Do firms borrow at the lowest-cost maturity? The long-term share in debt issues and predictable variation in bond returns*

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Abstract

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Abstract

We document that firms tend to borrow at the lowest-cost maturity. In aggregate time series data, the share of long-term debt issues in total debt issues is negatively related to subsequent excess bond returns, meaning that firms substitute toward long-term debt when the cost of long-term debt is low relative to the cost of short-term debt. The long-term share is also contemporaneously negatively related to the components of the long-term interest rate that predict higher excess bond returns, including inflation, the real short-term rate, and the term spread. The results suggest that firms use predictable variation in excess bond returns in an effort to reduce the cost of capital.

I. Introduction

How corporations should manage financial policy to minimize the cost of capital is a question of great theoretical and practical interest. In efficient and integrated and otherwise perfect capital markets, Modigliani and Miller (1958) and Stiglitz (1974) show that financial policy cannot reduce the cost of capital. Their key insight is that the costs of different forms of capital do not vary independently in such idealized markets, so there is never any gain to substituting between debt and equity or between short- and long-term debt. In inefficient or segmented markets, by contrast, the overall cost of capital can be reduced by "market timing" – substituting toward whatever form of finance is available at the lowest risk-adjusted cost.

Recent research has focused on equity market timing, the hypothesis that firms substitute between equity and debt depending on the cost of equity. Baker and Wurgler (2000) find that firms issue more equity, as a share of total equity and debt issues, when future equity market returns are unusually low. Firm-level studies also find that firms issue equity when the idiosyncratic cost of equity is unusually low and repurchase when it is unusually high.[1] The evidence suggests that equity market timing has a substantial influence on the choice between equity versus debt.[2]

In this paper we consider debt market timing, by which we mean the hypothesis that firms substitute between short- and long-term debt depending on the relative costs. This sort of market timing is explicit in the survey by Graham and Harvey (2001), in which many chief financial officers state that they prefer short-term debt "when short-term interest rates are low

[1] Stigler (1964), Ritter (1991), Loughran and Ritter (1995), Speiss and Affleck-Graves (1995), and Brav and Gompers (1997) find that (idiosyncratic) equity returns are low following equity issues. Ikenberry, Lakonishok, and Vermaelen (1995) find that (idiosyncratic) equity returns are high following repurchases.

[2] See Baker and Wurgler (2002) and Ritter (2002) for more comprehensive surveys of the evidence for equity market timing.

compared to long term rates" and when they are "waiting for long-term interest rates to decline."[3] Consistent with these responses, Bosworth (1971), White (1974), Taggart (1977), and Marsh (1982) find that the level of debt issues is sensitive to the level and term structure of interest rates; Guedes and Opler (1996) find that the maturity of issues is negatively related to the term spread; and Barclay and Smith (1995) and Stohs and Mauer (1996) find that outstanding debt maturity is negatively related to the term spread. Perhaps surprisingly, the literature has not yet asked whether manipulating maturity in this manner actually reduces borrowing costs.

The main empirical test in this paper is whether the maturity of corporate debt issues predicts excess long-term bond returns. In particular, a negative relationship between issue maturity and subsequent excess bond returns would mean that firms tend to borrow long-term when the cost of long-term debt is low relative to the cost of short-term debt. The maturity of debt issues is measured as the annual share of long-term issues in total debt issues from the Federal Reserve *Flow of Funds,* from 1953 through 1999. Debt market conditions are represented by five variables: inflation, the real short-term interest rate (the nominal short rate minus inflation), the term spread, the credit spread, and the credit term spread. The relative cost of long-term borrowing is measured as the future excess return of Treasury bonds over Treasury bills and the future excess return of corporate bonds over commercial paper.

The main result is that firms do appear to substitute toward the lower-cost maturity. The long-term share in total debt issues is a reasonably strong univariate predictor of one- to three-year-ahead excess bond returns. For example, an increase in the long-term share by one standard deviation, say from its sample mean of 22 percent to 26 percent, is associated with a 10 percent

[3] Managers focus more on public information about general debt market conditions than private information about credit quality. Graham and Harvey find that only nine percent of managers state that "we expect our credit rating to improve, so we borrow short-term until it does."

decrease in cumulative three-year-ahead excess Treasury bond returns and a similar decrease in cumulative excess corporate bond returns. The long-term share is also contemporaneously negatively related to several variables which themselves predict excess bond returns, including inflation, the real short rate, and the term spread; these are the three components of the nominal long-term government bond yield. Multivariate predictive regressions that include these market conditions alongside the long-term share suggest that they account for much of its univariate predictive power.

We also find that the long-term share's predictive power is concentrated in the latter part of the sample. This is also when both debt market conditions and excess bond returns were particularly volatile. One interpretation of this apparent instability is that managers rely on debt market conditions to inform maturity choice, and so when market conditions do not have forecasting power, issue maturity decisions do not either. Consistent with this interpretation, the predictive power of the term spread is also concentrated in the latter part of the sample.

There are three general explanations for the results. (1) The debt market is efficient (and integrated with the equity market) and debt issues predict time-varying excess bond returns because optimal debt maturity structure is for some reason inversely related to future excess bond returns. Under this explanation, manipulating maturity does not (and is not intended to) reduce the overall cost of capital. (2) Managers try in vain to time an efficient debt market but also do no harm beyond transactions costs. Manipulating maturity does not reduce the overall cost of capital but does no harm beyond transaction costs. Modigliani and Miller would call this the "neutral mutations" explanation. (3) Managers successfully time an inefficient debt market. The predictable variation in excess bond returns represents inefficiency, at least in part, and managers reduce the overall cost of capital by manipulating maturity accordingly.

Further analysis favors explanations (2) and (3) over explanation (1). One problem with explanation (1) is that it is hard to connect the long-term share to a risk that seems likely to require a risk premium. The long-term share does not forecast consumption covariance or variance risk. It does forecast higher excess bond return variance, but the magnitude of this effect is modest, and it is unclear why excess bond return variance would require a risk premium. A more conspicuous problem with (1) is that we find no theoretical reason why optimal debt maturity would be inversely related to future excess bond returns. The only theory of optimal debt maturity that explicitly involves interest rates is a tax theory that predicts that managers should lengthen debt maturity when the term spread is *high*. This prediction is quite opposite to our aggregate results and the firm-level results in Barclay and Smith (1995), Guedes and Opler (1996), and Stohs and Mauer (1996). A final problem with (1), and a compelling affirmation of (2) and (3), is that the aforementioned survey evidence strongly suggests that managers try to time the debt market using market conditions like the term spread and the long rate. In summary, the results suggest that firms use predictable variation in excess bond returns in an effort to time the debt market and thereby reduce the cost of capital.

The paper proceeds as follows. Section II summarizes the predictable variation in excess bond returns provided by indicators of debt market conditions. Section III examines how market conditions determine the long-term share in total debt issues and account for much of its predictive power for excess bond returns. Section IV considers three general explanations for the results. Section V concludes.

II. Debt market conditions and predictable variation in excess bond returns

In this section we summarize sources of predictable variation in excess bond returns. This is a prelude to understanding how the maturity of debt issues relates to expected excess bond returns. Readers comfortable with the conclusion that future excess bond returns are positively related to debt market conditions such as inflation, the real (realized) interest rate, and the term spread, can skip to the next section where we examine how the maturity of debt issues responds to these same variables.

A. Data on debt market conditions and excess bond returns

The basic data include annual time series from 1953 through 2000 on the maturity of corporate debt issues, debt market conditions such as interest rates and inflation, and excess bond returns. Because the Federal Reserve pegged nominal Treasury bill rates up to 1952, most academic studies of the government bond market begin in 1953. We follow this convention and focus on this more recent sample period. The debt issues data are described in the next section.

Debt market conditions are represented by five variables: inflation, the real (realized) short-term rate, the term spread, the credit spread, and the credit term spread. Most research on bond return predictability focuses on the term spread (Shiller (1979), Shiller, Campbell, and Schoenholtz (1983), Fama (1984), Keim and Stambaugh (1986), Fama and Bliss (1987), Fama and French (1989), and Campbell and Shiller (1991)). We also examine whether four other market conditions predict excess bond returns or affect the maturity of debt issues. Inflation (π_t) is the annual percentage change in the Consumer Price Index. The real short-term rate (y_{GSt}-π_t) is estimated as the annualized December Treasury bill return minus inflation. The term spread (y_{GLt} – y_{GSt}) is the difference between the December Treasury bond yield and the annualized December Treasury bill return. The credit spread (y_{CSt} – y_{GSt}) is the difference between the

December commercial paper yield and the annualized December Treasury bill return. The credit term spread $((y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt}))$ involves the December Moody's Baa corporate bond yield and the other yields just introduced. These series are from Ibbotson Associates (2001) and Ibbotson Associates' *EnCorr* software.

The relative cost of borrowing at short and long maturities is measured as the future excess return of Treasury bonds over bills and the future excess return of investment-grade corporate bonds over commercial paper. Returns on long-term government bonds (r_{GLt}), short-term government bills (r_{St}), long-term corporate bonds (r_{CLt}), and commercial paper (r_{CSt}) are from Ibbotson Associates (2001) and Ibbotson Associates' *EnCorr* software. The government and corporate bond indexes track bonds of approximately 20-year maturity.[4] Excess government and corporate bond returns in year t are $(r_{GLt} - r_{GSt})$ and $(r_{CLt} - r_{CSt})$, respectively. Cumulative excess returns are denoted $(R_{GLt+k} - R_{GSt+k})$ and $(R_{CLt+k} - R_{CSt+k})$, where the accumulation includes years t+1 through t+k. We measure cumulative returns up to three years.[5] As a matter of terminology, the rest of the paper uses the phrases "relative cost of long-term borrowing" and "expected excess bond return" interchangeably.

These variables are summarized in Table 1 and Figure 1. Panel A of Figure 1 reveals a loose negative correlation between inflation and the real interest rate since 1953, indicating that the variability of the nominal short rate is an important source of variation in the real (realized) short rate. Panel B shows the inversion of the yield curve at several points during the 1970s. It

[4] The government bond returns series uses data from the Wall Street Journal for 1977 through 2000 and the CRSP Government Bond File for 1976 and earlier. The corporate bond returns series uses the Salomon Brothers Long-Term High-Grade Corporate Bond Index, which includes most Aaa- and Aa- rated bonds, for 1969 through 2000, a backdated Salomon Brothers return series for 1946 through 1968, and a return index derived from the Standard & Poor's High-Grade Corporate Composite yield index for 1926 through 1945.

