and as cash flow shock-driven in the opposite case. On average, 48.0% (52.0%) of incoming conservative and aggressive stocks that can be classified are classified as discount rate (cash flow) shock-driven.

Stocks keep their classifications for the whole time they remain uninterrupted in the factor portfolios. We assign the stocks in the market-channel, book-channel, cash flow shock-driven, and discount rate shock-driven subsets the same weights as in the complete portfolios and scale them up such that they sum to one.

4. The Relation between Book-to-Market and Investment

4.1. Correlation between Investment and Book-to-Market

We begin our empirical analysis by characterizing the relation between book-to-market and investment. Panel A of Figure 2 presents cross-sectional rank correlations of book-to-market and investment changes with up to five-year ago and up to ten-year ahead investment changes. Book-to-market changes are negatively correlated with contemporaneous investment changes (-0.094) and even more so with one-year-ahead investment changes (-0.142). Panel B shows that the negative correlation between their changes carries over to a negative correlation between book-to-market and investment in general. Specifically, the correlation of book-to-market with investment is negative across all five lags and ten leads but peaks again for contemporaneous and one-year ahead investment (around -0.27). These observations confirm a negative relation between book-to-market and investment. The result that book-to-market is more strongly related to one-year ahead than contemporaneous investment is intuitive: as a market-based variable, book-to-market is likely to reflect cash flow and discount rate shocks more timely than investment, which is accounting-based[13].

[Insert Figure 2 near here.]

In Figure 3, we evaluate whether book-to-market and investment are in fact related because both are driven by cash flow and discount rate shocks. For this purpose, we first orthogonalize

[13] Investment is likely to reflect firms' actual investment decisions and thus the effects of cash flow and discount rate shocks with a lag for two reasons. First, depending on the timing of the shocks during the fiscal year, firms' decisions to adjust their investment may be only reflected in the financial statements of the following fiscal year. Second, firms' investment plans may be sticky, meaning that they cannot immediately adjust their investment upon a shock. Investors, on the other hand, can immediately react to cash flow and discount rate shocks, wherefore stock prices, and thus book-to-market, are likely to reflect the shocks quite timely.

book-to-market and investment with respect to our cash flow and discount rate shock proxies. Specifically, we regress both variables at the end of each June cross-sectionally on up to ten year-lagged profitability shocks and residual returns. Thereby, we use weighted least squares with the stocks' market capitalizations as weights and winsorize all variables at the 0.5%- and 99.5%-level. Then, we calculate in each year the cross-sectional rank correlations between the residuals from the two regressions, and average them across our sample period. For comparison, we orthogonalize the variables also to profitability shocks and residual returns individually as well as to the compound returns across the past fiscal years.

The results support our thesis that the relation between book-to-market and investment is due to cash flow and discount rate shocks. Panel A shows that the correlation between contemporaneous book-to-market and investment of -0.274 quickly attenuates when the variables are orthogonalized to past profitability shocks and residual returns, turning even slightly positive when they are orthogonalized to eight or more lags. Similarly, Panel B shows that the correlation between current book-to-market and one-year ahead investment of -0.268 also attenuates substantially after the variables are orthogonalized to past profitability shocks and residual returns. The figure further indicates that the correlation between book-to-market and investment is driven by both - discount rate shocks and cash flow shocks: orthogonalizing to profitability shocks and residual returns individually, or to simple compound returns, attenuates the correlation much less.

[Insert Figure 3 near here.]

4.2. Average Investment of Value and Growth Stocks

Next, we examine whether the negative relation between book-to-market and investment holds also based on the factor portfolios of the value factor and whether it varies across the portfolios' different subsets[14]. To begin, Panel A of Figure 4 displays value and growth stocks' average investment across the five years before and the ten years after they become value and growth stocks, respectively. Their average investment is similar in the years before as well as in the year they become value and growth stocks. However, in subsequent years, growth stocks exhibit much higher investment than value stocks. Thus, incoming value and growth stocks also reflect the negative relation between book-to-market and investment.

[Insert Figure 4 near here.]

[14]In the Internet Appendix, we implement cross-sectional Fama-MacBeth (1973) regressions that regress investment on book-to-market and changes in book and market equity. The results support the same conclusions as those based on the factor portfolios discussed in this section. Moreover, we also verify that the relation between book-to-market and investment is not driven by firms' issuance and distribution policy but in fact by the return component of book-to-market, and thus arguably by cash flow and discount rate shocks.

This negative relation is only associated with variation in book-to-market that is due to market equity changes. Specifically, market-channel incoming growth stocks exhibit a higher contemporaneous and future investment than market-channel incoming value stocks. Since market-channel stocks' variation in book-to-market is arguably driven by discount rate and cash flow shocks, this result is consistent with the notion that these shocks are responsible for the relation between book-to-market and investment. Moreover, the spread between market-channel value and growth stocks peaks for one-year ahead investment, supporting our conjecture that the shocks are reflected earlier in book-to-market than in investment.

By contrast, book-channel growth stocks exhibit a much lower investment in the year of their entry than book-channel value stocks, implying a positive rather than a negative relation between book-to-market and investment. This pattern is intuitive: since book equity plus debt equals total assets in the balance sheet, investment, as measured by asset growth, should be positively related to contemporaneous book equity changes. This balance sheet effect counteracts the effect of discount rate and cash flow shocks, thereby attenuating the negative contemporaneous relation between book-to-market and investment to some extent.

Panel B of Figure 4 displays the results for the total portfolios. They are in line with those for the incoming stocks: value stocks exhibit lower investment than growth stocks, and this pattern is only observable for market- but not for book-channel stocks.

Furthermore, Panels C and D show that the results are quite similar for the discount rate shock- and cash flow shock-driven subsets of the value and growth portfolios. The only distinct difference is that the spread between cash flow shock-driven incoming value and growth stocks peaks for contemporaneous investment while the spread between discount rate shock-driven incoming value and growth stocks peaks for one-year ahead investment. This observation suggests that the intertemporal pattern between book-to-market and investment is primarily due to discount rate shock-driven stocks. The reason may be that cash flow shocks originate from the firm side whereas discount rate shocks originate from the investor side. Therefore, firm managers become aware of cash flow shocks earlier than of discount rate shocks, and thus, adjust their investment timelier to the former than the later. This observation is therefore in line with our theoretical framework.

In sum, the findings from this section confirm our prediction that the relation between book-to-market and investment is negative. They also support our thesis that the relation is driven by cash flow and discount rate shocks. Moreover, the relation seems to be most pronounced between current book-to-market and one-year ahead investment. We argue that this pattern arises because book-to-market is likely to lead investment in reflecting the shocks.

5. The Comovement of the Value Factor with the Investment Factor

5.1. Overlaps of Value and Growth Stocks with CMA Portfolios

Having confirmed the negative relation between book-to-market and investment, we evaluate how it shapes the comovement between the value and investment factors. For this purpose, we first examine the overlap between the factors' portfolios. Specifically, we compute the average overlaps of the value and growth portfolios with up to five-year ago and up to ten-year ahead CMA portfolios. The overlap of a value (growth) portfolio with a given CMA portfolio is calculated as the weighted percentage of value (growth) stocks that are in the respective conservative portfolio minus the weighted percentage of value (growth) stocks that are in the respective aggressive portfolio. If the factors' portfolios were independent of each other, we would expect the value and growth portfolios to exhibit similar overlaps with the CMA portfolios.

[Insert Figure 5 near here.]

Panel A of Figure 5 shows that this is not the case. In line with their investment patterns, incoming value stocks exhibit in general a positive overlap with contemporaneous and future CMA portfolios whereas incoming growth stocks exhibit negative overlaps. That is, incoming value stocks are more likely to be or to become conservative stocks than aggressive stocks, and vice versa for incoming growth stocks. This pattern is entirely driven by market-channel stocks: only market-channel incoming value stocks exhibit a more positive overlap with the contemporaneous and future CMA portfolios than market-channel growth stocks. By contrast, book-channel incoming value stocks exhibit a more negative overlap with the contemporaneous CMA portfolio than book-channel incoming growth stocks. Thus, the variation in book-to-market that is due market equity changes, and thus ultimately due to discount rate and cash flow shocks, is responsible for the overlap between the value and investment factors' portfolios.

Panel B displays consistent results for the total portfolios. The value portfolio has higher overlaps with all past and future CMA portfolios than the growth portfolio, and this pattern is again primarily driven by market-channel stocks. The difference between the overlaps of value and growth stocks with the contemporaneous CMA portfolio is 43.6%, meaning that the overlap between the contemporaneous HML and CMA portfolios is 21.8% (=43.6%/2).

Panels C and D show that the patterns are again similar for the discount rate shock- and cash flow shock-driven subsets of the value and growth portfolios[15]. Like for their average investment, discount rate shock-driven stocks are again more responsible for the intertemporal relation than cash flow shock-driven stocks.

[15]In the Internet Appendix, we further document that, as can be expected, discount rate shock-driven value and growth stocks are more strongly associated with the discount rate shock-driven subset of the CMA portfolio than cash flow shock-driven value and growth stocks, and vice versa.

5.2. *Drivers of the Factors' Comovement*

The finding that the value factor and the investment factor select to a considerable extent the same stocks into their portfolios should naturally lead to a positive comovement between the factors. Yet, the documented overlaps of below 25% between the portfolios seem rather small when compared to the factors' correlation of 0.66. In this subsection, we therefore analyse the factors' strong comovement in more detail.

To this end, we consider the book- and market-channel subsets as well as the cash flow shock- and discount rate shock-driven subsets of the HML portfolio[16]. For comparison, we also consider the book- and market-channel subsets together[17]. In order to examine to what extent the factors' comovement is driven by the overlap of their portfolios, we further split the subsets according to whether the value (growth) stocks are contemporaneously also conservative (aggressive) stocks (hf. overlapping part) or not (hf. non-overlapping part).

[Insert Table 3 near here.]

Table 3 presents the subsets' size as a percentage of the total HML portfolio, their overlaps with the contemporaneous CMA portfolio, their correlations with the investment factor, and their betas on the investment factor obtained by regressing their monthly returns on the market, size, profitability, and investment factors[18]. The results show that the HML portfolio's market-channel subset is the predominant driver of the value factor's comovement with the investment factor. It exhibits a considerably higher correlation with the investment factor (0.648 vs. 0.189) as well as a considerably higher investment beta (1.06 vs. 0.44) than the book-channel subset.

Yet, the market-channel subset's comovement with the investment factor is not only stemming from its overlap with the CMA portfolio. Although the correlation of the non-overlapping part with the investment factor is naturally lower than for the overlapping part (0.399 vs. 0.772), it is still considerable, especially given its negative overlap with the CMA portfolio of -27.4%. Thus, market-channel value (growth) stocks behave like conservative (aggressive) stocks even if they are not, or not yet, conservative (aggressive) stocks. This finding is intuitive: stocks whose discount rate and cash flow shocks are reflected in book-to-market but not, or not yet, in investment nevertheless behave like stocks whose discount rate and cash flow shocks are (already) reflected in investment. Since the non-overlapping part of the market-channel subset is larger than the overlapping part, accounting on average for 46.2% of the total HML portfolio as compared to 33.3%, it is an important driver for the factors' comovement.

Furthermore, Table 3 also reveals that the cash flow shock- and discount rate shock-driven subsets exhibit in general similar investment factor correlations and investment betas. Thus, they contribute to similar degrees to the factors' comovement.

[16] In the Internet Appendix, we implement cross-sectional Fama-MacBeth (1973) regressions that predict stocks' correlations with the investment factor. The results support the same conclusions as those based on the factor portfolios discussed in this section.

[17] Note that the two subsets taken together do not equal the complete HML portfolio since stocks that are new in the sample or that lack data on relevant variables cannot be classified. The two subsets together capture, on average, 62.5% of the complete HML portfolio and exhibit similar properties as the complete HML portfolio.

[18] See Appendix B for the construction of the market, size, and profitability factors.

Overall, the results in this section confirm that there is a positive association between the factors' portfolios that drives the factors' comovement. In line with our theoretical framework, this association, and thus the factors' comovement, is almost entirely due to market-channel value and growth stocks. Yet, the factors' comovement is not only mechanical, corroborating the notion that the factors comove because both reflect the covariation of stocks that experienced discount rate and/or cash flow shocks.

6. The Value and Investment Factors' Pricing Information

6.1. Value and Investment Premia

Our findings so far support the thesis that cash flow and discount rate shocks give rise to the relation between book-to-market and investment, and that the value and investment factors reflect the covariation of stocks that experienced such shocks. Yet, only discount rate shocks give rise to differences in expected returns. Hence, only stocks whose book-to-market and investment are driven by discount rate shocks should contain the factors' pricing information.

In order to examine this prediction, we conduct portfolios sorts[19]. First, we sort stocks at the end of each June into quintiles with respect to their market equity using NYSE breakpoints. Second, we take the intersections of the size quintiles with the value, growth, conservative, and aggressive portfolios as well as their market-channel, book-channel, cash flow shock-driven, and discount rate shock-driven subsets. The stocks in the resulting portfolios are value-weighted. Panel A of Table 4 displays the average long-short returns and five-factor alphas of the value and conservative portfolios over the corresponding growth and aggressive portfolios. These are essentially market-channel, book-channel, discount rate shock-driven, and cash flow shock-driven value and investment premia within each size quintile. The table further presents results for strategies that go long the market-channel and short the book-channel value premia, and that go long the discount rate shock-driven and short the cash flow shock-driven value and investment premia. These strategies are close to book-to-market- respectively investment-neutral since value and growth stocks respectively conservative and aggressive stocks exhibit similar book-to-market respectively investment, no matter whether they are market equity-, book equity-, discount rate shock-, or cash flow shock-driven. The standard value and investment effects would thus suggest that these strategies' returns should, on average, be zero.

[Insert Table 4 near here.]

[19] In the Internet Appendix, we implement cross-sectional Fama-MacBeth (1973) regressions that predict stocks' one-month respectively one-year ahead returns based on book-to-market, market equity changes, book equity changes, investment, and investment changes while controlling for size, operating profitability, momentum, and short-term reversal. The results support largely the same conclusions as discussed in this section.

Panel A of Table 4 documents a strong value premium of on average 0.32% per month across the size quintiles. The value premium is, however, only observable for market-channel stocks. In particular, the average market-channel value premium across the size quintiles is 0.32% per month whereas the average book-channel value premium is only -0.01% per month. The difference between the average market- and book-channel value premia is a highly significant 0.33% per month[20]. The five-factor model fails to explain this difference, leaving a significant alpha of 0.22%.

When further separating market-channel stocks into discount rate shock-driven and cash flow shock-driven stocks, we find that the former contain almost the entire pricing information of the value factor. Specifically, discount rate shock-driven value stocks earn a strong and highly significant value premium of on average 0.49% per month over discount rate shock-driven growth stocks. The five-factor model is unable to entirely capture this value premium, producing a significant alpha of 0.16%. Contrary to the discount rate shock-driven value premium, the cash flow shock-driven value premium of 0.13% per month is small and insignificant. The difference of 0.36% per month between the two value premia is highly significant[21]. It cannot be explained by the five-factor model, leaving an alpha of 0.24%.

Panel A also documents a significant investment premium of on average 0.19% per month. Like for the value factor, the discount rate shock-driven stocks contain the entire pricing information of the investment factor, generating a significant investment premium of 0.30% per month. The five-factor model produces a non-negligible but insignificant alpha of 0.07%. The cash flow shock-driven investment premium, on the other hand, exhibits an insignificant average return of only 0.04% per month. The difference of 0.26% per month between the discount rate shock- and cash flow shock-driven investment premia is significant, and the five-factor model leaves a significant alpha of 0.14%.

