Option-Based Credit Spreads

On-Line Technical Appendix

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This Technical Appendix contains additional material that did not find space in the main text. The Appendix is divided in five sections:

A. Data description and filters

B. Default frequencies from Moody's data

C. Methodology

D. Extensions and Robustness

E. Tables and figures

Appendix A. Data Description and Filters.

Equity Prices and Accounting Variables. We obtain stock prices and accounting information from the Center for Research in Security Prices (CRSP). We use returns in the postwar period (1946 - 2013) to compute asset returns and *ex ante* default probabilities for our pseudo firms, as explained in the text.

Risk-Free Securities. We construct the risk-free zero-coupon bonds from 1-, 3-, and 6-month T-bill rates and 1-, 2-, and 3-year constant maturity Treasury yields obtained from the Federal Reserve Economic Data (FRED) database. We convert constant maturity yields into zero-coupon yields and linearly interpolate to match option maturities. We also obtain commercial paper rates from FRED, which we use to compute credit spreads for short-term debt.

Corporate Bonds. We construct the panel data of corporate bond prices from the Lehman Brothers Fixed Income Database, TRACE, the Mergent FISD/NAIC Database, and DataStream, prioritized in this order when there are overlaps among the four databases. Detailed descriptions of these databases and the effects of prioritization are discussed in Nozawa (2016). In addition, we remove bonds with floating coupon rates and/or embedded option features other than callable bonds.

As call options embedded in corporate bonds bias credit spreads on these bonds up, we adjust the call premium based on regressions. Specifically, we follow Gilchrist and Zakrajsek (2012) (GZ) to estimate the value of embedded call options using both callable and non-callable bonds. We run a panel regression,

$$\log s_{i,t} = b_0 Callable_i + b_1 Callable_i X_{i,t} + b_2 Z_{i,t} + \varepsilon_{i,t},$$

where $s_{i,t}$ is credit spread, $Callable_i$ is a dummy variable for a callable bond, $X_{i,t}$ is a vector of bond characteristics that affect call premiums, and $Z_{i,t}$ is a measure of default risk, motivated by the Merton model.

Following the spirit of GZ, we include seven credit rating dummies (Aaa, Aa, A, Baa, Ba, B, Caa-), log duration, log par amount outstanding, log coupon rate, log age, the first three principal components of Treasury yield curves, and 1-year rolling volatility of daily changes in 10-year Treasury yield in the characteristic vector $X_{i,t}$. For the default risk measure $Z_{i,t}$, we include Merton's Distance to Default (DD), log duration, log par amount outstanding, log coupon rate, log age, three industry dummies based on FISD industry classification (financial, utility, industrials), and seven credit rating dummies.

There are two major differences between our specification and GZ's. First, we use all bonds with maturities from 1 month to 2.5 years, including the ones issued by private firms, for which information about balance sheet and stock prices is not available. We use bonds issued by private firms to maximize the number of observations, as we look at finely classified data based on credit ratings and maturity instead of aggregate data. Because we do not have DD measures for such bonds, we populate the missing data by the average DD for a month for each rating.

Second, we truncate credit spreads at the 1st and 99th percentiles of the distribution, as compared to GZ's truncation at 0.05% and 35%. The truncation at the 1st percentile rather than 0.05% is necessary for us to estimate Aaa/Aa-rated spreads precisely, as some of these bonds, especially ones with very short maturity, have spreads below 0.05% including some negative values. Thus, we transform the credit spreads by

$$\tilde{s} = s - \min(s) + 0.01,$$

and take logarithm of transformed spreads to run the regression.

The first two columns of Table A1 show the estimated slope coefficients of the regression. As expected, bonds with high default risk (DD), longer duration, greater size, larger coupon rate, and long age have higher credit spreads. The call premium is greater for bonds with longer duration, larger coupon rate, when the level of risk-free rates are low (low $PC1$), or when volatility is high. In addition, call premiums (as a fraction of credit spreads) are larger for IG bonds than HY bonds.

Based on these estimates, we adjust corporate credit spreads on callable bonds in our sample. Specifically, we use adjusted spreads for callable bonds, calculated as follows:

$$s_{i,t}^{adj} = \exp(\log \tilde{s}_{i,t} - b_0 - b_1 X_{i,t}) + \min(s) - 0.01.$$

The resulting adjustments for credit spreads are non-trivial, as the 10th, 50th and 90th percentile differences of, $s_{i,t} - s_{i,t}^{adj}$, are 0%, 0.41% and 1.38%, respectively. These estimates for call premiums are large because we estimate the regression only using short-term bonds. As reported in the third and fourth columns of Table A1, when we include bonds with all maturities, the median call premium falls to 0.10%, which is close to the value Huang and Huang (2012) use to adjust for call premiums. Our regression specification leads to conservative estimates for call premiums. When we estimate the regression following GZ (truncating at 0.05% and 35%, use public firms only, use all maturities above one year), the median call premiums rise to 0.22%.

Credit Default Swaps. We obtained five-year CDX indices for the investment-grade CDX.IG and high yield CDX.HY from JP Morgan and single-name CDS spreads from Markit. The samples start in November 2001 and April 2003 for CDX.HY and CDX.IG, respectively, and end in August 2014.

Stock Options. We use the OptionMetrics Ivy DB database for daily prices on SPX index options and options on individual stocks from January 4, 1996, through August 31, 2014. In addition, we use SPX options from the MDR data of Market Data Express to cover the 1990 to 1995 sample. To minimize the effects of quotation errors in SPX options, we generally follow Constantinides, Jackwerth, and Savov (2013) (CJS) to filter the data. As in CJS, we apply the filters only to the prices to buy – not to the prices to sell – so that our portfolio formation strategy is feasible for real-time investors. As in CJS, we apply the following specific filters:

1. *Level 1 Filters:* We remove all but one of any duplicate observations. If there are quotes with identical contract terms but different prices, we pick the quote with the implied volatility (IV) closest to that of the moneyness of its neighbors and remove the others. We also remove the quotes with bids of zero.

2. *Level 2 and Level 3 Filters:* Because we need quotes for long-term, deep out-of-the-money puts and deep in-the-money calls, we do not apply filters based on moneyness or maturity, but we remove all options with zero open interest. Following CJS, we also remove options with less than seven days to maturity. We also apply "implied interest rate < 0," "unable to compute IV," "IV," and "put-call parity" filters.[1]

For individual equity options that are typically American style, put-call parity only holds as an inequality and we thus apply a different set of filters. We follow Frazzini and Pedersen (2012) to detect likely data errors and drop all observations for which the ask price is lower than the bid price and the bid price is equal to zero. In addition, we require options to have positive open interest, and non-missing delta, IV, and spot price. We also drop options violating the put-call parity bounds for American options, and basic arbitrage bounds of a non-negative "time value" P-V where V is the option "intrinsic value' equal to $\max(K-S,0)$ for puts and P is the option's price. We then drop equity options with a time value $(P-V)/P$ (in percentage of option value) below 5%, as the low time value tends to lead to early exercise. Furthermore, to mitigate the effect of the outliers, we drop options with embedded leverage, $\frac{\partial P}{\partial S}\frac{S}{P}$, in the top or bottom 1% of the distribution. Finally, we drop the options on the firms whose $\mu_{t,\tau}$ and $\sigma_{t,\tau}$ are in the top or bottom 5% of the distribution.

Commodity Futures and Options. We obtain monthly settlement prices for commodity futures option for light, sweet crude oil, natural gas (Henry Hub), gold, corn, and soybeans from CME Group. The sample periods vary depending on the underlying commodity futures contracts, and are shown in Table A2. We also obtain the underlying futures settlement prices from CME, and spot prices from Global Financial Data. The expiry date for futures is close to that of options (typically they are apart less than a month), and we assume for

[1]The "implied interest rate <0" filter removes options with negative interest rates implied by put-call parity. The "unable to compute IV" filter removes options that imply negative time value. The "IV" filter removes options for which implied volatility is one standard deviation away from the average among the peers. In this case, the peer group is defined by the bins of moneyness with a width of 0.05. The "put-call parity" filter removes options for which the put-call parity implied interest rate is more than one standard deviation away from the average among the peers.

our analysis that they expire at the same time. We use the convenience yield backed out from spot and futures prices as a predictor to compute the *ex ante* probabilities of default.

CME commodity futures options are American options, but we treat them as European in computing pseudo bond prices because they are so deep out-of-the-money that the early exercise premium is likely negligible. We remove the observations if *i*) the price does not satisfy the put-call parity bound, *ii*) open interest is zero, or *iii*) the number of days to maturity is less than or equal to seven days. In computing the put-call parity bound, we use LIBOR and swap rates obtained from FRED and Barclays, while the pseudo bond prices are computed based on Treasury yields. (We use swap rates to compute the put-call parity bound, since CJS show that the risk-free rate that investors use to evaluate options is higher than T-bill rate.)

Currency Futures and Options. We use two different datasets.

1. We obtain prices for currency futures options for GBP, EUR, JPY, CHF, AUD and CAD from CME, and the corresponding spot exchange rates from Global Financial Data. We apply the same cleaning procedure as we do for the other commodity futures options, as described above.

2. We also use the monthly physical currency option data from JP Morgan for 9 currencies (CAD, EUR, NOK, GBP, SEK, CHF, AUD, JPY and NZD) from 1999 to 2014. The exchange rates are relative to US dollar. The quoted implied volatility for 1-, 3-, 6-, 12- and 24-month options are used to compute currency option prices. The strike prices for currency options are expressed in terms of deltas, and we use at-the-money (50-delta) options, 10-delta calls and puts, and 25-delta calls and puts. When converting implied volatilities into prices, we follow Jurek (2014) and use LIBOR and swap rates for each currency. The pricing of pseudo bonds are computed based on US Treasury yields (FRED). To estimate the *ex ante* and *ex post* probabilities of default, we also use spot exchange rates obtained from JP Morgan.

Swaptions. We use monthly swaption price data obtained from ICAP from July 2002 through December 2014. The data provides the premium for the right to enter an interest rate swap contract (in USD) in which investors pay or receive a fixed rate in exchange for 3-month LIBOR. We use the option expiries of 3, 6, 12 and 24 months on swaps with 5-, 10- and 20-year tenors. The available strike prices are at-the-money and $\pm 300, \pm 200, \pm 150, \pm 100, \pm 75, \pm 50, \pm 25, \pm 12.5$ basis points from the at-the-money swap rate. The option premiums in the data are end-of-the-day aggregate quotes in the interdealer broker market in which ICAP is a major participant. To compute the underlying forward swap rate, we use the swap rate from JP Morgan.

Appendix B. Default Frequencies for Real Corporate Bonds.

As explained in the text, our goal is to construct pseudo bonds that match the realized default frequencies of the actual corporate bonds used as our main empirical benchmark. To that end, we employ a large dataset of corporate defaults spanning the 44-year period from 1970 to 2013 obtained from Moody's Default and Recovery Database. For each credit rating assigned by Moody's to our universe of firms, we estimate *ex post* default frequencies at various horizons from 30 days up to two years. We use our own estimates rather than the original Moody's default frequencies for three main reasons. First, we are interested in the variation of default frequencies over the business cycle, whereas Moody's historical default frequencies are only available as unconditional averages. Second, we are interested in the default frequencies at horizons of below one year, and default frequencies are not provided by Moody's for such short time horizons. And third, we need default frequencies for coarser categories (such as Aaa/Aa, A/Baa) as options' strike prices often lack sufficient granularity to differentiate across such credit ratings.

Table A3 reports historical default rates from 1970 through 2013 from our sample of firms across credit rating categories and time horizons. We compute historical default frequencies separately for international and U.S. firms. Our results are directly comparable to Moody's historical default rates (reported in Moody's (2014)) for one- and two-year horizons. As Table A3 shows, our estimated default rates closely match the Moody's global default rates for those horizons.

The last two columns of Table A3 report default rates for U.S. firms in NBER-dated booms and recessions. Predictably, we find that default frequencies are higher in recessions than in booms across all credit ratings. At the 1-year horizon, for instance, A-rated bonds have a default frequency of only 0.02% in booms but 0.13% in recessions (as compared to an unconditional U.S. average of 0.04%). Default frequencies for speculative-grade bonds also show large variations over the business cycle. For example, a B-rated bond has a 3.57% default rate at the 1-year horizon during booms but more than twice that in recessions (as compared to an unconditional average of 4.01%).

Table A3 also shows default frequencies at short horizons of 30, 91, and 183 days. At the 30-day horizon, all IG bonds have essentially zero historical default frequencies (although, in recessions, the historical default rate ticks up 0.01% for bonds rated A- and Baa). Some more action for these bonds is observable at the 91- and 183-day horizons, especially during recessions. For example, Baa-rated bonds have defaulted with 0.04% and 0.12% frequencies at the 91- and 183-day horizons (respectively) during recessions, which are much higher than the corresponding unconditional default frequencies of 0.02% and 0.05%. HY bonds, by contrast, exhibit relatively substantial historical default activity even at short horizons. For instance, B-rated bonds have 0.22%, 0.75%, and 1.69% unconditional default frequencies over 30, 91, and 183 days, respectively, which increase to 0.43%, 1.48%, and 3.33%, respectively, during recessions.

Appendix C. Methodology.

C.1. *Ex Ante* Default Probabilities

In this section we describe in detail the methodology to compute *ex ante* default probabilities for pseudo bonds, that we summarize in Section 2.2. of the text.

At every time t and for each bond with maturity τ and face value $K_{i,t}$, we want to compute

$$p_t(\tau) = \Pr\left[A_{i,t+\tau} < K_{i,t} \,|\mathcal{F}_t\right] \tag{9}$$

where $\mathcal{F}_t$ denotes the information available at time t.

To avoid making explicit distributional assumptions about asset returns and to keep our approach as model-free as possible, we use the empirical distribution of underlying asset values to compute $p_t(\tau)$. Nevertheless, we need to take into account any time-varying market conditions, which could have a substantial impact on default probabilities for a given current market leverage ratio $L_{i,t} = K_{i,t}/A_t$.

