Levered Returns: Factors or Characteristics?

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Abstract

This paper provides a risk-based explanation for the leverage anomalies. Following Daniel and Titman's (1997) methodology, we show that the characteristic-based explanations for the book-leverage and the market-leverage anomalies are both rejected by Ferguson and Shockley's (2003) leverage-based three-factor model, which receives stronger support for the period before 1980. With independent samples from six other non-U.S. G7 countries, we obtain robust results which support the superiority of Ferguson and Shockley's (2003) three-factor model in explaining the leverage anomalies. Further evidence shows that leverage premia are reduced, or even eliminated after returns are adjusted by Ferguson and Shockley's factors.

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1 Introduction

One of the famous propositions in modern corporate finance is the leverage-return relation proposed by Modigliani and Miller (1958), who argue that expected stock returns should increase with financial leverage. However, empirical evidence on the leverage-return relation is mixed, and is further complicated with two different definitions of financial leverage, namely the book-leverage and the market-leverage.

Bhandari (1988) demonstrates the existence of a positive premium for stocks with a high market-leverage. Fama and French (1992), instead, find that both book-leverage and market-leverage are related to stock returns, but with opposite signs. They further show that the two effects are absorbed by the inclusion of the book-to-market equity (BM), which is equivalent to the difference between book-leverage and market-leverage. Livdan, Sapriza, and Zhang (2009) develop a dynamic capital structure model, and show that the market-leverage effect is captured by the positive relation between financial constraints and stock returns.[1] In a seminal work, Gomes and Schmid (2010) propose another dynamic model that incorporates corporate investment and financing decision under market imperfection. With simulated data, they show that the prediction of their model fits some stylized facts, including the positive relation between market-leverage and stock returns, and the negative relation between book-leverage and stock returns. Despite the existence of a large body of empirical literature, it is not clear whether the documented leverage anomalies are related to rational asset pricing factors.

George and Hwang (2010) show that stock returns are negatively related to financial distress intensity and book-leverage, and demonstrate that such a relation is even stronger after returns are adjusted with Fama and French's (1993) three asset-pricing factors. They ascribe this result to the low correlation between distress costs and Fama

[1] The result is consistent with the predictions of Lamont, Polk, and Saá-Requejo (2001) and Whited and Wu (2006).

and French's (1993) pricing factors. As a result, controlling for systematic risk that is unrelated to leverage and distress costs would only strengthen the negative relation between book-leverage and stock returns.

The main thrust of this paper is to ascertain the following question: if there exists an asset pricing model with factors that are related to leverage and distress costs, does it fully explain the leverage anomalies? To the best of our knowledge, Ferguson and Shockley's (2003) three-factor model serves as the best candidate for the leverage-based pricing model. Leverage as a firm characteristic, however, could have information independent of the covariance structure of stock returns that helps explain expected stock returns. To isolate variations in loadings on risk factors that are independent of firm characteristics, we apply the methodology developed by Daniel and Titman (1997) to examine whether Ferguson and Shockley's (2003) model can explain the leverage anomalies. In so doing, we are able to distinguish the relative explanatory power of Ferguson and Shockley's (2003) model against the leverage-based characteristic model. More importantly, this paper is the first one that contributes to the "factors versus characteristics" debate on the leverage anomalies.

Overall, our empirical results show supportive evidence for Ferguson and Shockley's (2003) three-factor model against the characteristic model in explaining both book-leverage and market-leverage anomalies. The result is robust to several alternative sets of characteristic models, including BM, size, and Altman's (1968) Z-score as the alternative firm characteristics. The support for Ferguson and Shockley's (2003) three-factor model is even stronger for pre-1980 period. In addition, we document different patterns in January and non-January months. The book-leverage and the market-leverage anomalies are better characterized by the characteristic model in January, and are driven by the risk-based factor model in non-January months. Furthermore, to safeguard the potential data-snooping biases as observed by Lo and Mackinlay (1990), we also extend our empirical investigation to the national markets of six other non-U.S. G7 countries. Empirical results for these six other countries are qualitatively similar to that of the U.S. market, which further support the superiority of Ferguson and Shockley's (2003) three-factor model in explaining the leverage anomalies.

To further examine the validity of our results, we replicate George and Hwang's (2010) testing procedure to see if Ferguson and Shockley's (2003) three-factor model provides better risk adjustment for the book-leverage and the market-leverage premia. We find that the market-leverage premium is completely eliminated under Ferguson and Shockley's risk adjustment. An alternative Ferguson-Shockley model constructed on the book-leverage, however, is able to reduce the book-leverage premium by 36% to 67% in magnitude.

The rest of the paper is organized as follows. Section 2 lays out methodologies adopted in constructing testing portfolios and hypotheses. In particular, we introduce the testing procedure of Daniel and Titman (1997). Section 3 describes data used in this paper. Empirical results are presented in Section 4. We provide the cross-sectional test for the risk-based explanation on leverage premia in Section 5. Finally, Section 6 concludes this paper.

2 Methodology

In a capital asset pricing model (CAPM) framework, Ferguson and Shockley (2003) argue that the true market portfolio should be composed of two sub-portfolios: the economy's debt claims and the economy's equity claims. They construct two mimicking portfolios to capture the part of returns associated with relative leverage (based on the ratio of market debt-to-equity, D/E) and the part of returns associated with relative distress (based on the Altman's (1968) Z-score) to complement the unobserved debt claims in the market portfolio. They show that the two proposed factors, namely the D/E and Z factors, subsume Fama and French's SMB and HML factors in explaining the cross-sectional variation in stock returns on the Fama-French 25 size-BM portfolios.

The leverage-based factor model of Ferguson and Shockley (2003) implies the following risk-return relation:

$$E(R_i) - R_f = b_i R_{Mkt} + d_i R_{D/E} + z_i R_Z, \tag{1}$$

where R_i is the return on asset i, R_f is the risk-free rate, R_{MKT} is the excess return on the market portfolio, and $R_{D/E}$ and R_Z are the returns on the D/E factor and the Altman's Z factor. One way to test equation (1) is to test the joint-zero-intercept hypothesis of the following regression model:

$$R_{i,t} - R_{f,t} = a_i + b_i R_{MKT,t} + d_i R_{D/E,t} + z_i R_{Z,t} + \varepsilon_{i,t}. \tag{2}$$

According to the leverage-factor-based argument, the intercepts, a_is, should be zero for all stocks. On the contrary, the characteristic-based model says that non-zero a_is are expected when stocks' factor loadings on $R_{D/E}$ do not line up with firms' characteristics. To distinguish the factor model from the characteristic model, we follow the methodology proposed by Daniel and Titman (1997) in forming portfolios by isolating variations in factor loadings so that they are independent of firm characteristics. To do so, we first sort individual stocks in an independent two-way sorting into three book (or market) leverage groups and three firm-characteristics (including BM, size and Z-score) groups at the end of June of each year, where the breakpoints are the 33rd and 67th percentiles for the NYSE firms in the sample. This results in nine different characteristic portfolios.

We then allocate individual stocks within each of the nine portfolios into five sub-portfolios using pre-formation $R_{D/E}$ slopes (d_i), which are obtained from estimating equation (2) with monthly returns of the past five years (with the availability of data for at least 24 observations) ending in December of year t-1. To have better predictions of the future covariance of firms with the factors, we follow Daniel and Titman (1997) in using the constant-weight factor-portfolio returns to construct the pre-formation factor loadings. That is, we apply the portfolio weights of factor portfolios ($R_{D/E}$ and R_Z) at the end of June of year t to the individual stock returns from December of year t-1 to January of year t-5, and calculate the returns on the constant-weight factor portfolios in estimating the pre-formation d_i slopes. After sorting individual stocks into five factor-loading portfolios within each of the nine characteristic portfolios, we calculate the value-weighted returns for each of the 45 test portfolios from July of year t to June of year t+1.

