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Macroeconomic Conditions, Financial Constraints, and Firms' Financing Decisions*

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ABSTRACT

We examine how time-varying macroeconomic conditions affect firms' financing decisions. A principal components decomposition of a number of macroeconomic variables characterizes three phases of the business cycle relative to recessions: early recovery, robust recovery, and economic crest; a fourth represents "windows of opportunity" in capital markets that are unrelated to recessions. This characterization yields results that traditional approaches miss. Specifically, debt issuance exhibits a non-monotonic pattern during the upward phase of the business cycle: it declines in robust recovery relative to recessions, but peaks at the economic crest. Financially constrained firms issue more equity during the windows of high stock market valuation, while unconstrained firms time debt issuance in response to debt market spreads.

***JEL classification*:** G32, E32
***Keywords*:** Capital structure, Debt maturity, Financial constraints, Macroeconomic conditions, Market timing.

1. Introduction

Economic intuition suggests that macroeconomic conditions should have effects on firms' financing decisions, however, quantifying the effects is challenging. A common approach is to examine financing patterns in "expansions" and "recessions".[1] Capital market conditions, however, vary over the business cycle. It is common for the financial press, for example, to use a richer vocabulary than plain "expansion" and "recession" to describe the state of the economy. Practitioners and policy makers debate whether a recovery is "robust" or "fragile", whether markets are "overvalued" or correctly valued, or whether the economy is "overheated". Credit market conditions, inflation, and interest rates vary continuously over the expansionary phase of the business cycle leading to the next contraction. Thus, it appears that a more nuanced characterization of the phases of the business cycle is likely to be more informative about how firms' financing choices respond to changing macroeconomic conditions than one in terms of recession and expansion only.

An alternative approach is to examine how specific macroeconomic variables affect firms' financing decisions. For example, Korajczyk and Levy (2003) capture the macroeconomic environment in terms of three aggregate variables: the corporate profit growth rate, equity market returns, and the excess returns of commercial paper. This alternative approach exploits the time-variation in the macroeconomic environment better. However, since not all macroeconomic variables move in tandem, it is difficult to interpret which state of the economy a particular variable represents. Further, it is also unclear whether a particular macroeconomic variable captures all relevant aspects of the macroeconomic environment, or which macroeconomic variables track more faithfully various phases of the business cycle.

[1] This is the approach taken, for example, in Halling, Yu, and Zechner (2016) and Erel et al. (2012). The structural models of Hackbarth, Miao, and Morellec (2006) and Bhamra, Kuehn, and Strebulaev (2010) also model basically two phases of the business cycle.

In this paper, we combine the above two approaches by means of a principal components (PC hereafter) decomposition of a set of key macroeconomic variables. The decomposition not only provides a richer characterization of different phases of the business cycle, but also allows us to capture the effect of time variation in underlying macroeconomic variables, representing changing conditions in the real economy as well as credit and equity markets, on firms' financing decisions. The four principal components with eigenvalues greater than one are the key explanatory variables in our empirical tests.[2] They have intuitive explanations in terms of their loadings on the underlying macroeconomic variables. The first three principal component scores attain their lowest values in recessions, and their highest values, respectively, during phases that we characterize as "early recovery", "robust recovery", and "crest" of the business cycle. The fourth principal component is characterized by high equity values but fragile real economic conditions, and is termed "window of opportunity", reflecting possibly irrational exuberance. We read U.S. country reports from OECD Economic Surveys (1972 -1985) and the Economist Intelligence Unit (1985 – 2014) to confirm our characterizations of the U.S. economy.

This more granular characterization of the business cycle not only yields many new results, but also challenges the conventional wisdom on several existing ones. One possible reason is that the traditional classification of phases of the business cycle in terms of crest-trough comparisons misses out on the fact that during economic expansions, what happens at the crest of the business cycle can be very different from what happens in recovery. When the effects of recovery dominate those at the crest, the results derived from the traditional measures of cyclicality can be

[2] In our regressions, we control for a number of firm characteristics, which have been shown in previous studies to affect financing and investment decisions. The environment in which the firm operates includes not only elements specific to the firm (such as the quality of its projects, its information environment, or competitive position in the industry) but also the overall macroeconomic environment (expectations about future inflation, economic activity, or market sentiment). To the extent that the latter are important for firms' financing and investment decisions, we expect the sensitivity of firm policies to our principal components to convey incremental information about the determinants of these decisions.

somewhat misleading. For example, Korajczyk and Levy (2003) begin their well-known paper on the effect of macroeconomic conditions on firms' financing choices by summarizing the existing evidence as follows: *"Capital structure choice varies over time and across firms. For example, aggregate equity issues vary pro-cyclically and aggregate debt issues vary counter-cyclically for firms that access public financial markets. Meanwhile, firms that exhibit higher degrees of financial constraints do not exhibit these pronounced counter-cyclical debt issue patterns."*[3]

However, our findings differ from the conventional wisdom represented in the above segment. We do not find evidence that debt issuance is unambiguously counter-cyclical: in fact, consistent with Pecking Order behavior, while debt issuance decreases in robust recovery relative to recessions, it peaks during the crest of expansion. This non-monotonic pattern is present for both financially constrained and unconstrained firms. In contrast to debt issuance, equity issues are more pro-cyclical for financially constrained firms. This is consistent with the idea that financially constrained firms, being more subject to adverse selection, issue more equity when economic conditions improve (Choe, Masulis, and Nanda, 1993). Mirroring debt and equity issuance activities, the change in the book leverage ratio of both financially constrained and unconstrained firms falls during robust recovery and increases during the crest of the business cycle.

[3] The cyclicality of firm leverage is still under debate. While Korajczyk and Levy (2003) document that aggregate debt issuance is counter-cyclical for firms that access public financial markets, Covas and Den Haan (2011) find that debt issuance is pro-cyclical for all U.S. listed firms but the largest ones. Korteweg and Strebulaev's (2015) general (S, s) model of capital structure predicts that firms' *target* leverage ratios, which are unobservable, should be pro-cyclical. However, they find that the *observed* leverage ratios are counter-cyclical. Their OLS regressions also reproduce the counter-cyclical leverage ratios documented in Korajczyk and Levy (2003). They argue that target leverage ratios and observed leverage ratios diverge because, for example, firm values decrease during recessions, and thus raise observed leverage ratios (measured in terms of market values). Many firms do not find it optimal to refinance and reduce leverage ratios, even though their target leverage ratios have decreased.

An interesting question concerns whether constrained or unconstrained firms respond more to changing macroeconomic conditions. Korajczyk and Levy (2003) examine how the debt-equity choice of financially constrained and unconstrained firms is affected by variables that represent favorable macroeconomic conditions, after controlling for the "leverage deficit" (or the deviation of the leverage ratio from an estimated target leverage ratio).[4] They find that only the financially unconstrained firms issue more equity relative to debt when macroeconomic conditions are favorable and present a window of opportunity; however, financially constrained firms' debt-equity choice is unaffected by macroeconomic conditions. Since estimating the leverage target is controversial (e.g., Chang and Dasgupta, 2009), we do not follow Korajczyk and Levy (2003) in examining the effect of macroeconomic variables on target leverage or the propensity of firms to deviate from target behavior. Instead, we examine the response of debt and equity issuances to the principal component that represents a window of opportunity (the stock market rebounds but economic fundamentals are fragile). We find that during such periods, all firms issue more equity, but constrained firms issue much more than do unconstrained firms. Moreover, while both groups increase their cash holdings, constrained firms' cash holdings increase more but investment in long-term assets does not increase correspondingly, suggesting market-timing behavior.

While constrained firms, in particular, seem to exploit equity overvaluation, unconstrained firms' timing behavior extends to the debt market and is reflected in their choice of debt maturity. In the early stages of recovery, when inflation is low and the term spread starts to widen, unconstrained firms tend to issue more long-term debt and reduce short-term debt. At the same time, they reduce investment in long-term assets. This is consistent with "debt market timing"

[4] The argument here is that if macroeconomic factors affect the debt-equity choice after controlling for the leverage deficit, then such issuances presumably represent deviations from target behavior, motivated, e.g., by market timing considerations.

whereby the unconstrained firms attempt to lock-in lower rates on long-term debt if they expect future borrowing costs to be higher due to higher expected inflation. Similarly, at the crest of the business cycle, when the environment is inflationary but the term spread begins to narrow, indicating lower future expected inflation, unconstrained firms lean more towards short-term debt, even though they invest in long-term projects.

We also measure the variation effect of macroeconomic variables as the combined contribution of our four principal components to the time-series variation of our seven dependent variables regarding firms' financing activities. The variation of the PC scores account for 9.15%-13.76% of the time-series variations of our dependent variables. This compares quite favorably with, and exceeds, the contribution of a majority of the most commonly used firm-specific explanatory variables to the combined cross-sectional and time-series variation of the dependent variables. Korajczyk and Levy (2003) argue that unconstrained firms show greater sensitivity to changing macroeconomic conditions as they are able to sustain deviations from target leverage more effectively. We find that the variation effect of the PC scores on several dependent variables (e.g., the change in the leverage ratio and the change in debt maturity) is larger for financially unconstrained firms than for constrained ones. While this appears consistent with the findings of Korajczyk and Levy (2003), there are important differences. We find that the financially unconstrained firms do indeed show greater sensitivity to changing debt market conditions. However, it is the financially constrained firms that show greater sensitivity to changing equity market conditions., and in particular, issue equity more aggressively in the window of opportunity when equity appears to be overvalued. This is consistent with the notion that the financially constrained firms, who normally incur higher deadweight costs associated

with security issuance, are most likely to take advantage of favorable market conditions (Chang, Dasgupta, and Hilary, 2006).

The rest of the paper is organized as follows. The next section introduces and interprets the principal components that form the basis for our analysis. In Section 3, we discuss the Data. Section 4 describes our empirical models. Section 5 presents the empirical results, while Section 6 concludes.

2. Principal components decomposition of macroeconomic variables

We expect macroeconomic conditions and financial constraints to induce both time-series and cross-sectional heterogeneity in firm financing behavior. Theories of optimal debt maturity and capital structure suggest that both should respond to time variation in macroeconomic conditions, such as economy-wide growth opportunities, capital market conditions, and interest rates. At the same time, firms' access to the capital markets can vary cross-sectionally, and financially constrained and unconstrained firms may respond differently in terms of their security issuance decisions in any given state of the macroeconomy.

Most studies of the effect of macroeconomic conditions on firms' financing choices look at behavior in two phases of the business cycle: "expansion and "recession." However, macroeconomic variables such as real GDP growth, inflation, interest rates, and default spreads, change continuously throughout the business cycle, and it is very likely that firms' financing decisions respond to these changes. Thus, there is a need for a more nuanced characterization of phases of the business cycle than is captured by "expansion" and "recession." Further complicating matters is the fact that some of the macroeconomic variables which are supposed to represent a certain state of the economy do not typically move in tandem: for example, high GDP growth is associated with higher rates of fixed capital formation and improved investment

outlook, and high stock market returns are also thought to be symptomatic of improving economic prospects; however, the annual contemporaneous correlation between these two variables for the U.S. economy over our sample period (1975-2014) is -0.02 and statistically insignificant.[5] A smaller term spread is supposed to predict recessions. However, it has insignificant correlations with real GDP growth and the NBER recession indicator.

