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Probability of Recession Implied by Credit Market Sentiment

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As noted in the companion memo by Travis Berge, Nitish Sinha, and Michael Smolyansky, corporate bond spreads and the slope of the Treasury yield curve (that is, the term spread) are two financial indicators that appear to be especially informative about the likelihood of an economic downturn over a year-ahead horizon. One reason for this statistical result is that those yield spreads—like all financial asset prices—are forward-looking variables, and thus they contain important information about the real economy: the term spread, for example, may be a useful summary of the current stance of monetary policy (relative to long-run expectations), while credit spreads may anticipate future economic activity because they incorporate investors' expectations of future corporate defaults.[1]

A number of recent papers have emphasized that credit spreads, in particular, may help predict economic activity for reasons unrelated to default risk.[2] The purpose of this memo is to evaluate the information content of a component of credit spreads that is not directly attributable to expected default risk and thus to news about future cash flows. Specifically, we use a measure of investor sentiment in the corporate bond market—the so-called excess bond premium (EBP) introduced by Gilchrist and Zakrajšek (2012)—to predict the likelihood of an NBER-dated recession occurring over the next 12 months. We first document that over the past four decades, the predictive power of credit spreads for economic downturns is due entirely to the EBP. According to this measure, credit market sentiment has deteriorated noticeably since the summer of 2015, and as of the end of February, our simple model predicts about a 45 percent chance that the U.S. economy

[1] Indeed, considerable empirical evidence suggests that these yield spreads may be the clearest aggregators of information on incipient recessions; see, for example, Estrella and Hardouvelis (1991); Estrella and Mishkin (1998); Ang, Piazzesi, and Wei (2006); Stock and Watson (2003); Gilchrist, Yankov, and Zakrajšek (2009); and Faust, Gilchrist, Wright and Zakrajšek (2013).

[2] Gilchrist and Zakrajšek (2012); Greenwood and Hanson (2013); Krishnamurthy and Muir (2015); and Lopez-Salido, Stein, and Zakrajšek (2016).

will enter a recession at some point over the next year, about 15 percentage points above the unconditional probability of such an event occurring since 1973. We then briefly discuss two economic mechanisms related to investor beliefs and the supply of credit that may explain the relationship between the EBP and the real economy.

The excess bond premium as a measure of credit market sentiment

We begin by decomposing the Gilchrist and Zakrajšek (2012) credit spread (the GZ credit spread)—which the companion memo has shown to have significant predictive power for NBER-dated recessions—into two parts. The first is a component that captures default risk of individual firms, and the second is a residual component, the EBP, that can be thought of as capturing investor attitudes toward corporate credit risk—that is, credit market sentiment.[3] In effect, the EBP tries to capture the variation in the average price of bearing U.S. corporate credit risk—above and beyond the compensation that investors in the corporate bond market require for expected defaults. Gilchrist and Zakrajšek (2012) document that the EBP is significantly more informative—in both economic and statistical terms—about future economic activity than a component of the GZ credit spread that can be directly attributed to expected defaults. As shown in Figure 1, both the GZ credit spread and the EBP have increased significantly prior to or during most of the cyclical downturns since the early 1970s. Note also that during the past six months, the EBP has climbed to levels last seen in the early summer of 2009, a period when the U.S. economy was just beginning to emerge from the Great Recession.

Predicting NBER-dated recessions with the excess bond premium

To estimate the probability that the U.S. economy will enter a recession sometime during the next 12 months, we use a simple probit regression and focus on the credit and term spreads as the only two predictors.[4] Essentially, this regression looks at the behavior of the credit and term spreads at times of past NBER-dated recessions and

[3] The construction of both the GZ credit spread and the EBP are outlined in the appendix.
[4] The companion memo estimates the probability of an NBER-dated recession at a specific forecast horizon, that is, 3- 6-, or 12-months ahead. This memo, by contrast, estimates the probability that the U.S. economy will enter a recession at any time between month *t* and month *t+12*, a modeling choice that is economically more appealing given our focus on the 12-month forecast horizon.

estimates the probability that these two indicators are signaling the occurrence of an economic downturn over the next year.[5]

The first column in Table 1 complements the analysis of the companion memo by reporting the marginal effects of the term spread and the GZ spread on the probability of a recession over the 12-month horizon. The estimates imply that a decrease in the term spread—a flattening of the yield curve—of 10 basis point in month *t* is associated with an increase in the probability of a recession over subsequent 12 month of about 1.5 percentage points; the same-sized increase in the GZ credit spread in month *t* is estimated to boost this probability by about one percentage point.