The next step is to form nine characteristic-balanced portfolios with the 45 sub-portfolios. The characteristic-balanced portfolios, denoted as $(Hh - Lh)_i$, $i = 1, \ldots, 9$, are constructed by investing a one-dollar long position in the high (fourth and fifth) d_i portfolios, and a one-dollar short position in the low (first and second) d_i portfolios within each of the nine characteristic-sorted groupings. We expect that if the characteristic model is correct, the time-series average returns of characteristic-balanced portfolios should be insignificantly different from zero, since they hold long and short positions of stocks with similar characteristics. By contrast, the time-series average returns will be positive if the leverage-based factor model is true, because the characteristic-balanced portfolios have high loadings on the $R_{D/E}$ factor.

As in Daniel and Titman (1997), we propose an alterative test of the factor model against the characteristic model, which can be inferred from the estimated intercept terms in the following regressions:

$$(Hh - Lh)_{i,t} = a_i + b_i R_{MKT,t} + d_i R_{D/E,t} + z_i R_{Z,t} + \varepsilon_{i,t}, \text{ for } i = 1, \ldots, 9. \tag{3}$$

The null hypothesis in favor of the factor model predicts that the intercepts from Equation (3) are insignificantly different from zero. By contrast, the alternative hypothesis in favor of the characteristic model predicts negative intercept terms in Equation (3), because the positive d_i loadings for the $(Hh - Lh)_i$ portfolios do not affect the expected returns of the characteristic-balanced portfolios.

As a joint test, we construct an equally weighted portfolio, denoted as $(Hh - Lh)_p$, out of the nine characteristic-balanced portfolios, $(Hh - Lh)_i$s. The model specification now becomes:

$$(Hh - Lh)_{p,t} = a_p + b_p R_{MKT,t} + d_p R_{D/E,t} + z_p R_{Z,t} + \varepsilon_{p,t}. \tag{4}$$

The null hypothesis in favor of the factor model of the joint test predicts that a_p is insignificantly different from zero. By contrast, a_p should be negative under the characteristic-based alternative hypothesis.

3 Data

The sample consists of all NYSE/AMEX/NASDAQ ordinary common stocks from July 1964 to December 2008. We obtain monthly data on return and market equity from the Center for Research in Security Prices (CRSP) database. Book equity and debt data are retrieved from the Compustat. Following Fama and French (1992), for the period from July of year t to June of t+1, we use a firm's market equity at the end of June of year t as its size, and together with the book equity at the end of December of year t-1 to construct the book-to-market (BM) ratio. Book-leverage is calculated as the ratio of book value of debt to total assets, while market-leverage is calculated as the ratio of book value of debt to the sum of market equity and book value of debt at the end of December of year t-1. To be included in our sample, we require a firm to have at least 24 monthly returns between January of year t-5 and December of year t-1 to calculate the ex ante factor loadings for individual stocks. Following the convention, we also exclude stocks with negative book equity.

To calculate Ferguson and Shockley's (2003) D/E and Z factors (denoted as $R_{D/E}$ and R_Z), we retrieve the required accounting variables from the Compustat. The two factors are constructed over the period from July 1964 to December 2008. The detail of the portfolio formation process is presented in the Appendix. Table 1 summarizes the properties of the $R_{D/E}$ factor, the R_Z factor, and the excess return of the market portfolio (R_{MKT}). The average returns of $R_{D/E}$, R_Z and R_{MKT} are 0.5748% (t-statistic = 2.35), 0.1929% (t-statistic = 1.38) and 0.3572% (t-statistic = 1.76) per month. $R_{D/E}$ and R_Z are highly correlated with a correlation of 0.8611. In addition, the correlation is -0.2460 between $R_{D/E}$ and R_{MKT}, and is -0.1522 between R_Z and R_{MKT}.

[Insert Table 1 about here]

4 Empirical Results

Since book-leverage and market-leverage are identified as two different anomalies, we start with investigating whether the two anomalies are better characterized by the factor model or the characteristic model in Sections 4.1 and 4.2, respectively. Robustness checks including subperiod analysis, consideration of January seasonality, and examinations based on six other non-U.S. G7 countries are provided in Sections 4.3, 4.4, and 4.5.

4.1 The Book-Leverage Anomaly

Panel A of Table 2 reports the average monthly returns as well as the estimation results of Equation (3) for the characteristic-balanced portfolios formed on book-leverage, BM, and loadings on the D/E factor. For tests of average returns, only one out of the nine characteristic-balanced portfolios exhibits significantly positive average return, while the remainders have insignificant returns. As a result, the combined portfolio has an insignificant average return of 0.146% per month with a t-statistic of 1.13. Overall, the results for average returns suggest weak supportive evidence for the factor model against the characteristic model.

The second column in Panel A of Table 2 reports the intercepts from the regressions of the characteristic-balanced portfolio returns on Ferguson and Shockley's (2003) factors. The intercepts are mostly positive for the nine characteristic-balanced portfolios, as well as for the combined portfolio. Only one of them has a negative but insignificant intercept. Overall, our results show that book-leverage and BM, as the alternative characteristics, are rejected by the leverage-based three-factor model.

The average returns and regression results for the characteristic-balanced portfolios with size and Z-score as alternative characteristics are presented in Panels B and C of Table 2. The results are quantitatively and statistically similar to those reported in Panel A. Tests for average returns provide even stronger support for the factor model. Two (three) out of the nine leverage-size-d_i (leverage-Z-score-d_i) characteristic-balanced portfolios have significantly positive mean returns. One should also note that, the post-formation $R_{D/E}$ loadings reported in Table 2 do not have apparent patterns across different book-leverage and other characteristics groups. As argued by Davis, Fama, and French (2000), the weak correlation between firm characteristics and $R_{D/E}$ loadings suggests the ability to produce variation in the risk loading independent of firm characteristics, thus increases the power of the tests to distinguish the characteristic model from the factor model.

[Insert Table 2 about here]

4.2 The Market-Leverage Anomaly

As in the previous section, we calculate the average returns and perform time-series regressions of Equation (3) for the characteristic-balanced portfolios formed on market-leverage, alternative characteristics, and $R_{D/E}$ loadings. The empirical results are reported in Table 3, and are summarized as follows:

1. There is weak evidence in favor of the factor model for tests of the mean returns. The average returns are 0.126% (t-statistic = 0.94), 0.111% (t-statistic = 1.18), and 0.238% (t-statistic = 1.74) for the combined portfolios formed on market-leverage-BM-d_i, market-leverage-size-d_i, and market-leverage-Z-score-d_i, respectively. The support for the factor model is particularly strong when Z-score is used as the alternative firm characteristic. Three out of the nine characteristic-balanced portfolios, as well as the combined portfolio, have significantly positive average returns.

2. The intercepts are 0.104 (t-statistic = 0.86), 0.078 (t-statistic = 1.02), and 0.220 (t-statistic = 1.83) for the combined portfolios in Panels A, B, and C. None of the individual characteristic-balanced portfolios has a significantly negative intercept. Thus, results of tests on intercepts suggest that the market-leverage anomaly is better explained by the factor model.

3. No apparent pattern for the post-formation $R_{D/E}$ loadings is observed across

different firm characteristics groups, suggesting our tests are powerful in distinguishing the characteristic model from the factor model.

[Insert Table 3 about here]

Overall, our empirical results show supportive evidence for Ferguson and Shockley's (2003) three-factor model against the characteristic model in explaining both book-leverage and market-leverage anomalies. The findings are robust among different sets of characteristic models.