To address these issues, we conduct a principal components analysis using a number of key macroeconomic variables. We consider both current and lagged values of the macroeconomic variables that are commonly used in the literature as the basis of our principal components analysis: real GDP growth, a dummy variable for NBER recession, inflation, nominal interest rate, the term spread, the default spread, and the value-weighted stock market return. As we see below, the correlation of the PCs with different macroeconomic variables provide highly meaningful interpretations of the former in terms of the state of the macroeconomy, or different phases of the business cycle. Thus, in the remainder of this paper, we use the first four PCs as proxies of macroeconomic conditions to investigate what effects they have on firms' financing activities. In this section, we first present the definition of each macroeconomic variable separately, and then discuss the interpretations of the principal components.

2.1. Macroeconomic variables

Real GDP Growth is measured as the percentage increase in real GDP in 2000 dollars. *NBER Recession* is a dummy variable that takes the value 1 if an NBER-defined recession is present and 0 otherwise.[6] While both variables are likely to reflect macroeconomic risk (Bhamra, Kuehn,

[5] While earlier studies (e.g., Fama, 1981; Fama, 1990 and Schwert, 1990) find that stock market returns predict future economic activities in the U.S. from the 1950s to the 1980s, Binswanger (2000) documents that the relationship between current stock market returns and future economic performance in the U.S. has disappeared since the early 1980s (e.g., Stock and Watson, 1998).

[6] According to the NBER website, a recession is determined if "*a significant decline in economic activity spread across the economy, lasting more than a few months*". In other words, a recession is defined based on the subsequent economic performance. To the extent that the recession dummy may contain some future information, our findings

and Strebulaev, 2010), the latter largely captures the worst stage of the economy. *Inflation* is the annual percentage change in the Consumer Price Index. If inflation is mean reverting, low current inflation suggests high expected inflation in the future, making issuance of longer maturity bonds more attractive if the yield curve does not fully reflect the expected real borrowing cost in the future. *Nominal Interest Rate*, which captures the tightness of monetary policy, is the annualized December 3-month Treasury bill interest. *Term Spread* is defined as the difference between the December 10-year Treasury bond yield and the annualized December 3-month Treasury bill yield. Korajczyk and Levy (2003) argue that the term spread serves as a proxy for investment opportunities. Estrella and Mishkin (1996) find that a smaller term spread is a strong predictor of U.S. recessions. A high term spread implies good economic prospects, which should lead to an increase in leverage, and a longer debt maturity if firms borrow long to finance long-term investments. Following Bernanke and Blinder (1992) and Korajczyk and Levy (2003), we use *Default Spread* to measure liquidity risk, which is defined as the difference between the December yields on Moody's Baa and Aaa rated corporate bonds with maturities of approximately 20-25 years. The default spread reflects the economy-wide likelihood of bankruptcy, which tends to widen dramatically prior to an economic slowdown or during credit-crunches induced by the Federal Reserve. Therefore, we expect the escalating liquidity risk to induce firms to lengthen the maturity of their debt (Diamond, 1991). Our last macroeconomic variable is *Stock Market Return*, computed by compounding monthly returns on the CRSP value-weighted index of stocks traded on NYSE, NASDAQ, and AMEX. While it is unclear whether stock returns are a leading indicator of future economic performance, Choe, Masulis, and Nanda (1993) find a positive relation between stock market returns and the frequency of equity issues

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can be subject to look-ahead bias. To alleviate this concern, in robustness check, we replace the NBER dummy with a negative GDP growth dummy, which equals one when the real GDP growth rate is negative, and zero otherwise. Our main results still hold.

(relative to bond issues) and various business cycle variables, and argue it is due to lower adverse selection costs associated with promising economic conditions. Panel A of Table 1 reports the summary statistics of macroeconomic variables over the 1975-2014 period.

[Insert Table 1 here]

Panel B of Table 1 reports the correlation among macroeconomic variables. Not surprisingly, we find that GDP growth is negatively correlated with NBER recession (the correlation coefficient is -0.75). GDP growth is also significantly and negatively correlated with the default spread, suggesting that the default spread is counter-cyclical. Consistent with the Fisher equation, the correlation between inflation and the nominal interest rate is positive and significant. This also indicates that monetary policy tightens when inflation is high. The stock market returns are negatively correlated with the default spread, indicating that favorable stock markets generally coincide with lower default risk. Panel B of Table 1 also shows that macroeconomic variables do not always move in tandem. While term spreads and stock market returns are high during the expansionary phases of the economic cycle, neither of them has a significant correlation with the real GDP growth rate.

2.2. Principal components

The results of Principal Component Analysis (PCA) of our macroeconomic variables are reported in the Internet Appendix A. Following common practice, we retain the first four PCs whose eigenvalues exceed one and use them as proxies for macroeconomic conditions. We name them as Score 1, Score 2, Score 3, and Score 4, respectively. These four scores collectively explain 79.6% of the total variation in the underlying macroeconomic variables.

To understand which phase of the business cycle each of the scores corresponds to, it is useful to examine the correlations between a particular score and the macroeconomic variables

that are the basis for our PCA. This is shown in Table 2. Figure 1 also shows how the values of the scores vary from one recession to another, which facilitates the interpretation. To further ensure that our interpretation of these scores is accurate, we read U.S. country reports from the OECD Economic Surveys (1972 – 1985) and the Economist Intelligence Unit reports (1985 – 2014). The findings are reported below. We discuss the principal components in the order in which they relate to phases of the business cycle, rather than the percentage of the total variation they explain.

[Insert Table 2 and Figure 1 here]

Early Recovery (Score 1): Panel A of Figure 1 shows that Score 1 typically reaches high values immediately after a recession, and low values occur in the early stages of a recession (but begin to decline and hit low values prior to the onset of a recession). Table 2 shows Score 1 is not significantly correlated with either lagged or subsequent real GDP growth, but is significantly and positively (negatively) correlated with concurrent real GDP growth (NBER Recession). It is also negatively correlated with concurrent inflation, nominal interest rate, and default spread. These imply that when Score 1 is high, recession-related defaults have already occurred, and the economy starts emerging from recession. However, the recovery is still fragile. Low inflation and interest rates suggest that the pace of recovery is slow, and monetary policy is geared towards stimulating the economy.

Over our sample period, the highest values for Score 1 occurred in 2014. The Economist Intelligence Unit (EIU henceforth) noted in its December 2014 report that: *"The US economy has been enjoying a brisk expansion, growing by more than 3% annually for four out of the past five quarters, faster than almost any other country in the developed world. ... Nonetheless, the US is not on the verge of a boom. ... Inflation will remain soft in the coming months. ... With the Fed*

likely to raise its policy rate only gradually from mid-2015, and strong economic demand expected, we forecast that annual inflation will average 2.3% in 2015-18, before slowing in 2019 as economic demand declines."

The lowest values for Score 1 occurred in 1980. The OECD country report for the U.S. states: *"In 1980 Q1,…, the higher prices of energy, a more general acceleration of inflation and a tighter policy stance brought declines in a broad range of indicators of economic activity. The recession which had been widely anticipated for over a year has begun. … There are perhaps two particularly important sets of questions in assessing the current situation. The first is the timing and extent of the downturn which has now begun. … The second set of questions concern inflation. … [I]t seems likely that in the course of 1981 a much higher level of unemployment … will be associated with an underlying rate of inflation of 9 to 10 per cent."*

[Insert Table 3 here]

Robust Recovery (Score 3): Table 2 shows that Score 3 is significantly and negatively correlated with lagged real GDP growth, and negatively correlated with the contemporaneous NBER recession dummy. Thus, high values of Score 3 also indicate a recovering economy. Unlike Score 1, however, Score 3 is positively and significantly correlated with concurrent stock market return, and subsequent nominal interest rate and real GDP growth. These imply that the buoyant stock market during these periods is a leading indicator of stronger and more robust economic prospects. Panel B of Figure 1 confirms our conjecture. Score 3 dips (peaks) immediately before or in the early stages of recession (expansion). In Panel A of Table 3, we report a Vector Autoregression on the four Scores. In Column (3), we find that Score 3 strongly

leads Score 2 (corresponding to the crest of the cycle, discussed next), providing support for our interpretation that high values of Score 3 indicate "robust recovery". [7]

The highest values of Score 3 occur in 1983. The OECD country report for 1983 states: *"The early stages of the recovery have gathered considerable momentum. After a relatively subdued first quarter of 1983, when GNP advanced at only a 2½ per cent rate, real growth rates of nearly 10 per cent and 8 per cent were recorded in the subsequent quarters."*

The lowest values occur in 2008. The EIU report for December 2008 states: *"There is little doubt that the world's biggest economy is now in recession. ... The Fed has eased monetary policy aggressively in its drive to loosen credit markets and stimulate the economy. ... The rate has now been lowered nine times since September 2007, bringing it down ... to the record lows last seen in 2003-04. A further drop is widely expected for the next monetary policy review on December16th. Equity and bond markets remain highly strained ... Fear gripped the stock market as a slew of weak economic data and disappointing corporate news hammer shares of even the most blue-chip companies. In bond markets, spreads between riskier corporate bonds rated BBB and more resilient ones rated AAA have actually continued to widen until late November. ... This suggests an extreme level of risk aversion."*

Crest (**Score 2):** Panel C of Figure 1 shows that Score 2 almost monotonically increases from low values in recessions to peak values immediately prior to the next recession. From Column (3) of Table 2, we see that Score 2 is significantly and positively correlated with contemporaneous real GDP growth, and negatively correlated with the contemporaneous default spread. These indicate that when Score 2 is high, economic activity is buoyant, and default risk is low.

[7] In contrast, Column (3) of Table 3 Panel A shows that lagged values of Score 1 have a positive but much more modest effect on Score 2, suggesting that high values of Score 1 correspond to early stages of the recovery from recession. Score 2 itself shows serial autocorrelation, consistent with the interpretation that it largely tracks the expansionary phase of the business cycle. High values of Score 2 lead to low values of Score 1 (Column (1)), again confirming that low values of Score 1 indicate the end of expansion.

However, a significant and positive correlation with both concurrent and subsequent nominal interest rates and inflation suggests signs of monetary tightening to fight against an acceleration of inflation when Score 2 attains high values. A higher value of Score 2 is also negatively related to the contemporaneous and subsequent term spread. Estrella and Mishkin (1996, 1998) find that the term spread decreases prior to U.S. recessions. Indeed, we find Score 2 is no longer significantly correlated with real GDP growth in the subsequent year (Panel C of Table 2). Taken together, high (low) values of Score 2 seem to correspond to the crest (bottom) of the business cycle, or an overheating economy (recession).

The highest values of Score 2 occur in our sample period during the years 1979. The OECD country report for the U.S. states: *"Economic activity was again buoyant in 1978, the fourth year of expansion following the 1974 – 1975 recession. ... The continued expansion was accompanied by a further acceleration of inflation ... by the final quarter of 1978 the deflator was 8¼ per cent up on the previous year. By the first half of 1979, the GNP deflator had risen almost 9 per cent, ... measured from the previous year, while in the second quarter, the consumer price index rose at an annual rate of about 13½ per cent – the largest increase since the early 1950s."*

The lowest values for Score 2 occur in 2009. The EIU report for December 2009 states: *"Although the US economy expanded in the third quarter for the first time in more than a year, few are convinced that it is out of the woods. ... Meanwhile, the Fed pledged on November 4th that it would keep its key Fed funds rate near 0% for an extended period ... The message was reinforced a few days later by G20 finance ministers who agreed that monetary stimulus should continue."*

Window of Opportunity (Score 4): Finally, turning to Score 4, we find that it is significantly and negatively correlated with lagged stock market returns, but positively correlated with

concurrent stock market returns in Column (4) of Table 2. This indicates that high values of Score 4 coincide with a rebound in stock markets. A positive correlation between Score 4 and lagged real GDP growth suggests that the improved stock market may be driven by encouraging economic data in the previous period, which give investors an illusion that the economy will continue to expand. However, these upbeat views of economic prospects fail to materialize, as the correlation coefficient of Score 4 and contemporaneous GDP growth flips to negative, and the stock market conditions are no longer favorable in the subsequent year. In short, high values of Score 4 indicate favorable stock market conditions, which are not supported by fundamentals. High and low values of Score 4 often occur in adjacent years (sometimes during the same recession), as can be seen from Panel D of Figure 1. Consistently, in Panel A of Table 3, we find that lagged Score 4 is unrelated to the first three scores measured at time *t*. Further, Score 4 exhibits a significantly negative serial correlation.

