Is the Bright Line Between Agency and Corporate Debt Dim?

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Abstract

Investors and regulators often treat agency and Treasury debt as substitutes. To evaluate the extent to which this is appropriate, we study the portion of offering yield spreads over Treasury yields not explained by standard issue and issuer characteristics for Government Sponsored Enterprise (GSE) and financial corporation debt floated during 1994-2004. GSE and corporate residual yield spreads strongly correlate, appear to reflect macroeconomic risk, and respond similarly during the Long Term Capital Management Crisis. Agency debt is surprisingly comparable to corporate debt in its response to macroeconomic risk and, on this dimension, is not a good substitute for Treasury debt.

The investment community often views debt issued by Government Sponsored Enterprises (GSEs) as a near substitute for Treasury debt, to same extent due to a presumption that GSE debt carries an implicit federal guarantee. For example, in describing agency debt, the Securities Industry and Financial Markets Association notes that "investors generally treat [agency or GSE] securities as if they had negligible credit risk. The markets believe the federal government would prevent an agency or GSE from defaulting on its debt because of its role in promoting public policy and because of the shear size of the largest of the agencies."[1] Mutual funds typically report their holdings of Treasury and agency debt together in a single category, and Ambrose and King (2002) document that investors increasingly turned to a growing supply of GSE obligations as the stock of Treasury debt fell during the late 1990s.

Regulatory positions also support the notion that GSE and Treasury debt are substitutes. Title 15 of the U.S. Code, which regulates commerce and trade, stipulates that securities issued by the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation (two of the largest GSEs) are equivalent to obligations issued by the United States when any applicable law regulates the holdings of obligations issued or guaranteed by the United States. Furthermore, U.S. banks are allowed to pledge agency debt as security for discount window borrowings at a discount very close to that applied to Treasury securities, and GSE issuers are exempt from Securities and Exchange Commission filing requirements. Broaddus and Goodfriend (2002) and Meyer (2001) go so far as to frame a debate over using

[1] Quoted from www.investinginbonds.com, accessed November 14, 2006.

agency debt to execute monetary policy in a world with a significantly decreased stock of Treasury securities.

Although investors and regulators often view Treasury and GSE debt as close substitutes, in this paper we show that GSE debt behaves more like corporate debt in terms of how offering yields respond to macroeconomic risk. On this important dimension, agency debt is not a good substitute for Treasury debt. It is unclear whether our results are due to perceptions about default or liquidity risk. Our results *do* imply, however, that like holding corporate debt, holding agency debt appears to expose investors to considerably more price risk than Treasuries.

We begin by estimating regressions to explain the yield spreads (offering yields over the yields of maturity-matched Treasury rates) of 4,864 debt issues floated by sixty-three non-GSE (corporate) issuers in the financial sector who were frequent borrowers during 1994-2004. These regressions include standard explanatory variables to control for bond and issuer characteristics. We then compute the cross-sectional medians (across all issues regardless of issuer identity) of the residuals to obtain a time series of unexplained residual spreads. Since we control for bond and issuer characteristics and compute medians cross-sectionally across multiple issuers, these monthly residual spreads should capture a time series of unmodeled macroeconomic risk that is priced in the non-GSE issues. We then apply the same methodology to nearly 8,946 GSE debt issues over the same time period and obtain a similar

time series of median residual spreads for the GSE issues.[2] As Figure 1 shows, median GSE and non-GSE residual spreads appear to reflect time-varying risk factors that have similar patterns over the sample period.

We next extend the regression framework to show that median non-GSE residual spreads at issue have significant power to explain GSE offering yield spreads. Specifically, we first estimate a baseline regression to explain GSE yield spreads without including median non-GSE residuals on the right-hand side and obtain an adjusted R-squared of 0.253. Adding the median non-GSE residual spread as a regressor increases the adjusted R-squared to 0.357. As an additional refinement, we allow for distinct monthly intercept terms to include an additional control for macroeconomic risk.[3] In this model, the adjusted R-squared further increases to 0.482. Figure 2 plots the median GSE residual spreads from these three models and illustrates the dramatic reduction in unexplained variation that results from controlling for macroeconomic risk with median non-GSE residuals and monthly intercept terms.

To further investigate whether GSE and non-GSE offering yields respond similarly to macroeconomic shocks, we examine yield spread behavior around the Long Term Capital Management (LTCM) crisis in 1998, a time period when there was a reported flight from risky

[2] It is important to distinguish between the debt issues of GSEs and the pass-through securities they create as part of their legislative mandate. This study focuses on GSE unsecured bond issues, not pass-through securities.

[3] The non-GSE median residuals are also included as an explanatory variable in this regression. As discussed later, however, to mitigate multicolinearity in the second step regression these residuals are first reestimated (in the first step) so that they only include residual non-GSE yields beyond those explained by monthly indicator variables.

debt to Treasury debt. We first reestimate a regression for the non-GSE sample and include an indicator variable for the LTCM crisis period. The results imply that after controlling for other factors, non-GSE spreads were around 73% (38 basis points) higher, on average, during the crisis.

Performing the same exercise for the GSE sample, we find a similar reaction in that spreads were around 75% higher (24 basis points) higher, on average, during the LTCM crisis. This is notable because it implies that GSE and financial sector investors both demanded considerably higher spreads than usual during the crisis period. After a refinement that controls for shifts in the treasury yield curve during this crisis, we obtain the same qualitative result. The issues of both GSEs and non-GSEs experienced significantly elevated spreads over Treasuries during this significant and exogenous macroeconomic shock, and this provides additional evidence that agency issues behave similarly to corporate securities in terms of how yield spreads respond to macroeconomic events.

Our findings have significant implications for bond investors and policy makers. Prior literature documents that agency debt carries positive yield spreads over Treasury rates but notes that spreads are lower than those on high quality corporate, financial sector debt by 20-40 basis points. This result is interpreted to support the view that agency debt has a probabilistic federal guarantee and greater liquidity than corporate debt (see Ambrose and King, 2002). We show, however, that agency debt and corporate debt both exhibit significant exposure to macroeconomic risk over and above that exhibited by Treasury debt. Investors and policy makers should carefully evaluate the extent to which, and in what contexts, Treasury and agency debt should be viewed as substitutes. In terms of exposure to macroeconomic risk, the bright line between agency and corporate debt is actually quite dim.

The rest of the paper proceeds as follows. Section I contains background discussion and a literature review, Section II outlines the data construction, and Section III documents the borrowing behavior of GSEs and non-GSE financial firms that are frequent issuers of debt. In Section IV we report median yield spreads of the issues in our sample, where spreads are calculated by benchmarking each issue against a maturity-matched Treasury issue. Section V presents the analysis of yield spreads and their residuals through time, and Section VI concludes.

I. Background Discussion and Related Literature

A. The Seven Government Sponsored Entities

There are seven major GSEs charged with improving efficiency and liquidity in various economic sectors:

Freddie Mac (FHLMC)	Federal Home Loan Mortgage Corporation, a conventional loan residential mortgage market pass through guarantor,
Fannie Mae (FNMA)	Federal National Mortgage Corporation, a conventional loan residential mortgage market pass through guarantor,
Federal Home Loan Bank System (FHLB)	Federal Home Loan Bank System, an entity providing advances to commercial banks,
Ginnie Mae (GNMA)	Government National Mortgage Association, a FHA/VA loan pass through guarantor,
Sallie Mae (SLMA)	Student Loan Marketing Association, a provider of student loans for college education,
Federal Farm Credit Banks	An agricultural lending entity, and
Farmer Mac	Federal Agricultural Mortgage Corporation, an agricultural lending entity.

Of these, Fannie Mae, Freddie Mac, Sallie Mae, and Farmer Mac are publicly traded companies as of the fall of 2006. Collectively, the GSEs are major players in the financial markets, with borrowing approaching $3.6 trillion (in 2005 dollars) over the 2001-2004 period.

B. Concerns Over Asset Risk and Financial Disclosure

Because of the implicit federal backing GSE debt is often thought to carry, and hence the possibility of a taxpayer funded bailout, how GSEs disclose and manage risk receives considerable attention. In 1992 Congress established the Office of Federal Housing Enterprise Oversight (OFHEO) to oversee Fannie Mae and Freddie Mac, at least partially in response to a strategic decision by those agencies to accumulate large debt-financed portfolios of mortgages and the pass-through securities they create. Despite the increased scrutiny, both firms were accused of understating earnings in 1999 and 2000 in an apparent effort to smooth their income streams. More recently, Fannie Mae was charged with *overstating* earnings and failing to account correctly for the interest rate risk of its retained mortgage portfolio. In response to such charges, OFHEO's administrators successfully pressured Fannie Mae's Chairman and CFO to resign in December 2004. In related news that same month, the Office of the Federal Housing Finance Board of Directors announced that the Federal Home Loan Banks Combined Financial Reports for 2002, 2003 and the first two quarters of 2004 needed to be restated.

Concerns about the risk of mortgage-backed assets are not limited to Fannie Mae and Freddie Mac. Nine of the twelve Federal Home Loan Bank System members now participate in the Mortgage Partnership Finance Program, designed to directly compete with Fannie Mae and Freddie Mac in the residential loan market. Although the credit risk is borne by the local

commercial bank originating the loans, the loans are owned by the FHLB and ultimately financed by FHLB debt issues.

The possibility of a taxpayer funded bailout is not the only reason why the risks that GSEs face, and how they manage them, receive so much attention. Financial distress could interfere with the ability of a GSE to effectively pursue one of its intended goals: namely, to increase liquidity and efficiency in a specific sector of the economy. Furthermore, GSEs are large and active players in the bond sector, and their activities have significant implications that extend well beyond the market for agency debt. For example, in September 2002 Fannie Mae announced that its portfolio duration gap had decreased to negative 14 months, far outside its six-month duration gap target. Fixed income analysts contemplated whether Fannie Mae would shorten the duration gap by buying large volumes of long-term Treasury bonds (or Treasury futures), thereby affecting the shape of the Treasury yield curve.