4.3 Subperiod Analysis

Motivated by the argument of Davis, Fama, and French (2000) and Chou and Ko (2008) that the result in favor of the factor model or the characteristic model may be due to chance result, or due to the fact that there may be structural breaks in the risk-return relation, we conduct sub-sample analyses by using 1980 as the cutoff point. The reason of choosing 1980 as the cutoff point is based on the evidence of George and Hwang (2010) in which the relation between stock returns and the leverage is stronger for post-1980 period. Table 4 reports the results for pre-1980 and post-1980 periods.[2]

All of the six combined portfolios have positive intercepts for both periods, suggesting the rejection of the characteristic model is not special to a particular sample period. Moreover, the average returns for the combined portfolios are larger in periods before 1980. Among which, four portfolios (except for those formed on firm size) have significantly positive mean returns in 1964-1980, suggesting stronger explanatory power for the leverage-based three-factor model in the pre-1980 period. The result is not surprising, since weaker relation between stock returns and the leverage for pre-1980

[2]To conserve space, we only report the results for the combined portfolios. Detail results are available upon request.

period would result in lower explanatory power for the characteristic model and thus a higher probability to be rejected by the factor model.

[Insert Table 4 about here]

Overall, our sub-sample analyses show that the supportive evidence for Ferguson and Shockley's (2003) three-factor model is robust to different sample periods, and is even stronger for pre-1980 period.

4.4 The January Seasonality

In this subsection, we further examine how the empirical results are affected by the January seasonality. This is done by including an January dummy into Equation (4), which can be rewritten as:

$$(Hh - Lh)_{p,t} = a_{p0} + a_{p1} D_{Jan} + b_p R_{MKT,t} + d_p R_{D/E,t} + z_p R_{Z,t} + \varepsilon_{p,t}, \qquad (5)$$

where D_{Jan} equals 1 for the month of January, and 0 otherwise. One would expect an insignificant value of a_{p1} if the empirical results are not affected by the January Seasonality.

However, the results in Table 5 indicate that it is not the case. The coefficients on the January dummy, a_{p1}s, are all significantly negative for the six combined portfolios. To test whether the intercepts are significant in January months, we provide the F-statistics on $a_{p0} + a_{p1}$ in the last column of Table 5, and find that all are significantly negative at the 5% level. In comparison, the intercepts in non-January months (a_{p0}) are mostly significantly positive. Thus, tests on intercepts suggest that the factor model is rejected by the characteristic model in January months, while the characteristic model is rejected by the factor model in non-January observations.

Tests on the average returns strengthen this evidence. The combined characteristic-balanced portfolios have higher returns in non-January months than in January months, reinforcing the evidence of higher explanatory power of the factor model in non-January months. Thus, our results show that, the book- and market-leverage anomalies in January are better characterized by behavioral forces than by the rationality-based factor model.

[Insert Table 5 about here]

4.5 Evidence from Other G7 Countries

In this subsection, we provide further evidence based on data from other non-U.S. G7 countries, including Canada, France, Germany, Italy, Japan, and the United Kingdom (U.K.), to see if our results sustain in samples independent of the U.S. market. This is motivated by Lo and Mackinlay's (1990) observation that empirical findings of the asset-pricing anomalies are likely to be contaminated by the data-snooping biases. A solution to this problem suggested by Schwert (2002) is to test the anomalies on an independent sample. The non-U.S. G7 markets, thus, serve as the most representative independent samples. We obtain market and accounting data for the non-U.S. G7 countries from the Datastream. Limited to data availability, the sample period is from January 1989 to December 2009 for Canada, Japan and U.K.; from January 1992 to December 2009 for France and Germany; and from January 1998 to December 2009 for Italy.

We replicate the factor construction and testing procedure described in Section 2 for data from each of the six non-U.S. G7 countries' national markets. Estimation results of Equation (4) for the combined characteristic-balanced portfolio formed on leverage, BM, and $R_{D/E}$ loadings are presented in Table 6.[3] Intercept terms from estimating Equation (4) with combined portfolios formed on both book-leverage and market-leverage (reported in Panels A and B respectively) are insignificantly different from zero for all of the non-U.S. G7 markets. Therefore, the results suggest that the superiority of Ferguson and Shockley's (2003) three-factor model in explaining the leverage anomalies is not special to the U.S. market, but is robust in other non-U.S. developed countries' national markets as well.

[Insert Table 6 about here]

5 The Leverage Premia in the Cross Section

So far, we have shown that Ferguson and Shockley's (2003) leverage-based three-factor model has better explanatory power for the leverage anomaly in time series tests based on Daniel and Titman's (1997) methodology. The next task is to provide risk-based explanations for the leverage premia in the cross section. Our methodology follows the Fama and Macbeth (1973) style regression approach in George and Hwang (2004, 2007, and 2010), but with Ferguson and Shockley's (2003) three-factor model as the risk adjustment. This approach has the advantage of isolating the return to a particular variable by hedging the impact of other variables known to affect returns. The methodology is described as follows.

For each month, we perform 12 ($j = 1, \ldots, 12$) cross-sectional regressions of the

[3]The results for portfolios formed on size and Z-score are similar and hence not reported to save space.

following form:

$$
\begin{aligned}
R_{i,t} \;=\;& \beta_{0j,t} + \beta_{1j,t}R_{i,t-1} + \beta_{2j,t}SIZE_{i,t-1} + \beta_{3j,t}BM_{i,t-1} + \beta_{4j,t}52WHH_{i,t-j} \\
&+\beta_{5j,t}52WHL_{i,t-j} + \beta_{6j,t}BLevH_{i,t-j} + \beta_{7j,t}BLevL_{i,t-j} \\
&+\beta_{8j,t}MLevH_{i,t-j} + \beta_{9j,t}MLevL_{i,t-j} + \varepsilon_{i,t}, \qquad (6)
\end{aligned}
$$

where $R_{i,t}$, $SIZE_{i,t}$, and $BM_{i,t}$ are the return, the market capitalization, and book-to-market ratio of stock i in month t; $52WHH_{i,t-j}$ ($52WHL_{i,t-j}$) is the 52-week high winner (loser) dummy which takes the value of 1 if stock i's 52-week high measure[4] is ranked in the top (bottom) 30% in month $t-j$; $BLevH_{i,t-j}$ and $BLevL_{i,t-j}$ are the book-leverage dummies constructed based on highest and lowest 30% rankings by book-leverage in month $t-j$; $MLevH_{i,t-j}$ and $MLevL_{i,t-j}$ are the market-leverage dummies constructed based on highest and lowest 30% rankings by market-leverage in month $t-j$.

The coefficient estimates of a given independent variable are averaged over $j = 1, \ldots, 12$. For example, the return in month t of high (low) book-leverage can be expressed as $\bar{\beta}_{6,t} = \frac{1}{12}\sum_{j=1}^{12}\beta_{6j,t}$ ($\bar{\beta}_{7,t} = \frac{1}{12}\sum_{j=1}^{12}\beta_{7j,t}$). The coefficient estimates of other variables are calculated accordingly. We report the time-series average of $\bar{\beta}_{m,t}$ as well as the risk-adjusted return in Table 7. The risk-adjusted return is obtained by the intercept (a_m) from the time-series regressions of the averages of the coefficients on the contemporaneous factor realizations, which takes the following form:

$$
\bar{\beta}_{m,t} = a_m + b_m R_{MKT,t} + d_m R_{D/E,t} + z_m R_{Z,t} + \varepsilon_{m,t}, \quad \text{for } m = 0, \ldots, 9. \qquad (7)
$$

[Insert Table 7 about here]

[4]Following George and Hwang (2004), we calculate stock i's 52-week-high measure as $52WH_i = P_{i,t-1}/\text{high}_{i,t-1}$, where $P_{i,t-1}$ is stock i's closing price at the end of month t-1, and $\text{high}_{i,t-1}$ is stock i's highest price during the 12-month period that ends on the last day of month t-1.