[5] The most relevant period is the life of the bond, which could be ten or more years, though if open market repurchases are possible the relevant period could be any shorter length. In any case, beyond three years, we do not have enough non-overlapping samples to do meaningful statistical analysis.

also shows how the relative stability of the credit spread causes the credit term spread to move inversely to the government term spread. Panel C shows the high volatility of both excess government and corporate bond returns in the last thirty years. It also shows the high correlation (ρ = 0.93) between excess Treasury and corporate bond returns.

B. Predicting excess bond returns with debt market conditions

Table 2 shows predictive regressions for excess bond returns using inflation, the real interest rate, the term spread, the credit spread, and the credit term spread. The first four rows of each panel estimate:

$$\text{Future excess bond return} = a + b\pi_t + c\left(y_{GSt} - \pi_t\right) + d\left(y_{GLt} - y_{GSt}\right) + e\left(y_{CSt} - y_{GSt}\right) + f\left(\left(y_{CLt} - y_{GLt}\right) - \left(y_{CSt} - y_{GSt}\right)\right) + u_{t+k} \quad (1)$$

where future excess bond returns are one-, two-, and three-year ahead returns and cumulative three-year-ahead returns, respectively. The standard errors in all regressions are adjusted for heteroskedasticity and autocorrelation up to two lags using the procedure of Newey and West (1987). The alternative adjustments of Hansen and Hodrick (1980) and Hodrick (1992) to correct for overlapping cumulative returns do not change the basic inferences.

The results indicate that future excess government bond returns are positively related to inflation, the real short rate, and the term spread. The independent variables are standardized to have unit variance, so the coefficients can be interpreted as the change in predicted return per standard deviation change in the independent variable. As is widely recognized, the term spread is a useful one-year-ahead predictor. Inflation and the real short rate are also marginally significant at short horizons and the real short rate is relatively strong at the cumulative three-year horizon.

In the last two rows of each panel we summarize the predictive power of (1) by combining the five market conditions, each weighted by its least squares coefficient, into a single fitted value. By construction, this fitted value explains the same fraction of variation in future returns, but combining this information into a single regressor allows us to address the small-sample bias analyzed in Nelson and Kim (1993) and Stambaugh (1999) in a simple manner. (We also use these fitted values later in the paper.) Nelson and Kim and Stambaugh point out that autocorrelated predictors whose innovations are negatively (positively) correlated with innovations in excess returns will have upward-biased (downward-biased) estimates.

This suggests a potential statistical problem with the Table 2 results. First, inflation, the real short rate, and the term spread sum up to the long rate. Second, the long rate is highly autocorrelated. And third, its innovations are almost perfectly negatively correlated with innovations in excess bond returns. However, it turns out that the fitted value has a correlation of only 0.6 with the long rate, because the coefficients on inflation, the real short rate, and the term spread – when they are not standardized – are quite different. More importantly, the innovations in the fitted value are statistically uncorrelated with innovations in the long rate. The bias-adjusted estimate for the fitted value coefficient suggested by Stambaugh (1999) confirms that the combined predictive power of these market conditions is robust. Because the innovations in the fitted value are also uncorrelated with innovations in excess returns, the adjustment has no effect on the coefficient. In Panel A, for example, the bias-adjusted coefficient for the one-year-ahead fitted value is 5.06, the same as the least-squares estimate reported in the table.

We revisit the interpretation of this predictability later in the paper. The point here is that five debt market conditions explain about twenty-five percent of the variability of one-year-ahead excess bond returns and about forty percent of the variability of cumulative three-year-ahead returns. This suggests that the relative cost of long-term borrowing may be predictable enough to influence the maturity of debt issues. We consider this hypothesis in the next section.

III. The maturity of corporate debt issues and the relative cost of long-term debt

In this section we examine how the maturity of corporate debt issues is related to contemporaneous market conditions and future excess bond returns. We start by describing the data on aggregate corporate debt issues.

A. Aggregate corporate debt issues data

The aggregate corporate debt issues data is from the Federal Reserve *Flow of Funds* accounts, which are available on the Internet from the Federal Reserve Bank of St. Louis. The Federal Reserve calibrates their series with capital market flows data from several internal and commercial sources. The available accounts cover 1945 through 2000. As mentioned above, we follow recent fixed income research and start at 1953.[6]

Our data is taken from the credit market liabilities of the nonfarm nonfinancial corporate business sector, Table L.102 in the accounts. We ignore non-credit market liabilities because we lack information on their maturity and because they are less likely to be affected by debt market conditions. The Federal Reserve defines short-term credit market debt outstanding as the sum of "commercial paper," "bank loans n.e.c.," and "other loans and advances."[7] Long-term credit

[6] The basic results have slightly greater statistical significance if we include the 1945 through 1953 data.

[7] The online *Guide to the Flow of Funds Accounts* gives complete details on definitions and primary sources. Commercial paper typically has a maturity of six months or less. Bank loans not elsewhere classified refers to commercial and industrial loans held by U.S. banks. Other loans and advances includes loans to nonfarm nonfinancial corporate business held by savings institutions and the government, acceptance liabilities to banks, foreign loans to U.S. entities, and business loans held by issuers of asset-backed securities. Over the sample, commercial paper represents an average of 6.2 percent of short-term debt. Bank debt and other loans and advances average 67.1 percent and 26.7 percent of total short-term debt, respectively. These proportions are fairly stable throughout the sample.

market debt outstanding is defined as the sum of "industrial revenue bonds," "corporate bonds," and "mortgages."[8] We define net short-term debt issues (d_{St}) as the level of short-term credit market debt outstanding. Assuming that short-term debt has a maturity of exactly one year, then the level outstanding at the end of the year equals the amount issued during the year. We define net long-term debt issues (d_{Lt}) as the gross change in the level of long-term credit market debt outstanding, plus one-tenth the level of long-term debt in the previous year. This assumes that one-tenth of the long-term debt matures each year.[9] To measure the level of net debt issues controlling for growth in the economy, we scale issues by lagged total credit-market debt outstanding (d_{St}/D_{t-1} and d_{Lt}/D_{t-1}). To control for the level of debt issues and isolate the maturity decision, we construct the long-term share in total debt issues ($d_{Lt}/[d_{Lt}+d_{St}]$).[10] This variable is our primary focus in the rest of the paper.

These definitions necessarily involve several approximations. It would be preferable to have more detailed data on maturity, the fraction of long-term debt that is callable, and the fraction of long-term debt tied to a floating rate. A call provision reduces the effective maturity of an issue. However, if the call option is not exercisable for several years from the date of issue,

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[8] Industrial revenue bonds issued by state and local governments to finance private investment and are secured in principal by the industrial user of the bonds. Mortgages include construction loans, multifamily mortgage debt, and commercial mortgage debt, less commercial mortgage debt of nonprofit organizations, and less commercial mortgage debt of nonfarm noncorporate business. Over the sample, industrial revenue bonds average only 3.8 percent of total long-term debt. Corporate bonds and mortgages respectively average 73.8 percent and 22.3 percent of total long-term debt. These figures are also relatively stable through the sample.

[9] The *Flow of Funds* data do not identify this retirement rate; the one-tenth assumption is chosen to be consistent with Guedes and Opler (1996), who report that the median maturity of debt issues is 10 years in their sample. It may appear possible to glean additional information about the appropriate retirement rate from the pattern of new issues. The intuition is that if there is a lump of long-term issues today, then at the point this debt retires, more of the change in long-term debt should be attributed to new issues. We attempted to incorporate this intuition and found that the adjusted series has a correlation of 0.94 with the simpler measure and does not change the basic results. We therefore report results for the simpler, unadjusted measure.

[10] Note that small variations in the long-term share variable may reflect substantial variation in the average maturity of new issues. For example, the long-term share does not depend on whether the maturity of long-term debt issues is five years or twenty years. Dividing issues between short and all-other maturities is still useful, however, since most movements of the yield curve occur between short and intermediate-and-longer maturities.

then over the first few years of the issue (the prediction horizon we consider) the cost of callable debt is likely to resemble the cost of straight long-term debt. Not accounting for floating rate features is a more serious limitation. A long-term floating rate issue suggests an expectation that the relative cost of long-term debt will be high, not low, and so grouping long-term floating debt with long-term straight debt seems likely to weaken the hypothesized negative relationship between the long-term share and subsequent excess bond returns. We address these limitations of the data in robustness tests at the end of this section. We consider alternative assumptions about the retirement rate of long-term debt, and we use other data sources to examine recent trends in callability and floating rate features.[11] All things considered, we regard the long-term share variable as a rough but useful guide to trends in the maturity of debt issues.

Table 3 and Figure 2 summarize the debt issues data. Panel A of Figure 2 indicates that the scaled level of short-term debt issues has generally increased since 1953 but has fallen from its 1984 maximum. Panel B reveals no clear patterns in the level of long-term debt issues. Panel C shows that the long-term share in total debt issues has therefore declined slightly since 1953 but has rebounded in recent years.[12] Table 3 reports that the average long-term share is 21.78 percent. The most recent values are slightly above this average.

B. The effect of market conditions on the maturity of debt issues

In Table 4 we examine how debt market conditions affect the maturity of corporate debt issues. In Panel A we include all debt market conditions measures, even those that do not predict

[11] The data also do not contain information on interest rate swaps, but not accounting for swaps seems unlikely to greatly affect the interpretation of the long-term share variable. First, the interest rate swaps market did not exist until 1982. Second, swaps within the corporate sector do not reduce the aggregate exposure to interest rate fluctuations, they simply redistribute the exposure. Not accounting for swaps is therefore less of a problem for an aggregate study than a firm-level study.

[12] Dickey-Fuller tests reject the hypothesis of a unit root in the long-term share.

excess bond returns, to be consistent with earlier tables. In Panel B we combine the predictive power of market conditions into a single fitted excess return. In the first row of Panel A, the level of long-term debt issues is regressed on market conditions:

$$\frac{d_{Lt}}{D_{t-1}} = a + b\pi_t + c(y_{GSt} - \pi_t) + d(y_{GLt} - y_{GSt}) + e(y_{CSt} - y_{GSt}) + \tag{2}$$

$$f((y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})) + h\frac{d_{Lt} + d_{St}}{D_{t-1}} + u_t .$$

We do not report the coefficient *h*, but it is important to note that we control for the overall level of debt issues. If the interest rate or the term spread is very high, then the cost of long-term borrowing will tend to be high on an absolute basis, and under diminishing returns the optimal level of borrowing at any maturity would be low. Without controlling for the level of new borrowing, it would be impossible to determine whether the results reflect an effect on the total level of borrowing or substitution between short- and long-term debt.