C. Prior Literature

Much of the existing academic literature focuses on measuring the funding "subsidy" that GSEs receive in order to appraise the value of the implicit federal guarantee GSE debt is thought to include. For example, Ambrose and Warga (2002) and Nothaft, Pearce and Stevanovic (2002) document that offering yields for Fannie Mae and Freddie Mac debt are about 25-30 basis points below that on AA banking sector bonds in recent years, and that discounts were even larger during the 1980s.[4]

[4] It is not clear how much of the lower offering yield on GSE debt is due to a perception that agency debt has greater perceived liquidity than corporate debt. Ambrose and King (2002) argue that there are

The paper most related to ours is Ambrose and King (2002), who study how spreads on GSE debt have changed over time as the stocks of outstanding Treasury and GSE debt have changed. They control for the increased liquidity of GSE issues due to the creation of benchmark securities (large volume issues), and document that investors have turned to GSE debt as a substitute for Treasury debt. A subject not directly answered in prior literature, however, is whether it is appropriate to view agency debt as a good substitute for Treasury debt in terms of yield behavior. Although agency debt shares certain regulatory and institutional features with Treasury debt, our research directly examines whether agency debt is closer to Treasury debt or corporate debt along an entirely different dimension: yield behavior through time in response to macroeconomic risk. Our research has important implications in terms of the price risk that investors face when they hold agency debt.

II. Data

We build the data set of frequent GSE and non-GSE financial issuers as follows. First, we select all non-convertible debt issues during 1994-2004 in the Thomson Financial Securities Data Corporation (SDC) Platinum database. From this sample we collect the debt issued by eight separate entities identified by SDC as Federal Credit Agencies: Fannie Mae (FNMA), the Federal Agricultural Mortgage Association (Farmer Mac), Federal Farm Credit Banks and

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indeed links between the yields on Fannie Mae, Freddie Mac, and FHLB issues and their liquidity. Nothaft, Pearce and Stevanovic (2002) place a lower bound of 3-6 basis points for the liquidity component of the funding subsidy, noting that further work is needed.

Federal Farm Credit Banks Funding (which we combine into a single issuer, abbreviated as FARM), Federal Home Loan Banks (FHLB), Freddie Mac (FHLMC), Ginnie Mae (GNMA), and Sallie Mae (SLMA). We also collect the debt issues floated by non-GSE firms for which SDC has an SIC code in the 6000s (the financial industry).

We retain only the issues by GSE and non-GSE firms that floated at least 50 separate offerings over the 1994-2004 period in order to have a material number of observations per issuer and to improve comparability across our set of borrowers.[5] The retained sample includes five GSE issuers (Ginnie Mae and Farmer Mac did not offer enough separate issues to meet our definition of frequent borrowers) that float a total of 72,879 issues and an additional 70 separate non-GSE issuers that float 15,504 issues.

The yield spread analysis is limited to fixed-rate, non-callable issues with maturities of one year or longer where the SDC database contains an expected yield to maturity or labels the yield to maturity as "market."[6] We assume the coupon rate and the yield to maturity are equal for the latter set of observations (excluding these observations does not materially change the results). Our yield spread regressions include factors such as credit ratings for each non-GSE issue, so we require sufficient data to code these issue characteristics. The final sample for the

[5] In this step we are careful to account for mergers and holding companies. For example, we consider all of the Banc One holding companies as a single issuer and debt issued by the various legal arms of Citibank, such as the holding company or the separate equipment trusts, as debt issued by the parent. In contrast we treat First Union and Wachovia as separate issuers prior to their merger but include pre- and post-merger Wachovia debt as being from a single issuer.

[6] We exclude seven of the 70 financial corporation issuers from the yield spread analysis because they do not have 50 or more issues meeting this requirement.

yield spread regressions consists of 8,946 issues by five GSEs (the "GSE" sample) and 4,864 issues by 63 corporate, financial sector corporate issuers (the "non-GSE" sample).

III. Borrowing Behavior

Table I shows the total amount of borrowing and the number of issues over time and across maturity buckets for the five separate GSEs and the non-GSEs as a group. Amounts in the table are reported in January 2005 dollars using the Producer Price Index (all commodities, no seasonal adjustment). In total, the GSEs issue over $6 trillion in debt during the sample period. As shown, none of the GSEs place much reliance on short-term debt, possibly because their congressional mandates tilt their lending activity toward longer maturities.

Generally, we observe that FNMA, FHLB, FHLMC, and FARM issue increasing amounts of debt (both in total dollar volume and in the number of issues) during the sample period. Although there is a significant decline in both the amount and the number of new issues in the year 2000, the upward trend resumes in 2001 until a drop off in 2004. Despite the decline in 2004, total issuing activity in this year is still much greater than in the early part of the sample period. In contrast, non-GSE firms steadily increase their borrowing until 2000, after which the trend reverses. It is possible that the lower issuing activity is due to a relatively weaker economy after the year 2000.

Table II reports the mean and median issue size and maturity, the dollar-weighted average maturity, and the proportions of debt that are variable rate or callable (these are non-mutually exclusive categories). The mean issue size is consistently larger than the median, indicating skewness in the amount borrowed per issue. The two rightmost columns show striking patterns in the use of variable rate and callable debt. Variable rate issues drop during

the middle of the sample period for the housing GSEs (FNMA, FHLB, and FHLMC) and rise over time for the non-GSE financial firms. In addition, the percentage of variable rate debt is significantly higher for non-GSE financial issuers. In contrast, the GSEs rely more heavily on callable debt than their non-GSE financial counterparts and this reliance is much greater in the later years for all GSEs but Sallie Mae.

IV. Spreads Over Maturity-Matched Treasury Yields

The yield spread analysis focuses on the portion of the sample that consists of non-callable issues with maturities of at least one year. Table III presents median yield spreads over maturity matched Treasury yields for this sample. We fit a regression-based term structure model for each trading day in the sample using 1, 2, 3, 5, 7, 10 and 20 year Treasury yields taken from the Federal Reserve Bank of St. Louis' FRED database to estimate an issue's comparable constant maturity Treasury yield.[7]

[7] We follow Nelson and Siegel (1987) and use a three-factor algorithm to fit level, slope and curvature components of a yield curve. The model also requires the specification of an inflection point, which we assume to be two years. The formal Nelson and Siegel equation is:

$$R_m = \beta_0 + \beta_1 \frac{\tau}{m}\left[1 - e^{-\frac{m}{\tau}}\right] + \beta_2 \frac{\tau}{m}\left\{1 - e^{-\frac{m}{\tau}}\left[\frac{m}{\tau} + 1\right]\right\}$$

where:

- R_m = the yield on a bond with expected maturity (m),
- τ = the inflection point of the estimated curve;
- β_0 = the estimated level of the long-term yield,
- β_1 = the height of the short end of the yield curve relative to its long-term mean, which gives the curve its overall slope,
- β_2 = the height of the center of the curve relative to its endpoints, which creates the typical curved shape observed in the middle section of fitted term structures.

Table III shows that median GSE yield spreads are nearly always below those of the non-GSEs. Prior literature usually interprets this finding as consistent with an implicit Federal protection against default.[8] Yield spreads for the GSE issuers and the non-GSE financial firms exhibit two similar patterns through time. First, spreads are relatively stable during the first four years of the sample, followed by significant volatility in the later years. Second, all of the median raw spread columns exhibit a humped-shape pattern, reaching a maximum during 1999-2001. This coincides with the relative decline in debt issuance during the middle of the sample that is evident in Table I. We investigate in more detail how GSE and non-GSE issue spreads covary through time in the section that follows.

V. Time Series Behavior of Residual Maturity-Matched Yield Spreads

We now turn to our main research question, whether offering yields on GSE issues contain macroeconomic risk premia that vary in a similar way to the risk premia contained in non-GSE issues. We wish to answer three questions. First, do GSE spreads over Treasury yields display time-varying volatility that suggests priced macroeconomic risk? Second, do GSE spreads covary through time with non-GSE spreads? Third, do GSE and non-GSE spreads react similarly to a significant and exogenous macroeconomic shock? The answers to

[8]As implied by Ambrose and King (2002), however, a portion of lower yield spreads that GSE debt enjoys may be due to its increased liquidity compared to corporate issues.

these questions have important implications for the extent to which agency and Treasury debt should be viewed as substitutes.[9]

To focus on the portion of yields due to macroeconomic risk instead of that due to idiosyncratic issuer and issue features, we implement a two-step procedure. First, we estimate an OLS regression to explain corporate (non-GSE) spreads on the basis of bond characteristics and aggregate borrowing behavior by the issuer. We then use the residuals from this corporate regression to construct a time series of monthly median residuals (the "non-GSE monthly median residuals"). Because the residuals reflect yield spreads that are not explained by standard issue and issuer characteristics, and because medians are taken across multiple issues and issuers, we argue that this monthly time series will serve as a good proxy for priced, time-varying macroeconomic risk.

In the second step we investigate whether the non-GSE monthly median residuals help explain GSE yield spreads. If so, we can conclude that the macroeconomic risk priced in corporate yields is also priced in GSE yields. Finally, we examine yield spread behavior in each sample during the Long Term Capital Management crisis of 1998 to investigate how yield spreads responded to a significant and exogenous macroeconomic shock.

[9] We should emphasize upfront that our examination of yield spreads means that the analysis implicitly focuses on how yields respond to macroeconomic factors over and above the response in Treasury rates. Hence, we control for market wide fluctuations in yields as reflected in Treasury securities.

A. The Response of Non-GSE and GSE Spreads to Time-Varying Macroeconomic Risk

Model (1) of Table IV estimates a regression explaining the log of non-GSE offering yields to Treasury spreads on the basis of various issue and issuer characteristics. We also include issuer-specific indicator variables (not reported in the table for brevity) in order to allow for issuer-specific constant terms. Our overriding goal is to include reasonable controls for obvious issue and issuer characteristics so that the residuals will capture macroeconomic risk when aggregated across issues and issuers. We do, however, briefly discuss some of the estimated coefficients as we sequentially define each control variable.

