– NOT FOR PUBLICATION –

Internet Appendix for "External Equity Financing Shocks, Financial Flows, and Asset Prices"

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Abstract

This appendix reports additional analysis and robustness checks for Belo, Lin, and Yang (2018), "External equity financing shocks, financial flows, and asset prices ".

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A. Robustness checks

We report the correlation between the equity ICS with several macroeconomic variables. We then examine the robustness of the asset pricing tests reported in the main text to using alternative measures of equity issuance cost shocks.

A.1. Correlation with other variables

To help understand the characteristics of the equity ICS, Table A1 reports the correlation (and corresponding p-values) of the equity ICS with selected macroeconomic variables, aggregate shocks, and financial variables. This correlation table extends the correlation table reported in the main text. We use these variables in the empirical analysis below (we describe in more detail the construction of these variables in Section A.4.).

[Table A1 here]

The equity ICS is significantly correlated with sentiment index (correlation of 0.37 with p-value 0.01) and intermediary capital ratio growth (correlation of 0.35 with p-value 0.02).

A.2. Equity ICS using different definitions of equity issuance

Here we consider different definitions of equity issuance. In constructing all these measures, we exclude utility and financial firms (SIC code from 4900 to 4999 and from 6000 to 6999) from our sample as in our baseline measure of issuance shocks in the paper to be consistent with our portfolio formation. Consistent with our baseline asset pricing tests, we use three sets of value weighted and equal weighted portfolios as test assets. The first two sets of portfolios include 5 book-to-market portfolios (5 BM) and 5 investment portfolios (5 IK). The third set of portfolios, which includes 5×5 portfolios double sorted by size (market equity) and book-to-market and 5×5 portfolios double sorted by size (market equity) and investment rate, is used to perform a large cross sectional test. We perform the tests using both value- and equal-weighted average returns. Table A2 reports the key results from the asset pricing tests using value-weighted and equal-weighted average returns. To facilitate the comparison, we report the corresponding asset pricing results in the baseline measure of issuance shocks (0. Baseline), which are the results reported in the main text.

[Table A2 here]

We use changes in the fraction of equity issuing firms as alternative ICS shocks. We examine the following alternative measures of equity issuance:

1. Net equity issuance (not gross as in the main text): We measure net equity issuance as SSTK (gross issuance) - PRSTKC (repurchase) - DV (cash dividend) from annual Compustat following Eisfeldt and Muir (2016). To exclude the equity issuances due to the exercising of employees' stock options, we use 3% of the average of year-begin and year-end market equity as the cutoff similar to our baseline shock. If a firm's net equity issuance is higher than the cutoff in a year, the firm is defined as an issuance firm in this year.

2. Change in log split-adjusted shares: Other than using the cash flow statement items, we define net equity issuance as change in log split-adjusted shares following Fama and French (2008). The split-adjusted shares are the products of common shares outstanding (annual Compustat data item CSHO) and the stock split and dividend adjustment factor (annual Compustat data item AJEX). A firm is issuing if the change is greater than 3% to exclude small issuances due to the exercising of employees' stock options. We remove observations with missing change in log split-adjusted shares.

3. Monthly adjusted CRSP shares: We use CRSP data to construct a measure of equity issuance following Boudoukh, Michaely, Richardson, and Roberts (2007). We only include common stocks (CRSP data item SHRCD = 10 or 11) traded in three major exchanges (CRSP data item EXCHCD = 1, 2, or 3). The monthly net equity issuance is computed as follows

   $$(shrout_t \times cfacshr_t - shrout_{t-1} \times cfacshr_{t-1}) \times (prc_t/cfapr_t + prc_{t-1}/cfapr_{t-1})/2$$

   where $shrout$ is the number of shares outstanding, $cfacshr$ is the cumulative factor to adjust shares, $cfacpr$ is the cumulative factor to adjust price, and prc is the share price. We annualize the monthly issuance data to get annual fraction of issuance.[1] A firm is defined as an issuance firm if its net equity issuance is positive for any of the twelve months of a year.

Overall, the main asset pricing results using these alternative measures appears to be consistent with the results for the baseline equity ICS reported in the main text.

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[1] We have also considered estimating the two-factor model at the monthly frequency using monthly equity issuance data. However, the monthly equity issuance data exhibits a very strong seasonality, and the pattern of seasonality appears to vary over time. To avoid this seasonality, we perform our analysis at the annual frequency using annual data.

A.3. Equity ICS controlling for size, age, and industry effects

To show that our main results (in particular, the construction of equity ICS) is not driven by size, age, or industry effects, we perform robustness checks in which we first sort firms into portfolios using firm characteristics (size, age, or industry) and then construct ICS for each portfolio separately. In particular, we compute the fraction of equity issuing firms within each portfolio. For every year, we then take average change in portfolio-level fraction of issuance across all portfolios to construct the market-level ICS. By taking the average across the portfolios, we mitigate the concern that the portfolio characteristic is the driver of the equity ICS measure.

In constructing these alternative measures, we exclude utility and financial firms (SIC code from 4900 to 4999 and from 6000 to 6999) from our sample as in our baseline case to be consistent with our portfolio formation. As before, consistent with our baseline asset pricing tests, we use three sets of value weighted and equal weighted portfolios as test assets. The first two sets of portfolios include 5 book-to-market portfolios (5 BM) and 5 investment portfolios (5 IK). The third set of portfolios, which includes 5×5 portfolios double sorted by size (market equity) and book-to-market and 5×5 portfolios double sorted by size (market equity) and investment rate, is used to perform a large cross sectional test. We perform the tests using both value- and equal-weighted average returns.

[Table A3 here]

Table A3 reports the key results from the asset pricing tests using value-weighted and equal-weighted average returns. To facilitate the comparison, we report the corresponding asset pricing results in the baseline model (0. Baseline), which are the results reported in the main draft. We examine the results across the following sorts:

1. Size: We construct an alternative size-adjusted measure of equity ICS that uses information about the intensive margin of gross issuance while at the same time mitigating the disproportionate influence of the very large firms on this measure. Specifically, we use year-end market equity as the measure for firm size and sort firms into ten portfolios. For each portfolio, we aggregate gross issuance dollar amount and lag book equity across firms. We then construct, for each size-portfolio, the portfolio-level gross issuance dollar amount to book equity ratio. To then obtain the time series of aggregate equity ICS, we compute log growth of an equal weighted average of portfolio-level gross issuance dollar amount to book equity ratio across the ten size portfolios in each year. We use this measure of aggregate equity ICS to replicate all the asset pricing tests reported in the main text.

2. Age: We define a firm's age as the difference in months between January at current year and the month and year of its first observation in CRSP. We sort all firms by their age and split them into ten portfolios based on NYSE breakpoints. We then compute, for each age-portfolio, the fraction of equity issuance based on the baseline case in the paper. In particular, a firm is an equity issuing firm in a year if its gross issuance exceeds 3% of its market equity. Change in an equal weighted average of fraction of equity issuance across portfolios is defined as an alternative measure of equity ICS.
3. Industry: We split Compustat firms excluding financial and utility firms into 9 industry portfolios based on Fama and French's definitions of 10 industries. Among them, the utility industry is totally removed and financial firms are removed from the portfolio of other industries. We then repeat the same analysis as in the age sort.

Overall, the main asset pricing results across these alternative measures appear to be consistent with the results for the baseline equity ICS reported in the main text.

A.4. Equity ICS controlling for other macro shocks

In this section, we investigate how the main empirical findings change when we purge the baseline ICS measure from the information contained in many other variables related to financial conditions in the economy, as well as other variables correlated with asset prices in the cross section.

We proceed as follows. Let Z_t be a vector of control variables. We orthogonalize our ICS measure to these variables by running the following regression:

$$\mathrm{ICS}_t = a + b' Z_t + e_t \tag{1}$$

and extract the residuals. We then replicate the asset pricing tests reported in the main text using these residuals. By construction, the residuals capture the component of ICS that is not explained by the control variables. For those control variables that are levels rather than innovations, we use their annual log growth as Z_t.

[Table A4 here]

As in the main text, we use three sets of value weighted and equal weighted portfolios as test assets. The first two sets of portfolios include 5 book-to-market portfolios (5 BM) and 5 investment portfolios (5 IK). The third set of portfolios, which includes 5×5 portfolios double sorted by size (market equity) and book-to-market and 5×5 portfolios double sorted by size (market equity) and investment rate, is used to perform a large cross sectional test. We perform the tests using both value- and equal-weighted average returns. Table A4 reports the summary of the asset pricing tests using value-weighted and equal-weighted returns. The control variables that we examine here are the following:

1. Investment shocks: We use the quality adjusted price of new equipment and software from 1947-2012 to extract investment shocks following the empirical procedure described in Papanikolaou (2011).[2]
2. Change in credit spread: We use the change in Moody's Baa-Aaa corporate bond spreads as the control variable.
3. Liquidity shocks: We download the liquidity factor in Pastor and Stambaugh (2003) from Robert F. Stambaugh's website. The data is from 1962-2012. We take the sum of the twelve months innovations in aggregate liquidity in a year to obtain annual time series of liquidity shocks.
4. Collateral constraint shocks: We use the collateral constraint shocks (financial shocks) from Jermann and Quadrini (2012).[3] The data is from 1985-2010. We sum up the four quarters innovations in to financial conditions (debt market) in a year to obtain annual time series of collateral constraint shocks.
5. Aggregate cost of external finance: We obtain the time series of aggregate costs of external finance from Eisfeldt and Muir (2016). In contrast to equity issuance shocks, these costs include both equity and debt financing costs. We use change in the aggregate costs as a control variable.
6. Sentiment index: We download the sentiment indices constructed in Baker and Wurgler (2006) from Jeffrey Wurgler's website. The data is from 1965-2010. We use the changes in the orthogonal sentiment index as a control variables. We also check the other sentiment index in their paper. The test results are very close.
7. Uncertainty shocks: To obtain long time series of annual uncertainty shocks of aggregate economy, we compute the realized variance of the twelve months log industry production growth in a year following Bansal, Kiku, Shaliastovich, and Yaron (2014). The monthly industry production index is from FRED Economic Data. The data is from 1919-2012. We use the change in annual realized variances as a measure for uncertainty shocks.

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[2] Thanks to Ryan Israelsen for sharing the data.

[3] Thanks to Vincenzo Quadrini for sharing the data.

8. Leverage ratio of securities broker-dealers: We use annual growth of market leverage of broker and dealer firms from Adrian, Etula, and Muir (2014) as a control variable. They find that this factor also help price the cross sectional stock returns.
9. Stock market factor: We use annual stock market factor from Ken French's website as a control variable.
10. Change in CAPE: We use annual change in the cyclically adjusted price-to-earnings ratio (CAPE) which is downloaded from Robert Shiller's website as a control variable.
11. Real risk-free rate: We use the annual risk-free rate from Kenneth French's website adjusted by the December value of the consumer price index (CPI) from the Bureau of Labor Statistics.
12. Intermediary capital ratio growth: This data is from He, Kelly, and Manela (2016).
13. Aggregate sale growth: We aggregate sales across CRSP/Compustat firms excluding financial and utility firms. This aggregate sale is a TFP-type measure for CRSP/Compustat firms only. Then, we use log growth of aggregate sale as a control variable.

Overall, the correlation between these alternative equity ICS and the baseline equity ICS is high (above 93% across the thirteen cases). This high correlation does not mean that the control variables are not correlated with the ICS. For example, the correlation between the equity ICS and the sentiment index is high. In addition, the slope coefficient from the regression of ICS on the sentiment index is positive 4.92) and statistically significant (t-stat of 2.40), and the regression R^2 is 13.56%. The high correlation between the baseline equity ICS and the alternative equity ICS means that the baseline equity ICS is not perfectly explained by these control variables, consistent with the interpretation that this measure captures information about the wealth of the financial sector/economy that is not captured by these alternative measures.

As a result of the high correlation between the baseline equity ICS and the alternative equity ICS measures considered here, the main asset pricing results obtained using the alternative equity ICS are similar to those obtained for the baseline equity ICS and reported in the main text.

A.5. Model implied ICS controlling for investment opportunity and cost of debt ($\text{ICS}^{\perp}$)

We consider an alternative equity ICS proxy that captures the component of the model-implied equity ICS proxy that is orthogonal to a set of proxy (control) variables of time-varying investment opportunities and cost of debt. To obtain this alternative proxy we estimate the following regression by standard OLS and using a rolling regression with an expanding window:[4]

$$\text{ICS}_t = a_{0,T} + a_{1,T}\text{CAPE}_t + a_{2,T}\Delta\text{CAPE}_t + a_{3,T}\Delta\text{B-A}_t + a_{4,T}\text{RF}_t + v_t, \tag{2}$$

from t= 1951 to T, with T from 1963 to 2013. We first estimate the regression from 1951 to 1963 (T= 1963), and then extract the out-of-sample residual in 1964 using the parameters estimated in the previous (expanding) period. We denote the residual as $\text{ICS}_t^{\perp} = v_t$, in which we use the symbol $\perp$ to refer to the component of the equity ICS proxy that is orthogonal to the control variables. As control variables, we include the level and growth rate of the Shiller's cyclically adjusted price-to-earnings ratio (firms' tend to issue more equity when stock prices are high, which we interpret as periods with good investment opportunities),[5] the changes in the BAA-AAA spread, and the aggregate risk-free rate RF, which, as discussed above, capture changes in the cost of debt.[6] Note that the Shiller's CAPE ratio can also be interpreted as a measure of aggregate risk premium (prices are high when discount rates are low), and in that sense the previous regression also controls for the component of time-variation in aggregate risk that drives equity issuance decisions (and hence, the equity ICS proxy in the data).

The recursive estimation of equation (2) produces a time series of regression intercept, slopes, and regression $\text{R}^{2\prime}s$. To facilitate the discussion of the results from this estimation, we focus here on the results from the long sample window (T= 2013). The estimation produces a small regression R^2 of 5%, and only the regression slope coefficients on ΔCAPE is (borderline) significant, with a point estimate of 0.69, which is 1.5 standard errors from zero (results not tabulated). Again, this low R^2 reinforces the conclusions from the univariate correlations.

[Table A5 here]

Table A5 reports the full asset pricing test results of the model implied ICS controlling for investment opportunity and cost of debt ($\text{ICS}^{\perp}$). The asset pricing test results are very close to the model implied ICS in the main text.

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[4] The use of rolling regressions allows us to mitigate any look ahead bias in the estimated innovations, an important concern when relating the estimated innovations (shocks) to asset price data, which is forward looking by nature.

[5] Using the aggregate book-to-market ratio or dividend-price ratio produces similar results.