The highest values of Score 4 occur in our sample period in the year 2009. The EIU report for December 2009 states: *"Risk appetite rises ... On Wall Street, equity prices hit their highest levels of the year on November 17th, with the S&P500 index reaching 1,110 or two-thirds above its 2009 low of 667. In other signs of investors' higher tolerance for risk, interest rates for investment-grade corporate borrowers have declined relative to government bonds, and investors are once again willing to support some sectors that were virtually frozen out of capital markets a year ago."*

Panel B of Table 3 reports the summary statistics of the four PC scores.

3. Firm-level data and summary statistics

3.1. Data

The sample includes all non-financial and non-utility firms in annual Compustat fundamentals files from 1975 to 2014 that have non-missing values for the dependent variables and independent variables. Our data are in annual frequency because detailed information on debt maturity is only available in annual files. Data on stock prices and returns are retrieved from CRSP Files. We begin the sample period in 1975 because it is the first year for which one can measure the *change* in debt maturity using COMPUSTAT data. To reduce the impact of extreme observations, all variables are winsorized at the 0.5% level in both tails of their distributions.[8] Dollar values are converted into 2000 constant dollars using the GDP deflator. The final data set is an unbalanced panel consisting of117,682 firm-year observations.

3.2. Measuring financial constraints

A firm is financially constrained if its external funds are more costly than internal funds (Kaplan and Zingale, 1997). We rank firms based on Hadlock and Pierce's (2010) financial constraint index (HP Index hereafter), which is defined as $-0.737 \times Ln(Assets) + 0.043 \times Ln(Assets)^2 - 0.04 \times Firm\ Age$. *Firm Age* is the number of years that a firm is listed with a non-missing stock price on Compustat. By construction, *higher* scores of the *HP* index indicate that firms are *more* financially constrained. The intuition is that smaller and younger firms are typically less well known, more subject to capital market imperfections (such as information asymmetry and agency problems), and more likely to face higher levels of market friction. They tend to have limited means of financing, and largely rely on financial intermediaries, such as banks. Thus for each year, a firms is defined as financially constrained (unconstrained) if its HP index is above (below) the median value. As robustness checks, in unreported tests we also experiment with other alternative measures of financial constraints, such as firm size, dividend-payer indicator (Fazzari, Hubbard, and Petersen, 1988), Whited and Wu's (2006) financial

[8] Qualitatively similar results (untabulated) are obtained if we trim outliers in all variables at the 0.5% level.

constraint index, Kaplan and Zingales' (1997) index, Altman's *Z* score, and bond ratings, and find similar results.[9]

[Insert Table 4 here]

Panel A of Table 4 reports the mean values of firm characteristics for constrained and unconstrained firms, all of which are significantly different at the 1% level between the two subsamples. As standard corporate finance considerations suggest, our financially constrained (FC) firms on average are much smaller, have less debt on their balance sheets, have better investment opportunities as captured by the market-to-book ratio, and have lower return on assets. They also have fewer tangible assets as suggested by the Net PPE (plant, property and equipment) to assets ratio, more volatile stock returns, and a lower dividends-to-assets ratio. They tend to be unrated and have proportionally more short-term debt than their financially unconstrained (FU) counterparts. In short, these comparisons indicate that our classification scheme has successfully captured the desired cross-sectional properties of financial constraints, i.e., the financial ratios are superior for FU firms relative to the FC firms. In addition, the firms categorized as FC appear to have characteristics associated with difficult access to external finance.

4. Empirical models

We model firm financing decisions as functions of both firm-specific variables and macroeconomic variables. Specifically, our empirical models can be written as

$$Financing\ Decisions_{i,t} = \alpha + \sum_{j=1}^{4} \beta_j PC_{j,t} + \delta X_{i,t-1} + \gamma \sum_{i} Firm_i + \lambda I_{year \geq 1982} + \varepsilon_{i,t} \quad (1)$$

We next provide detailed definitions of the dependent and explanatory variables.

4.1. Dependent variables

[9] Unreported results verifying the robustness of the results reported in the paper are available upon request.

The dependent variables, *Financing Decisions*, refer to firms' financing decision variables. In this paper, we investigate not only the change in the leverage ratio, but also debt and equity issuances. We define the leverage ratio (*Lev*) as total debt (the sum of short-term and long-term debt) divided by total assets.[10] ΔLev is the change in *Lev* from *t*-1 to *t* (i.e., $Lev_t - Lev_{t-1}$). The reason we also focus on issuance activity is that existing evidence (e.g., Huang and Ritter, 2009; Iliev and Welch, 2010) suggests that the change in leverage ratios may reflect shocks to the firms' earnings that may move these ratios away from the desired direction of adjustment if firms are unable to readjust sufficiently quickly.[11] *Net debt issued* (ΔD) is defined as the difference in debt from *t*-1 to *t*, divided by total assets at *t*-1. *Net equity issued* (ΔE) is measured as the change in book equity minus the change in retained earnings (ΔRE), divided by total assets at *t*-1. Besides equity and debt issuances, corporate retention policy also affects leverage. Therefore, we define *Change in retained earnings* (ΔRE) as the change in retained earnings from *t*-1 to *t*, scaled by total assets at *t*-1.

To investigate how macroeconomic conditions affect firms' debt maturity decisions, we examine the change in average debt maturity, as well as the changes in short- and long-term debt separately. Importantly, we focus on "active changes" by removing the mechanical changes that would occur if firms were entirely passive by not issuing new debt and not retiring existing debt before the due date. By doing this, we believe, our results are more informative about how reactive firms are to macroeconomic conditions. Specifically, we obtain the maturity-related information from COMPUSTAT, which includes the amount of debt in current liability (debt due

[10] We primarily rely on the book leverage and scale all dependent variables by the book value of assets. By doing so, the detection of the cyclicality of firms' financing activities is unaffected by firms' market value, which by nature is pro-cyclical. An untabulated robustness check shows that our result regarding the leverage cyclicality still holds when we use the market value of assets (book value of debt + market value of equity) to define the leverage ratio.

[11] Bhamra, Kuehn, and Strebulaev (2010) make a related point and argue that the aggregate dynamics of the leverage ratio could be very different from that at "refinancing points" because the leverage ratios of firms that do not issue debt (in their model) could be driven by changes to the market value of equity over the business cycle.

within one year), the total amount of long-term debt, and the amount of long-term debt due in two to five years.[12] We denote the total amount of debt as *D*, the amount of debt maturing in *i* years as D^i, and the amount of debt maturating in more than *i* years as $D^{>i}$. $D^{>i}/D$ represents the ratio of debt due in more than *i* years to total debt. Following Barclay and Smith (1995), Johnson (2003), and Datta, Datta, and Raman (2005), we use the proportion of debt maturing in more than 3 years ($D^{>3}/D$) as our measure of debt maturity. Accordingly, we define debt maturing in more than 3 years as "long-term" and debt maturing in 3 years or less as "short-term" for the purposes of the subsequent empirical analysis.[13]

To examine how the variation in the maturity structure of debt is related to macroeconomic conditions, we focus on the *active* change in debt maturity structure from year to year. The *total* change in debt maturity structure from *t*-1 to *t* can be written as $\frac{D_t^{>3}}{D_t} - \frac{D_{t-1}^{>3}}{D_{t-1}}$. The subscripts denote time. However, maturity structure can change mechanically from year to year due to the pre-scheduled debt repayments; that is, the maturity of long-term debt is reduced by one year automatically and the current debt is paid off by the end of the fiscal year. Even if firms are completely inert and unresponsive to any change in macroeconomic conditions (that is, they do nothing but pay off the debt that is due), the total change in debt maturity can be substantial.[14]

[12] As pointed out by Barclay and Smith (1995), one advantage of COMPUSTAT balance-sheet data is its broad view of corporate debt. Long-term debt includes bonds, mortgages, capital lease obligations, publishing companies' royalty contract payable, and other long-term fixed claims. Short-term debt includes short-term notes, the current portion of long-term debt, sinking funds, installments on loans, and bank acceptances and overdrafts. Thus our debt maturity measure covers many important forms of debt, including domestic and Euro-commercial paper, asset-backed securities financing, private placements, and bank debt.

[13] Our results hold using alternative cutoffs (2 years or 4 years) to measure debt maturity structure.

[14] For example suppose at time *t*-1, a firm has $100 million debt payable in 1 year and $900 million debt payable in 4 years. If the firm issues/repurchases no debt and pays off the debt that is immediately due, the debt maturity, as measured by $D^{>3}/D$, will decrease from 0.9 to 0.

The total change in debt maturity structure can be decomposed into *active* change in maturity structure (*ΔMAT_A*) and the *passive* change in maturity structure (*ΔMAT_P*), as shown below:

$$\frac{D_t^{>3}}{D_t} - \frac{D_{t-1}^{>3}}{D_{t-1}} = \left(\frac{D_t^{>3}}{D_t} - \frac{D_{t-1}^{>4}}{D_{t-1} - D_{t-1}^{1}}\right) + \left(\frac{D_{t-1}^{>4}}{D_{t-1} - D_{t-1}^{1}} - \frac{D_{t-1}^{>3}}{D_{t-1}}\right) = \Delta MAT\_A + \Delta MAT\_P$$

Note that $\frac{D_{t-1}^{>4}}{D_{t-1} - D_{t-1}^{1}}$ reflects the hypothetical debt maturity at time *t* obtained by assuming there is no new debt issuance or early debt retirement between *t*-1 and *t*. In short, the *ΔMAT_A* captures the effects of the new debt issuance and the debt retirements that are not pre-scheduled.[15] On the other hand, the *ΔMAT_P* captures the effect of predetermined debt repayment schedules, which should not be correlated with macroeconomic conditions.[16]

To understand how firms adjust the maturity structure of their debt, one needs to know whether or not they issue or retire a particular form of debt, or whether or not they issue/retire relatively more of one type than another. Therefore, to obtain a more comprehensive understanding of firms' maturity choice decisions, we decompose the annual change in total amount of debt as follows.

$$\begin{aligned} D_t - D_{t-1} &= (D_t^{>3} + D_t^{\le 3}) - (D_{t-1}^{>3} + D_{t-1}^{\le 3}) = (D_t^{>3} - D_{t-1}^{>3}) + (D_t^{\le 3} - D_{t-1}^{\le 3}) \\ &= (D_t^{>3} - D_{t-1}^{>4} - D_{t-1}^{4}) + (D_t^{\le 3} - D_{t-1}^{3} - D_{t-1}^{2} - D_{t-1}^{1}) \\ &= (D_t^{>3} - D_{t-1}^{>4}) + (D_t^{\le 3} - D_{t-1}^{4} - D_{t-1}^{3} - D_{t-1}^{2}) - D_{t-1}^{1} \\ &= \Delta LTD + \Delta STD - D_{t-1}^{1} \end{aligned}$$

By rearranging terms, we have

$$D_t - D_{t-1}^{>1} = \Delta LTD + \Delta STD,$$

[15] Notice that our *active* change in debt maturity structure is not equivalent to the change in debt maturity caused by *net* debt issuances. For example, if the firm in the previous footnote refinances its outstanding debt with the same maturity, the total change in debt maturity is zero and the net debt issuance is zero. However, the *active* change in debt maturity is 0.9 - 0 = 0.9, which reflects the effort of the active refinancing that keeps the debt maturity structure unchanged.