When pseudo firm i's assets consist solely of the SPX, the market value of the firm's assets at time t is $A_{i,t} = SPX$. Dropping the subscript i for notational simplicity, let log asset growth for this firm be given by:

$$\ln\left(\frac{A_{t+\tau}}{A_t}\right) = \mu_{t,\tau} + \sigma_{t,\tau}\varepsilon_{t+\tau} \tag{10}$$

where $\varepsilon_{t+\tau}$ are standardized unexpected asset returns. Because we do not impose any distributional assumption on $\varepsilon_{t+\tau}$, this is just a statement that log asset growth $\ln(A_{t+\tau}/A_t)$ has an expected component and a volatility scaling parameter $\sigma_{t,\tau}$.

A structural assumption is required to estimate $\mu_{t,\tau}$ and $\sigma_{t,\tau}$. Accordingly, we estimate $\mu_{t,\tau}$ by running return forecasting regressions (excluding dividends) using the dividend-price ratio for τ horizons, and $\sigma_{t,\tau}$ by fitting a GARCH(1,1) process based on monthly asset returns.[2] Given estimates of $\mu_{t,\tau}$ and $\sigma_{t,\tau}$, we collect the (overlapping) history of shocks

$$\varepsilon_{t+\tau} = \frac{\ln\left(A_{t+\tau}/A_t\right) - \mu_{t,\tau}}{\sigma_{t,\tau}}$$

and use the empirical distributions of these shocks to compute empirical default probabilities for each leverage ratio $L_{i,t}$ at any given time t.

In particular, we rewrite the probability $p_t(\tau)$ in (9) as follows:

$$p_t(\tau) = \Pr\left[\varepsilon_{t+\tau} < X_{i,t} \middle| \mathcal{F}_t\right] \qquad \text{where} \qquad X_{i,t} = \frac{\ln\left(L_{i,t}\right) - \mu_{t,\tau}}{\sigma_{t,\tau}} \tag{11}$$

Thus, we can estimate such probabilities simply as:

$$\widehat{p}_t(\tau) = \frac{n(\varepsilon_{s+\tau} < X_{i,t})}{n(\varepsilon_{s+\tau})} \quad \text{for all} \quad s + \tau < t. \tag{12}$$

where $n(x)$ counts the number of events x. We perform these computations on expanding windows, so that at any time t we only use information available at time t to predict the default probability of a pseudo bond with maturity $t+\tau$. The empirical distribution of shocks $\varepsilon_{t+\tau}$ thus determines these default probabilities. Panel A of Figure A1 presents the histogram of shocks $\{\varepsilon_{t+\tau}\}$ for maturity $\tau = 2$. The Kolmogorov-Smirnov test rejects normality at 1% confidence level.

To illustrate, Panel D of Figure 1 in the paper plots the default probabilities of the two SPX pseudo bonds in Panel A. The high-leverage pseudo firm has higher default probability than the low-leverage pseudo firm, which is not surprising because both pseudo firms have the same underlying assets, the SPX. (As we shall see, when firms differ from the type of underlying assets, firms with the same leverage may have different default probabilities due to different underlying assets' characteristics). Both default probabilities increased during the financial crisis, with the high-leverage pseudo bond jumping to almost 100% and hovering around that value up to maturity. The default probability of the low-leverage bond returned to zero by maturity, as it became clear that no default would occur.

We extend the above procedure to the case of single-stock pseudo bonds. When pseudo firm i's assets $A_{i,t}$ consist of shares of an individual stock included in the SPX, we must take into account survivorship bias – *i.e.*, if at time t a given stock is part of the SPX, it must have

[2] Specifically, we use monthly returns to estimate $\sigma^2_{t,1}$ and compute $\sigma^2_{t,\tau}$ for $\tau > 1$ from the properties of the fitted GARCH(1,1) model.

done well in the past and thus its shocks are biased upwards. To avoid survivorship bias, for every t we consider the full cross-section of all firms underlying the SPX index before t (including those that dropped out of the index). For each firm i and $s < t$, we use its previous-year return volatility and unconditional average return (before s) to compute its normalized return shock. We then use the full empirical distribution of all these normalized shocks across firms i for all $s < t$ to obtain the default probabilities for each bond issued by each pseudo firm j as of time t. As before, for each firm j we scale the shocks by their unconditional means and previous-year volatilities. Panel B of Figure A1 shows the histogram of the resulting normalized shocks. These shocks display fat tails, and the Kolmogorov-Smirnov test rejects normality at the 1% confidence level.

C.2. Pseudo Ratings of Pseudo Bonds

In this section we describe the results of the pseudo rating assignment for two-year pseudo bonds introduced in Section 2.2. of the text.

Panel A of Table A4 presents the default frequencies, both average and over the business cycle, estimated from Moody's dataset on corporate defaults for the credit ratings reported in the first column. The last two columns report break points in booms and recessions, computed as the middle points of the corresponding default probabilities in columns three and four.[3] So, for every month t, we compare the probability of each bond i, $\widehat{p}_{i,t}(\tau)$, to the corresponding thresholds in the last two columns, depending on whether month t is a boom or recession, and obtain a classification into a pseudo rating category.

Panels B and C report the results of our pseudo rating classification methodology for pseudo bonds based on single stocks and the SPX, respectively. In both panels, for each rating in the first column, the second and the third columns show the weighted average *ex ante* default probabilities for pseudo bonds in each rating category. According to the procedure, these probabilities should be close to the historical default frequencies reported in columns three and four of Panel A, and indeed they are. Columns four to six of Panels B and C of Table A4 test whether *ex post* default frequencies are close to the *ex ante* default probabilities. We cannot reject that *ex ante* and *ex post* default probabilities are equivalent.

The second-to-last column in Panels B and C reports the average moneyness of the options ($\overline{K/A}$). The options used for highly rated pseudo bonds are deeply out-of-the-money to be consistent with low default probabilities. As noted, we sometimes lack sufficient data to compute any default rate for the Aaa/Aa category because options that far out-of-the-money

[3] To keep the default probability of the Caa- category close to the target from Moody's data, we exogenously set the upper limit equal to 1.5 times Moody's default probabilities in columns three and four.

are excluded by our minimum liquidity filters (*see* Appendix A).

The last column of Panels B and C report the average maturities $\overline{\tau}$ of the options used by pseudo rating category. Across the two panels, these averages are between 620 and 674 days (*i.e.*, 1.69 and 1.85 years). Times to maturity thus are a bit smaller than the two-year (730-day) target mainly due to lack of data in the early part of the historical sample. Even so, the lower average maturity biases the empirical results against us, given that shorter maturities imply lower probabilities for the put options to end up in-the-money at maturity. We continue to refer to these pseudo bonds as two-year bonds for expositional simplicity.

C.3. Default Probabilities for Other Asset Classes

The general methodology to compute default probabilities for SPX and single-stock pseudo bonds explained in Section C.1 is applied for other asset classes, with some minor modifications, as explained next.

Futures options. The price of pseudo bonds based on futures options is computed in the same way as SPX and single-stock pseudo bonds:

$$B_t\left(t+\tau, K_{i,t}\right) = K_{i,t} Z_t\left(t+\tau\right) - P_t^{Option}\left(t+\tau, K_{i,t}\right),$$

as are the yields. To compute the probability of default, we assume that the dynamics of the spot price of the underlying asset follows

$$\log S_{t+1} - \log S_t = \mu_t + \sigma_t \varepsilon_{t+1}.$$

The parameters μ_t and σ_t are estimated using the available history of log spot prices up to time t. Specifically, μ_t is the cumulative average log price change, and σ_t is estimated using GARCH(1,1) except for natural gas. For natural gas, the available spot price starts only about a year before the beginning of the options data, and thus there is not enough spot price data available to estimate the out-of-sample forecast for the volatility at the beginning of the options data. Thus, we simply use the monthly volatility estimated from daily changes in log spot prices. The methodologies are summarized in Table A2.

The *ex ante* probability of default is computed by

$$p_t\left(L_{i,t}\right) = \Pr\left[\varepsilon_{t+\tau} < X_{i,t}\right] \quad \text{where} \quad X_{i,t} = \frac{\ln L_{i,t} - \left(\mu_{t,\tau} - r_{t,\tau} + q_{t,\tau}\right)}{\sigma_{t,\tau}}$$

where $q_{t,\tau}$ is a convenience yield minus physical storage costs. We adjust the leverage by $r_{t,\tau} - q_{t,\tau}$ because the leverage for options on futures is defined using a futures price rather than a spot price.

For currency futures options, we compute the pseudo bond price and probability of default in the same way as other commodity options, except that we estimate the conditional mean log spot rate changes by regressing the changes onto the difference in 3-month T-bill rates between USD and the other currency.

JP Morgan FX options. The FX options from JP Morgan are for spot currency exchanges. Thus, we apply the same procedure to these FX options as we do for stock options. In estimating the conditional mean log price change parameter, we forecast the changes in exchange rates using the difference in three-month interbank rates between the two currencies. We estimate the conditional volatility using GARCH(1,1).

Swaptions. As discussed in Section 5.1. of the text, the price of the swaption-based pseudo bond is

$$\hat{B}_t\left(t+\tau,1\right) = \hat{Z}_t\left(t+\tau\right) - \hat{P}_t^{swap}\left(t+\tau,c,M\right),$$

and the probability of default is given by

$$\Pr\left(\mathcal{B}_{t+\tau}\left(c,M\right) < 1 | \mathcal{F}_t\right).$$

In order to estimate the probability of default, we estimate the parameters using the following presumptive dynamics for pseudo firm assets:

$$\log \mathcal{B}_{t+\tau}\left(c,M\right) - \log \mathcal{B}_t\left(c,M\right) = \mu_t + \sigma_t \varepsilon_{t+\tau}. \tag{13}$$

From the term structure of swap rates, we compute the historical price of pseudo firm's assets, $\mathcal{B}_t\left(c,M\right)$. Then we forecast its change over the period up to the option expiry using the following forecasting regression:

$$\log \mathcal{B}_{t+\tau}\left(c,M\right) - \log \mathcal{B}_t\left(c,M\right) = a + b\cdot\left(Swap\left(t,M\right) - LIBOR_t\right) + \varepsilon_{t+\tau},$$

where $Swap\left(t,M\right)$ is the swap rate at time t for maturity $M-t$, and $LIBOR_t$ is 3-month LIBOR.Then the estimated mean parameter is given by

$$\hat{\mu}_t = \hat{a} + \hat{b}\cdot\left(Swap\left(t,M\right) - LIBOR_t\right).$$

We use the 60-month rolling volatility of $\log \mathcal{B}_{t+\tau}\left(c,M\right) - \log \mathcal{B}_t\left(c,M\right)$ to account for time-varying volatility.

C.4. Matching LGDs between Corporate and Pseudo Bonds

From Section 5.2., the expected payoff from bonds scaled by a face value conditional of default is given by

$$E\left[\text{Bond Payoff at } t+\tau\left|A_{t+\tau} < K_{i,t}\right.\right]/K_{i,t} = 1 - \left(1-\kappa_i\right)\kappa_i^{Put} - \kappa_i,$$

where κ_i is the bankruptcy cost of pseudo-firm i, and $\kappa_i^{Put} \equiv E\left[1 - A_{t+\tau}/K_{i,t} \,|A_{t+\tau} < K_{i,t}\right]$. We compute the *ex ante* values for $E\left[1 - A_{t+\tau}/K_{i,t} \,|A_{t+\tau} < K_{i,t}\right]$ for each option in our sample using the historical data of underlying assets and the parameter values of their dynamics based on the information up to time t. Specifically, based on the histogram of $\varepsilon_{t+\tau}$ and parameters $\mu_{t,\tau}$ and $\sigma_{t,\tau}$, we construct the histogram of $A_{t+\tau}$. We then take the average of $1 - A_{t+\tau}/K_{i,t}$ if $A_{t+\tau} < K_{i,t}$.

Our goal is to find the value of κ_i which equates the *ex ante* LGD of pseudo bonds to the corporate LGD in the data, κ_i^{Corp}. Thus, we impose

$$E\left[\text{Bond Payoff at } t+\tau \,|A_{t+\tau} < K_{i,t}\right]/K_{i,t} = 1 - \kappa_i^{Corp},$$

which yields

$$\kappa_i = 1 - \frac{1 - \kappa_i^{Corp}}{1 - \kappa_i^{Put}}.$$

We use Moody's data, shown in Table A5, to find κ_i^{Corp}.

As Chen (2010) documents, corporate LGDs vary over business cycle. Using the Moody's data at the aggregate level, we find that the recovery rate from senior unsecured debt is 5% higher during booms compared with the overall average, whereas it is 27% lower during recessions. Thus, we multiply the recovery rate for each rating by 1.05 and 0.73 depending on business conditions to obtain time-varying recovery rate, $1 - \kappa_i^{Corp}$, for each rating and each month.

Appendix D. Extensions and Robustness

D.1. Equity as Assets of Pseudo Firms

In this section we show that the impact of the inherently leveraged nature of most firms' equity values on the size of the credit spreads is likely small, both theoretically and empirically.

First, theoretically, consider the following experiment: Start with a "Merton firm" with log-normally distributed assets financed by zero-coupon debt, with face value K and maturity T, and equity, which can be viewed as a call option on the assets of the firm. As in the paper, we then create a pseudo firm using the equity of the "Merton firm" as assets of the pseudo firm. The maturity of the debt of the pseudo firm, τ is lower than the one of the Merton firm T in order to mimic our empirical analysis that employs options with at most two years to maturity. We consider three values for the debt maturity T of Merton firm (2.5, 5, and 10 years) and two values of its asset volatility ($\sigma_V = 10\%$ and $\sigma_V = 20\%$).