The first and second columns in each panels of Table 7 report the raw and adjusted returns. We first look at the results for the full sample, which are reported in the left panel. The average raw return for the low book-leverage indicator is 0.143% per month, while that for the high book-leverage indicator is -0.185% per month, resulting in a book-leverage premium of 0.328% per month (t-statistic = 3.79). The market-leverage premium is 0.240% per month (t-statistic = 2.09), resulted from an average raw return of 0.071% per month for the high market-leverage indicator and an average raw return of -0.169% per month for the low market-leverage indicator. The significant book- and market-leverage premia are consistent with the findings in the literature. After the returns are adjusted by Ferguson and Shockley's (2003) factors, the market-leverage premium is eliminated (with a return of 0.058% and a t-statistic of 0.78), but the book-leverage premium is strengthened (with a return of 0.420% and a t-statistic of 5.55).

The subperiod results are similar to the full period, as reported in the intermediate and right panels of Table 7. The book-leverage premium is pronounced in both periods, and is not mitigated by Ferguson and Shockley's (2003) factors. In addition, consistent with George and Hwang's (2010) finding, the market-leverage premium is significant only in post-1980 period. The premium between high-leverage and low-leverage is eliminated after returns are adjusted by Ferguson and Shockley's (2003) factors for both periods.

Why does Ferguson and Shockley's (2003) three-factor model explain the market-leverage anomaly, but not the book-leverage anomaly? One possibility is that the D/E and Z factors constructed based on market-leverage may not be able to capture the covariance risk between book-leverage and stock returns, since the two effects have distinct sources. To verify this conjecture, we reconstruct the D/E and Z factors based on book-leverage and investigate whether the new model (denoted as B-FS model) can explain the book-leverage premium.

The third column in each panels of Table 7 reports the risk-adjusted returns by the B-FS model. The risk-adjusted book-leverage premia are 0.179%, 0.107%, and 0.213% for the full, pre-, and post-1980 periods. Compared with the raw returns of 0.328%, 0.323%, and 0.331%, the B-FS model explains about 36% to 67% of the book-leverage premia. The risk-adjusted premium even becomes insignificant in pre-1980 period (the t-statistic is 1.20). Hence, the results confirm our conjecture that a book-leverage-based three-factor model can better account for the book-leverage anomaly, further supporting the risk-based explanation.

6 Conclusions

In this paper, we propose a possible risk-based explanation for the leverage anomaly. The anomaly typically has two different roots. The part associated with the market-leverage is positively related to stick returns, while that associated with the book-leverage is negatively related to stick returns. We examine whether a leverage-based three-factor model proposed by Ferguson and Shockley (2003) explains the two anomalies.

Following the methodology proposed by Daniel and Titman (1997), we contribute to the factors versus characteristics debate on the leverage anomalies. Our evidence is in favor of Ferguson and Shockley's (2003) three-factor model against the characteristic model in explaining both book-leverage and market-leverage anomalies. The support for Ferguson and Shockley's (2003) three-factor model is even stronger for pre-1980 period. In addition, we document an "January leverage effect" that is not explained by the risk-based model. Moreover, empirical results based on other G7 countries further support Ferguson and Shockley's (2003) model in explaining the leverage anomalies.

We further use Ferguson and Shockley's (2003) three-factor model to explain George and Hwang's (2010) result. We show that, after controlling for systematic risk that is related to leverage and distress costs, the leverage premia are reduced, or even eliminated. Overall, our results provide supportive evidence for the leverage-based factor model in explaining the leverage anomalies.

Appendix: The Formation of D/E and Z Factors

Following Ferguson and Shockley's (2003) methodology, we construct two factors associated with relative leverage (based on the ratio of debt-to-equity) and relative distress (based on Altman's Z). In June of each year t, firms are assigned to one of three book debt-to-market equity (BD/ME) portfolios based on the 33% and 67% percentile cuts determined only from the NYSE firms in the sample. Independently and simultaneously, firms are assigned to one of two Altman's Z portfolios: $Z \leq 2.675$ and $Z > 2.675$. The Altman's Z is defined as:

$$Z = 1.2 \times \frac{WC}{TA} + 1.4 \times \frac{RE}{TA} + 3.3 \times \frac{EBIT}{TA} + 0.6 \times \frac{ME}{BD} + 1.0 \times \frac{S}{TA},$$

where WC is net working capital, TA is total book assets, RE is retained earnings, BD is book debt, $EBIT$ is earnings before interest and taxes, S is total sales revenue, and ME is market value of equity.

The intersection of the two sorts based on BD/ME and Z results in six portfolios as of June of each year. For July of t through June of t+1, the return on each portfolio is calculated as the value-weighted average return of the stocks in the portfolio. As a result, we have six return series that cover the period from July 1964 to December 2008. In each month t, $R_{D/E}$ is calculated as the simple average return of the two Z portfolios within the highly levered firms minus the simple average return of the two Z portfolios within the least levered firms. Similarly, R_Z is the simple average return of the three D/E portfolios within high-Z firms minus the simple average return of the three D/E portfolios within the low-Z firms.

References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance 23*, 589–609.

Bhandari, L. (1988). Debt/equity ratio and expected stock returns: Empirical evidence. *Journal of Finance 43*, 507–528.

Chou, P.-H. and K.-C. Ko (2008). Characteristics, covariances, and structural breaks. *Economics Letters 100*, 31–34.

Daniel, K. and S. Titman (1997). Evidence on the characteristics of cross sectional variation in stock returns. *Journal of Finance 52*, 1–33.

Davis, J. L., E. F. Fama, and K. R. French (2000). Characteristics, covariances, and average returns: 1929 to 1997. *Journal of Finance 55*, 389–406.

Fama, E. F. and K. R. French (1992). The cross section of expected stock returns. *Journal of Finance 47*, 427–466.

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

Fama, E. F. and J. Macbeth (1973). Risk and return: Some empirical tests. *Journal of Political Economy 81*, 607–636.

Ferguson, M. F. and R. L. Shockley (2003). Equilibrium "anomalies". *Journal of Finance 58*, 2549–2580.

George, T. J. and C.-Y. Hwang (2004). The 52-week high and momentum investing. *Journal of Finance 59*, 2145–2176.

George, T. J. and C.-Y. Hwang (2007). Long-term return reversals: Overreaction or taxes? *Journal of Finance 62*, 2865–2896.

George, T. J. and C.-Y. Hwang (2010). A resolution of the distress risk and leverage puzzles in the cross section of stock returns. *Journal of Financial Economics 96*, 56–79.

Gomes, J. F. and L. Schmid (2010). Levered returns. *Journal of Finance 65*, 467–494.

Lamont, O., C. Polk, and J. Saá-Requejo (2001). Financial constraints and stock returns. *Review of Financial Studies 14*, 529–554.

Livdan, D., H. Sapriza, and L. Zhang (2009). Financially constrained stock returns. *Journal of Finance 64*, 1827–1862.

Lo, A. W. and A. C. Mackinlay (1990). Data-snooping biases in tests of financial asset pricing models. *Review of Financial Studies 3*, 431–468.

Modigliani, F. and M. H. Miller (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review 48*, 261–297.

Schwert, G. W. (2002). Anomalies and market efficiency. In G. Constantinides, M. Harris, and R. Stulz (Eds.), *Handbook of the Economics of Finance*, pp. 939–974. Amsterdam: North Holland.