[16] Indeed, we find (in results not tabulated) that the effects of macroeconomic conditions on the total change in maturity structure are quite similar to those on the *ΔMAT_A*.

where *STD* denotes short-term debt, or debt maturing in 3 years or less, and *LTD* represents long-term debt, or debt maturing in more than 3 years. Note that both Δ*STD* and Δ*LTD* capture the *active* change in short-term and long-term debt, respectively. In other words, we do not consider long-term debt to be reduced or short-term debt to be increased if the maturity of debt due in 4 years (defined as long-term debt) automatically reduces by one year and becomes short-term debt. The pre-scheduled debt repayment (D_{t-1}^{1}) is also excluded. In sum, Δ*STD* (Δ*LTD*) reflects *net* short-term (long-term) debt issuance that is due to new issuance or early retirement of existing short-term (long-term) debt. We then deflate the active changes in short-term and long-term debt by total assets at *t*-1.[17]

4.2. Explanatory variables

The key explanatory variables are the four PC scores discussed in Section 2.2. All our regression specifications incorporate firm-fixed effects ($Firm_i$) to control for time invariant factors that influence firm financing decisions.[18] Other control variables (*X*), which have been shown by previous studies to influence firm financing decisions, are discussed next.

Lagged debt maturity ($(\frac{D^{>3}}{D})_{t-1}$) and lagged leverage (Lev_{t-1}) are two key control variables that are especially relevant for the issuance, change in leverage, and change in maturity structure regressions. The trade-off theory of capital structure suggests that firms have leverage and debt maturity targets, and thus have mean-reverting leverage and average debt maturity. To the extent

[17] In the Internet Appendix B, we show that the active change in debt maturity (*ΔMAT_A*) is related to active changes in short-term (*ΔSTD*) and long-term debt (*ΔLTD*) as follows. The active change in debt maturity is positive (negative) if the ratio of net short-term debt issuance to net long-term debt issuance is smaller (greater) than what the ratio of short-term debt to long-term debt would be if no new debt were issued.

[18] When the dependent variables are in changes (i.e., *ΔLev and ΔMAT_A*), the inclusion of firm fixed effects essentially accounts for individual trend effects of leverage and debt maturity. Similar results (untabulated) are obtained if we use 4-digit SIC industry fixed effects, instead of firm fixed effects.

that firms attain desired leverage and debt maturity structure through issuance and retention activities, these two variables are included to account for the target behavior.

In addition, we include the log value of total assets, *Ln*(*Assets*), as a proxy for company size. Companies with more tangible assets are expected to support more debt, particularly long-term debt, as these assets can be pledged as collateral. The net PPE-to-asset ratio (*Tangibility*) is used to measure the tangibility of the firm's assets. To capture business variability, we include *Earnings Volatility*, which is measured as the standard deviation of the EBIT to assets ratio over the past 5 years. The market-to-book ratio (*Market-to-book*) is considered an important variable in both debt maturity and leverage decisions. It has been used as a proxy for a firm's long-term growth potential as well as equity market conditions. We use return on assets (*ROA*), measured as operating income after depreciation over total assets, as a proxy for profitability. Flannery (1986) predicts that firms with favorable private information tend to issue short-term debt because short-term debt is less subject to information asymmetry than long-term debt. A widely accepted notion in the debt maturity literature is that firms match the maturity of their debt to that of their assets. Following Stohs and Mauer (1996), Johnson (2003), and Datta, Datta, and Raman (2005), we measure *Asset Maturity* as the (book) value-weighted average maturity of current assets and net property, plant, and equipment. Corporate tax rate is arguably an important factor of both leverage (Gordon and MacKie-Mason, 1990; Graham, 1996) and debt maturity decisions (Brick and Ravid, 1985; Kane, Marcus, and McDonald, 1985). Following Stohs and Mauer (1996), we include *Effective Tax Rate*, which is measured as the ratio of income tax expenses to taxable income. We include *Stock Return Volatility*, measured as the standard deviation of daily stock return, to capture firms' risk. The model of Lucas and McDonald (1990) implies a stock price run-up (high stock return) usually precedes the issue of information-

disadvantaged securities, such as equity or long-term debt. We thus include *Risk-adjusted Stock Return*, which is the CAPM-adjusted stock return compounded monthly over the past 12 months, as a control variable.

All the above control variables are lagged one period to ensure that *ex-ante* firm characteristics are used to predict the issuance activity and active changes in debt maturity and leverage. We also include an indicator variable, $I_{year \geq 1982}$, which equals one for firm years after 1982 and zero otherwise, to capture a structural break in monetary policy documented by Butler, Grullon, and Weston (2006). They provide evidence of a regime shift in monetary policy that occurred in 1981-1982.

4.3. Uses of funds

To better understand firms' motives to choose a particular type of financing in response to changing macroeconomic conditions, it is important to also examine how the latter affect the use of funds (i.e., the asset side of the balance sheet). Therefore, we also examine the impact of macroeconomic conditions on firms' cash holding decisions, change in net working capital, and long-term asset accumulation. More specifically, the *change in cash holdings* ($\Delta Cash$) is measured as the change in cash balance scaled by total assets at *t*-1. The change in non-cash net working capital (ΔNWC) is measured as the change in non-cash current assets less the change in non-debt current liabilities, scaled by total assets at *t*-1. The change in long-term assets (ΔLTA) is the change in total assets less the change in current assets, scaled by total assets at *t*-1. Panel B of Table 4 reports the summary statistics of the key firm-specific variables.

5. Empirical results

We now present the results of the regression analyses that shed light on how macroeconomic conditions and financial constraints jointly affect firms' financial decisions. We first discuss the

results based on the entire sample in Table 5. In Table 6, we split the sample and examine how macroeconomic conditions differentially affect financially constrained (FC) and unconstrained (FU) firms.

5.1. Results on the overall sample

[Insert Table 5 here]

In models (1)-(4) of Table 5, we present results based on the entire sample with dependent variables being net debt issuances (*ΔD*), net equity issuances (Δ*E*), the change in retained earnings (*ΔRE*), and the change in the leverage ratio (Δ*Lev*). The results reported in the last three columns are based on firms with non-zero debt and non-missing amount of debt due in 2-5 years, for which the active change in debt maturity (Δ*MAT_A*), the active change in short, and long-term debt (*ΔSTD* and *ΔLTD*) can be measured.

Three interesting findings are worth highlighting. First, during economic expansions, firms' financial decisions in economic recovery can be very different from those at the economic crest. Column (4) shows that firms reduce leverage when the economy is recovering (i.e., when Score 1 or Score 3 is high), while they increase leverage at the economic crest (i.e., when Score 2 is high).[19] Economically, a one-standard deviation increase in Score 3 (Score 2) is associated with a 0.39% (0.43%) decrease (increase) in Δ*Lev*. To put this into context, the average value of Δ*Lev* in our sample is 0.67%. Firms' debt maturity decisions also exhibit a significant variation over the expansionary phase of the business cycle. Column (5) shows that firms extend debt maturity during recovery but shorten it at the crest.[20] These variations can be overlooked by the traditional classification of the business cycle, which combines economic recovery and crest into the

[19] Similar results are obtained (untabulated) when we use the market leverage ratio, which is defined as total debt divided by the sum of total debt and the market value of equity.

[20] A one-standard deviation increase in Score 3 (Score 2) is associated with a 0.37% (0.22%) increase (decrease) in Δ*MAT_A*. These effects are economically significant, given the mean value of Δ*MAT_A* in the sample is -0.37%.

expansionary phase of the economy. It suggests the importance of a finer description of the state of the economy in analyzing the effects of macroeconomic conditions on firms' financing decisions.

Second, equity financing increases in early and robust recovery (high values of Score 1 and Score 3), but firms do not issue more equity relative to recession at the crest (that is, when Score 2 is high). The increase in equity financing in the early phases of expansion is consistent with an improvement in the general information environment and reduction in adverse selection costs of equity issuance (Choe, Masulis and Nanda, 1993). Equity financing is especially responsive to a window of opportunity during which equity valuations improve without a corresponding improvement in real economic activity – that is, when Score 4 is high.

Third, in the last row of Table 5, we report *Total Macro Effects*, which summarize how much variation in firm financing activities can be explained by the PC scores. Since the PC scores only have time-series variations, to estimate the effects of their variations on each dependent variable, we first calculate the time-series standard deviation of a particular dependent variable for each firm, and average that over all sample firms. The variation effect of a PC score is then computed as the product of a one-standard deviation change in a score and the corresponding coefficient estimate, divided by the average time-series standard deviation of the dependent variable. The total variation effect of macroeconomic conditions (*Total Macro Effects*) is the sum of the absolute values of the variation effects of the four PC scores, and reflects the percentage of the variation in each dependent variable that can be explained by our PC scores. The variation effects of the firm-specific variables are also computed and reported in the Internet Appendix C.[21]

[21] Because firm-specific variables contribute to explaining both the cross-sectional and the time-series variations of the dependent variables, we compute their variation effects somewhat differently. In particular, the standard

We find that *Total Macro Effects* range from 9.15% for net equity issuance (ΔE) to 13.76% for the active change in short-term debt (ΔSTD). These overall effects of macroeconomic conditions on the time-series variation of the dependent variables are substantial when they are compared with the effects of the firm-specific variables on the variation of the dependent variables. Internet Appendix C shows that for the change in the leverage ratio (ΔLev) in Column (4), the aggregate economic effect of macroeconomic factors is second in importance to the lagged leverage ratio. For the active change in maturity (ΔMAT_A) in Column (5), macroeconomic factors are third in importance, behind the lagged debt maturity and firm size. For all the dependent variables, macroeconomic factors are more important than many key firm-specific factors documented by Frank and Goyal (2009), such as the market-to-book ratio (except for equity issuance and change in retained earnings), *ROA* (except for equity issuance and retentions), and asset tangibility.

5.2. Financially constrained and unconstrained firms

While we have documented that macroeconomic conditions are highly important in affecting firms' financing decisions, the effects of macroeconomic conditions on *all* firms in the aggregate can hide important differences in the financing behavior of different groups of firms. Therefore, in this section, we examine how financially constrained (FC) and unconstrained firms (FU) firms respond to our PC Scores. To get a better understanding of the motives for firms' financing choices, we also examine how firms use the funds. For the sake of brevity, we only present the coefficients of PC scores in the tables. The other firm-specific variables reported in Table 5 are also included in the regressions, but not tabulated, because their coefficients are quantitatively similar to those in Tables 5.

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deviations of the explanatory and dependent variables are calculated based on their total variations in both the time series and the cross section.

[Insert Table 6 here]

Models (1) and (4) of Table 6 show that both FC and FU firms exhibit a non-monotonic pattern in debt issuance and the leverage ratio over the economic expansion. Both measures decline in robust recovery relative to recessions (i.e., counter-cyclical), but peak at the crest of the economic cycle (i.e., pro-cyclical). These results illustrate that the leverage cyclicality is sensitive to how the business cycle is characterized, and therefore, whether or not leverage increases from trough to crest may well depend on the strength of the effects of robust recovery relative to those at the crest, or how long the economy is at each of these phases. Thus, our findings can potentially reconcile the somewhat conflicting evidence on the leverage cyclicality documented in prior studies (e.g., Korajczyk and Levy, 2003; Covas and Den Haan, 2011).