For each combination of these parameters (T and σ_V), we consider several debt levels K of the Merton firm, and for each debt level, we compute its risk-neutral default probability $N(-d_2)$ where $d_2 = (log(K/S) + (r - 1/2\sigma_V^2)T)/(\sigma_V\sqrt{T})$. To compare the credit spreads of this Merton firm with its associated pseudo firm, whose debt has maturity τ, we compute a target default probability at τ as $EDF(\tau) = 1 - (1 - N(-d_2))^{\tau/T}$. Given the simulated value of equity at τ, $E_\tau = Call(S_\tau, K, T, r, \sigma_V)$, where S_τ is simulated under the risk-neutral probabilities, we can find the pseudo firm's debt level K_{pseudo} to yield the pseudo firm's default probability equal to $EDF(\tau)$, that is, such that $Pr(K_{pseudo} - E_\tau > 0) = EDF(\tau)$. We then compare the credit spreads of this pseudo firm to the one of the original Merton firm to quantify the bias from using the equity of the Merton firm in lieu of its asset values. Because some term structure effect may be at play (because debt maturity T of Merton firm is larger than debt maturity τ of pseudo firm) we also consider another Merton firm with maturity τ constructed exactly like the pseudo firm, except that we use the value of assets V_τ instead of the equity value E_τ in its construction. The credit spread of this short-maturity Merton firm controls for the maturity difference.

Tables A6 and A7 show the simulation results for the default probabilities used throughout the paper, except that for this exercise we use risk-neutral probabilities instead of true probabilities to be conservative, as risk-neutral probabilities are higher than true probabilities and yield higher credit spreads under Merton's model. In each Table and in each panel, we report the corporate quantities from the data – if available – the empirical quantities for pseudo firms, and finally the theoretical implications from the experiment. For these, we report the simulation results for the underlying Merton firm whose debt has T years to maturity, the short-term Merton firm whose debt has only two years to maturity, and the pseudo firm.

Panel A shows that across all of our scenarios, the increase in credit spreads due to the use of leveraged equity is small, especially for highly rated firms. To take an example, for a Aaa/Aa firm, the biggest increase in pseudo spreads due to leveraged equity is for a Merton firm with $T = 2.5$ and $\sigma_V = .2$ (right-most columns in Table A7). In this case, the Merton firm's credit spread is only 0.11 basis points, while the leveraged pseudo firm with $\tau = 2$ has a credit spread of 0.57 basis points. Percentage-wise, the increase in credit spreads due to the use of leveraged equity is very large. But there is still a gulf between the credit spread of the pseudo firm defined on leveraged equity and the data, which recall from Table 1 shows a spread of 71 bps for corporate bond spreads, 98 bps for single-stock pseudo bonds, and 51 bps for SPX pseudo bonds. Similar findings can be observed across other high credit ratings. The only case in which we find that leverage increases spreads substantially is for Merton firms with very low credit ratings and low debt maturities, in which case the bias generates a credit spread that is closer to the data. But the puzzling high credit spreads are for high credit ratings, and not low credit rating firms.

Second, empirically the mechanism underlying the increase in spreads resulting from leveraged equity does not hold in the data. The increase in spreads due to leveraged equity is due to an increase in the negative skewness and kurtosis of log equity returns, as documented in Panels B and C of Tables A6 and A7. For instance, in the previous example ($T = 2.5$ and $\sigma_V = 20\%$) the equity of a leveraged firm has skewness of -0.38 for Aaa/Aa and -2.88 for Caa-. For these two cases, excess kurtosis of leveraged equity is 4.22 and 17.54, respectively. While the skewness of SPX monthly log returns is indeed -0.31, the average skewness of single stocks is only -.11, much smaller (in absolute value) than that implied by the leveraged equity in Merton's model.

More importantly, the tails of leveraged equity in the data are far thinner than those implied by leveraged equity, with excess kurtosis of only -.34 for SPX log returns and -.19 (average) for single stock log returns, against the range between 4.22 and 17.54 in the Merton model. Panel D finally shows that the LGD implied by using levered equity in Merton's model is too small for highly rated firms although it may become quite large for low-rated firms in some cases. Indeed, in the case ($T = 2.5$ and $\sigma_V = 0.2$) LGDs range between 35.22% for Aaa/Aa to 69.93% for Caa- . These LGDs are too small for highly rated firms compared to the data, in which LGDs are around 61%, with a minimum of 56% for intermediate ratings. Single-stock pseudo firms in the data have LGDs that range between 49% for highly rated pseudo firms and 25% for low-rated pseudo firms. As discussed in the text, these LGDs of pseudo firms are smaller than corporate LGDs, but they are higher than Merton's implied LGDs for highly rated pseudo bonds. Overall, this experiment does not lend much support to the possibility that the use of levered equity as assets of pseudo firms is the main source of the high credit spreads.

Third, we can check in the data the size of a potential upward bias due to the use of levered equity for pseudo-firm assets. Although our goal in the paper is not to match pseudo bonds made from individual firms' equity options with the bonds issued by the same firms (e.g. Apple bonds with Apple-based pseudo bonds), we can still check the difference in credit spreads between corporate bonds of individual firms and pseudo spreads obtained from options on the same firms' equities. In addition, because we also compare Markit's CDX.IG and CDX.HY indices with our CNV indices, it is informative to exploit the CDS spreads of firms in the CDX indices to make a full three-way comparison between pseudo spreads, corporate spreads, and CDS spreads of the *same* issuer.[4] One difficulty with this exercise, however, is that we must match the credit ratings of the issuing firm with pseudo ratings. This matching is not straightforward, as most of the firms in the SPX index have high credit ratings. Therefore, to match their credit ratings when we build pseudo bonds we need options that are deeply out-of-the-money. This hurdle severely limits the number of firms in the sample for this comparison.

Nonetheless, we proceed as follows: for each month t, we consider every firm i that both has put options that are sufficiently out-of-the-money so that its pseudo rating matches the firm's actual credit rating, and it also belongs to the CDX.IG or CDX.HY indices. For that month and firm, we obtain the triplet of pseudo credit spread, corporate bond spread, and CDS spread. For each credit rating bucket (Aaa/Aa, A/Baa etc) we then take their time average as in earlier tables.

Table A8 shows the results. First, there are no valid data for the highest rating Aaa/Aa or the lowest rating Caa- due to an essentially empty intersection for the data requirement.[5] The intermediate rating categories are well-populated, especially the A/Baa. In this case, we find that average pseudo spreads (146 bps, 317 bps, and 514 bps for A/Baa, Ba, and B, respectively) are very close to average corporate bond spreads (136 bps, 349 bps, and 414 bps, respectively). These credit spreads are though higher than the corresponding CDS spreads (59 bps, 283 bps, and 372 bps, respectively). That is, there is a CDS - pseudo-bond basis of the same magnitude as the very well documented CDS - bond basis (*see e.g.* the review by Culp, Van der Merwe, and Stärkle (2016)). This result is unsurprising because from Table 1, pseudo bonds do match actual bond spreads. The empirically documented CDS - bond basis suggests that we should find a similar spread between pseudo bond and CDS spreads, and we do.

In sum, starting from the Merton model, it does not seem that our procedure of using equity as underlying asset induces a bias in credit spreads that would come anywhere close to explaining the large credit spreads observed in the data, especially for highly rated firms.

D.2. Robustness and Additional Results

This section reports several robustness tables and additional results:

[4]We thank an anonymous referee for suggesting this exercise with individual CDS.

[5]This is not too surprising, as for the Aaa/Aa bin we need deep OTM options from such highly rated firms which instead mostly do not in fact have options with such OTM strike prices. On the other hand, there are few SPX firms that are junk with Caa- credit rating.

- Tables A9, A10 and A11 show the full table with the predictive regressions of future economic growth from the CNV spreads, in the full sample and in two subsamples.

- Tables A12 and A13 shows the decomposition of the predictive regression of future economic growth from expected losses and risk premium in two subsamples.

- Table A14 shows the decomposition of the predictive regression of future economic growth from SPX pseudo spread and the spread difference between single-stock spreads and SPX spreads in two subsamples.

- Table A15 shows the *ex ante* and *ex post* default frequencies of pseudo bonds and corporate bonds for maturities of T =30 days, 91 days, 183 days, and 365 days.

- Table A16 indicates the results about credit spreads and excess returns of single-stock pseudo bonds when we use equivalent European options as opposed to the American traded options.

- Table A17 shows the average credit spreads and LGDs for 1-year pseudo bonds whose assets are the SPX, single stocks, commodities, foreign currencies, fixed income securities, and single stocks with negligible leverage.

- Table A18 reports the results of a factor analysis of credit spreads of pseudo bonds of pseudo firms whose assets are the SPX, single stocks, commodities, foreign currencies, and fixed income securities.

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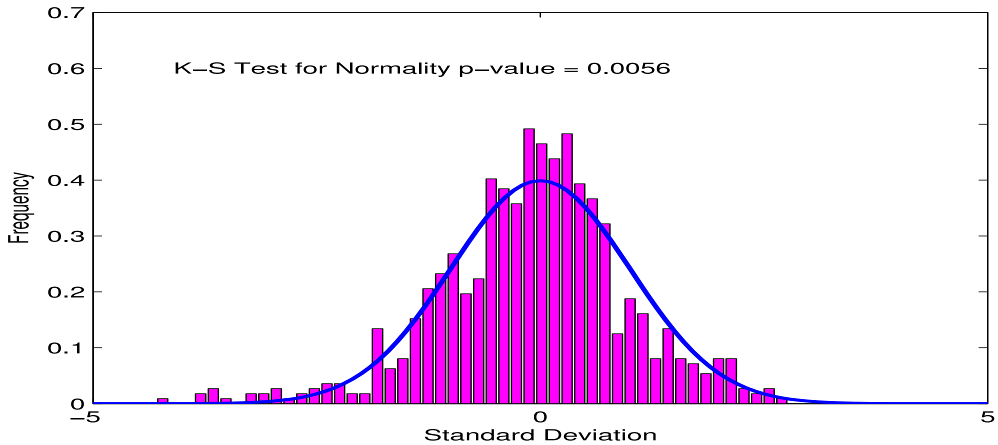
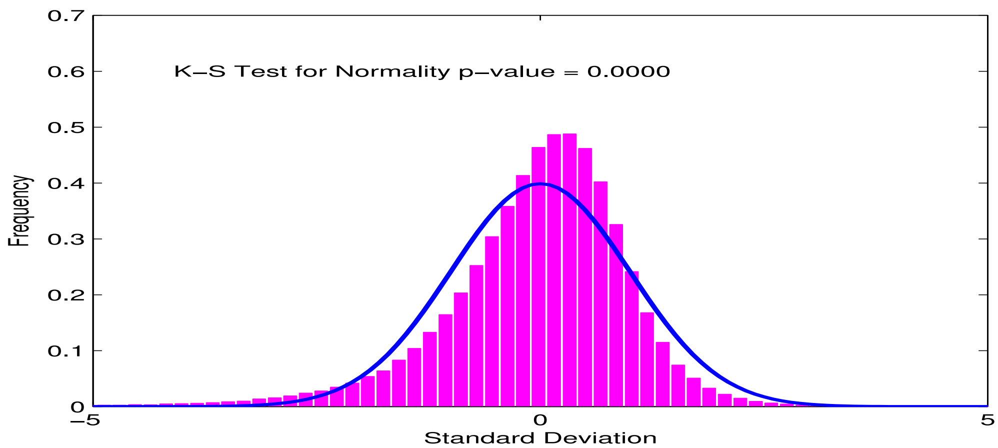
Appendix E. Additional Figures and Tables.

Figure A1: Normalized Monthly Shocks to Two-Year Pseudo Bonds

Panel A: S&P500 Index as Assets



Panel B: Individual Firms as Assets



Notes: Histograms of residuals computed as

$$\epsilon^i_{t,t+\tau} = \frac{\log\left(A^i_{t+\tau}/A^i_t\right) - \left(\mu_{i,t,\tau} - \frac{1}{2}\sigma^2_{i,t,\tau}\right)}{\sigma_{i,t,\tau}}$$

In Panel A, A^i_t is the SPX index, $\mu_{i,t,\tau}$ is computed from a predictive regression of future two-year returns using the dividend yield as predictors, and $\sigma_{i,t,\tau}$ is obtained from fitting a GARCH(1,1) model to monthly stock returns. All computations are made on an expanding window.

In Panel B, A^i_t are the individual stocks in the SPX index, where $\mu_{i,t,\tau}$ is the average two-year stock return until t, and $\sigma_{i,t,\tau}$ is the realized volatility the previous year. For every t, all the stocks in the SPX index are used to compute shocks before t to avoid survivorship bias.

Table A1: Panel Regression of Log Credit Spreads On Bond Characteristics

We use all bonds with maturity between 1 month to 2.5 years to run a pooled OLS regression of log credit spreads, $\log s_{i,t} = b_0 Callable_i + b_1 Callable_i X_{i,t} + b_2 Z_{i,t} + \varepsilon_{i,t}$. $PC1 - PC3$ are the first three principal components of Treasury yield curve, $\sigma(yield)$ is the rolling one-year volatility of daily changes in 10-year Treasury yield and D_R is a dummy variable for credit rating R. Standard errors are clustered by month and adjusted for 12 month serial correlation. The data is from 1973-2015 and the number of observations is 296,592.