A simpler way to eliminate the diminishing returns effect is to use the long-term share in total debt issues as the dependent variable. This variable is not mechanically related to the level of issues but instead reflects only maturity. The specification in the second row of Panel A is:

$$\frac{d_{Lt}}{d_{Lt} + d_{St}} = a + b\pi_t + c(y_{GSt} - \pi_t) + d(y_{GLt} - y_{GSt}) + e(y_{CSt} - y_{GSt}) + \tag{3}$$

$$f((y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})) + u_t .$$

The results for both specifications indicate that the level of long-term debt issues is strongly negatively related to inflation, the real interest rate, and the term spread, and insignificantly related to the credit spread and the credit term spread. Note that this pattern of coefficients corresponds precisely to the patterns in bond return predictability in Table 2. Variables that enter positively there enter negatively here; variables that are insignificant there are insignificant here. In other words, *when debt market conditions indicate that the relative cost of long-term debt is high, firms substitute toward short-term debt*. Market conditions also explain a large fraction of the time series variation in maturity.

We can verify more directly that the maturity of debt issues responds to the variation in market conditions that relates to the relative cost of long-term borrowing. From earlier results we take the excess government bond return predicted by market conditions. Like the other independent variables, the predicted return is standardized to have unit variance. Panel B of Table 4 uses this predicted return to explain the maturity of debt issues:

$$\frac{d_{Lt}}{D_{t-1}} = a + g\left(\hat{R}_{GLt+3} - \hat{R}_{GSt+3}\right) + h\frac{d_{Lt} + d_{St}}{D_{t-1}} + u_t\,, \tag{4a}$$

$$\frac{d_{Lt}}{d_{Lt} + d_{St}} = a + g\left(\hat{R}_{GLt+3} - \hat{R}_{GSt+3}\right) + u_t\,. \tag{4b}$$

These regressions show more directly that the maturity of issues is sensitive to predicted excess bond returns. Note that the predicted excess bond return, by itself, explains nearly as much of the variation in the long-term share as do the five debt market variables when they are allowed to enter in an unrestricted way; the R^2 falls only marginally from Panel A to Panel B.

Together, Tables 2 and 4 suggest that firms substitute toward long-term debt when debt market conditions indicate that the relative cost of long-term debt is low. This is a basic statement about corporate finance patterns and, in a nutshell, is the central message of the paper.

C. Predicting excess bond returns from the maturity of debt issues

The preceding results suggest that the long-term share in total debt issues is sensitive to predictable variation in excess bond returns. A natural question is whether the long-term share itself predicts excess bond returns. Figure 3 divides the long-term share into quartiles and tabulates it against one-year-ahead and cumulative three-year-ahead excess returns. Figure 3 confirms that there is a negative univariate relationship between the long-term share and subsequent excess returns. The three-year cumulative excess government bond returns that follow a bottom-quartile share average 21.8, while the returns following a top-quartile share average –5.2 percent. For corporate bond returns, the difference is even larger, from 25.9 to –4.8. The fact that predicted excess returns actually switch sign is particularly relevant to a debt market timing strategy.

Table 5 investigates this predictive power more formally. The table reports results for two specifications:

$$Future\ excess\ bond\ return = a + b_1 \frac{d_{Lt}}{D_{t-1}} + b_2 \frac{d_{St}}{D_{t-1}} + u_{t+k}, \tag{5a}$$

$$Future\ excess\ bond\ return = a + b \frac{d_{Lt}}{d_{Lt} + d_{St}} + u_{t+k}. \tag{5b}$$

The results for (5a) indicate that long-term debt issues predict lower excess returns and short-term debt issues predict higher returns. The results for (5b) indicate that the long-term share in total debt issues is by itself about as useful a predictor as the combination of the levels; R^2 is similar for (5b) and (5a). The long-term share is generally successful at predicting the excess return in each of the next three years, and is thus quite successful at predicting the cumulative three-year-ahead return.

Whether the small-sample bias analyzed by Stambaugh (1999) affects these estimates is not obvious a priori. The long-term share is indeed highly autocorrelated, but there is no mechanical reason why its innovations would be correlated with innovations in excess bond returns. In fact, they are not correlated, so the correction suggested by Stambaugh does not materially affect the least-squares estimates. For example, for one-year-ahead excess government returns the bias-corrected coefficient is –3.14 (unreported) compared to the least-squares coefficient of –3.18.

An interesting question is whether debt issue decisions embody any incremental information over contemporaneous market conditions. In the left columns of Table 6, we regress excess bond returns on debt issues and the predicted value of excess bond returns based on market conditions. For example, the regression in column (2) of Panel A is:

$$\textit{Future excess bond return} = a + b\frac{d_{Lt}}{d_{Lt} + d_{St}} + c\left(\hat{R}_{GLt+k} - \hat{R}_{GSt+k}\right) + u_{t+k}\ . \tag{6}$$

For one-year-ahead excess returns, debt issue maturity does not add much to the predictability based on market conditions. In Panel A for example, the long-term share is insignificant and the regression has an R^2 of 0.25 in column (2). Column (1) shows that without the long-term share, market conditions alone provide an R^2 of 0.24. There is more evidence of incremental predictive power for three-year cumulative returns. Again focusing on Panel A, the long-term share is significant and raises the R^2 from 0.40 to 0.48.

Since most recent bond market research focuses exclusively on the term spread, some readers may be interested to know whether the long-term share adds predictive power to this variable alone. The right columns of Table 6 indicate that the long-term share does have significant incremental predictive power over the term spread, even at the one-year horizon. The overall message here is that much of the long-term share's predictive power can be accounted for by its relationship to market conditions, but it is more than the term spread in disguise.

D. Robustness tests

In Table 7 we examine several robustness issues. For reference, the first row repeats the baseline predictability results from Table 5. The next two rows address the lack of information on floating rate and call provisions. We construct a short time series (1974 through 1999) of the fraction of long-term debt outstanding that is tied to a floating interest rate using Compustat. We also construct a short time series (1974 through 2000) of the fraction of long-term debt issues with call provisions using data from the Securities Data Corporation.[13] The long-term share is uncorrelated with the fraction of long-term debt linked to prime and has a correlation of –0.49 with the fraction of callable debt. In other words, when firms issue a relatively high share of short-term debt, the long-term debt that they do issue is more likely to be callable – more like short-term debt in terms of its effective cost – than is normally the case.

As mentioned before, the forecasting power of the long-term share is likely to be particularly diminished by counting long-term floating rate debt as fixed rate debt; issuing floating rate debt suggests an expectation that the relative cost of long-term debt is high, not low. Using these series we make an adjustment to remove long-term callable issues from all debt issues and reclassify long-term debt linked to prime as effectively short-term. In the period where data allows this adjustment, the floating-rate-adjusted variable is a marginally stronger predictor than the unadjusted share, while the call-adjusted variable is marginally weaker.

The next two rows examine the stability of the relationships over time. Though the sample is already rather short, we split it into halves. The long-term share is significant and large within the second half but not within the first half. Note that the first half also corresponds to much lower volatility in inflation, the term spread, and excess bond returns (see Figure 1), so there may not be enough predictable variation in excess returns in this period to induce informative adjustments in debt maturity. Consistent with this explanation, the univariate

[13] Van Horne (1984) describes historical trends in callability. Long-term public issues before the late 1950s were generally immediately callable. As the nominal targeting period passed and interest rate volatility increased, investors began to demand call protections. By the late 1960s, the majority of public issues had call protections of five or ten years.

predictive power of the term spread is similarly unstable. Like the long-term share in debt issues, a predictive regression using the term spread and the first half of the sample has an R-squared of only 0.01 for one-year returns and three-year cumulative returns. (In the three-year regression, the term spread coefficient actually changes sign, negative in the first half and positive in the second.) One interpretation is that when market conditions are more or less informative about future excess returns, the maturity of debt issues responds in proportion.

The last two rows examine our assumption that one-tenth of long-term debt is retired each year. This assumption is made to be consistent with the summary statistics reported in Guedes and Opler (1996). Alternative assumptions that the retirement rate is instead one-fifth or one-twentieth give similar results.

IV. Discussion

The fact that corporate debt maturity is closely tied to predictable variation in excess bond returns is interesting at face value since it sheds light on a basic pattern in corporate finance. But it also raises two fundamental questions. Does the predictable variation reflect inefficiency? Do firms really reduce their overall cost of capital by substituting between short- and long-term debt in the observed manner?

In fact, the Modigliani-Miller theorem shows that these two questions are equivalent. In efficient and integrated and otherwise perfect markets, the theorem fixes the overall cost of capital in proportion to cash flow risk alone. The only way to reduce the average cost of a portfolio of short- and long-term debt is to increase the risk and thus the cost of equity. The bottom line of the MM theorem is that the costs of different forms of capital do not vary *independently* in efficient and integrated markets, so the overall cost of capital cannot be reduced. In inefficient or segmented markets, by contrast, the MM theorem does not apply, and market timing – raising finance in whatever form is currently available at the lowest risk-adjusted cost – can reduce the overall cost of capital.

This framework suggests three general explanations for the results. (1) The debt market is efficient (and integrated with the equity market) and debt issues are linked to time-varying excess bond returns because optimal debt maturity structure is related to excess bond returns. In this explanation, manipulating maturity does not (and is not intended to) reduce the cost of capital. (2) Managers try in vain to time an efficient debt market. Manipulating maturity does not reduce the overall cost of capital but does no harm beyond transaction costs. Modigliani and Miller would call this the "neutral mutations" hypothesis. (3) Managers successfully time an inefficient debt market. The predictability of excess bond returns reflects inefficiency, at least in part, and managers reduce the overall cost of capital by adjusting maturity in response.

It is difficult to determine which explanation is most accurate, but some progress is possible. To preview the following discussion, we find more support for explanations (2) and (3) than explanation (1). Managers are almost surely trying to time the debt market, but despite suggestive evidence it is hard to prove that their efforts reduce the overall cost of capital.

A. Debt market efficiency and integration with the equity market

Here we address the difficult question of whether the predictive power of the long-term share reflects an efficient and integrated debt market, as called for by explanations (1) and (2). We do not develop theories of debt market inefficiency but we note that the basic theoretical ingredients are the same as for equity market inefficiency, namely limited arbitrage and correlated investor sentiment (Shleifer (2000)). Persuasive evidence of limits on debt market arbitrage include: the on-the-run bond premium (Amihud and Mendelson (1991), Boudoukh and Whitelaw (1991), Elton and Green (1998), Krishnamurthy (2001)) and related anomalies (Cornell and Shapiro (1989)); the phenomenon of "specialness" in the repo market (Duffie (1996)); the difference in prices between Treasury securities and equivalent STRIPS portfolios (Grinblatt and Longstaff (2000)); and more generally the downward-sloping excess demand curves for auctioned Treasury securities (Jovanovic and Rousseau (2001)). Prior work on bond investor sentiment includes Modigliani and Sutch (1966a, 1966b) and Shiller (1996), who argue that investors have time-varying preferences for short- and long-term debt, and Shiller, Campbell, and Schoenholtz (1983), who argue that long-term rates overreact to information more relevant to short-term rates. The survey evidence in Froot (1989) also suggests that bond investors do not have unbiased expectations.