Taken together, these results give rise to two conclusions. First, our discount rate shock proxy is able to identify the variation in book-to-market and investment that is informative about future returns, respectively to identify those stocks that contain the factors' pricing information. Secondly, the standard Fama-French (2015) five-factor model cannot sufficiently differentiate between stocks that contain pricing information and those that do not. It assigns too similar expected returns to market- and book-channel value and growth stocks, to discount rate shock- and cash flow shock-driven value and growth stocks, and to discount rate shock- and cash flow shock-driven conservative and aggressive stocks - although they have, predictably, very different expected returns.

[20]The results on the difference between the market- and book-channel value premia do not add up perfectly with those on the individual market- and book-channel value premia because a few of the book-channel size quintiles are empty in the first two years of the sample period (in total, five portfolio-year observations are missing).

[21]The results on the difference between the discount rate shock- and cash flow shock-driven value premia do not add up perfectly with those on the individual discount rate shock- and cash flow shock-driven value premia because a few of the discount rate shock-driven as well as of the cash flow shock-driven size quintiles are empty in the early years of the sample period (in total, five respectively nine portfolio-year observations are missing).

6.2. Complementarity of Value and Investment Effects

Having identified the stocks that contain the factors' pricing information, we examine next whether they capture independent pricing information. To begin, Panel B of Table 4 displays the results for the value premia when we control for investment rather than size. The value premia are somewhat attenuated compared to those in Panel A, indicating that the standard investment effect subsumes the standard value effect to some extent. Nevertheless, the general patterns remain intact: the average market-channel and discount rate shock-driven value premia (0.28% and 0.35% per month, respectively) are significantly higher than the average book-channel and cash flow shock-driven value premia (0.06% and 0.15% per month, respectively).

Panel C displays the results for the investment premia when we control for book-to-market rather than size. Like the value premia in Panel B, the investment premia are notably attenuated, meaning that the standard value effect also subsumes the standard investment effect to some extent. Yet, the general pattern is again preserved: the average discount rate shock-driven investment premium of 0.19% per month is considerably higher than the average cash flow shock-driven investment premium of only 0.03% per month. Although the difference of 0.16% per month is not significant anymore, it is still sizable.

Finally, Panel D examines whether the discount rate shock-driven value and investment effects can subsume each other. For this purpose, we exclude all discount rate shock-driven conservative (aggressive) stocks from the discount rate shock-driven subset of the value (growth) portfolio, and vice versa. These portfolios are then intersected with the size quintiles. The results show that the discount rate shock-driven value and investment effects cannot subsume each other: the average discount rate shock-driven value (investment) premium amounts to a highly significant 0.44% (0.23%) per month when the discount rate shock-driven stocks of the CMA (HML) portfolio are excluded. This represents a decline of only 0.05%-points (0.07%-points) per month as compared to Panel A. Thus, the discount rate shock-driven subsets of the value and investment factors represent complementary sources of excess returns. Put differently, the variation in book-to-market that is informative about future returns captures incremental information relative to the variation in investment that is informative about future returns, and vice versa. This conjecture contrasts with the finding that the standard value and investment effects subsume each other to a large extent, suggesting that this finding arises because both variables also reflect information about future profitability. Their information about future profitability thus seems to overshadow their complementary information about future returns.

In sum, the findings from this section are in line with our prediction that only stocks whose book-to-market and investment are driven by discount rate shocks contain the factors' pricing information[22]. We find that the standard five-factor model cannot determine whether stocks' variation in book-to-market and investment is driven by differences in expected returns or by differences in expected profitability. Moreover, we show that the actual pricing information of

[22] In the Internet Appendix, we show that the conclusions from this section hold also for equal-weighted portfolios as well as within each of the two subperiods from 1964 to 1992 and from 1993 to 2019.

the two factors is largely complementary to each other.

7. Discount Rate Shock-Driven Value and Investment Factors

7.1. Factor Construction and Summary Statistics

Amid the findings from the previous section, we construct value and investment factors that use only discount rate shock-driven stocks. These factors should reflect less unpriced covariation than the standard factors because they use only stocks for which book-to-market and investment are good indicators of expected returns. We construct the discount rate shock-driven value (investment) factor in the same way as the standard value (investment) factor but keep only stocks that are classified as discount rate shock-driven value (conservative) and growth (aggressive) stocks in the portfolios used for the construction of the standard factor. For comparison, we analogously construct cash flow shock-driven value and investment factors that use only cash flow shock-driven stocks as well as market- and book-channel value factors that use only market- respectively book-channel stocks. Panel A of Table 5 presents summary statistics on the factors. The discount rate shock-driven value and investment factors exhibit highly significant mean returns of 0.54% and 0.34% per month, respectively. These mean returns exceed those of the standard factors considerably (0.30% and 0.21% per month, respectively). As can be expected given their less diversified portfolios, the discount rate shock-driven factors' volatilities are higher than the standard factors' volatilities, but the increase is rather moderate.

[Insert Table 5 near here.]

Figure 6 compares the performance of our discount rate shock-driven value and investment factors with the performance of the standard factors. Panels A and C show that both discount rate shock-driven factors strongly outperform their standard counterparts over the entire sample period. Panels B and D show the factors' rolling ten-year performance. We can observe that the discount rate shock-driven factors quite consistently and considerably outperform the standard factors for the vast majority of ten-year periods.

[Insert Table 6 near here.]

Panel B of Table 5 displays the correlations between the factors. First, the discount rate shock- and cash flow shock-driven factors' correlations with the standard factors are quite similar, implying that the standard factors reflect both effects to similar degrees. Second, the correlations between the discount rate shock- and cash flow shock-driven value factors as well as between the discount rate shock- and cash flow shock-driven investment factors are rather moderate (0.63 and 0.40, respectively). This result indicates that they reflect in fact different effects. Third, the correlation between the discount rate shock-driven factors is somewhat lower than the correlation between the standard factors (0.59 vs. 0.66), suggesting that they reflect more independent covariation.

7.2. Spanning Regressions

Panel D of Table 4 shows that the value and investment factors' discount rate shock-driven stocks capture incremental pricing information with respect to each other. Therefore, our discount rate shock-driven value factor may, contrary to the standard value factor, no longer be redundant. In order to investigate this conjecture, we conduct spanning regressions. Table 6 presents the results. They reveal that the discount rate shock-driven factors capture in fact incremental pricing information. Specifically, the discount rate shock-driven value and investment factors always exhibit significant alphas, no matter whether we employ the standard, cash flow shock-driven, or discount rate shock-driven version of the respective other factor as explanatory factor. In particular, when we use both discount rate shock-driven factors (specification (9)), the alpha of the value factor is 0.25% and the alpha of the investment factor is 0.20%, both of which are highly significant. The cash flow shock-driven factors, on the other hand, exhibit in general small and insignificant alphas, implying that they hardly capture incremental pricing information.

[Insert Table 6 near here.]

These results imply that the value factor would not be redundant anymore if it is built only from discount rate shock-driven stocks. Put differently, the factors' incremental pricing information is only discernible when purging them of their cash flow shock-driven stocks. These stocks contain hardly any pricing information but strongly contribute to the factors' comovement. Hence, the value factor can be resurrected from its redundancy when its construction methodology is adjusted such that it takes into account which stocks' variation in book-to-market is informative about expected returns, and thus, which stocks contain pricing information.

7.3. Pricing Factors

Next, we evaluate whether our discount rate shock-driven value and investment factor should replace their standard counterparts in the Fama-French (2015) five-factor model. To this end, we regress our discount rate shock-driven factors on the standard five-factor model, and the standard factors on an adjusted five-factor model that uses our discount rate shock-driven rather than the standard value and investment factors.

[Insert Table 7 near here.]

Table 7 presents the results. Panel A shows that the standard five-factor model cannot price our discount rate shock-driven factors. The discount rate shock-driven value factor exhibits an alpha of 0.25% and the discount rate shock-driven investment factor an alpha of 0.10%, both of which are significant. By contrast, Panel B reveals that the adjusted five-factor model that uses our discount rate shock-driven factors can price the standard value and investment factors: both factors exhibit insignificant alphas. These results imply that our discount rate shock-driven factors reflect all of the pricing information of the standard factors, but not vice versa. Consequently, replacing the standard factors by our discount rate shock-driven factors would improve the five-factor model's pricing performance.

7.4. Pricing Performance

In order to illustrate the improved pricing performance of our adjusted five-factor model, we price the double-sorted portfolios from Panel A of Table 4 with our adjusted as well as the standard five-factor model. We start by regressing the average value and investment premia across the size quintiles on the two factor models. The results are displayed in Panel A of Table 8. As already observed in Table 4, the standard five-factor model fails to explain the differences between the market- and book-channel value premia as well as between the discount rate shock- and cash flow shock-driven value and investment premia, leaving significant alphas of 0.22%, 0.24%, and 0.14%. That is, the standard five-factor model cannot explain why market-channel and discount rate shock-driven stocks generate value and investment premia while book-channel and cash flow shock-driven stocks do not. As expected, the adjusted five-factor model performs better in this regard. It produces only for the difference between the market- and book-channel value premia a significant alpha, but leaves rather small and insignificant alphas for the differences between the discount rate shock- and cash flow shock-driven value and investment premia. Thus, it can explain why discount rate shock-driven stocks earn value and investment premia while cash flow shock-driven stocks do not.

[Insert Table 8 near here.]

In Panel B of Table 8, we conduct formal asset pricing tests using the portfolios that are constructed as the intersections of the size quintiles with the value, growth, conservative, and aggressive portfolios as well as their cash flow shock- and discount rate shock-driven subsets as test assets. We also use the long-short portfolios that go long the discount rate shock-driven size quintiles of the value, growth, conservative, and aggressive portfolios and short the corresponding cash flow shock-driven size quintiles. We compare the standard and the adjusted five-factor models' pricing performance for these test assets based on several metrics. First, the GRS statistic of Gibbons et al. (1989) as well as its p-value, testing whether the alphas of the test assets are jointly zero. Second, the average absolute alpha across the test assets as well as the fraction of significant alphas. Third, the ratio of the average absolute alpha to the average absolute deviation of the test assets' mean returns from their mean, reflecting the unexplained proportion of the mean returns' dispersion. Fourth, the cross-sectional R^2, reflecting the proportion of the mean returns' variance that is explained by the factor model[23]. Finally, the test assets' average time-series R^2.

The two models perform quite similar in pricing the size quintiles of the standard value, growth, conservative, and aggressive portfolios. Both models are rejected by the GRS test and leave average absolute alphas of 0.091% (standard model) and 0.090% (adjusted model). Thus, using the discount rate shock-driven versions of the value and investment factors does not harm the explanation of the value and investment effects in general.

The adjusted model outperforms the standard model in pricing the discount rate shock-driven test assets. For instance, it is not rejected by the GRS test at any conventional significance level and it produces a lower average alpha (0.090% vs. 0.102%). This result is expected since the discount rate shock-driven factors are designed to explain the discount rate shock-driven value and investment premia. Although its performance worsens, the adjusted model outperforms the standard model also in pricing the cash flow shock-driven test assets. It produces a lower average alpha (0.102% vs. 0.114%) and a much higher cross-sectional R^2 (21.4% vs. 2.1%). On the one hand, the deterioration in the models' pricing performance suggests that they have more problems to explain why cash flow shock-driven stocks do not earn value and investment premia rather than to explain why discount rate shock-driven stocks do. On the other hand, the adjusted model's outperformance in pricing the cash flow shock-driven test assets is a strong testimony for its improved performance as it is not designed to explain them.

Importantly, the adjusted five-factor model also improves upon the standard model in pricing the long-short strategies that go long the discount rate shock-driven and short the corresponding cash flow shock-driven test assets. It generates a much lower average absolute alpha (0.126% vs. 0.154%) and a much higher cross-sectional R^2 (22.6% vs. 8.3%). Moreover, the adjusted model performs also better in pricing the long-short strategies jointly with the size quintiles of the value, growth, conservative, and aggressive portfolios. Hence, it explains the two stylized facts that there exist value and investment premia and that the discount rate shock- and cash flow shock-driven value and investment premia are very different better than the standard model.

Overall, the findings from this section suggest that value and investment factors that use only stocks for which book-to-market and investment are good indicators of expected returns improve upon the standard factors. These adjusted factors capture incremental pricing information with respect to each other, meaning that the adjusted value factor is no longer redundant. Moreover, we show that the adjusted factors capture the pricing information of the standard factors, but not vice versa. Replacing the standard factors in the five-factor model with our adjusted factors would therefore improve the model's pricing performance.

[23]The cross-sectional R^2 is calculated as one minus the ratio of the variance of the test assets' alphas to the variance of the test assets' mean returns.

8. Why is the Value Factor the Redundant Factor?

Our empirical evidence supports our thesis that the standard value and investment factors are closely related because book-to-market and investment are both driven by cash flow and discount rate shocks. Since both factors reflect therefore largely the same effects, this raises the question why the value factor rather than the investment factor is the redundant one in the Fama-French (2015) five-factor model. We address this question by conducting spanning regressions with manipulated versions of value and investment factors. Table 9 presents the results. In specification (1), we regress the standard value and investment factors on the market, size, and profitability factors. Both factors exhibit significantly positive alphas, meaning that neither of the two is redundant with respect to the market, size, and profitability factors. In specification (2), we add the investment factor as an explanatory factor to explain the value factor, and vice versa. The usual result unfolds: the value factor is subsumed by the market, size, profitability, and investment factors, exhibiting an insignificant alpha of 0.00%. The investment factor, on the other hand, is not subsumed by the other factors, exhibiting a significant alpha of 0.20%.

[Insert Table 9 near here.]

The evidence from the previous sections indicates that the value factor's book-channel part is a "noise" component that reflects other effects than the value factor's market-channel part or the investment factor. Thus, the book-channel part may be the reason why the investment factor trumps the value factor. The results from specification (3) reveal that the book-channel part is, in fact, to a considerable extent responsible for the value factor's redundancy. Specifically, the alpha of the value factor increases from 0.00% to 0.09% when its market-channel rather than its standard version is employed. Nevertheless, given its insignificant alpha, the market-channel value factor is still redundant.

Comparing the results for the value factor with those for the investment factor reveals three further potential reasons why the former is the redundant one. First, the investment factor's beta on the value factor is much lower than vice versa (0.41 vs. 1.05). Second, the value factor exhibits a higher volatility than the investment factor (2.75% vs. 1.82%). Third, the value factor's betas on the market, size, and profitability factors are higher than those of the investment factor.

The first and the second difference are related: a higher standard deviation of the dependent variable implies, all else equal, a lower regression coefficient. In specification (4), we rescale the value factor to have the same volatility as the investment factor while keeping its mean constant. The results show that the factors' betas with respect to each other are much more similar in this case (0.62 vs. 0.69). Moreover, the value factor would exhibit a significant alpha of 0.10% and would thus not be redundant anymore. Its elevated volatility as compared to the investment factor is thus a major reason for its redundancy. Importantly, the investment factor remains also non-redundant. Hence, both factors may be non-redundant simultaneously even though both reflect largely the same effects.