		Main Results		All Maturity		GZ Specification	
		b	s.e.	b	s.e.	b	s.e.
$-DD$		0.008	(0.004)	0.021	(0.007)	0.074	(0.013)
$\log duration$		0.064	(0.019)	0.059	(0.013)	0.203	(0.040)
$\log paramt$		0.032	(0.008)	0.061	(0.019)	0.193	(0.032)
$\log coupon$		0.065	(0.017)	0.155	(0.050)	0.027	(0.126)
$\log age$		0.012	(0.005)	0.005	(0.013)	0.055	(0.015)
$Callable$	1	0.489	(0.177)	0.114	(0.216)	0.745	(0.569)
	$\log duration$	0.028	(0.013)	-0.030	(0.013)	-0.187	(0.048)
	$\log paramt$	-0.051	(0.010)	-0.055	(0.019)	-0.204	(0.035)
	$\log coupon$	0.165	(0.025)	0.416	(0.067)	1.043	(0.179)
	$\log age$	-0.019	(0.008)	0.026	(0.013)	-0.023	(0.019)
	$PC1$	-0.017	(0.002)	-0.023	(0.003)	-0.040	(0.005)
	$PC2$	0.005	(0.002)	-0.001	(0.006)	-0.008	(0.010)
	$PC3$	-0.017	(0.008)	-0.002	(0.018)	0.023	(0.039)
	$\sigma(yield)$	0.016	(0.005)	0.028	(0.006)	0.071	(0.010)
	D_{Aaa}	0.031	(0.079)	0.059	(0.091)		
	D_{Aa}	0.080	(0.073)	0.034	(0.098)		
	D_{A}	0.076	(0.073)	0.047	(0.086)		
	D_{Baa}	0.032	(0.063)	-0.028	(0.075)		
	D_{Ba}	0.008	(0.059)	-0.086	(0.069)		
	D_{B}	-0.095	(0.057)	-0.229	(0.072)		
	D_{Caa-}	-0.152	(0.055)	-0.373	(0.095)		
	$-DD$					-0.048	(0.011)
Industry dummies		Yes		Yes		Yes	
Rating dummies		Yes		Yes		Yes	
$\bar{R}^2$		0.33		0.47		0.54	
Implied Call Premium Adjustment, $s - s^{adj}$, percentage points							
	10%	0		0		0	
	50%	0.41		0.10		0.22	
	90%	1.38		1.05		1.57	

Table A2: Options Data

	Spot Price Starts	Option Data Starts	Option Data Ends	Conditional Mean Model	Conditional Vol Model
SPX	194601	199601	201408	Dividend yields	GARCH(1,1)
Individual	194601	199601	201408	Cumulative average	Monthly vol
Commodities:					
Crude oil	197702	198611	201502	Cumulative average	GARCH(1,1)
Natural gas	199004	199210	201502	Cumulative average	Monthly vol
Gold	197402	198601	201502	Cumulative average	GARCH(1,1)
Corn	190002	198502	201502	Cumulative average	GARCH(1,1)
Soybeans	191312	198410	201502	Cumulative average	GARCH(1,1)
FX (CME):					
GBP	197201	198801	201502	Yield difference	GARCH(1,1)
EUR	197201	199901	201502	Yield difference	GARCH(1,1)
JPY	197201	198603	201502	Yield difference	GARCH(1,1)
CHF	197201	198502	201502	Yield difference	GARCH(1,1)
AUD	197201	198801	201502	Yield difference	GARCH(1,1)
CAD	197201	198606	201502	Yield difference	GARCH(1,1)
FX (JPM):					
9 Currencies (*1)	199001	199901	201412	Yield difference	GARCH(1,1)
Swaptions:					
5-, 10-, 20-yr tenor	199105	200207	201412	Forward swap rate	Monthly vol

*1 CAD, EUR, NOK, GBP, SEK, CHF, AUD, JPY, NZD

Table A3: Corporate Bond Historical Default Rates: 1970 — 2013

This table reports the historical cumulative default rates (in percent) of corporate bonds in our sample of firms from 1970 - 2013 and compares them with Moody's default frequencies, when available. The "Global" sample is an international sample of firms. The "US" sample only focuses on US firms. Booms and recessions are determined by NBER business cycle dates, and default rates are computed using US firms.

Moody's		Our Sample			
Rating	Global	Global	US	Boom	Recession
		Horizon: 30 days			
Aaa/Aa	-	0.00	0.00	0.00	0.00
A	-	0.00	0.00	0.00	0.01
Baa	-	0.00	0.00	0.00	0.01
Ba	-	0.04	0.05	0.04	0.11
B	-	0.19	0.22	0.19	0.43
Caa-	-	1.91	1.89	1.61	3.47
		Horizon: 91 days			
Aaa/Aa	-	0.00	0.00	0.00	0.01
A	-	0.01	0.01	0.00	0.03
Baa	-	0.02	0.02	0.01	0.04
Ba	-	0.17	0.19	0.16	0.38
B	-	0.67	0.75	0.65	1.48
Caa-	-	4.99	4.90	4.07	9.51
		Horizon: 183 days			
Aaa-Aa	-	0.00	0.00	0.00	0.03
A	-	0.02	0.01	0.01	0.05
Baa	-	0.05	0.05	0.04	0.12
Ba	-	0.42	0.47	0.40	0.91
B	-	1.55	1.69	1.47	3.33
Caa-C	-	9.04	8.88	7.25	17.73
		Horizon: 365 days			
Aaa-Aa	0.01	0.01	0.01	0.00	0.05
A	0.06	0.06	0.04	0.02	0.13
Baa	0.17	0.16	0.16	0.13	0.34
Ba	1.11	1.08	1.19	1.08	1.91
B	3.90	3.78	4.01	3.57	7.31
Caa-C	15.89	15.46	15.37	12.63	29.49
		Horizon: 730 days			
Aaa-Aa	0.04	0.04	0.03	0.02	0.05
A	0.20	0.19	0.16	0.14	0.25
Baa	0.50	0.47	0.47	0.43	0.66
Ba	3.07	2.94	3.23	3.15	3.76
B	9.27	8.72	9.16	8.67	12.81
Caa-C	27.00	25.13	25.18	21.93	41.37

Table A4: Default Frequencies of Two-Year Corporate Bonds and Pseudo Bonds

Panel A of this table reports *ex post* default frequencies of corporate bonds by credit rating category (shown in the first column.) The second column is the aggregate average, while columns 3 and 4 report default frequencies during NBER booms and recessions, respectively. The last two columns report the cutoff points used to assign pseudo credit ratings to pseudo bonds, which equal the mid-points of the default frequencies in columns 3 and 4. The exception is the final cut off for Caa- ratings, that is chosen as 150% the historical default rate for Caa- bonds. Panels B and C report the results of our credit rating system for single-stock and SPX pseudo bonds, respectively. Pseudo bonds are constructed from a portfolio of risk-free debt minus single-stock (Panel B) or SPX (Panel C) put options. Pseudo credit ratings of pseudo bonds are assigned based on the pseudo bond *ex ante* default probability, *i.e.* the probability the put option is in-the-money at maturity during booms and recessions. The *ex ante* default probabilities of pseudo bonds are computed from the empirical distribution of underlying asset returns. The first two columns of each Panel B and C report the *ex ante* average default probabilities for bonds in each pseudo credit rating category. The next three columns show the actual *ex post* default frequencies of the pseudo bonds across the pseudo credit ratings and their confidence intervals. The *ex post* default frequency is computed as the fraction of times that the two-year return (excluding dividends) on stock prices falls below the given moneyness of the pseudo bonds in each portfolio. The last two columns report the average moneyness of the options $\overline{K/A}$, and the average maturity $\overline{\tau}$ in days. *Ex ante* probabilities of default are computed using asset prices from 1946 to the prediction date, while *ex post* frequencies are from 1970 to 2014.

Panel A: Corporate Bonds

Credit Rating	Historical Default Frequencies: Mean	Boom	Recession	Pseudo Rating Cutoffs: Boom	Recession
Aaa/Aa	0.03	0.02	0.05	[0.00, 0.15)	[0.00, 0.26)
A/Baa	0.31	0.28	0.47	[0.15, 1.72)	[0.26, 2.12)
Ba	3.23	3.15	3.76	[1.72, 5.91)	[2.12, 8.29)
B	9.16	8.67	12.81	[5.91, 15.3)	[8.29, 27.1)
Caa-	25.18	21.93	41.37	[15.3, 32.9]	[27.1, 62.1]

Panel B: Pseudo Bonds (Single-Stock)

	Ex ante Def. Prob.		*Ex post* Def. Prob.				
	Boom	Recession	Mean	C.I.(2.5%)	C.I.(97.5%)	$\overline{K/A}$	$\overline{\tau}$
Aaa/Aa	0.12	0.21	0.16	0.00	0.34	0.46	620
A/Baa	1.21	1.59	0.62	0.00	1.27	0.53	625
Ba	3.98	5.75	3.32	0.82	5.83	0.62	642
B	10.49	17.36	8.58	3.94	13.22	0.76	657
Caa-	22.74	36.39	23.69	17.31	30.08	0.93	668

Panel C: Pseudo Bonds (SPX)

	Ex ante Def. Prob.		*Ex post* Def. Prob.				
	Boom	Recession	Mean	C.I.(2.5%)	C.I.(97.5%)	$\overline{K/A}$	$\overline{\tau}$
Aaa/Aa	0.02	0.01	1.94	0.00	4.65	0.40	674
A/Baa	0.99	1.27	2.13	0.00	5.18	0.61	621
Ba	3.49	4.95	6.98	0.07	13.89	0.73	627
B	10.16	18.08	12.60	1.24	23.96	0.83	638
Caa-	23.81	45.03	19.57	5.31	33.83	0.94	644

Table A5: Corporate LGDs: 1982 - 2013

The average corporate recovery rate for senior unsecured bonds, based on rating 2 years before the default. As Aaa-rated bonds have a few defaults, the recovery rate for Aaa/Aa is based on Aa bonds. The recovery rate of A/Baa is the average between A and Baa. The recovery rate in booms is 1.05 multiplied by the average, while the recovery rate in recessions is 0.73 multiplied by the average.

	Recovery rates for Corporate Bonds			LGDs for Corporate Bonds		
	Average	Boom	Recession	Average	Boom	Recession
Aaa/Aa	0.39	0.41	0.28	0.61	0.59	0.72
A/Baa	0.42	0.44	0.31	0.58	0.56	0.69
Ba	0.44	0.46	0.32	0.56	0.54	0.68
B	0.37	0.39	0.27	0.63	0.61	0.73
Caa-	0.37	0.39	0.27	0.63	0.61	0.73

Table A6: **The Impact of Levered Equity on Pseudo Firm Credit Spreads in Merton Model: Low Asset Volatility**
This table reports the results of the following experiment. Start with a "Merton firm" with log-normally distributed assets financed by zero-coupon debt, with face value K and maturity T, and equity. Equity is a call option on the firm. We create a pseudo firm from the equity of the "Merton firm" as its assets whose pseudo debt has mauturity $\tau = 2 < T$, as is in our data. We consider three values of maturity of Merton firm maturity T (10, 5, and 2.5) and two values of asset volatility ($\sigma_V = 10\%$ and $\sigma_V = 20\%$). In each panel, we report the corporate quantities from the data – if available – the empirical quantities for pseudo firms in the data, and finally the theoretical implications from the experiment. For these, we report the simulation results for the underlying Merton firm with debt maturity T, another equivalent Merton firm with debt maturity $\tau =$ two-years with otherwise the same fundamentals except that its leverage is adjusted to match the two-year default probability in the first column, and finally the "theoretical" two-year pseudo firm built on the theoretical T-year Merton firm's equity. To be conservative and avoid adding more parameters, we match Merton firms' risk-neutral probabilities to the true default frequencies in the first column. Panel A reports credit spreads, Panel B and C the skewness and excess kurtosis of leveraged equity, and Panel D the loss-given-default (LGDs).

Panel A: Credit Spreads (bps)

			Data		$T = 10$, $\sigma_V = .1$			$T = 5$, $\sigma_V = .1$			$T = 2.5$, $\sigma_V = .1$		
Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03	71.00	68.00	42.00	0.13	0.06	0.14	0.09	0.05	0.17	0.06	0.06	0.43
Baa/A	0.31	121.00	171.00	119.00	1.58	0.64	1.87	1.07	0.60	3.15	0.74	0.64	6.83
Ba	3.23	293.00	308.00	209.00	22.01	8.46	33.14	14.69	8.31	47.07	9.90	8.65	88.18
B	9.16	512.00	514.00	325.00	73.82	28.38	129.28	49.72	28.36	174.03	33.09	29.03	286.65
Caa+	25.18	956.00	862.00	496.00	242.23	100.14	555.36	171.12	99.45	671.17	115.94	101.31	975.71

Panel B: Skewness of Equity Returns

Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03		-0.11	-0.31	0.00	0.00	-0.06	0.00	0.01	-0.11	0.00	-0.01	-0.59
Baa/A	0.31		-0.11	-0.31	0.00	0.00	-0.10	0.00	0.01	-0.19	0.00	-0.01	-1.86
Ba	3.23		-0.11	-0.31	0.00	0.00	-0.16	0.00	0.01	-0.34	0.00	-0.01	-3.77
B	9.16		-0.11	-0.31	0.00	0.00	-0.17	0.00	0.01	-0.39	0.00	-0.01	-3.71
Caa+	25.18		-0.11	-0.31	0.00	0.00	-0.16	0.00	0.01	-0.39	0.00	-0.01	-3.01

Panel C: Kurtosis of Equity Returns

Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03		-0.19	-0.34	-0.01	-0.01	0.12	0.00	-0.01	0.39	0.01	0.02	6.73
Baa/A	0.31		-0.19	-0.34	-0.01	-0.01	0.27	0.00	-0.01	0.97	0.01	0.02	29.92
Ba	3.23		-0.19	-0.34	-0.01	-0.01	0.56	0.00	-0.01	1.96	0.01	0.02	48.43
B	9.16		-0.19	-0.34	-0.01	-0.01	0.59	0.00	-0.01	2.05	0.01	0.02	35.20
Caa+	25.18		-0.19	-0.34	-0.01	-0.01	0.44	0.00	-0.01	1.60	0.01	0.02	18.93

Panel D: Loss-Given-Default (LGD)

Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03	61.00	49.60	10.20	8.15	2.45	9.71	5.35	1.87	11.34	3.29	1.75	28.38
Baa/A	0.31	57.00	44.70	10.20	10.07	2.75	11.80	7.12	2.86	20.07	4.61	2.74	42.39
Ba	3.23	59.00	32.10	14.90	14.36	4.10	20.35	9.33	4.07	28.90	6.05	4.09	53.03
B	9.16	56.00	27.30	15.10	18.68	5.19	27.84	11.48	5.23	37.14	7.18	5.22	60.06
Caa+	25.18	63.00	25.00	18.00	28.15	7.25	41.71	15.95	7.23	49.67	9.28	7.25	69.69

Table A7: **The Impact of Levered Equity on Pseudo Firm Credit Spreads in Merton Model: High Asset Volatility**

This table reports the results of the following experiment. Start with a "Merton firm" with log-normally distributed assets financed by zero-coupon debt, with face value K and maturity T, and equity. Equity is a call option on the firm. We create a pseudo firm from the equity of the "Merton firm" as its assets whose pseudo debt has mauturity $\tau = 2 < T$, as is in our data. We consider three values of maturity of Merton firm maturity T (10, 5, and 2.5) and two values of asset volatility ($\sigma_V = 10\%$ and $\sigma_V = 20\%$). In each panel, we report the corporate quantities from the data – if available – the empirical quantities for pseudo firms in the data, and finally the theoretical implications from the experiment. For these, we report the simulation results for the underlying Merton firm with debt maturity T, another equivalent Merton firm with debt maturity τ = two-years with otherwise the same fundamentals except that its leverage is adjusted to match the two-year default probability in the first column, and finally the "theoretical" two-year pseudo firm built on the theoretical T-year Merton firm's equity. To be conservative and avoid adding more parameters, we match Merton firms' risk-neutral probabilities to the true default frequencies in the first column. Panel A reports credit spreads, Panel B and C the skewness and excess kurtosis of leveraged equity, and Panel D the loss-given-default (LGDs).