[6] We focus on these variables because these variables have a long time-series coverage, and we use a small number of variables for parsimonious reasons.

A.6. Model independent ICS measure ($\Delta\mathrm{EI}^{\perp}$)

We examine a model independent measure of the ICS shock. Naturally, part of the innovation in the fraction of equity issuance (ΔEI) reflects variation in market conditions (for example, as captured by aggregate valuations measures) and also in the cost of debt, among other possible reasons. To understand the variation in equity issuance that is not directly driven by these variables, we also consider a measure of innovations in issuing activity that is orthogonal to these variables. Specifically, we estimate the following regression by standard OLS and using a rolling regression with an expanding window:

$$\mathrm{Fraction}_{t+1} = a_{0,T}+a_{1,T}\mathrm{Fraction}_{t}+a_{2,T}\mathrm{CAPE}_{t+1}+a_{3,T}\Delta\mathrm{CAPE}_{t+1}+a_{4,T}\Delta\mathrm{B\text{-}A}_{t+1}+a_{5,T}\mathrm{RF}_{t+1}+v_{t+1}, \tag{3}$$

which is estimated from t= 1951 to T, with T from 1963 to 2013. Here, we include as control variables the Shiller's cyclically adjusted price-to-earnings ratio (CAPE) and its change (ΔCAPE), to capture the overall level of stock market value (firms' tend to issue more equity when stock prices are high), the changes in the BAA-AAA spread, a measure of the cost of debt that approximates the return (and hence cost) on debt, and the risk free rate, which is also related to the cost of debt.[7] We first estimate the regression from 1951 to 1963 (T= 1963), and then extract the out-of-sample residual in 1964 using the parameters estimated in the previous (expanding) period. We will denote the residual as $\Delta\mathrm{EI}^{\perp}_{t+1} = v_{t+1}$, in which we use the symbol $\perp$ to refer to the component of equity issuance activity that is orthogonal to aggregate market conditions and cost of debt. The use of rolling regressions allows us to mitigate any look ahead bias in the estimated innovations, an important concern when relating the estimated innovations (shocks) to asset price data, which is forward looking by nature (as such, all asset pricing tests are performed for the 1964 to 2013 period).

The recursive estimation of equation (3) produces a time series of regression intercept, slopes, and regression $\mathrm{R}^{2\prime}s$. To facilitate the discussion of the results from this estimation, we focus here on the long sample window (T= 2013) results (the full set of estimation results is provided in the online appendix). The regression R^2 is 59%. This number suggest that the included variables captures some variation in the issuance activity, but the magnitude explained by the regression residuals is still sizeable. The regression slopes have the expected sign. The coefficient in lagged fraction is positive 0.68, and this value is more than 9 standard errors from zero. The coefficients on the valuation ratio CAPE and its change are also positive and statistically significant. The estimated coefficients are 0.1 and 0.33 respectively which are more than 1.9 and 1.7 standard errors from zero. Thus, consistent with previous studies, more firms

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[7] We focus on these variables because these variables have a long time-series coverage. We focus on a small number of variables for parsimonious reasons.

issue equity when aggregate valuations (stock prices) are high. The coefficient on the credit spread is not statistically significant, but the coefficient on the risk free rate is, as expected, positive, slope is 0.3, and statistically significant, the point estimate is more than 2 standard errors from zero. Thus, all else equal, firms issue relatively more equity when the cost of debt is higher. This suggests that firms substitute between different sources of external financing depending on the relative cost of each source. Furthermore, the fraction of equity issuance ΔEI and $\Delta\text{EI}^{\perp}$ are significantly correlated (75%) indicating that a nonnegligible component of the variation in equity issuance activity is not explained by current market conditions nor variation in the cost of debt, as captured by the control variables included in equation (3).

Then we test a two-factor model by including a market factor and the model independent ICS ($\Delta\text{EI}^{\perp}$). The test assets are 5 book-to-market portfolios (BM), and 5 investment rate portfolios (IK), and 25 portfolios double sorted by 5 size and 5 book–to-market portfolios, and 25 portfolios double sorted by 5 size and 5 investment rate portfolios.

[Table A6 here]

Table A6 reports the full asset pricing test results of $\Delta\text{EI}^{\perp}$. The asset pricing test results are very close to the model implied ICS in the main text.

A.7. Debt ICS

In this section, we explore debt ICS constructed from different variables from the debt market.

1. Change in credit spread: We use the change in Moody's Baa-Aaa corporate bond spreads as a second factor in addition to the stock market factor.
2. Total debt issuance fraction: We compute the fraction of positive debt growth firms relative to the total number of CRSP/Compustat firms for every year. Change in this fraction is defined as a measure for debt ICS shocks. In this case, debt is defined as the sum of both short-term debt (DLC) and long-term debt (DLTT). These data items include both private and public debt.

[Table A7 here]

Table A7 reports the asset pricing test results with these difference measures of debt ICS shocks. We find that the change in BBB-AAA credit spread (related to the cost of debt) does have explanatory power for some of the portfolios studied in the paper, for example, book-to-market portfolios (consistent with Jaganathan and Wang, 1996), but not so much for the investment portfolios. The change in credit spread carries a negative risk price estimated by 5×5 double sorted size and book-to-market portfolios and 5×5 double sorted size and investment portfolios. Additionally, our equity ICS is negatively correlated with the change in credit spread.[8] More importantly, our equity ICS is still able to explain the cross sectional stock returns after controlling for the change in credit spreads as reported in Table A4.

We do not find that the debt ICS constructed with total debt issuance fraction help price these portfolios.

A.8. Equity ICS controlling for firm characteristics

In the previous robustness checks, we control for important aggregate economic variables which affect firms' equity issuance. In this section, we compute the unexpected changes in the fraction of firms issuing equity after controlling for firm-level characteristics.

We proceed as follows. In each year, we estimate the probability that each firm will issue equity in the following year using a set of firm characteristics as predictors. Specifically, we estimate the following logistic function via maximum likelihood:

$$\mathrm{Pr}_{t-1}[Y_{i,t}=1]=\frac{1}{1+e^{-a-b'X_{i,t-1}}},$$

where the left hand side variable $Y_{i,t}$ is equal to 1 if firm i issues equity in year t and is equal to zero otherwise, and $X_{i,t-1}$ is a vector of firms' i characteristics in year $t-1$. We then compute, for each year, the expected fraction of firms that will issue equity by averaging the previous fitted probabilities (defined as $\hat{\mathrm{Pr}}_{t-1}[Y_{j,t}=1]$) across firms. Finally, we compute the alternative equity ICS measure (denoted Logit ICS) in each year t as the difference between the realized fraction of firms issuing equity in the cross section and the expected fraction from the previous regression:

$$\text{Logit ICS}_t=\frac{\sum_{i=1}^{N}\mathbf{1}_{\{Y_{i,t}=1\}}}{N}-\frac{\sum_{i=1}^{N}\hat{\mathrm{Pr}}_{t-1}[Y_{j,t}=1]}{N}, \tag{4}$$

where $\mathbf{1}_{\{Y_{i,t}=1\}}$ is an indicator variable equal to 1 if the firm i has issued equity in year t. As in the baseline equity ICS, a positive difference is associated with an unusually high equity issuance activity, which we again interpret as driven (at least partially) by a reduction in the cost of external equity issuance, and vice versa.

The firm characteristics include

- Firm size: log market equity ($\log(ME_t)$)
- Book-to-market ratio

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[8] This is perhaps not surprising since firms tend to deleverage in the face of a positive equity ICS (when cost of issuing equity decreases). Therefore, aggregate default risk is lower which leads to a lower credit spread.

- Market leverage: $\frac{DLTT_t+DLC_t}{ME_t+DLTT_t+DLC_t}$
- Book leverage: $\frac{DLTT_t+DLC_t}{AT_t}$
- Profitability: $\frac{SALE_t-COGS_t}{AT_t}$
- Investment rate: $\frac{CAPX_t-SPPE_t}{0.5\times(PPENT_{t-1}+PPENT_t)}$
- Asset Tangibility: $\frac{PPENT_t}{AT_t}$
- Trailing one-year stock return

These characteristics predict equity issuance activity: the $b's$ coefficients associated with these characteristics in the logistic regression are significant in most years. For consistency, we focus on the same sample used in the baseline case and we adopt the same criteria to classify a firm as an equity issuer (that is, we require gross equity issuance to be larger than 3% of market value of equity). To mitigate any forward-looking ahead bias, we estimate the equity issuance probability of a firm in year t using the parameters $[a, b]$ estimated with a panel data of firms only up to year $t-1$. The correlation between the logit equity ICS and the baseline equity ICS is significantly positive, 42%, with a p-value less than 1%.

[Table A8 here]

We then replicate the asset pricing tests as for the baseline ICS. Table A8 reports the results. The results are consistent with the baseline case in general.

A.9. Equity ICS using the intensive margin of equity issuance

In the model implied equity ICS measure we mainly use the fraction of firms issuing equity (extensive margin), but not on the total dollar amount of new equity raised (intensive margin). As discussed in the main text, this procedure allows us to focus on the time variation of equity issuance costs for a typical firm in the economy. This approach is motivated by the findings in Covas and Den Haan (2011) who show that external finance for the largest firms (especially those at the top 1% of the size distribution) is not representative of the financing behavior of the rest of the firms in the economy because their issuance is either acyclical or counter-cyclical, in contrast with the behavior of almost all of the other firms in Compustat, for which debt and equity issuance is procyclical. Because the dollar amount of issuance of the very large firms has an unusually large influence on the aggregate series, it completely dominates any intensive margin (that is based on dollar amount raised) measure of equity issuance activity in the economy.

Here we report the results from an alternative procedure to extract the equity ICS that also mitigates the disproportionate effect of the very large firms on the intensive margin measures. Specifically, we use year-end market equity as the measure for firm size and sort firms into twenty portfolios based on breakpoints across all three major exchanges. For each portfolio, we aggregate gross issuance dollar amount across firms and deflated it by the December value of the consumer price index (CPI) from the Bureau of Labor Statistics. As such, this measure incorporates the information on the intensive margin. We then construct the portfolio-level equity ICS as log growth of real gross issuance dollar amount. Then, we take the equal average across the twenty time series of portfolio-level equity ICS to construct the time series of aggregate equity ICS.

[Table A9 here]

Table A9 replicates the main asset pricing tests reported in the main text using this alternative aggregate equity ICS measure. The asset pricing results are similar to those implied by the baseline equity ICS measure that uses the fraction of firms issuing equity. Specifically, the two-factor model prices the portfolios considered here reasonably well, and the price of risk associated with this shock is also positive.

A.10. A relative debt-equity issuance cost shock measure

The main mechanism in the paper focuses on the importance of the debt-equity substitution margin for asset prices. Here, we attempt to create an alternative issuance cost measure that explicitly focuses on the relative cost of debt equity financing (as opposed to just the cost of equity as in the baseline measure). Specifically, we construct a relative financing cost factor by using the fraction of firms issuing equity relative to the fraction of firms issuing debt (a firm is a debt issuer if it has positive debt growth). In particular, we define a firm as a debt issuing firm if its total debt (Compustat items: DLC + DLTT) is higher than a year before. We use the change of difference between these two fractions as an alternative measure for the ICS shock. The correlation between the relative financing factor and the baseline shock is 39%. Table A10 reports the asset pricing test results using this alternative measure. The asset pricing performance of the relative financing factor is similar to the baseline equity ICS. The risk price of the relative financing factor is also significantly positive. However, this measure does not price the investment portfolios as well as the baseline equity ICS. This results suggests that the asset pricing performance of the equity ICS is more driven by the information on equity issuance margin than on the debt-equity margin.

[Table A10 here]

A.11. An alternative equity ICS mimicking portfolio at monthly frequency

We also construct a monthly factor mimicking portfolios of the baseline equity ICS by projecting the equity ICS onto the Fama and French five factors. We project the baseline ICS factor on the annual Fama-French five factors (Fama and French (2015)) and a constant using the OLS in the sample from 1964 to 2013. Then, we define the weights of a factor mimicking portfolio as the estimated coefficients of this regression (excluding the constant term). We normalize the sum of the weights to be 1. A monthly factor mimicking portfolio is constructed using these weights and the monthly Fama-French five factors. The factor mimicking portfolio is from 1964 to 2013 due to the availability of the portfolio returns. The annual average excess return of this portfolio is 4.4% and the Sharpe ratio equals to 0.49. The average excess return is significant (t-stat = 2.95). The results, which are reported in the Table A11, are consistent with the baseline ICS in general.

[Insert Table A11 here]

B. Additional empirical analysis

We provide additional empirical analysis in this section. First, we link the equity ICS to the financial sector. Second, we investigate the portfolio cash holdings across ICS states. Third, we study the portfolio payout dynamics around negative ICS years. Lastly, we compute the correlations between equity and debt issuance at portfolio level and the correlations between extensive and intensive margins of equity issuance.

B.1. Financial shocks (Jermann and Quadrini (2012))

Our analysis shows that the two-factor model with the market and the equity ICS as factors performs well on the set of test assets considered in the main text. For comparison and put the results into perspective, we also examine the performance of another two-factor model in which we include the collateral constraint shocks from Jermann and Quadrini (2012), as the second factor (in addition to the market factor) in the two-factor model.

[Insert Table A12 here]

Table A12 shows that the collateral constraint shock is unable to price these test assets. In particular, the two-factor model alphas for the spread portfolios are high across both the book-to-market and the investment portfolios. The risk price of this factor is not significant.

B.2. Link to the financial sector

For practical purposes, we interpret the equity ICS as an aggregate shock that captures a disruption in the financial sector.To provide support for this interpretation, we investigate the link between the equity ICS and several key variables (real quantities and prices) related to the performance of the financial sector of the economy.

First, we examine the correlation between the equity ICS and EBIT, dividends, market value of equity, and abnormal stock return of financial firms. Financial firms are defined by the SIC code (SIC >= 6000 and SIC<= 6999). We aggregate real quantities of the firms in financial sector to obtain the corresponding aggregate-level quantities. We then regress the real log growth of the industry-level quantities (deflated by CPI) on the TFP growth to control for the effect of macroeconomic conditions, and look at the correlation between the residuals of these regressions and the ICS.[9]

[Insert Table A13 here]

Table A13 shows that, after controlling for the effect of TFP growth, EBIT, dividends, the market value of equity, and abnormal stock return of financial sector, are all positively correlated with the ICS (to the extent that dividends are smoothed, this result is not surprising). To assess the significance of this correlation, we run a regression of the equity ICS on a constant and the corresponding X_t variable. The slope coefficient, reported in the table, are in general statistically significant.