Listed first are dichotomous variables to control for whether the issue is subordinated (181 out of 4,864 bonds) and whether it is a zero coupon bond (five bonds). The zero coupon indicator is significant in Model (1), but not in Model (2), which contains additional controls. Next are two variables that measure maturity effects. The positive significance of maturity and the negative significance of maturity squared show that spreads are increasing and concave in this characteristic.

The next variable is the log of the total principal issued to date for the current issue. In some cases the borrower reopens a bond issue and floats additional principal with the same terms (and same CUSIP) at a later date. This behavior potentially affects the liquidity of the issue. Therefore, the total principal issued variable for the current issue is constructed to reflect not only the current principal amount issued, but also any principal offered under the same CUSIP in the past. This variable is positive and significant, showing that larger corporate issues are subject to higher yields. One possibility is that although larger non-GSE issues are more liquid, they may also be considered riskier from a default perspective.

The next set of variables controls for borrower behavior. Corporations in the financial sector that are more active in the debt markets in terms of total principal issued during the month (across all issues) pay significantly higher yields, as shown by the positive significance of this variable. Total amount borrowed may work with issue size to proxy for default risk that is not fully captured by an issue's credit rating. Controlling for other factors, however, more frequent non-GSE issuers pay lower yields, as the number of issues during the month is negative and significant.

Although the sample does not includes callable or floating-rate bonds, we include the percent of overall debt the issuer floats during the month that is callable or floating-rate debt on the right hand side of the equations. These variables should partially capture managerial decisions the issuer makes based on the current and forecasted interest rate environment. We observe that a higher percentage of callable debt is associated with higher yield spreads while a higher percentage of floating rate debt is associated with lower yield spreads. Finally, we also include indicator variables for the issue's credit rating (274 are AAA, 3,638 are AA, 438 are BAA, and 5 are BA). There are no bonds rated single A in the sample, and none are rated below BA. The omitted class consists of bonds for which SDC provides no rating (509). The coefficients imply that the average bond rating for the omitted class is around BAA to BA, since the model estimates a negative coefficient for bonds rated BAA and higher but a positive coefficient for BA bonds.

In Model (2) we add two additional variables that help control for economic conditions in the debt market. The first is the yield on three-month Treasuries minus that on ten-year Treasuries, and its positive significance implies that a more negatively sloped Treasury yield curve is associated with higher spreads on non-GSE debt. This is intuitive in the sense that a

downward sloping yield curve often corresponds to recessionary forecasts and hence perceptions of increased default risk. Similarly, the regression shows that when default risk as measured by the spread between BAA bonds and AAA bonds is higher, non-GSE issuers pay higher yields.

Model (3) estimates similar regressions to explain the log of offering yield to Treasury spreads for the GSE issues.[10] Here we also include indicator variables for each of the GSE issuers (FHLB is the omitted class). It is not possible to learn much from the first two variables because only one bond is coded as subordinated and only seven are zero coupon bonds. The other variable coefficients show that GSE yield spreads are significantly affected by maturity, issue size, and issuer behavior during the month.

Model (4) adds the two economic condition variables (3 month Treasury – 10 year Treasury and Moody's Baa index – AAA index) and shows they have a significant impact on the yields that GSE issuers are charged. The magnitudes of the coefficients on the economic condition variables are fairly similar to those in Model (2) for non-GSE issuers, which is interesting in and of itself given the degree to which GSE debt is often viewed more like Treasury debt than corporate debt. The coefficients suggest that GSE yields and corporate, financial sector offer yields are affected similarly by macroeconomic conditions that relate to aggregate default or liquidity risk.

We now turn to a graphical analysis of the residuals to gain a sense of whether there is priced macroeconomic risk that is not captured by the various explanatory variables. We begin

[10] We do not include bond ratings in these regressions, since SDC does not include bond ratings for the GSE issues in our data.

with Model (2) for the non-GSE sample and calculate the median residual for all bonds (regardless of issuer) issued in a given month to aggregate, in each month, the portion of yield spreads not explained by traditional issue and issuer characteristics. We can view the residual spreads from the non-GSE regression as having two components: one that captures time-varying macroeconomic risk, and another that captures noise due to issuer and issue characteristics that the independent variables in the regression fail to incorporate. Note that the latter component will largely cancel out when we construct monthly medians across multiple issues floated by multiplier issuers.

We also construct monthly median residual spreads for the GSE issues using Model (4). Figure 1 plots the time series of monthly median residual spreads for the non-GSE sample from Model (2) alongside those for the GSE sample from Model (4). There are two observations of note. First, both sets of median residuals vary through time in a way that indicates some type of macroeconomic risk that is priced, but not controlled for in the empirical models. The monthly median residuals are clearly not completely random—there are sustained periods of positive residuals followed by sustained periods of negative residuals. Second, the two time series are significantly correlated (the correlation coefficient is 62% with a p-value of less than 0.0001). This is initial evidence on our main research question and suggests that GSE and non-GSE yield spreads reflect similar macroeconomic risk.

We investigate the link between GSE yield spreads and macroeconomic risk further in Table V. Model (1) repeats regression (4) from Table IV as a baseline. In Model (2) we include the monthly median non-GSE residual (estimated from Model (2) in Table IV) that corresponds to each observation's issue month. As can be seen, the median non-GSE residual variable is positive and highly significant, as we would expect given the positive correlation so

evident in Figure 1. The coefficient's magnitude of 1.367 implies that a one-standard deviation increase in the median non-GSE residual increases the GSE yield spread, on average, by 15 basis points (a 47% increase from the median GSE spread in the sample, which is 32 basis points). The adjusted R-square rises from 0.253 in Model (1) to 0.357 in Model (2).

An alternative way to incorporate macroeconomic risk is to include monthly indicator variables. We take this approach in Model (3), a model that should have greater explanatory power because it allows more degrees of freedom to fit the aggregate, monthly variation in the data. It is not surprising, therefore, that the adjusted R-squared in Model (3) increases to 0.479.

In Model (4) we include both the median non-GSE residuals and the monthly time indicators. To avoid collinearity problems, we first reestimate Model (2) of Table IV (for the non-GSE sample) but add monthly indicator variables as regressors on the right-hand side. In this way we obtain new residuals that only contain the *marginal* information over and above that reflected in monthly indicator variables. Using these new non-GSE residuals, we then construct a new times series of monthly median non-GSE residual spreads and include this variable in Model (4) of Table V, along with monthly indicator variables. The main point here is that Model (4) includes regressors that capture the maximum amount of time-varying macroeconomic risk we can measure through both monthly indicator variables and the information contained in non-GSE residual spreads.[11] Although this model has only slightly increased explanatory power (an adjusted R-squared of 0.482), the median non-GSE residual

[11] Given the strong time-series nature of monthly median non-GSE residuals, it is interesting in its own right to observe whether non-GSE residuals have explanatory power over and above that better captured through monthly time indicators.

variable is highly significant, showing that it does contain useful information beyond that captured with simple month indicator variables.

Perhaps the most interesting way to examine Table V results is to plot the monthly median GSE residuals from the models and observe, visually, how much volatility in median GSE residuals can be reduced by including the macroeconomic variables. In Figure 2 we plot the median monthly GSE residuals from Models (1), (2), and (4) of Table V and observe a dramatic reduction in volatility as we progress through the three models. The median residuals from Model (1), a model that excludes macroeconomic variables (except for the two economic condition variables, common across all models in Table V), display considerable volatility through time. The residuals from Model (2) (dotted line), a model that includes the median non-GSE residual as a regressor, display lower volatility and magnitude than the median residuals from Model (1) (light solid line), particularly during the first two-thirds of the sample period.

The most dramatic decrease in volatility is observed in the median residuals from Model (4) (heavy solid line), a model whose regressors include not only non-GSE median residuals but also a monthly indicator variable for each month. In summary, Table V and Figure 2 presents evidence that strongly suggests offering yield to Treasury spreads on GSE debt are significantly affected by macroeconomic risk. It is important to note that because we examine yield spreads over Treasuries (instead of raw yields), these results are not simply explained by shifts in Treasury rates.

B. The Response of Non-GSE and GSE Spreads to the LTCM Crisis

In Table VI we examine how financial corporation and GSE yield spreads responded to the Long Term Capital Management (LTCM) crisis of 1998 when Russia defaulted on its sovereign debt.[12] This event caused enormous losses for LTCM and sent shockwaves through the global debt market as LTCM and a consortium of investment banks managed the aftermath.[13] Figure 1 shows clear spikes in the median residual yield spreads for GSEs and non-GSEs alike during the fall of 1998.

To assess the magnitude and statistical significance of these spikes after controlling for other factors, we turn to regression analysis. Model (1) in Table VI gauges the impact of the LTCM crisis on the non-GSE yield spreads by including an indicator variable for the crisis as an explanatory variable. The coefficient on the LTCM indicator is positive (0.546) and highly significant, as we would expect given what we observe in Figure 1. The coefficient implies

[12] See Ericsson and Renault (2006) for a recent paper using the LTCM crisis as a natural experiment. We follow this paper in defining crisis period as August 17, 1998 to November 20, 1998.

[13] Nine-eleven is another potential candidate to examine, but we do not do so for two reasons. First, the Federal Government engaged in a very public and active effort to inject liquidity in the economy in the immediate aftermath of the terrorist attacks, complicating the interpretation of any results. Second, the number of non-GSE issues dropped 74% from the three months prior to September 2001 to the three months that followed (the number GSE issues dropped 35%). This dramatic drop in non-GSE issues would add further to interpretation concerns due to a somewhat small sample size for non-GSE issues following the event. By contrast, even though there were also declines in issuing activity after the LTCM crisis began, the declines were much less dramatic (6% for non-GSEs and 24% for GSEs).

that after controlling for other factors, non-GSE spreads increased around 73% on average (or 38 basis points) above the sample median non-GSE yield spread of 52 basis points.

Model (2) repeats the experiment on the GSE sample and the indicator variable's coefficient is again positive (0.557) and highly significant. Here the coefficient implies that spreads increased around 75% (or 24 basis points), on average, above the sample median GSE yield spread of 32 basis points. The reaction for the GSE sample is remarkably similar on a percent basis to that for the non-GSE sample. It is therefore hard to argue that the financial markets treated agency issues as close substitutes for Treasury issues during this crisis. Although we cannot say whether the impact was primarily due to perceptions about default or liquidity risk, clearly yields on agency and corporate financial sector debt were adversely affected in similar ways. Any perceptions that GSE issues are good substitutes for Treasury substitutes did not translate into reality during this particular macroeconomic shock.

