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Abstract

We document new evidence that the magnitude of the investment anomaly, the asset growth anomaly, the value premium, and the net stock issues puzzle is higher in financially more constrained firms than that in financially less constrained firms. We interpret the evidence using an investment-based asset pricing model augmented with costly external finance. Intuitively, financial frictions make marginal costs of investment more sensitive to investment in more constrained firms, giving rise to a stronger negative relation between investment and the discount rate.

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1 Introduction

Our central result is the empirical finding that the investment, asset growth, book-to-market, and the net stock issues anomalies are all stronger in financially more constrained firms.

Using payout ratio as a measure of costly external finance, for example, we find that the high-minus-low investment-to-assets quintile earns an equal-weighted average return of -1.23% per month ($t = -6.82$) in the low payout ratio (more constrained) tercile. This average return is more than halved in magnitude in the high payout ratio (less constrained) tercile, -0.57% per month ($t = -7.19$). The equal-weighted average returns are -1.61% and -0.52% for the high-minus-low asset growth quintile, 1.51% and 0.67% for the high-minus-low book-to-market quintile, and -1.03% and -0.67% for the high-minus-low net stock issues quintile across the low and high payout ratio terciles, respectively. Using the CAPM alpha and the Fama-French (1993) alpha to measure the magnitude of the anomalies yields quantitatively similar results.

We also document similar results using five other measures of financial constraints that include asset size, bond ratings, commercial paper ratings, the Whited-Wu (2004) index, and the Kaplan-Zingales (1997) index. For example, using bond ratings as a criterion, we assign all the firms whose bonds are rated to the unconstrained subsample and all the firms with debt outstanding but without a bond rating to the constrained subsample. We find that the value-weighted CAPM alphas are -0.36%, -0.33%, 0.41%, and -0.38% per month for the high-minus-low investment-to-assets, asset growth, book-to-market, and net stock issues quintile portfolios, respectively, in the unconstrained subsample. In contrast, the CAPM alphas are more than doubled in magnitude, $-0.74\%, -0.77\%, 0.88\%$, and -0.88% per month, respectively, in the constrained subsample.

Why does the magnitude of the asset pricing anomalies vary across subsamples split on measures of financial constraints? To shed light on this issue, we incorporate costly external finance into the q-theory framework à la Cochrane (1991). Using a two-period example, we show analytically that the anomalies are stronger when external finance is more costly. In investment-based asset pricing, high investment means higher marginal costs of investment, which in turn mean lower expected returns, all else equal. More important, in more constrained firms for which external equity is more costly, marginal costs of investment are more sensitive to changes in investment, implying that the negative relation between investment and expected returns is stronger for more constrained firms. We also demonstrate the quantitative relevance of this economic mechanism using a more realistic dynamic asset pricing model featuring decreasing returns to scale, convex adjustment costs of capital, as well as fixed and convex costs of financing.

Previous empirical literature has shown that the anomalies tend to be stronger in firms with smaller market capitalization (e.g., Fama 1998, Fama and French 2007). This evidence has been interpreted as suggesting limits to arbitrage because relative lack of liquidity of small stocks increases transaction costs. We complement the existing literature by documenting the variation of the anomalies across measures of financial constraints including asset size. We also provide an economic explanation of the evidence without relying on limits to arbitrage.

Griffin and Lemmon (2002) and Vassalou and Xing (2004) show that the value premium is most significant in firms with high probabilities of financial distress. By incorporating financial leverage into a real options model, Garlappi and Yan (2007) show that leverage amplifies the magnitude of the value premium, thereby explaining the relation between the magnitude of the value premium and financial distress. Our work complements but differs from this literature. The crux is that financial distress and financial constraints are different, albeit related, concepts. For example, Lamont, Polk, and Saá-Requejo (2001) define financial constraints as frictions that prevent the firm from funding all desired investments, while Wruck (1990) defines financial distress as situations where cash flow is insufficient to cover current obligations.[1]

Our story proceeds as follows. Section 2 describes our data and measures of financial constraints. Section 3 reports our main empirical results. Section 4 develops an investment-based asset pricing model with costly external finance to interpret our evidence. Finally, Section 5 concludes.

2 Data and Preliminary Analysis

Financial statement data, such as capital expenditure, cash flow, and debt are from Compustat. Stock returns data are from the Center for Research in Security Prices (CRSP). All domestic common shares trading on NYSE, AMEX, and NASDAQ with accounting and returns data available are included except for financial firms (firms with four-digit SIC codes between 6000 and 6999). In particular, utility firms are included in our sample. Following Fama and French (1993), we also exclude closed-end funds, trusts, ADRs, REITS, and units of beneficial interest. To mitigate backfilling bi-

[1] In their study of financial constraints, both Kaplan and Zingales (1997) and Lamont, Polk, and Saá-Requejo (2001) limit their samples to manufacturing firms with positive real sales growth because "[r]estricting attention to firms with growing sales also helps eliminate distressed firms from the construction of the financial constraints factor, helping ensure that we are measuring constraint and not distress (Lamont et al., p. 532, footnote 1)."

ases, we require firms to be listed on Compustat for two years before including them in our sample. The U.S. one-month Treasury bill rates are used as risk-free rates in computing excess returns. To be included in the sample, a firm must have all the variables required to compute the relevant variables.

2.1 Measures of Financial Constraints

Existing measures of financial constraints consist of two types. Single variable measures capture one aspect of constraints and index-based measures summarize different aspects into a single index.

Following Almeida and Campello (2007), we use four single variable measures of financial constraints that include payout ratio, asset size, bond ratings, and commercial paper ratings. The payout ratio is a traditional measure of financial constraints (e.g., Fazzari, Hubbard, and Peterson 1988, Almeida, Campello, and Weisbach 2004). The payout ratio is defined as the ratio of total distributions including dividends for preferred stocks (Compustat annual item 19), dividends for common stocks (item 21), and share repurchases (item 115) divided by operating income before depreciation (item 13). At the end of June of each year t, we rank firms based on their payout ratios measured at the end of fiscal year $t-1$. We assign to the more constrained subsample those firms in the bottom tercile of the annual payout distribution, and to the less constrained subsample those firms in the top tercile of the annual payout distribution.

Asset size is defined as book value of total assets (Compustat annual item 6). At the end of June of each year t, we rank firms based on their total assets at the fiscal year ending in $t-1$. We assign those firms in the bottom tercile of the annual asset size distribution to the more constrained subsample and those firms in the top tercile of the annual asset size distribution to the less constrained subsample (e.g., Gilchrist and Himmelberg 1995, Erickson and Whited 2000).

Following Almeida, Campello, and Weisbach (2004), we retrieve data on firms' bond ratings assigned by Standard & Poor's and categorize those firms that never had their public debt rated during our sample period as financially constrained. Observations from those firms are only assigned to the financially constrained subsample in years when the firms report positive debt. The financially unconstrained subsample contains those firms whose bonds have been rated during the sample period. This approach has been used extensively in the corporate investment literature (e.g., Whited 1992, Kashyap, Lamont, and Stein 1994, Cummins, Hasset, and Oliner 1999).

We retrieve data on commercial paper ratings assigned by Standard & Poor's and categorize as the financially constrained subsample those firms that never had their issues rated during our sample period. Observations from those firms are only assigned to the financially constrained subsample when the firms report positive debt. Firms that have issued commercial papers receiving ratings at some point during the sample period are considered unconstrained. This approach follows that of Calomiris, Himmelberg, and Wachtel 1995, Almeida, Campello, and Weisbach 2004, and Almeida and Campello 2007).

For index-based measures, we use the WW index developed by Whited and Wu (2006) and the KZ index developed by Kaplan and Zingales (1997) and Lamont, Polk, and Saá-Requejo (2001). The WW index is computed using Compustat quarterly data according to the following formula:

$$WW = -0.091\,CF - 0.062\,DIVPOS + 0.021\,TLTD - 0.044\,LNTA + 0.102\,ISG - 0.035\,SG, \quad (1)$$

in which CF is the ratio of cash flow to total assets, $DIVPOS$ is an indicator that takes the value of one if the firm pays cash dividends, $TLTD$ is the ratio of the long term debt to total assets, $LNTA$ is the natural log of total assets, ISG is the firm's three-digit industry sales growth, and SG is firm sales growth. All variables are deflated by the replacement cost of total assets as the sum of the replacement value of the capital stock plus the rest of the total assets. The computation of the replacement value of the capital stock is detailed in Whited (1992).

Lamont, Polk, and Saá-Requejo (2001) use the regression coefficients from Kaplan and Zingales (1997) to compute the KZ index as follows:

$$\begin{aligned} KZ = {} & -1.001909\,\text{Cash Flow}/K + 0.2826389\,\text{Tobin's}\,Q + 3.139193\,\text{Debt/Total Capital} \\ & -39.3678\,\text{Dividends}/K - 1.314759\,\text{Cash}/K \end{aligned} \quad (2)$$

Cash Flow/K is measured as (Compustat item 18+item 14)/item 8. Tobin's Q is (item 6+CRSP December Market Equity−item 60−item 74)/item 6, Debt/Total Capital is (item 9+item 34)/(item 9+item 34+item 216). Dividends/K is (item 21+item 19)/item 8, and Cash/K is item 1 divided by item 8. (Item 8 is lagged.) The Compustat annual item numbers are as follows: 1 (cash and short-term investments), 6 (liabilities and stockholders' equity–total), 8 (property, plant, and equipment), 9 (long-term debt–total), 14 (depreciation and amortization), 18 (income before extraordinary items), 19 (dividends–preferred), 21 (dividends–common), 34 (debt in current liabilities), 60 (common equity–total), 74 (deferred taxes), and 216 (stockholders' equity–total). A firm needs to have valid information on all the above annual items to be able to have a value for the KZ index.

Table 1 reports the average cross-sectional Spearman's correlations among measures of financial constraints. At the end of each year from 1963 to 2006, we calculate all the pairwise cross-sectional correlations. The table reports the time series averages of the cross-sectional correlations. When evaluated with their time series standard errors, all the correlations are significant at the 1% level. Consistent with Whited and Wu (2004), the table shows that the WW index and the KZ index are only weakly correlated. While the WW index is highly correlated with asset size (correlation $= -0.95$), the correlation between the KZ index and asset size is only -0.07. The bond rating and the commercial paper rating have a high correlation of 0.53, but the correlations of the two ratings with other measures are relatively low. Finally, payout ratio and asset size have a high correlation of 0.47, meaning that small firms payout less than big firms.

2.2 Preliminary Analysis

Following Lyandres, Sun, and Zhang (2007), we measure investment-to-assets, I/A, as the change in property, plant, and equipment (Compustat annual item 7 minus lagged item 7) plus change in inventories (item 3 minus lagged item 3) divided by lagged total assets (item 6). We also have experimented with an alternative measure of investment-to-assets as capital expenditure (item 128) divided by lagged net property, plant, and equipment (item 8). And the results are largely similar (not reported). Following Cooper, Gulen, and Schill (2008), we measure asset growth, $\triangle A/A$, as the change in total assets (item 6 minus lagged item 6) divided by lagged total assets (item 6).

Following Fama and French (2007), we measure net stock issues as the the natural log of the ratio of the split-adjusted shares outstanding at the fiscal year-end in $t-1$ divided by the split-adjusted shares outstanding at the fiscal year-end in $t-2$. The split-adjusted shares outstanding is Compustat shares outstanding (item 25) times the Compustat adjustment factor (item 27).

We measure book-to-market equity (BE/ME) following Fama and French (1993). BE is the Compustat 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, we use redemption, liquidation, or par value (in that order) to estimate the book value of preferred stock. ME is price per share times the number of shares outstanding. The BE/ME ratio used to form portfolios in June of year t is book equity for the fiscal year ending in calendar year $t-1$, divided by market equity at the end of December of year $t-1$. We do not use negative BE firms. Also, only firms with ordinary common equity are included in the tests.

Table 2 reports the descriptive statistics of one-way sorted quintile portfolios on investment-to-assets, asset growth, book-to-market equity, and net stock issues. We follow the Fama and French (1993) portfolio approach in constructing these portfolios. At the end of June of each year t, we sort stocks into five equal-numbered quintiles on I/A, $\triangle A/A, BE/ME$, and NS. Portfolio returns are calculated from July of year t to June of year $t+1$, and the portfolios are rebalanced in each June. The table reports average returns in excess of the one-month Treasury bill rates, the CAPM alphas, and the alphas from the Fama-French three factor model for all the portfolios. We report both equal-weighted and value-weighted results.

Consistent with prior studies such as Titman, Wei, and Xie (2004), Xing (2007), and Lyandres, Sun, and Zhang (2008), Panel A of Table 2 shows that high investment-to-assets firms earn lower average returns than low investment-to-assets firms. The high-minus-low quintile portfolio has an average equal-weighted return of -0.92% per month ($t = -9.21$) and an average value-weighted return of -0.43% ($t = -3.57$). The CAPM alphas are quantitatively similar to the average returns, meaning that the market beta does little in explaining the investment anomaly. The Fama-French (1993) model helps explain the high-minus-low I/A return by reducing its value-weighted alpha to -0.20% per month ($t = -1.91$), but its equal-weighted alpha is still -0.86% ($t = -9.18$). Untabulated results show that the Fama-French model helps because the high-minus-low I/A portfolio has a significant negative loading on HML, consistent with Xing's and Chen and Zhang's (2008) evidence.