Second, we examine the correlation between the returns of the firms in the finance sector with the ICS. Specifically, we construct a financial industry portfolio based on the Fama and French 12 industry classification (the finance sector corresponds to the industry classification "Money"), and compute the value-weighted returns of this portfolio. We then compute the abnormal return of this portfolio as $\alpha_t^{\mathrm{FIN}} = r_t^e - \beta \times \mathrm{MKT_t}$ where r^e is the excess returns of the portfolio, β is the market beta of the financial industry portfolio obtained from a time series regression of the returns of the portfolio on the market factor (MKT). We focus on abnormal returns to isolate the component of the returns of the finance industry portfolio that is not driven by the overall stock market (which in turn is related to aggregate TFP), but by other shocks such as, for example, financial shocks.

Column α^{FIN} in Table A13 reports the main results from the previous analysis. The abnormal returns of the financial industry portfolio are significantly positively correlated with the equity ICS with a correlation of 0.22 (at annual frequency). A regression of the equity ICS on a constant and the abnormal returns of the financial industry, generates a significant slope

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[9] The results remain robust after controlling for investment specific shock (results not tabulated here), another aggregate shock for investment opportunities (Kogan and Papanikolaou, 2011).

coefficient of 0.17, which is more than 3.57 standard errors from zero. Although the direction of the causality cannot be determined from this analysis, the positive link means that ICS is closely related to the performance of the firms in the financial sector. One possible interpretation for this link is as follows. When the firms in the financial sector are doing well, the willingness of this sector to supply equity capital to firms is high, making it effectively less costly for firms to raise new equity capital. This link manifests itself in the form of a high equity ICS (low cost of issuing equity).

Finally, given the positive link between the abnormal returns of the finance sector and the equity ICS, we can view the abnormal returns of the finance sector as yet another proxy of the equity ICS. Thus, we test a two-factor model in which we augment the standard CAPM market factor, with the abnormal returns of the financial sector (α_t^{FIN}) as the second factor. One attractive feature of this analysis, relative to the analysis using the baseline equity ICS measure, is that it is based on stock return data thus allowing us to test the two-factor model at the monthly (not annual) frequency and over a longer sample period (1964-2013).

We replicate the empirical asset pricing tests in the main text using this alternative equity ICS measure. Table A14 reports the asset pricing test results which are consistent with the baseline case.

[Insert Table A14 here]

Taken together, the analysis in this section provides support for the interpretation that ICS is a shock originating in the financial sector, given that it is significantly correlated with both the aggregate quantities and prices of the firms in the financial sector.

B.3. Portfolio-level cash holdings across equity ICS states

Our analysis focuses mostly on the debt-equity substitution mechanism to understand cross sectional variation in expected returns in the cross section. Firms in practice, can and do risk management through cash holdings to potentially mitigate the impact of external shocks to the cost of equity financing on the firms' operations. Here, we provide evidence that even though some firms are indeed doings this risk management, firms do not seem to be able to completely eliminate the impact of the external equity financing costs on their operations.

Table A15 reports the change in portfolio-level cash holdings across ICS states for the book-to-market and investment portfolios. To construct this table, as in the main text, we first split the sample into low, medium, and high equity ICS states based on the bottom and top 10th percentiles of the time series distribution of equity ICS. Then, we compute the time series average of the portfolio-level median realized (that is, after portfolio formation and hence contemporaneous with the realized equity ICS) change in cash holdings, for the high (H) and low (L) portfolios in each sort.

[Insert Table A15 here]

Table A15 shows that the low risk (growth/high investment) firms do not reduce their cash holdings to finance their operations with internal funds in periods in which it is more costly to issue equity. In the low equity ICS states (years with high cost of issuing equity - bad times), these low risk (growth/high investment) firms are all still accumulating cash (1.68% and 3.41%, respectively), although at a significantly smaller rate than during high equity ICS states (corresponding numbers are 16.24% and 5.46%, respectively). The high risk (value/low investment) are indeed reducing their cash holdings in low equity ICS states (-3.19% and -4.10%, respectively), but they are also de-leveraging, as reported in the main text. These results suggest that the effect of reducing cash for the high risk firms is not nearly enough to smooth their risk even if they also reduce their existing debt.

B.4. Payout dynamics around negative equity ICS years

We examine the portfolio payout dynamics around negative equity ICS years for 5 book-to-market and 5 investment portfolios. Consistent with the impulse response payout functions predicted by the model, we find that the payout of high risk (value and low IK) stocks are more impacted by negative equity ICS.

Specifically, we first define a firm's payout as the sum of cash dividend (Compustat data item DV) and share repurchase (Compustat data item PRSTKC). For a portfolio formed based on the sorting variable in year t, we aggregate firms' payouts in the portfolio for year $t+1$ and year $t+2$ to match the holding period of this portfolio. Note that portfolio returns are defined as from July in year $t+1$ to June in year $t+2$. Next, we compute the log growth rate of aggregate payout of the portfolio at year $t+2$ using the above aggregate payout.

After defining the years associated with the negative equity ICS as year 0, we conduct an event study for the portfolio payout growth following Koijen, Lustig, and van Nieuwerburgh (2017).[10] In particular, we compute the average portfolio payout growth in event years $-2, -1, 0, 1$, 2, and 3, after controlling for the real GDP growth.[11]

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[10] As a robusness check, we also defined the shock year -year 0- as corresponding to the years with ICS realizations in the bottom 33% or 10% of the ICS distribution, and find results to be overal similar to those reported here.

[11] To focus on the impact of the equity ICS on the payout that is unrelated to aggregate TFP shocks, we focus on the component of the portfolio payout that is orthogonal to aggregate GDP growth. Specifically, we run a time series regression of the portfolio-level payout growth on a constant and aggregate GDP growth, and use the sum of the intercept and residual as the orthogonalized measure. (FAN: please check if this footnote is correct)

[Insert Table A16 here]

Table A16 reports the results. We see that, except for the growth portfolio, all portfolios cut their payout in year 0 (for the growth portfolio, the growth rate of payouts is positive in all years, but the speed of the payout growth decreases in response to the negative equity ICS). The payout growth of high risk firms (value and low investment) remain significantly negative up to three years after the shock. In contrast, the payout growth of low risk firms (growth and high investment) become positive in year two after the negative ICS shock in year 0, that is, it recovers more quickly. This is consistent with the model predictions (e.g., the impulse response functions of dividend in Figure 3 in the main text). We interpret the results reported here as additional evidence that low risk firms are more flexible in their ability to raise external financing and hence are more able to payout dividends than high risk firms.

B.5. Correlation between equity issuance and debt growth

We compute the correlation between equity issuance and debt growth across 5 book-to-market and 5 investment portfolios in the data. The equity issuance is measured as the gross equity issuance over asset ratio averaging across equity issuing firms for each portfolio. The debt growth is measured as the average change in debt over asset ratio for each portfolio. We winsorize the variables at bottom and top 2% when taking the averages.

[Insert Table A17 here]

Table A17 compares these correlations in the data and in the model-simulated data. In general, the model-implied (unconditional) correlation between equity issuance and debt issuance is consistent with the data. Specifically, in the data, equity issuance is positively correlated with debt issuance for value firms and low investment firms, while this correlation is negative for growth firms and high investment firms, implying a unconditional debt-equity-substitution effect for these firms.

B.6. Correlation between intensive and extensive margin of equity issuance

we investigate the correlation between the intensive margin of equity issuance, measured by the log growth of aggregate gross equity issuance in dollar amount, and the extensive equity issuance margin, measured by the change in the fraction of equity issuing firms. In measuring the intensive margin, we consider different calculations of the total equity issuance by excluding the largest $0, 1\%, 5\%, 10\%$, or 20% firms based on the market equity. We use several different measures given the empirical evidence provided in Covas and Den Haan (2011) and Begenau and Salomao (2017), who show that equity issuance of large firms is acyclical, a pattern that is different from the rest of the firms in the U.S. economy (and, as shown in Begenau and Salomao, 2017, this pattern might be true not only for the very large firms (top 1%) but for a larger set of large firms (top 25%)). Hence, by using these different alternative metrics, we want to make sure that the patterns we report here are robust and representative of the pattern for a typical firm in the economy.

[Insert Table A18 here]

Table A18 reports the results. In general, the correlation between the intensive and extensive margin is high. Also, we see that the change in aggregate equity issuance is more correlated with the change in fraction of equity issuance when we exclude large firms, confirming the findings in Covas and Den Haan (2011) and Begenau and Salomao (2017). We believe this result provides additional support for our empirical choice of using the extensive margin of equity issuance to measure equity ICS, because the cyclicality of aggregate issuance is mainly driven by the issuance of the largest firms in the data, while the fraction of equity issuance is a better proxy for the equity issuance decision of average firms in the economy.

Table A18 also shows that, in the model, the correlation between aggregate gross equity issuance and the fraction of equity issuance is also high. Furthermore, the model replicates the pattern that the correlation between the intensive margin and the extensive margins of equity issuance is higher when we exclude the very large firms. For example, excluding the largest 20% firms based on market equity, the correlations between extensive and intensive margins is 95%, close to the data, 92%. This happens because small firms are more likely to issue equity than large firms since they need to grow and demand more external financing while large firms are more likely to payout dividend rather than issuing equity. Thus, removing large firms makes the aggregate equity issuance (intensive margin) to be mostly driven by the issuing firms, thus increasing the correlation between the intensive and extensive margin of equity issuance.

B.7. Business cycle properties of debt and equity issuance

To measure the link between the debt and equity issuances and the business cycle, a link that is commonly investigated in the literature, we investigate the debt and equity issuance patterns of the different portfolios across periods with different real GDP growth similar to the analysis of financial flows over financial cycles (ICS states) in the main text.

Specifically, we first classify the years in our sample as low, medium, and high GDP growth states, respectively, based on the bottom and top 10^{th} percentiles of the time series distribution of GDP growth. Then, we compute the time series average of the portfolio-level mean of the realized (that is, after portfolio formation and hence contemporaneous with the realized GDP growth) fraction of equity issuance (Equity issuance fraction), gross equity issuance-to-asset ratio (Gross equity issuance) computed among the set of firms with positive issuance, and the debt change-to-asset ratio (Debt growth), for the high (H) and low (L) portfolios in each sort.[12] To establish the business cycle properties of the debt and equity issuance of the portfolios we remove the effects of equity ICS on these variables. Accordingly, in each portfolio, we report the equity issuance and debt growth components of these variables that are orthogonal to equity ICS (we run a time series regression of the variable of interest on a constant and equity ICS and use the sum of the intercept and residual as the orthogonalized measure). The results from this analysis are reported in Table A19.

[Insert Table A19 here]

Comparing the High-good times with the Low-bad times, we find that both debt and equity issuance are mostly procyclical, consistent with the model. Specifically, equity issuance fraction (extensive margin) of all portfolios is higher in High-good times than in the Low-bad times. Gross equity issuance (computed conditional on firms' issuing equity) does not appear to be procyclical. Gross equity issuance is higher in low GDP growth states than in high GDP growth states for all portfolios considered here. This is most likely due to the fact that large firms' gross equity issuance is acyclical or countercyclical (Den Haan, 2011, and Begenau and Salomao, 2017). Turning to debt issuance cyclicality, for low risk firms (growth and high investment), their debt issuance decreases significantly in GDP growth while high risk firms (value and low investment) deleverage in low GDP growth states. In summary, there is no debt-equity substitution effect across GDP growth (business cycle) states, consistent with the model's predictions.

C. Additional theoretical results

In this section we examine additional predictions of the model.

C.1. Optimality conditions

Let q_t and μ_t be the Lagrangian multiplier associated the capital accumulation equation (Eq. 4 in the draft) and the debt collateral constraint equation (Eq. 6 in the draft). The first-order

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[12] To reduce the influence of outliers on the portfolio-level mean, we winsorize the firm level variables at 2% and 98% of the cross sectional distribution.

conditions with respect to I_t, K_{t+1}, and B_{t+1} are, respectively,[13]

$$q_t = \left(1 + \Psi'(H_t)\mathbf{1}_{\{H_t>0\}}\right)\left[1 + \frac{\partial G_t}{\partial I_t}\right], \tag{5}$$

$$q_t - \mu_t\varphi = \mathbb{E}_t M_{t,t+1}\left\{\left((1 + \Psi'(H_{t+1})\,\mathbf{1}_{\{H_{t+1}>0\}}\right)\left[\frac{\partial E_{t+1}}{\partial K_{t+1}} + (1-\delta)\left(1 + \frac{\partial G_{t+1}}{\partial I_{t+1}}\right)\right]\right\}, \tag{6}$$

$$\text{and } \mu_t - \mathbb{E}_t\left[M_{t,t+1}\left(1 + \Psi'(H_{t+1})\mathbf{1}_{\{H_{t+1}>0\}}\right)\frac{\partial E_{t+1}}{\partial B_{t+1}}\right] = \left(1 + \Psi'(H_t)\mathbf{1}_{\{H_t>0\}}\right)\frac{\partial E_t}{\partial B_{t+1}}, \tag{7}$$

where $\Psi'(H_t)$ is the partial derivative of $\Psi(H_t)$ with respect to H_t and $\mathbf{1}_{\{\}}$ is the indicator function.

Eq. (5) is the optimality condition for investment that equates the marginal cost of investing in capital, $\left(1 + \Psi'(H_t)\mathbf{1}_{\{H_t>0\}}\right)\left[1 + \frac{\partial G_t}{\partial I_t}\right]$, with its marginal benefit q_t. Here, q_t is known as the marginal q of investment. It differs from the standard q–theory of investment (e.g., Hayashi (1983)) in that the marginal cost of investment is the marginal capital adjustment cost $\left(1 + \frac{\partial G_t}{\partial I_t}\right)$ augmented by the marginal cost of issuance $\left(1 + \Psi'(H_t)\mathbf{1}_{\{H_t>0\}}\right)$. When firms take external equity financing, that is, $H_t > 0$, the effective marginal cost of investment is $(1 + \Psi'(H_t))\left[1 + \frac{\partial G_t}{\partial I_t}\right]$, which, all else equal, is larger than that implied by the standard q-theory without financial frictions, $1 + \frac{\partial G_t}{\partial I_t}$. More important, in contrast to the standard models, because the marginal issuance cost depends on the aggregate issuance cost shock ξ_t, the variations of marginal cost of investment is not only driven by shocks from the real sector, for example, aggregate productivity shocks, but also by the perturbations in the financial sector. In particular, the marginal cost of investment is inversely related to the realization of ξ_t. When firms use retained earnings to finance investment, i.e., $H_t = 0$, marginal cost of investment reduces to that implied by the standard models because $\Psi'(H_t)\mathbf{1}_{\{H_t>0\}}$ is zero in this case.