In results not reported in the table, we repeat these two regressions and add the maturity-matched Treasury yield on the right-hand side (i.e., the Treasury yield component of the spread). This controls for any shift that took place in the Treasury yield curve itself that might have been caused by a shift in investor preferences or other factors affecting Treasury yields. For the non-GSE sample, the coefficient on the LTCM indicator drops from 0.546 in the reported Model (1) to 0.485 in the new model. This implies that spreads increased on average by 62% (or 32 basis points) above the sample median yield spread after controlling for the Treasury yield. For the GSE sample, the LTCM coefficient changes to 0.337 from the 0.557 coefficient in the reported model, implying spreads increased on average by 40% (or 13 basis points) above the sample median. Hence, we conclude that the results in Table VI for

both financial corporation and GSE debt are not driven purely by changes in Treasury yields during the crisis.

The LTCM crisis may also have affected preferences (and hence yields) for long-term and short-term bonds differently due to potentially divergent effects on perceived default risk and liquidity. In Model (3) of Table VI, which uses the non-GSE sample, we include an additional indicator variable set to one if the issue is floated during the LTCM crisis and has a maturity of at least ten years. The negative and significant coefficient of -0.330 implies that long-term financial corporation bonds were more adversely affected than their short–term counterparts. Model (4) shows a similar maturity effect for long- and short-term GSE issues. Once again, there are striking similarities between how the financial markets treated GSE and non-GSE issues during the LTCM crisis.

VI. Concluding Remarks

Investors and policy makers view agency debt as a substitute for Treasury debt on many levels. Our research finds that non-callable offering yield spreads over maturity matched Treasury yields for GSE and financial sector, non-GSE issues respond very similarly to time-varying macroeconomic risk. Using 4,864 issues floated by non-GSE issuers and 8,946 issues floated by GSE issuers over 1994-2004, we show that macroeconomic innovations through time affect required yield spreads for each type of debt in a similar manner. The results are buttressed by an examination of issuing yields during the Long Term Capital Management crisis in 1998. Our findings suggest that investors and policy makers should carefully evaluate the extent to which, and in which contexts, agency debt should be viewed as a substitute for Treasury debt.

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Table I
Debt Issues by Five GSEs and 70 Frequent Issuer Financial Firms during 1994-2004

This table reports yearly dollar amounts and frequency of debt issued by five GSEs and 70 frequent issuer (non-GSE) financial firms during 1994-2004, grouped into maturity baskets. The total principal issued in billions of January 2005 dollars using the Producer Price Index is shown, with the number of issues to the right in parentheses. The five GSEs are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLB (Federal Home Loan Bank Board), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae).

		Maturity in Years					
	Year	<1 Yr. $B (#)	1+ to 3 Yrs. $B (#)	3+ to 6 Yrs. $B (#)	6+ to 10 Yrs $B (#)	> 10 Yrs. $B (#)	Total $B (#)
FNMA	1994	0.0 (0)	16.0 (41)	16.1 (77)	1.2 (8)	8.5 (40)	41.7 (166)
	1995	0.0 (0)	54.5 (135)	24.2 (172)	2.1 (18)	12.1 (91)	92.9 (416)
	1996	0.8 (2)	60.4 (146)	32.4 (213)	2.5 (27)	20.8 (203)	117.0 (591)
	1997	1.0 (2)	53.5 (152)	42.3 (284)	5.9 (64)	28.4 (223)	131.1 (725)
	1998	0.0 (0)	71.7 (192)	57.2 (387)	11.1 (113)	29.6 (263)	169.8 (955)
	1999	0.0 (0)	75.5 (217)	39.3 (296)	3.8 (65)	20.2 (176)	138.9 (754)
	2000	0.2 (1)	57.3 (87)	22.9 (245)	2.0 (52)	4.6 (110)	87.1 (495)
	2001	0.0 (0)	111.2 (340)	65.2 (633)	8.0 (162)	14.9 (266)	199.2 (1,401)
	2002	0.0 (0)	85.8 (349)	51.2 (482)	9.0 (166)	19.6 (351)	165.6 (1,348)
	2003	0.0 (0)	182.5 (492)	69.5 (756)	11.5 (274)	32.1 (544)	295.7 (2,066)
	2004	0.0 (0)	151.5 (402)	56.7 (706)	8.7 (269)	15.5 (404)	232.4 (1,781)
	All years	2.0 (5)	920.0 (2,553)	477.1 (4,251)	65.7 (1,218)	206.5 (2,671)	1,671.2 (10,698)
FHLB	1994	0.1 (2)	26.2 (240)	38.2 (496)	5.2 (83)	8.4 (126)	78.1 (947)
	1995	0.4 (3)	50.8 (551)	54.1 (811)	5.1 (96)	11.8 (198)	122.2 (1,659)
	1996	0.2 (2)	51.4 (590)	56.9 (1097)	4.1 (103)	12.6 (275)	125.2 (2,067)
	1997	0.1 (2)	74.9 (648)	59.9 (1225)	13.6 (318)	24.6 (464)	173.0 (2,657)
	1998	0.0 (0)	118.1 (749)	136.1 (1964)	18.4 (432)	44.7 (724)	317.2 (3,869)
	1999	0.0 (1)	156.2 (889)	73.7 (1321)	13.7 (341)	29.0 (635)	272.6 (3,187)
	2000	0.4 (1)	151.6 (1133)	34.7 (915)	11.3 (272)	9.8 (292)	207.7 (2,613)
	2001	1.0 (6)	211.7 (1697)	162.3 (3727)	22.4 (748)	34.9 (1022)	432.1 (7,200)
	2002	0.4 (4)	247.7 (2911)	146.8 (3582)	29.0 (623)	35.4 (825)	459.4 (7,945)
	2003	0.2 (1)	269.4 (2217)	210.8 (4060)	37.5 (803)	80.8 (1624)	598.8 (8,705)
	2004	0.2 (4)	231.8 (2704)	117.7 (2727)	14.5 (491)	30.1 (759)	394.3 (6,685)
	All years	3.0 (26)	1,589.6 (14,329)	1,091.3 (21,925)	174.8 (4,310)	322.0 (6,944)	3,180.7 (47,534)
FHLMC	1994	0.0 (0)	3.8 (28)	11.4 (69)	2.3 (24)	8.2 (54)	25.7 (175)
	1995	0.0 (0)	8.5 (73)	15.7 (221)	3.1 (49)	9.2 (135)	36.5 (478)
	1996	0.0 (0)	4.5 (38)	18.1 (212)	2.3 (42)	15.3 (272)	40.3 (564)
	1997	0.0 (0)	10.9 (70)	13.2 (136)	4.5 (56)	10.4 (171)	38.9 (433)
	1998	0.0 (0)	15.0 (63)	23.9 (219)	5.3 (90)	19.2 (294)	63.5 (666)
	1999	0.0 (0)	25.1 (125)	25.4 (318)	6.2 (152)	22.6 (394)	79.2 (989)
	2000	0.5 (2)	38.8 (227)	8.2 (158)	0.8 (33)	4.7 (124)	53.0 (544)
	2001	0.0 (0)	51.7 (321)	53.7 (560)	5.9 (154)	15.0 (320)	126.3 (1,355)
	2002	0.0 (0)	61.4 (333)	62.8 (544)	11.1 (121)	23.1 (331)	158.3 (1,329)
	2003	0.0 (0)	80.7 (272)	78.8 (665)	17.3 (223)	28.8 (379)	205.7 (1,539)
	2004	0.0 (0)	33.8 (302)	69.9 (491)	18.3 (157)	22.0 (330)	144.0 (1,280)
	All years	0.5 (2)	334.2 (1,852)	381.1 (3,593)	77.0 (1,101)	178.6 (2,804)	971.4 (9,352)

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Table I
(Continued)