Panel A: Credit Spreads

		Data			$T = 10$, $\sigma_V = .2$			$T = 5$, $\sigma_V = .2$			$T = 2.5$, $\sigma_V = .2$		
Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03	71.00	68.00	42.00	0.24	0.09	0.17	0.17	0.09	0.25	0.12	0.11	0.57
Baa/A	0.31	121.00	171.00	119.00	2.90	1.21	2.17	2.03	1.29	3.30	1.41	1.25	6.67
Ba	3.23	293.00	308.00	209.00	39.35	16.46	35.47	27.20	16.55	48.10	18.57	16.10	88.21
B	9.16	512.00	514.00	325.00	130.79	54.40	133.81	91.20	54.60	174.74	62.02	54.51	286.40
Caa+	25.18	956.00	862.00	496.00	432.36	190.23	559.47	312.81	188.93	673.63	216.15	190.30	972.78

Panel B: Skewness of Equity Returns

Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03		-0.11	-0.31	0.00	0.01	-0.02	0.01	0.00	-0.07	-0.02	-0.01	-0.38
Baa/A	0.31		-0.11	-0.31	0.00	0.01	-0.05	0.01	0.00	-0.13	-0.02	-0.01	-1.34
Ba	3.23		-0.11	-0.31	0.00	0.01	-0.11	0.01	0.00	-0.28	-0.02	-0.01	-3.25
B	9.16		-0.11	-0.31	0.00	0.01	-0.13	0.01	0.00	-0.35	-0.02	-0.01	-3.40
Caa+	25.18		-0.11	-0.31	0.00	0.01	-0.14	0.01	0.00	-0.37	-0.02	-0.01	-2.88

Panel C: Kurtosis of Equity Returns

Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03		-0.19	-0.34	0.01	0.00	0.03	-0.01	0.02	0.18	-0.01	-0.01	4.22
Baa/A	0.31		-0.19	-0.34	0.01	0.00	0.10	-0.01	0.02	0.50	-0.01	-0.01	20.46
Ba	3.23		-0.19	-0.34	0.01	0.00	0.33	-0.01	0.02	1.35	-0.01	-0.01	40.15
B	9.16		-0.19	-0.34	0.01	0.00	0.43	-0.01	0.02	1.64	-0.01	-0.01	31.20
Caa+	25.18		-0.19	-0.34	0.01	0.00	0.38	-0.01	0.02	1.46	-0.01	-0.01	17.54

Panel D: Loss-Given-Default (LGD)

Credit Ratings	Def. Prob.	Corporate	Pseudo Single-Stock	Pseudo SPX	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo	Merton (T)	Merton (2)	Pseudo
Aaa/Aa	0.03	61	49.6	10.2	15.86	2.84	11.72	11.98	2.53	15.97	7.55	2.55	35.22
Baa/A	0.31	57	44.7	10.2	18.74	3.67	13.68	13.20	3.72	20.78	8.56	3.42	41.83
Ba	3.23	59	32.1	14.9	25.38	5.95	21.79	17.01	5.81	29.53	11.47	5.83	53.71
B	9.16	56	27.3	15.1	32.15	7.94	28.82	20.72	7.88	37.35	13.62	7.96	60.41
Caa+	25.18	63	25	18	45.84	12.03	42.03	28.03	11.90	49.99	17.27	12.02	69.93

Table A8: Firm-by-Firm Matched Comparison of Pseudo Spreads, Corporate Bond Spreads, and CDS Spreads.

This table contains the firm-by-firm comparison of pseudo bonds, corporate bonds, and credit default swaps. We consider firms in the S&P500 – to ensure highly liquid underlying options – and in the CDX index – to ensure high liquid underlying corporate bonds. For each firm in the intersection of these portfolios, we construct a pseudo firm from its equity so as to match its credit rating. We report the average pseudo spreads, corporate bond spreads, and CDS spreads for this (small) set of firms. We are not able to fill data for Aaa/Aa, because it requires extreme OTM options that are not available for this set of firm highly rated firms.

	Pseudo Credit Spreads			Corporate Bonds			Credit Default Swaps		
	AvgSp	Boom	Recess	AvgSp	Boom	Recess	AvgSp	Boom	Recess
Aaa/Aa	-	-	-	-	-	-	-	-	-
A/Baa	146	139	201	136	114	295	59	54	101
Ba	317	311	404	349	340	455	283	273	411
B	514	493	717	414	394	594	372	359	501
Caa-	-	-	-	-	-	-	-	-	-

Table A9: Pseudo Spreads and Future Economic Growth

This table reports the results of the following predictive regression:

$$\Delta_h Y_{t+h} = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \gamma_1 \text{ Pseudo Spread}_t + \gamma_2 \text{ GZ Spread}_t + \mathit{Controls}_t + \varepsilon_{t+h}$$

where Δ_h is the "h-period" lag operator, Pseudo Spread$_t$ is the option-based pseudo spread index, GZ Spread$_t$ is Gilchrist Zakrajsek (2012) spread, or its orthogonal component to the Pseudo Spread$_t$ when the latter is in the same regression, and "Controls" include the term spread, the real Federal Funds rate, and the option-implied "fear gauge" VIX. The number of lags p is determined by the Akaike Information Criterion. The pseudo spread is computed separately for SPX pseudo bonds and single-stock pseudo bonds, and for each case reflects the equally weighted average of HY and IG spreads with 6-months, 1-year, and 2-year maturities (6 series). The prediction horizon is either $h = 3$ months or $h = 12$ months. The predicted economic variables are in the title of each panel. Frequency is monthly except for Panel D, where it is quarterly. All regression coefficients are multiplied by 100. Hodrick-adjusted t-statistics are in parenthesis.

Panel A: Single Stocks Pseudo Spreads (January 1996 to June 2015)

A1: Payroll Growth

	h = 3 months						h= 12 months					
Pseudo Spread	-0.18		-0.22	-0.19		-0.28	-0.78		-0.91	-1.11		-1.51
t-stat	-3.05		-2.91	-3.13		-3.47	-4.32		-4.87	-4.32		-5.28
GZ Spread		-0.28	-0.19		-0.33	-0.24		-1.11	-0.57		-1.66	-1.05
t-stat		-2.79	-1.71		-3.33	-2.26		-5.06	-3.20		-5.80	-5.27
Term Spread				0.05	-0.02	-0.01				0.13	-0.11	-0.11
t-stat				0.86	-0.37	-0.25				1.01	-0.83	-0.84
Real FFR				0.01	-0.03	-0.02				-0.09	-0.26	-0.25
t-stat				0.46	-1.06	-0.92				-1.17	-3.13	-2.98
VIX				0.00	0.01	0.01				0.08	0.08	0.11
t-stat				0.54	1.17	1.52				3.41	4.47	4.47
R^2	0.80	0.82	0.83	0.81	0.83	0.84	0.64	0.63	0.66	0.71	0.70	0.77

A2: Unemployment Rate Change

Pseudo Spread	13.26		15.36	14.41		21.29	51.38		52.94	75.48		97.03
t-stat	2.70		2.73	2.74		3.45	3.97		3.95	3.97		4.58
GZ Spread		17.81	11.58		24.78	20.11		51.14	8.85		98.06	61.30
t-stat		2.64	1.66		3.62	2.81		3.62	0.60		4.85	3.62
Term Spread				-5.29	-0.53	-0.52				-11.89	-0.77	1.45
t-stat				-1.01	-0.11	-0.10				-0.74	-0.05	0.09
Real FFR				-0.40	4.10	3.80				11.07	25.34	23.86
t-stat				-0.14	1.48	1.38				1.26	2.58	2.44
VIX				-0.23	-0.52	-0.82				-4.79	-4.23	-6.73
t-stat				-0.35	-1.00	-1.33				-2.54	-2.75	-3.31
R^2	0.50	0.51	0.53	0.51	0.57	0.58	0.46	0.37	0.46	0.60	0.59	0.67

A3: Industrial Production Growth

Pseudo Spread	-0.76		-0.89	-0.99		-1.37	-2.59		-2.61	-4.40		-5.48
t-stat	-3.62		-3.68	-3.70		-4.53	-3.78		-3.95	-3.98		-4.55
GZ Spread		-0.97	-0.52		-1.29	-0.85		-2.10	-0.10		-4.25	-2.34
t-stat		-3.44	-1.72		-4.49	-3.03		-3.58	-0.15		-4.65	-3.11
Term Spread				0.39	0.35	0.31				1.20	1.26	0.93
t-stat				1.94	1.80	1.58				1.91	1.97	1.46
Real FFR				0.19	0.09	0.09				0.32	-0.06	-0.05
t-stat				1.76	0.88	0.88				0.92	-0.16	-0.15
VIX				0.04	0.04	0.07				0.34	0.27	0.46
t-stat				1.16	1.47	2.28				3.31	3.49	4.06
R^2	0.55	0.54	0.58	0.59	0.57	0.64	0.30	0.19	0.29	0.45	0.30	0.49

A4: GDP Growth

Pseudo Spread	-0.21		-0.22	-0.44		-0.54	-0.52		-0.48	-1.38		-1.63
t-stat	-1.86		-2.08	-2.13		-2.62	-2.07		-2.01	-3.26		-3.45
GZ Spread		-0.16	-0.02		-0.39	-0.20		-0.28	0.17		-1.14	-0.54
t-stat		-1.89	-0.12		-2.68	-1.31		-1.19	0.46		-2.88	-1.39
Term Spread				0.14	0.12	0.11				0.68	0.63	0.61
t-stat				1.24	1.12	1.06				1.98	1.73	1.68
Real FFR				0.08	0.03	0.04				0.30	0.15	0.20
t-stat				1.28	0.44	0.80				1.84	0.79	1.13
VIX				0.04	0.03	0.05				0.14	0.12	0.17
t-stat				1.75	2.23	2.34				2.75	2.46	2.93
R^2	0.20	0.16	0.18	0.29	0.22	0.31	0.14	0.10	0.13	0.35	0.24	0.36

Table A9: (cntd.) Pseudo Spreads and Future Economic Growth

Panel B: SPX Pseudo Spreads (January 1990 to June 2015)

	h = 3 months						h= 12 months					
B1: Payroll Growth												
Pseudo Spread	-0.12		-0.14	-0.16		-0.25	-0.56		-0.67	-0.99		-1.48
t-stat	-2.82		-2.66	-2.49		-3.11	-3.94		-4.13	-3.11		-3.73
GZ Spread		-0.16	-0.11		-0.17	-0.16		-0.77	-0.54		-1.02	-0.91
t-stat		-2.24	-1.49		-2.18	-1.96		-4.10	-3.09		-4.10	-3.96
Term Spread				0.05	0.00	-0.01				0.29	0.08	-0.05
t-stat				1.40	0.10	-0.14				2.64	0.66	-0.40
Real FFR				0.00	-0.03	-0.04				-0.06	-0.22	-0.29
t-stat				0.09	-1.27	-1.85				-0.90	-2.85	-3.62
VIX				0.01	0.00	0.02				0.08	0.03	0.13
t-stat				0.65	-0.12	1.57				2.33	2.02	3.11
R^2	0.74	0.75	0.76	0.75	0.76	0.78	0.54	0.56	0.57	0.61	0.63	0.68
B2: Unemployment Rate Change												
Pseudo Spread	9.71		10.59	12.97		21.10	34.32		36.32	72.65		106.34
t-stat	2.51		2.48	2.26		2.96	3.14		3.11	3.06		3.67
GZ Spread		11.24	7.36		16.00	14.79		34.58	17.44		68.97	61.77
t-stat		2.18	1.45		2.71	2.54		2.67	1.36		3.77	3.58
Term Spread				-3.39	0.67	2.55				-13.51	0.25	10.91
t-stat				-0.83	0.16	0.59				-0.96	0.02	0.72
Real FFR				0.91	4.35	5.50				11.82	24.83	31.33
t-stat				0.39	1.73	2.12				1.50	2.62	3.22
VIX				-0.54	-0.17	-1.40				-6.10	-2.50	-9.74
t-stat				-0.65	-0.36	-1.67				-2.18	-1.71	-2.99
R^2	0.42	0.42	0.44	0.44	0.47	0.50	0.33	0.32	0.34	0.48	0.51	0.59
B3: Industrial Production Growth												
Pseudo Spread	-0.52		-0.62	-0.84		-1.37	-1.62		-1.84	-4.33		-6.23
t-stat	-3.28		-3.43	-2.62		-3.55	-3.09		-3.33	-3.00		-3.49
GZ Spread		-0.70	-0.51		-0.82	-0.79		-2.00	-1.34		-3.14	-2.97
t-stat		-3.23	-2.25		-3.27	-3.20		-3.53	-2.41		-3.70	-3.63
Term Spread				0.32	0.22	0.11				1.36	1.07	0.48
t-stat				2.00	1.44	0.67				2.51	1.87	0.82
Real FFR				0.12	0.00	-0.07				0.32	-0.09	-0.46
t-stat				1.27	0.01	-0.79				1.03	-0.25	-1.22
VIX				0.05	0.01	0.11				0.43	0.15	0.64
t-stat				1.12	0.54	2.24				2.59	2.21	3.20
R^2	0.39	0.42	0.43	0.42	0.43	0.48	0.18	0.19	0.21	0.31	0.27	0.41
B4: GDP Growth												
Pseudo Spread	-0.10		-0.12	-0.39		-0.52	-0.38		-0.41	-1.66		-2.11
t-stat	-1.23		-1.44	-1.20		-1.48	-1.60		-1.84	-2.41		-2.75
GZ Spread		-0.13	-0.10		-0.23	-0.21		-0.44	-0.30		-0.79	-0.69
t-stat		-1.93	-1.01		-1.94	-1.87		-2.32	-1.09		-2.26	-2.03
Term Spread				0.11	0.10	0.04				0.68	0.71	0.47
t-stat				1.11	1.22	0.43				2.15	2.01	1.38
Real FFR				0.04	0.02	-0.02				0.26	0.22	0.07
t-stat				0.64	0.35	-0.28				1.60	1.18	0.34
VIX				0.05	0.02	0.06				0.21	0.07	0.26
t-stat				1.10	1.33	1.38				2.34	1.53	2.65
R^2	0.13	0.13	0.13	0.17	0.14	0.19	0.09	0.10	0.09	0.29	0.19	0.32

Table A10: Pseudo Spread and Future Economic Growth: Subsample ending on 6/2005

See description of Table A9 for details.