Eqs. (6) and (7) are the Euler equations that describe the optimality conditions for capital and debt. Intuitively, Eq. (6) states that to generate one additional unit capital at the beginning of next period, K_{t+1}, the firm must pay the price of capital, $q_t - \mu_t\varphi$. Different from the standard model where the price of capital simply equals the marginal q_t of investment, here the price of capital also depends on $\mu_t\varphi$. When the collateral constraint binds, $\mu_t \geq 0$ measures the tightness of the constraint. One additional unit of capital K_{t+1} will relax the constraint and reduce the effective marginal cost of investment by $\mu_t\varphi$ where φ is the fraction of K_{t+1} that can be liquidated. The next-period marginal benefit of this additional unit of capital depends on the marginal benefit of investing in real technology $\frac{\partial E_{t+1}}{\partial K_{t+1}} + (1-\delta)\left(1 + \frac{\partial G_{t+1}}{\partial I_{t+1}}\right)$ and the reduction of the future marginal cost of issuance $1 + \Psi'\left(H_{t+1}\right)\mathbf{1}_{\{H_{t+1}>0\}}$ due to the increase in the retained earnings caused by one additional unit of capital K_{t+1}.

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[13] These first-order conditions are taken in the differentiable regions of the relevant variables.

Eq. (7) states that to raise one additional unit of debt at the beginning of next period, (B_{t+1}), the firm must pay the shadow price of debt μ_t plus the next-period interest expense of repaying this additional debt net of the reduction in the marginal debt adjustment cost $-\mathbb{E}_t\left[M_{t,t+1}\left(1+\Psi'(H_{t+1})\mathbf{1}_{\{H_{t+1}>0\}}\right)\frac{\partial E_{t+1}}{\partial B_{t+1}}\right] = \mathbb{E}_t\left[M_{t,t+1}\left(1+\Psi'(H_{t+1})\mathbf{1}_{\{H_{t+1}>0\}}\right)\left(\left(1+r_f\left(1-\tau\right)\right)-abs\left(\frac{\partial \Phi_{t+1}}{\partial B_{t+1}}\right)\right)\right]$.[14] This marginal cost is increasing the marginal issuance cost $\Psi'(H_{t+1})\mathbf{1}_{\{H_{t+1}>0\}}$ because firms may need to take on costly external equity financing to repay the debt due next period. The marginal benefit of debt $\left(1+\Psi'(H_t)\mathbf{1}_{\{H_t>0\}}\right)\frac{\partial E_t}{\partial B_{t+1}}$ is the benefit of one additional unit of debt financing to be used in production, $\frac{\partial E_t}{\partial B_{t+1}}$, augmented by the reduction in current the marginal issuance cost $\left(1+\Psi'(H_t)\mathbf{1}_{\{H_t>0\}}\right)$ due to the substitution of debt financing for equity financing at the margin. If firms choose to optimally save on cash with B_{t+1} being negative, the marginal cost and benefit of cash holding will be the reverse of those of optimal debt.

C.2. Cross correlations between investment and financing flows

Table A20 reports the model implied firm-level correlations between investment, sales (identified as output in the model) growth and financing flows and the data counterparts. Because the baseline calibration does not target these moments, this exercise allows us to perform a preliminary diagnostic of the baseline calibration. Overall, the cross correlations between investment and financing flows are qualitatively consistent with the data. For example, the investment rate is positively correlated with gross equity issuance and debt growth rate in both the model and in the data. In addition, consistent with the data, the model implies positive correlations between both gross equity issuance and debt growth with sales growth. Moreover, cash-to-asset ratio is positively correlated with investment rate, sales growth, and gross equity issuance in the model, which is again qualitatively consistent with the data.

[Table A20 here]

C.3. Optimal cash holding

The benchmark model also implies interesting cash holding dynamics. Specifically, unproductive firms use cash to pay off debt payments due when cost of equity financing is high (low ICS state), consistent with Bolton, Chen, and Wang (2013). When equity financing cost is low (high ICS state), productive firms accumulate internal funds (save in cash) using their equity financing proceeds, consistent with Eisfeldt and Muir (2016).

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[14] Note that $\frac{\partial E_{t+1}}{\partial B_{t+1}} = -\left(1+r_f\left(1-\tau\right)\right) + \text{abs}\left(\frac{\partial \Phi_{t+1}}{\partial B_{t+1}}\right)$ is mostly negative for reasonable parameter values of the debt adjustment cost parameter c_b.

Here, we conduct several comparative statics to understand the determinant of cash holding policy in the model. The parameters that affect firms' optimal cash policy are: i) the returns to scale θ; ii) the conditional volatility of idiosyncratic productivity σ_z; and iii) implicit debt financing cost (collateral constraint parameter φ). Table A21 reports the results from the model when we vary these parameters.

[Table A21 here]

When we increase the returns to scale parameter θ from 0.7 to 0.75 (specification 2), firms do not want to hold cash in equilibrium because the return on capital (marginal product of capital) is sufficiently high such that firms use all their funds to finance investment; saving is not optimal for them. On the contrary, when we lower the returns to scale parameter θ from 0.7 to 0.60, firms save more in cash (not tabulated).

When we lower the conditional volatility of idiosyncratic productivity by 1/3 relative to the benchmark (specification 3), firms reduce their cash holding and the cash-to-asset ratio is smaller. This finding is consistent with Bolton, Chen, and Wang (2013) who show that idiosyncratic cashflow risk affects firms' cash policy. In addition, the debt financing cost also affects the optimal cash holding in the model. When we loosen the collateral constraint (specification 4), firms save less in cash when external debt financing is less costly which is effectively reduces the precautionary savings motive.

C.4. Additional comparative statics

To understand the role of some parameters of the model we perform additional comparative statics exercises. The analysis in this section complements and expands the analysis of the comparative statics exercises reported in the manuscript.

In addition to financial frictions, real frictions also contribute to generating sizable premiums in the model. Specification 5 in Table A21 reports the model-implied selected moments when we lower capital adjustment cost from $c_k^- = 40$ in the benchmark calibration to $c_k^- = 4$. The value premium drops substantially (2.6% vs 6.5% in the benchmark model); the investment spread falls mildly only by 3.6% (2.2% relative to 5.8% in the benchmark model). Taken together, real inflexibility in the model also contributes to the value premium and the investment spread (provided that equity ICS costs also affect firm's payouts - see main text).

C.5. Extended models with debt issuance shocks

In this section we study the asset pricing implications of debt financing shocks, by focusing on the impact of an aggregate shock to the tightness of the collateral constraint in our model, following the specification in Jermann and Quadrini (2012). We believe that this is a natural way of modeling the debt shock given that it's rooted on previous research. To provide a detailed characterization of the impact of debt collateral shocks on the model's implications for asset prices, we consider the following three alternative model specifications:

Model i) **A calibration of the model with debt collateral constraint shock as the only financial shock.** That is, in this specification of the model, equity issuance is costly, but we shut down the time-variation in equity issuance cost function. By considering only one financial shock, the complexity of this model is the same as the baseline model. In addition, by having the collateral constraint shock as the only financial shock, it allows us to isolate the effect of collateral constraint shocks on asset prices directly and in a more clean manner;

Model ii) **A calibration of the model with perfectly correlated debt collateral constraint shock and equity issuance cost shock.** That is, both external equity financing costs and the tightness of the collateral constraint are time-varying, and their time-variation is driven by the same financial shock. This allows us to keep the number of state variables in the model to be the same as in the baseline model (five state variables) hence greatly simplifying the implementation of this model;

Model iii) **A calibration of the model with independent debt collateral constraint and equity issuance cost shocks.** This version with two financial shocks is the most flexible version of the model as it allows for a separate role for the equity ICS and the debt collateral shock, hence allowing each shock to separately affect asset prices.

In all these three specifications, we allow the collateral constraint shock to affect the stochastic discount factor (SDF). In addition, we keep other parts of the benchmark model unchanged, in particular, the production technology, capital adjustment cost, the functional form of external equity financing cost, aggregate productivity, and firm-specific productivity shocks are the same throughout our analysis (and equal to the baseline specification of the model).

In what follows, we discuss the results from these three alternative specifications of the model.

Results from Model i): Debt collateral constraint shock only. To understand the effect of the debt collateral constraint shocks on asset prices in the cleanest possible way, the first model we consider does not contain the equity ICS. Our main finding here is that, for a reasonable calibration of this model, this debt collateral shock alone does not generate large cross sectional return spreads on book-to-market and investment portfolios.

Specifically, we introduce the debt collateral constraint shock by allowing the liquidation value of capital to be time-varying. In the model, the collateral constraint captures the idea that the lender can fully observe whether or not the borrower is fulfilling his or her contractual obligations. But, the lender does not have the tools available to enforce the contractual obligations. For instance, even if the bank knows that firms (borrowers) are not exerting effort or are diverting funds, it may be difficult to prove in court. In the benchmark model without the debt collateral constraint shock, the parameter that determines the fire sale value of liquidated capital (i.e., the tightness of collateral constraint), φ, is set to a constant. The recent literature on the impact of credit shocks highlights the role of stochastic tightness of collateral constraint in generating recessions in DSGE models (for example, Jermann and Quadrini, 2012; Khan and Thomas, 2013). As such, we assume the following specification for the collateral constraint:

$$B_{t+1} \leq \bar{\varkappa} \exp\left(\eta \varphi_t\right) K_{t+1}, \tag{8}$$

where B_{t+1} and K_{t+1} are debt and capital, respectively and φ_t controls the time-variation of the tightness of collateral constraint which follows an AR(1) process,

$$\varphi_{t+1} = \rho_\varphi \varphi_t + \sigma_\varphi \varepsilon^\varphi_{t+1}, \tag{9}$$

with ρ_φ, and σ_φ are the first-order autocorrelation coefficient and conditional volatility of φ_{t+1} and $\varepsilon^\varphi_{t+1}$ is an i.i.d. standard normal shock that is independent of aggregate productivity shock ε^x_{t+1} and idiosyncratic productivity shock ε^z_{t+1}; $\bar{\varkappa}$ determines the average resale value of capital[15] and η controls the sensitivity of the tightness of the collateral constraint with respect to $\varepsilon^\varphi_{t+1}$ shock. Accordingly, the SDF takes the following form,

$$M_{t,t+1} = \frac{1}{1+r_f} \frac{e^{-\gamma_x \Delta x_{t+1} - \gamma_\varphi \Delta \varphi_{t+1}}}{\mathbb{E}_t\left[e^{-\gamma_x \Delta x_{t+1} - \gamma_\varphi \Delta \varphi_{t+1}}\right]}. \tag{10}$$

In our calibration, we set $exp(\eta\varphi_t) \in (0,1]$ so that firms cannot pledge more than their capital in issuing new debt, and set $\bar{\varkappa} = 0.85$, which is the value that we use in our benchmark calibration with the constant tightness φ. We set $\rho_\varphi = .97$ and $\sigma_\varphi = 0.035$, the same as the persistence and conditional volatility of the equity issuance cost wedge and the risk price $\gamma_\varphi = 12$, the same parameter used in for the equity issuance cost shock in the benchmark calibration of the model, to allow for an easy comparison between the two models. We also set the sensitivity parameter $\eta = 0.25$. We have also tried $\eta = 0.5$ and find that the asset pricing results do not

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[15] Even though $\exp\left(\eta\varphi_t\right)$ is log-normal, $\exp\left[\frac{1}{2}\left(\eta\sigma_\varphi\right)^2\right]$ is quantitatively close to zero in calibration so that it doesn't affect the average resale value of capital.

change much.

[Table A22 here]

Table A22 reports the main results from the analysis. We find that the debt collateral constraint shock does not generate significant cross sectional variations in expected stock returns. As reported in Panel A, in this specification of the model, the implied return spreads of the investment and book-to-market portfolios are −2.6% and 2.5%, respectively, much lower than in the data (4.0% and 6.5%, respectively) and in the benchmark model (5.7% and 5.8%, respectively). In particular, the exposure to the debt collateral constraint shock is close to zero (less than 0.001) for all investment and book-to-market portfolios, which implies that exposure to the debt collateral shock does not generate significant dispersion in risk in the cross section.

There are two reasons for the previous finding. First, the debt collateral constraint only binds occasionally in the model. Specifically, this constraint affects two types of firms. It affects the firms close to hit a binding constraint going forward, and firms facing a binding constraint currently. But, in equilibrium, the constraint rarely binds because firms can endogenously increase the capital stock, reduce debt and/or save in cash to avoid hitting the binding constraint (precautionary savings). Thus, the fraction of firms affected by the collateral shock in equilibrium is fairly small. And because the debt collateral constraint shock only affects investment decision occasionally, it does not affect the dividend or the continuation value of firms significantly.

Second, in order for the debt collateral constraint shock to generate large risk dispersion, low productivity (low investment, value) firms need to be affected more by this shock than high productivity (high investment, growth) firms. But, in the model, it is the high productivity firms that are more likely to face a binding constraint. This happens because when the collateral constraint tightens up (φ_{t+1} is smaller), firms with more investment demand (the high investment, growth firms) are the ones that are trying to borrow more, and hence are the ones that are more affected by the debt collateral constraint shock. Therefore, given the previous two effects, the endogenous cross-sectional risk dispersion is small in the specification of the model with debt collateral constraint shock as the only financial shock.

Results from Model ii): Perfectly correlated debt and equity shocks. We next consider the model with perfectly correlated debt collateral constraint shock and equity issuance cost shock. Assuming perfectly correlated shocks allows us to save one state variable, which greatly simplifies the analysis. We consider two model specifications in which equity ICS and the debt collateral constraint shock are perfectly: v1) positively correlated; and v2) negatively correlated. On economic grounds, we believe that a positive, instead of negative, correlation between the shocks is a more realistic specification, but examining these two cases helps us understand the impact of the debt collateral shock better.[16] The positive correlation is natural if we interpret the two financial shocks as being driven, at least partially, by time-varying asymmetric information. Indeed, as discussed in the current manuscript this is the motivation of the financial shock in both our paper and Jermann and Quadrini (2012). More asymmetric information in the economy is likely to make more costly to raise new equity (an information sensitive asset), but also more difficult to pledge current assets to raise new debt.

Intuitively, when the debt collateral constraint shock and the equity ICS are perfectly *positively* correlated, a period with a negative equity ICS (times of costly equity issuance) is associated with tightened collateral constraint, implying that external equity is costly when debt capacity is also constrained. This makes the debt-equity substitution effect somewhat weaker. But, as reported in Panel B of Table A22, keeping the benchmark parameters the same as before for the external equity issuance costs and setting the sensitivity of the collateral constraint shock parameter $\eta = 0.25$, the same as in the model i), the model implied investment and book-to-market spreads are still sizable at 4.0% and 2.8%, respectively, slightly smaller than in the benchmark model, 5.7% and 5.8%, respectively.