Yet, these results raise the question of why the value factor captures the effects with higher volatility than the investment factor. In general, a factor's volatility is determined by the volatilities of its long and short legs as well as the correlation between the legs[24]. Figure 7 displays three-year moving volatilities of the value and investment factors as well as their legs, and three-year moving correlations between the factors' legs. Panels C and D show that the short legs' volatilities as well as the long legs' volatilities are very similar. Panel B reveals, however, that the correlations between the factors' legs behave quite differently. The correlation between the investment factor's legs is quite stable across time and never drops below 0.85. It amounts to 0.944 across the entire sample period (unreported). By contrast, the correlation between the value factor's legs fluctuates strongly across time and amounts only to 0.864 (unreported). We can observe pronounced drops in the correlation during times of market-wide turbulences, such as the oil crises in the early 70's and 80's, the biotech and dotcom bubbles in the early 90's and 2000's, and the global financial crisis in 2007/08. Panel A shows that the low correlation between the value factor's legs during such periods is associated with surges in its volatility and, importantly, with strong divergences from the investment factor's volatility. The reason for the value factor's distortions during such periods is arguably that book-to-market is much more sensitive to market turbulences than investment because it relies on a market variable.

[Insert Figure 7 near here.]

A third reason for the value factor's redundancy is its less favourable exposure to the market, size, and profitability factors as compared to the investment factor. Specifically, the value factor's mean return is in parts explained by its slightly positive betas on these factors, deflating its alpha. By contrast, the investment factor's slightly negative betas on these factors inflate its alpha. In order to evaluate the importance of the factors' differential exposures to the other factors, we first orthogonalize both factors with respect to the market, size, and profitability factors, and then rescale them to their original means and volatilities. Specification (5) shows that the orthogonalized factors exhibit insignificant alphas of 0.09% and 0.08%, meaning that both factors are redundant now. Yet, these alphas represent an increase of 0.09% for the value factor and a decrease of 0.12% for the investment factor relative to their original alphas. Thus, the factors' differential exposures are also a reason why the value factor is the redundant one.

Next, we aim to evaluate whether the value factor's elevated volatility and worse hedge ability as compared to the investment factor are a typical feature or just a bad outcome. For this purpose, we obtain out-of-sample data on the value factor for the period from 1926 to 1963 from Kenneth French's website and on the investment factor for the period from 1940 to 1963 from Sunil Wahal's website[25]. In unreported results, we find that the correlation between the value and growth portfolio was 0.930 from 1926 to 1963, suggesting that their correlation of 0.864 was exceptionally low during our sample period. Based on a correlation of 0.930,

[24] A factor's variance may be expressed as follows: $\sigma^2_{Factor} = \sigma^2_{Long} + \sigma^2_{Short} - 2 \cdot \rho_{Long,Short} \cdot \sigma_{Long} \cdot \sigma_{Short}$.

[25] `https://cie.wpcarey.asu.edu/`

the volatility of the value factor during our period would have been only 2.00% per month. Moreover, we document that the value factor's profitability beta was much lower than the investment factor's profitability beta during the period from 1940 to 1963 (-0.72 vs. -0.34). By contrast, the investment factor was again a somewhat better hedge against the market and size factors. Nevertheless, both findings suggest that the value factor's elevated volatility and worse hedge ability were a bad outcome rather than a typical feature. Thus, the value factor may, even without any adjustments to its construction, recover from its redundancy going forward.

To sum up, the value factor is the redundant factor for three reasons. First, it comprises the noisy book-channel part that captures other effects than its market-channel part and than the investment factor. Second, it captures the effects less precisely than the investment factor because of distortions during market turbulences. Third, it is a slightly worse hedge for the other factors than the investment factor. Since the later two reasons may be specific to our sample period, the value factor may very well become non-redundant going forward. This conjecture supports Fama and French (2015)'s decision to keep the value factor in their five-factor model.

9. Exposure to Cash Flow News, Discount Rate News, and Variance News

The literature has put forward many explanations that aim to rationalize the value premium[26]. Our finding that only the discount rate shock-driven value factor earns a value premium provides a fresh laboratory to test these explanations. In particular, any explanation that aims to rationalize the value premium also needs to explain why only discount rate shock-driven stocks generate the value premium. While an evaluation of all explanations is beyond the scope of this paper, we verify whether one particularly promising explanation can rationalize the value premium: the three-beta ICAPM of Campbell et al. (2018). In this model, exposure to market cash flow news is positively priced while exposures to market discount rate news and market volatility news are negatively priced. Campbell et al. (2018) show that value stocks have a higher exposure to cash flow news and a lower exposure to volatility news than growth socks. Building on this finding, Gerakos and Linnainmaa (2018) investigate the exposures of a size value factor and of an orthogonal value factor, which are similar to our market- and book-channel value factors, to these news. In line with our findings, their size value factor earns the entire value premium whereas their orthogonal value factor does not earn a return premium. While both factors have similar exposures to market cash flow and discount rate news, the size value factor has a significantly lower exposure to volatility news than the orthogonal value factor. Based on the findings of Campbell et al. (2018) and Gerakos and Linnainmaa (2018), compensation for exposure to market volatility news therefore represents a potential explanation for the value premium.

[26]See Golubov and Konstantinidi (2019) for a comprehensive overview.

If exposure to market volatility news does in fact rationalize the value premium, our discount rate shock-driven value factor should have a lower volatility news beta than our cash flow shock-driven value factor. In order to investigate this conjecture, we obtain data on the quarterly estimated news terms for the period from July 1964 to December 2011 from Christopher Polk's website[27]. The factors' betas on the news terms are presented in Table 10. In line with the findings of Gerakos and Linnainmaa (2018), the cash flow and discount rate news betas of the market-channel and book-channel value factors are not significantly different whereas the former's volatility news beta is significantly lower. Yet, the discount rate shock- and cash flow shock-driven value factors have similar exposures to all types of news, and the differences between their exposures are insignificant. This holds in particular also for their exposure to volatility news. Since exposure to volatility news cannot explain the return difference between the two factors, it can also not rationalize the value effect in general.

[Insert Table 10 near here.]

We further examine whether exposure to any of the news may explain the investment premium. For the standard investment factor, the results reveal an insignificant beta on market cash flow news and significantly negative betas on market discount rate and volatility news. Thus, exposure to market discount rate and volatility news may potentially explain the investment premium. Yet, none of the differences between the cash flow shock- and discount rate shock-driven investment factors' news betas is significant. Thus, exposure to market discount rate or volatility news cannot explain the factors' return differential, and therefore, also not the investment effect in general.

Overall, contrary to the conclusions of Campbell et al. (2018) and Gerakos and Linnainmaa (2018), the results in this section suggest that neither the value nor the investment effect can be rationalized as compensation for exposure to market volatility news. Explanations that aim to rationalize these two effects should also be able to explain the disconnect between our cash flow shock-driven and discount rate shock-driven value and investment factors.

10. Alternative Explanations for the Relation between Book-to-Market and Investment

10.1. Mispricing

In Section 2, we argue that the negative relation between book-to-market and investment arises because both are driven by cash flow and discount rate shocks. Our results so far are

[27] `https://personal.lse.ac.uk/polk/research/work.htm`

consistent with this thesis. However, changes in firms' market equity, and thus the negative relation between book-to-market and investment, may be due to mispricing rather than cash flow and discount rate shocks. The literature has put forward several mechanisms how mispricing may in turn also affect firms' investment decisions[28]. In order to gauge the importance of mispricing for our results, we split our sample based on several mispricing proxies. If mispricing rather than cash flow and discount rate shocks drive the relation of investment with market equity-driven book-to-market, it should be much stronger for stocks that are more likely to be mispriced.

We split our sample based on three mispricing proxies. First, following Baker and Wurgler (2002), overvalued (undervalued) firms are more likely to issue (repurchase) equity. Second, following Baker et al. (2003), stocks with very high (low) returns across the subsequent three years are more likely to be undervalued (overvalued). Third, following Edmans et al. (2012), stocks that are subject to high selling pressure by mutual funds are likely to be undervalued. Therefore, at the end of each June and using NYSE breakpoints, we classify firms whose net share issues across the next fiscal year are below the 25th or above the 75th percentile (between the 25th and the 75th percentile), firms whose cumulative three-year ahead returns are below the 25th or above the 75th percentile (between the 25th and the 75th percentile)[29], and firms with above-median (below-median) mutual fund hypothetical sales across the previous fiscal year as mispriced (fairly priced).

For each subsample, we conduct annual Fama-MacBeth (1973) regressions that regress investment on up to four-year lagged book and market equity changes as well as five-year lagged book-to-market. The results are presented in columns (2) to (7) of Table 11. They reveal that the coefficients on the market equity changes are mostly somewhat higher for mispriced than for fairly priced stocks based on net stock issues and three-year ahead returns. Yet, the differences are rather small compared to the coefficients' absolute magnitudes. Moreover, the coefficients on the market equity changes are even somewhat lower for mispriced than for fairly priced firms based on mutual fund hypothetical sales. Consequently, mispricing drives, if anything, the relation between market equity-driven book-to-market and investment only to a limited extent.

[Insert Table 11 near here.]

10.2. Financial Constraints

A second alternative explanation for the negative relation between book-to-market and investment is that changes in firms' market equity may affect their ability to raise external capital. Specifically, negative returns may lead investors to be more pessimistic about firms'

[28] See for example Polk and Sapienza (2009) and Dessaint et al. (2019).

[29] We measure a firm's three-year ahead return across the 36-month period beginning at the end of the month of its last fiscal year ending.

prospects, making it more difficult for the firms to obtain external financing. Consequently, in case they are financially constrained, firms need to reduce their investment in new projects, even if these projects had positive net present values[30]. Like in the previous subsection, we conduct subsample analyses to verify how financial constraints affect our results. If financial constraints rather than cash flow and discount rate shocks drive the relation of investment with market equity-driven book-to-market, it should be much stronger for financially constrained firms.

We split our sample based on three proxies for financial constraints. First, following Fazzari et al. (1988), firms that are financially constrained should pay out less capital. Second, following Whited (1992), firms that have no S&P long-term debt rating or whose debt is in default should be more financially constrained. Third, we use the Kaplan-Zingales index as proposed by Lamont et al. (2001) as a composite score of firms' financial constraints. Therefore, at the end of each June and using NYSE breakpoints, we classify firms whose total payout-to-book ratios are below-median (above-median), firms with outstanding debt but no S&P long-term debt rating or whose debt is in default (firms with no outstanding debt or an S&P long-term debt rating and whose debt is not in default), and firms whose Kaplan-Zingales index value is above-median (below-median) as financially constrained (unconstrained).

For each subsample, we again conduct annual Fama-MacBeth (1973) regressions that regress investment on up to four-year lagged book and market equity changes as well as five-year lagged book-to-market. The results are presented in columns (8) to (13) of Table 11. They show that the coefficients on current market equity changes are somewhat higher for unconstrained than for constrained firms based on payout-to-book and the Kaplan-Zingales index, but are lower for unconstrained than for constrained firms based on debt rating. Lagged market equity changes' coefficients are higher for constrained than for unconstrained firms based on all proxies. This observation suggests that financial constraints may to some extent be responsible for the positive relation between lagged market equity changes and investment. Yet, the coefficients on lagged market equity changes for unconstrained firms are, if indeed, not substantially lower than for constrained firms. On balance, the effect of cash flow and discount rate shocks still seems to be the main driver of the relation between market equity-driven book-to-market and investment.

In sum, the results from this section support the notion that cash flow and discount rate shocks drive the relation between book-to-market and investment[31]. While financial constraints and mispricing may contribute to the relation, their effects are not unanimous and rather muted.

[30] The same reasoning holds analogously for positive returns and increased investment.

[31] In the Internet Appendix, we conduct the same analyses with investment factor correlation rather than investment as dependent variable. The results show that mispricing and financial constraints can hardly explain the association between market equity-driven book-to-market and comovement with the investment factor. This finding confirms that the comovement of the value factor with the investment factor is due to discount rate and cash flow shocks.

11. Conclusion

The finding of Fama and French (2015) that the value factor does not posses incremental explanatory power for the cross-section of stock returns in their five-factor model has sparked a lot of controversy about the value factor. In this work, we resolve this controversy.

The value factor's explanatory power is primarily subsumed by the investment factor. We argue that the factors' close relation arises because their sorting variables, book-to-market and investment, are both driven by cash flow and discount rate shocks. In line with this thesis, we document a negative relation between the two variables that is exclusively due to the market equity-driven part of book-to-market. This negative relation causes a positive overlap between the value and investment factors' portfolios. This overlap is, in turn, the primary driver of the factors' comovement.

Variation in book-to-market and investment should be informative about expected returns only if it is due discount rate shocks. We identify those stocks whose book-to-market and investment are primarily driven by discount rate shocks, and show that they contain in fact almost the entire pricing information of the value and investment factors. In order to reflect their pricing information more accurately, we construct adjusted versions of the factors that use only such discount rate shock-driven stocks. These adjusted factors have higher mean returns and Sharpe ratios than the standard value and investment factors. Importantly, we find that our discount rate shock-driven value factor is not redundant anymore. That is, a value factor that is built only from stocks whose book-to-market is a good indicator of expected returns captures incremental pricing information beyond an investment factor. A value factor has therefore still a place in a multifactor model - even in the presence of an investment factor - but its construction methodology should be adjusted such that its pricing information is reflected more accurately.

We further show that our discount rate shock-driven factors capture all of the pricing information of the standard factors, but not vice versa. As a consequence, the pricing performance of the Fama-French (2015) five-factor model improves when the standard factors are replaced with our discount rate shock-driven factors.

Given that they reflect the same effects, it is not surprising that one of the two factors is redundant. We uncover three reasons why the value rather than the investment factor is the redundant one. First, it comprises the noisy book equity-driven part. Second, it is much more distorted in times of market-wide turbulances. Third, it is a worse hedge for the market, size, and profitability factors. Since the later two reasons may be specific to our sample period, the value factor may - even without any adjustments to its construction - recover from its redundancy in the future.

Moreover, we use the documented disconnect between the discount rate shock- and cash flow shock-driven value and investment premia to reevaluate the three-beta ICAPM of Campbell et al. (2018) as an explanations for the value and investment effects. We find that it fails to explain this disconnect, implying that it is also unable to explain the value and investment effects in general. Future research may want to use our discount rate shock- and cash flow shock-driven value and investment factors to evaluate potential explanations for these effects.

Finally, our results have also implications for the implementation of factor investing strategies. First, value and investment factor investing strategies can be considerably enhanced if they take into account whether firms' book-to-market is high respectively whether firms' investment is low because of high expected returns or because of low expected profitability. Second, such enhanced value and investment strategies are largely independent sources of excess returns, meaning that it is beneficial for investors to engage in both strategies simultaneously.

Appendix A. Variable Definitions

Market Equity (ME):

A stock's market equity for the end of month t is calculated as the stock's price at the end of month t times the stock's shares outstanding at the end of month t. In order to reduce the skewness in ME, we transform it by the natural logarithm. If ME is non-positive, the ME data is considered to be missing.

Book-to-Market Ratio (BM):

A stock's book-to-market ratio for the end of June of year y is calculated as the firm's book equity from the last fiscal year ending in year $y-1$, divided by the firm's ME at the end of the month of this fiscal year ending[32]. Following Davis et al. (2000), book equity (BE) is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock (depending on availability, the redemption, liquidation, or par value of preferred stock is used, in that order); if the book value of stockholders' equity is not directly available, it is measured as the book value of common equity plus the par value of preferred stock or as the difference between the book value of total assets and the book value of total liabilities (in that order). In order to reduce the skewness in BM, we transform it by the natural logarithm. If either ME or BE is non-positive, the BM data is considered to be missing.

Investment (INV):

A stock's investment for the end of June of year y is calculated as the firm's total assets from the last fiscal year ending in year $y-1$ divided by the firm's total assets from the last fiscal year ending in year $y-2$, minus 1. In order to reduce the skewness in INV, we transform it by the natural logarithm. If total assets are non-positive, the INV data is considered to be missing.