Panel B shows that, consistent with Cooper, Gulen, and Schill (2007), firms with high asset growth earn lower average returns than firms with low asset growth. The high-minus-low $\triangle A/A$ portfolio earns an equal-weighted average return of -1.12% per month ($t = -8.60$) and the CAPM alpha of -1.20% ($t = -9.70$). The value-weighted average return and CAPM alpha are -0.36% ($t = -2.43$) and -0.48% per month ($t = -3.35$), respectively. Similar to the case of I/A portfolios, the Fama-French (1993) model reduces the value-weighted alpha to an insignificant level of -0.07% per month, but leaves a significant equal-weighted alpha of -1.01% ($t = -8.16$) unexplained.

The results for book-to-market portfolios in Panel C are more well-known. The high-minus-low B/M portfolio earns an equal-weighted average return of 1.11% per month ($t = 6.50$) and a value-weighted average return of 0.50% ($t = 2.77$). The CAPM cannot explain the value anomaly. The equal-weighted CAPM alpha is 1.31% per month ($t=8.77$) and the value-weighted CAPM alpha is 0.60% ($t=3.40$). The Fama-French (1993) model leaves a significant negative value-weighted alpha of -0.24% per month ($t=-2.61$) and a significant positive equal-weighted alpha of 0.66% ($t=7.29$).

Consistent with Ikenberry, Lakonishok, and Vermalaen (1995) and Loughran and Ritter (1995), Panel D shows that stocks with high net share issues earn lower average returns than stocks with low net share issues. The high-minus-low NS quintile earns an equal-weighted average return of -0.70% per month ($t = -4.99$) and a CAPM alpha of -0.86% ($t = -6.86$). The net stock issues anomaly is pervasive across different market-cap groups. The value-weighted average returns and alphas for the high-minus-low NS portfolio are largely similar to their equal-weighted counterparts. And the Fama-French (1993) model cannot explain the net issues puzzle: The equal-weighted alpha is -0.62% per month ($t = -5.78$) and the value-weighted alpha is -0.44% ($t = -4.13$).

3 Main Results

Our focus is on how the magnitude of the investment, asset growth, book-to-market, and net stock issues anomalies varies with measures of financial constraints. Our test design is simple. At the end of June of year t, we split the sample into two or three subsamples based on one financial constraints measure at the end of fiscal year $t-1$. Within each subsample, we sort stocks into five quintiles based on investment-to-assets, asset growth, book-to-market, or net stock issues, and compare the magnitude of the average returns and alphas of the high-minus-low portfolios across extreme subsamples split by constraints measures.

3.1 The Investment Anomaly and Financial Constraints

Table 3 reports the variation of the investment anomaly across subsamples split on payout ratio and asset size. From the equal-weighted results in Panel A, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low I/A portfolio are more than twice as high in magnitude in the low payout (most constrained) subsample as their counterparts in the high payout (least constrained) subsample: -1.23% vs. -0.57%, -1.31% vs. -0.58%, and -1.17% vs. -0.54% per month, respectively. The value-weighted results also go in the same direction, but are less dramatic. The value-weighted average return of the high-minus-low I/A return is -0.62% per month ($t = -2.61$) in the low payout subsample, which is higher than that in the high payout subsample, -0.33% ($t = -2.67$). The value-weighted CAPM alpha also is higher in the most constrained sample: -0.67% vs. -0.34% per month. The value-weighted alpha from the Fama-French (1993) model is insignificant across all three subsamples split on the payout ratio.

Panel B shows that using asset size to measure financial constraints yields quantitatively similar results. The equal-weighted average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low I/A portfolio are $-1.11\%, -1.13\%$, and -1.06% per month in the small asset size (most constrained) subsample, respectively. In contrast, their counterparts are at least halved in the big asset size (least constrained) subsample: $-0.48\%, -0.55\%$, and -0.34% per month, respectively. The value-weighted average return and CAPM alpha of the high-minus-low I/A portfolio are higher in the most constrained subsample than those in the least constrained subsample: -0.45% vs. -0.30% and -0.51% vs. -0.37% per month, respectively. Interestingly, the value-weighted Fama-French alpha becomes significant in the most constrained subsample, -0.41% per month ($t = -2.37$), while it remains insignificant in the least constrained subsample, -0.08% ($t = -0.74$).

Table 4 reports the variation of the investment anomaly across subsamples split by bond ratings and by commercial paper ratings. Panel A reports the results with bond ratings. The investment anomaly is clearly stronger in the constrained firms. In the unconstrained subsmple, the equal-weighted average returns, CAPM alpha, and the Fama-French (1993) alpha are $-0.66\%, -0.72\%$, and -0.59% per month. These are between 50–65% of their counterparts in the constrained subsample, $-1.02\%, -1.08\%$, and -0.97% per month, respectively. The value-weighted results are even stronger. In the unconstrained subsample, the value-weighted average returns, CAPM alpha, and the Fama-French alpha are $-0.31\%, -0.36\%$, and -0.08%, which are close to or more than halved from their counterparts in the constrained subsample, $-0.62\%, -0.74\%$, and -0.46% per month, respectively. From Panel B, the results with commercial paper ratings are quantitatively similar.

Panel A of Table 5 reports the variation of the investment anomaly across subsamples split by the Whited-Wu (2004) index. With equal-weighting, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low I/A portfolio are $-0.43\%, -0.49\%$, and -0.29% per month, respectively, in the low WW (least constrained) subsample. These are less than one half of their counterparts, $-1.21\%, -1.25\%$, and -1.29% per month, respectively, in the high WW (most constrained) subsample. The value-weighted results go in the same direction, but are somewhat weaker. For example, the Fama-French alpha of the high-minus-low I/A portfolio in the high WW subsample is -0.52% per month ($t = -1.95$), which is higher in magnitude than the alpha of -0.11% ($t = -0.80$) in the low WW subsample. However, the relation between the magnitude of the investment anomaly and the WW index is not monotonic across the three subsamples. The value-weighted CAPM alpha is -0.37% per month in the low WW sample, which is lower in magnitude than the alpha of -0.56% in the high WW subsample. But the median WW subsample has the highest value-weighted alpha in magnitude, -0.80% per month.

Panel B of Table 5 reports the results with the Kaplan-Zingales (1997) index. With equal-weighting, the magnitude of the investment anomaly is higher in the high KZ (most constrained) subsample than that in the low KZ (least constrained) subsample. But the difference is lower in magnitude than the case with the WW index. Further, the relation between the magnitude of the investment anomaly and the KZ index is again not monotonic: The median KZ subsample has the lowest magnitude of the investment anomaly. With value-weighting, the magnitude of the investment anomaly is actually lower in the most constrained subsample than that in the least constrained sample. But the difference is fairly small in magnitude.

3.2 The Asset Growth Anomaly and Financial Constraints

Table 6 reports the variation of the asset growth anomaly across subsamples split on payout ratio and asset size. From the equal-weighted results in Panel A, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low $\triangle A/A$ portfolio are much higher in magnitude in the low payout subsample than their counterparts in the high payout subsample: -1.61% vs. -0.52%, -1.70% vs. -0.57%, and -1.49% vs. -0.39% per month, respectively. The value-weighted average return of the high-minus-low $\triangle A/A$ return is -0.56% per month ($t = -2.13$) in the low payout subsample versus -0.32% ($t = -1.91$) in the high payout subsample. The value-weighted CAPM alpha also is higher in the low payout subsample: -0.63% vs. -0.41% per month. But the value-weighted Fama-French (1993) alphas are insignificant across all three subsamples.

From Panel B of Table 6, using asset size to measure financial constraints yields quantitatively similar results. The equal-weighted average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low $\triangle A/A$ portfolio are $-1.49\%, -1.51\%$, and -1.36% per month in the small asset size subsample, respectively. Their counterparts are more than halved in the big asset size subsample: $-0.58\%, -0.68\%$, and -0.37% per month, respectively. The value-weighted average return and Fama-French alpha of the high-minus-low $\triangle A/A$ portfolio are higher in magnitude in the small asset size subsample than those in the big asset size subsample: -0.53% vs. -0.36% and -0.33% vs. -0.03% per month, respectively. But the difference in the value-weighted CAPM alpha is small: -0.56% vs. -0.49% per month.

Table 7 reports the asset growth anomaly across subsamples split by bond ratings and commercial paper ratings. From Panel A, the investment anomaly is clearly stronger in the constrained firms defined by bond ratings. In the unconstrained subsmple, the equal-weighted average returns, CAPM alpha, and the Fama-French (1993) alpha are $-0.66\%, -0.77\%$, and -0.55% per month, respectively. They are close to or more than halved from their counterparts in the constrained subsample, $-1.33\%, -1.40\%$, and -1.23% per month, respectively. The value-weighted results are even stronger. In the unconstrained subsample, the value-weighted average returns, CAPM alpha, and the Fama-French alpha are -0.21%, -0.33%, and 0.11%, which are close to or more than halved in magnitude from their counterparts in the constrained subsample, $-0.66\%, -0.77\%$, and -0.44% per month, respectively. The results with commercial paper ratings are quantitatively similar.

Panel A of Table 8 reports the asset growth anomaly across subsamples split by the Whited-Wu (2004) index. With equal-weighting, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low $\triangle A/A$ portfolio are $-0.50\%, -0.61\%$, and -0.33% per month in the low WW subsample, which are less than one half of their counterparts, $-1.56\%, -1.55\%$, and -1.40%, respectively, in the high WW subsample. The value-weighted results go in the same direction, but are somewhat weaker. The value-weighted average return and Fama-French alpha of the high-minus-low $\triangle A/A$ portfolio in the low WW subsample are -0.41% and -0.13%, which are lower in magnitude than their counterparts in the high WW subsample, -0.55% and -0.34%, respectively. But the value-weighted CAPM alpha is -0.55% per month in both extreme subsamples. Further, the relation between the value-weighted asset growth anomaly and the WW index is non-monotonic.

This non-monotonic relation does not appear when we use the KZ index. For example, the value-weighted average return of the high-minus-low $\triangle A/A$ portfolio increases in magnitude from -0.31% ($t = -1.63$) in the low KZ subsample, to -0.41% ($t = -2.30$) in the median KZ subsample, and to -0.70% per month ($t = -3.03$) in the high KZ subsample. The value-weighted CAPM alpha and Fama-French (1993) alpha also increase in magnitude from -0.49% to -0.69% and from -0.14% to -0.46% per month, respectively, from the low KZ subsample to the high KZ subsample. In general, the magnitude of the asset growth anomaly also increases monotonically with the KZ index.

3.3 The Value Anomaly and Financial Constraints

Table 9 reports the variation of the value anomaly across subsamples split on payout ratio and asset size. From the equal-weighted results in Panel A, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low B/M portfolio are more than twice as high in magnitude in the low payout subsample as their counterparts in the high payout subsample: 1.51% vs. 0.67%, 1.76% vs. 0.81%, and 1.05% vs. 0.27% per month, respectively. The value-weighted average return of the high-minus-low B/M return is 0.72% per month ($t = 2.40$) in the low payout subsample, which is higher than that in the high payout subsample, 0.32% ($t = 1.59$). The value-weighted CAPM alpha also is higher in the most constrained sample: 0.95% ($t = 3.34$) vs. 0.42% per month ($t = 2.23$).

From Panel B of Table 9, using asset size to measure financial constraints yields quantitatively similar results. The equal-weighted average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low B/M portfolio are 1.59%, 1.83%, and 1.34% per month in the small asset size subsample, respectively. In contrast, their counterparts in the big asset size subsample, 0.57%, 0.65%, and −0.06% per month, respectively, are less than one third of their respective magnitudes. The value-weighted results are similar. The value-weighted average return and CAPM alpha of the high-minus-low B/M portfolio are higher in the small asset size subsample than those in the big asset size subsample: 1.24% vs. 0.32% and 1.49% vs. 0.40% per month, respectively. Interestingly, the value-weighted Fama-French alpha becomes significant positive in the small asset size subsample, 0.86% per month ($t = 5.36$), but is significant negative in the big asset size subsample, −0.35% ($t = -4.18$).

Table 10 reports the value anomaly across subsamples split by bond ratings and commercial paper ratings. From Panel A, the value anomaly is stronger in the constrained firms defined by bond ratings. In the unconstrained subsmple, the equal-weighted average returns, CAPM alpha, and the Fama-French (1993) alpha of the high-minus-low B/M portfolio are 0.89%, 1.07%, and 0.44% per month, respectively. These are lower in magnitude than their counterparts in the constrained subsample, 1.15%, 1.34%, and 0.74% per month, respectively. The value-weighted results seem stronger. In the unconstrained subsample, the average return and CAPM alpha are 0.31% and 0.41%, which are less than one half in magnitude of their counterparts in the constrained subsample, 0.71% and 0.88% per month, respectively. The Fama-French alpha is weakly positive in the constrained subsample, but is significant negative in the unconstrained subsample. The results with commercial paper ratings are largely similar.