A perfectly negatively correlated equity ICS and debt collateral constraint shock has two opposing effects. On the one hand, it strengthens the debt-equity substitution effect. Specifically, when equity ICS is negative (time of high equity financing cost), firms' collateral constraint is loosened, implying more debt capacity, thus strengthening the equity-debt substitution effect. On the other hand, there is also an offsetting effect when the debt collateral constraint shock is negative, because this reduces all firms' debt capacity (even though equity is less costly due to the negative correlation between two shocks), thus weakening the debt-equity substitution effect. In our calibration, Panel C in Table 1 below shows that the first effect dominates, because this model specification generates bigger cross-sectional return spreads on investment and book-to-market, 5.0% and 3.8%, respectively, than the model with perfectly positively correlated collateral constraint and equity financing shocks (but still less than the benchmark).

As also reported in Panels B and C of Table A22, the exposure of the investment and value spread portfolios to the debt collateral constraint shock is essentially zero in v1 and v2 and, hence, the cross sectional variation of expected returns in these versions of the model is mainly driven by the differential exposure to the equity ICS.

Taking together, comparing the the results of Model i) and Model ii), we find that the improvement of asset pricing moments in the two version of model ii) relative to model i), is

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[16] Naturally, the assumption of perfect correlation is extreme. We address this issue in the specification of the model iii). This specification is useful for pedagogical purposes because it helps understand the model mechanism better. We use the insights here to understand the richer specification of model iii).

essentially driven by the introduction of the equity ICS in Model ii).

Results from Model iii): Independent debt and equity shocks. In this last specification we allow for independent debt collateral constraint shock and equity ICS. We believe this is the empirically relevant case given that our empirical proxies of debt ICS and equity ICS are almost uncorrelated (3%, as reported in the main draft). This specification introduces an extra state variable to this already-complicated problem, hence making the numerical solution of the model significantly more time-consuming.

In this specification, the SDF includes three aggregate shocks, and takes the following form:

$$M_{t,t+1} = \frac{1}{1+r_f} \frac{e^{-\gamma_x \Delta x_{t+1} - \gamma_\xi \Delta \xi_{t+1} - \gamma_\varphi \Delta \varphi_{t+1}}}{\mathbb{E}_t \left[e^{-\gamma_x \Delta x_{t+1} - \gamma_\xi \Delta \xi_{t+1} - \gamma_\varphi \Delta \varphi_{t+1}} \right]}. \tag{11}$$

We set $\gamma_\varphi = \gamma_\xi = 12$ and keep the other parameter values to be the same as those in Model i). Intuitively, this model specification falls in between the two specifications (perfect positive and negative correlation) investigated in Model ii).

The two financial shocks affect the debt-equity substitution mechanism, and hence risk dispersion in the model, as follows (the effects are a mixture of the effects analysed in Model ii)-v1 and v2). On the one hand, when costly external equity issuance states coincide with the states of loosening collateral constraints, the debt-equity substitution effect is strengthened. On the other hand, when costly external equity issuance states coincide with tightening collateral constraint states, and hence no firms have financial flexibility, the debt-equity substitution effect is weakened. Quantitatively, Panel D in Table A22 shows that the first effect dominates, and hence the model still generates sizable return spreads on investment and book-to-market portfolios at 4.3% and 3%, respectively, somewhat smaller than those of the benchmark model with constant tightness of collateral constraint.

To further understand the previous result, Panel D in Table A22 also reports the endogenous exposures of the investment and value spread portfolios to the three aggregate shocks. The results in this table reveals two patterns. First, the exposure to the collateral constraint shock is not zero. This happens because the equity ICS is present, which makes firms more exposed to the collateral constraint shock (for example, when a negative equity issuance shock states coincide with the positive collateral constraint shock states, this strengthens the debt-equity substitution effect). Second, the exposure to the debt collateral constraint shock is an order of magnitude smaller than the exposure to the equity issuance cost shock.

Taken together, the results from this specification of the model shows that the debt collateral constraint shock does not seem to play a quantitatively important role for the investment and book-to-market return spreads in this model.

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Table A1 : Correlations among macroeconomic variables, shocks, and asset pricing factors

This table reports correlations and their p-values among macroeconomic variables, shocks, and asset pricing factors. Among them, $\text{ICS}^{\perp}$ is the model implied ICS controlling for investment opportunity and cost of debt; ΔEI is the change in the fraction of equity issuance; ΔDK is the change in aggregate debt-to-capital ratio. $\Delta\text{EI}^{\perp}$ is the change in the fraction equity issuance after controlling for market conditions. ΔDI is the change in the fraction of debt issuance; ΔTFP is the growth rate of aggregate total factor productivity; ICS is the equity issuance cost shock; ISTS is the investment-specific technology shock from Papanikolaou (2011); Change in credit spread (ΔB-A) is the change in Moody's Baa-Aaa corporate bond spreads; ΔLIQ liquidity is the liquidity shock from Pastor and Stambaugh; ΔJQ is the collateral constraint shock from Jermann and Quadrini (2012); ΔEM is the change in the aggregate cost of external finance estimated in Eisfeldt and Muir (2016); ΔSENT is the sentiment index from Baker and Wurgler (2006); Volatility shock is the (uncertainty) shock from Bansal, Kiku, Shaliastovich, and Yaron (2014); Broker-dealer (BD) leverage growth is the change in the leverage ratio of securities brokers-dealers from Adrian, Etula, and Muir (2013); Intermediary capital ratio (ICR) growth is the change in the intermediary capital ratio growth from He, Kelly, and Manela (2016); CAPE growth is the change in the cyclically adjusted price-to-earnings ratio; Real risk-free rate is annual risk-free rate from Kenneth French's adjusted by the consumer price index; the growth rate in real aggregate consumption is per capital real non durables and services consumption growth; MKT is the market factor; SMB is the small-minus-big size factor from Fama and French (1993); and HML is the high-minus-low book-to-market factor from Fama and French (1993).

	$\text{ICS}^{\perp}$	ΔEI	ΔDK	$\Delta\text{EI}^{\perp}$	ΔDI	ΔTFP	ISTS	ΔC	ΔSENT	ΔJQ	ΔEM	ΔB-A	ΔLIQ	Uncertainty Shock	Growth of BD Lev.	Log Growth of CAPE	Real Risk Free Rate	Change in ICR	Aggregate Sale Growth	MKT	SMB	HML
ICS	0.75	0.71	-0.90	0.61	0.03	-0.02	-0.08	-0.02	0.37	-0.16	-0.18	-0.16	0.01	-0.06	0.08	0.21	-0.12	0.35	0.00	0.12	0.23	0.20
p-Value	0.00	0.00	0.00	0.00	0.86	0.91	0.56	0.90	0.01	0.44	0.33	0.26	0.92	0.65	0.60	0.14	0.43	0.02	0.98	0.41	0.10	0.16
$\text{ICS}^{\perp}$		0.47	-0.73	0.48	0.12	0.01	0.09	0.00	0.25	-0.34	0.04	-0.10	-0.14	0.01	0.00	0.04	-0.23	0.00	0.16	-0.27	0.10	0.36
p-Value		0.00	0.00	0.00	0.43	0.97	0.56	0.98	0.10	0.09	0.80	0.52	0.35	0.93	0.98	0.80	0.12	0.99	0.28	0.06	0.49	0.01
ΔEI			-0.34	0.74	0.08	0.01	0.07	0.15	0.48	-0.03	-0.36	-0.24	-0.07	-0.19	0.01	0.28	-0.06	0.43	0.06	0.18	0.30	0.13
p-Value			0.02	0.00	0.59	0.94	0.65	0.29	0.00	0.89	0.04	0.10	0.65	0.18	0.95	0.05	0.69	0.00	0.66	0.22	0.03	0.38
ΔDK				-0.36	0.01	0.03	0.15	0.12	-0.20	0.19	0.05	0.07	-0.06	-0.03	-0.11	-0.11	0.12	-0.23	0.04	-0.05	-0.13	-0.19
p-Value				0.01	0.93	0.84	0.29	0.41	0.18	0.35	0.78	0.64	0.68	0.82	0.51	0.43	0.42	0.14	0.76	0.72	0.39	0.18
$\Delta\text{EI}^{\perp}$					-0.23	0.08	-0.28	-0.07	0.20	-0.14	-0.33	0.00	0.08	-0.16	-0.09	-0.10	-0.15	0.21	0.00	0.14	0.40	0.20
p-Value					0.11	0.60	0.05	0.65	0.17	0.49	0.06	0.98	0.57	0.25	0.58	0.47	0.32	0.17	0.99	0.32	0.00	0.16
ΔDI						-0.37	0.50	0.41	0.28	0.27	-0.18	-0.46	-0.30	-0.04	0.24	0.45	-0.13	-0.01	0.44	-0.24	-0.16	0.09
p-Value						0.01	0.00	0.00	0.05	0.19	0.32	0.00	0.03	0.79	0.12	0.00	0.37	0.95	0.00	0.09	0.26	0.53
ΔTFP							-0.02	0.22	-0.17	0.30	-0.11	0.20	0.18	-0.22	-0.27	-0.16	-0.05	0.07	-0.15	0.26	0.22	-0.06
p-Value							0.88	0.13	0.26	0.15	0.55	0.17	0.20	0.12	0.08	0.26	0.73	0.65	0.31	0.07	0.13	0.67

Table A2 : Asset pricing tests using alternative measures of equity issuance

This table reports the important estimates from the asset pricing tests of the CAPM and the two-factor model (stock market and alternative ICS) using three sets of value weighted and equal weighted portfolios as test assets. The first two sets of portfolios include 5 book-to-market portfolios (5 BM) and 5 investment portfolios (5 IK). The third set of portfolios, which includes 5×5 portfolios double sorted by size (market equity) and book-to-market and 5×5 portfolios double sorted by size (market equity) and investment rate, is used to perform a large cross sectional test. The estimation of the asset pricing models is by the generalized method of moments (GMM) using the standard asset pricing moment condition $E_T[r^e_{i,t+1}M_{t+1}] = 0$, in which $M_{t+1} = 1 - b_M \times MKT_t - b_I \times ICS_t$ is the model specific stochastic discount factor (SDF), MKT_t is the (demeaned) market excess return, ICS_t is the (demeaned) ICS, and b_M and b_{ICS} are the corresponding risk factor loadings on the SDF. In the table, Correl.(ICS, Base.) is the correlation between ICS shocks constructed using alternative measure of equity issuance shocks and the baseline ICS shocks in the paper; Cov(ICS, Spread) the univariate covariance between the spread portfolio return and the ICS factor; spread 2F alphas are the pricing errors (abnormal returns) implied by the estimation of the 2 factor model for three spread portfolios. The pricing errors are inferred from the errors on the moment condition estimated above in the GMM; factor loadings are the GMM estimates of the risk factor loadings in the SDF. MAE is the estimation implied mean absolute pricing errors (mean of the CAPM alphas or the two-factor model alphas) for the GMM. The sample period varies depending on the availability of measures of ICS. All the t-statistics are adjusted using Newey West corrections with 5-year lags.

		Value Weighted								Equal Weighted							
	(ICS, Base.)	Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section				Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section			
Measure	Corr.	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE
0. Baseline																	
Est.		0.45	-0.38	0.15	-0.49	1.41	11.65	2.16	1.24	0.58	-0.50	0.24	-1.39	0.98	12.59	2.48	1.52
[t]		3.61	-2.27	0.23	-1.12	0.85	2.46			3.41	-3.37	0.34	-1.74	0.50	2.49		
1. Net equity issuance																	
Est.	0.73	0.11	-0.10	0.15	-0.36	0.77	43.08	2.47	1.77	0.12	-0.15	1.13	-0.62	0.32	49.94	2.82	1.87
[t]		1.74	-2.04	0.20	-0.44	0.44	2.07			1.86	-1.98	0.85	-1.33	0.19	1.96		
2. Change in log split-adjusted shares																	
Est.	0.61	0.17	-0.17	0.33	-0.17	-0.03	21.77	2.16	1.40	0.22	-0.21	1.04	-1.50	-0.69	26.07	2.48	1.65
[t]		2.44	-2.01	0.43	-0.51	-0.01	2.07			2.94	-2.57	1.07	-2.08	-0.33	2.00		
3. Monthly adjusted CRSP shares																	
Est.	0.35	0.27	-0.42	0.91	0.32	2.41	11.52	2.16	1.24	0.37	-0.24	0.36	-0.73	2.20	15.03	2.48	1.59
[t]		2.12	-1.92	1.33	0.48	1.58	2.42			2.26	-2.21	0.52	-0.86	1.42	2.75		

Table A3 : Asset pricing tests for ICS aggregated from alternative groups of firms

This table performs a similar analysis to Table A2. Please see Table A2 for the descriptions of the estimates.

		Value Weighted								Equal Weighted							
	(ICS, Base.)	Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section				Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section			
Measure	Corr.	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE
0. Baseline																	
Est.		0.45	-0.38	0.15	-0.49	1.41	11.65	2.16	1.24	0.58	-0.50	0.24	-1.39	0.98	12.59	2.48	1.52
[t]		3.61	-2.27	0.23	-1.12	0.85	2.46			3.41	-3.37	0.34	-1.74	0.50	2.49		
1. 10 size portfolios																	
Est.	0.58	0.79	-1.26	1.10	0.00	-1.83	4.99	2.47	1.82	1.01	-1.43	0.63	-1.30	-2.67	6.21	2.82	1.94
[t]		1.21	-2.45	0.90	0.00	-0.77	2.03			1.92	-2.04	0.68	-1.93	-1.35	2.66		
2. 10 age portfolios																	
Est.	0.62	0.08	-0.13	-0.13	0.07	0.08	48.54	2.47	1.72	0.11	-0.14	0.56	-0.79	-0.40	54.68	2.82	1.80
[t]		1.57	-2.33	-0.44	0.07	0.05	2.11			1.84	-2.10	0.48	-1.36	-0.30	2.45		
3. 9 industry portfolios																	
Est.	0.74	0.11	-0.11	0.40	-0.31	0.21	48.24	2.47	1.74	0.12	-0.14	1.59	-0.98	0.18	47.11	2.82	2.00
[t]		2.16	-2.21	0.49	-0.31	0.12	2.16			2.00	-2.20	0.81	-1.55	0.10	2.19		

Table A4 : Asset pricing tests for ICS controlled for return factors or macroeconomic shocks

This table performs a similar analysis to Table A2. Please see Table A2 for the descriptions of the estimates.