In column 2, we zoom in on the information content of the GZ credit spread by allowing its two components to enter into the regression separately. These estimates indicate that the predictive content of the GZ spread is due entirely to the EBP—the marginal effect of the default-risk component of the GZ spread is statistically and economically indistinguishable from zero. By contrast, a 10 basis point increase in the EBP in month *t* is associated with a 3 percentage points increase in the probability of recession over the subsequent 12 months. According to the (pseudo) R-squared reported in column 3, the regression involving only the EBP has an in-sample goodness-of-fit that is more than two-thirds of that implied by the model that conditions on both the term spread and the GZ spread (column1).

To better isolate the role of credit market sentiment in U.S. business cycle fluctuations, Figure 2 plots the in-sample fitted probability of a recession over the subsequent 12 months, based on the specification reported in column 3. As shown by the solid line, this probability has moved up significantly since the summer of last year, when concerns about global growth prospects, centered on China, sparked an increase in financial market volatility and a deterioration in investor sentiment in the United States and abroad. This simple model implies about a 45 percent chance that the U.S. economy will be in recession at some point between March 2016 and February 2017.[6] As a benchmark, the unconditional probability of entering into a recession at any point over

[5] The term spread is defined as the difference between the yield on the 10-year Treasury note and the 3-month Treasury bill rate.

[6] The model specified in column 2 implies a probability of recession over the same horizon of about 40 percent.

the subsequent 12 months, the dashed black line in Figure 2, is about 30 percent over our sample period.

There are some important caveats worth spelling out. First, the EBP measures the sentiment of investors transacting in the corporate bond market. While there is a certain degree of arbitrage across financial markets, investors in other markets may have a different assessment of current and prospective economic conditions. As a result, fluctuations in the EBP may not be fully indicative of swings in broad credit market sentiment. Second, the portion of credit spreads not accounted for by movements in expected defaults may reflect other factors, such as time-varying liquidity premiums, which may be unrelated to investor sentiment. Finally, our statistical analysis should be taken with a grain of salt, as recessions occur rather infrequently and the time series model is estimated over a sample period that includes only six NBER-dated recessions.

Additionally, as shown in Figure 2, the statistical model in column 3 produces some—albeit only a few—false negative inferences (failing to predict recessions that did occur) and false positive predictions (predicting recessions that did not happen) over the past four decades. The most notable false positive prediction in our sample occurred in 2002, when credit spreads and the EBP increased sharply in response to a slew of corporate accounting scandals that led to the bankruptcy of several large firms.

Possible economic mechanisms linking credit market sentiment and the real economy

While the results reported above suggest that the EBP provides a timely and useful leading indicator of economic downturns, it is important to discuss the economic mechanisms through which fluctuations in credit market sentiment may affect the real economy. There are at least two potential mechanisms, which are not necessarily mutually exclusive.

One possible mechanism linking investor sentiment and the real economy is related to the way investors update their beliefs in light of incoming data. In particular, investors may over-react to the most recent news and thus assign excessive weight to future outcomes that have become more likely in view of recent data. For example, after a few years of economic expansion, investors may become complacent about default risk, an attitude leading to a compression in credit spreads, a loosening of other credit terms

and standards, and a surge of issuance of credit to very risky borrowers. In such an environment, the sudden arrival of a string of unfavorable economic news may lead investors to revise disproportionally their assessment of recession risk, thus amplifying the widening in credit spreads. This reasoning implies that investor psychology can itself be a cause of volatility in credit and investment, even in the absence of significant changes in economic fundamentals.[7]

Another possible mechanism linking fluctuations in credit market sentiment to economic outcomes is related to changes in the supply of credit. Large unlevered institutions such as mutual funds, insurance companies, and pension funds have become in recent years the main investors in the corporate bond market. These institutions effectively act as a marginal investor in a wide range of financial markets.[8] To the extent that real and financial disturbances affect their willingness or ability to fund the provision of new credit, the resulting tighter financial conditions may exert a significant drag on future economic growth.[9]

[7] Barberis, Shleifer, and Vishny (1998), Rabin and Vayanos (2010), and Bordalo, Gennaioli, and Shleifer (2015) discuss psychological models of investor confidence, in which overly-extrapolative expectations may lead to credit and business cycles, even without changes in economic fundamentals.
[8] He and Krishnamurthy (2013) and Adrian, Etula, and Muir (2014) argue that the wealth of financial intermediaries is an important factor for pricing various types of credit risk.
[9] Lopez-Salido, Stein and Zakrajšek (2016) document the effects of credit market sentiment on economic growth vis-à-vis changes in the supply of credit.