Whited, T. M. and G. Wu (2006). Financial constraints risk. *Review of Financial Studies 19*, 531–559.

Table 1: Properties of factors

This table reports the properties of the $R_{D/E}$ and R_Z factors, as well as the market excess returns on R_{MKT} for the period from July 1964 to December 2008. In Panel A we report the summary statistics of the factor premia, while in Panel B we report the Pearson correlation coefficients among the factors.

Variable	Mean (%)	Median (%)	Std. Dev. (%)
Panel A: Summary statistics of factor premia			
R_{MKT}	0.3572	0.7350	4.4921
	(1.76)		
$R_{D/E}$	0.5748	0.3586	5.3232
	(2.35)		
R_Z	0.1929	0.1948	3.2641
	(1.38)		
Variable	R_{MKT}	$R_{D/E}$	R_Z
Panel B: Correlations across factors			
R_{MKT}	1	-0.2460	-0.1522
$R_{D/E}$		1	0.8611
R_Z			1

Table 2: Regressions for portfolios formed on book-leverage, firm characteristics, and $R_{D/E}$ loadings

We construct the characteristic-balanced portfolios based on book-leverage, alternative firm characteristics, and factor loadings on $R_{D/E}$, using all NYSE, AMEX and NASDAQ stocks with nonnegative BE for year t-1. We independently sort individual stocks into three book-leverage and three BM (or size or Altman's Z-score) groups based on their corresponding values on these firm characteristics for December of the preceding year. The breakpoints are the 33rd and 67th percentiles for the NYSE firms in the sample. Nine portfolios at the intersections of the three book-leverage and three BM (or size or Z-score) groups are formed. We then subdivide each of the nine portfolios into five sub-portfolios using pre-formation slopes. Value-weighted returns on the portfolios are calculated from July of year t to June of year t+1. We form the arbitrage portfolios, $(Hl - Ll)_i$, defined as the difference between the average of the returns on the two highest $R_{D/E}$ loading portfolios of a leverage-BM (or size or Z-score) group minus the average of the returns on the two lowest $R_{D/E}$ loading portfolios of the leverage-BM (or size or Z-score) for each of the nine portfolios. A combined portfolio is simply calculated as the average of the nine portfolios. We then perform the following regressions:

$$(Hl - Ll)_{i,t} = a_i + b_i R_{MKT,t} + d_i R_{D/E,t} + z_i R_{Z,t} + \varepsilon_{i,t},$$

for portfolios i. Panels A, B, and C report the regression results for portfolios firstly formed on book-leverage/BM, book-leverage/size, and book-leverage/Z-score, respectively. In the parentheses are the t-statistics. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Portfolio		Mean Returns and Regression Coefficients				
Leverage	BM	Ave. (%)	a	b	d	z
Panel A: Portfolio formed on book-leverage, BM and $R_{D/E}$ slopes						
1	1	0.109	0.095	-0.096 **	0.283 ***	-0.546 ***
		(0.54)	(0.48)	(-2.17)	(3.92)	(-4.69)
1	2	0.119	0.016	-0.017	0.429 ***	-0.678 ***
		(0.58)	(0.08)	(-0.39)	(5.90)	(-5.77)
1	3	-0.037	-0.046	-0.052	0.221 ***	-0.472 ***
		(-0.16)	(-0.20)	(-1.02)	(2.67)	(-3.54)
2	1	0.204	0.146	-0.136 ***	0.304 ***	-0.365 ***
		(1.13)	(0.89)	(-3.68)	(5.05)	(-3.75)
2	2	0.326 *	0.287 *	-0.173 ***	0.304 ***	-0.387 ***
		(1.80)	(1.68)	(-4.52)	(4.87)	(-3.84)
2	3	0.028	0.019	-0.081 **	0.206 ***	-0.389 ***
		(0.16)	(0.11)	(-2.12)	(3.32)	(-3.88)
3	1	0.223	0.165	-0.093 **	0.256 ***	-0.297 ***
		(1.08)	(0.89)	(-2.26)	(3.80)	(-2.73)
3	2	0.197	0.211	-0.205 ***	0.123 **	-0.081
		(1.10)	(1.24)	(-5.36)	(1.98)	(-0.81)
3	3	0.146	0.151	-0.121 ***	0.185 ***	-0.330 ***
		(0.77)	(0.78)	(-2.79)	(2.62)	(-2.90)
Combined		0.146	0.116	-0.108 ***	0.257 ***	-0.394 ***
portfolio		(1.13)	(1.03)	(-4.27)	(6.22)	(-5.90)

Table 2 Continued

Portfolio		Mean Returns and Regression Coefficients				
Leverage	Size	Ave. (%)	a	b	d	z
Panel B: Portfolio formed on book-leverage, size and $R_{D/E}$ slopes						
1	1	0.126	0.089	-0.141 ***	0.263 ***	-0.337 ***
		(1.03)	(0.78)	(-5.47)	(6.28)	(-4.98)
1	2	0.088	-0.021	-0.099 ***	0.386 ***	-0.422 ***
		(0.66)	(-0.18)	(-3.76)	(8.98)	(-6.08)
1	3	0.082	0.018	-0.054 *	0.198 ***	-0.176 **
		(0.60)	(0.14)	(-1.86)	(4.15)	(-2.29)
2	1	0.256 *	0.158	-0.196 ***	0.498 ***	-0.617 ***
		(1.83)	(1.35)	(-7.46)	(11.66)	(-8.95)
2	2	0.143	0.064	-0.135 ***	0.363 ***	-0.432 ***
		(1.11)	(0.60)	(-5.67)	(9.36)	(-6.90)
2	3	0.043	0.015	-0.060 *	0.187 ***	-0.290 ***
		(0.30)	(0.11)	(-1.93)	(3.71)	(-3.55)
3	1	0.094	-0.033	-0.107 ***	0.528 ***	-0.712 ***
		(0.48)	(-0.19)	(-2.71)	(8.25)	(-6.88)
3	2	0.345 **	0.306 **	-0.167 ***	0.379 ***	-0.593 ***
		(2.16)	(2.18)	(-5.31)	(7.38)	(-7.15)
3	3	0.043	0.036	-0.176 ***	0.284 ***	-0.462 ***
		(0.27)	(0.23)	(-5.06)	(5.02)	(-5.06)
Combined		0.135	0.070	-0.126 ***	0.343 ***	-0.449 ***
portfolio		(1.31)	(0.89)	(-7.11)	(11.89)	(-9.64)
Panel C: Portfolio formed on book-leverage, Z-score and $R_{D/E}$ slopes						
1	1	-0.268	-0.180	-0.290 ***	0.176	-0.405 *
		(-0.75)	(-0.47)	(-3.36)	(1.25)	(-1.78)
1	2	0.085	0.109	-0.398 ***	0.232 **	-0.126
		(0.31)	(0.43)	(-7.09)	(2.54)	(-0.85)
1	3	0.129	0.101	-0.148 ***	0.335 ***	-0.555 ***
		(0.61)	(0.50)	(-3.26)	(4.54)	(-4.66)
2	1	0.519 ***	0.435 **	-0.085 **	0.413 ***	-0.616 ***
		(2.62)	(2.25)	(-1.97)	(5.84)	(-5.39)
2	2	0.601 ***	0.592 ***	-0.128 ***	0.261 ***	-0.466 ***
		(3.89)	(4.14)	(-3.99)	(4.99)	(-5.52)
2	3	0.258	0.181	0.034	0.223 ***	-0.315 ***
		(1.35)	(1.01)	(0.86)	(3.41)	(-2.99)
3	1	0.171	0.096	-0.069 *	0.390 ***	-0.620 ***
		(0.93)	(0.59)	(-1.86)	(6.49)	(-6.38)
3	2	0.343 *	0.231	0.042	0.361 ***	-0.549 ***
		(1.85)	(1.23)	(0.99)	(5.25)	(-4.94)
3	3	0.018	-0.061	-0.258 ***	0.543 ***	-0.728 ***
		(0.05)	(-0.17)	(-3.29)	(4.25)	(-3.53)
Combined		0.206	0.167	-0.144 ***	0.326 ***	-0.487 ***
portfolio		(1.54)	(1.39)	(-5.36)	(7.43)	(-6.87)

