Credit Spreads and the Macroeconomy

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Credit Spreads and Economic Activity

- Research on the role of financial asset prices in cyclical fluctuations stresses the information content of credit spreads for the state of the economy and risks to the economic outlook.
- Information content of credit spreads likely reflects disruption in the supply of credit stemming from:
  - Worsening of the quality of borrowers' balance sheets.
  - Deterioration in the soundness of financial intermediaries.

GYZ (2009): Methodology

- Use security-level data to construct bond portfolios that assign each bond outstanding to a category determined by:
  - Firm-specific expected probability of default (EDF).
  - Bond-specific remaining term-to-maturity.
- Use CRSP equity returns to construct matched equity portfolios.

GYZ (2009): Forecasting Framework

- Measures of economic activity:
  - EP: log of private nonfarm payroll employment
  - IP: log of industrial production
- Forecasting VAR specification:

$$\Delta^h EP_{t+h} = \beta_1(L)\Delta EP_t + \beta_2(L)\Delta IP_t + \eta_1' Z_{1t} + \eta_2' Z_{2t} + \epsilon_{1,t+h}$$
$$\Delta^h IP_{t+h} = \gamma_1(L)\Delta EP_t + \gamma_2(L)\Delta IP_t + \theta_1' Z_{1t} + \theta_2' Z_{2t} + \epsilon_{2,t+h}$$

- Z_{1t} = standard default-risk indicators
       (CP-bill spread, Aaa, Baa, HY spread)
- Z_{2t} = EDF-based portfolio credit spreads

GYZ (2009): In-Sample Predictive Power
(Sample period: Feb1990–Sep2008; 12-month forecast horizon)

Credit Spreads	Nonfarm Employment (EP)			Industrial Production (IP)		
	$Pr > W_1$	$Pr > W_2$	Adj. R^2	$Pr > W_1$	$Pr > W_2$	Adj. R^2
Standard	0.003	-	0.665	0.109	-	0.200
EDF-Q1	-	0.000	0.727	-	0.000	0.563
EDF-Q2	-	0.000	0.759	-	0.000	0.641
EDF-Q3	-	0.000	0.739	-	0.000	0.528
EDF-Q4	-	0.000	0.704	-	0.000	0.439
EDF-Q5	-	0.000	0.685	-	0.000	0.420
Standard & EDF-Q1	0.000	0.000	0.809	0.297	0.000	0.585
Standard & EDF-Q2	0.016	0.000	0.817	0.128	0.000	0.679
Standard & EDF-Q3	0.000	0.000	0.816	0.000	0.000	0.645
Standard & EDF-Q4	0.000	0.000	0.795	0.021	0.000	0.552
Standard & EDF-Q5	0.000	0.000	0.791	0.015	0.000	0.500
Memo: None	-	-	0.537	-	-	0.042

GYZ (2009): Out-of-Sample Predictive Power
(Sample period: Feb1990–Sep2008; 12-month forecast horizon)

Credit Spreads	Nonfarm Employment (EP)			Industrial Production (IP)		
	RMSFE	Ratio	$\Pr > |S|$	RMSFE	Ratio	$\Pr > |S|$
Standard	1.113	-	-	3.676	-	-
EDF-Q1	0.693	0.387	0.002	2.087	0.323	0.000
EDF-Q2	0.667	0.359	0.001	2.004	0.297	0.000
EDF-Q3	0.740	0.442	0.000	2.279	0.384	0.000
EDF-Q4	0.902	0.659	0.094	2.704	0.541	0.004
EDF-Q5	0.872	0.613	0.092	2.574	0.490	0.001
Standard & EDF-Q1	0.827	0.551	-	2.571	0.489	-
Standard & EDF-Q2	0.816	0.537	-	2.238	0.371	-
Standard & EDF-Q3	0.814	0.535	-	2.376	0.418	-
Standard & EDF-Q4	0.869	0.609	-	2.686	0.539	-
Standard & EDF-Q5	0.864	0.602	-	2.948	0.643	-
Memo: None	1.115	-	-	3.882	-	-

GYZ (2009): Summary of Results

- Predictive content of credit spreads is concentrated in long-maturity corporate bonds issued by medium-risk firms.
- Shocks to medium-risk, long-maturity credit spreads account for a significant fraction of the variance in economic activity at 1–2 year horizon over the 1990–2008 period.

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GOZ (2009): Methodology

- Use bond-level data to construct a medium-risk, long-maturity corporate credit spread for the 1973:Q1–2009:Q1 period.
  - Compare its predictive content for economic activity with that of other standard financial indicators.
  - Predictive power of medium-risk long-maturity spreads suggests important linkages between financial conditions and macroeconomic outcomes.
- Estimate a DSGE model (CEE/SW) with the financial accelerator mechanism emphasized by BGG.
  - Distinguish between movements in credit supply and demand.
  - Account for GE effects between financial and real sectors.