In an efficient debt market, the long-term share is inversely related to future returns because it is inversely related to time-varying risk. Covariance with consumption is the only risk factor in Breeden (1979), and Lettau and Ludvigson (2001) argue for the empirical validity of the consumption-based paradigm. Our first test is whether the long-term share is inversely related to consumption covariance. Following Duffee (2001) we test whether the long-term share predicts a lower covariance of excess bond returns with consumption growth by estimating the following system with two-stage least squares:

$$\begin{bmatrix} r_{GLt+k} - r_{GSt+k} \\ Y_{t+k} \end{bmatrix} = \mathbf{a} + \mathbf{b}X_t + \begin{bmatrix} \varepsilon_{1t+k} \\ \varepsilon_{2t+k} \end{bmatrix}, \tag{7a}$$

$$\hat{\varepsilon}_{1t+k} \cdot \hat{\varepsilon}_{2t+k} = c + dX_t + u_{t+k}, \tag{7b}$$

where Y is the log growth in consumption and X is the long-term share or the term spread. Consumption is real per capita expenditure on non-durables and services from the Bureau of Economic Analysis.

For time-varying covariance with consumption to be a candidate explanation for the predictive power of a variable X, d should have the same sign as b_1. Thus d should be negative when X is the long-term share and positive when X is the term spread. Table 7 presents the results of the second-stage regressions in (7b). The results show no negative relationship between the long-term share and the subsequent consumption growth – bond return covariance. As emphasized by Duffee (2001), there is also no positive relationship for the term spread.

The lack of a connection to covariance risk leads us to consider variance risk. Breeden (1986) derives a relationship between expected excess bond returns and the conditional variance of consumption. The intertemporal CAPM of Merton (1973) and the APT of Ross (1976) admit multiple risk factors, and in some implementations the risk premia are specified as related to the conditional variances of underlying state variables (e.g. French, Schwert, and Stambaugh (1987)). Several studies have attempted to connect predictor variables to future variance risks, including Fama and French (1989), Harvey (1989, 1991), Schwert (1989), Bollerslev, Chou, and Kroner (1992), Chou, Engle, and Kane (1992), and Duffee (2001). We follow Schwert (1989) and test whether the long-term share predicts the standard deviation of the residuals from equation (7a):

$$1.253 \cdot \left| \hat{\varepsilon}_{1t+k} \right| = e + fX_t + u_{t+k} , \tag{7c}$$

$$1.253 \cdot \left| \hat{\varepsilon}_{2t+k} \right| = g + hX_t + u_{t+k} . \tag{7d}$$

As in Schwert (1989), scaling the absolute residual by 1.253 allows the slope coefficient to be interpreted as the effect on the standard deviation of the residual.[14]

Again, for time-varying risk to be a candidate explanation, f or h should be negative when X is the long-term share and positive when X is the term spread. Table 8 presents mixed results. The long-term share is indeed negatively related to future excess bond return variance but is marginally positively related to future consumption variance. The former result is at least in the right direction, but even there the magnitude seems rather small to account for the large return predictability effects. For example, a one standard deviation increase in the long-term share reduces the standard deviation of one-year-ahead excess bond returns by 2.27 percentage points. This is smaller than its effect on future returns and therefore indicates a Sharpe ratio above one. Term spread variance forecasts are also mixed.

Another way that debt market timing could reduce the overall cost of capital is if the debt and equity markets are not perfectly integrated. Consider two firms with the same cash flow risk and the same leverage. One firm switches between short- and long-term debt following the historical pattern of the long-term share. The other firm uses long-term debt exclusively. Ex post, the predictability results show that the first firm has paid less for its debt than the second firm. The MM theorem says that it must have paid commensurately more for its equity, if capital markets are efficient and integrated, since equity would have had to absorb the cash flow risk allegedly responsible for the time-varying term premium.

A testable implication is that the long-term share should predict the cost of equity in the same direction as the relative cost of long-term debt. Table 9 tests this hypothesis. The coefficients on the long-term share are generally negative as suggested by the integration

[14] Replacing the absolute error in the second stage regression with the squared error gives similar results. A table is available upon request.

hypothesis, but none approaches significance, and the coefficients on both long and short issues have weak negative signs. We point out that the weak results here could reflect a lack of power. That is, although the maturity of new issues is quite variable, overall debt maturity may not vary enough from year to year to push an econometrically identifiable amount of "term risk" onto equity.

B. Optimal debt maturity structure

The second half of explanation (1) holds that debt issues are related to future excess returns because optimal debt maturity is connected to future excess returns. This offers a second way to evaluate this explanation.

There is just one theory of optimal debt maturity that directly involves interest rates, the tax theory developed by Brick and Ravid (1985, 1991) and outlined in Gordon (1982). In this theory, managers accelerate tax deductions by issuing *more* long-term debt when long-term rates are relatively *high* or, under a convex tax schedule, when interest rates are particularly volatile. Under the expectations hypothesis, this perhaps counterintuitive strategy does not increase the present value of pre-tax interest payments. The evidence in Tables 5 and 8 is directly opposite to the predictions of the tax theory, however. Firms issue more long-term debt when the term structure is flat and future interest rates are stable. The firm-level results in Barclay and Smith (1995), Guedes and Opler (1995), and Stohs and Mauer (1996) also contradict the tax theory.

It is possible to construct ad hoc stories to connect our predictability results to optimal maturity theories without directly involving debt market conditions. One such story involves debt overhang and time-varying business conditions. Myers (1977) notes that an overhang of long-term debt can force firms to forgo positive net present value investments that require new capital. To avoid this, firms with more growth opportunities should prefer short-term debt. If growth opportunities vary over time, the long-term share would then vary inversely. This theory does not directly connect to subsequent bond returns, but Fama and French (1989) suggest that expected excess bond returns are generally low when business conditions are good – which is perhaps when growth opportunities are good and, according to the debt overhang theory, when the long-term share should be low. This story appears to predict a positive relationship between the long-term share and subsequent excess bond returns, not the negative relationship that we observe. Furthermore, measures of business cycle activity as defined by the National Bureau of Economic Research are statistically uncorrelated with the long-term share variable.[15] Lastly, a Fama and French (1989) business conditions explanation predicts high contemporaneous equity returns. In other words, a long-term-share risk premium should influence both equity and debt markets. Table 9 shows that this effect is weak.

Another story involves time-varying liquidity risk. Diamond (1991) and Rajan (1992) note that short-term debt may be difficult to refinance, leading to costly financial distress. This suggests that when liquidity risk is higher the preference for long-term debt will be higher. These models do not directly involve interest rate risk. If one roughly equates liquidity risk with interest rate risk, however, these models tend to predict that when interest rate risk is high, corporations prefer long-term debt. This is opposite to the evidence. Yet another story involves liquidity itself as opposed to liquidity risk. Firms may prefer to issue debt at the lowest current interest cost. One reason is to conserve internal finance. Another reason is that managers have short horizons, and issuing bonds at the lowest interest rate maximizes short-term earnings (as in Stein (1989)). This links the long-term share to the term spread and perhaps to future excess bond returns by

[15] A table documenting this is available upon request.

coincidence. This explanation does not explain why the long-term share has incremental predictive power over and above the term spread (Table 6) or why the long-term share is negatively related to the real short rate and inflation (Table 4).

Finally, several lines of argument lead to the principle that debt maturity should be set to match asset maturity, including Myers (1977), Diamond (1991), and Hart and Moore (1995). According to this principle, the long-term share should be positively correlated with changes in aggregate asset maturity. While this still does not tie changes in asset maturity to future excess bond returns, it does represent a potentially testable implication. We construct a crude measure of changes in asset maturity from balance sheet data reported by the Internal Revenue Service *Statistics of Income*. We estimate the maturity of net fixed assets as the ratio of net fixed assets to depreciation expense and assume the maturity of all other assets is one year. We then estimate overall asset maturity as the book-value weighted-average asset maturity; the weight on the maturity of fixed assets is net fixed assets over total assets. This procedure is similar to that used in Guedes and Opler (1996). We find that the correlation between annual changes in this asset maturity proxy and the long-term share is negative and insignificant, which differs from the positive correlation predicted by the matching theory. We are hesitant to put much value on this result, however. The quality of the proxy for fixed asset maturity is questionable since depreciation expense is dictated as much by tax rules as economic reality, and our assumption about the maturity of non-fixed assets is even less justified.

C. Debt market timing

The discussion so far casts most doubt on explanation (1), which requires both that the long-term share's predictive power reflects a rational risk premium and that optimal debt maturity varies inversely with this premium. The evidence for a risk premium is ambiguous, and existing corporate finance theory gives at best obscure explanations for a negative relationship between optimal debt maturity and subsequent excess bond returns. The only theory that directly involves interest rates is the tax theory, which makes opposite predictions.

We believe the best explanation for the behavior of the maturity of debt issues is market timing, as in explanations (2) and (3). With the lack of support for (1) this is true by default. But there is also strong affirmative support for debt market timing. First, there are realistic incentives for managers to try to time the debt market. The only requirement is that they care about shareholders. Indeed, many top managers are large shareholders themselves, and most have their compensation otherwise tied to share performance through bonus formulas and stock options. Second, and most convincing, surveys of managers prove that debt market timing is an explicit strategy. A substantial number of financial managers in the Graham and Harvey (2001) survey state that they issue debt "when interest rates are particularly low." Given the decision to issue debt, managers prefer short-term debt "when short-term interest rates are low compared to long-term rates" and when they are "waiting for long-term market interest rates to decline." These statements indicate that the relationship between issue maturity and market conditions is intentional, not coincidental.

We close with some contrasts between the apparent nature of equity market timing and debt market timing. Baker and Wurgler (2000) find that the share of equity issues in total equity and debt issues is high when the cost of equity, as measured by subsequent equity market returns, is low. They interpret this result as the combination of firm-level equity market timing and equity-market-wide investor sentiment. Correlated investor sentiment leads to correlated misvaluation and therefore correlated equity issue decisions. As a result, the aggregate equity share in new equity and debt issues predicts equity market returns even though individual firms may respond only their own misvaluation.