Table 3: Regressions for portfolios formed on market-leverage, firm characteristics, and $R_{D/E}$ loadings

We construct the characteristic-balanced portfolios based on market-leverage, alternative firm characteristics, and factor loadings on $R_{D/E}$, using all NYSE, AMEX and NASDAQ stocks with nonnegative BE for year t-1. We independently sort individual stocks into three market-leverage and three BM (or size or Z-score) groups based on their corresponding values on these firm characteristics for December of the preceding year. The breakpoints are the 33rd and 67th percentiles for the NYSE firms in the sample. Nine portfolios at the intersections of the three market-leverage and three BM (or size or Z-score) groups are formed. We then subdivide each of the nine portfolios into five sub-portfolios using pre-formation slopes. Value-weighted returns on the portfolios are calculated from July of year t to June of year t+1. We form the arbitrage portfolios, $(Hl - Ll)_i$, defined as the difference between the average of the returns on the two highest $R_{D/E}$ loading portfolios of a leverage-BM (or size or Z-score) group minus the average of the returns on the two lowest $R_{D/E}$ loading portfolios of the leverage-BM (or size or Z-score) for each of the nine portfolios. A combined portfolio is simply calculated as the average of the nine portfolios. We then perform the following regressions:

$$(Hl - Ll)_{i,t} = a_i + b_i R_{MKT,t} + d_i R_{D/E,t} + z_i R_{Z,t} + \varepsilon_{i,t},$$

for portfolios i. Panels A, B, and C report the regression results for portfolios firstly formed on market-leverage/BM, market-leverage/size, and market-leverage/Z-score, respectively. In the parentheses are the t-statistics. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Portfolio		Mean Returns and Regression Coefficients				
Leverage	BM	Ave. (%)	a	b	d	z
Panel A: Portfolio formed on market-leverage, BM and $R_{D/E}$ slopes						
1	1	0.165	0.155	-0.116 ***	0.313 ***	-0.617 ***
		(0.83)	(0.83)	(-2.75)	(4.58)	(-5.59)
1	2	-0.064	-0.030	-0.131 ***	0.131 *	-0.296 **
		(-0.29)	(-0.14)	(-2.80)	(1.72)	(-2.40)
1	3	-0.330	-0.403	-0.037	0.187	-0.131
		(-0.83)	(-1.02)	(-0.42)	(1.30)	(-0.56)
2	1	0.238	0.153	-0.117 ***	0.387 ***	-0.494 ***
		(1.27)	(0.87)	(-2.97)	(6.00)	(-4.75)
2	2	0.343 *	0.326 *	-0.184 ***	0.273 ***	-0.378 ***
		(1.82)	(1.93)	(-4.86)	(4.43)	(-3.80)
2	3	-0.033	-0.052	-0.095 **	0.154 **	-0.191 *
		(-0.17)	(-0.27)	(-2.20)	(2.19)	(-1.68)
3	1	0.276	0.204	-0.111 **	0.296 ***	-0.318 **
		(1.15)	(0.82)	(-1.97)	(3.24)	(-2.16)
3	2	0.418 **	0.457 **	-0.234 ***	0.118 *	-0.132
		(2.04)	(2.38)	(-5.42)	(1.68)	(-1.16)
3	3	0.119	0.121	-0.146 ***	0.137 **	-0.158
		(0.66)	(0.73)	(-3.91)	(2.25)	(-1.61)
Combined		0.126	0.104	-0.130 ***	0.222 ***	-0.302 ***
portfolio		(0.94)	(0.86)	(-4.83)	(5.05)	(-4.26)

Table 3 Continued

Portfolio		Mean Returns and Regression Coefficients				
Leverage	Size	Ave. (%)	a	b	d	z
Panel B: Portfolio formed on market-leverage, size and $R_{D/E}$ slopes						
1	1	0.109	0.108	-0.183 ***	0.201 ***	-0.261 ***
		(0.82)	(0.84)	(-6.34)	(4.28)	(-3.43)
1	2	0.041	0.040	-0.126 ***	0.141 ***	-0.183 **
		(0.32)	(0.33)	(-4.69)	(3.23)	(-2.59)
1	3	-0.056	-0.171	0.021	0.292 ***	-0.320 ***
		(-0.44)	(-1.44)	(0.80)	(6.70)	(-4.55)
2	1	0.235	0.136	-0.205 ***	0.491 ***	-0.586 ***
		(1.63)	(1.14)	(-7.66)	(11.27)	(-8.33)
2	2	0.125	0.134	-0.121 ***	0.122 ***	-0.184 ***
		(1.08)	(1.33)	(-5.36)	(3.32)	(-3.09)
2	3	0.008	-0.040	-0.010	0.168 ***	-0.229 ***
		(0.05)	(-0.27)	(-0.30)	(3.14)	(-2.66)
3	1	0.205	0.099	-0.125 ***	0.491 ***	-0.672 ***
		(1.11)	(0.60)	(-3.39)	(8.15)	(-6.91)
3	2	0.296 **	0.336 **	-0.183 ***	0.157 ***	-0.314 ***
		(1.99)	(2.54)	(-6.17)	(3.25)	(-4.02)
3	3	0.039	0.058	-0.191 ***	0.136 **	-0.159 *
		(0.24)	(0.39)	(-5.62)	(2.45)	(-1.77)
Combined		0.111	0.078	-0.125 ***	0.244 ***	-0.323 ***
portfolio		(1.18)	(1.02)	(-7.33)	(8.81)	(-7.21)
Panel C: Portfolio formed on market-leverage, Z-score and $R_{D/E}$ slopes						
1	1	0.296	0.264	-0.085 *	0.343 ***	-0.644 ***
		(1.30)	(1.17)	(-1.69)	(4.17)	(-4.86)
1	2	0.150	0.261	-0.381 ***	0.133	-0.253 *
		(0.58)	(1.12)	(-7.32)	(1.56)	(-1.85)
1	3	-0.094	-0.130	-0.109 *	0.220 **	-0.271 *
		(-0.34)	(-0.50)	(-1.89)	(2.34)	(-1.79)
2	1	0.269	0.206	-0.070 *	0.350 ***	-0.559 ***
		(1.59)	(1.27)	(-1.93)	(5.90)	(-5.84)
2	2	0.487 ***	0.404 **	-0.123 ***	0.375 ***	-0.465 ***
		(2.61)	(2.35)	(-3.17)	(5.95)	(-4.57)
2	3	-0.020	0.021	-0.194 ***	0.108 *	-0.172 *
		(-0.13)	(0.12)	(-5.06)	(1.72)	(-1.71)
3	1	0.241	0.246	-0.137 ***	0.251 ***	-0.482 ***
		(1.14)	(1.18)	(-2.92)	(3.30)	(-3.93)
3	2	0.387 **	0.385 **	0.004	0.134 **	-0.352 ***
		(2.12)	(2.41)	(0.11)	(2.30)	(-3.73)
3	3	0.421 **	0.324 *	0.020	0.214 ***	-0.191 *
		(2.28)	(1.81)	(0.50)	(3.27)	(-1.81)
Combined		0.238 *	0.220 *	-0.119 ***	0.236 ***	-0.377 ***
portfolio		(1.74)	(1.83)	(-4.44)	(5.39)	(-5.32)