Panel A: Single Stocks Pseudo Spreads (January 1996 to June 2005)

A1: Payroll Growth

	h = 3 months						h= 12 months					
Pseudo Spread	-0.17		-0.19	-0.19		-0.23	-0.74		-0.94	-0.80		-1.19
t-stat	-3.29		-3.61	-2.92		-3.52	-5.56		-5.76	-5.52		-5.89
GZ Spread		-0.20	-0.10		-0.22	-0.12		-1.18	-0.96		-1.43	-1.20
t-stat		-3.14	-1.00		-2.78	-1.12		-5.26	-3.62		-5.28	-4.13
Term Spread				0.08	-0.01	0.02				0.55	-0.52	-0.36
t-stat				0.82	-0.08	0.24				1.32	-1.38	-0.96
Real FFR				0.02	-0.02	-0.01				0.12	-0.47	-0.37
t-stat				0.31	-0.44	-0.14				0.60	-2.24	-1.82
VIX				0.01	0.00	0.01				0.04	0.05	0.06
t-stat				0.97	0.71	1.42				2.08	2.18	2.78
R^2	0.81	0.79	0.82	0.82	0.79	0.84	0.72	0.82	0.83	0.76	0.88	0.90

A2: Unemployment Rate Change

Pseudo Spread	13.73		14.11	13.76		14.98	43.48		45.49	51.66		61.81
t-stat	2.72		2.75	2.26		2.42	3.82		3.79	3.46		3.47
GZ Spread		12.03	4.30		12.19	5.71		47.10	32.42		72.85	61.55
t-stat		2.20	0.62		2.05	0.83		2.93	1.71		3.23	2.76
Term Spread				-7.30	-4.35	-5.26				-35.23	16.27	8.55
t-stat				-0.71	-0.43	-0.52				-1.03	0.53	0.28
Real FFR				-2.71	-0.10	-1.08				-10.66	28.01	22.48
t-stat				-0.50	-0.02	-0.20				-0.57	1.54	1.31
VIX				-0.10	0.10	-0.29				-2.60	-2.61	-3.49
t-stat				-0.14	0.16	-0.41				-1.50	-1.43	-1.80
R^2	0.34	0.26	0.35	0.34	0.28	0.35	0.40	0.46	0.50	0.48	0.73	0.75

A3: Industrial Production Growth

Pseudo Spread	-0.57		-0.67	-0.65		-0.89	-1.89		-2.41	-2.07		-3.23
t-stat	-3.01		-3.29	-2.77		-3.47	-4.32		-4.67	-3.91		-4.27
GZ Spread		-0.77	-0.61		-0.99	-0.84		-3.26	-3.12		-4.56	-4.53
t-stat		-2.94	-1.90		-3.26	-2.40		-4.33	-3.45		-4.32	-4.14
Term Spread				0.59	0.48	0.49				3.33	1.14	1.16
t-stat				1.52	1.25	1.28				2.05	0.70	0.74
Real FFR				0.27	0.10	0.12				1.53	-0.29	-0.28
t-stat				1.31	0.47	0.57				1.75	-0.31	-0.32
VIX				0.02	0.03	0.05				0.08	0.18	0.18
t-stat				0.61	1.36	1.71				1.03	2.02	2.04
R^2	0.43	0.50	0.52	0.45	0.56	0.58	0.31	0.56	0.55	0.35	0.75	0.75

A4: GDP Growth

Pseudo Spread	-0.19		-0.21	-0.31		-0.39	-0.77		-0.84	-1.34		-1.60
t-stat	-1.30		-1.38	-1.58		-1.83	-2.33		-2.43	-2.84		-2.93
GZ Spread		-0.20	-0.16		-0.39	-0.34		-0.80	-0.64		-1.65	-1.44
t-stat		-1.43	-0.96		-1.83	-1.36		-2.43	-1.73		-2.90	-2.52
Term Spread				-0.10	-0.17	-0.16				0.85	-0.67	-0.39
t-stat				-0.42	-0.77	-0.71				0.65	-0.49	-0.29
Real FFR				-0.07	-0.17	-0.15				0.35	-0.74	-0.55
t-stat				-0.68	-1.59	-1.43				0.55	-1.03	-0.81
VIX				0.03	0.04	0.04				0.14	0.15	0.16
t-stat				1.68	2.16	2.21				2.60	2.55	2.71
R^2	0.15	0.18	0.16	0.13	0.23	0.22	0.19	0.25	0.24	0.30	0.56	0.56

Table A10: (cntd.) Pseudo Spread and Future Economic Growth: Subsample ending on 6/2005

Panel B: SPX Pseudo Spreads (January 1990 to June 2005)

	h = 3 months						h= 12 months					
B1: Payroll Growth												
Pseudo Spread	-0.08		-0.09	-0.09		-0.14	-0.41		-0.46	-0.22		-0.63
t-stat	-2.38		-2.53	-1.23		-1.89	-3.82		-4.14	-1.18		-3.18
GZ Spread		-0.10	-0.06		-0.09	-0.10		-0.67	-0.55		-0.74	-0.76
t-stat		-1.87	-1.03		-1.34	-1.46		-3.61	-2.61		-2.92	-3.03
Term Spread				0.05	0.03	0.00				0.46	-0.02	-0.12
t-stat				0.74	0.43	0.06				1.66	-0.08	-0.41
Real FFR				0.00	-0.02	-0.04				0.05	-0.29	-0.34
t-stat				-0.05	-0.47	-0.81				0.30	-1.46	-1.79
VIX				0.00	0.00	0.01				0.00	0.02	0.05
t-stat				0.46	0.04	1.21				-0.17	0.80	1.88
R^2	0.68	0.67	0.69	0.69	0.69	0.71	0.52	0.56	0.58	0.57	0.65	0.66
B2: Unemployment Rate Change												
Pseudo Spread	6.34		6.46	3.36		6.15	21.70		22.34	5.04		24.86
t-stat	2.12		2.13	0.64		1.01	2.05		2.08	0.28		1.21
GZ Spread		6.04	3.54		4.82	5.10		26.92	20.06		35.27	35.95
t-stat		1.47	0.80		0.93	0.97		1.78	1.24		1.77	1.79
Term Spread				-6.39	-5.08	-3.80				-41.68	-16.09	-12.68
t-stat				-0.86	-0.66	-0.49				-1.53	-0.58	-0.47
Real FFR				-1.75	-0.42	0.30				-8.18	10.76	12.66
t-stat				-0.43	-0.09	0.07				-0.52	0.62	0.75
VIX				0.25	0.27	-0.20				0.78	-1.11	-2.22
t-stat				0.32	0.50	-0.23				0.30	-0.59	-0.77
R^2	0.22	0.20	0.22	0.23	0.24	0.24	0.22	0.23	0.25	0.37	0.46	0.46
B3: Industrial Production Growth												
Pseudo Spread	-0.36		-0.38	-0.36		-0.74	-1.14		-1.25	-0.46		-2.13
t-stat	-2.68		-2.88	-1.34		-2.70	-2.54		-2.74	-0.59		-2.46
GZ Spread		-0.53	-0.43		-0.59	-0.63		-2.16	-1.96		-2.78	-2.86
t-stat		-3.00	-1.98		-2.30	-2.52		-3.46	-2.80		-3.16	-3.26
Term Spread				0.20	0.05	-0.07				0.59	-1.00	-1.19
t-stat				0.63	0.16	-0.22				0.55	-0.88	-1.08
Real FFR				0.08	-0.07	-0.14				0.06	-1.20	-1.32
t-stat				0.46	-0.40	-0.78				0.10	-1.62	-1.83
VIX				0.00	0.01	0.06				-0.09	0.06	0.17
t-stat				0.12	0.22	1.69				-0.77	0.66	1.33
R^2	0.20	0.24	0.26	0.19	0.25	0.28	0.15	0.30	0.31	0.17	0.39	0.40
B4: GDP Growth												
Pseudo Spread	-0.04		-0.04	-0.11		-0.24	-0.24		-0.25	-0.80		-1.44
t-stat	-0.44		-0.46	-0.53		-1.13	-0.78		-0.80	-1.34		-2.20
GZ Spread		-0.07	-0.07		-0.19	-0.20		-0.39	-0.35		-0.88	-0.98
t-stat		-0.70	-0.55		-1.31	-1.43		-1.34	-1.03		-1.96	-2.17
Term Spread				-0.19	-0.24	-0.28				-0.40	-0.85	-1.16
t-stat				-1.04	-1.41	-1.52				-0.59	-1.06	-1.55
Real FFR				-0.13	-0.19	-0.21				-0.32	-0.70	-0.89
t-stat				-1.42	-2.01	-2.03				-0.90	-1.50	-2.02
VIX				0.01	0.01	0.03				0.09	0.06	0.19
t-stat				0.44	1.07	1.20				1.19	1.26	2.20
R^2	0.08	0.09	0.07	0.06	0.09	0.08	0.03	0.06	0.05	0.03	0.11	0.19

Table A11: Pseudo Spread and Future Economic Growth: Subsample 7/2005 - 6/2015

See description of Table A9 for details.

Panel A: Single Stocks Pseudo Spreads (July 2005 to June 2015)

	h = 3 months						h= 12 months					
A1: Payroll Growth												
Pseudo Spread	-0.17		-0.25	-0.15		-0.33	-0.80		-0.78	-1.18		-1.65
t-stat	-2.31		-2.14	-1.69		-2.26	-3.49		-3.49	-2.94		-3.38
GZ Spread		-0.32	-0.30		-0.44	-0.47		-1.04	0.05		-1.97	-1.15
t-stat		-2.16	-1.47		-2.26	-1.94		-3.49	0.20		-3.51	-3.93
Term Spread				0.03	-0.11	-0.11				-0.29	-0.73	-0.61
t-stat				0.34	-1.32	-1.36				-1.27	-2.62	-2.50
Real FFR				-0.02	-0.11	-0.12				-0.45	-0.83	-0.68
t-stat				-0.50	-2.20	-2.10				-2.83	-3.83	-3.99
VIX				-0.01	0.01	0.01				0.07	0.07	0.11
t-stat				-0.38	0.79	0.54				1.81	2.28	2.38
R^2	0.79	0.83	0.83	0.80	0.87	0.87	0.60	0.53	0.60	0.72	0.70	0.76
A2: Unemployment Rate Change												
Pseudo Spread	13.49		18.47	14.57		33.06	54.72		50.98	86.74		125.83
t-stat	2.07		2.17	1.86		2.86	3.22		3.02	2.83		3.36
GZ Spread		24.17	23.51		44.05	45.51		55.17	-18.18		137.44	89.09
t-stat		2.16	1.64		2.96	2.65		2.79	-0.75		3.61	3.68
Term Spread				-3.77	8.23	8.42				16.50	42.91	39.35
t-stat				-0.47	0.97	1.00				0.58	1.45	1.36
Real FFR				1.63	11.49	11.84				37.46	67.70	57.05
t-stat				0.34	2.00	2.03				1.88	3.02	2.80
VIX				-0.06	-1.77	-1.67				-4.98	-5.12	-8.80
t-stat				-0.05	-1.81	-1.40				-1.46	-1.93	-2.22
R^2	0.55	0.62	0.61	0.56	0.73	0.73	0.46	0.36	0.46	0.66	0.66	0.72
A3: Industrial Production Growth												
Pseudo Spread	-0.87		-0.94	-1.23		-1.85	-3.01		-2.41	-6.21		-7.54
t-stat	-3.01		-2.68	-2.57		-3.01	-3.09		-2.74	-3.26		-3.12
GZ Spread		-1.12	-0.33		-1.82	-1.18		-2.41	2.72		-6.37	-2.51
t-stat		-2.46	-0.54		-2.81	-1.90		-2.45	2.30		-2.89	-1.87
Term Spread				0.22	0.08	0.08				-1.04	-1.35	-1.35
t-stat				0.77	0.26	0.28				-0.97	-1.17	-1.17
Real FFR				0.09	-0.07	0.00				-1.18	-1.82	-1.41
t-stat				0.58	-0.40	0.00				-1.42	-1.86	-1.58
VIX				0.06	0.07	0.13				0.55	0.36	0.69
t-stat				0.92	1.40	1.84				3.05	2.69	3.06
R^2	0.58	0.54	0.58	0.60	0.57	0.64	0.35	0.18	0.38	0.57	0.31	0.58
A4: GDP Growth												
Pseudo Spread	-0.34		-0.32	-0.51		-0.69	-0.92		-0.69	-1.29		-1.21
t-stat	-2.23		-2.47	-1.67		-1.97	-2.79		-2.37	-2.57		-2.15
GZ Spread		-0.23	0.10		-0.49	-0.28		-0.21	0.96		-0.46	0.13
t-stat		-1.84	0.37		-1.84	-1.18		-0.70	1.65		-0.97	0.28
Term Spread				-0.01	-0.06	-0.08				-0.43	-0.34	-0.40
t-stat				-0.04	-0.30	-0.36				-0.78	-0.63	-0.73
Real FFR				-0.04	-0.12	-0.08				-0.73	-0.81	-0.71
t-stat				-0.31	-0.83	-0.66				-1.31	-1.42	-1.30
VIX				0.03	0.03	0.06				0.05	-0.04	0.04
t-stat				0.88	0.97	1.34				0.81	-0.77	0.57
R^2	0.23	0.08	0.22	0.26	0.09	0.26	0.19	-0.02	0.26	0.45	0.23	0.44