The evidence here is that the long-term share in debt issues is high when the relative cost of long-term debt is low. This has a similar flavor to the equity market timing results. But, unlike in the equity market, the source of the apparent market timing can be explained almost entirely with publicly-available information. This is intuitive. Firms do not possess private information about the relative valuation of short- and long-term government bonds. Rather, when trying to determine which maturity is lowest cost, the best they can do is rely on signals from debt market conditions.

V. Conclusion

We document that the maturity of corporate debt issues depends on predictable variation in the relative cost of short- and long-term borrowing. Put simply, firms tend to borrow at the lowest-cost maturity. The aggregate share of long-term debt issues in total debt issues is negatively related to future excess bond returns, and negatively related to several market conditions which themselves forecast higher excess bond returns. These results shed new light on a basic time series pattern in corporate finance, the maturity of corporate debt.

We believe the best explanation for the results is that managers use predictable variation in the relative cost of long-term borrowing in an effort to reduce the overall cost of capital. Direct support for this explanation comes from the survey by Graham and Harvey (2001), in which managers reveal that they try to time the debt market using market conditions such as the term spread and the level of interest rates. Whether managers succeed in reducing the overall cost of capital ultimately depends on whether the debt market is entirely efficient and integrated with the equity market. This remains an open question.

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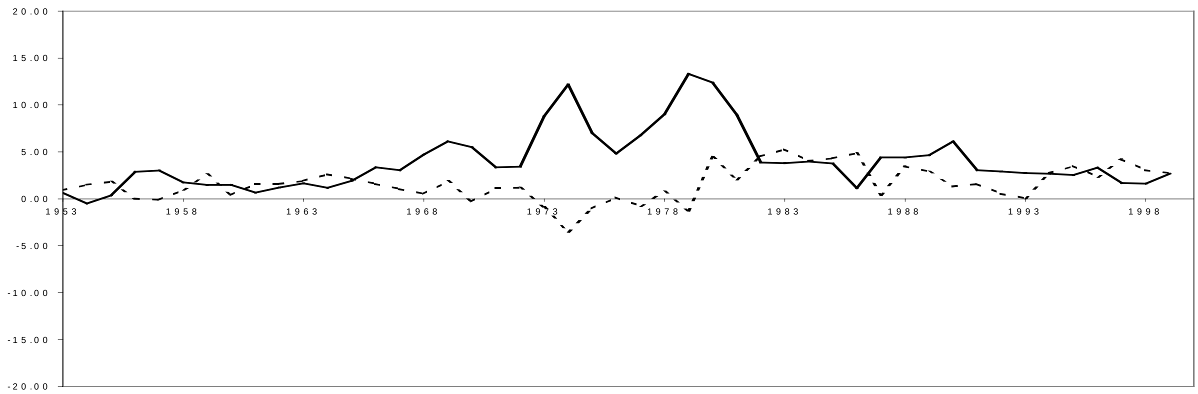
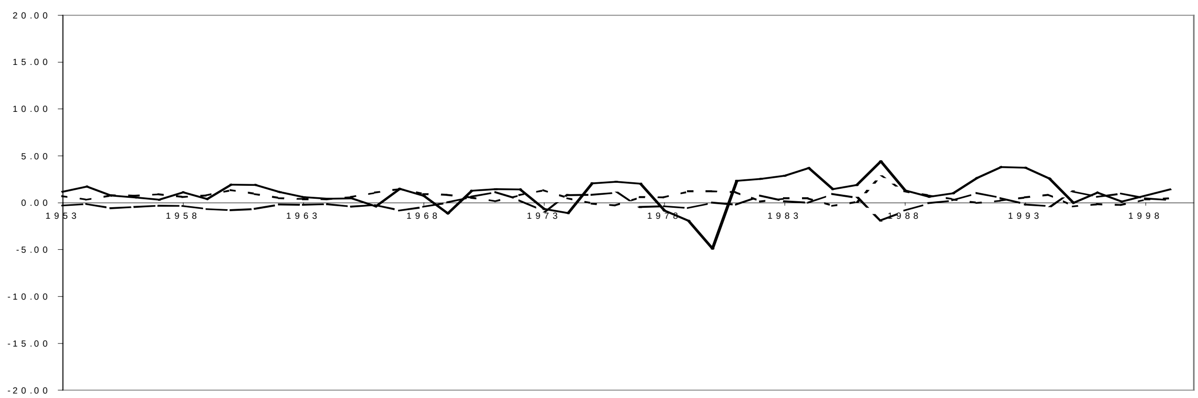
Figure 1. Debt market conditions and excess bond returns, 1953-2000. Inflation (π) is measured as realized inflation over the course of the year. The real interest rate (y_{GS}-π) is the difference between the December Treasury bill return and realized inflation. The term spread (y_{GL}-y_{GS}) is the difference between the annualized December long-term government bond yield and the annualized December Treasury bill return. The credit spread (y_{CS}-y_{GS}) is the difference between the commercial paper yield and the annualized December Treasury bill return. The credit term spread ((y_{CL}-y_{GL})-(y_{CS}-y_{GS})) is the difference between the December Baa corporate bond yield and the December long-term government bond yield minus the credit spread. Excess bond returns are measured as the difference between the annual return on long-term government bonds and Treasury bills (r_{GL}-r_{GS}), and the difference between the annual return on corporate bonds and commercial paper (r_{CL}-r_{CS}). All data is from Ibbotson (2001) or Ibbotson Associates' *EnCorr* software.

Panel A. Inflation (solid) and the real short-term interest rate (dash)



Panel B. Term spread (solid), credit spread (short dash), and the credit term spread (long dash)



Panel C. Excess government (solid) and corporate (dash) bond returns

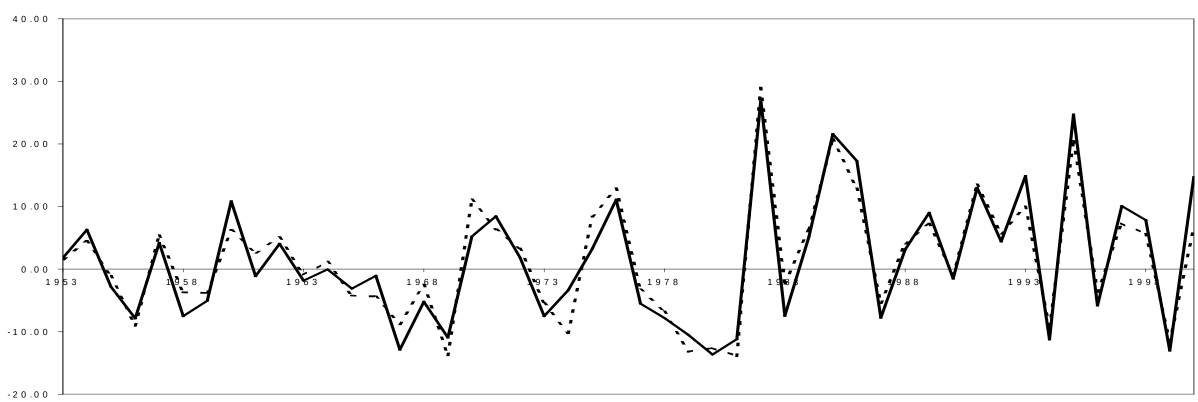
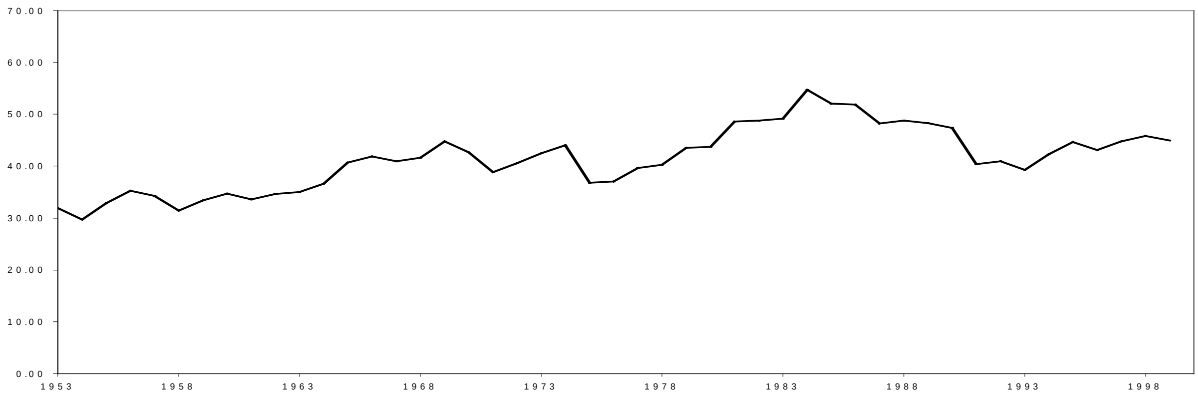
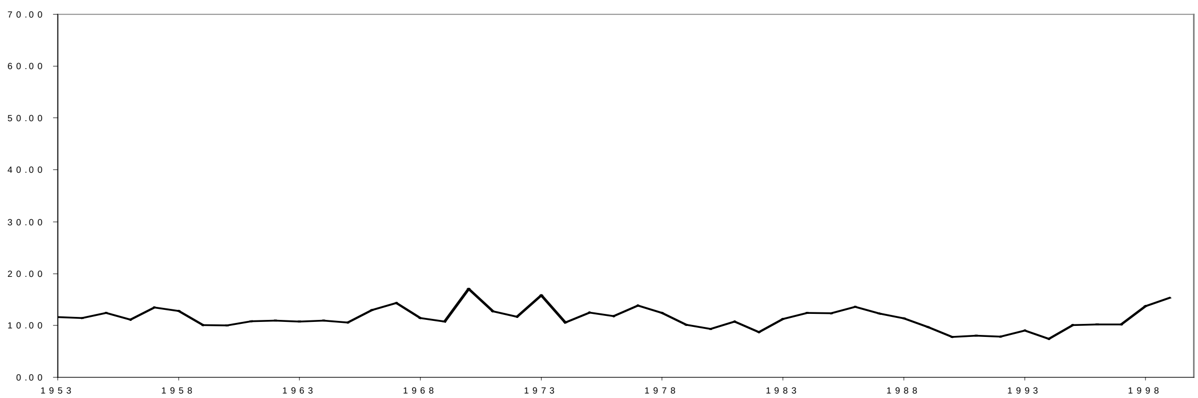


Figure 2. The maturity of corporate debt issues, 1953-1999. Debt issues data from the Federal Reserve *Flow of Funds*. Long-term debt includes industrial revenue bonds, corporate bonds, and mortgages. Total debt also includes commercial paper, bank loans not elsewhere classified, and other short-term loans and advances. All short-term debt is assumed to be new short-term issues. The change in long-term debt plus one-tenth of lagged long-term debt is assumed to be new long-term issues. Panel A shows short-term issues scaled by lagged total debt. Panel B shows long-term issues scaled by lagged total debt. Panel C shows the long-term share in total debt issues. All variables are expressed in percentage terms.