Table 4: Regressions for portfolios formed on book or market-leverage, firm characteristics, and $R_{D/E}$ loadings in subperiods

We construct the combined portfolio based on the nine characteristic-balanced portfolios, and perform the following regression:

$$(Hh - Lh)_{p,t} = a_p + b_p R_{MKT,t} + d_p R_{D/E,t} + z_p R_{Z,t} + \varepsilon_{p,t},$$

in two subperiods, 1964-1980 and 1981-2008. Panels A, B, and C report the regression results for portfolios firstly formed on book-leverage and BM/size/Z-score, respectively. Panels D, E, and F report the regression results for portfolios firstly formed on market-leverage and BM/size/Z-score, respectively. In the parentheses are the t-statistics. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Period	Ave. (%)	a	b	d	z
Panel A: Portfolio formed on book-leverage, BM and $R_{D/E}$ slopes					
1964-1980	0.313 *	0.255 *	0.019	0.283 ***	-0.331 ***
	(1.86)	(1.70)	(0.59)	(4.19)	(-3.31)
1981-2008	0.066	0.078	-0.177 ***	0.232 ***	-0.371 ***
	(0.39)	(0.52)	(-5.11)	(4.48)	(-4.37)
Panel B: Portfolio formed on book-leverage, size and $R_{D/E}$ slopes					
1964-1980	0.182	0.127	-0.080 ***	0.371 ***	-0.454 ***
	(1.22)	(1.13)	(-3.32)	(7.36)	(-6.10)
1981-2008	0.113	0.053	-0.152 ***	0.328 ***	-0.431 ***
	(0.85)	(0.51)	(-6.27)	(9.08)	(-7.29)
Panel C: Portfolio formed on book-leverage, Z-score and $R_{D/E}$ slopes					
1964-1980	0.382 *	0.304	0.008	0.389 ***	-0.502 ***
	(1.97)	(1.65)	(0.19)	(4.67)	(-4.08)
1981-2008	0.122	0.136	-0.232 ***	0.280 ***	-0.426 ***
	(0.71)	(0.90)	(-6.61)	(5.34)	(-4.97)
Panel D: Portfolio formed on market-leverage, BM and $R_{D/E}$ slopes					
1964-1980	0.280 *	0.261	-0.001	0.126 *	-0.050
	(1.73)	(1.58)	(-0.03)	(1.69)	(-0.45)
1981-2008	0.051	0.057	-0.194 ***	0.238 ***	-0.348 ***
	(0.28)	(0.36)	(-5.32)	(4.37)	(-3.91)
Panel E: Portfolio formed on market-leverage, size and $R_{D/E}$ slopes					
1964-1980	0.178	0.154	-0.066 ***	0.203 ***	-0.206 ***
	(1.37)	(1.37)	(-2.71)	(4.02)	(-2.76)
1981-2008	0.079	0.055	-0.154 ***	0.252 ***	-0.345 ***
	(0.64)	(0.55)	(-6.73)	(7.38)	(-6.18)
Panel F: Portfolio formed on market-leverage, Z-score and $R_{D/E}$ slopes					
1964-1980	0.448 **	0.379 **	0.018	0.335 ***	-0.450 ***
	(2.34)	(2.27)	(0.50)	(4.45)	(-4.05)
1981-2008	0.136	0.175	-0.200 ***	0.182 ***	-0.300 ***
	(0.77)	(1.12)	(-5.51)	(3.35)	(-3.38)

Table 5: Regressions for portfolios formed on book or market-leverage, firm characteristics, and $R_{D/E}$ loadings after considering the January seasonality

We construct the combined portfolio based on the nine characteristic-balanced portfolios, and perform the following regression:

$$(Hh - Lh)_{p,t} = a_{p0} + a_{p1} D_{Jan} + b_p R_{MKT,t} + d_p R_{D/E,t} + z_p R_{Z,t} + \varepsilon_{p,t},$$

where D_{Jan} equals 1 for the month of January, and 0 otherwise. Panels A, B, and C reports the regression results for portfolios firstly formed on book-leverage and BM/size/Z-score, respectively. Panels D, E, and F reports the regression results for portfolios firstly formed on market-leverage and BM/size/Z-score, respectively. In the parentheses are the t-statistics. In the parentheses under $a_0 + a_1$ are the F-statistics under the null hypothesis of $a_0 + a_1 = 0$. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Portfolios sorted by	Jan. Ave. (%)	Non-Jan. Ave. (%)	a_0	a_1	b	d	z	$a_0 + a_1$
book-leverage/BM	-0.116	0.170	0.208 *	-1.184 ***	-0.103 ***	0.290 ***	-0.469 ***	-0.975 **
	(-0.23)	(1.16)	(1.77)	(-2.69)	(-4.07)	(6.77)	(-6.52)	(5.37)
book-leverage/size	0.030	0.145	0.145 *	-0.957 ***	-0.122 ***	0.370 ***	-0.510 ***	-0.812 ***
	(0.07)	(1.22)	(1.77)	(-3.12)	(-6.91)	(12.38)	(-10.17)	(7.68)
book-leverage/Z-Score	0.048	0.220	0.262 **	-1.211 ***	-0.139 ***	0.360 ***	-0.564 ***	-0.949 **
	(0.09)	(1.47)	(2.10)	(-2.59)	(-5.18)	(7.90)	(-7.37)	(4.51)
market-leverage/BM	-0.388	0.172	0.197	-1.198 **	-0.125 ***	0.255 ***	-0.378 ***	-1.001 **
	(-0.75)	(1.14)	(1.58)	(-2.56)	(-4.65)	(5.61)	(-4.94)	(5.01)
market-leverage/size	-0.120	0.132	0.145 *	-0.863 ***	-0.121 ***	0.269 ***	-0.378 ***	-0.717 **
	(-0.35)	(1.24)	(1.84)	(-2.92)	(-7.13)	(9.34)	(-7.83)	(6.46)
market-leverage/Z-Score	-0.062	0.264 *	0.314 **	-1.204 **	-0.114 ***	0.270 ***	-0.453 ***	-0.890 **
	(-0.11)	(1.76)	(2.52)	(-2.58)	(-4.25)	(5.93)	(-5.93)	(3.97)

Table 6: Regressions for portfolios formed on book/market-leverage, BM, and $R_{D/E}$ loadings for other G7 countries

We construct the combined portfolio based on the nine characteristic-balanced portfolios, and perform the following regression:

$$(Hh - Lh)_{p,t} = a_p + b_p R_{MKT,t} + d_p R_{D/E,t} + z_p R_{Z,t} + \varepsilon_{p,t},$$

for each of the six G7 countries. Panels A and B report the regression results for portfolios firstly formed on book-leverage and market-leverage, respectively. In the parentheses are the t-statistics. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