Operating Profitability (OP):

A stock's operating profitability for the end of June of year y is calculated as the firm's annual revenues minus cost of goods sold, interest expense, and selling, general, and administrative expenses, divided by the firm's BE, all from the last fiscal year ending in year $y-1$. The OP data is considered to be missing if annual revenues data is missing, if data for each of cost of goods sold, interest expense, and selling, general, and administrative expenses is missing, or if BE is non-positive.

Net Share Issues (NSI):

A firm's net share issues for the end of June of year y is calculated as the natural logarithm of the firm's split-adjusted shares outstanding from the last fiscal year ending in year $y-1$

[32] This construction of BM slightly differs from Fama and French (2015) who divide the book equity by the firm's ME from the end of December of year $y-1$.

minus the natural logarithm of the firm's split-adjusted shares outstanding from the last fiscal year ending in year $y-2$. Split-adjusted shares outstanding is shares outstanding times the adjustment factor, both from Compustat.

Total Payout-to-Book Ratio (TPB):

A firm's total payout-to-book ratio for the end of June of year y is calculated as total payout from the last fiscal year ending in year $y-1$ divided by the firm's BE from the last fiscal year ending in year $y-2$. Total payout is dividends on common stocks plus total expenditure on the purchase of common and preferred stocks (zero if missing) plus reductions in the redemption value of preferred stocks (i.e. increases are set to zero). The TPB data is considered to be missing if data on dividends, preferred stocks' redemption value, or BE is missing.

Kaplan-Zingales Index (KZ Index):

Following Lamont et al. (2001), we calculate firm i's Kaplan-Zingales index for the end of June of year y as follows:

$$KZ_{i,y} = -1.002\frac{CF_{i,y}}{K_{i,y-1}} + 0.283Q_{i,y} + 3.139\frac{Debt_{i,y}}{Debt_{i,y} + SEQ_{i,y}} - 39.368\frac{D_{i,y}}{K_{i,y-1}} - 1.315\frac{Cash_{i,y}}{K_{i,y-1}}$$

CF is cash flow measured as income before extraordinary items plus depreciation and amortization. K is net property, plant, and equipment. Q is Tobin's Q measured as total assets plus market equity (from CRSP, measured at the end of December) minus book value of common equity and deferred taxes, divided by total assets. $Debt$ is the sum of short-term debt and long-term debt. SEQ is stockholders' equity. D is total dividends. $Cash$ is cash and short-term investments. y-variables are from the last fiscal year ending in year $y-1$.

Mutual Fund Hypothetical Sales (MFHS):

We determine stocks' mutual fund hypothetical sales across a given fiscal year following the approaches of Edmans et al. (2012) and Dessaint et al. (2019). For this purpose, we obtain monthly mutual fund data from CRSP as well as quarterly mutual fund holdings data from Thomson Reuters, which is available from 1980 onwards. We use all US mutual funds that are not specialized in a certain industry.

CRSP reports mutual funds' monthly returns and total net asset values by share class. We calculate fund f's average return across all share classes in month m by averaging its share classes' returns in month m as follows:

$$Return_{f,m} = \frac{\sum_{s=1}^{S_f}(TNA_{f,m,s} \times Return_{f,m,s})}{\sum_{s=1}^{S_f} TNA_{f,m,s}}$$

where $Return_{f,m,s}$ is the return of share class s of fund f in month m, $TNA_{f,m,s}$ is the total net asset value of share class s of fund f at the end of month m, and S_f is the number of share classes of fund f. We compound funds' average monthly returns on a quarterly basis. Moreover, we calculate funds' total net asset values at the end of each quarter by aggregating the total net asset values of their share classes.

Next, we estimate the net inflow of fund f across quarter q as a percentage of its beginning-of-quarter total net asset value as follows:

$$Flow_{f,q} = \frac{TNA_{f,q} - TNA_{f,q-1} \times (1 + Return_{f,q})}{TNA_{f,q-1}}$$

where $TNA_{f,q}$ is fund f's total net asset value at the end of quarter q and $Return_{f,q}$ is fund f's compounded return across quarter q.

Using the mutual fund holdings data from Thomson Reuters, we estimate stock i's hypothetical sales in quarter q caused by mutual fund outflows as follows:

$$MFHS_{i,q} = \frac{\sum_f Flow_{f,q} \times Shares_{i,f,q-1} \times Price_{i,q-1}}{Volume_{i,q}}$$

where $Shares_{i,f,q}$ is the number of shares in stock i held by fund f at the end of quarter q, $Price_{i,q}$ is stock i's price at the end of quarter q, and $Volume_{i,q}$ is stock i's dollar trading volume in quarter q. We use only funds with extreme outflows, defined as funds with $Flow_{f,q} \leq -0.05$.

Finally, we calculate stocks' average mutual fund hypothetical sales across their fiscal years. For this purpose, we first assign $MFHS_{i,q}$ to each month m in quarter q. Then, we calculate stock i's average hypothetical sales across fiscal year y as follows:

$$MFHS_{i,y} = \frac{\sum_{m \in y} MFHS_{i,m}}{N_{i,y}}$$

where $N_{i,y}$ is the number of months in stock i's fiscal year y (i.e., usually 12).

Appendix B. Market, Size, and Profitability Factors

We construct the market, size, and profitability factors as described in Fama and French (2015). First, the market portfolio in a given month contains all stocks that are listed on the NYSE, AMEX, or NASDAQ and have a CRSP share code of 10 or 11 as well as good market equity data at the beginning of the month. The market portfolio is newly formed at the beginning of each month and the stocks in the market portfolio are value-weighted based on their market capitalizations at the beginning of the month. The return on the market factor (MP) is the return on the market portfolio in excess of the one-month T-bill rate.

The profitability factor is constructed in the same way as the value factor (see Section 3.2), only that the second sort is with respect to operating profitability (OP) from the last fiscal year ending. The return on the profitability factor (RMW) is the average of the value-weighted returns on the two high OP portfolios minus the average of the value-weighted returns on the two low OP portfolios.

Finally, the return on the size factor (SMB) is the average of the returns on the nine low ME portfolios resulting from the bivariate sorts with respect to ME and any of BM, OP, and INV, minus the average of the returns on the nine high ME portfolios.

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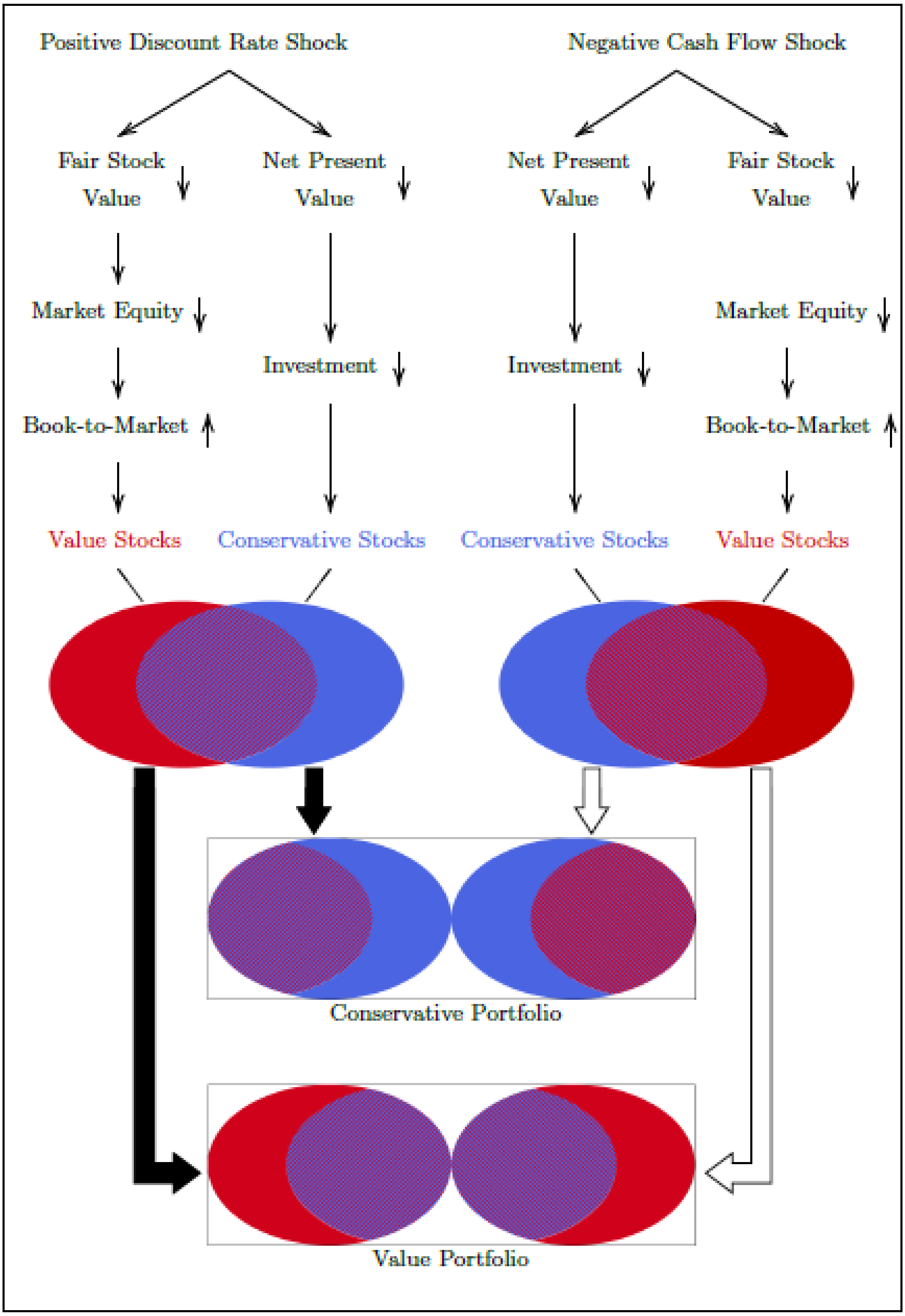
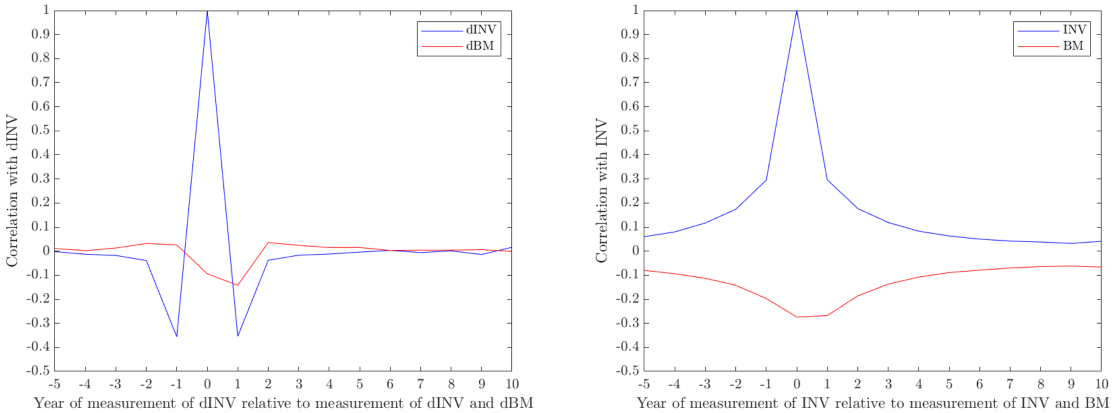


Figure 1
Cash Flow Shocks and Discount Rate Shocks as Drivers of the Relation between the Value Factor and the Investment Factor

This figure illustrates our thesis on how negative cash flow shocks and positive discount rate shocks drive the association between value stocks (red) and conservative stocks (blue). The case of how positive cash flow shocks and negative discount rate shocks drive the association between growth stocks and aggressive stocks is analogous. The black arrows indicate that these stocks contain cross-sectional pricing information, the white arrows indicate that these stocks do not contain cross-sectional pricing information.

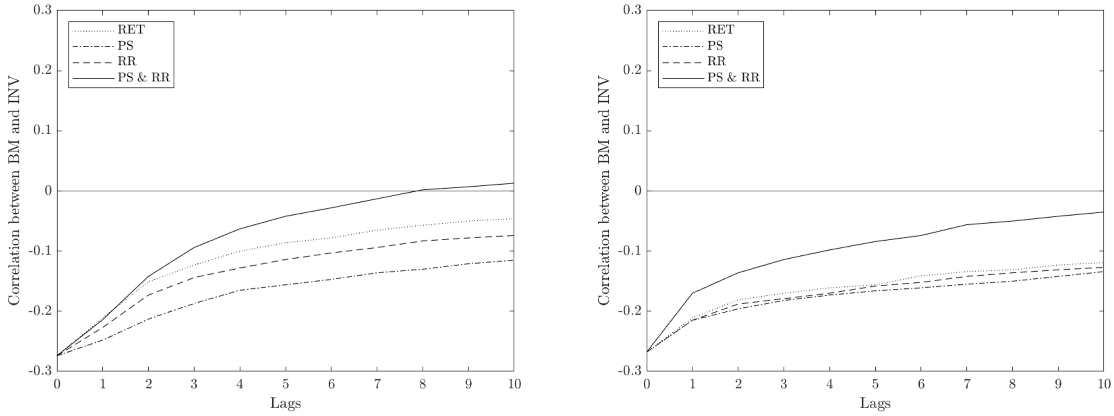


(a) Correlation with dINV

(b) Correlation with INV

Figure 2
Correlation between Book-to-Market and Investment

Panel A of this figure displays time-series averages of annual cross-sectional rank correlations of the change in investment (dINV) and of the change in book-to-market (dBM) with past (up to five years), contemporaneous, and future (up to ten years) changes in investment. Panel B displays time-series averages of annual cross-sectional rank correlations of investment (INV) and of book-to-market (BM) with past (up to five years), contemporaneous, and future (up to ten years) investment. Variables are measured at the end of each June from 1963 to 2019. INV and BM are calculated as described in Appendix A and are both in log-terms. dINV and dBM are the annual log-changes in INV and BM, respectively.