		Maturity in Years					
	Year	<1 Yr. $B (#)	1+ to 3 Yrs. $B (#)	3+ to 6 Yrs. $B (#)	6+ to 10 Yrs $B (#)	> 10 Yrs. $B (#)	Total $B (#)
FARM	1994	0.0 (0)	7.2 (35)	2.7 (39)	0.1 (2)	0.0 (1)	9.9 (77)
	1995	0.0 (0)	16.6 (91)	5.5 (73)	0.2 (8)	0.2 (9)	22.6 (181)
	1996	0.0 (1)	23.0 (138)	8.8 (151)	0.3 (16)	0.4 (15)	32.6 (321)
	1997	0.0 (0)	17.1 (102)	8.9 (136)	1.0 (24)	2.1 (39)	29.1 (301)
	1998	0.0 (0)	21.8 (153)	12.3 (202)	2.6 (41)	2.9 (49)	39.6 (445)
	1999	0.0 (0)	19.9 (130)	8.1 (109)	1.8 (39)	0.3 (7)	30.0 (285)
	2000	0.0 (0)	13.6 (79)	2.7 (58)	0.8 (17)	1.6 (25)	18.7 (179)
	2001	0.0 (0)	21.6 (155)	14.7 (203)	2.2 (42)	1.1 (19)	39.5 (419)
	2002	0.0 (0)	34.2 (279)	16.6 (221)	2.7 (88)	1.9 (49)	55.4 (637)
	2003	0.0 (0)	30.1 (336)	21.4 (326)	4.5 (118)	1.9 (69)	57.9 (849)
	2004	0.3 (7)	23.5 (320)	14.7 (290)	2.2 (77)	1.3 (63)	41.9 (757)
	All years	0.3 (8)	228.5 (1,818)	116.3 (1,808)	18.3 (472)	13.8 (345)	377.1 (4,451)
SLMA	1994	0.0 (0)	5.6 (18)	12.5 (47)	1.4 (5)	1.4 (5)	20.9 (75)
	1995	0.0 (0)	6.0 (16)	11.1 (73)	0.3 (3)	0.4 (1)	17.8 (93)
	1996	0.0 (0)	10.8 (71)	5.2 (55)	0.2 (3)	0.0 (1)	16.2 (130)
	1997	0.0 (0)	14.0 (57)	1.8 (19)	0.0 (0)	0.0 (0)	15.8 (76)
	1998	0.0 (0)	21.4 (85)	0.0 (0)	0.0 (0)	0.0 (0)	21.4 (85)
	1999	0.0 (0)	30.5 (128)	0.0 (0)	0.0 (0)	0.0 (0)	30.5 (128)
	2000	0.0 (0)	28.7 (80)	0.2 (2)	0.0 (0)	0.0 (0)	29.0 (82)
	2001	0.0 (0)	16.1 (66)	5.1 (8)	0.0 (0)	0.0 (0)	21.2 (74)
	2002	0.8 (2)	20.2 (75)	0.0 (0)	0.0 (0)	0.0 (0)	21.0 (77)
	2003	0.0 (0)	5.2 (22)	0.1 (2)	0.0 (0)	0.0 (0)	5.3 (24)
	2004	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
	All years	0.8 (2)	158.5 (618)	36.0 (206)	1.9 (11)	1.8 (7)	199.0 (844)
Non-GSE	1994	2.7 (22)	66.4 (499)	24.7 (217)	2.3 (22)	11.7 (75)	107.9 (835)
Financial	1995	0.8 (9)	78.2 (686)	28.8 (270)	10.3 (62)	16.4 (119)	134.4 (1,146)
	1996	3.3 (30)	84.2 (923)	38.1 (483)	9.9 (89)	17.7 (181)	153.3 (1,706)
	1997	1.8 (26)	117.3 (1,073)	49.9 (698)	7.9 (113)	24.6 (265)	201.4 (2,175)
	1998	1.8 (18)	153.2 (1,267)	75.5 (653)	14.4 (93)	28.4 (178)	273.3 (2,209)
	1999	0.5 (8)	166.8 (1,076)	98.0 (505)	10.9 (36)	44.5 (175)	320.7 (1,800)
	2000	3.2 (27)	196.3 (1,216)	108.6 (403)	11.9 (35)	25.1 (114)	345.1 (1,795)
	2001	1.7 (9)	110.7 (655)	96.5 (334)	24.8 (43)	29.9 (93)	263.6 (1,134)
	2002	0.5 (6)	109.1 (581)	86.9 (206)	13.9 (34)	64.0 (117)	274.2 (944)
	2003	0.7 (2)	101.4 (494)	105.2 (257)	22.5 (44)	35.7 (148)	265.5 (945)
	2004	1.3 (7)	82.0 (326)	126.0 (296)	12.0 (45)	39.5 (141)	260.7 (815)
	All years	18.2 (164)	1265.6 (8,796)	838.1 (4,322)	140.7 (616)	337.5 (1,606)	2600.2 (15,504)

Table II
Descriptive Statistics for Debt Issued by Five GSEs
and 70 Frequent Issuer Financial Firms during 1994-2004

This table reports yearly summary statistics for debt issued by five GSEs and 70 frequent issuer (non-GSE) financial firms during 1994-2004. Mean and median dollar issue size is in millions of January 2005 dollars using the Producer Price Index. Mean and median maturies are in years. The dollar-weighted maturity (the $-weighted column) is the weighted- average maturity using the relative dollar size of each issue for weights. Proportion variable rate is the percent of issues that do not have fixed coupon rates, and proportion callable is the percent of issues that are callable. The five GSEs are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLB (Federal Home Loan Bank Board), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae).

	Year	N	Mean Size ($m)	Median Size ($m)	Mean Mat. (Yrs.)	Median Mat. (Yrs.)	$-weighted Mat. (Yrs.)	Proportion Variable Rate	Proportion Callable
FNMA	1994	166	251	175	5.9	5.0	5.0	37.3%	53.6%
	1995	416	223	121	5.0	5.0	3.5	13.7%	54.6%
	1996	591	198	118	6.2	5.0	4.0	13.9%	62.3%
	1997	725	181	119	6.5	5.0	5.0	8.1%	62.6%
	1998	955	178	121	6.2	5.0	4.7	3.5%	83.5%
	1999	754	184	122	5.5	5.0	3.8	6.1%	85.3%
	2000	495	176	55	5.6	5.0	2.7	5.1%	85.7%
	2001	1,401	142	57	5.6	4.5	3.4	6.9%	93.6%
	2002	1,348	123	58	6.7	5.0	4.3	10.2%	96.7%
	2003	2,066	143	54	7.1	5.0	3.7	15.4%	97.1%
	2004	1,781	130	50	6.4	5.0	3.3	39.2%	97.4%
	All years	10,698	156	60	6.3	5.0	3.9	15.1%	87.5%
FHLB	1994	947	82	62	4.8	4.2	4.3	54.3%	55.8%
	1995	1,659	74	54	4.3	3.0	3.9	11.0%	72.5%
	1996	2,067	61	48	4.7	3.6	4.0	8.5%	78.2%
	1997	2,657	65	31	5.4	5.0	4.5	5.2%	75.3%
	1998	3,869	82	42	5.7	5.0	4.7	3.8%	82.3%
	1999	3,187	86	31	5.5	5.0	3.6	5.9%	78.3%
	2000	2,613	79	29	4.4	3.1	2.8	4.0%	65.9%
	2001	7,200	60	28	5.3	4.1	3.8	5.8%	86.7%
	2002	7,945	58	29	4.4	3.6	3.6	18.7%	88.3%
	2003	8,705	69	33	5.6	4.1	4.4	27.8%	91.8%
	2004	6,685	59	26	4.4	3.1	3.4	22.5%	88.4%
	All years	47,534	67	30	5.0	4.0	3.9	15.3%	83.9%
FHLMC	1994	175	147	126	6.3	5.0	6.1	17.1%	78.9%
	1995	478	76	55	5.8	5.0	5.2	0.8%	82.4%
	1996	564	71	54	7.8	7.0	6.6	4.8%	86.7%
	1997	433	90	43	7.3	7.0	5.8	6.9%	81.1%
	1998	666	95	37	8.1	7.0	6.1	5.9%	95.9%
	1999	989	80	31	7.9	7.0	6.8	5.3%	97.0%
	2000	544	97	34	5.1	3.1	2.7	9.2%	94.1%
	2001	1,355	93	44	6.3	5.0	4.5	10.0%	98.2%
	2002	1,329	119	58	6.2	4.1	4.9	27.8%	98.3%
	2003	1,539	134	55	6.4	5.1	4.5	31.8%	98.4%
	2004	1,280	112	41	6.3	5.0	5.4	36.3%	97.1%
	All years	9,352	104	52	6.7	5.0	5.1	18.1%	94.9%

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Table II
(Continued)

	Year	N	Mean Size ($m)	Median Size ($m)	Mean Mat. (Yrs.)	Median Mat. (Yrs.)	$-weighted Mat. (Yrs.)	Proportion Variable Rate	Proportion Callable
FARM	1994	77	129	63	3.0	3.0	1.9	32.5%	36.4%
	1995	181	125	66	3.1	2.8	2.0	26.5%	30.9%
	1996	321	101	59	3.5	3.0	2.1	19.9%	42.7%
	1997	301	97	59	4.3	3.1	3.0	10.6%	55.5%
	1998	445	89	60	4.2	3.1	3.3	13.9%	50.8%
	1999	285	105	59	3.6	3.0	2.5	14.4%	54.7%
	2000	179	104	40	4.7	3.0	3.1	20.1%	35.2%
	2001	419	94	57	3.9	3.0	3.1	5.3%	67.1%
	2002	637	87	52	4.1	3.0	2.9	14.3%	65.9%
	2003	849	68	33	4.2	3.1	3.3	12.7%	70.6%
	2004	757	55	26	4.0	3.0	3.1	16.4%	63.7%
	All years	4,451	85	47	4.0	3.0	2.9	14.7%	58.8%
SLMA	1994	75	278	125	4.2	4.0	4.2	73.3%	65.3%
	1995	93	191	120	4.0	5.0	3.4	18.3%	61.3%
	1996	130	125	60	2.8	2.5	2.2	14.6%	75.4%
	1997	76	208	118	1.8	1.1	1.4	17.1%	63.2%
	1998	85	251	154	1.4	1.0	1.3	38.8%	49.4%
	1999	128	238	123	1.3	1.1	1.2	58.6%	30.5%
	2000	82	353	197	1.4	1.3	1.4	93.9%	3.7%
	2001	74	286	156	1.8	1.6	2.2	36.5%	45.9%
	2002	77	273	117	1.4	1.1	1.6	44.2%	53.2%
	2003	24	221	125	2.0	1.8	1.8	16.7%	87.5%
	2004	0	0	0	0.0	0.0	0.0	0.0%	0.0%
	All years	844	236	120	2.2	1.6	2.0	41.9%	51.2%
Non-GSE	1994	835	129	75	3.2	2.0	3.3	64.6%	3.8%
Financials	1995	1,146	117	61	3.5	2.0	3.9	50.9%	6.1%
	1996	1,706	90	59	3.8	2.0	3.9	49.9%	3.0%
	1997	2,175	93	58	4.1	3.0	3.9	50.8%	2.9%
	1998	2,209	124	60	3.6	2.0	3.9	58.5%	3.2%
	1999	1,800	178	62	3.6	2.0	4.1	60.7%	6.6%
	2000	1,795	192	86	2.9	2.0	3.3	75.7%	5.1%
	2001	1,134	232	83	3.6	2.0	4.4	72.4%	6.7%
	2002	944	291	115	4.2	2.0	5.9	67.6%	8.6%
	2003	945	281	112	5.1	3.0	5.1	70.7%	9.6%
	2004	815	320	154	5.2	3.0	4.8	79.9%	9.8%
	All years	15,504	168	62	3.8	2.0	4.3	61.9%	5.3%

Table III

Median Spreads Between Yields at Issue and Maturity-Matched Constant-Maturity Treasury Yields for Non-Callable, Fixed Rate Debt Issued by Five GSEs and 70 Frequent Issuer Financial Firms

This table reports yearly medians of spreads between when-issued yields to maturity and maturity-matched constant-maturity treasury yields for non-callable debt issued by five GSEs and 70 frequent issuer (non-GSE) financial firms during 1994-2004. Constant maturity treasury yields are estimated using the term structure model in Nelson and Siegel (1987). The five GSEs are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLB (Federal Home Loan Bank Board), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae).