Table 11 reports the value anomaly across subsamples split by the Whited-Wu (2004) index and by the Kaplan-Zingales (1997) index. The value anomaly is clearly stronger in more financially constrained firms. From the equal-weighted results in Panel A, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low B/M portfolio are 0.56%, 0.68%, and 0.00% per month, respectively, in the low WW subsample. These are close to or less than one third of their counterparts, 1.57%, 1.82%, and 1.27% per month, respectively, in the high WW subsample. The value-weighted results are largely similar. The value-weighted average return, CAPM alpha, and Fama-French alpha of the high-minus-low B/M portfolio in the high WW subsample are higher in magnitude than those in the low WW subsample, 0.42% vs. 1.34%, 0.49% vs. 1.59%, and −0.18% vs. 0.91% per month. The results with the KZ index go in the same direction, but are less dramatic.

3.4 The Net Issues Anomaly and Financial Constraints

Table 12 reports the net stock issues anomaly across subsamples split on payout ratio and asset size. From the equal-weighted results in Panel A, the average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low NS portfolio are much higher in magnitude in the low payout subsample than their counterparts in the high payout subsample: −1.03% vs. −0.67%, −1.22% vs. −0.67%, and −0.92% vs. −0.54% per month, respectively. The value-weighted average return of the high-minus-low NS return is −0.95% per month in the low payout subsample, which is almost twice as high in magnitude as that in the high payout subsample, −0.50%. The value-weighted CAPM alpha and Fama-French (1993) alpha also are higher in magnitude in the low payout sample: −1.12% vs. −0.49% and −0.57% vs. −0.28% per month, respectively.

Panel B of Table 12 shows that using asset size to measure financial constraints yields quantitatively similar results. The equal-weighted average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low NS portfolio are −0.88%, −1.07%, and −0.86% per month in the small asset size subsample, respectively. In contrast, their counterparts in the big asset size subsample, −0.48%, −0.59%, and −0.43% per month are about one half of their respective magnitudes. The value-weighted results are largely similar. The average return, CAPM alpha, and Fama-French alpha of the high-minus-low NS portfolio are higher in magnitude in the small asset size subsample than those in the big asset size subsample: −1.02% vs. −0.48%, −1.20% vs. −0.56%, and −0.91% vs. −0.41% per month, respectively.

Table 13 reports the net stock issues anomaly across subsamples split by bond ratings and commercial paper ratings. From Panel A, the net stock issues anomaly is stronger in the constrained firms defined by bond ratings. In the unconstrained subsmple, the equal-weighted average return, CAPM alpha, and the Fama-French (1993) alpha of the high-minus-low NS portfolio are −0.46%, −0.57%, and −0.37% per month, respectively. These are lower in magnitude than their counterparts in the constrained subsample, −0.76%, −0.94%, and −0.69% per month, respectively.

The value-weighted results are largely similar. In the unconstrained subsample, the average return, CAPM alpha, and Fama-French alpha are $-0.31\%, -0.38\%$, and -0.28%, which are less than one half in magnitude of their counterparts in the constrained subsample, $-0.74\%, -0.88\%$, and -0.59% per month, respectively. The results with commercial paper ratings are largely similar.

Table 14 reports the net stock issues anomaly across subsamples split by the Whited-Wu (2004) index and by the Kaplan-Zingales (1997) index. From Panel A, the equal-weighted average return, CAPM alpha, and Fama-French (1993) alpha of the high-minus-low NS portfolio are $-0.43\%, -0.55\%$, and -0.42% per month, respectively, in the low WW subsample. These are less than one half in magnitude of their counterparts, $-1.02\%, -1.22\%$, and -0.94% per month, respectively, in the high WW subsample. The value-weighted results are largely similar. The average return, CAPM alpha, and Fama-French alpha of the high-minus-low NS portfolio in the low WW subsample are lower in magnitude than those in the high WW subsample, -0.46% vs. -1.31%, -0.56% vs. -1.52%, and -0.44% vs. -1.28% per month, respectively. From Panel B, the results with the KZ index go in the same direction, but are less dramatic. The equal-weighted average return, CAPM alpha, and Fama-French alpha are $-0.60\%, -0.81\%$, and -0.54% per month in the low KZ subsample and $-0.90\%, -1.02\%$, and -0.80% in the high KZ subsample, respectively. The value-weighted results are largely similar.

4 Theoretical Analysis

Why does the magnitude of the asset pricing anomalies vary across subsamples split on measures of financial constraints? The theoretical analysis in this section aims to shed light on this issue. Section 4.1 uses a simple two-period example to illustrate the basic intuition. Section 4.2 develops a dynamic model to demonstrate the quantitative relevance of the economic mechanism.

4.1 A Simple Two-Period Example

We incorporate costly external equity into investment-based asset pricing à la Cochrane (1991, 1996) and Liu, Whited, and Zhang (2007).

4.1.1 The Setup

Firms use capital and a vector of costlessly adjustable inputs to produce a perishable good. Firms choose the levels of these inputs each period to maximize their operating profits, defined as revenues minus the expenditures on these inputs. Taking the operating profits as given, firms then choose optimal investment to maximize their market value.

There are only two periods, t and $t+1$. Firm j starts with capital stock, k_{jt}, invests in period t, and produces in both t and $t+1$. The firm exits at the end of period $t+1$ with a liquidation value of $(1-\delta)k_{jt+1}$, in which δ is the firm-specific rate of capital depreciation. Operating profits, $\pi_{jt} = \pi(k_{jt}, x_{jt})$, depend on capital, k_{jt}, and a vector of exogenous aggregate and firm-specific productivity shocks, x_{jt}. Operating profits exhibit constant returns to scale, i.e., $\pi(k_{jt}, x_{jt}) = \pi_1(k_{jt}, x_{jt})k_{jt}$, in which the subscript denotes partial derivatives so $\pi_1(k_{jt}, x_{jt})$ is the marginal product of capital. Capital evolves as $k_{jt+1} = i_{jt} + (1-\delta)k_{jt}$, in which i_{jt} denotes capital investment. We use the one-period time-to-build convention: Capital goods invested today only become productive at the beginning of the next period. To highlight the role played by costly external equity, we assume that investment does not involve adjustment costs of capital as in Cochrane (1991).

We model costly external equity à la Kaplan and Zingales (1997) as follows. Define:

$$e_{jt} \equiv \max(0, i_{jt} - \pi(k_{jt}, x_{jt})) \tag{3}$$

When $e_{jt} > 0$, firm j raises the amount of e_{jt} via external equity. In this case, we assume that the firm incurs quadratic financing costs of $(\lambda/2)(e_{jt}/k_{jt})^2 k_{jt}$. Following Kaplan and Zingales, we use the constant parameter $\lambda > 0$ to capture the degree of financial constraints: A higher λ means that firms are more constrained and a lower λ means that firms are less constrained. The financing-cost function is increasing and convex in e_{jt}, decreasing in k_{jt}, and exhibits constant returns to scale.

Let m_{t+1} be the stochastic discount factor from time t to $t+1$, which is correlated with the aggregate component of x_{jt+1}. Firm j chooses i_{jt} to maximize the market value of equity as follows:

$$\max_{\{i_{jt}\}} \; \pi(k_{jt}, x_{jt}) - i_{jt} - \frac{\lambda}{2}\left(\frac{e_{jt}}{k_{jt}}\right)^2 k_{jt} + E_t\left[m_{t+1}\left[\pi(k_{jt+1}, x_{jt+1}) + (1-\delta_j)k_{jt+1}\right]\right] \tag{4}$$

The first part of this expression, denoted by $\pi(k_{jt}, x_{jt}) - i_{jt} - (\lambda/2)(e_{jt}/k_{jt})^2 k_{jt}$, is net cash flow during period t. Firms use operating profits $\pi(k_{jt}, x_{jt})$ to invest, which incurs the purchase costs, i_{jt}, and the financing costs, $(\lambda/2)\left(e_{jt}/k_{jt}\right)^2 k_{jt}$. The price of capital is normalized to be one. The second part of equation (4) contains the expected discounted value of the next period cash flow given by the sum of operating profits and the liquidation value of the capital stock.

The first-order condition is:

$$1 + \lambda \left(\frac{e_{jt}}{k_{jt}} \right) = E_t \left[m_{t+1} \left[\pi_1(k_{jt+1}, x_{jt+1}) + (1 - \delta) \right] \right] \quad (5)$$

The left side of the equality is the marginal cost of investment, and the right side is the marginal benefit of investment. To generate one additional unit of capital at the beginning of next period, k_{jt+1}, firms must pay the price of capital and the marginal financing cost, $\lambda(e_{jt}/k_{jt})$. The next-period marginal benefit of this additional unit of capital includes the marginal product of capital and the liquidation value of capital net of depreciation, $1 - \delta$. Discounting this next-period benefit using the pricing kernel m_{t+1} yields the marginal q.

Following Cochrane (1991), we define the investment return as the ratio of the marginal benefit of investment at period $t + 1$ divided by the marginal cost of investment at period t:

$$r^I_{jt+1} \equiv \frac{\pi_1(k_{jt+1}, x_{jt+1}) + (1 - \delta)}{1 + \lambda \left(e_{jt}/k_{jt} \right)} \quad (6)$$

Dividing equation (5) by the marginal cost of investment yields:

$$E_t \left[m_{t+1} r^I_{jt+1} \right] = 1 \quad (7)$$

Following Cochrane and Restoy and Rockinger (1994), we can show that stock returns equal investment returns with constant returns to scale.[2] Because of this equivalence, we use r_{jt+1} to denote by stock and investment returns in what follows.

[2]We define the ex-dividend equity value at period t as $p_{jt} \equiv E_t \left[m_{t+1} \left[\pi(k_{jt+1}, x_{jt+1}) + (1 - \delta) k_{jt+1} \right] \right]$. The ex-dividend equity value equals the cum-dividend equity value (the maximum in equation 4) minus the net cash flow over period t. We can define the stock return, r^S_{jt+1}, as

$$r^S_{jt+1} = \frac{\pi(k_{jt+1}, x_{jt+1}) + (1 - \delta) k_{jt+1}}{E_t[m_{t+1}[\pi(k_{jt+1}, x_{jt+1}) + (1 - \delta) k_{jt+1}]]}$$

in which the ex-dividend market value of equity in the numerator is zero in this two-period setting. Dividing both the numerator and the denominator of r^S_{jt+1} by k_{jt+1}, and invoking constant returns to scale yield:

$$r^S_{jt+1} = \frac{\pi_1(k_{jt+1}, x_{jt+1}) + (1 - \delta)}{E_t[m_{t+1}[\pi_1(k_{jt+1}, x_{jt+1}) + (1 - \delta)]]} = \frac{\pi_1(k_{jt+1}, x_{jt+1}) + (1 - \delta)}{1 + \lambda(e_{jt}/k_{jt})} = r^I_{jt+1}$$

The second equality follows from the first-order condition given by equation (5).

4.1.2 Qualitative Implications

Taking conditional expectations of equation (6) and differentiating $E_t[r_{jt+1}]$ with respect to i_{jt}/k_{jt} (and e_{jt}/k_{jt}) yield:

$$\frac{\partial E_t[r_{jt+1}]}{\partial(i_{jt}/k_{jt})} = \frac{\partial E_t[r_{jt+1}]}{\partial(e_{jt}/k_{jt})} = -\frac{\lambda(E_t[\pi_1(k_{jt+1}, x_{jt+1}) + 1 - \delta])}{[1 + \lambda(e_{jt}/k_{jt})]^2} < 0 \tag{8}$$

Our focus is on how the magnitude of asset pricing anomalies varies with the degree of costly external equity parsimoniously captured by the parameter λ in the model. Differentiating the absolute value of equation (8) with respect to λ, we obtain:

$$\partial\left|\frac{\partial E_t[r_{jt+1}]}{\partial(i_{jt}/k_{jt})}\right|/\partial\lambda = \partial\left|\frac{\partial E_t[r_{jt+1}]}{\partial(e_{jt}/k_{jt})}\right|/\partial\lambda = \frac{[1 - \lambda(e_{jt}/k_{jt})]E_t[\pi_1(k_{jt+1}, x_{jt+1}) + 1 - \delta]}{[1 + \lambda(e_{jt}/k_{jt})]^3} \tag{9}$$

which is positive as long as $1 - \lambda(e_{jt}/k_{jt}) > 0$.

Intuitively, with financing costs, higher investment means higher marginal costs of investment, which in turn mean lower expected returns, all else equal. This negative relation between investment-to-capital and the discount rate has been articulated before in the q-theory framework by Cochrane (1991) with adjustment costs of capital. We show that this negative relation also can be generated by costly external equity with convex financing costs. More important, for more constrained firms in which external equity is more costly, marginal costs of investment are more sensitive to increases in investment, meaning that the negative relation between expected returns and investment is stronger for more constrained firms.

The condition that $1 - \lambda(e_{jt}/k_{jt}) > 0$ is empirically plausible. We demonstrate this point using back-of-the-envelope calculations. The average investment-to-capital ratio is about 12% per annum, which is about 1% per month. Suppose 50% of the investment is financed by new equity, the average new equity-to-capital ratio is about 0.50% per month. Thus, $1 - \lambda(e_{jt}/k_{jt}) > 0$ holds as long as $\lambda < 200$ in monthly frequency. With an average new equity-to-capital ratio of 0.50%, $\lambda = 200$ means that financing costs are as high as 50% of the proceeds raised from external equity: $[(\lambda/2)(e_{jt}/k_{jt})^2 k_{jt}]/e_{jt} = (\lambda/2)(e_{jt}/k_{jt}) = (200/2) \times 0.50\% = 50\%$.