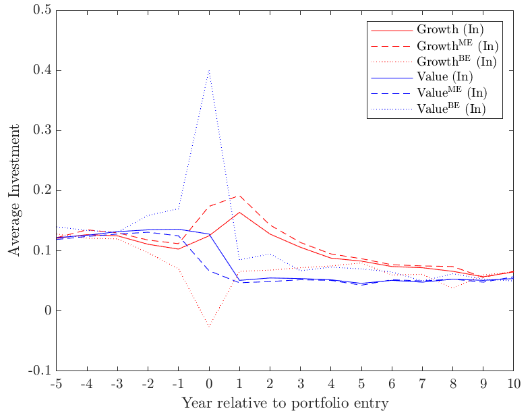


(a) Contemporaneous Correlation **(b)** Intertemporal Correlation

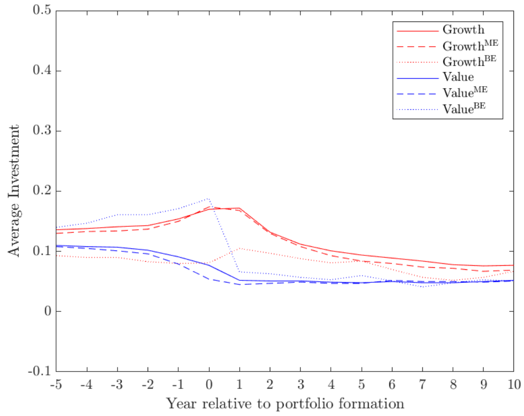
Figure 3

Correlation between Orthogonalized Book-to-Market and Investment

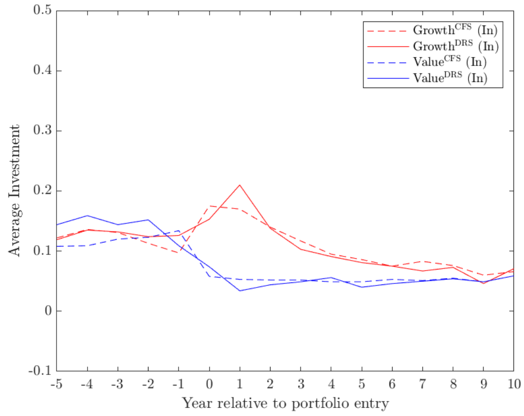
Panel A of this figure displays time-series averages of annual cross-sectional rank correlations between contemporaneous investment (INV) and book-to-market (BM) when both are orthogonalized to past (1 to 10 years) fiscal-year returns (RET), profitability shocks (PS), residual returns (RR), or profitability shocks and residual returns simultaneously (PS & RR). Panel B displays the correlations between one-year ahead orthogonalized investment and current orthogonalized book-to-market. Orthogonalization is conducted by cross-sectionally regressing BM and INV at the end of each June on the explanatory variables. The regressions are implemented with weighted least squares with the stocks' market capitalizations as weights. Variables are measured at the end of each June from 1963 to 2019 and are winsorized at the 0.5%- and 99.5%-level. INV and BM are calculated as described in Appendix A and are both in log-terms. PS and RR are estimated as described in Section 3.4.



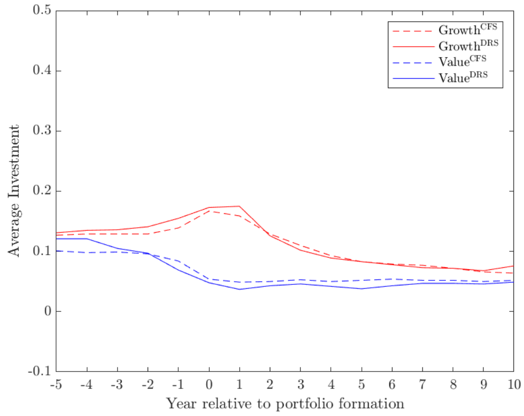
(a) Incoming HML Stocks (ME vs. BE)



(b) All HML Stocks (ME vs. BE)



(c) Incoming HML Stocks (CFS vs. DRS)

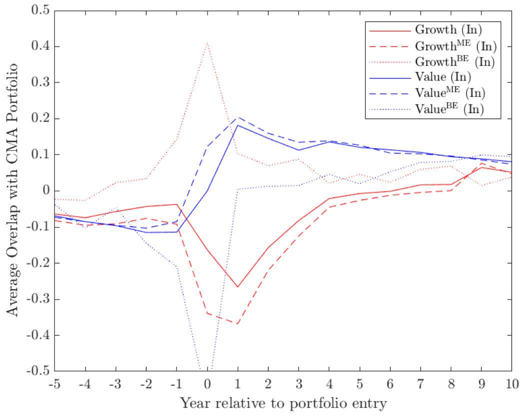


(d) All HML Stocks (CFS vs. DRS)

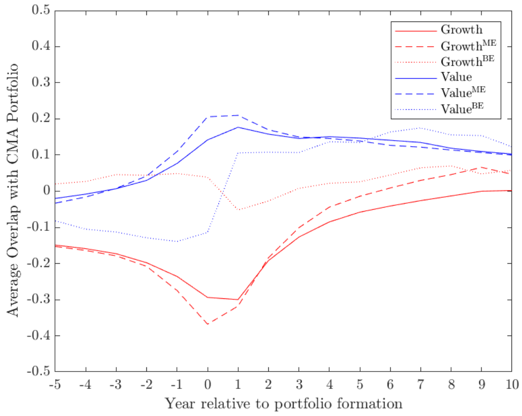
Figure 4

Average Investment of Value and Growth Stocks

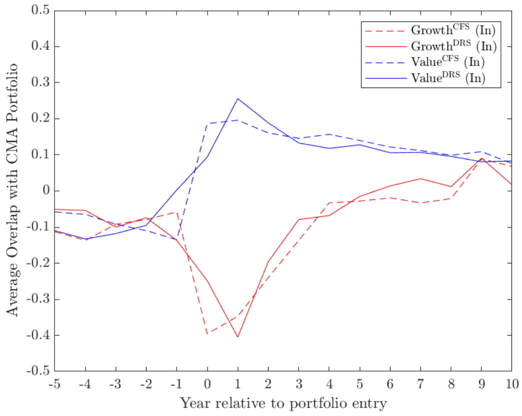
This figure displays time-series averages of portfolios' weighted average past (up to five years), contemporaneous, and future (up to ten years) investment. Investment is calculated as described in Appendix A, is measured at the end of each June from 1963 to 2019, and is winsorized at the 0.5% and 99.5% levels. Panel A displays the results for the portfolios consisting of all incoming value (Value (In)) and growth (Growth (In)) stocks as well as their market-channel (Value$^{\text{ME}}$ (In) and Growth$^{\text{ME}}$ (In)) and book-channel (Value$^{\text{BE}}$ (In) and Growth$^{\text{BE}}$ (In)) subsets. Panel B displays the results for the entire value and growth portfolios as well as their market-channel (Value$^{\text{ME}}$ and Growth$^{\text{ME}}$) and book-channel (Value$^{\text{BE}}$ and Growth$^{\text{BE}}$) subsets. Panel C displays the results for the portfolios consisting of incoming discount rate shock-driven value (Value$^{\text{DRS}}$ (In)) and growth (Growth$^{\text{DRS}}$ (In)) stocks and incoming cash flow shock-driven value (Value$^{\text{CFS}}$ (In)) and growth (Growth$^{\text{CFS}}$ (In)) stocks. Panel D displays the results for the portfolios consisting of all discount rate shock-driven value (Value$^{\text{DRS}}$) and growth (Growth$^{\text{DRS}}$) stocks and all cash flow shock-driven value (Value$^{\text{CFS}}$) and growth (Growth$^{\text{CFS}}$) stocks. The construction of the portfolios and the classification of value and growth stocks are described in Sections 3.2 and 3.5. Stocks are weighted proportionally the same as in the aggregate value and growth portfolios, respectively.



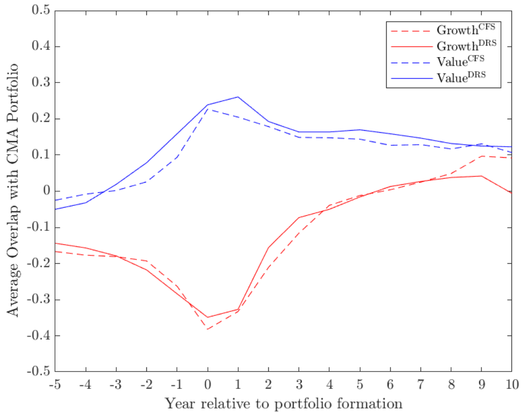
(a) Incoming HML Stocks (ME vs. BE)



(b) All HML Stocks (ME vs. BE)



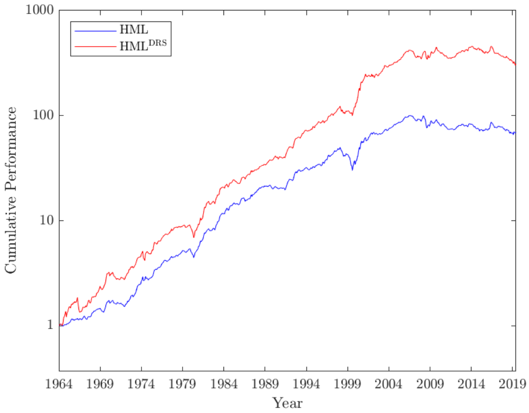
(c) Incoming HML Stocks (CFS vs. DRS)



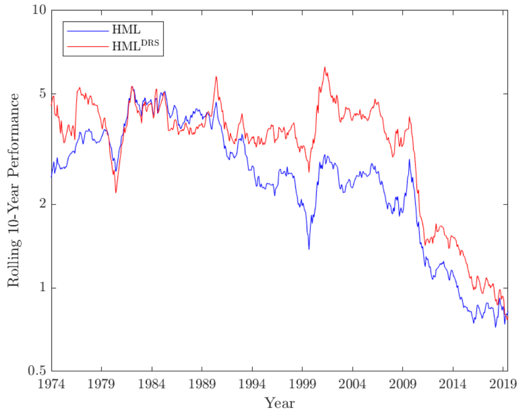
(d) All HML Stocks (CFS vs. DRS)

Figure 5
Average Overlaps of Value and Growth Stocks with CMA Portfolios

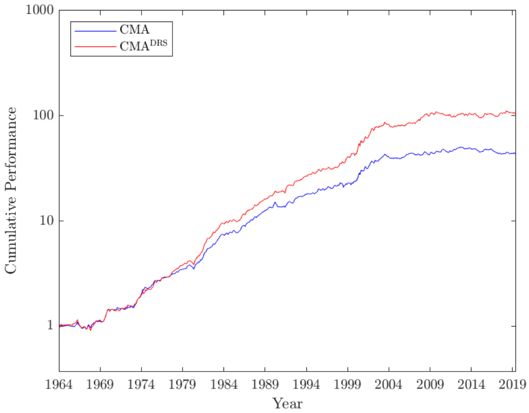
This figure displays time-series averages of portfolios' overlaps with past (up to five years), contemporaneous, and future (up to ten years) CMA portfolios. The overlap of a portfolio with a CMA portfolio is the weighted fraction of the portfolios' stocks that are in the respective conservative portfolio minus the weighted fraction of the portfolios' stocks that are in the respective aggressive portfolio. Panel A displays the results for the portfolios consisting of all incoming value (Value (In)) and growth (Growth (In)) stocks as well as their market-channel (Value^{ME} (In) and Growth^{ME} (In)) and book-channel (Value^{BE} (In) and Growth^{BE} (In)) subsets. Panel B displays the results for the entire value and growth portfolios as well as their market-channel (Value^{ME} and Growth^{ME}) and book-channel (Value^{BE} and Growth^{BE}) subsets. Panel C displays the results for the portfolios consisting of incoming discount rate shock-driven value (Value^{DRS} (In)) and growth (Growth^{DRS} (In)) stocks and incoming cash flow shock-driven value (Value^{CFS} (In)) and growth (Growth^{CFS} (In)) stocks. Panel D displays the results for the portfolios consisting of all discount rate shock-driven value (Value^{DRS}) and growth (Growth^{DRS}) stocks and all cash flow shock-driven value (Value^{CFS}) and growth (Growth^{CFS}) stocks. The construction of the portfolios and the classification of value and growth stocks are described in Sections 3.2 and 3.5. Stocks are weighted proportionally the same as in the aggregate value and growth portfolios, respectively.



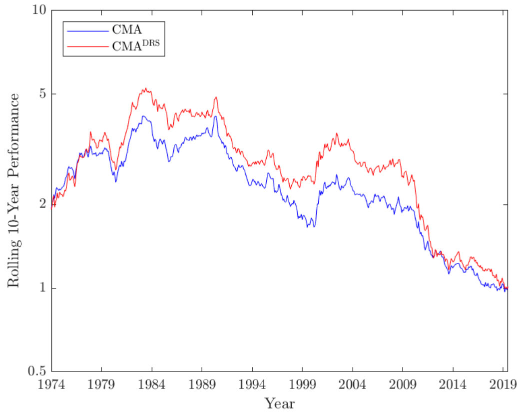
(a) Cumulative Performance of Value Factors



(b) Rolling 10-Year Performance of Value Factors



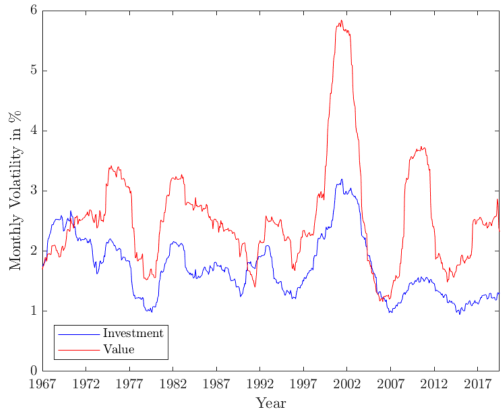
(c) Cumulative Performance of Investment Factors



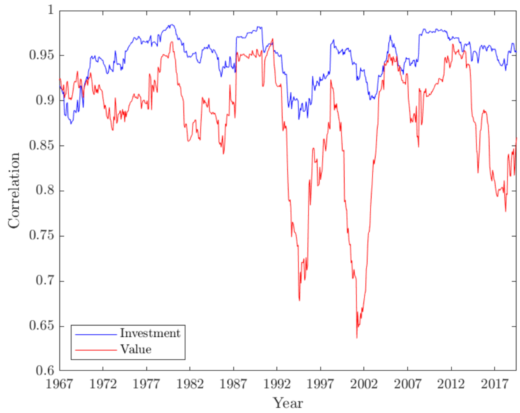
(d) Rolling 10-Year Performance of Investment Factors

Figure 6
Factor Performance

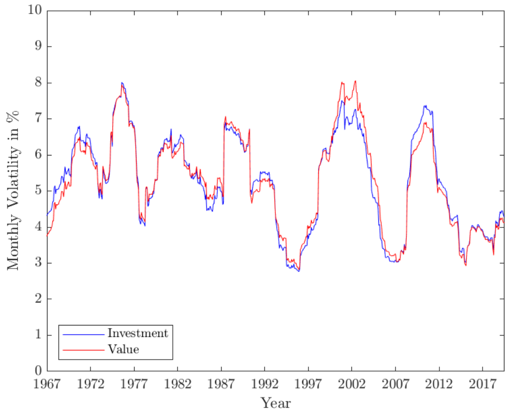
Panel A (C) of this figure displays the cumulative performance of the standard and discount rate shock-driven value (investment) factors. Panel B (D) displays the rolling 10-year cumulative performance of the standard and discount rate shock-driven value (investment) factors. The y-axis has a log-scale. The sample period is from July 1964 to December 2019.



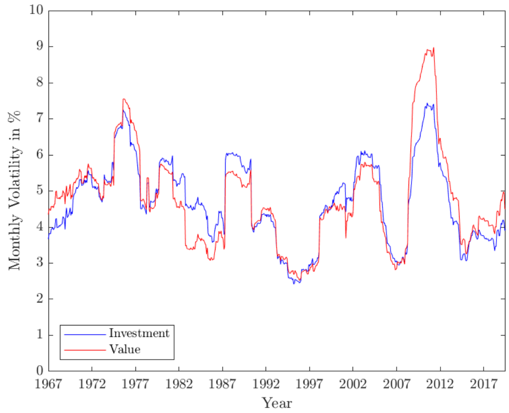
(a) Volatility of Factors



(b) Correlation between Legs



(c) Volatility of Short Legs



(d) Volatility of Long Legs

Figure 7
Factor Volatilities

Panel A of this figure displays the three-year rolling volatilities of the value factor and the investment factor. Panel B displays the three-year rolling correlations between the factors' long and short legs. Panel C (D) displays the three-year rolling volatilities of the factors' short (long) legs. The sample period is from July 1964 to December 2019.