		Mean Returns and Regression Coefficients				
Country	Period	Ave. (%)	a	b	d	z
Panel A: Portfolio formed on book-leverage, BM and $R_{D/E}$ slopes						
Canada	1989-2009	0.016	-0.067	0.123 ***	0.136 ***	-0.042
		(0.05)	(-0.26)	(3.45)	(3.94)	(-0.89)
France	1992-2009	-0.269	-0.264	-0.070	0.092	0.004
		(-0.87)	(-0.89)	(-1.24)	(1.47)	(0.04)
Germany	1992-2009	-0.021	-0.054	-0.073 *	0.135 ***	-0.139 **
		(-0.09)	(-0.25)	(-1.79)	(3.02)	(-2.14)
Italy	1998-2009	0.096	0.449	0.051	0.286 ***	0.182
		(0.21)	(1.10)	(0.65)	(4.06)	(1.56)
Japan	1989-2009	0.221	0.177	0.149 ***	0.302 ***	0.042
		(1.13)	(0.96)	(4.38)	(5.31)	(0.37)
U.K.	1989-2009	0.145	0.285	-0.106 **	0.034	-0.053
		(0.73)	(1.31)	(-2.25)	(0.69)	(-0.66)
Panel B: Portfolio formed on market-leverage, BM and $R_{D/E}$ slopes						
Canada	1989-2009	-0.005	-0.090	0.123 ***	0.137 ***	-0.043
		(-0.02)	(-0.34)	(3.46)	(3.98)	(-0.91)
France	1992-2009	-0.283	-0.276	-0.070	0.090	-0.003
		(-0.93)	(-0.94)	(-1.26)	(1.45)	(-0.03)
Germany	1992-2009	-0.021	-0.054	-0.073 *	0.135 ***	-0.139 **
		(-0.09)	(-0.25)	(-1.79)	(3.02)	(-2.14)
Italy	1998-2009	0.103	0.456	0.050	0.288 ***	0.179
		(0.22)	(1.11)	(0.63)	(4.09)	(1.53)
Japan	1989-2009	0.223	0.179	0.149 ***	0.302 ***	0.042
		(1.14)	(0.97)	(4.38)	(5.32)	(0.36)
U.K.	1989-2009	0.143	0.281	-0.103 **	0.034	-0.054
		(0.72)	(1.30)	(-2.18)	(0.69)	(-0.66)

Table 7: The leverage premia in the cross section

For each month, we perform 12 ($j = 1, \ldots, 12$) cross-sectional regressions of the following form:

$$\begin{aligned} R_{i,t} \quad = \quad & \beta_{0j,t} + \beta_{1j,t} R_{i,t-1} + \beta_{2j,t} SIZE_{i,t-1} + \beta_{3j,t} BM_{i,t-1} + \beta_{4j,t} 52WHH_{i,t-j} + \beta_{5j,t} 52WHL_{i,t-j} + \beta_{6j,t} BLevH_{i,t-j} + \beta_{7j,t} BLevL_{i,t-j} + \beta_{8j,t} MLevH_{i,t-j} \\ & + \beta_{9j,t} MLevL_{i,t-j} + \varepsilon_{i,t}, \end{aligned}$$

where $R_{i,t}$, $SIZE_{i,t}$, and $BM_{i,t}$ are the return, the market capitalization, and book-to-market ratio of stock i in month t; $52WH_{i,t-j}$ ($52WL_{i,t-j}$) is the 52-week high winner (loser) dummy which takes the value of 1 if stock i's 52-week high measure is ranked in the top (bottom) 30% in month $t-j$; $BLevW_{i,t-j}$ and $BLevL_{i,t-j}$ are the book-leverage dummies constructed based on highest and lowest 30% rankings by book-leverage in month $t-j$; $MLevW_{i,t-j}$ and $MLevL_{i,t-j}$ are the market-leverage dummies constructed based on highest and lowest 30% rankings by market-leverage in month $t-j$. The coefficient estimates of a given independent variable are averaged over $j = 1, \ldots, 12$. We report the time-series average of the average coefficients as well as the risk-adjusted return. The risk-adjusted return is obtained by the intercept from the time-series regressions of the averages of the coefficients on the contemporaneous factor realizations based on Ferguson and Shockley's (2003) three-factor model. In the parentheses are the t-statistics. * denotes significance at the 10% level, ** denotes significance at the 5% level, and *** denotes significance at the 1% level.

Period	1964-2008			1964-1980			1981-2008		
	Raw returns	FS-Adj. returns	B-FS-Adj. returns	Raw returns	FS-Adj. returns	B-FS-Adj. returns	Raw returns	FS-Adj. returns	B-FS-Adj. returns
Intercept	1.548 ***	1.072 ***	0.342	1.924 **	1.257 ***	1.380 ***	1.328 **	1.026 ***	-0.084
	(3.44)	(4.12)	(1.33)	(2.40)	(2.95)	(3.16)	(2.57)	(3.21)	(-0.31)
$R_{i,t-1}$	-0.061 ***	-0.059 ***	-0.056 ***	-0.083 ***	-0.079 ***	-0.079 ***	-0.048 ***	-0.046 ***	-0.044 ***
	(-13.55)	(-15.11)	(-14.25)	(-9.64)	(-10.93)	(-10.49)	(-11.07)	(-10.95)	(-10.48)
SIZE	-0.172 ***	-0.171 ***	-0.063	-0.257 ***	-0.204 ***	-0.222 ***	-0.123 **	-0.161 ***	0.005
	(-3.52)	(-4.54)	(-1.62)	(-2.90)	(-3.02)	(-3.18)	(-2.19)	(-3.71)	(0.13)
BM	0.186 ***	0.145 ***	0.217 ***	0.016	-0.013	-0.070	0.286 ***	0.230 ***	0.375 ***
	(2.84)	(3.28)	(4.56)	(0.12)	(-0.15)	(-0.75)	(4.24)	(5.31)	(8.27)
52-week high winner	0.262 ***	0.323 ***	0.409 ***	0.106	0.190 ***	0.168 **	0.354 ***	0.412 ***	0.517 ***
	(4.46)	(6.61)	(8.40)	(1.06)	(2.72)	(2.29)	(4.86)	(6.44)	(8.47)
52-week high loser	-0.067	-0.092	-0.396 ***	-0.186	-0.285 ***	-0.200 **	0.003	0.018	-0.421 ***
	(-0.58)	(-0.95)	(-4.26)	(-1.43)	(-3.04)	(-2.13)	(0.02)	(0.13)	(-3.33)
High book-leverage	-0.185 ***	-0.228 ***	-0.117 ***	-0.187 ***	-0.202 ***	-0.106	-0.183 ***	-0.237 ***	-0.122 **
	(-3.92)	(-4.99)	(-2.93)	(-2.63)	(-2.88)	(-1.58)	(-2.89)	(-4.10)	(-2.46)
Low book-leverage	0.143 **	0.193 ***	0.062	0.136	0.144 *	0.001	0.148 **	0.208 ***	0.090
	(2.44)	(3.73)	(1.33)	(1.41)	(1.88)	(0.02)	(2.02)	(3.20)	(1.47)
High market-leverage	0.071	-0.007	-0.016	0.157	0.109	0.072	0.021	-0.088	-0.073
	(1.10)	(-0.14)	(-0.31)	(1.53)	(1.39)	(0.87)	(0.27)	(-1.44)	(-1.11)
Low market-leverage	-0.169 **	-0.065	-0.162 ***	0.004	0.049	0.120	-0.270 ***	-0.137 *	-0.291 ***
	(-2.25)	(-1.21)	(-2.85)	(0.04)	(0.61)	(1.46)	(-2.67)	(-1.93)	(-3.98)
Low minus high book-leverage	0.328 ***	0.420 ***	0.179 ***	0.323 **	0.346 ***	0.107	0.331 ***	0.446 ***	0.213 ***
	(3.79)	(5.55)	(2.98)	(2.53)	(3.19)	(1.20)	(2.88)	(4.70)	(2.70)
High minus low market-leverage	0.240 **	0.058	0.146 *	0.154	0.060	-0.048	0.291 *	0.049	0.219 **
	(2.09)	(0.78)	(1.78)	(0.96)	(0.51)	(-0.39)	(1.92)	(0.50)	(2.06)