Firms' investment can help explain the difference in debt issuance between the two periods. While firms' profitability improves when Score 3 and Score 2 are high, as indicated by the significant increase in retentions (Model (3)), firms significantly increase cash holdings, but increase long-term investment modestly, during robust recovery (Models (8) and (10)). A one-standard deviation increase in Score 3 is associated with an increase in cash holdings (as a fraction of total assets) of 0.0115 and 0.0027 for FC and FU firms, respectively. Given that the sample mean of $\Delta Cash$ is 0.0229, these represent 50% and 12% increases, respectively, over and above the sample mean. Meanwhile, a one-standard deviation increase in Score 3 enhances long-term investment by 5% and 2% of the sample mean for FC and FU firms, respectively. On the contrary, firms invest in long-term projects more aggressively at the economic crest. A one-standard deviation increase in Score 2 leads to 12% and 11% increases in long-term investment over and above the sample mean for FC and FU firms, respectively. These imply that firms have an incentive to delay projects until the economic expansion is well under way, as the recovery

may turn out to be fragile. The debt issuance of both types of firms is consistent with the pecking order theory of capital structure in that they retire debt (mainly short-term debt) when profitability improves but have limited investment opportunities (i.e., when Score 3 is high), and borrow more when they have higher financing deficits (i.e., when Score 2 is high).[22]

Model (2) of Table 6 shows that both types of firms issue more equity in robust recovery when the stock market improves and indicates favorable future economic prospects (i.e., when Score 3 is high). These are the periods in which adverse selection costs become lower (Choe, Masulis, and Nanda, 1993). Since FC firms are more opaque and have more volatile earnings, they face greater adverse selection costs than FU firms. Consistent with Lucas and MacDonald (1990) and Choe, Masulis, and Nanda (1993), we find that FC firms take advantage of improved stock market conditions and issue equity more aggressively than FU firms. The estimate coefficient of Score 3 for FC firms (0.87) is about 4.6 times that for FU firms (0.19), and the coefficient difference between FC and FU firms is significant at the 1% level.

Model (2) of Table 6 also shows that firms issue more equity when Score 4 is high. Recall that Score 4 has a positive loading on stock market returns and a negative loading on real GDP growth. High and low values of Score 4 often occur in adjacent periods, indicating sharp changes in market sentiment in response to fragile economic fundamentals. These are periods when windows of opportunities for equity issuance may arise. Baker and Wurgler (2006) find that investor sentiment has more significant effects on financially constrained firms, such as small, young, non-dividend-paying, and high growth firms. These firms seem to have abundant investment opportunities but lack an earnings history. Thus, the valuations of these firms are highly subjective. In addition, these firms are also highly risky and more costly to arbitrage

[22] That both types of firms increasing the debt ratio at the crest is also consistent with the tradeoff theory of capital structure, which suggests that firms should be financed with more debt when taxable earnings are higher and the expected bankruptcy costs are lower.

because of higher idiosyncratic risk, greater short-sale constraints, and lower liquidity (Wurgler and Zhuravskaya, 2002; Amihud and Mendelsohn, 1986; D'Avolio, 2002; Brunnermeier and Pedersen, 2005). All of these suggest that equity values of the FC firms are more likely to deviate from fundamentals, and therefore, they should be more likely to take advantage of the brief window when market conditions are favorable. Indeed, our result shows that FC firms issue equity more aggressively when Score 4 is high (Model (2)). A one-standard deviation increase in Score 4 increases equity issuance by 9% of the sample mean for FC firms, but merely 3.7% for FU firms. The coefficient difference between FC and FU firms is significant at the 5% level. Meanwhile, FC firms significantly increase cash holdings (Model (8)), but do not significantly increase investment in long-term assets (Model (10)). These results suggest that FC firms do not issue equity to fund real investment but to exploit a window of opportunity and save equity issuance proceeds as cash.

Apart from exploiting favorable equity market conditions, firms seem to time the debt market in setting their debt maturity. Models (5)-(7) of Table 6 show that in early recovery (when Score 1 is high), FU firms replace short-term debt with long-term debt, and thus increase average debt maturity. This result is consistent with FU firms' "market timing" behavior. Recall that in early recovery, inflation is low, and the yield curve starts to slope upwards. The expectation of inflation reverting back to high levels in the longer term may make long-term debt financing at current low yields more attractive. FC firms, on the other hand, do not take this opportunity. This can be due to their weak earnings, and high adverse selection costs when the economic recovery is still fragile.

At the economic crest (when Score 2 is high), firms make more long-term investments (Model (10)). The maturity matching literature (e.g., Diamond, 1991; Guedes and Opler, 1996)

suggests that firms should extend the maturity of their liabilities. However, during this period, inflation is high and term spread drops, implying that inflation may decrease in the future. Therefore, short-term debt should be more attractive for firms. Models (5)-(7) of Table 6 confirm that FU firms exhibit such a "market timing" behavior. They issue more short-term debt than long-term debt and shorten their debt maturity structure. FC firms, however, are more risky and face more frictions in external financing, particularly during economic downturns. Chen, Xu, and Yang (2016) argue that firms with high systematic risk exposure, such as small firms with volatile earnings, are more likely to default in bad times. This makes them more inclined to borrow long-term during expansions. Mian and Santos (2018) also argue that forward-looking firms should extend the maturity of their loans during normal times to minimize the possibility of refinancing debt in economic downturns when liquidity is either costly or simply unavailable. Consistent with these arguments, we find that at the economic crest, FC firms increase long-term debt more aggressively than FU firms, and length their debt maturity. This implies that the systematic fluctuation in refinancing risk over the business cycle plays an important role in FC firms' debt maturity decision. Taken together, debt maturity of FC firms is generally pro-cyclical, while that of FU firms exhibits a non-monotonic pattern during the expansionary phase of the business cycle: it increases in recovery relative to recessions but falls at the economic peak.

5.3. Financial constraints and the variation effect of macroeconomic conditions

The issue of whether financially constrained firms' financial decisions are more affected by changing macroeconomic conditions than the unconstrained ones is ultimately an empirical one. On the one hand, as the economic environment improves and adverse selection costs decrease when the economy recovers from a recession, constrained firms are expected to benefit more and raise more equity financing (Choe, Masulis, and Nanda, 1993). Moreover, as economic

conditions improve, constrained firms should also be able to rely more on internal funds for investment. On the other hand, given that financially unconstrained firms are larger firms, they may be able to increase profitability more quickly – for example, because they have gained market shares during recessions as smaller and financially weaker firms exit, or because they are able to maintain advertising expenditure through the recession as they have healthier bottom lines. If this is the case, the unconstrained firms are also likely to step up investment in capital formation sooner.

Korajczyk and Levy (2003) find that unconstrained firms' issuance activities are more affected by macroeconomic conditions than that of constrained firms. They attribute this to a better timing ability for unconstrained firms that stems from their capacity to deviate from target leverage. An alternative argument would suggest that when the relative pricing of securities is more favorable, constrained firms, which are typically more subject to mispricing and adverse selection costs, are likely to respond more aggressively and issue the more favorably priced securities. Consistent with this view, Chang, Dasgupta, and Hilary (2006) find that the equity issuance decision and the size of equity issuance of firms that are less covered by sell-side analysts are more sensitive to favorable equity market conditions.

The last row in Table 6 reports the total contribution of the PC scores to the time series variation of the corresponding dependent variable (*Total Macro Effects*) for FU and FC firms separately. The results show that for four dependent variables associated with the financing decisions (Models (1), (4), (5), and (6)), the variance contribution of the PC scores is higher for the unconstrained firms. In particular, macroeconomic conditions contribute more to the variation of the change in leverage (ΔLev) of financially unconstrained firms than that of constrained ones (10.93% Vs 9.07%), consistent with Korajczyk and Levy's (2003) claim. FU

firms also seem to have greater flexibility in adjusting debt maturity, as seen in models (5)-(7). In particular, FU firms immediately reduce short-term debt and increase long-term debt as the recovery begins (early recovery), In contrast, FC firms seem to have to wait until recovery is robust to increase debt maturity, and continue to do so at the crest. By this time, FU firms are already reducing debt maturity in anticipation of lower borrowing costs in the future.

The variations of constrained firms' equity issuance and active changes in long-term debt (Models (2) and (7)), on the other hand, are more sensitive to macroeconomic conditions, which is somewhat contrary to Korajczyk and Levy's argument, given that these securities are more likely to be affected by adverse selections or mis-pricing. Of particular interest is the sensitivity of equity issuance to Score 4, high values of which indicate equity market overvaluation. While both FC and FU firms respond significantly to Score 4 and issue equity, FC firms do so to a greater extent. Moreover, FC firms do so mainly to buffer up on their cash holdings, whereas FU firms simultaneously increase investment in fixed assets. These results are consistent with the notion that firms that normally have difficulty accessing financial markets are more likely to take advantage of windows of opportunity and exploit misvaluation, consistent with Chang, Dasgupta, and Hilary (2006).

6. Conclusion

In this study, we investigate the impact of real economic forces and overall capital market conditions on firms' financial decisions between 1975 and 2014. We find that commonly used macroeconomic variables capturing economic activity and market conditions can be decomposed into four major principal components that have highly intuitive interpretations and offer a more nuanced characterization of different phases of the business cycle than simply "recessions" and "expansions". The richer characterization reveals important variations in financing activity that

are missed by standard approaches, i.e. those that either contrast only recessions and expansions, or focus on specific macroeconomic variables such as GDP or profit growth to capture economic conditions. This, in part, explains why we find financing patterns differ from conventional wisdom based on these alternative approaches.

We find that contrary to conventional wisdom, debt issuance is not unambiguously counter-cyclical: debt issuance decreases in robust recovery relative to recessions but increases significantly near the crest of the business cycle. This is true of both financially constrained and unconstrained firms, and consistent with Pecking Order behavior (but not inconsistent with tradeoff theory, especially at the crest). Equity issuance of financially constrained firms increases more significantly in recovery than that of financially unconstrained firms, consistent with the notion that adverse selection matters more for equity issuance by financially constrained firms, which are smaller and younger. Both financially constrained and unconstrained firms issue more equity when the equity market is buoyant but economic fundamentals are not very robust – representing a window of opportunity. However, financially constrained firms are more responsive to such timing opportunities in the equity market. Macroeconomic conditions also have important effects on firms' choice of debt maturity structure, but here, it is the financially unconstrained firms that seem to time debt issuance in response to spreads in the debt market. In particular, they lengthen (shorten) debt maturity when inflation is expected to increase (decrease) in the future. Financially constrained firms, on the other hand, lengthen debt maturity when the economy peaks and inflation increases, presumably to reduce refinancing risk should the economy go into recession.

Collectively, the four principal components explain a significant part of the time-series variation of our dependent variables that capture firms' financing activities. Importantly, for

financially constrained firms, the macroeconomic variables explain a higher percentage of the variation of equity and long-term debt issuances than for unconstrained firms. This result stands in contrast to Korajczyk and Levy (2003) who find that the issuance activities of unconstrained firms are more affected by macroeconomic conditions.

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Table 1: Macroeconomic variables

Macroeconomic variables are for the years 1975 to 2014. *Real GDP Growth* is the percentage increase in real GDP in 2000 dollars. *NBER Recession* is a dummy variable that is 1 if an NBER-defined recession is present in that year and 0 otherwise. *Inflation* is the annual percentage change in the Consumer Price Index. *Nominal Interest Rate* is the annualized December 3-month Treasury bill interest. *Term Spread* is the difference between the December 10-year Treasury bond yield and the annualized December 3-month Treasury bill yield. *Default Spread* is the difference between the December yields on Baa and Aaa Moody's rated corporate bonds with maturity of approximately 20-25 years. *Stock Market Return* is computed by compounding monthly returns on the CRSP value-weighted index of stocks traded on NYSE, NASDAQ, and AMEX. Panel A reports the summary statistics of macroeconomic variables, and Panel B reports their correlation matrix. Correlations significant at the 10%, 5%, and 1% levels are marked with *, **, and *** in superscripts, respectively.