Table 1
Decomposition of the Cross-Sectional Variation in Book-to-Market

This table displays the time-series averages of the percentage contributions of lagged book-to-market (BM), book equity changes (dBE), and market equity changes (dME) to the total variation in book-to-market (BM). Book-to-market is measured at the end of each June, is calculated as described in Appendix A, and is in log-terms. At the end of June of each year t, we decompose the cross-sectional variance in book-to-market for $k = 1, ..., 5$ as follows:

$$var(BM_{i,t}) = cov(BM_{i,t}, BM_{i,t-k}) + \sum_{s=0}^{k-1} cov(BM_{i,t}, dBE_{i,t-s}) + \sum_{s=0}^{k-1} cov(BM_{i,t}, -dME_{i,t-s})$$

The percentage contributions are calculated by dividing the three terms on the right side of the equation by $var(BM_{i,t})$. The annual percentage contributions are averaged across the sample period from 1963 to 2019. Panel A displays the results when in each year all common US stocks traded on the NYSE, AMEX, or NASDAQ are used. Panel B displays the results when in each year only stocks that are newly entering the value and growth portfolios in the respective year are used (see Section 3.2 for more details).

	Panel A: Full Sample			Panel B: Incoming HML Stocks		
k	$BM_{i,t-k}$	$\sum dBE_{i,t-s}$	$-\sum dME_{i,t-s}$	$BM_{i,t-k}$	$\sum dBE_{i,t-s}$	$-\sum dME_{i,t-s}$
1	81.5	0.2	18.3	1.5	24.0	74.6
2	71.0	−1.5	30.5	7.6	29.4	63.1
3	63.9	−3.1	39.2	12.0	31.0	57.0
4	58.2	−4.7	46.4	14.1	30.8	55.1
5	53.1	−5.7	52.6	13.2	33.1	53.7

Table 2
Cross-Sectional Estimation of Profitability Shocks and Residual Returns

Panel A of this table displays time-series averages of regression coefficients from the cross-sectional profitability model of Hou and van Dijk (2019). The regressions are estimated at the end of each June from 1964 to 2019 using common US stocks traded on the NYSE, AMEX, or NASDAQ with total assets above \$10 million and book equity above \$5 million. The dependent variable is operating income-to-total assets as measured at the end of June. The independent variables are market-to-book value of assets (FV/AT), a dummy variable that equals one if the firm does not pay dividends (DD), the dividend-to-book ratio (D/BE), and operating income-to-total assets (OI/AT). The independent variables are lagged by one year with respect to the dependent variable. The variables are constructed as described in Appendix A and are measured at the end of June. Multiplying the estimated coefficients from an annual regression with the contemporaneous independent variables yields a prediction for firms' operating income-to-total assets across the next fiscal year. Panel B displays the time-series average of the regression coefficient from the annual regressions of stocks' returns on their estimated profitability shocks. The regressions are estimated at the end of each June from 1964 to 2019 using all common US stocks traded on the NYSE, AMEX, or NASDAQ. The dependent variable is the cross-sectionally demeaned compounded return across the previous fiscal year. The independent variable is the cross-sectionally demeaned profitability shock across the previous fiscal year. Stocks' profitability shocks are calculated as their realized operating income-to-total assets across the previous fiscal year minus their predicted operating income-to-total assets for this fiscal year. R^2 is the average adjusted R-squared across all annual regressions. t-statistics are reported in parentheses. In Panel A, t-statistics are based on Newey-West (1987) heteroskedasticity-robust standard errors with five lags. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Panel A: Profitability Shock Estimation						Panel B: Residual Return Estimation	
	Intercept	FV/AT	DD	D/BE	OI/AT	R^2	PS	R^2
Coefficient	0.0155***	0.0064**	−0.0128***	0.0675***	0.7187***	0.613	1.3341***	0.079
	(7.37)	(2.14)	(−4.50)	(3.65)	(40.55)		(7.72)	

Table 3

Comovement of Subsets of the Value Factor Portfolio with the Investment Factor

This table displays characteristics for subsets of the HML portfolio over the period from July 1964 to December 2019. The HML portfolio is reformed annually at the end of each June and is constructed as described in Section 3.2. The following subsets of the HML portfolio are considered: (1) market- and book-channel stocks (HML^{Total}), (2) market-channel stocks (HML^{ME}), (3) discount rate shock-driven stocks (HML^{DRS}), (4) cash flow shock-driven stocks (HML^{CFS}), and (5) book-channel stocks (HML^{BE}). The subsets are constructed as described in Section 3.5. These subsets of the HML portfolio are further split into subsets consisting only of stocks that are contemporaneously in the corresponding leg of the CMA portfolio (i.e., in the conservative (aggressive) portfolio in the case of value (growth) stocks), denoted as "CMA-Overlap", and into subsets consisting only of stocks that are contemporaneously not in the corresponding leg of the CMA portfolio, denoted as "Non-CMA-Overlap". "%" is the subsets' average size as a percentage of the size of the subset that consists of all market- and book-channel stocks. "Overlap" is the time-series average of the overlaps with the contemporaneous CMA portfolio, calculated as the weighted fraction of stocks that are in the conservative portfolio minus the weighted fraction of stocks that are in the aggressive portfolio, divided by two. ρ^{CMA} is the correlation with the investment factor. β^{CMA} is the loading on the investment factor from a multivariate regression on a four-factor model consisting of the market (MP), size (SMB), profitability (RMW), and investment (CMA) factors. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	All				CMA-Overlap				Non-CMA-Overlap			
	%	Overlap	ρ^{CMA}	β^{CMA}	%	Overlap	ρ^{CMA}	β^{CMA}	%	Overlap	ρ^{CMA}	β^{CMA}
HML^{Total}	100.0	0.207	0.599	0.92***	38.2	1.000	0.783	1.40***	61.8	−0.319	0.341	0.54***
				(17.96)				(29.88)				(9.02)
HML^{ME}	79.5	0.287	0.648	1.06***	33.3	1.000	0.772	1.45***	46.2	−0.274	0.399	0.65***
				(20.22)				(28.90)				(10.46)
HML^{DRS}	29.9	0.294	0.576	1.11***	13.1	1.000	0.611	1.41***	16.8	−0.320	0.334	0.72***
				(17.25)				(19.20)				(8.40)
HML^{CFS}	43.8	0.304	0.590	1.02***	17.8	1.000	0.686	1.48***	26.1	−0.245	0.328	0.58***
				(17.34)				(22.24)				(8.44)
HML^{BE}	20.5	−0.076	0.189	0.44***	5.0	1.000	0.424	1.23***	15.5	−0.467	0.031	0.15
				(5.43)				(11.26)				(1.57)

Table 4
Average Returns and Alphas on Subsets of the Value and Investment Factor Portfolios

This table displays average monthly returns and monthly five-factor alphas (in percent) on long-short portfolios across the period from July 1964 to December 2019. In Panel A, all common US stocks are at the end of each June first sorted into quintiles with respect to their market equity. The breakpoints for the sorts are based only on NYSE stocks. Second, the size quintiles are intersected with the aggregate value, growth, conservative, and aggressive portfolios, with the market-channel (ME) and book-channel (BE) subsets of the value and growth portfolios, and with the cash flow shock-driven (CFS) and discount rate shock-driven (DRS) subsets of the value, growth, conservative, and aggressive portfolios. The construction of the aggregate value, growth, conservative, and aggressive portfolios is described in Section 3.2, the construction of their subsets is described in Section 3.5. The stocks in each of these portfolios are in each month value-weighted based on their market capitalizations at the beginning of the respective month. The table displays the returns and alphas of strategies that go, within each size quintile, long in value stocks and short in growth stocks (HML) respectively long in conservative stocks and short in aggressive stocks (CMA). The column "Avg" displays results when the returns of a given sort are in each month averaged across the ME quintiles. Panel B (C) displays the same results when the first sort is with respect to investment (book-to-market) rather than market equity. In Panel D, the first sort is again with respect to market equity, but discount rate shock-driven conservative (aggressive) stocks are excluded from the value (growth) portfolios, and discount rate shock-driven value (growth) stocks are excluded from the conservative (aggressive) portfolios. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Controlling for Size

	Mean Returns						Five-Factor Alphas					
	Q1	Q2	Q3	Q4	Q5	Avg	Q1	Q2	Q3	Q4	Q5	Avg
HML	0.63***	0.35***	0.31**	0.18	0.12	0.32***	0.32***	0.07	−0.03	−0.14**	−0.16**	0.01
	(4.52)	(2.66)	(2.38)	(1.44)	(0.90)	(2.84)	(4.22)	(0.99)	(−0.50)	(−2.03)	(−2.42)	(0.50)
HML^{ME}	0.44***	0.42***	0.26**	0.24*	0.24	0.32***	0.15	0.18*	0.00	−0.03	−0.03	0.06
	(3.32)	(3.13)	(1.96)	(1.82)	(1.55)	(2.96)	(1.52)	(1.88)	(−0.03)	(−0.28)	(−0.29)	(1.24)
HML^{BE}	0.38*	−0.42*	0.25	−0.24	0.00	−0.01	0.13	−0.71***	0.04	−0.19	−0.07	−0.16*
	(1.65)	(−1.71)	(1.14)	(−1.25)	(0.02)	(−0.06)	(0.62)	(−3.09)	(0.17)	(−1.00)	(−0.38)	(−1.73)
HML$^{ME\text{-}BE}$	0.06	0.84***	0.00	0.50**	0.22	0.33***	0.02	0.89***	−0.05	0.18	0.00	0.22**
	(0.25)	(3.40)	(0.01)	(2.44)	(1.06)	(3.02)	(0.10)	(3.58)	(−0.23)	(0.89)	(0.02)	(2.15)
HML^{DRS}	0.70***	0.66***	0.53***	0.22	0.41**	0.49***	0.40**	0.28	0.22	−0.17	0.15	0.16**
	(3.63)	(3.31)	(2.94)	(1.27)	(2.26)	(3.85)	(2.27)	(1.58)	(1.45)	(−1.13)	(0.96)	(2.05)
HML^{CFS}	0.10	0.18	0.08	0.26*	0.08	0.13	−0.24	−0.01	−0.10	0.15	−0.20	−0.08
	(0.53)	(1.14)	(0.51)	(1.84)	(0.46)	(1.16)	(−1.44)	(−0.08)	(−0.83)	(1.39)	(−1.63)	(−1.18)
HML$^{DRS\text{-}CFS}$	0.68***	0.27	0.46**	−0.01	0.33*	0.36***	0.71***	0.06	0.32*	−0.31*	0.34*	0.24**
	(3.68)	(1.40)	(2.45)	(−0.07)	(1.77)	(3.72)	(3.65)	(0.28)	(1.66)	(−1.74)	(1.81)	(2.45)
CMA	0.42***	0.20**	0.13	0.05	0.17	0.19***	0.42***	0.08	−0.03	−0.23***	−0.18***	0.01
	(5.36)	(2.46)	(1.43)	(0.50)	(1.55)	(2.92)	(6.28)	(1.34)	(−0.43)	(−3.16)	(−3.12)	(0.70)
CMA^{DRS}	0.41***	0.39***	0.20	0.15	0.37***	0.30***	0.24*	0.18*	0.00	−0.15	0.07	0.07
	(3.32)	(3.39)	(1.64)	(1.22)	(2.88)	(4.02)	(1.96)	(1.65)	(0.02)	(−1.43)	(0.70)	(1.33)
CMA^{CFS}	0.22**	0.04	−0.10	0.03	0.01	0.04	0.22**	0.00	−0.17*	−0.08	−0.33***	−0.07
	(1.99)	(0.38)	(−0.95)	(0.32)	(0.07)	(0.61)	(2.04)	(0.01)	(−1.79)	(−0.87)	(−3.09)	(−1.60)
CMA$^{DRS\text{-}CFS}$	0.18	0.35**	0.30**	0.12	0.36**	0.26***	0.01	0.18	0.18	−0.07	0.41**	0.14*
	(1.20)	(2.41)	(2.09)	(0.83)	(2.23)	(3.43)	(0.08)	(1.18)	(1.20)	(−0.48)	(2.48)	(1.84)

Panel B: Controlling for Investment

	Mean Returns						Five-Factor Alphas					
	Q1	Q2	Q3	Q4	Q5	Avg	Q1	Q2	Q3	Q4	Q5	Avg
HML	0.25*	0.21	0.20	0.28*	0.16	0.22**	0.13	−0.02	0.01	−0.01	−0.32***	−0.04
	(1.88)	(1.58)	(1.53)	(1.85)	(0.96)	(2.06)	(1.13)	(−0.23)	(0.06)	(−0.08)	(−2.92)	(−1.13)
HML^{ME}	0.25	0.17	0.24	0.27	0.46**	0.28**	0.10	−0.05	0.03	0.05	0.05	0.04
	(1.49)	(1.04)	(1.52)	(1.48)	(2.44)	(2.32)	(0.66)	(−0.36)	(0.27)	(0.37)	(0.33)	(0.55)
HML^{BE}	−0.08	0.18	0.07	0.13	−0.02	0.06	−0.01	0.05	−0.07	−0.08	−0.21	−0.08
	(−0.30)	(0.73)	(0.29)	(0.51)	(−0.08)	(0.43)	(−0.05)	(0.21)	(−0.27)	(−0.30)	(−0.84)	(−0.71)
HML$^{ME\text{-}BE}$	0.30	−0.06	0.13	0.14	0.48*	0.22*	0.11	−0.14	0.08	0.15	0.26	0.12
	(1.07)	(−0.23)	(0.50)	(0.52)	(1.65)	(1.68)	(0.39)	(−0.50)	(0.28)	(0.52)	(0.88)	(0.91)
HML^{DRS}	0.43**	0.35*	0.11	0.27	0.63***	0.35**	0.31	0.14	−0.04	−0.01	0.14	0.09
	(1.98)	(1.66)	(0.55)	(1.29)	(2.70)	(2.55)	(1.41)	(0.72)	(−0.25)	(−0.04)	(0.69)	(0.91)
HML^{CFS}	0.04	−0.03	0.20	0.19	0.39*	0.15	−0.19	−0.30	0.02	0.02	0.04	−0.09
	(0.19)	(−0.16)	(1.11)	(0.91)	(1.70)	(1.20)	(−1.00)	(−1.63)	(0.11)	(0.13)	(0.17)	(−1.06)
HML$^{DRS\text{-}CFS}$	0.47*	0.30	−0.10	0.08	0.24	0.19*	0.55*	0.37	−0.06	−0.03	0.13	0.18
	(1.71)	(1.17)	(−0.46)	(0.33)	(0.91)	(1.67)	(1.95)	(1.41)	(−0.29)	(−0.13)	(0.46)	(1.50)

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Panel C: Controlling for Book-to-Market

	Mean Returns						Five-Factor Alphas					
	Q1	Q2	Q3	Q4	Q5	Avg	Q1	Q2	Q3	Q4	Q5	Avg
CMA	−0.02	0.09	0.25**	0.07	0.14	0.11	−0.41***	−0.04	0.11	−0.04	0.12	−0.05
	(−0.13)	(0.86)	(2.27)	(0.67)	(1.08)	(1.61)	(−4.54)	(−0.42)	(1.19)	(−0.38)	(0.94)	(−1.31)
CMA^{DRS}	0.18	0.15	0.44***	0.18	0.02	0.19**	−0.17	−0.04	0.36**	0.02	0.04	0.04
	(1.08)	(1.08)	(2.88)	(1.27)	(0.13)	(2.37)	(−1.13)	(−0.32)	(2.40)	(0.14)	(0.24)	(0.63)
CMA^{CFS}	0.02	−0.01	0.05	−0.10	0.20	0.03	−0.38***	−0.17	−0.05	−0.14	0.16	−0.12
	(0.10)	(−0.03)	(0.36)	(−0.65)	(1.21)	(0.37)	(−2.63)	(−1.20)	(−0.38)	(−0.91)	(0.97)	(−1.58)
$CMA^{DRS\text{-}CFS}$	0.16	0.15	0.39*	0.28	−0.17	0.16	0.22	0.13	0.42*	0.16	−0.12	0.16
	(0.77)	(0.77)	(1.84)	(1.35)	(−0.70)	(1.38)	(1.04)	(0.65)	(1.88)	(0.74)	(−0.46)	(1.36)