4.2 The Dynamic Model

While the two-period example is useful for illustrating the basic intuition. Its setup is unrealistic. To evaluate the quantitative relevance of the mechanism under reasonable parameter values, we develop and simulate from a more realistic dynamic asset pricing model à la Li, Livdan, and Zhang (2008).

4.2.1 The Environment

We parameterize the stochastic discount factor, denoted m_{t+1}:

$$\log m_{t+1} = \log \eta + \gamma_t (x_t - x_{t+1}) \tag{10}$$

$$\gamma_t = \gamma_0 + \gamma_1 (x_t - \overline{x}) \tag{11}$$

in which $1 > \eta > 0$, $\gamma_0 > 0$, and $\gamma_1 < 0$ are constant parameters and x_t is aggregate productivity. Equations (10) and (11) imply that the real interest rate is $1/E_t[m_{t+1}] = (1/\eta)\exp(-\mu_m - (1/2)\sigma_m^2)$ and the maximum Sharpe ratio is $\sigma_t[m_{t+1}]/E_t[m_{t+1}] = \sqrt{\exp(\sigma_m^2) - 1}$, in which $\mu_m \equiv [\gamma_0 + \gamma_1(x_t - \bar{x})](1-\rho_x)(x_t - \bar{x})$ and $\sigma_m \equiv \sigma_x[\gamma_0 + \gamma_1(x_t - \bar{x})]$. When $\gamma_1 = 0$, the Sharpe ratio is constant. Thus, we set $\gamma_1 < 0$ to capture the countercyclical Sharpe ratio à la Campbell and Cochrane (1999).

Production requires capital and is subject to aggregate productivity and firm-specific productivity shocks. The production function is given by:

$$\pi_{jt} = e^{x_t + z_{jt}} k_{jt}^{\alpha} - f \tag{12}$$

in which π_{jt} and k_{jt} are the operating profits and capital of firm j at time t, respectively, and f denotes nonnegative fixed costs of production. The production function exhibits decreasing returns to scale, i.e., $0 < \alpha < 1$. The aggregate productivity, x_t, has a stationary and monotone Markov transition function, $Q_x(x_{t+1}|x_t)$, and is given by:

$$x_{t+1} = \overline{x}(1 - \rho_x) + \rho_x x_t + \sigma_x \varepsilon_{t+1}^x \tag{13}$$

in which ε_{t+1}^x is an i.i.d. standard normal variable. The aggregate shock serves as the ultimate source of systematic risk. Without it, all firms will earn expected returns that equal the real interest rate. The firm-specific shock is the ultimate source of firm heterogeneity. The firm-specific productivity, z_{jt}, is uncorrelated across firms, indexed by j. z_{jt} has a common stationary and monotone Markov transition function, $Q_z(z_{jt+1}|z_{jt})$, given by:

$$z_{jt+1} = \rho_z z_{jt} + \sigma_z \varepsilon_{jt+1}^z \tag{14}$$

in which ε_{jt+1}^z is an i.i.d. standard normal variable (the firm-specific shock). ε_{jt+1}^z and ε_{it+1}^z are uncorrelated for any pair (i, j) with $i \neq j$, and ε_{t+1}^x is independent of ε_{jt+1}^z for all j.

Upon observing current aggregate and firm-specific productivity shocks, firm j chooses optimal investment, i_{jt}, to maximize its market value of equity. The capital accumulation follows:

$$k_{jt+1} = i_{jt} + (1-\delta)k_{jt} \tag{15}$$

in which δ denotes the constant rate of capital depreciation. Capital investment entail quadratic adjustment costs $(a/2)\left(i_{jt}/k_{jt}\right)^2 k_{jt}$, in which $a > 0$ is a constant parameter. When investment, i_{jt}, exceeds internal funds, π_{jt}, the firm raises new capital, e_{jt}, from the external markets:

$$e_{jt} \equiv \max\left(0, i_{jt} + \frac{a}{2}\left(\frac{i_{jt}}{k_{jt}}\right)^2 k_{jt} - \pi_{jt}\right) \tag{16}$$

External equity is costly (e.g., Smith 1977, Lee, Lochhead, Ritter, and Zhao 1996, and Altinkilic and Hansen 2000). To capture this effect, we parameterize the total financing-cost function as:

$$\lambda_0 \mathbf{1}_{\{e_{jt}>0\}} + \frac{\lambda_1}{2}\left(\frac{e_{jt}}{k_{jt}}\right)^2 k_{jt} \tag{17}$$

in which $\lambda_0 > 0$ captures the fixed costs, $\mathbf{1}_{\{e_{jt}>0\}}$ is an indicator that takes the value of one if the event described in $\{\cdot\}$ occurs, and the second term captures the variable costs of financing. When investment is lower than internal funds, firms pay the difference, d_{jt}, back to shareholders:

$$d_{jt} \equiv \max\left(0, \pi_{jt} - i_{jt} - \frac{a}{2}\left(\frac{i_{jt}}{k_{jt}}\right)^2 k_{jt}\right) \tag{18}$$

Firms do not incur costs when paying dividends or repurchasing shares.

Let $v(k_{jt}, z_{jt}, x_t)$ denote the cum-dividend market value of equity for firm j. Define:

$$o_{jt} \equiv d_{jt} - e_{jt} - \lambda_0 \mathbf{1}_{\{e_{jt}>0\}} - \frac{\lambda_1}{2}\left(\frac{e_{jt}}{k_{jt}}\right)^2 k_{jt} \tag{19}$$

to be the effective cash flow accrued to shareholders (cash distributions minus the sum of external equity raised and the financing costs). The dynamic value-maximizing problem for firm j is:

$$v(k_{jt}, z_{jt}, x_t) = \max_{\{i_{jt}\}} \; o_{jt} + \iint m_{t+1} v(k_{jt+1}, z_{jt+1}, x_{t+1})\, Q_z\left(dz_{jt+1}|z_{jt}\right) Q_x\left(dx_{t+1}|x_t\right) \tag{20}$$

subject to the capital accumulation equation (15) and the flow of funds constraint (19). Evaluating the value function at the optimum yields:

$$v_{jt} = o_{jt} + E_t\left[m_{t+1} v_{jt+1}\right] \quad \Rightarrow \quad 1 = E_t\left[m_{t+1} r_{jt+1}\right] \tag{21}$$

in which firm j's return is defined as: $r_{jt+1} \equiv v_{jt+1}/(v_{jt} - o_{jt})$. The risk-free rate is $r_{ft} \equiv 1/E_t[m_{t+1}]$.

4.2.2 Quantitative Results

We calibrate the model in monthly frequency. Following Zhang (2005), we use three aggregate moments (the mean and volatility of real interest rate and the average Sharpe ratio) to pin down the three parameters in the pricing kernel, $\eta = 0.994$, $\gamma_0 = 50$, and $\gamma_1 = -1,000$. The long-run average level of the aggregate productivity, $\bar{x}$, is a scaling variable, which we choose such that the average long-run capital in the economy is roughly one. We set the persistence of the aggregate productivity $\rho_x = \sqrt[3]{0.95}$ and its conditional volatility $\sigma_x = 0.007/3$. With the specification of x_t in equation (13), these monthly values correspond to quarterly values of 0.95 and 0.007, respectively, as in Cooley and Prescott (1995). The persistence ρ_z and conditional volatility σ_z of the firm-specific productivity are set to be 0.965 and 0.10, respectively, close to the values in Zhang.

We set the curvature of the production function α to be 0.70, close to the value estimated by Cooper and Ejarque (2001) and Hennessy and Whited (2006). The depreciation rate $\delta = 0.01$, which corresponds to an annual rate of depreciation of 12%, the empirical estimate of Cooper and Haltiwanger (2005). The adjustment cost parameter, a, is set to be 15. The fixed cost of production, f, is set to be 0.005 to match the average aggregate market-to-book ratio.

The focus of our analysis is on costly external finance. We study two economies that differ only in the degree of which external finance is costly. In the less constrained economy, the fixed financing cost parameter λ_0 is set to be zero and the convex financing cost parameter λ_1 is set to be 25. In the more constrained economy, λ_0 and λ_1 are set to be 0.02 and 50, respectively. All the other parameters are identical across the two economies.

We solve the dynamic model using the standard value function iteration techniques. Once the model is solved, we simulate 100 artificial panels, each of which has 3,500 firms and 480 months. We start the simulations with all firms having identical capital stock that equals its long-run level of one and firm-specific productivity drawn from the unconditional distribution of z. We simulate 600 months of panel data and discard the initial 120 months to alleviate the effect of initial conditions on the simulation results. On each artificial panel, we sort all firms into quintiles based on investment-to-capital, i/k, book-to-market, k/v, and net stock issues, $(e - d)/k$. The timing of the sorts follows that of the standard Fama-French (1993) portfolio approach.

Table 15 reports the sorting results averaged across 100 simulations. The magnitude of the anomalies clearly increases with the degree of financial frictions. The value-weighted high-minus-low investment portfolio has an average return of −0.05% per month and a CAPM alpha of −0.10% ($t = -1.41$) in the less constrained economy. The average return and the CAPM alpha increase in magnitude to −0.14% and −0.21% per month ($t = -2.97$), respectively, in the more constrained economy. The value-weighted high-minus-low book-to-market portfolio earns an average return of 0.53% and a CAPM alpha of 0.87% per month in the less constrained economy. The average return increases to 1.42% and the CAPM alpha increases to 1.59% per month in the more constrained economy. The value-weighted high-minus-low net stock issues portfolio earns an average return of −0.68% and a CAPM alpha of −1.51% per month in the less constrained economy. The average return increases in magnitude to −1.51% and the CAPM alpha to −1.69% per month in the more constrained economy. The results using equal-weighted returns are largely similar. However, the model fails to generate significant Fama-French (1993) alpha for the high-minus-low portfolios and the evidence that the Fama-French alpha is higher for the more constrained firms.

5 Conclusion

Our main contribution is to document that the magnitude of the investment anomaly, the asset growth anomaly, the value premium, and the net stock issues puzzle is higher in financially more constrained firms than that in financially less constrained firms. We also show that an investment-based asset pricing model with costly external finance can help interpret the evidence. Intuitively, financial frictions make marginal costs of investment more sensitive to investment in more constrained firms, giving rise to a stronger negative relation between investment and the discount rate.

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Table 1 : Correlation Matrix of Measures of Financial Constraints (1963–2006, 44 Years)

This table reports the average cross-sectional Spearman's rank correlations across measures of financial constraints. The measures include the Kaplan-Zingales (1997, KZ) index, the Whited-Wu (2004, WW) index, payout ratio, asset size, bond ratings, and commercial paper ratings. Their detailed definitions are provided in Section 2. At the end of each year from 1963 to 2006, we calculate the pairwise cross-sectional Spearman correlations across the six financial constraints measures. The table reports the time series averages of these cross-sectional correlations.

	KZ	WW	Payout ratio	Asset size	Bond rating	Commercial paper rating
KZ	1	0.15	−0.35	−0.07	0.22	0.26
WW		1	−0.52	−0.95	0.24	0.10
Payout ratio			1	0.47	−0.17	−0.11
Asset size				1	−0.23	−0.04
Bond rating					1	0.53
Commercial paper rating						1

Table 2 : Descriptive Statistics of One-Way Sorted Portfolios (July 1963–December 2006, 534 Months)