Panel A. New issues of short-term debt ($d_{St}/D_{t\text{-}1}$)



Panel B. New issues of long-term debt ($d_{Lt}/D_{t\text{-}1}$)



Panel C. Long-term share of total debt issues ($d_{lt}/[d_{lt}+d_{st}]$)

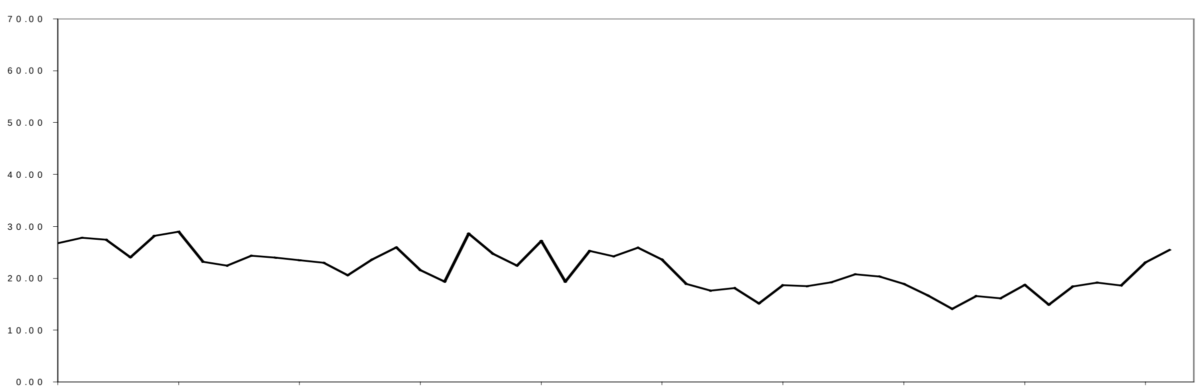
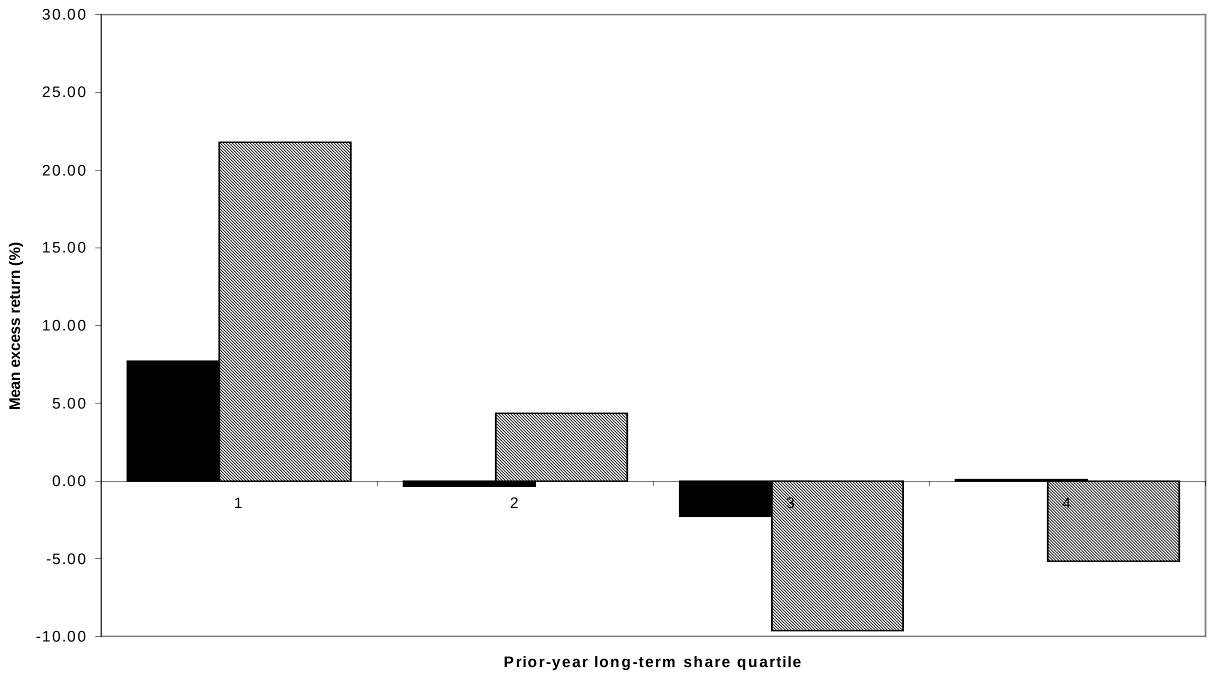


Figure 3. The maturity of corporate debt issues and subsequent excess bond returns, 1954-2000. Excess government bond returns as predicted by the historical quartile of the prior year long-term share in total debt issues. The maturity of corporate debt issues comes from the Federal Reserve *Flow of Funds.* Panel A shows excess government bond returns. Panel B shows excess corporate bond returns. Excess bond returns are calculated for one-year (solid) and cumulative three-year (hatch) periods.

Panel A. Excess government bond returns (one-year-ahead returns - solid, cumulative three-year returns - hatch)



Panel B. Excess corporate bond returns (one-year-ahead returns - solid, cumulative three-year returns - hatch)

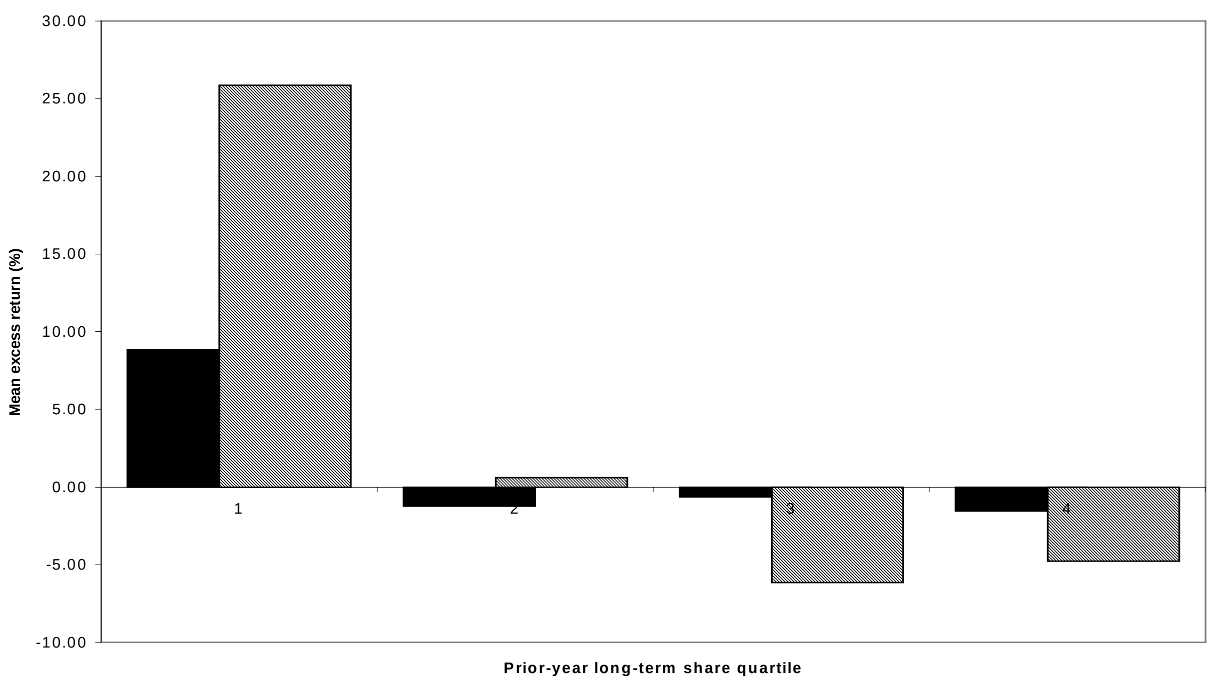


Table 1. Debt market conditions and excess bond returns, 1953-2000. All variables are expressed in percentage terms. In Panel A, inflation (π) is measured as realized inflation over the course of the year. The real interest rate (y_{GS} -π) is the difference between the December Treasury bill return and realized inflation. The term spread (y_{GL}-y_{GS}) is the difference between the December long-term government bond yield and the annualized December Treasury bill return. The credit spread (y_{CS}-y_{GS}) is the difference between the commercial paper yield and the annualized December Treasury bill return. The credit term spread ((y_{CL}-y_{GL})-(y_{CS}-y_{GS})) is the difference between the December Baa corporate bond yield and the December long-term government bond yield minus the credit spread. In Panel B, excess bond returns are measured as the difference between the annual return on long-term government bonds and Treasury bills (r_{GL}-r_{GS}) and the difference between the annual return on corporate bonds and commercial paper (r_{CL}-r_{CS}). All data is from Ibbotson (2001) or Ibbotson Associates' *EnCorr* software.

(%)	**N**	**Mean**	**SD**	**Min**	**Max**
		Panel A. Debt market conditions			
π_t	47	4.04	3.16	-0.50	13.31
$y_{GSt} - \pi_t$	47	1.63	1.82	-3.50	5.28
$y_{GLt} - y_{GSt}$	47	1.12	1.61	-4.87	4.41
$y_{CSt} - y_{GSt}$	47	0.61	0.57	-0.40	2.81
$(y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})$	47	-0.01	0.66	-1.91	1.19
		Panel B. Excess bond returns			
$r_{GLt+1} - r_{GSt+1}$	47	1.32	10.28	-13.65	26.97
$r_{CLt+1} - r_{CSt+1}$	47	1.40	9.62	-13.90	28.96

Table 2. Debt market conditions and excess bond returns, 1954-2000. OLS regressions of excess bond returns on lagged inflation (π), real interest rates (y_{Gs} - π), the term spread (y_{GL} – y_{GS}), and the credit spread (y_{CS} – y_{GS}), and the credit term spread ((y_{CL}–y_{GL})-(y_{CS}–y_{GS})). We also reduce the regressions to a standardized univariate prediction.

$$\text{Future excess bond return} = a + b\pi_t + c(y_{GSt} - \pi_t) + d(y_{GLt} - y_{GSt}) + e(y_{CSt} - y_{GSt}) + f((y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})) + g(\hat{R}_{Lt+k} - \hat{R}_{St+k}) + u_{t+k}$$

Excess bond returns are expressed in percentage terms. In Panel A, the dependent variable is the excess return on long-term government bonds over Treasury bills ($r_{GL} - r_{GS}$). In Panel B, the dependent variable is the excess return of corporate bonds over commercial paper (r_{CL}–r_{CS}). Each panel predicts one-year-ahead, two-year-ahead and three-year-ahead returns (r) as well as cumulative three-year returns (R). The independent variables are standardized to have unit variance. T-statistics are heteroskedasticity robust and correct for time-series dependence up to two lags.