				Value Weighted								Equal Weighted							
	(ICS, Base.)			Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section				Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section			
Measure	Corr.	Slope	R^2	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE
0. Baseline																			
Est.				0.45	-0.38	0.15	-0.49	1.41	11.65	2.16	1.24	0.58	-0.50	0.24	-1.39	0.98	12.59	2.48	1.52
[t]				3.61	-2.27	0.23	-1.12	0.85	2.46			3.41	-3.37	0.34	-1.74	0.50	2.49		
1. Investment shocks																			
Est.	1.00	-0.40	0.72	0.42	-0.36	0.19	-0.51	1.53	11.74	2.16	1.23	0.58	-0.50	0.52	-1.51	1.18	12.23	2.48	1.58
[t]		-0.84		3.29	-2.34	0.28	-1.10	0.93	2.44			3.28	-3.32	0.58	-1.80	0.60	2.38		
2. Change in credit spread																			
Est.	0.99	-0.05	2.58	0.40	-0.36	0.20	-0.89	1.57	12.10	2.16	1.33	0.52	-0.44	0.09	-1.85	1.26	12.16	2.48	1.65
[t]		-1.81		3.60	-2.24	0.31	-1.23	0.89	2.40			3.02	-3.18	0.12	-1.81	0.60	2.17		
3. Liquidity shocks																			
Est.	1.00	0.04	0.02	0.45	-0.38	0.17	-0.42	1.46	11.72	2.16	1.23	0.58	-0.50	0.24	-1.35	1.03	12.76	2.48	1.51
[t]		0.09		3.71	-2.27	0.24	-1.05	0.89	2.45			3.38	-3.36	0.35	-1.73	0.53	2.52		
4. Collateral constraint shocks																			
Est.	0.99	-0.73	2.59	0.42	-0.43	1.70	-2.08	2.30	9.54	2.67	1.74	0.93	-0.70	0.59	-1.10	2.03	9.65	2.85	2.09
[t]		-1.34		1.56	-1.70	0.99	-1.12	0.98	1.46			4.16	-5.28	0.73	-1.36	0.77	1.90		
5. Aggregate cost of external finance																			
Est.	0.98	-1.49	3.10	0.52	-0.42	0.80	-1.40	3.62	10.69	2.81	1.73	0.82	-0.77	0.78	-1.03	3.15	11.05	3.14	2.28
[t]		-1.87		3.12	-1.78	0.86	-1.29	1.58	1.99			4.00	-3.58	0.91	-1.54	1.19	2.34		
6. Sentiment index																			
Est.	0.93	4.92	13.56	0.44	-0.39	0.42	-1.23	0.84	12.48	2.28	1.34	0.65	-0.50	0.58	-1.16	0.34	13.47	2.65	1.74
[t]		2.40		3.31	-2.51	0.77	-1.46	0.52	2.54			4.36	-3.31	0.60	-1.54	0.17	2.64		
7. Uncertainty shocks																			
Est.	1.00	-0.72	0.42	0.41	-0.37	0.22	-0.63	1.51	11.96	2.16	1.25	0.56	-0.49	0.25	-1.56	1.12	12.66	2.48	1.57
[t]		-0.39		3.42	-2.25	0.31	-1.19	0.91	2.39			3.20	-3.23	0.34	-1.79	0.57	2.41		
8. Leverage ratio of securities broker-dealers																			
Est.	1.00	0.03	0.68	0.50	-0.43	0.29	-1.26	0.97	10.44	2.27	1.33	0.73	-0.59	0.45	-1.28	0.55	11.25	2.68	1.74
[t]		0.72		3.86	-2.41	0.46	-1.46	0.58	2.31			3.80	-3.41	0.58	-1.51	0.29	2.47		
9. Stock market factor																			
Est.	0.99	0.07	1.45	0.44	-0.37	0.15	-0.49	2.19	11.65	2.16	1.24	0.58	-0.49	0.24	-1.39	1.83	12.59	2.48	1.52
[t]		0.93		3.57	-2.30	0.23	-1.12	1.37	2.46			3.34	-3.12	0.34	-1.74	1.01	2.49		
10. Change in CAPE																			
Est.	0.98	0.13	4.57	0.48	-0.40	0.05	-1.27	1.50	9.73	2.16	1.35	0.63	-0.49	0.45	-1.77	1.16	9.71	2.48	1.65
[t]		1.54		4.25	-1.98	0.08	-1.51	0.90	2.56			3.44	-3.43	0.53	-1.80	0.57	2.29		
11. Real risk-free rate																			
Est.	0.99	-42.17	1.33	0.44	-0.35	0.05	-0.15	1.44	11.94	2.16	1.17	0.63	-0.50	-0.01	-1.16	1.01	13.11	2.48	1.44
[t]		-1.28		3.34	-2.13	0.07	-0.60	0.85	2.39			3.67	-3.23	-0.03	-1.73	0.51	2.50		
12. Change in intermediary capital ratio																			
Est.	0.94	0.21	12.15	0.38	-0.35	1.63	-2.15	3.25	13.00	2.40	1.61	0.53	-0.42	0.70	-2.47	2.85	11.65	2.74	2.10
[t]		4.53		3.27	-1.91	1.19	-1.43	1.48	2.23			2.70	-2.55	0.61	-1.78	1.33	1.96		
13. Aggregate sale growth																			
Est.	1.00	-0.01	0.00	0.45	-0.38	0.16	-0.48	1.41	11.65	2.16	1.24	0.58	-0.50	0.24	-1.40	0.99	12.59	2.48	1.52
[t]		-0.03		3.60	-2.27	0.23	-1.11	0.86	2.46			3.40	-3.36	0.35	-1.74	0.51	2.49		

Table A5 : Asset pricing tests for $\mathrm{ICS}^{\perp}$

Panel A in this table reports the average equal- and value weighted return characteristics of two sets of portfolio sorts: 5 book-to-market portfolios (5 BM) and 5 investment portfolios (5 IK). For each portfolio sort, the table reports the characteristics of the portfolios 1 (Low, L), and 5 (High, H), and the high-minus-low portfolio (H-L). Panel B reports the asset pricing tests on these portfolios using the following two asset pricing models as the benchmarks: the CAPM, in which the return on the market (MKT) is the only pricing factor, and a two factor model, in which the return on the market and the controlled equity issuance cost shock ($\mathrm{ICS}^{\perp}$) are the two factors. The estimation of the asset pricing models is by the generalized method of moments (GMM) using the standard asset pricing moment condition $\mathrm{E}_T\left[r^e_{it+1}\mathrm{M}_{t+1}\right] = 0$, in which M_{t+1}=1-b_M×MKT_t-b_I×ICS_t is the model specific stochastic discount factor (SDF), MKT_t is the (demeaned) market return, ICS_t is the (demeaned) equity ICS, and b_M and b_I are the corresponding risk factor loadings on the SDF. Panel A reports the following characteristics: $\mathrm{E}[r^e]$ is the portfolio average annual excess return; $[t]$ is the corresponding Newey-West t-statistic; SR is the portfolio Sharpe ratio; $\mathrm{Cov}^{\mathrm{MKT}}$ is the multivariate covariance between the portfolio excess return and the MKT factor; $\mathrm{Cov}^{\mathrm{ICS}}$ is the multivariate covariance between the portfolio excess return and the ICS factor; Panel B reports the GMM estimates of the risk factor loadings in the SDF with the corresponding t-statistic in parenthesis. The estimation is performed on a cross section of 50 assets (25 5-by-5 SZ and BM portfolios, and 25 5-by-5 SZ and IK portfolios. MAE is the estimation implied mean absolute pricing errors (mean of pricing errors (alphas) inferred from the errors on the moment condition estimated above). The data is annual from 1964 to 2013.

Panel A: Portfolio return characteristics and pricing errors

	VW						EW					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
Portfolio returns and Sharpe ratios												
$\mathrm{E}[r^e]$	5.39	12.16	6.77	9.37	4.89	-4.48	5.57	19.61	14.04	15.93	9.09	-6.84
$[t]$	2.21	5.78	3.00	3.99	2.01	-2.35	1.59	5.54	7.61	4.41	2.71	-6.78
SR	0.26	0.58	0.40	0.48	0.20	-0.28	0.17	0.56	0.82	0.49	0.28	-0.62
Risk factor betas												
Cov^{MKT}	3.42	3.44	0.02	3.25	3.98	0.73	5.21	5.17	-0.04	4.98	5.04	0.06
$[t]$	6.26	4.94	0.05	5.61	5.20	1.74	6.15	4.54	-0.10	5.32	5.38	0.24
Cov^{ICS}	-0.28	0.44	0.72	0.38	-0.13	-0.51	0.69	1.46	0.77	1.33	0.85	-0.48
$[t]$	-2.26	2.75	3.21	2.40	-0.88	-1.95	2.28	4.43	3.23	4.05	4.01	-2.78
Pricing errors: CAPM and 2 factor model												
Alpha	-3.43	3.98	7.41	2.58	-3.92	-6.50	-8.32	6.67	14.99	3.00	-4.55	-7.56
$[t]$	-1.89	2.07	2.02	1.71	-2.37	-2.15	-2.44	2.52	2.51	2.29	-2.51	-2.56
Alpha^{2F}	0.45	1.40	0.95	-0.85	-1.80	-0.95	-2.68	-1.58	1.11	-0.51	-3.13	-2.62
$[t]$	0.89	1.38	1.29	-1.03	-1.34	-1.36	-0.88	-0.98	0.73	-1.30	-1.68	-1.70

Panel B: Risk factor loadings

	VW						EW					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	2.50	3.91	2.18	4.18	2.51	3.31	2.81	2.75	2.89	2.82	2.70	3.03
$[t]$	3.36	2.14	2.80	1.98	2.02	1.95	3.37	1.39	3.52	2.09	3.13	1.76
b_I		9.51		11.43		7.67		17.78		9.93		8.51
$[t]$		2.35		1.81		2.53		2.30		2.87		2.34
MAE	2.10	0.77	1.91	1.23	2.16	1.43	4.31	1.84	2.04	1.59	2.50	1.73

Table A6 : Asset pricing tests for $\Delta \mathbf{EI}^{\perp}$

This table performs a similar analysis to Table A5. Please see Table A5 for the descriptions of the estimates.

Panel A: Portfolio return characteristics and pricing errors

	VW						EW					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
Portfolio returns and Sharpe ratios												
E[r^e]	5.76	12.30	6.54	9.40	5.38	-4.02	6.11	19.99	13.87	16.22	9.83	-6.39
[t]	2.45	6.13	2.98	4.19	2.27	-2.05	1.76	5.82	7.70	4.65	2.97	-5.96
SR	0.28	0.60	0.40	0.50	0.22	-0.25	0.19	0.58	0.82	0.51	0.31	-0.57
Risk factor betas												
Cov^{MKT}	3.33	3.27	-0.06	3.10	3.87	0.77	4.94	4.79	-0.15	4.60	4.75	0.15
[t]	6.18	4.92	-0.18	5.39	5.04	1.87	5.71	4.26	-0.34	4.84	5.02	0.60
Cov^{ICS}	-0.12	0.23	0.35	0.20	-0.04	-0.24	0.30	0.63	0.34	0.54	0.35	-0.19
[t]	-2.61	4.78	3.87	3.58	-0.64	-2.30	4.02	5.74	3.69	7.01	3.98	-3.18
Pricing errors: CAPM and 2 factor model												
Alpha	-3.36	3.87	7.23	2.41	-3.74	-6.15	-8.31	6.58	14.89	2.80	-4.39	-7.19
[t]	-1.91	2.06	2.02	1.65	-2.30	-2.08	-2.50	2.54	2.55	2.21	-2.49	-2.51
Alpha^{2F}	0.52	0.92	0.40	-0.71	-1.91	-1.20	-1.78	-1.25	0.53	-0.86	-2.21	-1.35
[t]	1.12	1.12	0.69	-1.65	-2.06	-2.07	-1.53	-1.62	1.16	-1.58	-1.83	-1.70

Panel B: Risk factor loadings

	VW						EW					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	2.68	2.99	2.34	2.84	2.76	2.53	3.02	0.81	3.12	1.68	2.94	2.30
[t]	3.52	2.70	2.93	2.48	2.19	1.72	3.43	0.56	3.61	1.48	3.21	1.48
b_I		19.47		19.68		14.96		39.49		27.26		16.21
[t]		3.02		2.12		2.32		4.00		3.33		2.59
MAE	2.08	0.62	1.79	1.24	2.16	1.44	4.31	1.31	1.95	1.33	2.48	1.62

Table A7 : Asset pricing tests for ICS measures constructed from debt

This table performs a similar analysis to Table A2. Please see Table A2 for the descriptions of the estimates.