		Maturity in Years							
		1+ to 3 Yrs.		3+ to 6 Yrs.		6+ to 10 Yrs.		10 + Yrs.	
	Year	N	Med. % Spr.	N	Med. % Spr.	N	Med. % Spr.	N	Med. % Spr.
FNMA	1994	16	0.15	16	0.07	0	n.a.	3	0.23
	1995	49	0.11	47	0.12	4	0.11	20	0.17
	1996	51	0.07	53	0.06	8	0.36	27	0.36
	1997	81	0.13	84	0.07	8	0.05	48	0.16
	1998	78	0.22	21	0.47	4	0.90	21	0.39
	1999	60	0.34	3	0.40	1	1.07	6	0.68
	2000	37	0.35	4	1.10	2	1.35	3	0.96
	2001	9	0.41	7	0.69	4	0.81	1	1.03
	2002	8	0.45	9	0.65	0	n.a.	8	0.79
	2003	2	0.48	5	0.24	0	n.a.	1	0.49
	2004	7	0.16	1	0.27	1	0.51	5	0.14
	All years	398	0.19	250	0.11	32	0.23	143	0.29
FHLB	1994	104	0.14	91	0.09	20	0.13	18	0.16
	1995	186	0.10	159	0.11	17	0.14	30	0.17
	1996	176	0.09	161	0.07	13	0.16	20	0.18
	1997	263	0.19	221	0.11	48	0.12	54	0.15
	1998	209	0.25	259	0.21	67	0.30	102	0.32
	1999	273	0.34	185	0.35	63	0.36	70	0.48
	2000	454	0.62	194	0.80	112	1.01	30	1.41
	2001	420	0.53	288	0.72	105	0.80	25	0.70
	2002	397	0.41	280	0.65	76	0.72	14	0.60
	2003	288	0.33	238	0.52	73	0.51	18	0.56
	2004	399	0.31	215	0.47	67	0.44	23	0.36
	All years	3,169	0	2,291	0	661	1	404	0
FHLMC	1994	14	0.14	8	0.08	0	n.a.	1	0.38
	1995	25	0.29	38	0.11	1	0.53	17	0.14
	1996	11	0.07	19	0.08	4	0.11	24	0.19
	1997	19	0.18	17	0.12	14	0.06	16	0.12
	1998	8	0.25	4	0.31	0	n.a.	3	0.41
	1999	11	0.41	1	1.04	4	0.42	2	1.01
	2000	12	0.50	1	1.38	1	0.56	1	1.20
	2001	11	0.22	3	0.96	1	0.93	1	0.45
	2002	3	0.67	8	0.87	1	0.95	0	n.a.
	2003	5	0.06	3	0.28	0	n.a.	1	0.74
	2004	15	0.17	5	0.40	4	0.33	9	0.37
	All years	134	0.20	107	0.13	30	0.27	75	0.20

(Continued on next page)

Table III
(Continued)

		Maturity in Years							
		1+ to 3 Yrs.		3+ to 6 Yrs.		6+ to 10 Yrs.		10 + Yrs.	
	Year	N	Med. % Spr.	N	Med. % Spr.	N	Med. % Spr.	N	Med. % Spr.
FARM	1994	13	0.13	15	0.08	2	0.06	1	0.14
	1995	21	0.10	36	0.11	8	0.13	9	0.21
	1996	39	0.08	50	0.07	11	0.17	13	0.17
	1997	32	0.16	39	0.06	13	0.14	15	0.17
	1998	43	0.24	70	0.21	20	0.18	28	0.27
	1999	43	0.37	27	0.37	12	0.51	5	0.61
	2000	40	0.45	25	0.66	5	0.75	14	0.99
	2001	41	0.35	48	0.62	12	0.74	10	0.82
	2002	39	0.19	42	0.42	17	0.62	19	0.57
	2003	52	0.09	41	0.30	16	0.44	15	0.43
	2004	65	0.13	57	0.33	12	0.38	14	0.41
	All years	428	0.19	450	0.30	128	0.41	143	0.42
SLMA	1994	4	0.22	0	n.a.	0	n.a.	0	n.a.
	1995	6	0.31	11	0.37	0	n.a.	0	n.a.
	1996	11	0.08	1	0.32	0	n.a.	1	0.23
	1997	19	0.23	0	n.a.	0	n.a.	0	n.a.
	1998	10	0.21	0	n.a.	0	n.a.	0	n.a.
	1999	14	0.32	0	n.a.	0	n.a.	0	n.a.
	2000	2	0.31	0	n.a.	0	n.a.	0	n.a.
	2001	9	0.12	3	0.56	0	n.a.	0	n.a.
	2002	9	0.07	0	n.a.	0	n.a.	0	n.a.
	2003	1	0.12	2	0.45	0	n.a.	0	n.a.
	2004	0	n.a.	0	n.a.	0	n.a.	0	n.a.
	All years	85	0.21	17	0.43	0	n.a.	1	0.23
Non-GSE	1994	246	0.19	221	0.17	40	0.18	77	0.44
Financial	1995	493	0.19	447	0.18	74	0.48	172	0.48
	1996	550	0.12	598	0.26	105	0.38	216	0.53
	1997	764	0.23	721	0.24	173	0.27	300	0.41
	1998	682	0.35	688	0.44	160	0.46	267	0.49
	1999	674	0.42	442	0.56	101	0.42	138	0.72
	2000	749	0.61	314	0.83	138	1.04	72	1.32
	2001	564	0.46	435	0.76	143	0.81	74	1.02
	2002	506	0.35	425	0.67	112	0.73	89	0.82
	2003	368	0.28	379	0.53	117	0.53	88	0.64
	2004	502	0.27	340	0.46	102	0.46	87	0.51
	All years	6,098	0.33	5,010	0.44	1,265	0.52	1,280	0.55

Table IV

Regressions Explaining Log Spreads Between Yields at Issue and Maturity-Matched Constant-Maturity Treasury Yields for Non-Callable, Fixed Rate Debt Issued by Five GSEs and 63 Frequent Issuer Financial Firms

This table reports OLS regressions explaining the log spreads between when-issued yields to maturity and maturity-matched constant maturity treasury yields for non-callable debt issued by five GSEs and 63 frequent issuer (non-GSE) financial firms during 1994-2004. Constant maturity treasury yields are estimated using the term structure model in Nelson and Siegel (1987). Models (1)-(2) use the sample of issues by non-GSE financial firms, and Models (3)-(4) use the sample of issues by the five GSEs. Subordination Feature and Zero-Coupon are indicator variables set to one if the issue is subordinated or zero-coupon. Log (Total Principal of Issue to Date) is the log of the principal issued under the same cusip as of the time of the issue (which differs from the current issue's principal only when an issue is reopened to float additional principal with the same terms and cusip). Log (Principa Issued During Month) and Number of Issues During Month are the log of total principal and number of issues by the issuer during the issue month (across all issues including callable debt and floating debt). Percent of Monthly Principal Callable and Percent of Monthly Principal Floating are the percent of total issues made by the issuer during the month that are callable or floating, respectively. The Issuer Credit Rating variables are indicator variables (issues without debt ratings are the omitted class). These variables are excluded in models (3) - (4) because GSE issues do not carry formal debt ratings. In models (3) - (4), the four indicator variables for the GSEs are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae). FHLB (Federal Home Loan Bank Board) is the omitted class. The two Economic Condition variables are measured daily, and are the spread between 3-month and 10-year treasury yields and the spread between BAA and AAA corporate bond yields. T-values (in parentheses) are adjusted for heteroskedasticity.

Model	(1)		(2)		(3)		(4)	
Sample	Non-GSEs		Non-GSEs		GSEs		GSEs	
Issuer indicator variables included?	Yes (not shown)		Yes (not shown)		Yes (shown)		Yes (shown)	
	Coeff.	(t-value)	Coeff.	(t-value)	Coeff.	(t-value)	Coeff.	(t-value)
Constant	-6.799	(-35.32)	-7.228	(-39.12)	-7.907	(-32.25)	-8.043	(-35.88)
Issue Characteristics								
Subordination Feature	-0.026	(-0.65)	0.029	(0.74)	1.339	(21.16)	0.742	(11.46)
Zero-Coupon	0.487	(2.34)	0.356	(1.20)	1.453	(10.27)	1.043	(6.72)
Maturity in years	0.087	(15.33)	0.100	(18.10)	0.100	(15.57)	0.099	(16.09)
Maturity-squared	-0.002	(-8.52)	-0.002	(-10.58)	-0.002	(-7.82)	-0.002	(-8.21)
Log (Total Principal of Issue to Date)	0.057	(6.90)	0.061	(7.88)	0.022	(3.31)	0.016	(2.42)
Issuer Behavior								
Log (Principal Issued During Month)	0.103	(7.34)	0.065	(5.09)	0.238	(9.15)	0.137	(5.60)
Number of Issues During Month	-0.005	(-2.18)	-0.005	(-2.36)	0.001	(13.81)	0.001	(12.90)
Percent of Monthly Principal Callable	0.316	(3.22)	0.336	(3.54)	-1.605	(-20.37)	-1.348	(-16.86)
Percent of Monthly Principal Floating	-0.106	(-2.62)	-0.073	(-1.94)	-1.029	(-11.14)	-0.713	(-7.35)
Issuer Credit Rating (Dichotomous)*								
AAA	-0.237	(-2.31)	-0.377	(-3.22)				
AA	-0.071	(-1.70)	-0.203	(-3.32)				
BAA	-0.096	(-1.67)	-0.264	(-3.69)				
BA	0.656	(3.44)	0.416	(1.81)				
GSE Issuer (Dichotomous)								
FNMA					-0.341	(-6.88)	-0.280	(-5.87)
FHLMC					0.244	(3.17)	0.215	(2.96)
FARM					0.208	(4.13)	0.087	(1.73)
SLMA					0.264	(2.56)	0.123	(1.19)
Economic Conditions								
3 Month Treasury - 10 Year Treasury			0.523	(15.52)			0.316	(12.71)
Moody's BAA Index - AAA Index			1.440	(23.85)			1.412	(22.82)
Summary Statistics								
Adjusted R-Square	0.308		0.411		0.205		0.253	
Number of Observations	4,864		4,864		8,946		8,946	