	Real GDP Growth	*NBER Recession*	*Inflation*	*Nominal Interest Rate*	*Term Spread*	*Default Spread*	*Stock Market Return*
Panel A: Summary Statistics							
Q1	1.9%	0	2.1%	1.9%	0.8%	0.8%	2.5%
Mean	2.8%	0.25	3.9%	4.8%	1.7%	1.2%	13.7%
Median	3.0%	0	3.2%	5.0%	2.1%	1.0%	16.0%
Q3	4.2%	1	4.4%	6.9%	2.8%	1.3%	27.6%
SD	2.0%	0.44	2.9%	3.6%	1.5%	0.5%	17.0%
N	40	40	40	40	40	40	40
Panel B: Correlation Matrix							
Real GDP Growth	1						
NBER Recession	-0.752***	1					
Inflation	0.025	0.224	1				
Nominal Interest Rate	0.231	0.111	0.803***	1			
Term Spread	-0.145	0.114	-0.517***	-0.550***	1		
Default Spread	-0.496***	0.635***	0.189	0.179	0.090	1	
Stock Market Return	-0.023	-0.114	0.147	0.202	-0.164	-0.354**	1

Table 2: Correlation between PCs and macroeconomic variables

Scores 1-4 are obtained using Principal Component Analysis reported in the Internet Appendix B. Macroeconomic variables are defined in Table 1. Panel A, B, and C report the correlation matrix of Scores 1-4 and those for macroeconomic variables at previous, current, and subsequent years, respectively. Correlations significant at the 10%, 5%, and 1% levels are marked with *, **, and *** in superscripts, respectively.

	Score 1 Early Recovery	*Score 3* Robust Recovery	*Score 2* Economic Crest	*Score 4* Window of Opportunity
Panel A: Macroeconomic Variables at *t*-1				
Real GDP Growth	0.062	-0.294*	0.731***	0.330**
NBER Recession	-0.325**	0.222	-0.768***	-0.350**
Inflation	-0.905***	0.143	0.088	-0.076
Nominal Interest Rate	-0.832***	0.092	0.300*	-0.213
Term Spread	0.680***	0.344**	-0.242	-0.104
Default Spread	-0.383**	0.397**	-0.670***	0.003
Stock Market Return	0.101	-0.065	0.482***	-0.696***
Panel B: Macroeconomic Variables at *t*				
Real GDP Growth	0.373**	0.240	0.675***	-0.468***
NBER Recession	-0.690***	-0.352**	-0.477***	0.203
Inflation	-0.748***	0.194	0.410***	0.021
Nominal Interest Rate	-0.724***	0.252	0.560***	-0.116
Term Spread	0.298*	0.092	-0.732***	-0.288*
Default Spread	-0.639***	-0.405***	-0.397**	-0.211
Stock Market Return	-0.091	0.769***	0.107	0.447***
Panel C: Macroeconomic Variables at *t*+1				
Real GDP Growth	0.240	0.664***	0.068	0.053
NBER Recession	-0.530***	-0.433***	0.239	-0.027
Inflation	-0.472***	0.252	0.426***	-0.021
Nominal Interest Rate	-0.538***	0.352**	0.558***	-0.108
Term Spread	-0.118	-0.187	-0.640***	-0.129
Default Spread	-0.544***	-0.176	0.117	-0.027
Stock Market Return	-0.062	0.061	-0.048	-0.039

Table 3: Properties of the principal component scores

Scores 1-4 are obtained using Principal Component Analysis. In Panel A, each of the four scores is regressed on one-year lag of itself and the other three scores simultaneously. Coefficients significant at the 10%, 5%, and 1% levels are marked with *, **, and *** in superscripts, respectively. Panel B reports summary statistics of the four principal component scores.

Panel A: Vector Autoregressive models

	(1) *Score 1* Early Recovery	(2) *Score 3* Robust Recovery	(3) *Score 2* Economic Crest	(4) *Score 4* Window of Opportunity
Score 1 $_{t-1}$	0.770***	-0.140*	0.254***	0.235***
	(13.26)	(-1.73)	(4.35)	(4.15)
Score 3 $_{t-1}$	0.064	0.171	0.940***	-0.489***
	(0.65)	(1.24)	(9.50)	(-5.10)
Score 2 $_{t-1}$	-0.505***	-0.245***	0.617***	0.141**
	(-8.24)	(-2.86)	(10.02)	(2.37)
Score 4 $_{t-1}$	0.012	-0.059	-0.016	-0.327***
	(0.12)	(-0.42)	(-0.15)	(-3.29)
Constant	0.002	0.000	0.001	0.000
	(1.27)	(-0.24)	(0.57)	(-0.08)
N	39	39	39	39

Panel B: Summary statistics of the principal component scores

	Score 1 Early Recovery	*Score 3* Robust Recovery	*Score 2* Economic Crest	*Score 4* Window of Opportunity
Q1	-0.006	-0.005	-0.011	-0.006
Mean	0.000	0.000	0.000	0.000
Median	0.005	0.001	0.003	0.003
Q3	0.014	0.007	0.015	0.009
SD	0.021	0.012	0.020	0.012

Table 4: Summary statistics

Data for the entire sample are obtained from Compustat for the years 1975 to 2014. Panel A reports the mean values of firm characteristics for financially constrained (FC) and financially unconstrained (FU) firms, which are defined according to Hadlock and Pierce's (2010) financial constraint index (HP index). For each year, a firms is defined as financially constrained (unconstrained) if its HP index is above (below) the median. The symbols ***, **, and * indicate that subsample means are significantly different from each other at the 1%, 5%, and 10% levels, respectively. Panel B reports summary statistics of the key firm-specific variables. *Total Assets* is the book value of assets in 2000 dollars. *Leverage ratio* (*Lev*) is total debt (the sum of short-term and long-term debt), divided by total assets. *Market-to-book* is the market-to-book asset ratio. *ROA* is operating income after depreciation over total assets. *Tangibility* is the net PPE-to-asset ratio. *Stock Return Volatility* is the standard deviation of daily stock return, to capture firms' risk. *Dividend* is the total amount of cash dividend of common and preferred stocks, scaled by lagged total assets. *Credit Rating* equals 1 if the firm has a S&P issuer long-term rating in a given year, and 0 otherwise. *Debt maturity structure* ($D^{>3}/D$) is the ratio of debt maturing in more than three years to total debt. *Net Debt Issues* (ΔD) is the difference in total debt from *t*-1 to *t*, divided by lagged total assets. *Net Equity Issuance* (ΔE) is measured as the change in book equity minus the change in retained earnings (ΔRE), divided by lagged total assets. *Change in Retained Earnings* (ΔRE) is the difference in retained earnings from *t*-1 to *t*, divided by lagged total assets. *Change in Leverage* (ΔLev) is the different in book leverage from *t*-1 to *t*. *Active Change in Maturity Structure* (ΔMAT_A) is measured as the change in maturity structure due to new debt issuance and the debt retirements that are not pre-scheduled. *Active Change in Short-term Debt* (ΔSTD) is the change in short-term debt due to new issuance or early retirement of existing short-term debt, divided by lagged total assets. *Active Change in Long-term Debt* (ΔLTD) is the change in long-term debt due to new issuance or early retirement of existing long-term debt, divided by lagged total assets. *Ln*(*Assets*) is the log value of total assets. *Earnings Volatility* is the standard deviation of the EBIT to assets ratio over the past 5 years. *Asset Maturity* is the (book) value-weighted average maturity of current assets and net property, plan, and equipment. *Effective Tax Rate* is measured as the ratio of income tax expenses to taxable income. *Risk-adjusted Stock Return* is the CAPM-adjusted stock return compounded monthly over the past 12 months. *Change in Cash Holdings* ($\Delta Cash$) is defined as the change in cash balance, scaled by lagged total assets. *Change in Non-cash Net Working Capital* (ΔNWC) is defined as the change in non-cash current assets less the change in non-short-term-debt current liabilities, scaled by lagged total assets. *Change in Long-term Assets* (ΔLTA) is defined as the change in total assets less the change in current assets, scaled by lagged total assets.

Panel A: Characteristics of financially constrained and financially unconstrained firms

	Financially Constrained (FC)	Financially Unconstrained (FU)
Total Assets (million)	258.996	3198.936***
Lev	0.183	0.252***
Market-to-book	2.290	1.572***
ROA	-0.048	0.089***
Tangibility	0.254	0.339***
Stock Return Volatility	0.047	0.029***
Dividend	0.009	0.015***
Credit Rating	0.023	0.345***
$D^{>3}/D$	0.239	0.517***

Panel B: Summary statistics of the key firm-specific variables

	Q1	Mean	Median	Q3	SD	N
Dependent Variables						
ΔD	-0.023	0.037	0.000	0.049	0.206	117,682
ΔE	0.000	0.099	0.004	0.037	0.479	117,682
Δ *RE*	-0.055	-0.035	0.023	0.070	0.286	117,682
Δ *Lev*	-0.029	0.007	0.000	0.032	0.102	117,682
ΔMAT_A	-0.087	-0.004	0.000	0.051	0.250	80,219
ΔSTD	-0.001	0.048	0.012	0.076	0.139	80,219
ΔLTD	0.000	0.048	0.003	0.052	0.142	80,219
Explanatory Variables						
$D^{>3}/D$	0.000	0.378	0.335	0.705	0.353	117,682
Lev	0.034	0.218	0.191	0.341	0.194	117,682
Ln(*Assets*)	3.708	5.175	5.048	6.520	2.069	117,682
Tangibility	0.117	0.296	0.243	0.423	0.224	117,682
Earnings Volatility	0.030	0.119	0.057	0.116	0.230	117,682
Market-to-book	1.002	1.932	1.339	2.054	2.080	117,682
ROA	0.000	0.021	0.074	0.131	0.266	117,682
Asset Maturity	1.707	5.299	2.889	5.202	11.535	117,682
Effective Tax Rate	0.025	0.251	0.340	0.412	0.372	117,682
Stock Return Volatility	0.022	0.038	0.032	0.047	0.023	117,682
Risk-adjusted Stock Return	-0.298	0.076	-0.029	0.278	0.649	117,682
Variables Regarding the Use of Funds						
Δ*Cash*	-0.030	0.023	0.001	0.039	0.242	117,682
Δ*NWC*	-0.030	0.014	0.007	0.052	0.128	117,682
Δ*LTA*	-0.021	0.072	0.019	0.090	0.292	117,682