This table reports the descriptive statistics of one-way sorted portfolios on book-to-market (B/M) defined as the ratio of book equity to market equity as in Fama-French (1993), investment (I/A) defined as change in gross property, plant, and equipment (Compustat annual item 3) plus change in inventories (item 3) divided by lagged total assets (item 6), asset growth ($\triangle A/A$) defined as change in total assets divided by lagged total assets, and net stock issues (NS) defined as the change in the natural logarithms of the number of shares outstanding adjusted for splits to capture the effect of share repurchases and seasoned equity offerings. At the end of each June of year t, firms are sorted into five equal-numbered portfolios based on the sorting variables. The high-minus-low portfolio is created by going long on the high portfolio and short on the low portfolio. Portfolio returns are computed from July of year t to June of year $t+1$. The portfolios are rebalanced in each June. For high-minus-low portfolios, heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r-r_f$) is the difference between portfolio returns and one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regressions of portfolio returns on the market factor and the three Fama-French (1993) factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Investment-to-assets, I/A						Panel B: Asset growth, $\triangle A/A$					
Low	1.37	0.82	0.44	0.77	0.26	0.09	1.49	0.92	0.56	0.65	0.15	−0.01
	(4.75)	(4.49)	(4.33)	(3.51)	(3.20)	(1.13)	(4.69)	(4.29)	(4.23)	(2.94)	(1.63)	(−0.15)
2	1.09	0.56	0.28	0.56	0.09	0.05	1.03	0.55	0.22	0.56	0.14	0.01
	(4.25)	(4.07)	(3.72)	(2.84)	(1.54)	(0.92)	(4.56)	(4.71)	(3.20)	(3.13)	(2.22)	(0.19)
3	0.94	0.42	0.18	0.47	0.05	0.07	0.85	0.37	0.10	0.47	0.05	−0.01
	(3.91)	(3.64)	(2.86)	(2.65)	(0.95)	(1.50)	(3.89)	(3.67)	(1.93)	(2.64)	(0.85)	(−0.30)
4	0.78	0.24	0.00	0.39	−0.11	0.01	0.77	0.23	0.00	0.52	0.02	0.16
	(3.10)	(1.95)	(0.03)	(1.87)	(−1.74)	(0.13)	(3.12)	(2.00)	(−0.02)	(2.50)	(0.40)	(2.95)
High	0.45	−0.16	−0.43	0.34	−0.24	−0.12	0.37	−0.29	−0.45	0.29	−0.33	−0.09
	(1.56)	(−1.08)	(−4.49)	(1.38)	(−3.01)	(−1.58)	(1.18)	(−1.83)	(−4.45)	(1.08)	(−3.51)	(−1.14)
H−L	−0.92	−0.98	−0.86	−0.43	−0.50	−0.20	−1.12	−1.20	−1.01	−0.36	−0.48	−0.07
	(−9.21)	(−10.17)	(−9.18)	(−3.57)	(−4.23)	(−1.91)	(−8.60)	(−9.70)	(−8.16)	(−2.43)	(−3.35)	(−0.59)
	Panel C: Book-to-market, B/M						Panel D: Net share issues, NS					
Low	0.36	−0.32	−0.21	0.31	−0.22	0.11	1.16	0.68	0.30	0.68	0.24	0.12
	(1.13)	(−1.89)	(−1.94)	(1.36)	(−2.64)	(1.88)	(5.06)	(5.52)	(4.68)	(3.61)	(3.71)	(2.00)
2	0.62	0.03	−0.11	0.46	−0.03	−0.04	1.06	0.58	0.19	0.49	0.09	0.01
	(2.28)	(0.24)	(−1.46)	(2.24)	(−0.55)	(−0.77)	(4.45)	(4.15)	(2.30)	(2.80)	(1.24)	(0.16)
3	0.86	0.32	0.03	0.49	0.05	−0.08	0.94	0.40	0.14	0.55	0.07	0.12
	(3.41)	(2.55)	(0.44)	(2.54)	(0.63)	(−1.19)	(3.73)	(3.19)	(2.16)	(2.71)	(1.14)	(2.13)
4	1.07	0.59	0.18	0.63	0.22	−0.13	0.86	0.26	0.09	0.45	−0.10	0.05
	(4.51)	(4.41)	(2.87)	(3.40)	(2.59)	(−2.31)	(3.07)	(1.88)	(1.23)	(1.94)	(−1.32)	(0.72)
High	1.47	0.99	0.46	0.81	0.38	−0.13	0.46	−0.17	−0.31	0.14	−0.40	−0.32
	(5.62)	(5.74)	(4.90)	(3.85)	(3.20)	(−1.67)	(1.49)	(−1.02)	(−2.84)	(0.59)	(−5.23)	(−4.51)
H−L	1.11	1.31	0.66	0.50	0.60	−0.24	−0.70	−0.86	−0.62	−0.55	−0.64	−0.44
	(6.50)	(8.77)	(7.29)	(2.77)	(3.40)	(−2.61)	(−4.99)	(−6.86)	(−5.78)	(−4.40)	(−5.36)	(−4.13)

Table 3 : The Variation of the Investment Anomaly across Subsamples Split by Payout Ratio and by Asset Size (July 1963–December 2006, 534 Months)

At the end of June of year t, we split firms into three equal-numbered subsamples based on their payout ratios (Panel A) and on their asset size (Panel B) using accounting variables in fiscal year ending in calendar year $t-1$. Payout ratio is defined as the sum of dividends and stock repurchase divided by operating income. Asset size is total book assets (Compustat annual item 6). Within each payout ratio or asset size subsample, firms are sorted into five equal-numbered portfolios based on investment-to-assets (I/A) defined as (change in item 7 + change in item 3)/lagged item 6. The high-minus-low portfolio goes long on the high I/A portfolio and short on the low I/A portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by payout ratio						Panel B: Subsamples by asset size					
	Low payout ratio (most constrained)						Small asset size (most constrained)					
Low	1.50	0.89	0.54	0.63	−0.10	−0.26	1.69	1.13	0.76	0.57	−0.05	−0.15
2	1.44	0.82	0.56	0.61	−0.06	0.00	1.67	1.12	0.84	0.71	0.08	0.06
3	1.04	0.39	0.18	0.68	−0.06	−0.03	1.42	0.85	0.61	0.70	0.03	0.05
4	0.86	0.20	0.02	0.39	−0.37	−0.10	1.11	0.53	0.28	0.60	−0.06	0.04
High	0.27	−0.41	−0.63	0.01	−0.77	−0.46	0.59	0.00	−0.30	0.11	−0.57	−0.55
H−L I/A	−1.23	−1.31	−1.17	−0.62	−0.67	−0.19	−1.11	−1.13	−1.06	−0.45	−0.51	−0.41
	(−6.82)	(−7.46)	(−6.79)	(−2.61)	(−2.82)	(−0.86)	(−7.84)	(−8.09)	(−8.09)	(−2.61)	(−2.94)	(−2.37)
	Median payout ratio						Median asset size					
Low	1.19	0.68	0.27	0.77	0.21	0.01	1.20	0.66	0.26	0.87	0.28	0.20
2	0.95	0.42	0.08	0.64	0.08	0.07	0.97	0.43	0.13	0.75	0.15	0.16
3	0.88	0.35	0.07	0.52	−0.02	0.04	0.93	0.39	0.13	0.68	0.07	0.20
4	0.77	0.21	−0.09	0.46	−0.13	−0.09	0.76	0.19	−0.08	0.58	−0.07	0.09
High	0.47	−0.10	−0.46	0.28	−0.29	−0.26	0.40	−0.25	−0.51	0.39	−0.31	−0.24
H−L I/A	−0.72	−0.78	−0.72	−0.48	−0.50	−0.27	−0.80	−0.91	−0.77	−0.48	−0.60	−0.44
	(−5.99)	(−6.73)	(−6.11)	(−2.63)	(−2.64)	(−1.44)	(−7.29)	(−9.05)	(−7.50)	(−3.53)	(−4.59)	(−3.42)
	High payout ratio (least constrained)						Big asset size (least constrained)					
Low	1.13	0.66	0.29	0.72	0.25	0.07	0.86	0.33	−0.06	0.66	0.19	0.03
2	0.89	0.44	0.12	0.52	0.05	0.03	0.74	0.27	−0.03	0.52	0.08	0.08
3	0.87	0.43	0.19	0.55	0.14	0.10	0.69	0.22	−0.03	0.45	0.03	0.04
4	0.78	0.35	0.06	0.50	0.05	0.10	0.61	0.10	−0.12	0.36	−0.14	−0.02
High	0.57	0.08	−0.25	0.39	−0.09	−0.10	0.38	−0.21	−0.40	0.37	−0.19	−0.05
H−L I/A	−0.57	−0.58	−0.54	−0.33	−0.34	−0.17	−0.48	−0.55	−0.34	−0.30	−0.37	−0.08
	(−7.19)	(−7.28)	(−6.87)	(−2.67)	(−2.68)	(−1.33)	(−5.07)	(−5.85)	(−3.78)	(−2.51)	(−3.17)	(−0.74)

Table 4 : The Variation of the Investment Anomaly across Subsamples Split by Bond Ratings and by Commercial Paper Ratings (July 1963–December 2006, 534 Months)

At the end of June of year t, we split firms into two subsamples based on their bond ratings (Panel A) and on commercial paper ratings (Panel B) at the fiscal year ending in calendar year $t-1$. In Panel A, the constrained subsample contains all the firms with debt outstanding but without a bond rating, and the unconstrained subsample contains all the firms whose bonds are rated. In Panel B, the constrained subsample contains all the firms with debt outstanding but without a commercial paper rating, and the unconstrained subsample contains all the firms whose commercial papers are rated. Within each bond ratings or commercial paper ratings subsample, firms are sorted into five equal-numbered portfolios based on investment-to-assets (I/A) defined as (change in item 7 + change in item 3)/lagged item 6. The high-minus-low portfolio goes long on the high I/A portfolio and short on the low I/A portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by bond ratings						Panel B: Subsamples by commercial paper ratings					
	With bond ratings (unconstrained)						With commercial paper ratings (unconstrained)					
Low	1.41	0.90	0.58	0.79	0.32	0.18	1.37	0.86	0.54	0.83	0.37	0.26
2	1.10	0.61	0.43	0.57	0.15	0.17	1.06	0.57	0.40	0.61	0.18	0.22
3	0.96	0.49	0.32	0.47	0.07	0.09	0.83	0.35	0.21	0.44	0.05	0.08
4	0.88	0.39	0.24	0.43	−0.04	0.12	0.81	0.31	0.16	0.44	−0.03	0.14
High	0.74	0.18	−0.02	0.48	−0.04	0.10	0.63	0.06	−0.16	0.56	0.04	0.20
H−L I/A	−0.66	−0.72	−0.59	−0.31	−0.36	−0.08	−0.74	−0.80	−0.70	−0.27	−0.33	−0.05
	(−5.07)	(−5.64)	(−4.90)	(−2.25)	(−2.62)	(−0.63)	(−5.17)	(−5.70)	(−5.43)	(−1.91)	(−2.30)	(−0.40)
	Without bond ratings (constrained)						Without commercial paper ratings (constrained)					
Low	1.36	0.82	0.41	0.69	0.18	0.00	1.39	0.86	0.44	0.71	0.22	−0.03
2	1.10	0.58	0.24	0.49	0.00	−0.11	1.15	0.64	0.28	0.50	0.02	−0.16
3	0.92	0.40	0.12	0.35	−0.12	−0.12	0.98	0.47	0.16	0.45	−0.01	−0.06
4	0.74	0.20	−0.10	0.24	−0.31	−0.29	0.78	0.24	−0.07	0.21	−0.33	−0.32
High	0.34	−0.26	−0.57	0.07	−0.56	−0.46	0.36	−0.25	−0.53	0.06	−0.55	−0.48
H−L I/A	−1.02	−1.08	−0.97	−0.62	−0.74	−0.46	−1.04	−1.11	−0.97	−0.65	−0.78	−0.45
	(−9.59)	(−10.67)	(−9.49)	(−4.14)	(−5.11)	(−3.49)	(−8.49)	(−9.35)	(−7.97)	(−4.07)	(−5.01)	(−3.08)

Table 5 : The Variation of the Investment Anomaly across Subsamples Split by the Whited-Wu (2004) Index and by the Kaplan-Zingales (1997) Index (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their Whited-Wu (WW) index values (Panel A) and on their Kaplan-Zingales (KZ) index values (Panel B) using accounting variables in fiscal year ending in calendar year $t{-}1$. The details of constructing the WW and KZ indexes are described in Section 2. By construction, more constrained firms have higher WW and KZ indexes. Within each financial constraints subsample, firms are sorted into five equal-numbered portfolios based on investment-to-assets (I/A) defined as (change in item 7 + change in item 3)/lagged item 6. The high-minus-low portfolio goes long on the high I/A portfolio and short on the low I/A portfolio. Portfolio returns are computed over the period from July of year t to June of year $t{+}1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by the WW-index						Panel B: Subsamples by the KZ-index					
	Low WW (least constrained)						Low KZ (least constrained)					
Low	0.91	0.29	−0.11	0.67	0.08	−0.04	1.21	0.70	0.50	0.81	0.36	0.21
2	0.93	0.35	−0.04	0.78	0.21	0.06	1.00	0.45	0.33	0.60	0.13	0.17
3	0.86	0.29	0.06	0.64	0.10	0.16	0.82	0.29	0.20	0.38	−0.03	0.03
4	0.70	0.12	−0.13	0.50	−0.12	−0.06	0.76	0.19	0.09	0.42	−0.09	0.12
High	0.61	−0.08	−0.34	0.52	−0.17	−0.13	0.36	−0.28	−0.36	0.36	−0.19	−0.02
H−L I/A	−0.43	−0.49	−0.29	−0.28	−0.37	−0.11	−0.86	−0.98	−0.86	−0.46	−0.55	−0.23
	(−3.89)	(−4.41)	(−2.65)	(−1.98)	(−2.61)	(−0.80)	(−7.53)	(−9.52)	(−7.90)	(−2.65)	(−3.25)	(−1.48)
	Median WW						Median KZ					
Low	1.20	0.56	0.17	0.96	0.21	0.01	1.31	0.78	0.42	0.66	0.16	−0.02
2	1.10	0.48	0.30	0.91	0.20	0.25	1.05	0.55	0.23	0.49	0.07	−0.06
3	0.86	0.31	0.09	0.78	0.15	0.26	0.94	0.46	0.17	0.51	0.09	0.02
4	0.94	0.24	0.00	0.74	−0.10	0.05	0.78	0.26	−0.02	0.39	−0.09	−0.08
High	0.33	−0.42	−0.67	0.25	−0.59	−0.53	0.57	−0.03	−0.31	0.36	−0.23	−0.05
H−L I/A	−0.87	−0.98	−0.84	−0.70	−0.80	−0.55	−0.74	−0.81	−0.73	−0.30	−0.39	−0.03
	(−6.33)	(−7.50)	(−6.27)	(−4.08)	(−4.69)	(−3.21)	(−6.48)	(−7.38)	(−6.55)	(−1.80)	(−2.34)	(−0.17)
	High WW (most constrained)						High KZ (most constrained)					
Low	2.04	1.32	1.12	0.88	0.08	0.04	1.52	0.93	0.40	0.70	0.12	−0.22
2	1.83	1.03	0.40	0.72	−0.20	−0.59	1.41	0.84	0.38	0.67	0.13	−0.11
3	1.58	0.94	0.70	0.73	−0.07	−0.10	0.97	0.43	0.06	0.35	−0.13	−0.23
4	1.35	0.69	0.49	0.75	−0.06	0.00	0.86	0.29	−0.05	0.48	−0.04	−0.06
High	0.82	0.07	−0.17	0.42	−0.48	−0.48	0.48	−0.14	−0.53	0.27	−0.34	−0.35
H−L I/A	−1.21	−1.25	−1.29	−0.47	−0.56	−0.52	−1.05	−1.07	−0.93	−0.43	−0.46	−0.13
	(−5.64)	(−5.78)	(−5.71)	(−1.85)	(−2.21)	(−1.95)	(−6.70)	(−6.93)	(−6.27)	(−2.41)	(−2.58)	(−0.75)