		π_t		y_{GSt} -π_t		$y_{GLt} - y_{GSt}$		$y_{CSt} - y_{GSt}$		$(y_{CLt} - y_{GLt})$ – $(y_{CSt} - y_{GSt})$		$\hat{R}_{Lt+k} - \hat{R}_{St+k}$		
(%)	**N**	**b**	**[t]**	**c**	**[t]**	**d**	**[t]**	**e**	**[t]**	**f**	**[t]**	**G**	**[t]**	$\mathbf{R^2}$
						Panel A. Excess government bond returns								
$r_{GLt+1} - r_{GS\,t+1}$	47	4.65	[1.63]	5.63	[1.99]	4.83	[4.19]	-1.73	[-0.41]	-0.45	[-0.13]			0.24
$r_{GLt+2} - r_{GSt+2}$	46	1.41	[0.44]	7.80	[2.18]	0.47	[0.25]	7.16	[1.49]	5.34	[1.30]			0.16
$r_{GLt+3} - r_{GSt+3}$	45	3.62	[1.25]	7.52	[1.99]	1.48	[0.82]	1.52	[0.31]	0.18	[0.05]			0.10
$R_{GLt+3} - R_{GSt+3}$	45	10.11	[1.60]	21.19	[4.17]	7.11	[2.95]	5.57	[0.57]	3.73	[0.49]			0.40
$r_{GLt+1} - r_{GS\,t+1}$	47											5.06	[4.65]	0.24
$R_{GLt+3} - R_{GSt+3}$	45											10.58	[5.49]	0.40
						Panel B. Excess corporate bond returns								
$r_{CLt+1} - r_{CSt+1}$	47	3.76	[1.36]	4.01	[1.58]	4.86	[3.67]	0.81	[0.21]	1.95	[0.62]			0.28
$r_{CLt+2} - r_{CSt+2}$	46	2.09	[0.58]	7.59	[2.09]	0.13	[0.08]	6.39	[1.18]	4.45	[0.96]			0.17
$r_{CLt+3} - r_{CSt+3}$	45	3.98	[1.44]	7.15	[2.26]	1.20	[0.74]	1.88	[0.37]	-0.57	[-0.15]			0.13
$R_{CLt+3} - R_{CSt+3}$	45	9.96	[1.45]	19.51	[3.58]	6.56	[2.66]	8.25	[0.76]	5.25	[0.61]			0.38
$r_{CLt+1} - r_{CS\,t+1}$	47											5.11	[4.64]	0.28
$R_{CLt+3} - R_{CSt+3}$	45											10.17	[5.04]	0.38

Table 3. The maturity of corporate debt issues, 1953-1999. All variables are expressed in percentage terms. Debt issues data from the Federal Reserve *Flow of Funds*. Long-term debt includes industrial revenue bonds, corporate bonds, and mortgages. Total debt also includes commercial paper, bank loans not elsewhere classified, and other short-term loans and advances. All short-term debt is assumed to be new short-term issues. The change in long-term debt plus one-tenth of lagged long-term debt is assumed to be new long-term issues.

(%)	**N**	**Mean**	**SD**	**Min**	**Max**
d_{Lt}/D_{t-1}	47	11.42	2.06	7.42	17.09
d_{St}/D_{t-1}	47	41.44	6.01	29.74	54.70
$d_{Lt}/[d_{Lt}+d_{St}]$	47	21.78	3.98	14.10	28.96

Table 4. Debt market conditions and the maturity of corporate debt issues, 1953-1999. OLS regressions of the maturity of corporate debt issues on lagged inflation (π), real interest rates (y_{GS} -π), term spread (y_{GL} –y_{GS}), credit spread (y_{CS} –y_{CS}), and credit term spread ((y_{CL}–y_{GL})-(y_{CS}–y_{GS})). We also consider the predicted excess long-term government bond return from Table 2 as an independent variable.

$$\frac{d_{Lt}}{D_{t-1}} = a + b\pi_t + c(y_{GSt} - \pi_t) + d(y_{GLt} - y_{GSt}) + e(y_{CSt} - y_{GSt}) + f((y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})) + g(\hat{R}_{GLt+3} - \hat{R}_{GSt+3}) + h\frac{d_{Lt} + d_{St}}{D_{t-1}} + u_t$$

$$\frac{d_{Lt}}{d_{Lt} + d_{St}} = a + b\pi_t + c(y_{GSt} - \pi_t) + d(y_{GLt} - y_{GSt}) + e(y_{CSt} - y_{GSt}) + f((y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})) + g(\hat{R}_{GLt+3} - \hat{R}_{GSt+3}) + u_t$$

We do not report *h*. Issue data is expressed in percentage terms and the independent variables are standardized to have unit variance. We measure the maturity structure of new issues as new issues of long-term debt (d_L/D_{t-1}) controlling for total issues ($[d_L+d_S]/D_{t-1}$) and alternately as the long-term share of total issues ($d_L/[d_L+d_S]$). The issue data are from the Federal Reserve *Flow of Funds*. T-statistics are heteroskedasticity robust and correct for time-series dependence up to two lags.

		π_t		y_{GSt} -π_t		$y_{GLt} - y_{GSt}$		$y_{CSt} - y_{GSt}$		$(y_{CLt} - y_{GLt}) - (y_{CSt} - y_{GSt})$		$\hat{R}_{GLt+3} - \hat{R}_{GSt+3}$		
(%)	**N**	**b**	**[t]**	**c**	**[t]**	**D**	**[t]**	**e**	**[t]**	**f**	**[t]**	**h**	**[t]**	$\mathbf{R^2}$
Panel A. Debt market conditions														
d_{Lt}/D_{t-1}	47	-2.40	[-4.26]	-3.83	[-4.09]	-0.92	[-3.41]	-0.45	[-0.69]	-0.58	[-0.96]			0.49
$d_{Lt}/[d_{Lt}+d_{St}]$	47	-3.45	[-4.37]	-5.32	[-4.67]	-1.30	[-3.09]	-0.46	[-0.38]	-0.83	[-0.71]			0.46
Panel B. $\hat{R}_{GLt+3} - \hat{R}_{GSt+3}$ fitted with debt market conditions														
d_{Lt}/D_{t-1}	47											-1.51	[-3.90]	0.39
$d_{Lt}/[d_{Lt}+d_{St}]$	47											-2.46	[-5.95]	0.38

Table 5. The maturity of corporate debt issues and excess bond returns, 1954-2000. Univariate regressions of excess bond returns on the maturity of corporate debt issues [**X**].

$$\textit{Future excess bond return} = a + \mathbf{b}'\mathbf{X}_t + u_{t+k}$$

Excess bond returns are expressed in percentage terms. The independent variables are standardized to have unit variance. In Panel A, the dependent variable is the excess return on long-term government bonds over Treasury bills. In Panel B, the dependent variable is the excess return of corporate bonds over commercial paper. We predict one-year-ahead, two-year-ahead, three-year-ahead returns (r) and cumulative three-year-ahead returns (R). We measure changes in the maturity structure as new issues of long-term debt ($d_L/D_{t\text{-}1}$) controlling for new issues of short-term debt ($d_S/D_{t\text{-}1}$) and as the long-term share of total new issues ($d_L/[d_L+d_S]$). The issue data are from the *Flow of Funds*. T-statistics are heteroskedasticity robust and correct for time-series dependence up to two lags. The F-test reports the joint significance level of ($d_L/D_{t\text{-}1}$) and ($d_S/D_{t\text{-}1}$).

		$d_{Lt}/D_{t\text{-}1}$		$d_{St}/D_{t\text{-}1}$					$d_{Lt}/[d_{Lt}+d_{St}]$		
(%)	**N**	$\mathbf{b_1}$	**[t]**	$\mathbf{b_2}$	**[t]**	**[F]**	$\mathbf{R^2}$	**N**	**b**	**[t]**	$\mathbf{R^2}$
Panel A. Excess government bond returns											
$r_{GLt+1} - r_{GSt+1}$	47	-1.83	[-1.25]	2.82	[2.58]	[0.01]	0.11	47	-3.18	[-2.84]	0.10
$r_{GLt+2} - r_{GSt+2}$	46	-1.62	[-1.49]	2.89	[2.85]	[0.01]	0.11	46	-3.06	[-2.82]	0.09
$r_{GLt+3} - r_{GSt+3}$	45	-2.65	[-1.90]	3.26	[3.18]	[0.01]	0.17	45	-4.07	[-3.09]	0.15
$R_{GLt+3} - R_{GSt+3}$	45	-6.47	[-2.99]	8.86	[4.05]	[0.00]	0.43	45	-10.47	[-4.99]	0.39
Panel B: Excess corporate bond returns											
$r_{CLt+1} - r_{CS\,t+1}$	47	-2.21	[-1.90]	2.63	[2.46]	[0.00]	0.13	47	-3.25	[-3.63]	0.11
$r_{CLt+2} - r_{CSt+2}$	46	-1.67	[-1.51]	2.73	[3.04]	[0.01]	0.11	46	-3.01	[-2.85]	0.10
$r_{CLt+3} - r_{CSt+3}$	45	-2.12	[-1.51]	3.01	[2.88]	[0.02]	0.15	45	-3.51	[-2.62]	0.13
$R_{CLt+3} - R_{CSt+3}$	45	-5.99	[-3.18]	8.59	[3.75]	[0.00]	0.41	45	-9.89	[-4.72]	0.35

Table 6. The maturity of corporate debt issues, debt market conditions, and excess bond returns, 1954-2000. Multivariate regressions of excess bond returns on the maturity of corporate debt issues [**X**] and debt market conditions.

$$\textit{Future excess bond return} = a + \mathbf{b}'\mathbf{X}_t + c\left(\hat{R}_{Lt+k} - \hat{R}_{St+k}\right) + d\left(y_{GLt} - y_{GSt}\right) + u_{t+k}$$

Excess bond returns are expressed in percentage terms. The independent variables are standardized to have unit variance. In Panel A, the dependent variable is the excess return on long-term government bonds over Treasury bills. In Panel B, the dependent variable is the excess return of corporate bonds over commercial paper. We predict one-year-ahead and cumulative three-year-ahead returns. We measure changes in the maturity of corporate debt as the long-term share of new issues ($d_L/(d_L+d_S)$). The issue data are from the Federal Reserve *Flow of Funds*. We control for debt market conditions in two ways. In the first four columns, we include the predicted excess long-term government bond return from Table 2. In the second four columns, we include the term spread. T-statistics in brackets are heteroskedasticity robust and correct for time-series dependence up to two lags.