Panel D: Excluding each others' Discount Rate Shock-Driven Stocks

	Mean Returns						Five-Factor Alphas					
	Q1	Q2	Q3	Q4	Q5	Avg	Q1	Q2	Q3	Q4	Q5	Avg
HML^{DRS}	0.77***	0.53***	0.48***	0.10	0.39*	0.44***	0.45***	0.29	0.20	−0.22	0.09	0.15*
	(4.50)	(2.67)	(2.58)	(0.52)	(1.93)	(3.54)	(2.99)	(1.58)	(1.19)	(−1.38)	(0.54)	(1.83)
CMA^{DRS}	0.36***	0.27**	0.10	0.04	0.36***	0.23***	0.21*	0.14	−0.07	−0.20*	0.08	0.03
	(2.99)	(2.56)	(0.83)	(0.31)	(2.77)	(3.32)	(1.73)	(1.36)	(−0.59)	(−1.86)	(0.70)	(0.65)

Table 5
Factor Statistics

Panel A of this table displays the monthly mean returns and standard deviations of the market (MP), size (SMB), profitability (RMW), value (HML), market-channel value (HML^{ME}), book-channel value (HML^{BE}), discount rate shock-driven value (HML^{DRS}), cash flow shock-driven value (HML^{CFS}), investment (CMA), discount rate shock-driven investment (CMA^{DRS}), and cash flow shock-driven investment (CMA^{CFS}) factors. Panel B displays the correlations between the factors' monthly returns. The sample period is from July 1964 to December 2019. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Summary Statistics

	MP	SMB	RMW	HML	HML^{ME}	HML^{BE}	HML^{CFS}	HML^{DRS}	CMA	CMA^{CFS}	CMA^{DRS}
Mean	0.54***	0.24**	0.25***	0.30***	0.35***	−0.03	0.17	0.54***	0.21***	0.07	0.34***
	(3.23)	(2.08)	(2.88)	(2.79)	(3.17)	(−0.21)	(1.45)	(4.14)	(2.93)	(0.90)	(4.28)
Std	4.38	2.95	2.22	2.75	2.87	3.35	3.05	3.38	1.82	1.94	2.07

Panel B: Correlations

	MP	SMB	RMW	HML	HML^{ME}	HML^{BE}	HML^{CFS}	HML^{DRS}	CMA	CMA^{CFS}	CMA^{DRS}
MP	1.00	0.27	−0.24	−0.26	−0.24	−0.07	−0.20	−0.22	−0.38	−0.19	−0.28
SMB		1.00	−0.35	−0.08	0.00	−0.14	0.01	0.01	−0.09	−0.08	0.03
RMW			1.00	0.12	−0.02	0.15	−0.08	0.01	−0.07	−0.18	0.01
HML				1.00	0.89	0.62	0.81	0.75	0.66	0.52	0.49
HML^{ME}					1.00	0.49	0.89	0.85	0.65	0.48	0.55
HML^{BE}						1.00	0.44	0.38	0.22	0.23	0.11
HML^{CFS}							1.00	0.63	0.60	0.46	0.48
HML^{DRS}								1.00	0.59	0.39	0.59
CMA									1.00	0.78	0.78
CMA^{CFS}										1.00	0.40
CMA^{DRS}											1.00

Table 6
Spanning Regressions

This table displays results from spanning regressions that aim to explain different versions of the investment factor (INV) with the market factor (MP), the size factor (SMB), the profitability factor (RMW), and different versions of the value factor (VAL) as well as different versions of the value factor with the market factor, the size factor, the profitability factor, and different versions of the investment factor. The sample period is from July 1964 to December 2019. The first two columns of each row depict which versions of the investment and value factors are used in the respective spanning regressions. "standard" refers to the usual factors as described in Section 3.2. "CFS" refers to the cash flow shock-driven factors. "DRS" refers to the discount rate shock-driven factors. α is in percent. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

			Dependent Factor: Investment						Dependent Factor: Value					
	INV	VAL	α	β^{MP}	β^{SMB}	β^{RMW}	β^{VAL}	R^2	α	β^{MP}	β^{SMB}	β^{RMW}	β^{INV}	R^2
(1)	standard	standard	0.20***	−0.11***	−0.03*	−0.18***	0.41***	0.525	0.00	0.03	0.04	0.24***	1.05***	0.465
			(3.92)	(−9.11)	(−1.79)	(−7.76)	(22.25)		(−0.04)	(1.32)	(1.34)	(6.22)	(22.25)	
(2)	standard	CFS	0.25***	−0.12***	−0.04*	−0.10***	0.32***	0.442	−0.06	0.01	0.06*	−0.02	1.02***	0.362
			(4.58)	(−9.21)	(−1.95)	(−3.69)	(17.94)		(−0.57)	(0.50)	(1.67)	(−0.38)	(17.94)	
(3)	standard	DRS	0.16***	−0.12***	−0.05***	−0.14***	0.29***	0.442	0.25**	0.01	0.11***	0.13**	1.14***	0.360
			(2.90)	(−9.05)	(−2.60)	(−5.39)	(17.93)		(2.24)	(0.27)	(2.81)	(2.49)	(17.93)	
(4)	CFS	standard	0.07	−0.04***	−0.08***	−0.27***	0.37***	0.346	0.21**	−0.08***	0.07**	0.26***	0.76***	0.326
			(1.05)	(−2.70)	(−3.56)	(−9.01)	(15.98)		(2.29)	(−3.71)	(2.06)	(5.96)	(15.98)	
(5)	CFS	CFS	0.12*	−0.05***	−0.08***	−0.19***	0.27***	0.263	0.16	−0.10***	0.08**	−0.01	0.70***	0.229
			(1.77)	(−3.31)	(−3.55)	(−6.02)	(12.37)		(1.47)	(−3.78)	(2.14)	(−0.13)	(12.37)	
(6)	CFS	DRS	0.06	−0.06***	−0.09***	−0.23***	0.21***	0.222	0.50***	−0.12***	0.13***	0.12**	0.67***	0.184
			(0.90)	(−3.49)	(−3.79)	(−7.06)	(10.47)		(4.12)	(−4.23)	(2.91)	(1.98)	(10.47)	
(7)	DRS	standard	0.29***	−0.10***	0.07***	−0.06*	0.34***	0.280	0.10	−0.06***	−0.04	0.10**	0.62***	0.263
			(4.12)	(−5.75)	(2.84)	(−1.70)	(13.34)		(1.06)	(−2.65)	(−1.10)	(2.24)	(13.34)	
(8)	DRS	CFS	0.32***	−0.10***	0.07***	0.02	0.30***	0.267	0.02	−0.06**	−0.02	−0.15***	0.67***	0.239
			(4.59)	(−5.95)	(2.59)	(0.68)	(12.78)		(0.18)	(−2.47)	(−0.54)	(−3.05)	(12.78)	
(9)	DRS	DRS	0.20***	−0.09***	0.05**	−0.01	0.33***	0.368	0.25**	−0.05*	0.01	−0.02	0.93***	0.342
			(3.01)	(−5.50)	(2.07)	(−0.46)	(17.17)		(2.28)	(−1.87)	(0.19)	(−0.30)	(17.17)	

Table 7
Pricing Factors

This table displays results from factor model regressions. In Panel A, the standard Fama-French (2015) five-factor model is used to explain the discount rate shock-driven value and investment factors (HML^{DRS} and CMA^{DRS}, respectively). In Panel B, the adjusted five-factor model with the discount rate shock-driven value and investment factors is used to explain the standard value and investment factors (HML and CMA, respectively). The sample period is from July 1964 to December 2019. α is in percent. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Fama-French (2015) Five-Factor Model

	α	β^{MP}	β^{SMB}	β^{RMW}	β^{CMA}	β^{HML}	R^2
HML^{DRS}	0.25***	−0.01	0.05*	−0.05	0.31***	0.78***	0.589
	(2.83)	(−0.61)	(1.77)	(−1.19)	(4.65)	(19.21)	
CMA^{DRS}	0.10*	0.01	0.10***	0.12***	0.95***	−0.03	0.622
	(1.93)	(0.66)	(5.61)	(4.66)	(24.22)	(−1.39)	

Panel B: Adjusted Five-Factor Model

	α	β^{MP}	β^{SMB}	β^{RMW}	$\beta^{CMA^{DRS}}$	$\beta^{HML^{DRS}}$	R^2
HML	−0.04	−0.03*	−0.04	0.11***	0.10**	0.56***	0.575
	(−0.56)	(−1.88)	(−1.61)	(3.21)	(2.35)	(22.07)	
CMA	0.05	−0.07***	−0.08***	−0.13***	0.54***	0.11***	0.681
	(1.22)	(−7.05)	(−5.22)	(−6.73)	(22.32)	(7.34)	

Table 8
Pricing Performance

Panel A of this table displays results from factor model regressions using the Fama-French (2015) five-factor model consisting of the market (MP), size (SMB), profitability (RMW), investment (CMA), and value (HML) factors as well as an adjusted five-factor model that replaces the standard value and investment factors with their discount rate shock-driven versions (HML^{DRS} and CMA^{DRS}, respectively). The dependent returns are the average HML and CMA returns across the size quintiles from Panel A of Table 4. The sample period is from July 1964 to December 2019. Monthly mean returns (μ) and alphas are in percent. Panel B displays metrics on the models' performance in pricing different sets of test assets. "Val" ("Inv") denotes the set of size quintiles of the value and growth (conservative and aggressive) portfolios. "DRS" ("CFS") denotes the set of size quintiles of the discount rate shock-driven (cash flow shock-driven) subsets of the value, growth, conservative, and aggressive portfolios. "LS" denotes the long-short strategies that go long the size quintiles of the discount rate shock-driven subsets of the value, growth, conservative, and aggressive portfolios and short the size quintiles of the corresponding cash flow shock-driven subsets. "N" is the number of portfolios in the test asset set. The performance metrics are the GRS statistic of Gibbons et al. (1989) and its associated p-value; the test assets' average absolute alpha (in percent) and the fraction of alphas that are significant at the 5% level; the test assets' average absolute alpha over the average absolute deviation of their mean returns from their mean returns' mean; the test assets' cross-sectional R^2; and the test assets' average time-series R^2. t-statistics are reported in parentheses. Boldface indicates significance at the 10% level.

Panel A: Pricing of Average Value and Investment Premia

		Fama-French (2015) Five-Factor Model							Adjusted Five-Factor Model						
	μ	α	β^{MP}	β^{SMB}	β^{RMW}	β^{CMA}	β^{HML}	R^2	α	β^{MP}	β^{SMB}	β^{RMW}	$\beta^{CMA^{DRS}}$	$\beta^{HML^{DRS}}$	R^2
HML	**0.32**	0.01	−0.01	**−0.12**	**0.16**	**0.10**	**0.91**	0.953	−0.03	**−0.05**	**−0.14**	**0.23**	**0.11**	**0.56**	0.615
	(2.84)	(0.50)	(−1.62)	(−13.14)	(12.72)	(5.46)	(78.17)		(−0.36)	(−2.74)	(−5.31)	(6.85)	(2.63)	(22.13)	
HML^{ME}	**0.32**	0.06	−0.01	**−0.06**	−0.01	**0.20**	**0.81**	0.843	−0.04	**−0.04**	**−0.09**	**0.05**	**0.14**	**0.62**	0.718
	(2.96)	(1.24)	(−1.24)	(−3.71)	(−0.28)	(5.97)	(39.04)		(−0.63)	(−2.53)	(−4.29)	(1.81)	(3.93)	(29.68)	
HML^{BE}	−0.01	**−0.16**	0.00	**−0.18**	**0.09**	**−0.55**	**0.96**	0.492	**−0.24**	0.01	**−0.15**	**0.25**	**−0.20**	**0.49**	0.261
	(−0.06)	(−1.73)	(0.12)	(−5.39)	(1.89)	(−7.73)	(21.91)		(−2.08)	(0.41)	(−3.72)	(4.76)	(−3.04)	(12.34)	
$HML^{ME\text{-}BE}$	**0.33**	**0.22**	−0.02	**0.12**	**−0.09**	**0.76**	**−0.15**	0.200	**0.20**	**−0.05**	0.06	**−0.20**	**0.34**	**0.13**	0.185
	(3.02)	(2.15)	(−0.66)	(3.38)	(−1.88)	(9.82)	(−3.22)		(1.95)	(−1.94)	(1.63)	(−4.23)	(5.68)	(3.63)	
HML^{DRS}	**0.49**	**0.16**	0.01	−0.02	**0.09**	**0.29**	**0.81**	0.646	−0.04	0.01	**−0.07**	**0.14**	**0.06**	**0.89**	0.882
	(3.85)	(2.05)	(0.61)	(−0.64)	(2.29)	(4.73)	(21.91)		(−0.80)	(1.18)	(−4.13)	(6.61)	(2.21)	(55.19)	
HML^{CFS}	0.13	−0.08	−0.03	**−0.08**	**−0.10**	**0.22**	**0.74**	0.675	−0.12	**−0.06**	**−0.11**	−0.06	**0.22**	**0.46**	0.446
	(1.16)	(−1.18)	(−1.60)	(−3.32)	(−3.07)	(4.28)	(23.60)		(−1.33)	(−2.88)	(−3.47)	(−1.37)	(4.31)	(14.65)	
$HML^{DRS\text{-}CFS}$	**0.36**	**0.24**	0.04	**0.06**	**0.19**	0.06	0.06	0.035	0.08	**0.07**	0.04	**0.20**	**−0.16**	**0.43**	0.284
	(3.72)	(2.45)	(1.58)	(1.76)	(3.93)	(0.86)	(1.40)		(0.95)	(3.62)	(1.38)	(4.97)	(−3.28)	(14.40)	
CMA	**0.19**	0.01	0.00	**−0.05**	0.00	**0.83**	**0.05**	0.920	0.05	**−0.05**	**−0.12**	**−0.10**	**0.45**	**0.13**	0.654
	(2.92)	(0.70)	(0.99)	(−7.48)	(0.18)	(55.94)	(5.98)		(1.19)	(−5.55)	(−8.12)	(−5.34)	(19.01)	(9.22)	
CMA^{DRS}	**0.30**	0.07	**0.03**	**0.05**	**0.12**	**0.80**	**0.04**	0.582	−0.02	**0.01**	**−0.03**	**0.03**	**0.77**	**0.09**	0.833
	(4.02)	(1.33)	(2.06)	(2.96)	(4.98)	(20.66)	(1.68)		(−0.56)	(1.84)	(−2.77)	(2.09)	(40.82)	(7.93)	
CMA^{CFS}	0.04	−0.07	**0.03**	**−0.08**	**−0.12**	**0.69**	0.01	0.576	0.02	**−0.04**	**−0.12**	**−0.21**	**0.23**	**0.09**	0.267
	(0.61)	(−1.60)	(2.33)	(−4.69)	(−5.20)	(19.93)	(0.63)		(0.28)	(−2.98)	(−5.59)	(−7.44)	(6.48)	(4.33)	
$CMA^{DRS\text{-}CFS}$	**0.26**	**0.14**	0.00	**0.13**	**0.24**	**0.11**	0.03	0.085	−0.03	**0.06**	**0.09**	**0.24**	**0.54**	0.00	0.364
	(3.43)	(1.84)	(−0.02)	(4.78)	(6.43)	(1.84)	(0.75)		(−0.54)	(3.74)	(3.87)	(8.08)	(14.54)	(−0.08)	