Table V
Regressions Explaining Log Spreads Between Yields at Issue and Maturity-Matched Constant Maturity Treasury Yields for Non-Callable, Fixed Rate Debt Issued by Five GSEs

This table reports OLS regressions explaining the log spreads between when-issued yields to maturity and maturity-matched constant-maturity treasury yields for non-convertible debt issued by five GSEs during 1994-2004. Constant maturity treasury yields are estimated using the term structure model in Nelson and Siegel (1987). In model (2), the Median Monthly Non-GSE Spread Residual is the monthly median of the residuals from model (2) of Table IV. In model (4), the Median Monthly Non-GSE Spread Residual is the monthly median of the residuals from a Non-GSE model similar to model (2) of Table IV, except that monthly indicator variables are also included in the non-GSE model. Subordination Feature and Zero-Coupon are indicator variables set to one if the issue is subordinated or zero-coupon. Log (Total Principal of Issue to Date) is the log of the principal issued under the same cusip as of the time of the issue (which differs from the current issue's principal only when an issue is reopened to float additional principal with the same terms and cusip). Log (Principal Issued During Month) and Number of Issues During Month are the log of total principal and number of issues by the issuer during the issue month (across all issues including callable debt and floating debt). Percent of Monthly Principal Callable and Percent of Monthly Principal Floating are the percent of total issues made by the issuer during the month that are callable or floating, respectively. The four indicator variables for the GSEs are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae). FHLB (Federal Home Loan Bank Board) is the omitted class. The two Economic Condition variables are measured daily, and are the spread between 3-month and 10-year treasury yields and the spread between BAA and AAA corporate bond yields. T-values (in parentheses) are adjusted for heteroskedasticity.

Model	(1)		(2)		(3)		(4)	
Sample	GSEs		GSEs		GSEs		GSEs	
Monthly indicator variables included?	No		No		Yes (not shown)		Yes (not shown)	
Issuer indicator variables included?	Yes (not shown)		Yes (shown)		Yes (shown)		Yes (shown)	
	Coeff.	(t-value)	Coeff.	(t-value)	Coeff.	(t-value)	Coeff.	(t-value)
Constant	-8.043	(-35.88)	-8.249	(-40.74)	-5.754	(-14.11)	-8.191	(-18.09)
Median Monthly Non-GSE Spread Residual (Model estimating non-GSE residuals *excludes* monthly indicator variables)			1.367	(35.23)				
Median Monthly Non-GSE Spread Residual (Model estimating non-GSE residuals *includes* monthly indicator variables)							6.872	(10.88)
Issue Characteristics								
Subordination Feature	0.742	(11.46)	0.266	(4.40)	-0.376	(-4.24)	-0.408	(-4.63)
Zero-Coupon	1.043	(6.72)	0.616	(3.60)	0.334	(2.74)	0.327	(2.58)
Maturity in years	0.099	(16.09)	0.099	(16.84)	0.111	(19.05)	0.111	(19.19)
Maturity-squared	-0.002	(-8.21)	-0.002	(-9.19)	-0.003	(-10.76)	-0.003	(-10.85)
Log (Total Principal of Issue to Date)	0.016	(2.42)	0.002	(0.36)	0.011	(2.05)	0.012	(2.27)
Issuer Behavior								
Log (Principal Issued During Month)	0.137	(5.60)	0.069	(3.13)	-0.055	(-1.70)	-0.091	(-2.83)
Number of Issues During Month	0.001	(12.90)	0.001	(7.72)	0.001	(9.09)	0.001	(9.02)
Percent of Monthly Principal Callable	-1.348	(-16.86)	-0.706	(-9.34)	0.180	(1.73)	0.185	(1.77)
Percent of Monthly Principal Floating	-0.713	(-7.35)	-0.465	(-5.23)	-0.118	(-0.97)	-0.044	(-0.37)
GSE Issuer (Dichotomous)								
FNMA	-0.280	(-5.87)	-0.151	(-3.61)	0.107	(2.16)	0.085	(1.72)
FHLMC	0.215	(2.96)	0.062	(0.93)	0.029	(0.42)	-0.013	(-0.19)
FARM	0.087	(1.73)	-0.061	(-1.31)	0.032	(0.39)	-0.048	(-0.59)
SLMA	0.123	(1.19)	0.094	(0.96)	0.276	(2.17)	0.181	(1.43)
Economic Conditions								
3 Month Treasury - 10 Year Treasury	0.316	(12.71)	0.457	(19.68)	0.146	(0.98)	-0.023	(-0.16)
Moody's BAA Index - AAA Index	1.412	(22.82)	2.192	(34.73)	-0.617	(-2.64)	-0.525	(-2.24)
Summary Statistics								
Adjusted R-Square	0.253		0.357		0.479		0.482	
Number of Observations	8,946		8,946		8,946		8,946	

Table VI
Regressions Estimating the Effect of the Long Term Capital Management Crisis

This table reports OLS regressions explaining the log spreads between when-issued yields to maturity and maturity-matched constant-maturity treasury yields for non-callable debt issued by five GSEs and 63 frequent issuer (non-GSE) financial firms during 1994-2004. Constant maturity treasury yields are estimated using the term structure model in Nelson and Siegel (1987). Models (1) - (2) use the sample of issues by non-GSE financial firms, and models (3) - (4) use the sample of issues by the five GSEs. LTCM crisis is an indicator variable set to one if the issue is floated between 8/14/1998 and 11/21/1998. LTCM crisis x Long-Term Bond multiplies LTCM crisis by an indicator set to one if the bond's maturity is at least 10 years. Subordination Feature and Zero-Coupon are indicator variables set to one if the issue is subordinated or zero-coupon. Log (Total Principal of Issue to Date) is the log of the principal issued under the same cusip as of the time of the issue (which differs from the current issue's principal only when an issue is reopened to float additional principal with the same terms and cusip). Log (Principal Issued During Month) and Number of Issues During Month are the log of total principal and number of issues by the issuer during the issue month (across all issues including callable debt and floating debt). Percent of Monthly Principal Callable and Percent of Monthly Principal Floating are the percent of total issues made by the issuer during the month that are callable or floating, respectively. The Issuer Credit Rating variables are indicator variables (issues without debt ratings are the omitted class). These variables are excluded in models (3) - (4) because GSE issues do not carry formal debt ratings. In models (3) - (4), the four indicator variables for the GSEs are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae). FHLB (Federal Home Loan Bank Board) is the omitted class. The two Economic Condition variables are measured daily, and are the spread between 3-month and 10-year treasury yields and the spread between BAA and AAA corporate bond yields. T-values (in parentheses) are adjusted for heteroskedasticity.

Model	(1)		(2)		(3)		(4)	
Sample	Non-GSEs		GSEs		Non-GSEs		GSEs	
Monthly indicator variables included?	No		No		No		No	
Issuer indicator variables included?	Yes (not shown)		Yes (not shown)		Yes (not shown)		Yes	
	Coeff.	(t-value)	Coeff.	(t-value)	Coeff.	(t-value)	Coeff.	(t-value)
Constant	-7.080	(-38.73)	-6.797	(-90.33)	-7.085	(-38.76)	-6.801	(-90.39)
LTCM crisis	0.546	(18.62)	0.557	(16.29)	0.591	(19.12)	0.638	(17.29)
LTCM crisis x Long-Term Bond					-0.330	(-5.30)	-0.452	(-7.03)
Issue Characteristics								
Subordination Feature	0.039	(1.01)	0.861	(13.03)	0.032	(0.83)	0.854	(12.92)
Zero-Coupon	0.383	(1.28)	1.064	(6.58)	0.371	(1.25)	1.063	(6.57)
Maturity in years	0.099	(18.10)	0.098	(16.02)	0.100	(18.22)	0.099	(16.09)
Maturity-squared	-0.003	(-10.69)	-0.002	(-8.31)	-0.003	(-10.75)	-0.002	(-8.24)
Log (Total Principal of Issue to Date)	0.065	(8.49)	0.016	(2.56)	0.065	(8.53)	0.017	(2.59)
Issuer Behavior								
Log (Principal Issued During Month)	0.058	(4.53)	0.000	(3.36)	0.057	(4.53)	0.000	(3.40)
Number of Issues During Month	-0.005	(-2.07)	0.001	(13.77)	-0.004	(-2.01)	0.001	(13.77)
Percent of Monthly Principal Callable	0.322	(3.39)	-1.446	(-17.98)	0.326	(3.46)	-1.448	(-17.99)
Percent of Monthly Principal Floating	-0.089	(-2.38)	-0.679	(-7.00)	-0.088	(-2.37)	-0.679	(-7.00)
Issuer Credit Rating (Dichotomous)								
AAA	-0.442	(-3.79)			-0.443	(-3.80)		
AA	-0.268	(-4.35)			-0.267	(-4.34)		
BAA	-0.359	(-4.96)			-0.362	(-4.99)		
BA	0.315	(1.40)			0.311	(1.38)		
GSE Issuer (Dichotomous)								
FNMA			-0.306	(-6.46)			-0.307	(-6.50)
FHLMC			0.137	(1.94)			0.136	(1.93)
FARM			-0.098	(-2.39)			-0.100	(-2.45)
SLMA			-0.118	(-1.23)			-0.117	(-1.23)
Economic Conditions								
3 Month Treasury - 10 Year Treasury	0.525	(15.44)	0.298	(12.15)	0.527	(15.47)	0.298	(12.13)
Moody's BAA Index - AAA Index	1.329	(22.02)	1.429	(22.87)	1.330	(22.02)	1.429	(22.86)
Summary Statistics								
Adjusted R-Square	0.431		0.257		0.431		0.258	
Number of Observations	4,864		8,946		4,864		8,946	