Table 5: Macroeconomic conditions and financing decisions

The dependent variables (ΔD, ΔE, ΔRE, ΔLev, ΔMAT_A, ΔSTD, and ΔLTD) are defined in Table 4. The key explanatory variables are *Score 1, Score 2, Score 3,* and *Score 4*, which are the value of the first four PCs divided by 100. PCs are generated through principal component analysis (PCA) based on the macroeconomic variables defined in Table 1. A set of lagged firm-specific variables are included in all regressions as control variables. Their definitions are in Table 4. Also included is an indicator variable ($I_{year \geq 1982}$), which equals one (zero) for the period after (prior to) year 1982. The total variation effect of macroeconomic conditions (*Total Macro Effects*) is the percentage of the variation in a dependent variable that can explained by the variations in the four PC scores. Constant terms and firm fixed effects are included in all regressions, but their coefficients are not reported. Robust *t*-statistics adjusted for clustering at the firm level are reported in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are marked with *, **, and *** in superscript, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ΔD	ΔE	Δ *RE*	Δ *Lev*	ΔMAT_A	ΔSTD	ΔLTD
Score 1	0.08	0.16**	-0.03	-0.06**	0.56***	-0.13***	0.12***
(Early Recovery)	(1.62)	(2.08)	(-0.64)	(-2.36)	(7.84)	(-3.63)	(3.38)
Score 3	-0.36***	0.39***	0.68***	-0.32***	0.30***	-0.33***	-0.02
(Robust Recovery)	(-6.29)	(3.34)	(10.92)	(-10.43)	(3.30)	(-7.13)	(-0.35)
Score 2	0.54***	-0.09	0.30***	0.22***	-0.11*	0.26***	0.34***
(Economic Crest)	(14.59)	(-1.12)	(6.87)	(11.31)	(-1.91)	(8.52)	(10.98)
Score 4	0.18***	0.82***	-0.04	-0.01	0.08	0.05	0.12***
(Window of Opportunity)	(3.53)	(8.40)	(-0.73)	(-0.36)	(0.96)	(1.15)	(2.69)
$D^{>3}/D$	0.04***	0.00	0.00	0.03***	-0.32***	0.02***	-0.09***
	(12.32)	(-0.24)	(-0.90)	(15.39)	(-54.32)	(7.75)	(-29.42)
Lev	-0.46***	0.16***	0.02*	-0.35***	-0.04***	-0.06***	-0.12***
	(-48.12)	(9.14)	(1.69)	(-70.16)	(-3.01)	(-8.52)	(-15.45)
Ln(Assets)	-0.03***	-0.07***	-0.02***	0.00***	0.02***	-0.02***	-0.02***
	(-16.32)	(-18.64)	(-10.34)	(6.44)	(6.97)	(-16.73)	(-10.29)
Tangibility	0.07***	0.06**	-0.05***	0.03***	0.04***	-0.02*	0.04***
	(5.23)	(2.32)	(-4.02)	(5.88)	(2.59)	(-1.88)	(4.30)
Earnings Volatility	0.02**	0.14***	-0.11***	0.01**	0.00	0.03**	0.02*
	(2.56)	(4.36)	(-6.81)	(2.37)	(0.30)	(2.56)	(1.93)
Market-to-book	0.00***	0.08***	-0.02***	-0.00**	0.00	0.01***	0.01***
	(5.43)	(14.38)	(-7.56)	(-2.21)	(1.25)	(3.41)	(5.69)
ROA	0.00	-0.51***	0.48***	-0.02***	0.07***	-0.04***	0.04***
	(-0.28)	(-11.49)	(20.53)	(-5.62)	(6.08)	(-3.22)	(5.85)
Asset Maturity	0.00	-0.00***	0.00	0.00**	0.00	0.00	0.00
	(1.50)	(-3.78)	(0.36)	(2.02)	(0.23)	(1.47)	(1.60)
Effective Tax Rate	0.01***	0.02***	-0.00***	0.00	-0.01*	0.00	0.00**
	(3.76)	(6.16)	(-2.67)	(-0.32)	(-1.85)	(1.41)	(2.15)
Stock Return Volatility	-0.53***	-0.31**	0.18**	-0.08***	-0.16*	-0.12**	-0.34***
	(-9.67)	(-2.06)	(2.26)	(-2.96)	(-1.92)	(-2.17)	(-7.54)
Risk-adjusted Stock Return	0.01***	0.03***	0.01***	-0.00***	0.01***	0.00	0.01***
	(7.82)	(5.86)	(7.80)	(-7.19)	(5.85)	(-1.42)	(5.76)
Iyear$\geqslant$*1982*	0.01***	-0.01**	0.00	0.01***	-0.02***	0.01**	0.00
	(2.98)	(-2.26)	(-0.98)	(5.73)	(-4.65)	(2.38)	(-0.88)
N	117,682	117,682	117,682	117,682	80,219	80,219	80,219
Adj. R^2	0.17	0.36	0.57	0.19	0.22	0.31	0.14
Total Macro Effects (%)	12.51	9.15	10.30	10.57	9.55	13.76	11.35

Table 6: Macroeconomic conditions, financial constraints, and capital structure decisions

Firms are partitioned into financially constrained (FC) and financially unconstrained (FU) groups according to Hadlock and Pierce's (2010) financial constraint index (HP Index). For each year, a firms is defined as financially constrained (unconstrained) if its HP index is above (below) the median. The dependent variables (ΔD, ΔE, ΔRE, ΔLev, ΔMAT_A, ΔSTD, and ΔLTD) are defined in Table 4. The key explanatory variables are *Score 1, Score 2, Score 3,* and *Score 4*, which are the value of the first four PCs divided by 100. PCs are generated through principal component analysis (PCA) based on the macroeconomic variables defined in Table 1. All control variables in Table 5 are included in all regressions, but their coefficients are not reported. The total variation effect of macroeconomic conditions (*Total Macro Effects*) is the percentage of the variation in a dependent variable that can explained by the variations in the four PC scores. Robust *t*-statistics adjusted for clustering at the firm level are reported in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are marked with *, **, and *** in superscript, respectively.

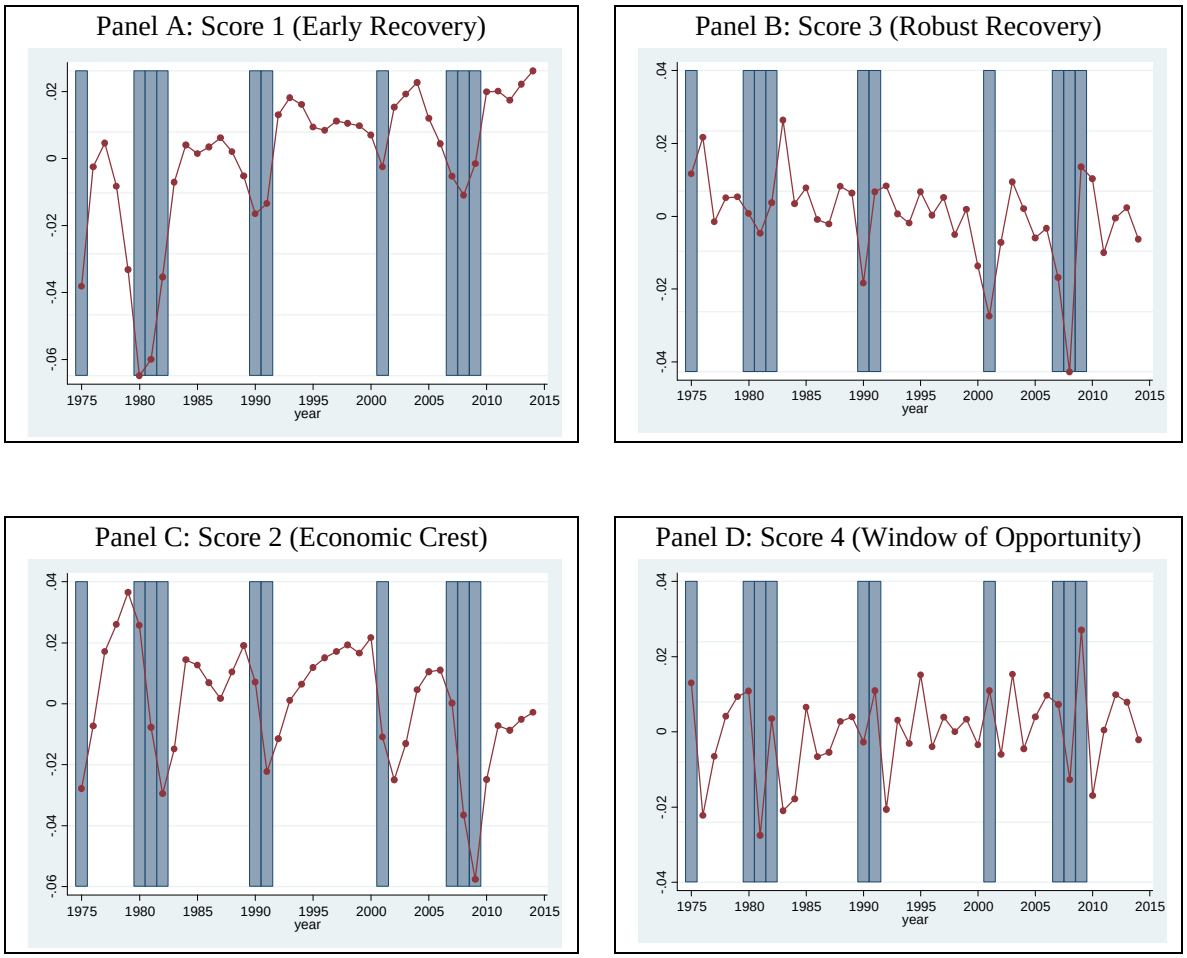
	(1) ΔD		(2) ΔE		(3) ΔRE		(4) ΔLev	
	FC	FU	FC	FU	FC	FU	FC	FU
Score 1 (Early Recovery)	0.00	0.08	0.06	-0.02	-0.27***	0.04	0.00	-0.06**
	(0.01)	(1.61)	(0.30)	(-0.37)	(-3.04)	(1.43)	(-0.06)	(-1.96)
Score 3 (Robust Recovery)	-0.24**	-0.37***	0.87***	0.19**	0.89***	0.68***	-0.34***	-0.36***
	(-2.51)	(-5.40)	(3.50)	(2.09)	(7.00)	(11.69)	(-6.46)	(-9.50)
Score 2 (Economic Crest)	0.55***	0.52***	0.15	-0.10*	0.24**	0.38***	0.19***	0.22***
	(8.62)	(12.16)	(0.87)	(-1.92)	(2.50)	(10.52)	(5.50)	(9.18)
Score 4 (Window of Opportunity)	0.03	0.23***	0.76***	0.31***	-0.21**	0.06	0.02	0.00
	(0.36)	(3.90)	(3.65)	(5.19)	(-1.98)	(1.59)	(0.50)	(0.10)
N	58,851	58,831	58,851	58,831	58,851	58,831	58,851	58,831
Adj. R^2	0.23	0.15	0.36	0.23	0.57	0.29	0.22	0.16
Total Macro Effects	9.55	12.90	11.07	3.91	16.07	11.74	9.07	10.93

continued	(5)		(6)		(7)	
	ΔMAT_A		*ΔSTD*		*ΔLTD*	
	FC	FU	FC	FU	FC	FU
Score 1 (Early Recovery)	-0.15	0.84***	0.00	-0.23***	-0.08	0.19***
	(-1.05)	(10.04)	(-0.01)	(-6.24)	(-1.09)	(4.52)
Score 3 (Robust Recovery)	0.59***	0.20*	-0.43***	-0.22***	0.18**	-0.07
	(3.53)	(1.78)	(-4.25)	(-4.63)	(1.96)	(-1.24)
Score 2 (Economic Crest)	0.50***	-0.32***	0.14**	0.30***	0.51***	0.28***
	(4.38)	(-4.38)	(2.07)	(9.33)	(8.37)	(7.43)
Score 4 (Window of Opportunity)	-0.48***	0.28***	0.15*	-0.04	-0.17**	0.25***
	(-3.31)	(2.90)	(1.71)	(-0.89)	(-1.99)	(5.10)
N	32,352	47,867	32,352	47,867	32,352	47,867
Adj. R^2	0.27	0.22	0.31	0.27	0.23	0.15
Total Macro Effects	13.29	15.30	10.85	15.33	16.70	13.90

continued	(8)		(9)		(10)	
	Δ*Cash*		Δ*NWC*		Δ*LTA*	
	FC	FU	FC	FU	FC	FU
Score 1 (Early Recovery)	-0.08	0.03	0.04	0.22***	-0.22*	-0.04
	(-0.72)	(0.85)	(0.73)	(7.90)	(-1.96)	(-0.57)
Score 3 (Robust Recovery)	0.94***	0.22***	0.42***	-0.02	0.28**	0.13
	(6.86)	(4.93)	(5.58)	(-0.65)	(2.00)	(1.37)
Score 2 (Economic Crest)	-0.04	-0.21***	0.34***	0.32***	0.70***	0.62***
	(-0.48)	(-7.46)	(7.44)	(13.36)	(7.58)	(10.45)
Score 4 (Window of Opportunity)	0.94***	0.33***	-0.24***	-0.10***	-0.02	0.39***
	(6.99)	(8.26)	(-3.27)	(-2.93)	(-0.13)	(5.40)
N	58,851	58,831	58,851	58,831	58,851	58,831
Adj. R^2	0.13	0.09	0.12	0.10	0.23	0.19
Total Macro Effects	16.38	7.36	14.69	11.67	11.24	9.76

Figure 1: The four scores and NBER recessions

The shaded areas represent NBER recessions. *Score 1-4* are the values of the first four PC divided by 100. They are generated through principal component analysis (PCA) based on the macroeconomic variables described in Section 2.