Table 6 : The Variation of the Asset Growth Anomaly across Subsamples Split by Payout Ratio and by Asset Size (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their payout ratios (Panel A) and on their asset size (Panel B) using accounting variables in fiscal year ending in calendar year $t-1$. Payout ratio is defined as the sum of dividends and stock repurchase divided by operating income. Asset size is total book assets (Compustat annual item 6). Within each payout ratio or asset size subsample, firms are sorted into five equal-numbered portfolios based on asset growth ($\triangle A/A$) defined as the change in total assets (item 6) divided by lagged total assets. The high-minus-low portfolio goes long on the high $\triangle A/A$ portfolio and short on the low $\triangle A/A$ portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by payout ratio						Panel B: Subsamples by asset size					
	Low payout ratio (most constrained)						Small asset size (most constrained)					
Low	1.78	1.12	0.81	0.59	−0.14	−0.24	1.96	1.34	0.98	0.57	−0.12	−0.24
2	1.44	0.86	0.51	0.76	0.09	−0.01	1.68	1.16	0.85	0.83	0.23	0.19
3	1.03	0.42	0.12	0.69	0.01	−0.01	1.32	0.80	0.51	0.70	0.10	0.08
4	0.74	0.11	−0.09	0.50	−0.24	−0.06	1.05	0.50	0.24	0.72	0.07	0.10
High	0.16	−0.58	−0.68	0.02	−0.77	−0.38	0.47	−0.17	−0.38	0.04	−0.68	−0.57
H−L $\triangle A/A$	−1.61	−1.70	−1.49	−0.56	−0.63	−0.13	−1.49	−1.51	−1.36	−0.53	−0.56	−0.33
	(−7.38)	(−8.02)	(−7.16)	(−2.13)	(−2.42)	(−0.56)	(−8.34)	(−8.61)	(−8.07)	(−2.82)	(−2.98)	(−1.85)
	Median payout ratio						Median asset size					
Low	1.24	0.73	0.24	0.68	0.17	−0.19	1.20	0.63	0.23	0.74	0.12	−0.04
2	1.05	0.57	0.18	0.67	0.16	0.03	1.03	0.54	0.18	0.83	0.29	0.19
3	0.95	0.44	0.16	0.68	0.15	0.07	0.88	0.37	0.07	0.81	0.25	0.24
4	0.66	0.09	−0.19	0.43	−0.15	−0.04	0.76	0.19	−0.06	0.71	0.08	0.19
High	0.37	−0.25	−0.49	0.09	−0.56	−0.39	0.30	−0.40	−0.53	0.31	−0.45	−0.17
H−L $\triangle A/A$	−0.87	−0.98	−0.73	−0.60	−0.74	−0.19	−0.90	−1.03	−0.76	−0.42	−0.57	−0.13
	(−6.49)	(−8.00)	(−6.05)	(−2.70)	(−3.47)	(−0.94)	(−6.91)	(−8.60)	(−6.59)	(−2.55)	(−3.67)	(−0.94)
	High payout ratio (least constrained)						Big asset size (least constrained)					
Low	1.13	0.66	0.25	0.77	0.33	0.08	0.86	0.34	−0.07	0.65	0.20	0.01
2	0.88	0.47	0.11	0.62	0.20	0.03	0.70	0.27	−0.05	0.46	0.07	−0.03
3	0.89	0.47	0.17	0.56	0.15	0.05	0.69	0.24	−0.02	0.45	0.03	−0.04
4	0.74	0.30	0.04	0.49	0.06	0.03	0.60	0.09	−0.10	0.53	0.05	0.17
High	0.61	0.09	−0.14	0.45	−0.08	0.14	0.28	−0.34	−0.44	0.29	−0.29	−0.03
H−L $\triangle A/A$	−0.52	−0.57	−0.39	−0.32	−0.41	0.06	−0.58	−0.68	−0.37	−0.36	−0.49	−0.03
	(−6.17)	(−7.02)	(−5.45)	(−1.91)	(−2.45)	(0.44)	(−4.89)	(−6.04)	(−3.83)	(−2.34)	(−3.25)	(−0.28)

Table 7 : The Variation of the Asset Growth Anomaly across Subsamples Split by Bond Ratings and by Commercial Paper Ratings (July 1963–December 2006, 534 Months)

At the end of June of year t, we split firms into two subsamples based on their bond ratings (Panel A) and on commercial paper ratings (Panel B) at the fiscal year ending in calendar year $t-1$. In Panel A, the constrained subsample contains all the firms with debt outstanding but without a bond rating, and the unconstrained subsample contains all the firms whose bonds are rated. In Panel B, the constrained subsample contains all the firms with debt outstanding but without a commercial paper rating, and the unconstrained subsample contains all the firms whose commercial papers are rated. Within each bond ratings or commercial paper ratings subsample, firms are sorted into five equal-numbered portfolios based on asset growth ($\triangle A/A$) defined as the change in total assets (item 6) divided by lagged total assets. The high-minus-low portfolio goes long on the high $\triangle A/A$ portfolio and short on the low $\triangle A/A$ portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

Portfolio	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by bond ratings						Panel B: Subsamples by commercial paper ratings					
	With bond ratings (unconstrained)						With commercial paper ratings (unconstrained)					
Low	1.39	0.87	0.59	0.65	0.20	0.05	1.39	0.85	0.58	0.66	0.19	0.08
2	0.91	0.47	0.23	0.54	0.15	0.06	0.87	0.43	0.20	0.59	0.21	0.11
3	0.86	0.41	0.21	0.44	0.03	0.00	0.82	0.37	0.18	0.46	0.04	0.03
4	0.86	0.35	0.22	0.52	0.05	0.18	0.81	0.29	0.17	0.50	0.03	0.19
High	0.73	0.09	0.05	0.45	−0.13	0.16	0.56	−0.09	−0.16	0.45	−0.13	0.18
H−L $\triangle A/A$	−0.66	−0.77	−0.55	−0.21	−0.33	0.11	−0.82	−0.94	−0.74	−0.21	−0.32	0.10
	(−4.18)	(−5.18)	(−3.80)	(−1.24)	(−2.02)	(0.81)	(−4.98)	(−6.04)	(−4.96)	(−1.14)	(−1.83)	(0.63)
	Without bond ratings (constrained)						Without commercial paper ratings (constrained)					
Low	1.53	0.97	0.57	0.66	0.12	−0.05	1.54	0.98	0.58	0.64	0.14	−0.10
2	1.08	0.60	0.22	0.47	0.04	−0.16	1.07	0.61	0.23	0.51	0.08	−0.10
3	0.85	0.37	0.06	0.41	−0.04	−0.10	0.81	0.32	0.03	0.39	−0.06	−0.18
4	0.71	0.17	−0.12	0.40	−0.13	−0.10	0.70	0.17	−0.12	0.32	−0.21	−0.19
High	0.21	−0.43	−0.65	0.00	−0.65	−0.49	0.28	−0.35	−0.57	0.05	−0.59	−0.46
H−L $\triangle A/A$	−1.33	−1.40	−1.23	−0.66	−0.77	−0.44	−1.26	−1.33	−1.14	−0.59	−0.73	−0.35
	(−9.87)	(−10.86)	(−9.40)	(−4.21)	(−5.06)	(−3.02)	(−8.89)	(−9.82)	(−8.25)	(−3.59)	(−4.71)	(−2.39)

Table 8 : The Variation of the Asset Growth Anomaly across Subsamples Split by the Whited-Wu (2004) Index and by the Kaplan-Zingales (1997) Index (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their Whited-Wu (WW) index values (Panel A) and on their Kaplan-Zingales (KZ) index values (Panel B) using accounting variables in fiscal year ending in calendar year t−1. The details of constructing the WW and KZ indexes are described in Section 2. By construction, more constrained firms have higher WW and KZ indexes. Within each financial constraints subsample, firms are sorted into five equal-numbered portfolios based on investment-to-assets (I/A) defined as (change in item 7 + change in item 3)/lagged item 6. The high-minus-low portfolio goes long on the high I/A portfolio and short on the low I/A portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by the WW-index						Panel B: Subsamples by the KZ-index					
	Low WW (least constrained)						Low KZ (least constrained)					
Low	0.87	0.34	−0.05	0.73	0.25	0.05	1.21	0.68	0.50	0.68	0.23	0.13
2	0.80	0.34	−0.02	0.53	0.08	−0.04	1.03	0.55	0.34	0.53	0.11	0.05
3	0.72	0.24	−0.09	0.60	0.12	−0.01	0.84	0.33	0.18	0.50	0.07	0.12
4	0.67	0.13	−0.13	0.48	−0.06	−0.04	0.79	0.20	0.15	0.51	0.01	0.24
High	0.37	−0.27	−0.38	0.32	−0.31	−0.09	0.29	−0.39	−0.39	0.36	−0.26	−0.01
H−L $\triangle A/A$	−0.50	−0.61	−0.33	−0.41	−0.55	−0.13	−0.92	−1.07	−0.89	−0.31	−0.49	−0.14
	(−3.73)	(−4.72)	(−2.91)	(−2.19)	(−3.06)	(−0.86)	(−6.15)	(−7.93)	(−6.08)	(−1.63)	(−2.71)	(−0.81)
	Median WW						Median KZ					
Low	1.14	0.57	0.17	0.76	0.12	−0.05	1.43	0.89	0.54	0.69	0.20	−0.06
2	1.09	0.58	0.17	0.98	0.38	0.18	1.05	0.58	0.23	0.56	0.15	0.00
3	0.96	0.49	0.26	0.86	0.31	0.32	0.92	0.45	0.13	0.54	0.13	−0.03
4	0.78	0.18	−0.06	0.83	0.14	0.21	0.80	0.28	−0.01	0.65	0.16	0.19
High	0.18	−0.53	−0.66	0.08	−0.71	−0.50	0.47	−0.16	−0.39	0.28	−0.33	−0.11
H−L $\triangle A/A$	−0.97	−1.10	−0.83	−0.68	−0.84	−0.45	−0.95	−1.05	−0.93	−0.41	−0.53	−0.04
	(−5.90)	(−7.19)	(−5.42)	(−3.31)	(−4.28)	(−2.37)	(−7.12)	(−8.23)	(−7.08)	(−2.30)	(−2.98)	(−0.29)
	High WW (most constrained)						High KZ (most constrained)					
Low	2.05	1.39	1.09	0.59	−0.15	−0.25	1.71	1.08	0.62	0.98	0.33	0.09
2	1.89	1.35	1.00	1.00	0.36	0.26	1.39	0.85	0.35	0.66	0.18	−0.17
3	1.39	0.84	0.51	0.89	0.23	0.21	0.94	0.43	0.02	0.43	−0.05	−0.18
4	0.96	0.42	0.10	0.44	−0.23	−0.34	0.74	0.19	−0.16	0.31	−0.22	−0.27
High	0.49	−0.17	−0.30	0.04	−0.70	−0.59	0.44	−0.19	−0.53	0.28	−0.36	−0.37
H−L $\triangle A/A$	−1.56	−1.55	−1.40	−0.55	−0.55	−0.34	−1.27	−1.27	−1.15	−0.70	−0.69	−0.46
	(−7.07)	(−7.38)	(−6.35)	(−2.37)	(−2.43)	(−1.47)	(−6.70)	(−6.82)	(−6.36)	(−3.03)	(−3.07)	(−1.82)