	Increment Over Forecast Return				*Increment Over Term Spread*			
	1-Year Return		*Cum. 3-Year Return*		*1-Year Return*		*Cum. 3-Year Return*	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
				Panel A: Excess government bond returns				
$d_{Lt}/[d_{Lt}+d_{St}]$		-1.05		-6.19		-2.84		-10.11
		[-0.84]		[-2.38]		[-3.12]		[-5.06]
$\hat{R}_{GLt+k} - \hat{R}_{GSt+k}$	5.06	4.57	10.58	6.68				
	[4.65]	[3.38]	[5.49]	[2.53]				
y_{GLt} - y_{GSt}					3.60	3.36	4.18	3.32
					[4.35]	[3.42]	[1.76]	[2.04]
N	47	47	45	45	47	47	45	45
R^2	0.24	0.25	0.40	0.48	0.15	0.23	0.08	0.43
				Panel B: Excess corporate bond returns				
$d_{Lt}/[d_{Lt}+d_{St}]$		-1.25		-5.67		-2.89		-9.59
		[-1.19]		[-2.46]		[-4.20]		[-4.67]
$\hat{R}_{CLt+k} - \hat{R}_{CSt+k}$	5.11	4.56	10.17	6.63				
	[4.64]	[3.10]	[5.04]	[2.50]				
y_{GLt} - y_{GSt}					3.75	3.51	3.52	2.70
					[3.99]	[3.04]	[1.53]	[1.54]
N	47	47	45	45	47	47	45	45
R^2	0.28	0.30	0.38	0.45	0.19	0.28	0.06	0.39

Table 7. Robustness tests. Univariate regressions of excess bond returns on the maturity of corporate debt issues [**X**].

$$\textit{Future excess bond return} = a + \mathbf{b}'\mathbf{X}_t + u_{t+k}$$

Excess bond returns are expressed in percentage terms. The independent variables are standardized to have unit variance. In Panel A, the dependent variable is the excess return on long-term government bonds. In Panel B, the dependent variable is the excess return of corporate bonds over commercial paper. We measure changes in the maturity structure as new issues of long-term debt (d_L/D_{t-1}) controlling for new issues of short-term debt (d_S/D_{t-1}) and as the long-term share of total new issues ($d_L/[d_L+d_S]$). The issue data are from the Federal Reserve *Flow of Funds*. We check for the robustness by (1) adjusting for floating rate and callable long-term debt, (2) varying the sample period, and (3) varying the retirement rate of long-term debt assumption. T-statistics are heteroskedasticity robust and correct for time-series dependence up to two lags. The F-test reports the joint significance level of (d_L/D_{t-1}) and (d_S/D_{t-1}).

		d_{Lt}/D_{t-1}		d_{St}/D_{t-1}					$d_{Lt}/[d_{Lt}+d_{St}]$		
Adjustment	**N**	**b_1**	**[t]**	**b_2**	**[t]**	**[F]**	**R^2**	**N**	**b**	**[t]**	**R^2**
Panel A. One-year excess government bond returns											
Unadjusted	47	-1.83	[-1.25]	2.82	[2.58]	[0.01]	0.11	47	-3.18	[-2.84]	0.10
Float adjusted	47	-2.31	[-1.56]	2.80	[2.44]	[0.01]	0.13	47	-3.67	[-3.27]	0.13
Call adjusted	47	-1.02	[-0.66]	2.66	[2.35]	[0.03]	0.09	47	-2.57	[-1.93]	0.06
First half	23	-0.76	[-0.38]	-0.37	[-0.22]	[0.91]	0.01	23	-0.72	[-0.41]	0.01
Second half	24	-2.95	[-1.21]	6.92	[3.50]	[0.01]	0.18	24	-5.32	[-2.11]	0.11
Retirement = 1/5	47	-2.00	[-1.38]	2.40	[1.97]	[0.01]	0.11	47	-3.30	[-3.26]	0.10
Retirement = 1/20	47	-1.77	[-1.18]	3.01	[2.83]	[0.01]	0.11	47	-2.93	[-2.33]	0.08
Panel A. Three-year excess government bond returns											
Unadjusted	45	-6.47	[-2.99]	8.86	[4.05]	[0.00]	0.43	45	-10.47	[-4.99]	0.39
Float adjusted	45	-6.97	[-3.12]	8.66	[4.02]	[0.00]	0.48	45	-11.11	[-5.52]	0.44
Call adjusted	45	-5.69	[-2.25]	7.89	[3.24]	[0.00]	0.39	45	-10.01	[-5.30]	0.34
First half	23	-0.52	[-0.21]	1.43	[0.33]	[0.94]	0.01	23	-1.15	[-0.35]	0.01
Second half	22	-14.18	[-6.58]	19.58	[10.19]	[0.00]	0.74	22	-21.24	[-8.31]	0.61
Retirement = 1/5	45	-6.84	[-3.16]	7.45	[3.25]	[0.00]	0.44	45	-10.72	[-4.78]	0.41
Retirement = 1/20	45	-6.35	[-2.89]	9.56	[4.39]	[0.00]	0.43	45	-9.80	[-4.69]	0.33

Table 8. The maturity of corporate debt issues and consumption risk, 1954-2000. Two-stage regressions of excess bond returns and log changes in consumption (*Y*) on the long-term share in total corporate debt issues and the term spread.

$$\begin{bmatrix} r_{GLt+k} - r_{GSt+k} \\ Y_{t+k} \end{bmatrix} = \mathbf{a} + \mathbf{b}X_t + \begin{bmatrix} \varepsilon_{1t+k} \\ \varepsilon_{2t+k} \end{bmatrix}$$

$$\hat{\varepsilon}_{1t+k} \cdot \hat{\varepsilon}_{2t+k} = c + dX_t + u_{t+k}$$

$$1.253 \cdot \left| \hat{\varepsilon}_{1t+k} \right| = e + fX_t + u_{t+k}$$

$$1.253 \cdot \left| \hat{\varepsilon}_{2t+k} \right| = g + hX_t + u_{t+k}$$

All returns are expressed in percentage terms. Consumption is measured as the change in the log of per capita real expenditure on non-durables and services. Bond returns are measured as the excess return on long-term government bonds. We predict one-year-ahead, two-year-ahead, and three-year-ahead returns. Panel A uses the long-term share in debt issues as a predictor. Panel B uses the term spread as a predictor. In the first stage (unreported), we predict bond returns and log changes in consumption. In the second stage, we regress the product of the residuals from the consumption and bond return regressions and the absolute residuals from both regressions multiplied by 1.253 on the first-stage predictor. The latter scaling allows the coefficient to be interpreted as the effect of the independent variable on the standard deviation (Schwert (1989)). The independent variables are standardized to have unit variance. T-statistics are heteroskedasticity robust and correct for time-series dependence up to two lags.

	Consumption Growth – Bond Return Covariance $\hat{\varepsilon}_{1t+k} \cdot \hat{\varepsilon}_{2t+k}$				*Bond Return Standard Deviation* $1.253 \cdot \left\|\hat{\varepsilon}_{1t+k}\right\|$				*Consumption Growth Standard Deviation* $1.253 \cdot \left\|\hat{\varepsilon}_{2t+k}\right\|$			
t+k	**N**	**d**	**[t]**	**R^2**	**N**	**f**	**[t]**	**R^2**	**N**	**h**	**[t]**	**R^2**
Panel A. $X_t = d_{Lt}/[d_{Lt}+d_{St}]$												
t+1	46	-0.89	[-0.64]	0.01	47	-2.27	[-1.82]	0.09	46	0.07	[0.56]	0.01
t+2	45	0.06	[0.05]	0.00	46	-2.36	[-2.34]	0.11	45	0.15	[1.33]	0.03
t+3	44	1.52	[1.41]	0.03	45	-1.26	[-1.30]	0.03	44	0.17	[1.56]	0.04
Panel B. $X_t = y_{GLt} - y_{GSt}$												
t+1	46	0.11	[0.12]	0.00	47	1.69	[2.45]	0.08	46	-0.17	[-1.94]	0.05
t+2	45	-1.80	[-1.15]	0.04	46	-0.47	[-0.24]	0.01	45	-0.15	[-1.43]	0.04
t+3	44	0.09	[0.09]	0.00	45	0.15	[0.13]	0.00	44	0.15	[1.48]	0.04

Table 9. The maturity of corporate debt issues and future excess stock returns, 1954-2000. Univariate predictive regressions of excess stock returns on the maturity of corporate debt issues [**X**].

$$\textit{Future excess stock return} = a + \mathbf{b}'\mathbf{X}_t + u_{t+k}$$

Excess stock returns ($r_{VW} - r_{GS}$) are the difference between the return on the CRSP value-weighted market portfolio and treasury bills and are expressed in percentage terms. These data are from Ibbotson (2001). The independent variables are standardized to have unit variance. We predict one-year-ahead, two-year-ahead, and three-year-ahead returns (r) and three-year-ahead cumulative returns (R). We measure the maturity structure of new issues as new issues of long-term debt (d_L/D_{t-1}) controlling for short-term debt (d_S/D_{t-1}) and as the long-term share of new issues ($d_L/[d_L+d_S]$). The issue data are from the Federal Reserve *Flow of Funds*. T-statistics are heteroskedasticity robust and correct for time-series dependence up to two lags. The F-test reports the joint significance level of (d_L/D_{t-1}) and (d_S/D_{t-1}).

		d_{Lt}/D_{t-1}		d_{St}/D_{t-1}					$d_{Lt}/[d_{Lt}+d_{St}]$		
(%)	**N**	**b_1**	**[t]**	**b_2**	**[t]**	**[F]**	**R^2**	**N**	**b**	**[t]**	**R^2**
$r_{VWt+1} - r_{GSt+1}$	47	-2.41	[-0.95]	-1.85	[-0.88]	[0.41]	0.03	47	-0.13	[-0.05]	0.00
$r_{VWt+2} - r_{GSt+2}$	46	-1.67	[-0.84]	0.28	[0.23]	[0.64]	0.01	46	-1.49	[-0.99]	0.01
$r_{VWt+3} - r_{GSt+3}$	45	-4.16	[-1.52]	-0.32	[-0.23]	[0.32]	0.06	45	-2.69	[-1.11]	0.03
$R_{VWt+3} - R_{GSt+3}$	45	-9.17	[-2.33]	-1.68	[-0.51]	[0.04]	0.11	45	-4.98	[-0.96]	0.04