		Value Weighted								Equal Weighted							
	(ICS, Base.)	Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section				Cov(ICS, Spread)		Spread 2F Alpha		Large Cross Section			
Measure	Corr.	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE	BM	IK	BM	IK	b_M	b_{ICS}	CAPM MAE	2F MAE
0. Baseline (Equity ICS)																	
Est.		0.45	-0.38	0.15	-0.49	1.41	11.65	2.16	1.24	0.58	-0.50	0.24	-1.39	0.98	12.59	2.48	1.52
[t]		3.61	-2.27	0.23	-1.12	0.85	2.46			3.41	-3.37	0.34	-1.74	0.50	2.49		
1. Change in credit spread																	
Est.	-0.16	-1.02	0.34	1.56	-4.28	1.56	-3.27	2.16	1.62	-1.24	1.16	2.91	-0.34	1.84	-3.07	2.48	2.11
[t]		-1.65	0.67	1.01	-1.31	0.98	-3.11			-1.50	2.20	1.26	-0.35	1.18	-2.31		
2. Total debt issuance fraction																	
Est.	0.03	-0.08	0.09	5.71	-5.14	1.58	-10.51	2.16	2.00	-0.13	0.03	4.42	-6.64	0.50	-16.82	2.48	2.21
[t]		-0.54	0.70	2.01	-2.27	1.27	-1.69			-1.06	0.35	0.85	-2.45	0.32	-1.74		

Table A8 : The logit equity ICS and systematic risk

This table reports the average value and equal weighted return characteristics of three sets of value weighted and equal weighted portfolios. The first two sets of portfolios include 5 book-to-market portfolios (5 BM) and 5 investment portfolios (5 IK). The third set of portfolios (Large), which includes 5×5 portfolios double sorted by size (market equity) and book-to-market and 5×5 portfolios double sorted by size (market equity) and investment rate, is used to perform a large cross sectional test. For the first two sets, the table reports the characteristics of the portfolios 1 (Low, L), and 5 (High, H), and the high-minus-low portfolio (H-L). In addition, the table reports the asset pricing tests on these portfolios using the following two asset pricing models as the benchmarks: the CAPM, in which the return on the market (MKT) is the only pricing factor, and a two factor model, in which the return on the market and an alternative measure of equity issuance cost shock (ICS) formed by a logit model with firm-level characteristics are the two factors. The estimation of the asset pricing models is by the generalized method of moments (GMM) using the standard asset pricing moment condition $E_T\left[r^e_{it+1}M_{t+1}\right]=0$, in which $M_{t+1}=1-b_{\mathrm{M}}\times\mathrm{MKT}_t-b_{\mathrm{I}}\times\mathrm{ICS}_t$ is the model specific stochastic discount factor (SDF), MKT_t is the (demeaned) market excess return, ICS_t is the (demeaned) logit ICS, and b_{M} and b_{I} are the corresponding risk factor loadings on the SDF. Panel A reports the following characteristics of 5 BM and 5 IK: $\mathrm{E}[r^e]$ is the average annual portfolio excess stock return (in percentage and in excess of the risk free rate); SR is the portfolio Sharpe ratio (average return-to-return standard deviation ratio); $[t]$ are heteroscedasticity and autocorrelation consistent t-statistics (Newey-West, with 5 year lag); $\mathrm{Cov}^{\mathrm{MKT}}$ is the univariate covariance between the portfolio excess return and the MKT factor; and $\mathrm{Cov}^{\mathrm{ICS}}$ is the univariate covariance between the portfolio excess return and the logit ICS factor; α and α^{2F} are the pricing errors (abnormal returns) implied by the estimation of the CAPM and the 2 factor model, respectively. The pricing errors are inferred from the errors on the moment condition estimated above. Panel B reports the GMM estimates of the risk factor loadings in the SDF with the corresponding t-statistic in parenthesis. The estimation is performed separately across each set of test assets. MAE is the estimation implied mean absolute pricing errors (mean of $|\alpha|$ or $|\alpha^{\mathrm{2F}}|$). The data is annual from 1971 to 2013 due to the availability of gross equity issuance (Compustat data item SSTK)

Panel A: Portfolio return characteristics and pricing errors

	Value-Weighted						Equal-Weighted					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
	Portfolio returns and Sharpe ratios											
$\mathrm{E}[r^e]$	5.79	13.19	7.40	10.71	5.40	-5.31	5.44	20.35	14.91	16.81	9.86	-6.95
$[t]$	2.14	6.79	2.97	5.09	2.06	-2.69	1.49	5.94	7.77	4.71	2.99	-6.09
SR	0.27	0.65	0.45	0.56	0.21	-0.33	0.16	0.59	0.86	0.52	0.31	-0.62
	Risk factor betas											
Cov^{MKT}	3.75	3.11	-0.64	3.12	4.26	1.14	5.03	4.25	-0.82	4.26	4.73	0.47
$[t]$	5.45	3.82	-1.33	4.39	4.53	1.87	4.93	3.45	-2.07	3.93	4.29	1.69
Cov^{ICS}	-0.07	0.09	0.15	0.03	-0.03	-0.06	-0.02	0.30	0.24	0.15	0.01	-0.14
$[t]$	-2.50	1.76	2.09	1.16	-1.35	-1.38	-0.37	2.96	3.25	2.27	0.18	-2.19
	Pricing errors: CAPM and 2 factor model											
Alpha	-4.20	4.55	8.75	3.20	-4.69	-7.89	-9.23	7.25	16.47	3.11	-4.91	-8.02
$[t]$	-2.06	2.03	2.06	1.85	-2.53	-2.30	-2.37	2.37	2.40	2.07	-2.40	-2.40
Alpha^{2F}	0.40	0.32	-0.08	0.38	-0.03	-0.42	0.09	0.00	-0.09	-0.46	-0.20	0.26
$[t]$	0.57	0.36	-0.18	0.19	-0.06	-0.25	0.11	0.00	-0.16	-0.58	-0.47	0.68

Panel B: Risk factor loadings

	Value-Weighted						Equal-Weighted					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	2.71	1.07	2.38	-0.97	2.64	1.25	2.92	-0.43	3.11	0.52	2.84	0.86
$[t]$	3.28	0.69	2.78	-0.25	1.48	0.94	3.23	-0.22	3.50	0.29	2.29	0.62
b_{ICS}		57.40		123.82		43.86		72.81		58.58		49.31
$[t]$		1.31		0.78		1.96		1.61		1.39		1.98
MAE	2.27	0.45	2.30	0.67	2.47	1.31	4.73	0.22	2.20	0.57	2.82	1.36

Table A9 : Asset pricing tests using an alternative equity ICS based on intensive margin We construct an alternative measure of the equity issuance cost shock (ICS) using log growth of gross equity issuance dollar amount adjusted by firm size. we use year-end market equity as the measure for firm size and sort firms into twenty portfolios. For each portfolio, we aggregate gross issuance dollar amount across firms and adjust it by inflation. We then construct the portfolio-level equity ICS using log growth of real gross issuance dollar amount. Then, we take the equal average across the twenty time series of portfolio-level equity ICS to construct the time series of aggregate equity ICS. The data is annual from 1972 to 2013. The analysis is similar to Table A8. Please see Table A8 for the descriptions of the estimates.

Panel A: Portfolio return characteristics and pricing errors

	Value-Weighted						Equal-Weighted					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
	Portfolio returns and Sharpe ratios											
$E[r^e]$	5.79	13.19	7.40	10.71	5.40	-5.31	5.44	20.35	14.91	16.81	9.86	-6.95
$[t]$	2.14	6.79	2.97	5.09	2.06	-2.69	1.49	5.94	7.77	4.71	2.99	-6.09
SR	0.27	0.65	0.45	0.56	0.21	-0.33	0.16	0.59	0.86	0.52	0.31	-0.62
	Risk factor betas											
Cov^{MKT}	3.77	3.12	-0.65	3.10	4.28	1.18	5.13	4.47	-0.67	4.34	4.86	0.52
$[t]$	5.38	3.81	-1.39	4.31	4.56	2.03	4.42	3.05	-1.21	3.53	3.87	1.52
Cov^{ICS}	-0.65	0.57	1.23	0.40	-0.35	-0.75	-0.95	0.09	1.04	0.49	-0.91	-1.40
$[t]$	-2.54	1.27	1.95	1.45	-1.33	-1.59	-0.73	0.07	1.90	0.39	-0.70	-2.43
	Pricing errors: CAPM and 2 factor model											
Alpha	-4.20	4.55	8.75	3.20	-4.69	-7.89	-9.23	7.25	16.47	3.11	-4.91	-8.02
$[t]$	-2.06	2.03	2.06	1.85	-2.53	-2.30	-2.37	2.37	2.40	2.07	-2.40	-2.40
Alpha^{2F}	0.54	1.75	1.20	2.14	-0.63	-2.77	-0.47	0.30	0.77	0.06	-1.11	-1.17
$[t]$	0.99	0.88	0.73	0.72	-0.76	-0.75	-0.20	0.09	0.35	0.03	-1.44	-0.65

Panel B: Risk factor loadings

	Value-Weighted						Equal-Weighted					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	2.71	-0.75	2.38	-1.37	2.64	0.62	2.92	-4.28	3.11	0.61	2.84	1.17
$[t]$	3.28	-0.24	2.78	-0.50	1.48	0.43	3.23	-0.67	3.50	0.31	2.29	0.81
b_{ICS}		6.47		6.59		3.86		16.78		5.27		3.71
$[t]$		1.45		1.83		2.13		0.90		2.54		2.32
MAE	2.27	0.93	2.30	1.19	2.47	1.81	4.73	0.55	2.20	1.05	2.82	2.29

Table A10 : Equity/debt ICS and systematic risk

We use the difference between the fraction of firms issuing equity and the fraction of firms issuing debt to construct the ICS shock. In particular, we define a firm as a debt issuing firm if its total debt (Compustat items: DLC + DLTT) is higher than a year before. We use the change of the difference between these two fractions as an alternative measure for the ICS shock. The analysis is similar to Table A8. Please see Table A8 for the descriptions of the estimates.

Panel A: Portfolio return characteristics and pricing errors

	Value-Weighted						Equal-Weighted					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
Portfolio returns and Sharpe ratios												
$E[r^e]$	5.76	12.30	6.54	9.40	5.38	-4.02	6.11	19.99	13.87	16.22	9.83	-6.39
$[t]$	2.45	6.13	2.98	4.19	2.27	-2.05	1.76	5.82	7.70	4.65	2.97	-5.96
SR	0.28	0.60	0.40	0.50	0.22	-0.25	0.19	0.58	0.82	0.51	0.31	-0.57
Risk factor betas												
Cov^{MKT}	3.40	2.96	-0.44	2.85	3.91	1.07	4.46	3.86	-0.60	3.83	4.25	0.42
$[t]$	5.85	4.82	-0.97	5.22	4.98	1.98	5.58	4.10	-1.45	4.56	4.99	1.44
Cov^{ICS}	0.00	0.24	0.24	0.18	-0.03	-0.21	0.41	0.76	0.34	0.61	0.40	-0.21
$[t]$	0.00	1.91	1.29	1.89	-0.24	-1.25	2.18	2.42	2.12	2.57	2.02	-1.60
Pricing errors: CAPM and 2 factor model												
Alpha	-3.36	3.87	7.23	2.41	-3.74	-6.15	-8.31	6.58	14.89	2.80	-4.39	-7.19
$[t]$	-1.91	2.06	2.02	1.65	-2.30	-2.08	-2.50	2.54	2.55	2.21	-2.49	-2.51
Alpha^{2F}	-0.36	-0.22	0.14	-0.36	-2.20	-1.84	-0.05	-0.29	-0.24	-0.53	-2.36	-1.83
$[t]$	-0.27	-0.30	0.22	-0.63	-1.32	-1.44	-0.03	-0.13	-0.29	-0.86	-1.42	-1.44

Panel B: Risk factor loadings

	Value-Weighted						Equal-Weighted					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	2.68	-2.24	2.34	-0.69	2.76	0.43	3.02	-7.60	3.12	-2.57	2.94	-0.26
$[t]$	3.52	-0.69	2.93	-0.30	2.19	0.25	3.43	-1.44	3.61	-0.81	3.21	-0.11
b_{ICS}		31.49		21.59		12.64		43.17		25.20		14.25
$[t]$		1.44		1.27		2.06		1.86		1.67		1.85
MAE	2.08	0.84	1.79	1.31	2.16	1.58	4.31	0.76	1.95	1.28	2.48	1.72

Table A11 : Monthly equity ICS factor mimicking portfolio and systematic risk

We project the baseline ICS factor on the annual Fama-French five factors and a constant using the OLS. Then we define the weights of a factor mimicking portfolio as the estimated coefficients of this regression (excluding the constant term). We normalize the sum of the weights to be 1. A monthly factor mimicking portfolio is constructed using these weights and the monthly Fama-French five factors. The annual average excess return of this portfolio is 4.4% and the Sharpe ratio equals to 0.49. The average excess return is significant (t-stat = 2.95). We use this factor mimicking portfolio as the second factor. All estimates are annualized. The data is from 1964 to 2013. The analysis is similar to Table A8. Please see Table A8 for the descriptions of the estimates.

Panel A: Portfolio return characteristics and pricing errors

	Value-Weighted						Equal-Weighted					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
Portfolio returns and Sharpe ratios												
$E[r^e]$	5.09	11.39	6.30	8.78	4.56	-4.22	4.64	16.25	11.61	13.54	8.30	-5.24
$[t]$	1.94	4.12	3.11	3.45	1.49	-2.02	1.15	4.29	6.15	3.67	2.17	-4.01
SR	0.30	0.59	0.48	0.51	0.23	-0.32	0.18	0.73	0.98	0.61	0.34	-0.61
Risk factor betas												
Cov^{MKT}	2.71	2.23	-0.48	2.31	3.00	0.70	3.25	2.16	-1.09	2.39	3.01	0.62
$[t]$	10.00	9.67	-3.58	9.79	9.42	3.58	9.19	8.47	-7.55	8.97	9.34	6.56
Cov^{ICS}	-0.23	0.53	0.76	0.17	-0.20	-0.37	0.10	0.67	0.58	0.50	0.28	-0.22
$[t]$	-6.11	5.14	5.61	2.97	-2.64	-2.97	0.86	4.39	4.78	3.82	2.14	-4.03
Pricing errors: CAPM and 2 factor model												
Alpha	-2.89	3.21	6.10	2.01	-3.42	-5.44	-7.43	6.65	14.08	3.03	-4.00	-7.03
$[t]$	-2.17	2.97	2.71	1.91	-2.60	-2.47	-5.59	5.29	5.73	3.67	-4.19	-4.58
Alpha^{2F}	0.23	0.10	-0.13	-0.72	-0.81	-0.09	0.00	0.35	0.35	0.57	-0.27	-0.83
$[t]$	0.45	0.21	-0.36	-1.04	-1.31	-0.27	-0.01	0.65	1.14	0.49	-0.67	-0.98

Panel B: Risk factor loadings

	Value-Weighted						Equal-Weighted					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	3.13	0.40	2.79	-1.18	3.23	0.29	3.64	-4.85	3.84	-5.18	3.38	-1.02
$[t]$	2.87	0.31	2.58	-0.48	2.72	0.22	2.69	-2.29	2.86	-1.53	2.73	-0.82
b_{ICS}		9.81		17.59		9.43		24.49		25.94		13.17
$[t]$		2.88		1.89		3.10		4.76		3.21		4.01
MAE	1.77	0.23	1.55	0.67	1.82	0.99	4.04	0.27	1.78	0.57	2.33	1.28

Table A12 : Collateral constraint shock (Jermann and Quadrini, 2012) and systematic risk

We use the collateral constraint shock from Jermann and Quadrini (2012) as the second factor. The data is quarterly from 1985 to 2010 due to the availability of the collateral constraint shock. The analysis is similar to Table A8. Please see Table A8 for the descriptions of the estimates.