Table 9 : The Variation of the Value Anomaly across Subsamples Split by Payout Ratio and by Asset Size (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their payout ratios (Panel A) and on their asset size (Panel B) using accounting variables in fiscal year ending in calendar year $t-1$. Payout ratio is defined as the sum of dividends and stock repurchase divided by operating income. Asset size is total book assets (Compustat annual item 6). Within each payout ratio or asset size subsample, firms are sorted into five equal-numbered portfolios based on book-to-market equity (B/M). The high-minus-low portfolio goes long on the high B/M portfolio and short on the low B/M portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by payout ratio						Panel B: Subsamples by asset size					
	Low payout ratio (most constrained)						Small asset size (most constrained)					
Low	0.26	−0.52	−0.33	0.01	−0.82	−0.28	0.46	−0.25	−0.21	0.06	−0.68	−0.44
2	0.62	−0.09	−0.14	0.33	−0.40	−0.19	0.89	0.25	0.07	0.57	−0.13	−0.09
3	0.94	0.27	0.00	0.61	−0.11	−0.29	1.24	0.68	0.37	0.87	0.25	0.14
4	1.32	0.75	0.38	0.75	0.11	−0.15	1.60	1.09	0.71	1.12	0.58	0.31
High	1.77	1.24	0.71	0.73	0.12	−0.38	2.04	1.57	1.13	1.30	0.81	0.42
H−L B/M	1.51	1.76	1.05	0.72	0.95	−0.10	1.59	1.83	1.34	1.24	1.49	0.86
	(6.37)	(8.54)	(6.54)	(2.40)	(3.34)	(−0.49)	(7.88)	(10.56)	(8.90)	(5.60)	(7.58)	(5.36)
	Median payout ratio						Median asset size					
Low	0.32	−0.33	−0.25	0.26	−0.35	−0.06	0.31	−0.42	−0.25	0.37	−0.37	0.05
2	0.69	0.12	−0.16	0.40	−0.17	−0.16	0.59	−0.03	−0.17	0.58	−0.03	−0.05
3	0.94	0.40	0.03	0.73	0.18	−0.01	0.79	0.23	−0.09	0.76	0.20	−0.03
4	1.03	0.53	0.04	0.83	0.32	−0.10	0.95	0.44	0.02	0.97	0.45	0.10
High	1.33	0.86	0.29	0.98	0.48	−0.07	1.31	0.83	0.25	1.14	0.65	0.15
H−L B/M	1.01	1.20	0.54	0.72	0.83	−0.01	1.01	1.25	0.50	0.77	1.01	0.10
	(5.33)	(7.25)	(4.66)	(2.98)	(3.48)	(−0.06)	(4.72)	(6.70)	(3.88)	(3.24)	(4.57)	(0.67)
	High payout ratio (least constrained)						Big asset size (least constrained)					
Low	0.54	−0.01	0.00	0.42	−0.05	0.17	0.37	−0.21	−0.06	0.39	−0.10	0.16
2	0.71	0.22	−0.04	0.56	0.10	−0.04	0.47	−0.06	−0.22	0.43	−0.05	−0.09
3	0.87	0.42	0.09	0.65	0.20	−0.03	0.60	0.12	−0.17	0.49	0.05	−0.09
4	0.87	0.47	0.04	0.67	0.31	−0.15	0.71	0.26	−0.14	0.58	0.19	−0.15
High	1.20	0.80	0.28	0.73	0.38	−0.20	0.94	0.45	−0.12	0.71	0.30	−0.18
H−L B/M	0.67	0.81	0.27	0.32	0.42	−0.37	0.57	0.65	−0.06	0.32	0.40	−0.35
	(4.45)	(6.06)	(3.07)	(1.59)	(2.23)	(−2.94)	(3.73)	(4.50)	(−0.88)	(1.97)	(2.53)	(−4.18)

Table 10 : The Variation of the Value Anomaly across Subsamples Split by Bond Ratings and by Commercial Paper Ratings (July 1963–December 2006, 534 Months)

At the end of June of year t, we split firms into two subsamples based on their bond ratings (Panel A) and on commercial paper ratings (Panel B) at the fiscal year ending in calendar year $t-1$. In Panel A, the constrained subsample contains all the firms with debt outstanding but without a bond rating, and the unconstrained subsample contains all the firms whose bonds are rated. In Panel B, the constrained subsample contains all the firms with debt outstanding but without a commercial paper rating, and the unconstrained subsample contains all the firms whose commercial papers are rated. Within each bond ratings or commercial paper ratings subsample, firms are sorted into five equal-numbered portfolios based on book-to-market equity (B/M). The high-minus-low portfolio goes long on the high B/M portfolio and short on the low B/M portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by bond ratings						Panel B: Subsamples by commercial paper ratings					
	With bond ratings (unconstrained)						With commercial paper ratings (unconstrained)					
Low	0.57	−0.05	0.12	0.37	−0.11	0.20	0.47	−0.17	0.00	0.37	−0.12	0.21
2	0.80	0.24	0.19	0.55	0.08	0.12	0.68	0.11	0.06	0.55	0.10	0.13
3	0.92	0.41	0.20	0.48	0.04	−0.11	0.86	0.35	0.15	0.51	0.08	0.00
4	0.98	0.54	0.21	0.63	0.24	−0.04	1.03	0.58	0.23	0.65	0.26	−0.03
High	1.46	1.02	0.56	0.68	0.30	−0.16	1.39	0.95	0.51	0.74	0.36	−0.07
H−L B/M	0.89	1.07	0.44	0.31	0.41	−0.36	0.92	1.12	0.51	0.37	0.48	−0.28
	(5.23)	(6.97)	(4.36)	(1.71)	(2.31)	(−3.44)	(5.19)	(7.14)	(4.64)	(1.95)	(2.59)	(−2.28)
	Without bond ratings (constrained)						Without commercial paper ratings (constrained)					
Low	0.33	−0.33	−0.31	0.02	−0.58	−0.30	0.34	−0.31	−0.28	0.02	−0.57	−0.27
2	0.60	0.04	−0.20	0.32	−0.20	−0.23	0.57	0.01	−0.22	0.28	−0.23	−0.31
3	0.87	0.36	0.01	0.47	0.03	−0.14	0.90	0.36	0.05	0.44	−0.04	−0.23
4	1.08	0.60	0.14	0.70	0.25	−0.11	1.10	0.63	0.17	0.57	0.14	−0.23
High	1.48	1.01	0.43	0.74	0.30	−0.24	1.49	1.03	0.44	0.76	0.35	−0.22
H−L B/M	1.15	1.34	0.74	0.71	0.88	0.06	1.15	1.34	0.72	0.74	0.91	0.05
	(6.46)	(8.68)	(6.80)	(3.44)	(4.45)	(0.51)	(6.48)	(8.57)	(6.57)	(3.40)	(4.46)	(0.42)

Table 11 : The Variation of the Value Anomaly across Subsamples Split by the Whited-Wu (2004) Index and by the Kaplan-Zingales (1997) Index (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their Whited-Wu (WW) index values (Panel A) and on their Kaplan-Zingales (KZ) index values (Panel B) using accounting variables in fiscal year ending in calendar year $t-1$. The details of constructing the WW and KZ indexes are described in Section 2. By construction, more constrained firms have higher WW and KZ indexes. Within each financial constraints subsample, firms are sorted into five equal-numbered portfolios based on book-to-market equity (B/M). The high-minus-low portfolio goes long on the high B/M portfolio and short on the low B/M portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by the WW-index						Panel B: Subsamples by the KZ-index					
	Low WW (least constrained)						Low KZ (least constrained)					
Low	0.35	−0.26	−0.15	0.35	−0.20	0.00	0.42	−0.21	0.00	0.33	−0.13	0.15
2	0.61	0.05	−0.15	0.55	0.02	−0.04	0.64	0.04	0.04	0.56	0.09	0.09
3	0.72	0.21	−0.11	0.62	0.14	−0.06	0.82	0.27	0.09	0.55	0.09	−0.03
4	0.76	0.27	−0.17	0.54	0.07	−0.23	1.02	0.49	0.21	0.61	0.12	−0.08
High	0.91	0.42	−0.15	0.77	0.29	−0.18	1.28	0.80	0.44	0.76	0.27	−0.09
H−L B/M	0.56	0.68	0.00	0.42	0.49	−0.18	0.86	1.02	0.44	0.43	0.40	−0.24
	(3.21)	(3.85)	(0.02)	(2.30)	(2.61)	(−1.38)	(5.16)	(6.66)	(3.82)	(2.18)	(2.10)	(−1.53)
	Median WW						Median KZ					
Low	0.26	−0.50	−0.33	0.35	−0.45	−0.06	0.51	−0.13	−0.10	0.39	−0.17	0.13
2	0.65	0.00	−0.15	0.62	−0.05	−0.08	0.73	0.17	−0.06	0.46	0.00	−0.10
3	0.83	0.31	0.08	0.81	0.26	0.14	0.95	0.45	0.10	0.60	0.18	−0.08
4	0.95	0.43	0.00	0.95	0.38	0.00	1.06	0.60	0.15	0.66	0.29	−0.09
High	1.25	0.75	0.17	0.99	0.46	−0.09	1.41	0.95	0.41	0.79	0.40	−0.15
H−L B/M	0.99	1.25	0.50	0.64	0.91	−0.03	0.90	1.09	0.51	0.40	0.57	−0.28
	(3.99)	(5.55)	(3.10)	(2.23)	(3.36)	(−0.16)	(5.44)	(7.68)	(4.95)	(1.81)	(2.68)	(−1.91)
	High WW (most constrained)						High KZ (most constrained)					
Low	0.54	−0.22	−0.22	−0.03	−0.83	−0.61	0.53	−0.16	−0.24	0.30	−0.33	−0.14
2	0.90	0.25	0.11	0.56	−0.14	−0.13	0.70	0.10	−0.22	0.30	−0.26	−0.30
3	1.45	0.89	0.58	1.06	0.41	0.29	1.06	0.51	0.04	0.53	0.05	−0.17
4	1.59	1.06	0.62	1.12	0.52	0.18	1.29	0.77	0.21	0.71	0.24	−0.21
High	2.11	1.60	1.05	1.31	0.76	0.31	1.63	1.12	0.48	0.84	0.35	−0.26
H−L B/M	1.57	1.82	1.27	1.34	1.59	0.91	1.10	1.28	0.71	0.54	0.68	−0.12
	(6.29)	(8.25)	(6.42)	(4.86)	(6.34)	(4.15)	(5.61)	(7.28)	(5.04)	(2.26)	(2.99)	(−0.63)

Table 12 : The Variation of the Net Stock Issues Anomaly across Subsamples Split by Payout Ratio and by Asset Size (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their payout ratios (Panel A) and on their asset size (Panel B) using accounting variables in fiscal year ending in calendar year $t-1$. Payout ratio is defined as the sum of dividends and stock repurchase divided by operating income. Asset size is total book assets (Compustat annual item 6). Within each payout ratio or asset size subsample, firms are sorted into five equal-numbered portfolios based on net stock issues (NS). NS is defined as the change in the natural logarithms of the number of shares outstanding adjusted for splits to capture the effect of share repurchases and seasoned equity offerings. The high-minus-low portfolio goes long on the high NS portfolio and short on the low NS portfolio. Portfolio returns are computed over the period from July of year t to June of year t+1. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

Portfolio	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by payout ratio						Panel B: Subsamples by asset size					
	Low payout ratio (most constrained)						Small asset size (most constrained)					
Low	1.52	0.97	0.60	0.68	0.06	−0.18	1.68	1.19	0.84	0.99	0.44	0.29
2	1.34	0.73	0.40	0.79	0.14	0.01	1.51	1.00	0.67	0.94	0.36	0.27
3	0.89	0.22	0.00	0.48	−0.25	−0.20	1.41	0.82	0.52	0.81	0.14	0.15
4	0.80	0.09	−0.06	0.50	−0.30	0.02	1.01	0.39	0.17	0.35	−0.35	−0.28
High	0.49	−0.25	−0.33	−0.27	−1.06	−0.74	0.80	0.12	−0.03	−0.02	−0.76	−0.62
H−L NS	−1.03	−1.22	−0.92	−0.95	−1.12	−0.57	−0.88	−1.07	−0.86	−1.02	−1.20	−0.91
	(−6.05)	(−8.32)	(−6.60)	(−4.01)	(−4.88)	(−2.84)	(−5.25)	(−7.16)	(−6.21)	(−5.51)	(−7.13)	(−5.91)
	Median payout ratio						Median asset size					
Low	1.24	0.76	0.28	0.91	0.42	0.16	1.11	0.64	0.23	0.87	0.35	0.14
2	0.92	0.43	0.00	0.54	0.06	−0.09	0.93	0.45	0.02	0.61	0.12	−0.07
3	0.97	0.44	0.13	0.81	0.27	0.23	0.92	0.35	0.08	0.66	0.07	0.08
4	0.81	0.24	−0.02	0.51	−0.09	−0.04	0.83	0.20	0.01	0.65	−0.05	0.14
High	0.36	−0.27	−0.47	0.01	−0.62	−0.54	0.36	−0.33	−0.46	0.34	−0.43	−0.14
H−L NS	−0.87	−1.03	−0.75	−0.90	−1.04	−0.70	−0.75	−0.96	−0.68	−0.53	−0.78	−0.28
	(−6.28)	(−8.62)	(−6.62)	(−4.63)	(−5.63)	(−3.95)	(−4.98)	(−7.65)	(−6.38)	(−2.62)	(−4.39)	(−1.90)
	High payout ratio (least constrained)						Big asset size (least constrained)					
Low	1.20	0.73	0.34	0.87	0.41	0.16	0.79	0.33	0.00	0.67	0.24	0.12
2	0.92	0.49	0.14	0.67	0.24	0.10	0.66	0.21	−0.12	0.39	−0.01	−0.06
3	0.82	0.38	0.08	0.55	0.12	0.09	0.67	0.18	−0.07	0.50	0.04	0.08
4	0.78	0.32	0.07	0.49	0.04	0.08	0.69	0.16	−0.04	0.49	−0.03	0.11
High	0.53	0.05	−0.20	0.37	−0.08	−0.12	0.32	−0.26	−0.44	0.19	−0.32	−0.29
H−L NS	−0.67	−0.67	−0.54	−0.50	−0.49	−0.28	−0.48	−0.59	−0.43	−0.48	−0.56	−0.41
	(−6.60)	(−6.57)	(−5.13)	(−3.81)	(−3.63)	(−2.18)	(−4.10)	(−5.29)	(−4.09)	(−4.16)	(−4.85)	(−3.88)