Appendix

This appendix briefly explains the construction of the GZ credit spread and its risk premium component, the excess bond premium (EBP). The GZ spread is built from the bottom up, using secondary market prices of over 8,000 senior unsecured bonds issued by more than 1,300 U.S. non-financial firms. To avoid duration mismatch issues, spreads for each underlying bond issue are derived from a synthetic risk-free security that exactly mimics the cash flows of that bond. The GZ spread in month *t* is a simple un-weighted cross-sectional average of credit spreads in that month:

$$S_t^{GZ} = \frac{1}{N_t}\sum_i \sum_k S_{i,t}[k],$$

where N_t is the number of bond observations in month *t* and $S_{i,t}[k]$ is the spread of bond *k* (a security that is a liability of firm *i)* in month *t*. The EBP is extracted from the GZ spread by first using a linear regression to remove expected default risk of individual firms from the underlying credit spreads. Specifically, the log of the credit spread on bond *k* is assumed to be linearly related to a firm-specific indicator of default $DFT_{i,t}$ and a vector of bond-specific characteristics ($Z_{i,t}[k]$), according to:[10]

$$\ln S_{i,t}[k] = \beta DFT_{i,t} + \gamma' Z_{i,t}[k] + \varepsilon_{i,t}[k],$$

where $\varepsilon_{i,t}[k]$ is a credit spread "pricing error." The predicted level of the spread for bond *k* of firm *i* at time *t* is then given by:

$$\hat{S}_{i,t} = \exp\left[\hat{\beta} DFT_{i,t} + \hat{\gamma}' Z_{i,t}[k] + \frac{\hat{\sigma}^2}{2}\right].$$

The part of the GZ spread that is directly attributable to expected default risk is given by the average of predicted spreads in month *t*:

$$\hat{S}_t^{GZ} = \frac{1}{N_t}\sum_i \sum_k \hat{S}_{i,t}[k],$$

while the EBP is the component of the GZ spread net of expected defaults:

$$EBP_t = S_t^{GZ} - \hat{S}_t^{GZ}.$$

[10] Gilchrist and Zakrajšek (2012) use the "distance-to-default," a default-risk indicator based on the firm's equity valuations and leverage to capture the likelihood of default over the near-term horizon; in addition to this market-based assessment of default risk, their credit spread pricing regression also includes bond-specific credit ratings, which capture the "through-the-cycle" information about the firm's creditworthiness. These credit risk factors account for about 70 percent of the variation in bond-level credit spreads over the sample period.

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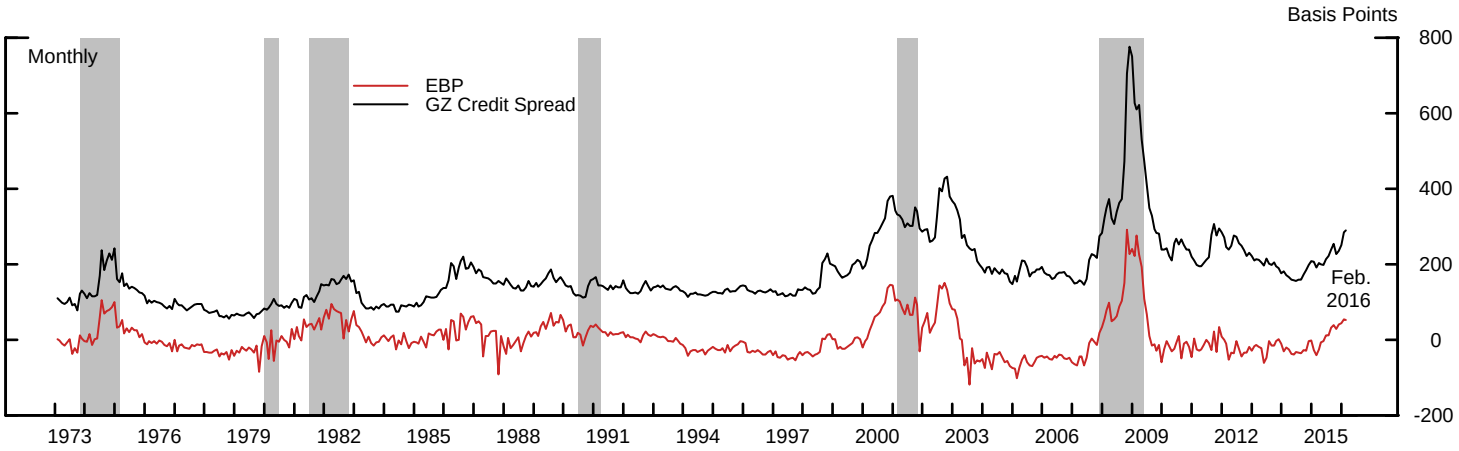
GZ Credit Spread, Excess Bond Premium, and the Probability of NBER-Dated Recessions