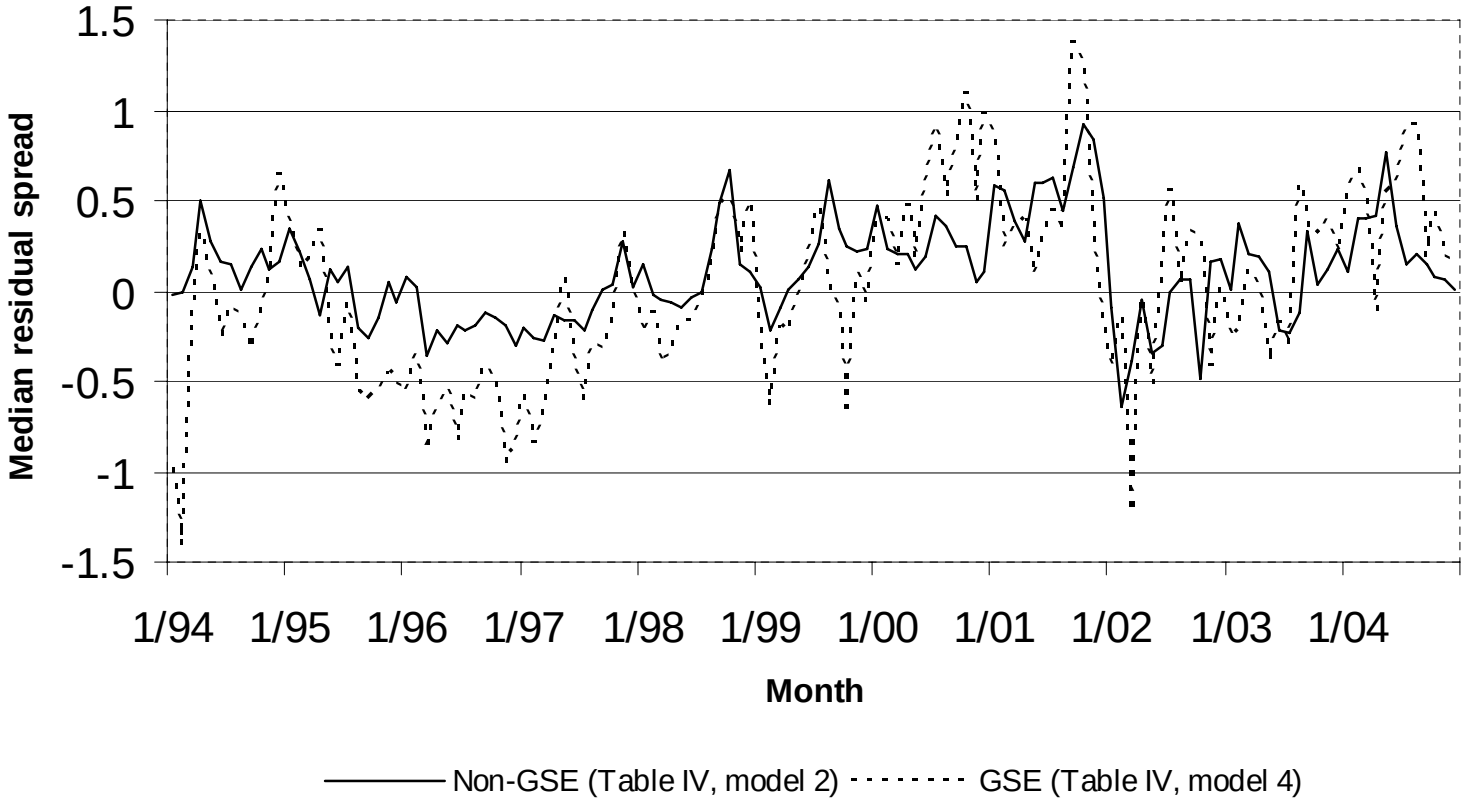

Figure 1. Monthly Median Residuals of the Regressions from Models (2) and (4) in Table IV that Explain Spreads Between Yields at Issue and Maturity-Matched Constant-Maturity Treasury Yields for Non-GSE and GSE Issues. The Non-GSE sample in Model (2) consists of debt issues floated by 63 Financial Firms that are frequent issuers of debt during the 1994-2004 sample period. The GSE sample in Model (4) consists of issues floated by five Government Sponsored Enterprises, which are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLB (Federal Home Loan Bank Board), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae). The regressions include various explanatory variables to capture issue characteristics (subordination feature, zero-coupon, maturity, the square of maturity, and the principal of the issue), issuer behavior (dollar principal issued and the number of total issues during month, and the percents of issues during the month that are callable and floating rate), issuer credit rating indicator variables (for the non-GSE sample), indicator variables for each issuer, and economic conditions (the spread between the 3-month and 10-year treasury yields and the spread between BAA and AAA bonds).

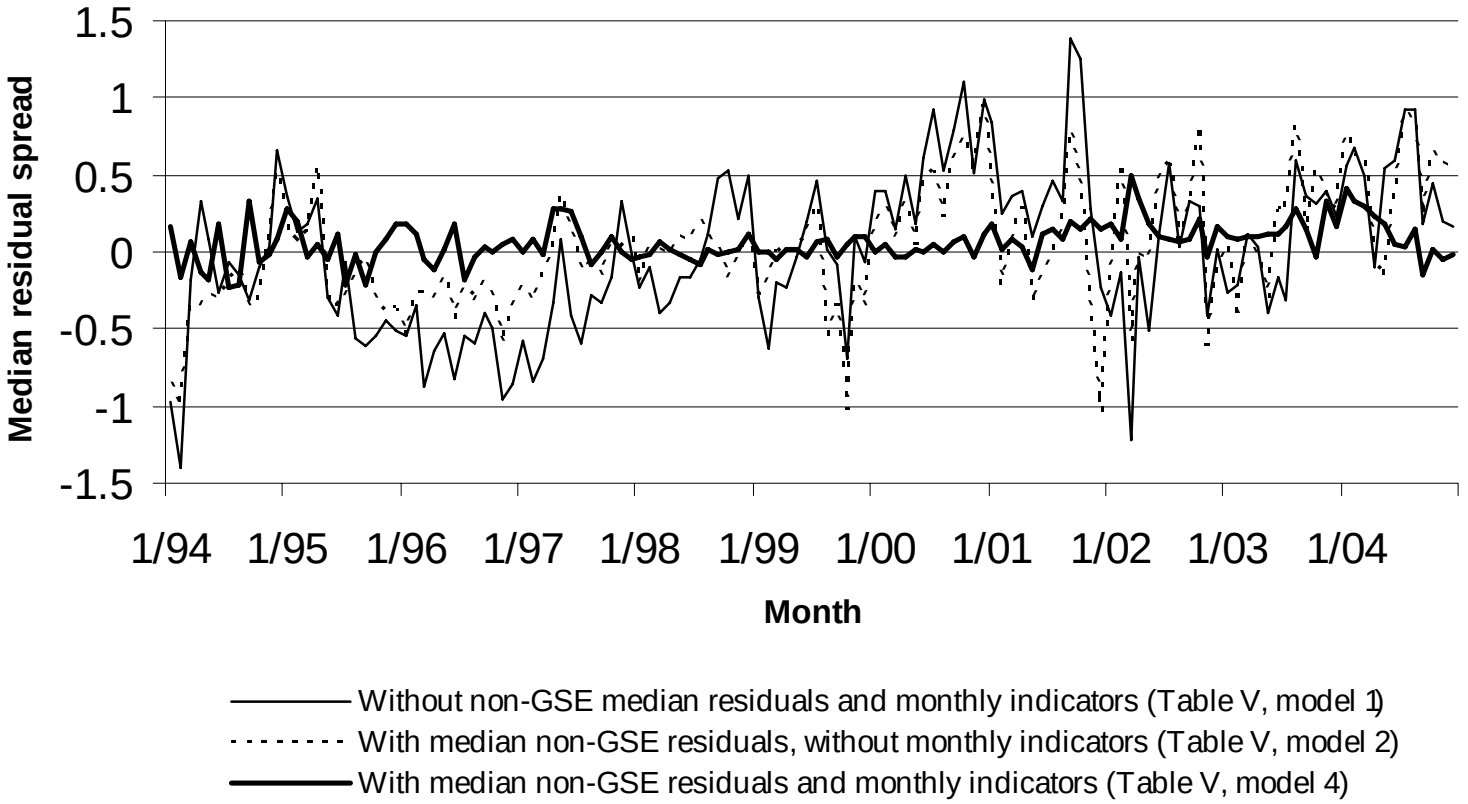

Figure 2. Monthly Median Residuals of the Regressions from Models (1), (2) and (4) in Table V that Explain Spreads Between Yields at Issue and Maturity-Matched Constant-Maturity Treasury Yields for GSE Issues. The sample consists of issues over 1994-2005 floated by five Government Sponsored Enterprises, which are FNMA (Federal National Mortgage Association, or Fannie Mae), FHLB (Federal Home Loan Bank Board), FHLMC (Federal Home Loan Mortgage Corporation, or Freddie Mac), FARM (Federal Farm Credit Banks and Federal Farm Credit Banks Funding), and SLMA (Student Loan Marketing Association, or Sallie Mae). The regressions include various explanatory variables to capture issue characteristics (subordination feature, zero-coupon, maturity, the square of maturity, and the principal of the issue), issuer behavior (dollar principal issued and the number of total issues during month, and the percents of issues during the month that are callable and floating rate), issuer credit rating indicator variables (for the non-GSE sample), indicator variables for each issuer, and economic conditions (the spread between the 3-month and 10-year treasury yields and the spread between BAA and AAA bonds). The light solid line plots median residuals from a baseline model. The dashed line plots median residuals from a model that includes monthly median residuals from a Non-GSE model that are meant to capture time-varying risk premia. The dark solid line plots median residuals from a model that includes both monthly median residuals from a Non-GSE model and monthly indicator variables.