Table 13 : The Variation of the Net Stock Issues Anomaly across Subsamples Split by Bond Ratings and by Commercial Paper Ratings (July 1963–December 2006, 534 Months)

At the end of June of year t, we split firms into two subsamples based on their bond ratings (Panel A) and on commercial paper ratings (Panel B) at the fiscal year ending in calendar year $t-1$. In Panel A, the constrained subsample contains all the firms with debt outstanding but without a bond rating, and the unconstrained subsample contains all the firms whose bonds are rated. In Panel B, the constrained subsample contains all the firms with debt outstanding but without a commercial paper rating, and the unconstrained subsample contains all the firms whose commercial papers are rated. Within each bond ratings or commercial paper ratings subsample, firms are sorted into five equal-numbered portfolios based on net stock issues (NS). NS is defined as the change in the natural logarithms of the number of shares outstanding adjusted for splits to capture the effect of share repurchases and seasoned equity offerings. The high-minus-low portfolio goes long on the high NS portfolio and short on the low NS portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r - r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Portfolio	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}	$r - r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by bond ratings						Panel B: Subsamples by commercial paper ratings					
	With bond ratings (unconstrained)						With commercial paper ratings (unconstrained)					
Low	1.14	0.68	0.40	0.65	0.22	0.18	1.12	0.65	0.39	0.63	0.19	0.18
2	1.05	0.61	0.30	0.42	0.03	−0.04	0.99	0.55	0.22	0.38	0.01	−0.10
3	0.89	0.38	0.25	0.48	0.00	0.10	0.85	0.33	0.19	0.51	0.05	0.15
4	0.97	0.40	0.32	0.53	0.01	0.20	0.89	0.30	0.26	0.57	0.05	0.25
High	0.68	0.11	0.03	0.34	−0.16	−0.09	0.57	−0.04	−0.10	0.29	−0.21	−0.10
H−L NS	−0.46	−0.57	−0.37	−0.31	−0.38	−0.28	−0.55	−0.69	−0.49	−0.34	−0.41	−0.28
	(−3.27)	(−4.19)	(−2.95)	(−2.62)	(−3.19)	(−2.43)	(−3.49)	(−4.59)	(−3.70)	(−2.84)	(−3.40)	(−2.43)
	Without bond ratings (constrained)						Without commercial paper ratings (constrained)					
Low	1.16	0.70	0.26	0.66	0.22	0.02	1.18	0.71	0.27	0.68	0.23	−0.03
2	1.06	0.59	0.16	0.45	0.01	−0.18	1.04	0.58	0.17	0.50	0.08	−0.08
3	0.93	0.40	0.08	0.54	0.05	0.01	0.90	0.35	0.07	0.51	0.01	−0.04
4	0.79	0.20	−0.02	0.23	−0.34	−0.27	0.80	0.22	−0.01	0.26	−0.32	−0.25
High	0.40	−0.25	−0.43	−0.08	−0.66	−0.57	0.46	−0.17	−0.36	−0.11	−0.66	−0.63
H−L NS	−0.76	−0.94	−0.69	−0.74	−0.88	−0.59	−0.71	−0.88	−0.63	−0.78	−0.89	−0.60
	(−4.97)	(−7.00)	(−6.13)	(−4.17)	(−5.23)	(−4.11)	(−4.65)	(−6.49)	(−5.41)	(−4.92)	(−5.71)	(−4.37)

Table 14 : The Variation of the Net Stock Issues Anomaly across Subsamples Split by the Whited-Wu (2004) Index and by the Kaplan-Zingales (1997) Index (July 1963–December 2006, 534 Months)

At the end of June of year t, we first sort firms into three equal-numbered subsamples based on their Whited-Wu (WW) index values (Panel A) and on their Kaplan-Zingales (KZ) index values (Panel B) using accounting variables in fiscal year ending in calendar year $t-1$. The details of constructing the WW and KZ indexes are described in Section 2. By construction, more constrained firms have higher WW and KZ indexes. Within each financial constraints subsample, firms are sorted into five equal-numbered portfolios based on net stock issues (NS). NS is defined as the change in the natural logarithms of the number of shares outstanding adjusted for splits to capture the effect of share repurchases and seasoned equity offerings. The high-minus-low portfolio goes long on the high NS portfolio and short on the low NS portfolio. Portfolio returns are computed over the period from July of year t to June of year $t+1$. The portfolios are rebalanced at the end of each June. Heteroscedasticity-robust t-statistics are reported in parentheses. Excess return ($r-r_f$) is the difference between portfolio returns and the one-month Treasury bill rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regression of portfolio returns on the market factor and the three Fama-French factors, respectively.

Portfolio	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Subsamples by the WW-index						Panel B: Subsamples by the KZ-index					
	Low WW (least constrained)						Low KZ (least constrained)					
Low	0.84	0.36	0.02	0.73	0.28	0.14	1.02	0.56	0.30	0.68	0.27	0.16
2	0.70	0.21	−0.13	0.44	−0.05	−0.08	0.91	0.44	0.18	0.56	0.16	0.18
3	0.72	0.20	−0.11	0.49	−0.01	−0.03	0.92	0.35	0.28	0.47	−0.01	0.12
4	0.75	0.18	−0.06	0.59	0.01	0.04	0.86	0.24	0.24	0.47	−0.10	0.20
High	0.41	−0.19	−0.40	0.28	−0.28	−0.30	0.42	−0.26	−0.24	0.37	−0.19	−0.02
H−L NS	−0.43	−0.55	−0.42	−0.46	−0.56	−0.44	−0.60	−0.81	−0.54	−0.30	−0.45	−0.19
	(−2.77)	(−3.62)	(−2.79)	(−2.90)	(−3.58)	(−2.94)	(−3.33)	(−5.15)	(−4.13)	(−1.61)	(−2.57)	(−1.19)
	Median WW						Median KZ					
Low	1.05	0.56	0.14	0.91	0.35	0.10	1.17	0.69	0.27	0.75	0.31	0.13
2	0.98	0.47	−0.01	0.74	0.16	−0.18	1.09	0.62	0.22	0.59	0.17	0.00
3	0.96	0.43	0.23	0.75	0.16	0.27	0.91	0.40	0.07	0.60	0.13	0.13
4	0.85	0.19	0.01	0.75	0.01	0.17	0.95	0.39	0.19	0.47	−0.06	0.00
High	0.29	−0.40	−0.51	0.17	−0.60	−0.40	0.55	−0.06	−0.25	0.05	−0.44	−0.43
H−L NS	−0.76	−0.96	−0.65	−0.74	−0.95	−0.50	−0.62	−0.75	−0.52	−0.70	−0.75	−0.56
	(−4.08)	(−5.90)	(−4.54)	(−3.18)	(−4.49)	(−2.85)	(−4.98)	(−6.54)	(−4.97)	(−4.69)	(−4.85)	(−3.99)
	High WW (most constrained)						High KZ (most constrained)					
Low	1.91	1.32	0.89	1.26	0.61	0.44	1.42	0.91	0.40	0.72	0.20	−0.03
2	1.53	1.02	0.64	0.70	0.11	−0.13	1.23	0.69	0.16	0.40	−0.08	−0.38
3	1.47	0.86	0.61	0.84	0.13	0.12	1.11	0.53	0.12	0.77	0.22	0.10
4	1.18	0.54	0.35	0.45	−0.31	−0.26	0.90	0.27	−0.05	0.34	−0.23	−0.24
High	0.79	0.12	−0.01	−0.10	−0.84	−0.73	0.52	−0.12	−0.40	0.15	−0.42	−0.52
H−L NS	−1.02	−1.22	−0.94	−1.31	−1.52	−1.28	−0.90	−1.02	−0.80	−0.57	−0.61	−0.49
	(−5.07)	(−6.53)	(−5.37)	(−5.79)	(−7.20)	(−6.73)	(−5.76)	(−6.89)	(−5.73)	(−3.41)	(−3.67)	(−2.79)

Table 15 : Asset Pricing Anomalies across Less Constrained and More Constrained Economies in Model Simulations

Using 100 simulated panels from the dynamic model delineated in Section 4.2, this table reports the cross-simulation averaged results of one-way sorted portfolios formed on investment-to-capital, i/k, book-to-market, k/v, and net stock issues, $(e-d)/k$. At the end of each June of year t, firms are sorted into five equal-numbered portfolios based on the sorting variables. Portfolio returns are computed from July of year t to June of year $t+1$. The portfolios are rebalanced in each June. Excess return $(r-r_f)$ is the difference between portfolio returns and the risk-free rate. The CAPM alphas (α_{CAPM}) and Fama-French alphas (α_{FF}) are the intercepts from time-series regressions of portfolio returns on the market factor and the three Fama-French (1993) factors, respectively. The Fama-French factors are constructed from the simulated data following the empirical procedure of Fama and French (1993). We report the simulated results across two economies that differ only in the degree of which external finance is costly. In the less constrained economy, the fixed financing cost parameter, λ_0, is zero, and the convex financing cost parameter, λ_1, is 25. In the more constrained economy, the fixed financing cost parameter, λ_0, is 0.02, and the convex financing cost parameter, λ_1, is 50. All the other parameters are identical across the two economies. All the returns are in monthly percent. The t-statistics in parentheses are heteroscedasticity-consistent t-statistics averaged across 100 simulations.

Portfolio	Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}	$r-r_f$	α_{CAPM}	α_{FF}
	Panel A: Less constrained ($\lambda_0=0, \lambda_1=25$)						Panel B: More constrained ($\lambda_0=0.02, \lambda_1=50$)					
	Portfolios formed on investment-to-capital						Portfolios formed on investment-to-capital					
Low	1.11	0.08	0.12	1.07	0.08	0.02	1.08	0.15	0.10	1.05	0.15	0.02
	0.96	−0.11	−0.02	1.00	−0.04	−0.01	1.00	0.07	0.07	1.03	0.14	0.02
	0.87	−0.24	−0.02	0.88	−0.24	−0.02	0.88	−0.06	0.06	0.88	−0.05	0.05
	0.91	−0.19	0.00	0.94	−0.13	−0.03	0.92	−0.03	0.21	0.94	0.03	0.12
High	1.07	−0.02	0.18	1.03	−0.02	0.07	0.94	−0.04	0.42	0.91	−0.05	0.34
H−L I/A	−0.04	−0.09	0.06	−0.05	−0.10	0.05	−0.14	−0.20	0.32	−0.14	−0.21	0.32
	(−0.22)	(−1.38)	(0.73)	(−0.21)	(−1.42)	(0.65)	(−1.65)	(−2.88)	(1.29)	(−1.94)	(−2.97)	(1.37)
	Portfolios formed on book-to-market						Portfolios formed on book-to-market					
Low	0.76	−0.51	0.00	0.72	−0.51	−0.16	−0.56	−1.15	0.03	−0.51	−1.09	0.00
	0.84	−0.36	0.03	0.82	−0.34	−0.08	0.14	−0.39	0.14	0.14	−0.38	0.04
	0.87	−0.22	−0.07	0.87	−0.22	−0.07	0.33	−0.16	−0.02	0.33	−0.16	−0.02
	1.09	0.08	0.06	1.08	0.10	0.01	0.65	0.20	0.05	0.64	0.20	−0.02
High	1.27	0.35	0.23	1.25	0.36	0.15	0.92	0.50	0.11	0.92	0.51	0.08
H−L B/M	0.51	0.86	0.23	0.53	0.87	0.31	1.48	1.65	0.09	1.42	1.59	0.08
	(4.31)	(15.72)	(2.33)	(4.09)	(15.14)	(2.92)	(2.66)	(31.63)	(1.74)	(4.46)	(30.51)	(1.40)
	Portfolios formed on net stock issues						Portfolios formed on net stock issues					
Low	1.32	0.44	0.19	1.32	0.46	0.17	0.97	0.56	0.15	0.97	0.57	0.13
	1.13	0.13	0.07	1.06	0.08	−0.02	0.67	0.21	0.05	0.62	0.17	−0.03
	0.87	−0.23	−0.07	0.87	−0.23	−0.07	0.33	−0.17	−0.02	0.33	−0.17	−0.02
	0.83	−0.38	0.05	0.77	−0.42	−0.04	0.12	−0.42	0.12	0.09	−0.44	0.03
High	0.67	−0.65	0.02	0.64	−0.67	−0.02	−0.58	−1.18	0.00	−0.53	−1.12	−0.01
H−L NS	−0.65	−1.09	−0.17	−0.68	−1.13	−0.20	−1.55	−1.73	−0.15	−1.51	−1.69	−0.14
	(−4.31)	(−31.24)	(−7.02)	(−4.32)	(−31.83)	(−8.19)	(−2.53)	(−39.11)	(−6.71)	(−3.66)	(−39.35)	(−6.90)