Panel A: Portfolio return characteristics and pricing errors

	Value-Weighted						Equal-Weighted					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
Portfolio returns and Sharpe ratios												
E[r^e]	7.46	11.56	4.10	10.84	6.47	-4.37	3.90	19.84	15.93	15.31	9.66	-5.65
[t]	2.29	6.32	1.47	6.36	2.17	-1.58	1.33	4.67	6.54	4.01	3.31	-3.29
SR	0.34	0.61	0.24	0.64	0.24	-0.23	0.11	0.52	0.91	0.45	0.29	-0.48
Risk factor betas												
Cov^{MKT}	3.69	2.78	-0.92	2.57	4.25	1.68	5.48	5.01	-0.47	4.84	5.13	0.29
[t]	4.40	2.95	-1.63	2.87	3.14	2.47	3.09	1.98	-0.49	2.33	2.76	0.59
Cov^{ICS}	-0.04	0.01	0.05	0.00	0.01	0.01	-0.30	-0.26	0.04	-0.26	-0.25	0.00
[t]	-0.52	0.16	0.37	-0.01	0.09	0.06	-3.03	-1.54	0.30	-2.06	-2.60	0.05
Pricing errors: CAPM and 2 factor model												
Alpha	-3.26	3.19	6.45	3.90	-5.05	-8.95	-9.99	7.07	17.06	2.04	-4.56	-6.60
[t]	-1.43	1.18	1.31	1.72	-2.03	-1.98	-1.88	1.76	1.84	1.37	-1.70	-1.66
Alpha^{2F}	-1.44	2.87	4.32	4.53	-4.34	-8.87	-8.47	7.91	16.37	3.06	-3.85	-6.90
[t]	-1.18	0.95	1.03	1.29	-1.42	-1.39	-1.58	1.59	1.60	1.54	-1.62	-1.58

Panel B: Risk factor loadings

	Value-Weighted						Equal-Weighted					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	2.98	0.11	2.70	-0.68	2.70	2.21	2.96	2.50	3.19	2.86	2.96	2.88
[t]	2.58	0.02	2.20	-0.15	0.71	0.71	2.99	1.01	2.98	2.15	1.23	1.46
b_{ICS}		50.35		55.82		11.52		58.48		21.57		3.53
[t]		0.50		0.71		0.61		1.33		1.12		0.17
MAE	1.60	1.54	2.66	2.30	2.67	2.63	4.81	5.00	1.98	1.74	2.85	2.82

Table A13 : Performance of the financial sector and equity ICS

This table presents the results of the relation between equity ICS shock and the aggregate variables in the U.S. financial sector. These variables include log growth EBIT, dividend (DV), and market capitalization (ME) adjusted by inflation. α^{FIN} is the abnormal returns of the financial sector, computed as the intercept and the residual from a CAPM regression of the excess return on the finance sector on a constant and the CAPM market factor. Slope is the from regressing the equity ICS on the X_t variable. [t] is the NW adjusted t-statistics. The data is annual from 1971 to 2013.

	X_t variable			
	EBIT	DV	ME	α^{FIN}
Correl(ICS,X_t)	0.20	0.15	0.25	0.22
Slope	0.05	0.06	0.11	0.17
$[t]$	5.34	1.97	3.74	3.57

Table A14 : Financial sector abnormal return and systematic risk

We use the abnormal return of the financial sector in one of the Fama and French 12 industry portfolios as the second factor. The abnormal returns are defined as the residuals of the CAPM regression. This measure of the ICS shock is in monthly frequency. But all estimates are annualized. The data is from 1964 to 2013. The analysis is similar to Table A8. Please see Table A8 for the descriptions of the estimates.

Panel A: Portfolio return characteristics and pricing errors

	Value-Weighted						Equal-Weighted					
	5 BM			5 IK			5 BM			5 IK		
	L	H	H-L	L	H	H-L	L	H	H-L	L	H	H-L
	Portfolio returns and Sharpe ratios											
$E[r^e]$	5.09	11.39	6.30	8.78	4.56	-4.22	4.64	16.25	11.61	13.54	8.30	-5.24
$[t]$	1.94	4.12	3.11	3.45	1.49	-2.02	1.15	4.29	6.15	3.67	2.17	-4.01
SR	0.30	0.59	0.48	0.51	0.23	-0.32	0.18	0.73	0.98	0.61	0.34	-0.61
	Risk factor betas											
Cov^{MKT}	2.55	2.61	0.06	2.43	2.86	0.44	3.32	2.64	-0.68	2.74	3.20	0.47
$[t]$	10.06	9.35	0.49	10.04	9.62	3.07	9.67	8.47	-5.41	9.14	9.80	5.74
Cov^{ICS}	-0.22	0.10	0.32	0.03	-0.41	-0.44	-0.31	0.03	0.34	-0.04	-0.28	-0.24
$[t]$	-6.26	2.01	4.13	0.51	-4.38	-3.10	-2.52	0.38	3.82	-0.45	-2.52	-4.85
	Pricing errors: CAPM and 2 factor model											
Alpha	-2.89	3.21	6.10	2.01	-3.42	-5.44	-7.43	6.65	14.08	3.03	-4.00	-7.03
$[t]$	-2.17	2.97	2.71	1.91	-2.60	-2.47	-5.59	5.29	5.73	3.67	-4.19	-4.58
Alpha^{2F}	0.57	0.53	-0.04	0.73	-0.27	-1.00	0.00	1.40	1.40	2.42	-0.42	-2.84
$[t]$	1.38	0.93	-0.16	0.98	-1.03	-1.31	0.00	1.47	2.23	2.37	-2.22	-2.43

Panel B: Risk factor loadings

	Value-Weighted						Equal-Weighted					
	5 BM		5 IK		Large		5 BM		5 IK		Large	
	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F	CAPM	2F
b_M	3.13	3.45	2.79	3.19	3.23	3.58	3.64	5.20	3.84	4.32	3.38	3.50
$[t]$	2.87	2.49	2.58	2.69	2.72	2.75	2.69	2.03	2.86	2.57	2.73	2.68
b_{ICS}		19.40		10.56		9.67		40.77		18.15		9.78
$[t]$		2.58		2.05		1.60		3.60		2.77		1.72
MAE	1.77	0.58	1.55	0.50	1.82	1.42	4.04	0.81	1.78	0.96	2.33	2.03

Table A15 : Cash holdings across equity ICS states

This table presents the time series average portfolio-level realized (that is, in the year after portfolio formation) cash growth for the low (L) and high (H) portfolios sorted on book-to-market (BM) and investment (IK). Cash growth is defined as Compustat item CHECH / lag(CHE). The reported time series averages of the portfolio characteristics are computed separately across different equity ICS states, defined as periods characterized by High, Medium, and Low realizations of the equity ICS shocks. The High ICS state periods, which correspond to years with unusually low costs of issuing equity (good times), are defined as the years in which the realized equity ICS is in the top 10th percentile of the ICS distribution. The Low ICS states (years with unusually high cost of issuing equity, hence, bad times) are defined as the years in which the realized ICS is in the bottom 10th percentile of the ICS distribution. The intermediate (Mid) states corresponds to the years in which the corresponding variable is between the 10th and 90th percentile of the corresponding distribution.

	5 BM		5 IK	
ICS states	G	V	L	H
Low - bad times	1.68	-3.19	-4.10	3.41
Mid	9.55	-0.38	2.75	3.91
High - good times	16.24	4.33	4.46	5.46

Table A16 : Payout dynamics around negative equity ICS years

This table presents the average portfolio payout growth for growth/value stocks and low/high investment stocks around negative equity ICS years. Portfolio payout is defined as the sum of cash dividend and share repurchase across all stocks within a portfolio. Growth/value stocks are defined the stocks with the highest/lowest 20% book-to-market ratios. Low/high investment stocks are defined as the stocks with the lowest/highest 20% investment rates. We define the event year 0 as the years with negative equity ICS. we focus on the component of the portfolio payout that is orthogonal to aggregate GDP growth.

	5 BM		5 IK	
	G	V	L	H
-2Y	5.45	−16.03	−4.20	1.06
-1Y	6.89	−13.69	3.78	6.69
0	3.67	−15.07	−7.65	−3.05
1Y	2.26	−22.41	−10.77	−5.25
2Y	4.74	−22.76	−2.66	3.27
3Y	7.35	−10.40	−5.70	4.61

Table A17 : Correlation between equity issuance and debt growth

This table presents the correlation between equity issuance and debt growth across 5 book-to-market and 5 investment portfolios in the data and in the model. The equity issuance is measured as the gross equity issuance over asset ratio averaging across equity issuing firms for each portfolio. The debt growth is measured as the average change in debt over asset ratio for each portfolio. We winsorize the variables at bottom and top 2% when taking the averages.

	Data						Model					
	L	2	3	4	H	H-L	L	2	3	4	H	H-L
BM	−0.33	0.01	0.07	0.16	0.16	0.49	−0.50	0.08	0.12	0.52	0.74	1.24
IK	0.16	0.09	0.06	0.00	−0.22	−0.37	0.01	0.01	0.32	0.23	−0.16	−0.17

Table A18 : Correlation between aggregate gross equity issuance and the fraction of equity issuance

This table presents the correlation between log growth of aggregate gross equity issuance and the change in fraction of equity issuance in the data and in the model. In order to show the impact of equity issuance of the largest stocks, we compute this correlation when excluding the largest $X\%$ ($X = 0, 1, 5, 10, 20$) stocks measured by market equity.

Excluding cutoff based on market equity	0	1%	5%	10%	20%
Data	0.62	0.70	0.79	0.89	0.92
Model	0.47	0.83	0.89	0.91	0.95

Table A19 : Financial flows across the business cycle

This table presents the time series average of portfolio-level realized (that is, in the year after portfolio formation) fraction of firms in the portfolio that issue equity (Equity issuance fraction), gross equity issuance-to-asset ratio (Gross Equity Issuance / Assets) computed among issuing firms, and the change in debt over assets (ΔDebt/Assets) for the low (L) and high (H) portfolios sorted on book-to-market (BM) and investment (IK). Among them, the portfolio-level Gross Equity Issuance/Assets and ΔDebt/Assets are computed as the averages across all firms in a portfolio. We winsorize the firm variables at top and bottom 2% to remove the outliers when computing the averages. All numbers reported are in percentage. The reported time series averages of the portfolio characteristics are computed separately across different GDP states, defined as periods characterized by High, Medium, and Low realizations of GDP in the real data. The High GDP state periods (good times), are defined as the years in which GDP is in the top 10th percentile of the GDP distribution. The Low GDP states (bad times), are defined as the years in which the realized GDP is in the bottom 10th percentile of the GDP distribution. The intermediate (Mid) states corresponds to the years in which the realized GDP is between the 10th and 90th percentile of the GDP distribution. The reported variables are the components of the variables that are orthogonal to the ICS to remove the effect of changes in market conditions related to equity ICS. The data is annual from 1964 to 2013.

	Business Cycle (across GDP states)			
	5 BM		5 IK	
	G	V	L	H
	Equity Issuance Fraction			
High - good times	25.08	9.51	16.95	16.59
Mid	27.59	8.90	19.86	18.95
Low - bad times	19.70	9.71	14.37	14.84
	Gross Equity Issuance / Assets			
High - good times	25.86	4.24	14.74	19.25
Mid	43.79	7.94	32.39	33.10
Low - bad times	36.07	6.51	25.71	26.40
	ΔDebt / Assets			
High - good times	4.06	0.85	-0.08	4.19
Mid	2.83	0.27	0.00	3.48
Low - bad times	1.90	-0.24	-1.84	2.60

Table A20 : Firm-level correlations (not targeted)

This table presents the selected firm-correlations not targeted in the calibration. The model-implied moments are the mean value of the corresponding moments across simulations. The cross-sectional firm-level moments are computed by first computing the cross sectional moments and then taking the average of these moments across years. The real data are from 1964 to 2013. The reported statistics for the model are obtained from 100 samples of simulated data, each with 3,600 firms and 600 monthly observations.

Moments	Data	Model
Investment rate, equity issuance	0.19	0.36
Investment rate, debt growth	0.18	0.92
Investment rate, cash-to-assets ratio	0.28	0.04
Investment rate, sales growth	0.37	0.78
Equity issuance, sales growth	0.11	0.11
Debt growth, sales growth	0.32	0.81
Cash-to-assets ratio, sales growth	0.13	0.02
Equity issuance, cash-to-asset ratio	0.31	0.05

Table A21 : Selected moments in the data and across alternative calibrations of the model

This table presents several comparative statics exercises across 5 specifications (Spec #). The reported statistics for the model are obtained from 100 samples of simulated data, each with 3,600 firms and 600 monthly observations.

	Quantities				Asset prices				
	Correl.	S.D.	Correl.	Cash/Asset	Mkt	BM		IK	
spec #	(ICS,$\Delta\xi$)	IK	(ICS,ΔSales)		r^e	r^e	α	r^e	α
0-Data									
	na	0.24	0.11	0.05	5.71	6.54	7.23	-4.02	-6.15
1-Benchmark									
	0.93	0.22	0.11	0.05	5.58	5.71	6.01	-5.81	-5.9
2-Higher returns to scale ($\theta = 0.75$; benchmark $\theta = 0.7$)									
	0.89	0.23	0.11	0	6.13	5.04	5.71	-4.47	-4.86
3-Low idiosyncratic volatility ($\sigma_z = 0.1$;benchmark $\sigma_z = 0.15$)									
	0.83	0.21	0.03	0.02	3.76	4.05	4.37	-3.62	-3.8
4-Less tight collateral constraint ($\varphi = 1$; benchmark $\varphi = 0.85$)									
	0.91	0.34	0.09	0.04	2.78	2.61	3.49	-2.22	-2.49
5-Low partial investment irreversibility ($c_k^- = 4$; benchmark $c_k^- = 40$)									
	0.88	0.21	-0.16	0.01	2.78	2.61	3.49	-2.22	-2.49

Table A22 : Average returns and aggregate shock exposures of the spread portfolios across model specifications

This table presents the average returns and risk exposures of the spread portfolios across model specifications. Panel A reports the model with debt collateral constraint shock as the only financial shock. Panels B (or C) report the model with perfectly positively (or negatively) correlated debt collateral constraint shock and equity issuance cost shock. Panel D report the model with independent debt collateral constraint shock and equity issuance cost shock.

	BM(H-L)	IK(L-H)
	Panel A: Model i	
$E\left[R^{\text{Spd}}\right]$ (in %)	2.47	-2.56
β^{TFP}	-0.21	-0.06
β^{φ} (collateral)	0.00	0.00
	Panel B: Model ii-v1	
$E\left[R^{\text{Spd}}\right]$ (in %)	2.72	3.93
β^{TFP}	-0.06	-0.03
β^{ξ} (equity ICS)	0.12	0.14
β^{φ} (collateral)	0.00	0.00
	Panel C: Model ii-v2	
$E\left[R^{\text{Spd}}\right]$ (in %)	3.83	4.90
β^{TFP}	0.00	-0.04
β^{ξ} (equity ICS)	0.13	0.17
β^{φ} (collateral)	0.00	0.00
	Panel D: Model iii	
$E\left[R^{\text{Spd}}\right]$ (in %)	2.92	4.29
β^{TFP}	-0.01	0.00
β^{ξ} (equity ICS)	0.08	0.09
β^{φ} (collateral)	0.01	0.03