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Data Description

- Credit Spreads: prices of outstanding corporate bonds traded in the secondary market (Lehman/Warga & Merrill Lynch):
  - Sample period: Jan1973–Mar2009
  - 921 U.S. (nonfarm) nonfinancial issuers
  - 5,635 senior unsecured issues
  - Spreads relative to yields on comparable-maturity Treasuries
- Credit Risk: Merton (1974) distance-to-default (DD) model

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Corporate Bond Characteristics
(Jan1973–Mar2009)

Bond Characteristic	Mean	SD	Min	P50	Max
# of bonds per firm/month	3.26	3.79	1.00	2.00	60.0
Mkt. Value of Issue ($mil.)	287.4	280.4	1.19	219.8	6,617
Maturity at Issue (years)	13.9	9.4	1.0	10.0	50.0
Term to Maturity (years)	11.8	8.63	0.01	8.7	30.0
Duration (years)	6.27	3.14	0.00	6.04	24.4
Credit Rating (S&P)	-	-	D	A3	AAA
Coupon Rate (pct.)	7.66	2.17	0.00	7.38	17.5
Nominal Effective Yield (pct.)	8.12	2.87	1.20	7.71	57.4
Credit Spread (bps.)	166	200	10	111	4,901

Panel Dimensions

Obs. $= 351,970$ $N = 5,635$ bonds
Min. Tenure $= 1$ Median Tenure $= 51$ Max. Tenure $= 279$

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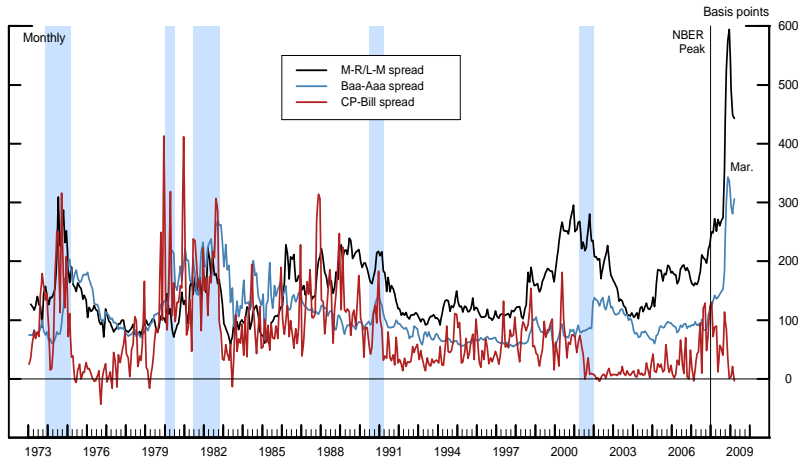Historical Shock Decomposition

Merton (1974) DD-Model

- Value of the firm (V) follows a geometric Brownian motion.
- Firm has just issued a discount bond (D) maturing in T periods.
- Distance-to-default (1-year horizon):

$$\text{DD} = \frac{\ln(V/D) + (\mu_V - 0.5\sigma_V^2)}{\sigma_V}.$$

  - V, μ_V, σ_V estimated using data on E, D, μ_E, σ_E
- Medium-risk, long-maturity (M-R/L-M) credit spreads:
  - DD_{it} between P25 and P75 of the cross-sectional distribution.
  - Remaining term-to-maturity greater than 15 years.

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Selected Corporate Credit Spreads
(Jan1973–Mar2009)

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Predictive Content of Credit Spreads for Economic Activity

- Forecasting specification:

$$\Delta^h Y_{t+h} = \alpha + \sum_{i=0}^{h-1} \beta_i \Delta Y_{t-i} + \gamma_1 TS_t + \gamma_2 RFF_t + \gamma_3 CS_t + \epsilon_{t+h}$$

  - Y_t = an indicator of economic activity
  - TS_t = term spread (3-month less 10-year)
  - RFF_t = real federal funds rate
  - CS_t = credit spread

- Economic activity indicators:
  - nonfarm payrolls, unemployment rate
  - manufacturing industrial production, real business inventories
  - real GDP, real business fixed investment

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Credit Spreads and Labor Market Indicators
(Sample period: 1973:Q1–2009:Q1; 4-quarter forecast horizon)

Unemployment Rate			
Financial Indicator	(1)	(2)	(3)
Term Spread (3m−10y)	0.314	0.289	0.268
	(0.021)	(0.019)	(0.020)
Real Federal Funds Rate	0.088	0.093	0.085
	(0.012)	(0.012)	(0.011)
Baa Credit Spread	-	-0.169	-
		(0.046)	
M-R/L-M Credit Spread	-	-	0.639
			(0.039)
Adj. R^2	0.400	0.399	0.473

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Credit Spreads and Production Indicators
(Sample period: 1973:Q1–2009:Q1; 4-quarter forecast horizon)