Panel B: Pricing Performance for Different Test Asset Sets

		Fama-French (2015) Five-Factor Model							Adjusted Five-Factor Model						
	N	GRS	p(GRS)	Avg($\lvert\alpha\rvert$)	% Sig	$\frac{\text{Avg}(\lvert\alpha\rvert)}{\text{Avg}(\lvert\mu\rvert)}$	CS-R^2	Avg(R^2)	GRS	p(GRS)	Avg($\lvert\alpha\rvert$)	% Sig	$\frac{\text{Avg}(\lvert\alpha\rvert)}{\text{Avg}(\lvert\mu\rvert)}$	CS-R^2	Avg(R^2)
Val & Inv	20	3.611	0.000	0.091	0.400	0.640	0.622	0.948	3.661	0.000	0.090	0.300	0.633	0.616	0.928
DRS	20	1.565	0.055	0.102	0.150	0.465	0.788	0.853	1.146	0.298	0.090	0.100	0.409	0.818	0.865
CFS	20	2.290	0.001	0.114	0.300	1.088	0.021	0.885	2.053	0.005	0.102	0.200	0.980	0.214	0.866
LS	20	2.602	0.000	0.154	0.250	0.927	0.083	0.071	2.267	0.001	0.126	0.200	0.756	0.226	0.104
Val & Inv & LS	40	2.956	0.000	0.127	0.350	0.373	0.811	0.510	2.869	0.000	0.113	0.275	0.332	0.831	0.518

Table 9
Spanning Regressions: Sensitivity Analysis

This table displays results from spanning regressions that aim to explain different versions of the investment factor (INV) with the market factor (MP), the size factor (SMB), the profitability factor (RMW), and different versions of the value factor (VAL) as well as different versions of the value factor with the market factor, the size factor, the profitability factor, and different versions of the investment factor. The sample period is from July 1964 to December 2019. The first two columns of each row depict which versions of the investment and value factors are used in the respective spanning regressions. "standard" refers to the usual factors as described in Section 3.2. "ME" refers to the market-channel value factor. "sc,M" indicates that the respective factor is scaled such that it has the same volatility as the other factor and that its mean is adjusted to equal its original mean. "t,orth" indicates that the factor is first orthogonalized with respect to the market, size, and profitability factors, and then rescaled such that it has the same mean and standard deviation as originally. ρ is the correlation between the respective value and investment factors. μ and σ are the factors' monthly mean returns and volatilities. μ, σ, and α are in percent. t-statistics are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

				Dependent Factor: Investment								Dependent Factor: Value							
	INV	VAL	ρ	μ	σ	α	β^{MP}	β^{SMB}	β^{RMW}	β^{VAL}	R^2	μ	σ	α	β^{MP}	β^{SMB}	β^{RMW}	β^{INV}	R^2
(1)	standard	standard	0.661	0.21***	1.82	0.34***	−0.17***	−0.03	−0.15***		0.171	0.30***	2.75	0.36***	−0.15***	0.01	0.08*		0.066
				(2.93)		(5.20)	(−11.15)	(−1.21)	(−4.81)			(2.79)		(3.38)	(−6.20)	(0.22)	(1.65)		
(2)	standard	standard	0.661	0.21***	1.82	0.20***	−0.11***	−0.03*	−0.18***	0.41***	0.525	0.30***	2.75	0.00	0.03	0.04	0.24***	1.05***	0.465
				(2.93)		(3.92)	(−9.11)	(−1.79)	(−7.76)	(22.25)		(2.79)		(−0.04)	(1.32)	(1.34)	(6.22)	(22.25)	
(3)	standard	ME	0.651	0.21***	1.82	0.17***	−0.11***	−0.05**	−0.12***	0.37***	0.495	0.35***	2.87	0.09	0.01	0.08**	0.08*	1.05***	0.427
				(2.93)		(3.34)	(−8.69)	(−2.49)	(−4.94)	(20.65)		(3.17)		(1.05)	(0.42)	(2.47)	(1.90)	(20.65)	
(4)	standard	standard	0.661	0.21***	1.82	0.14***	−0.11***	−0.03*	−0.18***	0.62***	0.525	0.30***	1.82	0.10*	0.02	0.03	0.16***	0.69***	0.465
		(sc,M)		(2.93)		(2.67)	(−9.11)	(−1.79)	(−7.76)	(22.25)		(4.21)		(1.82)	(1.32)	(1.34)	(6.22)	(22.25)	
(5)	standard	standard	0.654	0.21***	1.82	0.08				0.43***	0.425	0.30***	2.75	0.09				0.99***	0.425
	(t,orth)	(t,orth)		(2.93)		(1.41)				(22.25)		(2.79)		(1.12)				(22.25)	

Table 10
Cash Flow, Discount Rate, and Volatility News Betas of Factors

This table displays cash flow, discount rate, and volatility news betas of the standard (HML), market-channel (HML^{ME}), book-channel (HML^{BE}), discount rate shock-driven (HML^{DRS}), and cash flow shock-driven (HML^{CFS}) value factors as well as the standard (CMA), discount rate shock-driven (CMA^{DRS}), and cash flow shock-driven (CMA^{CFS}) investment factors. The construction of the standard versions of the factors is described in Section 3.2, the construction of the market-channel, book-channel, discount rate shock-driven, and cash flow shock-driven versions of the factors is described in Section 7.1. The betas are estimated from multivariate time-series regressions that regress the factors' quarterly returns on the quarterly news terms estimated by Campbell et al. (2018). The sample period is from July 1964 to December 2011. t-statistics are reported in parentheses and are calculated based on the approach of Shanken (1992). *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	Constant	β^{CF}	β^{DR}	β^{V}	R^2
HML	1.14***	0.27***	−0.24***	−0.78***	0.351
	(3.38)	(3.18)	(−5.30)	(−5.79)	
HML^{ME}	1.31***	0.29***	−0.17***	−0.87***	0.288
	(3.52)	(3.15)	(−3.38)	(−5.86)	
HML^{BE}	−0.07	0.44***	−0.15***	−0.41**	0.178
	(−0.17)	(4.43)	(−2.76)	(−2.53)	
$HML^{ME\text{-}BE}$	1.37***	−0.15	−0.02	−0.46***	0.068
	(3.60)	(−1.60)	(−0.38)	(−3.03)	
HML^{DRS}	2.04***	0.22*	−0.21***	−0.76***	0.196
	(4.45)	(1.89)	(−3.36)	(−4.14)	
HML^{CFS}	0.61	0.32***	−0.18***	−0.83***	0.282
	(1.61)	(3.46)	(−3.46)	(−5.49)	
$HML^{DRS\text{-}CFS}$	1.44***	−0.11	−0.03	0.07	0.010
	(3.81)	(−1.15)	(−0.64)	(0.45)	
CMA	0.83***	0.06	−0.21***	−0.29***	0.280
	(3.49)	(1.07)	(−6.47)	(−3.09)	
CMA^{DRS}	1.25***	0.07	−0.18***	−0.33***	0.199
	(4.57)	(1.06)	(−4.72)	(−3.04)	
CMA^{CFS}	0.28	0.12*	−0.12***	−0.21*	0.108
	(1.00)	(1.78)	(−3.17)	(−1.90)	
$CMA^{DRS\text{-}CFS}$	0.97***	−0.05	−0.06	−0.12	0.023
	(3.17)	(−0.67)	(−1.33)	(−0.98)	

Table 11

Market Equity Changes, Book Equity Changes, and Investment: Different Subsamples

This table displays time-series averages of regression coefficients from annual Fama-MacBeth (1973) regressions. The regressions are estimated at the end of each June from 1968 to 2019 using common US stocks traded on the NYSE, AMEX, or NASDAQ. The dependent variable is contemporaneous investment. The independent variables are five-year lagged book-to-market (Lagged BM), the change in book equity (dBE), and the change in market equity (dME). The variables are constructed as described in Appendix A, are measured at the end of June, and are winsorized at the 0.5% and 99.5% levels. dBE and dME are the annual log-changes in the book equity and the market equity, respectively, that are used in the calculation of BM. A subscript $t-l$ indicates that the respective variable is lagged by l years. The regressions are estimated with weighted least squares, whereby the stocks' weights correspond to their market capitalizations at the end of June of the respective year. R^2 is the average adjusted R-squared across all annual regressions. T is the number of annual Fama-MacBeth (1973) regressions. Column "All" uses in each annual regression all common US stocks traded on the NYSE, AMEX, or NASDAQ. Column "NSI (MV)" ("NSI (FV)") uses in each annual regression only firms whose net share issues across the next fiscal year are below the 25th or above the 75th percentile (between the 25th and 75th percentile) of NYSE stocks' net share issues. Column "Ret3Y (MV)" ("Ret3Y (FV)") uses in each annual regression only firms whose cumulative three-year ahead returns beginning from the last fiscal year ending are below the 25th or above the 75th percentile (between the 25th and 75th percentile) of NYSE stocks' cumulative three-year ahead returns. Column "MFHS (low)" ("MFHS (high)") uses in each annual regression only firms whose mutual fund hypothetical sales across the previous fiscal year are, in absolute terms, below (above) the median of NYSE stocks' mutual fund hypothetical sales. Column "Payout (Con)" ("Payout (Uncon)") uses in each annual regression only firms whose payout-to-book ratios are below (above) the median of NYSE stocks' payout-to-book ratios. Column "Rating (Con)" ("Rating (Uncon)") uses in each annual regression only firms that have debt outstanding but no S&P long-term debt rating or their debt is in default (that have no debt outstanding or a S&P long-term debt rating and their debt is not in default). Column "KZ Index (Con)" ("KZ Index (Uncon)") uses in each annual regression only firms whose Kaplan-Zingales index values are above (below) the median of NYSE stocks' Kaplan-Zingales index values. t-statistics are reported in parentheses and are computed using Newey-West (1987) heteroskedasticity-robust standard errors with five lags. Boldface indicates significance at the 10% level.

	All	NSI (FV)	NSI (MV)	Ret3Y (FV)	Ret3Y (MV)	MFHS (low)	MFHS (high)	Payout (Uncon)	Payout (Con)	Rating (Uncon)	Rating (Con)	KZ Index (Uncon)	KZ Index (Con)
Intercept	**0.026**	**0.029**	**0.025**	**0.028**	**0.029**	**0.018**	**0.015**	**0.029**	**0.024**	**0.028**	**0.025**	**0.022**	**0.032**
	(3.50)	(4.16)	(2.84)	(3.64)	(4.03)	(2.58)	(3.16)	(3.48)	(3.56)	(3.83)	(3.36)	(2.58)	(4.44)
Lagged BM	**−0.017**	**−0.017**	**−0.017**	**−0.015**	**−0.016**	**−0.024**	**−0.021**	**−0.016**	**−0.024**	**−0.015**	**−0.019**	**−0.013**	**−0.023**
	(−4.34)	(−2.64)	(−4.25)	(−4.05)	(−3.48)	(−5.10)	(−5.97)	(−3.45)	(−7.82)	(−4.18)	(−4.41)	(−2.74)	(−6.68)
dBE	**0.397**	**0.441**	**0.374**	**0.428**	**0.383**	**0.422**	**0.404**	**0.398**	**0.437**	**0.428**	**0.370**	**0.481**	**0.329**
	(15.75)	(15.07)	(11.74)	(14.53)	(16.36)	(14.16)	(14.78)	(11.73)	(16.84)	(13.53)	(18.61)	(11.69)	(15.03)
dBE_{t-1}	**0.029**	**0.020**	**0.035**	**0.021**	**0.041**	**0.027**	**0.030**	**0.028**	**0.019**	**0.022**	**0.033**	0.013	**0.037**
	(3.40)	(2.91)	(3.14)	(1.90)	(4.33)	(2.11)	(2.52)	(2.27)	(1.88)	(1.92)	(3.72)	(0.68)	(3.97)
dBE_{t-2}	**0.029**	**0.026**	**0.024**	**0.029**	**0.034**	0.013	0.024	**0.021**	0.014	**0.020**	**0.034**	**0.036**	**0.015**
	(2.98)	(1.86)	(1.77)	(2.07)	(3.20)	(1.51)	(1.49)	(1.84)	(1.10)	(1.85)	(4.17)	(2.44)	(2.08)
dBE_{t-3}	**0.018**	0.018	0.019	0.013	**0.019**	**0.033**	0.008	**0.026**	−0.008	0.010	**0.015**	**0.025**	0.011
	(2.31)	(1.40)	(1.39)	(1.42)	(1.65)	(2.61)	(1.33)	(1.89)	(−1.07)	(1.04)	(2.25)	(1.96)	(1.39)
dBE_{t-4}	−0.001	−0.019	0.012	−0.008	0.007	−0.012	−0.003	−0.012	0.000	0.009	−0.002	0.005	**−0.010**
	(−0.11)	(−1.26)	(1.61)	(−0.82)	(0.71)	(−0.73)	(−0.44)	(−0.78)	(−0.05)	(0.69)	(−0.35)	(0.33)	(−2.04)
dME	**0.075**	**0.069**	**0.079**	**0.067**	**0.072**	**0.079**	**0.073**	**0.072**	**0.063**	**0.062**	**0.087**	**0.078**	**0.066**
	(7.50)	(5.12)	(8.72)	(7.35)	(7.22)	(7.33)	(6.09)	(6.10)	(9.07)	(5.03)	(9.10)	(5.78)	(8.42)
dME_{t-1}	**0.049**	**0.035**	**0.064**	**0.039**	**0.059**	**0.046**	**0.042**	**0.036**	**0.061**	**0.035**	**0.070**	**0.042**	**0.059**
	(7.05)	(5.75)	(6.86)	(4.72)	(6.48)	(6.36)	(6.63)	(3.76)	(14.68)	(3.71)	(8.98)	(4.08)	(12.72)
dME_{t-2}	**0.042**	**0.037**	**0.047**	**0.037**	**0.041**	**0.046**	**0.039**	**0.036**	**0.052**	**0.041**	**0.042**	**0.030**	**0.055**
	(6.73)	(4.26)	(5.79)	(5.52)	(6.19)	(5.14)	(5.47)	(4.75)	(8.60)	(4.85)	(13.12)	(3.42)	(10.24)
dME_{t-3}	**0.029**	**0.027**	**0.031**	**0.028**	**0.027**	**0.028**	**0.037**	**0.025**	**0.038**	**0.034**	**0.023**	**0.018**	**0.034**
	(4.39)	(3.72)	(4.91)	(4.08)	(3.95)	(3.37)	(5.69)	(2.38)	(8.47)	(4.04)	(2.52)	(1.86)	(6.18)
dME_{t-4}	**0.028**	**0.030**	**0.024**	**0.026**	**0.027**	**0.032**	**0.028**	**0.028**	**0.032**	**0.027**	**0.030**	**0.024**	**0.029**
	(5.50)	(5.02)	(4.01)	(4.13)	(7.50)	(4.92)	(4.53)	(4.74)	(5.23)	(4.05)	(5.63)	(3.39)	(4.08)
R^2	0.504	0.510	0.532	0.501	0.531	0.557	0.482	0.452	0.604	0.504	0.517	0.519	0.561
T	52	51	51	50	50	39	39	52	52	52	52	52	52