Internet Appendix for "Macroeconomic Conditions, Financial Constraints, and Firms' Financing Decisions"

Internet Appendix A: Principal Component Analysis (PCA)

Principal component analysis is performed on lagged and contemporaneous seven macroeconomic variables collected for the years 1975 to 2014, i.e., real GDP growth, NBER recession dummy, inflation, nominal interest rate, term spread, default spread, and stock market return. Panel A reports Eigenvalues of fourteen principal components (PC) and the incremental and cumulative variations explained by PCs. Panel B reports the factor loadings of the first 7 principal components on the seven contemporaneous and lagged macroeconomic variables. To ease the interpretation, we flip the signs of the loadings, and thus the scores, of the first and fourth PCs in the empirical analysis.

Panel A: Eigenvalues and the percentage of variation explained by PCs

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	4.443	0.612	0.317	0.317
Comp2	3.831	2.340	0.274	0.591
Comp3	1.491	0.112	0.107	0.698
Comp4	1.378	0.582	0.099	0.796
Comp5	0.796	0.249	0.057	0.853
Comp6	0.548	0.119	0.039	0.892
Comp7	0.428	0.077	0.031	0.923
Comp8	0.352	0.099	0.025	0.948
Comp9	0.253	0.045	0.018	0.9657
Comp10	0.207	0.098	0.015	0.9805
Comp11	0.110	0.031	0.008	0.9883
Comp12	0.079	0.012	0.006	0.9939
Comp13	0.067	0.049	0.005	0.9987
Comp14	0.018	.	0.001	1

Panel B: Factor loadings of the first 7 principal components on macroeconomic variables

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7
Real GDP Growth$_t$	-0.1769	0.3450	0.1963	0.3983	0.1589	0.1172	-0.2863
NBER Recession$_t$	0.3272	-0.2434	-0.2883	-0.1730	-0.1175	0.2786	-0.0898
Inflation$_t$	0.3549	0.2095	0.1591	-0.0175	0.0307	-0.4276	-0.3414
Nominal Interest Rate$_t$	0.3437	0.2862	0.2061	0.0985	0.2120	0.0120	0.0026
Term Spread$_t$	-0.1412	-0.3739	0.0750	0.2453	0.2507	0.4390	-0.3591
Default Spread$_t$	0.3031	-0.2027	-0.3314	0.1799	0.2392	-0.1044	0.4895
Stock Market Return$_t$	0.0431	0.0547	0.6302	-0.3806	-0.2659	0.3050	0.3357
Real GDP Growth$_{t-1}$	-0.0292	0.3732	-0.2411	-0.2806	0.4816	0.2165	0.1648
NBER Recession$_{t-1}$	0.1541	-0.3924	0.1819	0.2980	-0.0759	-0.1753	-0.0157
Inflation$_{t-1}$	0.4292	0.0449	0.1168	0.0646	-0.0344	-0.2004	-0.0069
Nominal Interest Rate$_{t-1}$	0.3947	0.1533	0.0749	0.1815	0.2252	0.3953	0.0130
Term Spread$_{t-1}$	-0.3225	-0.1237	0.2813	0.0889	0.4745	-0.3275	0.3341
Default Spread$_{t-1}$	0.1816	-0.3425	0.3249	-0.0029	0.2372	0.1309	0.0972
Stock Market Return$_{t-1}$	-0.0479	0.2461	-0.0533	0.5929	-0.3915	0.1748	0.4042

Internet Appendix B: Net debt issuance and the active change in debt maturity

In the following derivation, we establish the link between the measures of net debt issuance and the *active* change in debt maturity (*ΔMAT_A*):

$$\Delta MAT\_A = \left(\frac{D_t^{>3}}{D_t} - \frac{D_{t-1}^{>4}}{D_{t-1} - D_{t-1}^{1}}\right) = \left(\frac{D_t^{>3}}{D_t} - \frac{D_{t-1}^{>4}}{D_{t-1}^{>1}}\right) \gtreqless 0$$

$$\Leftrightarrow D_t^{>3} D_{t-1}^{>1} - D_{t-1}^{>4} D_t \gtreqless 0$$

$$\Leftrightarrow D_t^{>3} D_{t-1}^{>1} - D_{t-1}^{>4} D_{t-1}^{>1} + D_{t-1}^{>4} D_{t-1}^{>1} - D_{t-1}^{>4} D_t \gtreqless 0$$

$$\Leftrightarrow D_{t-1}^{>1}(D_t^{>3} - D_{t-1}^{>4}) - D_{t-1}^{>4}(D_t - D_{t-1}^{>1}) \gtreqless 0$$

$$\Leftrightarrow D_{t-1}^{>1}(\Delta LTD) - D_{t-1}^{>4}(\Delta STD + \Delta LTD) \gtreqless 0$$

$$\Leftrightarrow (D_{t-1}^{2} + D_{t-1}^{3} + D_{t-1}^{4})\Delta LTD \gtreqless D_{t-1}^{>4}\Delta STD$$

Thus,

$$\Delta MAT\_A \gtreqless 0 \Leftrightarrow \frac{\Delta STD}{\Delta LTD} \lesseqgtr \frac{(D_{t-1}^{2} + D_{t-1}^{3} + D_{t-1}^{4})}{D_{t-1}^{>4}} \qquad \text{(B.1)}$$

Note that $\frac{(D_{t-1}^{2} + D_{t-1}^{3} + D_{t-1}^{4})}{D_{t-1}^{>4}}$ is the hypothetical short-term debt to long-term debt ratio at *t* if firms are passive and simply pay off their maturity debt. Clearly, inequality (B.1) says that the *active* change in debt maturity will be positive (negative) if the ratio of active change in short-term debt to active change in long-term debt issuance is smaller (greater) than the hypothetical ratio of short-term debt to long-term debt. In other words, average debt maturity will decrease (increase) if firms issue a greater (smaller) proportion of short-term debt than they did historically.

Internet Appendix C: The variation effect of the PC scores and firm-specific variables

This table reports the percentage of the variation in a dependent variable that can explained by the variations in the four PC scores and firm-specific variables. All the variables are defined in Table 4 of the manuscript. Constant terms and firm fixed effects are included in all regressions, but their effects are not reported. Robust *t*-statistics adjusted for clustering at the firm level are reported in parentheses. Coefficients significant at the 10%, 5%, and 1% levels are marked with *, **, and *** in superscript, respectively.

	(1) ΔD	(2) ΔE	(3) ΔRE	(4) ΔLev	(5) ΔMAT_A	(6) ΔSTD	(7) ΔLTD
Score 1	1.10	1.59**	-0.37	-1.38**	6.04***	-3.10***	2.67***
(Early Recovery)	(1.62)	(2.08)	(-0.64)	(-2.36)	(7.84)	(-3.63)	(3.38)
Score 3	-2.95***	2.24***	5.61***	-4.31***	1.91***	-4.38***	-0.22
(Robust Recovery)	(-6.29)	(3.34)	(10.92)	(-10.43)	(3.30)	(-7.13)	(-0.35)
Score 2	7.04***	-0.83	4.03***	4.75***	-1.14*	5.69***	7.03***
(Economic Crest)	(14.59)	(-1.12)	(6.87)	(11.31)	(-1.91)	(8.52)	(10.98)
Score 4	1.42***	4.49***	-0.29	-0.13	0.46	0.59	1.43***
(Window of Opportunity)	(3.53)	(8.40)	(-0.73)	(-0.36)	(0.96)	(1.15)	(2.69)
$D^{>3}/D$	6.95***	-0.09	-0.29	8.82***	-41.13***	5.08***	-20.15***
	(12.32)	(-0.24)	(-0.90)	(15.39)	(-54.32)	(7.75)	(-29.42)
Lev	-43.73***	6.36***	1.03*	-67.23***	-2.51***	-8.17***	-15.21***
	(-48.12)	(9.14)	(1.69)	(-70.16)	(-3.01)	(-8.52)	(-15.45)
Ln(Assets)	-29.61***	-31.38***	-12.04***	9.38***	13.42***	-34.88***	-22.84***
	(-16.32)	(-18.64)	(-10.34)	(6.44)	(6.97)	(-16.73)	(-10.29)
Tangibility	7.25***	2.81**	-3.81***	7.25***	3.58***	-2.90*	6.78***
	(5.23)	(2.32)	(-4.02)	(5.88)	(2.59)	(-1.88)	(4.30)
Earnings Volatility	2.30**	6.90***	-8.64***	1.76**	0.26	3.38**	2.10*
	(2.56)	(4.36)	(-6.81)	(2.37)	(0.30)	(2.56)	(1.93)
Market-to-book	4.97***	34.46***	-12.12***	-1.36**	1.03	5.38***	5.55***
	(5.43)	(14.38)	(-7.56)	(-2.21)	(1.25)	(3.41)	(5.69)
ROA	-0.25	-28.12***	44.65***	-4.83***	4.74***	-4.85***	4.93***
	(-0.28)	(-11.49)	(20.53)	(-5.62)	(6.08)	(-3.22)	(5.85)
Asset Maturity	1.19	-3.23***	0.23	1.43**	0.15	1.33	1.49
	(1.50)	(-3.78)	(0.36)	(2.02)	(0.23)	(1.47)	(1.60)
Effective Tax Rate	1.14***	1.34***	-0.53***	-0.10	-0.78*	0.58	0.87**
	(3.76)	(6.16)	(-2.67)	(-0.32)	(-1.85)	(1.41)	(2.15)
Stock Return Volatility	-5.99***	-1.50**	1.43**	-1.87***	-1.33*	-1.89**	-5.11***
	(-9.67)	(-2.06)	(2.26)	(-2.96)	(-1.92)	(-2.17)	(-7.54)
Risk-adjusted Stock Return	3.33***	3.58***	3.20***	-2.74***	2.68***	-0.75	3.02***
	(7.82)	(5.86)	(7.80)	(-7.19)	(5.85)	(-1.42)	(5.76)
Iyear≥1982	1.51***	-0.68**	-0.26	2.93***	-3.16***	1.64**	-0.51
	(2.98)	(-2.26)	(-0.98)	(5.73)	(-4.65)	(2.38)	(-0.88)
N	117,682	117,682	117,682	117,682	80,219	80,219	80,219
Adj. R^2	0.17	0.36	0.57	0.19	0.22	0.31	0.14