Figure 1: GZ Credit Spread and the Excess Bond Premium



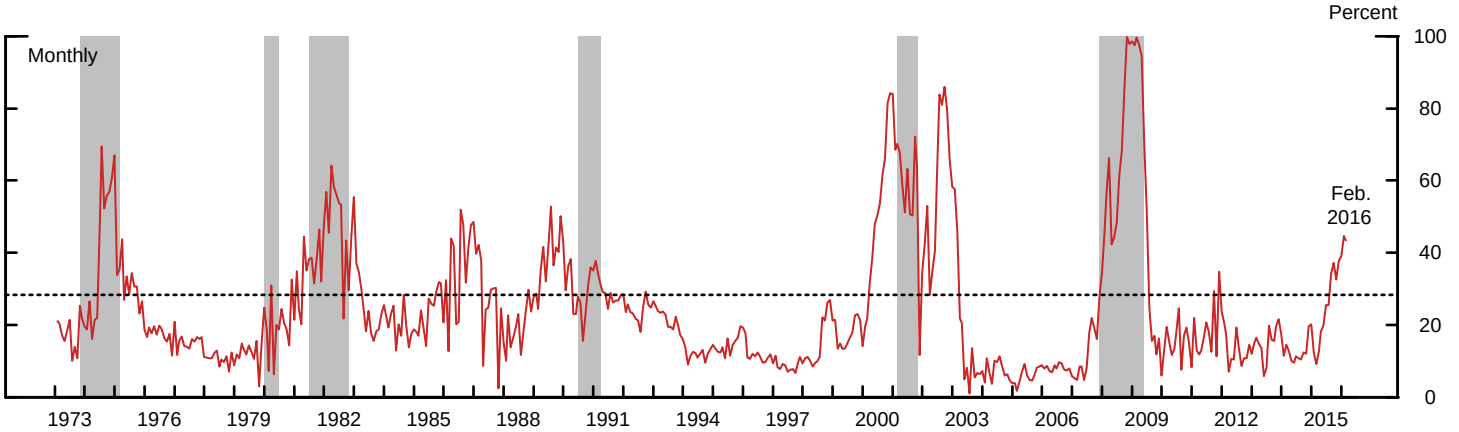
Shaded regions correspond to the NBER-dated recessions.

Table 1: Marginal Effects on the Probability of Recession over the Next 12 Months

	(1)	(2)	(3)
Term Spread	-0.138*** [0.023]	-0.113*** [0.022]	
GZ Credit Spread	0.108*** [0.036]		
Expected Default Component		-0.041 [0.051]	
Excess Bond Premium		0.308*** [0.055]	0.329*** [0.075]
Pseudo R-squared	0.37	0.54	0.29

Note: Sample period is January 1973 to February 2016 (518 monthly observations). Standard errors are reported in brackets. The Pseudo R-squared is the McKelvey and Zavoina (1975) measure.
*** denotes statistical significance at the 1-percent level.

Figure 2: Probability of Recession Implied by the Excess Bond Premium



Shaded regions correspond to the NBER-dated recessions. The dashed black line denotes the unconditional probability of entering into a recession at any point over the subsequent 12 months.