Table A11: (cntd.) Pseudo Spread and Future Economic Growth: Subsample 7/2005 - 6/2015

Panel B: SPX Pseudo Spreads (July 2005 to June 2015)

	h = 3 months						h= 12 months					
B1: Payroll Growth												
Pseudo Spread	-0.19		-0.27	-0.24		-0.38	-0.79		-0.88	-1.99		-2.34
t-stat	-2.56		-2.19	-2.23		-2.70	-3.61		-3.53	-3.26		-3.42
GZ Spread		-0.32	-0.33		-0.44	-0.42		-1.04	-0.38		-1.97	-1.02
t-stat		-2.16	-1.38		-2.26	-1.58		-3.49	-1.21		-3.51	-2.90
Term Spread				0.03	-0.11	-0.10				-0.22	-0.73	-0.53
t-stat				0.40	-1.32	-1.16				-0.98	-2.62	-2.26
Real FFR				-0.03	-0.11	-0.11				-0.52	-0.83	-0.71
t-stat				-0.79	-2.20	-1.97				-3.06	-3.83	-3.84
VIX				0.00	0.01	0.01				0.17	0.07	0.19
t-stat				0.25	0.79	0.67				2.64	2.28	2.78
R^2	0.78	0.83	0.83	0.80	0.87	0.87	0.55	0.53	0.55	0.77	0.70	0.80
B2: Unemployment Rate Change												
Pseudo Spread	14.00		19.33	26.29		39.60	47.90		49.79	152.01		179.55
t-stat	2.09		2.17	2.35		3.12	2.91		2.89	3.16		3.41
GZ Spread		24.17	29.95		44.05	40.52		55.17	11.41		137.44	77.17
t-stat		2.16	1.73		2.96	2.17		2.79	0.42		3.61	2.86
Term Spread				-4.32	8.23	7.56				10.65	42.91	32.77
t-stat				-0.55	0.97	0.88				0.38	1.45	1.14
Real FFR				3.18	11.49	11.04				44.62	67.70	59.91
t-stat				0.64	2.00	1.89				2.17	3.02	2.84
VIX				-1.48	-1.77	-2.31				-12.97	-5.12	-15.02
t-stat				-0.84	-1.81	-1.43				-2.45	-1.93	-2.68
R^2	0.53	0.62	0.62	0.59	0.73	0.73	0.38	0.36	0.38	0.73	0.66	0.78
B3: Industrial Production Growth												
Pseudo Spread	-0.71		-0.92	-1.46		-2.14	-2.38		-2.01	-9.89		-11.02
t-stat	-2.74		-2.48	-2.27		-2.97	-2.72		-2.46	-3.15		-3.13
GZ Spread		-1.12	-0.96		-1.82	-1.38		-2.41	1.60		-6.37	-2.29
t-stat		-2.46	-1.33		-2.81	-2.00		-2.45	1.31		-2.89	-1.76
Term Spread				0.36	0.08	0.16				-0.19	-1.35	-0.55
t-stat				1.29	0.26	0.54				-0.20	-1.17	-0.55
Real FFR				0.07	-0.07	-0.04				-1.21	-1.82	-1.41
t-stat				0.42	-0.40	-0.21				-1.45	-1.86	-1.60
VIX				0.10	0.07	0.16				1.05	0.36	1.15
t-stat				1.03	1.40	1.70				3.09	2.69	3.11
R^2	0.51	0.54	0.54	0.55	0.57	0.60	0.25	0.18	0.25	0.65	0.31	0.66
B4: GDP Growth												
Pseudo Spread	-0.24		-0.23	-0.84		-0.92	-0.67		-0.42	-2.74		-2.37
t-stat	-1.86		-2.08	-1.33		-1.55	-2.11		-1.50	-2.46		-2.38
GZ Spread		-0.23	0.05		-0.49	-0.18		-0.21	1.61		-0.46	0.83
t-stat		-1.84	0.13		-1.84	-0.67		-0.70	1.82		-0.97	1.36
Term Spread				0.03	-0.06	-0.02				-0.36	-0.34	-0.15
t-stat				0.12	-0.30	-0.11				-0.66	-0.63	-0.29
Real FFR				-0.07	-0.12	-0.09				-0.80	-0.81	-0.67
t-stat				-0.47	-0.83	-0.75				-1.38	-1.42	-1.27
VIX				0.09	0.03	0.09				0.26	-0.04	0.22
t-stat				1.03	0.97	1.21				2.14	-0.77	2.01
R^2	0.12	0.08	0.10	0.27	0.09	0.26	0.09	-0.02	0.21	0.64	0.23	0.67

Table A12: Pseudo Bond Expected Losses and Risk Premium: Subsample ending on June 2005

This table reports the results of the following predictive regression:

$$\Delta_h Y_{t+h} = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \gamma_1 \text{Expected Loss Spread}_t + \gamma_2 \text{ Risk Premium}_t + \textit{Controls}_t + \varepsilon_{t+h}$$

where Δ_h is the "h-period" lag operator, Expected Loss Spread$_t$ is the index of actuarially fair, non-risk adjusted pseudo spread to compensate for the expected losses of pseudo bonds, and Pseudo Risk Premium$_t$ is the residual risk premiums of individual pseudo bonds, given by Risk Premium$_{it}$ = Pseudo Credit Spread$_{it}$ − Expected Loss Spread$_{it}$. "Controls" include the term spread, the real Federal Funds rate, and the option-implied "fear gauge" VIX. The number of lags p is determined by the Akaike Information Criterion. The Expected Loss Spread$_{it}$ (Pseudo Risk Premium$_{it}$) is computed separately for single-stock pseudo bonds (Panel A) and SPX pseudo bonds (Panel B), and for each case, it equals the equally weighted average of HY and IG pseudo bonds with 6-months, 1-year, and 2-year maturities (6 series). ΔR^2 is the increment in the (adjusted) R^2 from including the Risk Premium$_t$ in the regression. The prediction horizon is either $h = 3$ month or $h = 12$ months. The predicted economic variables are payroll growth (PAY), unemployment rate changes (UNEMP), industrial production growth (IPG), and real GDP growth (GDP). Frequency is monthly except for GDP growth, where it is quarterly. All regression coefficients are multiplied by 100. Hodrick-adjusted t-statistics are in parenthesis.

Panel A: Single Stocks (January 1996 - June 2005)

	h = 3 months				h = 12 months			
	PAY	UNEMP	IPG	GDP	PAY	UNEMP	IPG	GDP
Expected Loss Spread	-0.24	19.17	-0.87	-0.29	-0.83	60.14	-2.14	-1.44
t-stat	-2.61	2.40	-2.97	-1.57	-4.25	3.36	-3.86	-3.06
Pseudo Risk Premium	-0.12	3.25	-0.35	-0.36	-0.75	29.54	-1.97	-0.80
t-stat	-1.85	0.53	-1.15	-1.38	-4.23	1.98	-2.57	-1.19
TERM	0.08	-7.55	0.72	-0.12	0.53	-27.24	3.34	0.68
t-stat	0.84	-0.74	1.86	-0.47	1.33	-0.84	2.04	0.53
RFFR	0.05	-5.61	0.42	-0.09	0.13	-10.04	1.56	0.32
t-stat	0.93	-1.00	1.89	-0.75	0.62	-0.54	1.68	0.51
VIX	0.00	0.32	0.01	0.03	0.04	-1.36	0.07	0.12
t-stat	0.60	0.46	0.19	1.62	1.97	-0.87	0.86	1.94
R2	0.84	0.44	0.48	0.11	0.76	0.53	0.35	0.33

Panel B: SPX (January 1990 - June 2005)

	h = 3 months				h = 12 months			
	PAY	UNEMP	IPG	GDP	PAY	UNEMP	IPG	GDP
Expected Loss Spread	-0.44	36.97	-2.07	-0.38	-1.14	78.05	-1.89	-2.08
t-stat	-2.25	2.35	-3.14	-1.49	-2.75	2.36	-1.66	-2.72
Pseudo Risk Premium	0.01	-5.23	0.04	-0.04	0.05	-14.00	-0.11	-0.46
t-stat	0.17	-1.00	0.15	-0.17	0.23	-0.70	-0.13	-0.67
TERM	0.08	-8.67	0.43	-0.14	0.55	-46.67	0.88	-0.05
t-stat	1.21	-1.18	1.41	-0.78	1.93	-1.68	0.84	-0.08
RFFR	0.03	-3.01	0.20	-0.11	0.12	-10.83	0.22	-0.13
t-stat	0.62	-0.74	1.16	-1.15	0.73	-0.69	0.35	-0.39
VIX	0.00	0.75	-0.01	0.01	-0.02	1.91	-0.10	0.08
t-stat	-0.29	0.98	-0.39	0.32	-0.91	0.72	-0.88	1.00
R2	0.74	0.36	0.32	0.05	0.59	0.45	0.18	0.06

Table A13: Pseudo Bond Expected Losses and Risk Premium: Subsample July 2005 – June 2015

This table reports the results of the following predictive regression:

$$\Delta_h Y_{t+h} = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \gamma_1 \text{Expected Loss Spread}_t + \gamma_2 \text{ Risk Premium}_t + Controls_t + \varepsilon_{t+h}$$

where Δ_h is the "h-period" lag operator, Expected Loss Spread$_t$ is the index of actuarially fair, non-risk adjusted pseudo spread to compensate for the expected losses of pseudo bonds, and Pseudo Risk Premium$_t$ is the residual risk premiums of individual pseudo bonds, given by Risk Premium$_{it}$ = Pseudo Credit Spread$_{it}$ − Expected Loss Spread$_{it}$. "Controls" include the term spread, the real Federal Funds rate, and the option-implied "fear gauge" VIX. The number of lags p is determined by the Akaike Information Criterion. The Expected Loss Spread$_{it}$ (Pseudo Risk Premium$_{it}$) is computed separately for single-stock pseudo bonds (Panel A) and SPX pseudo bonds (Panel B), and for each case, it equals the equally weighted average of HY and IG pseudo bonds with 6-months, 1-year, and 2-year maturities (6 series). ΔR^2 is the increment in the (adjusted) R^2 from including the Risk Premium$_t$ in the regression. The prediction horizon is either $h = 3$ month or $h = 12$ months. The predicted economic variables are payroll growth (PAY), unemployment rate changes (UNEMP), industrial production growth (IPG), and real GDP growth (GDP). Frequency is monthly except for GDP growth, where it is quarterly. All regression coefficients are multiplied by 100. Hodrick-adjusted t-statistics are in parenthesis.

Panel A: Single Stocks (July 2005 - June 2015)

	h = 3 months				h = 12 months			
	PAY	UNEMP	IPG	GDP	PAY	UNEMP	IPG	GDP
Expected Loss Spread	-0.33	27.81	-1.15	-0.70	-1.82	141.73	-7.44	-1.49
t-stat	-2.45	2.55	-1.45	-1.68	-3.72	3.69	-2.88	-2.63
Pseudo Risk Premium	-0.07	9.12	-1.27	-0.50	-0.96	69.58	-5.72	-1.28
t-stat	-0.77	1.18	-3.04	-1.66	-2.53	2.36	-3.36	-2.54
TERM	0.02	-4.54	0.20	-0.01	-0.27	12.63	-0.75	-0.43
t-stat	0.30	-0.57	0.78	-0.02	-1.16	0.44	-0.77	-0.78
RFFR	-0.05	3.93	0.09	-0.05	-0.53	46.26	-1.13	-0.75
t-stat	-0.99	0.79	0.56	-0.37	-3.17	2.27	-1.40	-1.33
VIX	-0.01	0.36	0.06	0.05	0.06	-4.19	0.55	0.06
t-stat	-0.92	0.29	0.91	1.06	1.54	-1.24	3.05	1.07
R2	0.83	0.59	0.60	0.27	0.76	0.71	0.58	0.44

Panel B: SPX (July 2005 - June 2015)

	h = 3 months				h = 12 months			
	PAY	UNEMP	IPG	GDP	PAY	UNEMP	IPG	GDP
Expected Loss Spread	-0.56	58.82	-1.22	-0.78	-2.24	196.07	-8.46	-1.18
t-stat	-2.56	2.74	-0.90	-1.23	-3.72	3.70	-2.56	-1.49
Pseudo Risk Premium	-0.07	10.18	-1.55	-0.87	-1.86	131.34	-10.46	-3.59
t-stat	-0.55	0.68	-2.34	-1.28	-2.81	2.52	-3.18	-2.46
TERM	0.03	-4.80	0.33	0.02	-0.22	9.74	-0.35	-0.43
t-stat	0.35	-0.60	1.24	0.10	-0.97	0.34	-0.37	-0.77
RFFR	-0.04	4.09	0.05	-0.07	-0.53	45.87	-1.29	-0.82
t-stat	-0.92	0.83	0.30	-0.47	-3.09	2.25	-1.55	-1.41
VIX	-0.01	-0.04	0.11	0.09	0.16	-11.24	1.09	0.31
t-stat	-0.54	-0.02	1.19	1.02	2.26	-1.99	3.09	2.19
R2	0.82	0.62	0.55	0.25	0.77	0.74	0.65	0.72

Table A14: Pseudo Spreads and Future Economic Growth

This table reports the results of the following predictive regression:

$$\Delta_h Y_{t+h} = \alpha + \sum_{i=1}^{p} \beta_i \Delta Y_{t-i} + \gamma_1 \text{ SPX Spread}_t + \gamma_2 \text{ Pseudo Spread Difference}_t + Controls_t + \varepsilon_{t+h}$$

where Δ_h is the "h-period" lag operator, the "Pseudo Spread Difference" is the difference in pseudo spreads between single-stock and SPX indices. "Controls" include the term spread, the real Federal Funds rate, and the option-implied "fear gauge" VIX. The number of lags p is determined by the Akaike Information Criterion. The pseudo spread is computed separately for SPX pseudo bonds and single-stock pseudo bonds, and for each case reflects the equally weighted average of HY and IG spreads with 6-months, 1-year, and 2-year maturities (6 series). The risk premium component of a pseudo spread is the difference between the pseudo spread and spread as compensation of expected losses, the latter computed as default probability times the loss-given default. The risk premium index is then computed as the equally weighted average of HY and IG risk premia with 6-months, 1-year, and 2-year maturities (6 series). The prediction horizon is either $h = 3$ months or $h = 12$ months. The predicted economic variables are payroll growth (PAY), unemployment rate changes (UNEMP), industrial production growth (IPG), and real GDP growth (GDP). Frequency is monthly except for Panel D, where it is quarterly. All regression coefficients are multiplied by 100. Hodrick-adjusted t-statistics are in parenthesis.

Panel A: Subsample January 1996 – June 2005

	h = 3 months				h= 12 months			
	PAY	UNEMP	IPG	GDP	PAY	UNEMP	IPG	GDP
SPX Spread	-0.20	14.34	-0.48	-0.30	-0.72	41.69	-1.31	-1.78
t-stat	-2.08	1.69	-1.48	-1.39	-3.34	1.98	-1.55	-2.52
Single-Stock - SPX Spread	-0.19	13.67	-0.67	-0.31	-0.82	53.26	-2.15	-1.23
t-stat	-2.93	2.29	-2.76	-1.43	-5.39	3.45	-3.86	-2.49
TERM	0.08	-7.07	0.65	-0.10	0.59	-40.19	3.58	0.52
t-stat	0.79	-0.69	1.62	-0.35	1.50	-1.25	2.33	0.44
RFFR	0.01	-2.58	0.31	-0.07	0.15	-13.33	1.66	0.16
t-stat	0.24	-0.48	1.43	-0.53	0.78	-0.75	2.01	0.28
VIX	0.01	-0.17	0.00	0.03	0.03	-1.38	-0.02	0.20
t-stat	0.72	-0.17	-0.09	0.96	1.12	-0.52	-0.14	2.39
R^2	0.82	0.33	0.45	0.10	0.76	0.48	0.36	0.32

Panel B: Subsample July 2005 – June 2015

	PAY	UNEMP	IPG	GDP	PAY	UNEMP	IPG	GDP
SPX Spread	-0.23	25.84	-1.45	-0.78	-1.92	147.97	-9.85	-2.76
t-stat	-2.23	2.35	-2.26	-1.23	-3.33	3.23	-3.14	-2.39
Single-Stock - SPX Spread	-0.06	2.98	-1.04	-0.26	-0.40	23.35	-2.88	0.08
t-stat	-0.49	0.28	-2.02	-1.34	-1.49	1.03	-2.68	0.15
TERM	0.03	-4.05	0.25	0.00	-0.26	13.31	-0.55	-0.36
t-stat	0.35	-0.51	0.90	0.01	-1.16	0.47	-0.57	-0.67
RFFR	-0.03	2.97	0.09	-0.06	-0.51	43.33	-1.19	-0.80
t-stat	-0.67	0.59	0.55	-0.39	-3.01	2.12	-1.43	-1.37
VIX	0.00	-1.44	0.09	0.07	0.17	-12.58	1.02	0.27
t-stat	0.22	-0.81	0.95	0.87	2.65	-2.47	3.06	2.07
R2	0.80	0.59	0.60	0.28	0.78	0.74	0.69	0.63

Table A15: Default Frequencies of Short-Term Corporate Bonds and Pseudo Bonds

The left-hand-side of this table reports *ex post* default frequencies of corporate bonds with Moody's credit ratings reported in the first column across maturities. The mean is the aggregate average and columns 3 and 4 report default frequencies during NBER booms and recessions, respectively. The two panels on the right-hand-side report the results of our credit rating methodology for SPX and single-stock pseudo bonds. Pseudo bonds are constructed from a portfolio of risk-free debt minus put options on the SPX index or individual stocks. Pseudo credit ratings of pseudo bonds are assigned based on the pseudo bonds *ex ante* default probabilities (i.e. the probabilities that the put options are in the money at maturity) during booms and recession. In each subpanel, the first two columns report the *ex ante* average default probabilities for pseudo bonds in booms and recessions, respectively, for each pseudo credit rating. The next three columns show the actual *ex post* default frequencies of the pseudo bonds across the pseudo credit ratings, and their confidence intervals. The *ex post* default frequency is computed as the fraction of times the stock return (excluding dividends) drops below the portfolio moneyness in the sample. The last two columns collect the average leverage K/A of pseudo bonds, and their average time to maturity (days). The sample of underlying asset price for *ex post* default frequency is 1970 to 2013.

	Corporate Bonds			Pseudo Bonds (Single-Stock)							Pseudo Bonds (SPX)						
				Ex ante Def. Prob.		*Ex post* Default Frequency					*Ex ante* Def. Prob.		*Ex post* Default Frequency				
	Mean	Boom	Bust	Boom	Bust	Mean	C.I. (2.5%)	C.I. (97.5%)	$\overline{K/A}$	$\overline{\tau}$	Boom	Bust	Mean	C.I. (2.5%)	C.I. (97.5%)	$\overline{K/A}$	$\overline{\tau}$
							Target Maturity: 30 days										
IG	0.00	0.00	0.01								0.00	0.00	0.37	0.00	0.90	0.77	33
Ba	0.05	0.04	0.11	0.07	0.19	0.10	0.03	0.17	0.70	50		0.18	0.37	0.00	0.90	0.8	33
B	0.22	0.19	0.43	0.58	1.23	0.34	0.16	0.52	0.78	50	0.32	0.82	0.56	0.00	1.20	0.86	31
Caa-	1.89	1.61	3.47	1.65	3.64	1.96	1.48	2.44	0.83	50	1.55	3.52	2.41	1.09	3.73	0.91	33
							Target Maturity: 91 days										
IG	0.01	0.01	0.03	0.05	0.14	0.02	0.01	0.04	0.54	147	0.00	0.01	0.56	0.00	1.20	0.67	119
Ba	0.19	0.16	0.38	0.27	0.63	0.29	0.10	0.48	0.61	139	0.23	0.68	0.56	0.00	1.20	0.74	108
B	0.75	0.65	1.48	1.43	3.23	0.94	0.42	1.47	0.70	128	1.24	2.87	1.68	0.00	3.43	0.82	90
Caa-	4.90	4.07	9.51	4.16	9.66	4.39	2.98	5.79	0.78	119	4.27	9.86	7.26	3.52	11.01	0.88	85
							Target Maturity: 183 days										
Aaa/Aa	0.00	0.00	0.03	0.01	0.04	0.01	0.00	0.02	0.32	280	0.00	0.00	0.75	0.00	1.91	0.59	197
A/Baa	0.03	0.02	0.09	0.14	0.35	0.08	0.02	0.13	0.50	233	0.15	0.25	0.94	0.00	2.46	0.68	192
Ba	0.47	0.40	0.91	0.60	1.45	0.65	0.18	1.12	0.57	215	0.48	1.16	2.06	0.00	4.72	0.73	193
B	1.69	1.47	3.33	2.69	6.51	1.79	0.75	2.82	0.68	195	2.35	5.83	2.25	0.00	5.13	0.80	189
Caa-	8.88	7.25	17.73	7.59	18.25	7.32	4.87	9.76	0.79	182	7.63	18.34	8.24	2.56	13.92	0.87	183
							Target Maturity: 365 days										
Aaa/Aa	0.01	0.00	0.05	0.03	0.12	0.03	0.00	0.07	0.33	372	0.00	0.05	1.14	0.00	3.01	0.47	355
A/Baa	0.10	0.08	0.24	0.38	0.76	0.21	0.00	0.41	0.46	372	0.31	0.70	2.08	0.00	4.91	0.61	348
Ba	1.19	1.08	1.91	1.50	3.16	1.30	0.24	2.37	0.55	361	1.37	2.37	3.22	0.00	7.45	0.71	352
B	4.01	3.57	7.31	5.16	11.84	3.61	1.43	5.80	0.69	348	4.62	10.48	6.82	0.40	13.24	0.80	353
Caa-	15.37	12.63	29.49	13.29	29.78	13.04	8.73	17.36	0.84	329	13.02	33.33	13.45	3.25	23.64	0.87	348

Table A16: Assets as Shares of Individual Firms: Equivalent European Options

This table contains the pseudo spreads constructed from individual stocks as presented in the paper, except that pseudo bonds are computed from European-equivalent put options. European-equivalent put options are obtained from volatilities reported from OptionsMetrics. Columns 2 to 4 report the Gaussian-kernel weighted average credit spread of pseudo bonds, on average, and across booms and recessions.

	Average	Boom	Recession
Aaa/Aa	97	97	103
A/Baa	214	213	224
Ba	341	332	399
B	559	530	764
Caa-	899	840	1311

Table A17: Extensions: Types of Assets and Bankruptcy Costs. 1-year Pseudo Bonds.

Credit spreads and LGDs are shown for corporate bonds and for pseudo bonds with one year to maturity. Pseudo bonds are constructed from a portfolio of risk-free debt minus put options on the SPX index (column "SPX"), on individual stocks (column "Single Stocks"), on commodity futures (column "Commodities"), on foreign currency (column "Currencies"), swaptions (column "Fixed Income"), or single stocks for underlying firms with negligible leverage (column "Low Leverage"). Pseudo credit ratings of pseudo bonds are assigned based on the pseudo bond *ex ante* default probability, i.e. the probability the put option is in the money at maturity. In Panel B the LGDs are computed from the empirical distributions of asset returns. Panel C and D report credit spreads and *ex post* LGDs for pseudo bonds that contain bankruptcy costs calibrated to match corporate LGDs. In this case, pseudo bonds are constructed from a portfolio of risk-free debt, put options and digital put options, the latter approximated from traded put options. Corporate bonds are non-callable, level-coupon corporate bonds with times to maturity between 0.5 and 1.5 years. LGDs for corporate bonds are from Moody's. Sample periods vary: SPX and single stocks – 1/1996 to 8/2014; commodities – mid 1980s to 2/2015; foreign currencies – 1/1999 to 12/2014; swaptions – 7/2002 to 12/2014.

Credit Rating	Corporate	SPX	Single Stocks	Commodities	Currencies CME	Currencies JPM	Fixed Income	Un-levered Equity
			Panel A: Credit Spreads across Types of Assets (bps)					
Aaa/Aa	55	39	71	22	21	-	30	94
A/Baa	114	83	112	39	53	-	68	169
Ba	310	166	193	68	69	83	97	319
B	597	270	424	174	119	75	138	658
Caa-	1196	424	867	341	196	152	261	1194
			Panel B: Ex-Post Loss-Given-Default (%)					
Aaa/Aa	63.0	6.3	32.6	9.6	4.3	-	4.1	26.1
A/Baa	68.0	7.2	32.8	9.6	4.2	0.1	4.1	22.5
Ba	60.0	16.0	26.0	12.7	5.4	5.6	3.8	24.3
B	54.0	11.7	21.0	12.0	4.8	4.6	2.2	20.9
Caa-	62.0	12.5	17.6	14.0	6.1	5.1	3.5	18.3
			Panel C: Credit Spreads with Bankruptcy Costs (bps)					
Aaa/Aa	55	138	124	124	206	-	318	-
A/Baa	114	295	244	190	675	-	665	713
Ba	310	484	488	325	688	1086	762	985
B	597	936	1237	859	1391	1213	1239	1990
Caa-	1196	1491	2651	1733	2272	1350	2505	3506
			Panel D: Ex-Post Loss-Given-Default with Bankruptcy Costs (%)					
Aaa/Aa	63.0	-	50.9	-	-	-	-	41.6
A/Baa	68.0	70.0	67.1	70.9	69.3	67.0	69.3	60.3
Ba	60.0	62.9	60.4	61.4	60.7	60.2	61.1	58.2
B	54.0	55.4	52.8	53.0	54.3	53.9	54.3	51.4
Caa-	62.0	63.6	59.8	61.8	62.5	61.7	62.1	59.1

Table A18: Common Factors in Pseudo Bonds of Pseudo Firms with Heterogeneous Assets

Regression result of credit spreads of pseudo bonds issued by pseudo firms with assets defined in the first row on a pseudo credit spread factor. The credit spread factor is equal to the average of standardized credit spreads across the asset classes in the first column. Panel A reports the results for IG pseudo bonds, and Panel B reports results for HY pseudo bonds. The left panels use 1-year pseudo bonds while right-hand panels use 2-year pseudo bonds. The sample periods is from January 1996 to August 2014, except for foreign currencies (start January 1999) and fixed income (start July 2002).

Panel A. IG Pseudo Bonds

	1-year			2-year		
	b	$t(b)$	R^2	b	$t(b)$	R^2
SPX	1.07	8.36	0.62	1.02	7.36	0.66
single-stock	1.12	5.25	0.53	0.98	12.01	0.65
commodity	1.03	6.90	0.71	0.94	3.9	0.55
cme fx	0.51	2.47	0.12			
jpm fx						
fixed income	1.01	5.70	0.41	1.29	6.45	0.52

Panel B. HY Pseudo Bonds

	1-year			2-year		
	b	$t(b)$	R^2	b	$t(b)$	R^2
SPX	1.09	17.29	0.80	1.09	11.97	0.83
single-stock	1.06	13.24	0.76	1.01	12.13	0.71
commodity	0.99	14.86	0.67	0.97	13.36	0.65
cme fx	0.98	10.45	0.71			
jpm fx	1.07	11.46	0.87	1.05	13.8	0.79
fixed income	0.80	5.49	0.57	0.89	5.99	0.65