Manufacturing Industrial Production			
Financial Indicator	(1)	(2)	(3)
Term Spread (3m−10y)	-1.248	-1.218	-1.009
	(0.408)	(0.358)	(0.424)
Real Federal Funds Rate	-0.502	-0.506	-0.474
	(0.211)	(0.208)	(0.193)
Baa Credit Spread	-	0.202	-
		(0.937)	
M-R/L-M Credit Spread	-	-	-3.540
			(0.974)
Adj. R^2	0.316	0.312	0.412

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Credit Spreads Economic Activity Indicators
(Sample period: 1973:Q1–2009:Q1; 4-quarter forecast horizon)

	Real GDP		
Financial Indicator	(1)	(2)	(3)
Term Spread (3m−10y)	-0.635	-0.581	-0.557
	(0.211)	(0.206)	(0.222)
Real Federal Funds Rate	-0.135	-0.139	-0.132
	(0.140)	(0.138)	(0.129)
Baa Credit Spread	-	0.364	-
		(0.482)	
M-R/L-M Credit Spread	-	-	-1.205
			(0.537)
Adj. R^2	0.285	0.297	0.345

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Credit Spreads and Economic Activity Indicators
(Sample period: 1973:Q1–2009:Q1; 4-quarter forecast horizon)

Real Business Fixed Investment			
Financial Indicator	(1)	(2)	(3)
Term Spread (3m−10y)	-0.703	-0.912	0.070
	(0.548)	(0.533)	(0.589)
Real Federal Funds Rate	-0.924	-0.875	-0.848
	(0.322)	(0.292)	(0.300)
Baa Credit Spread	-	-2.565	-
		(1.465)	
M-R/L-M Credit Spread	-	-	-7.508
			(1.324)
Adj. R^2	0.339	0.352	0.533

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Comparison of Out-of-Sample Predictive Accuracy
(Sample period: 1973:Q1–2009:Q1; 4-quarter forecast horizon)

- Specification 1: term spread, real funds rate, Baa credit spread
- Specification 2: medium-risk, long-maturity credit spread

Economic Activity Indicator	RMSFE-1	RMSFE-2	Ratio	$\Pr > |S|$
Private Payroll Employment	1.597	0.949	0.594	0.019
Unemployment Rate	0.840	0.562	0.669	0.022
Mfg. Industrial Production	4.693	3.132	0.667	0.007
Real Business Inventories	2.146	1.631	0.760	0.011
Real GDP	1.917	1.177	0.614	0.001
Real Business Fixed Investment	5.858	4.561	0.779	0.114

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"Great Moderation"
(Sample period: 1986:Q1–2009:Q1; 4-quarter forecast horizon)

Financial Indicator	Economic Activity Indicator					
	EMP	UEMP	IPM	INV	GDP	BFI
Term Spread	-0.356	0.189	-0.778	-0.467	-0.201	0.556
	(0.095)	(0.018)	(0.357)	(0.212)	(0.249)	(0.683)
Real FFR	-0.015	0.002	0.791	0.297	0.192	0.023
	(0.077)	(0.013)	(0.305)	(0.166)	(0.178)	(0.534)
M-R/L-M Credit Spread	-1.456	0.726	-6.790	-2.572	-1.954	-11.00
	(0.181)	(0.042)	(0.699)	(0.475)	(0.356)	(1.434)
Adj. R^2	0.758	0.545	0.517	0.544	0.386	0.683

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Civilian Unemployment Rate
(Sample period: Jan1973–Dec2008; 12-month forecast horizon)

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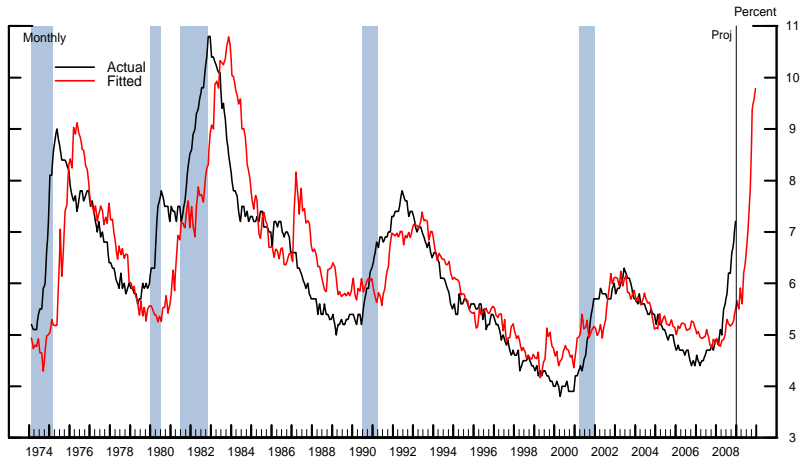
Real Business Fixed Investment
(Sample period: 1973:Q1–2008:Q4; 4-quarter forecast horizon)

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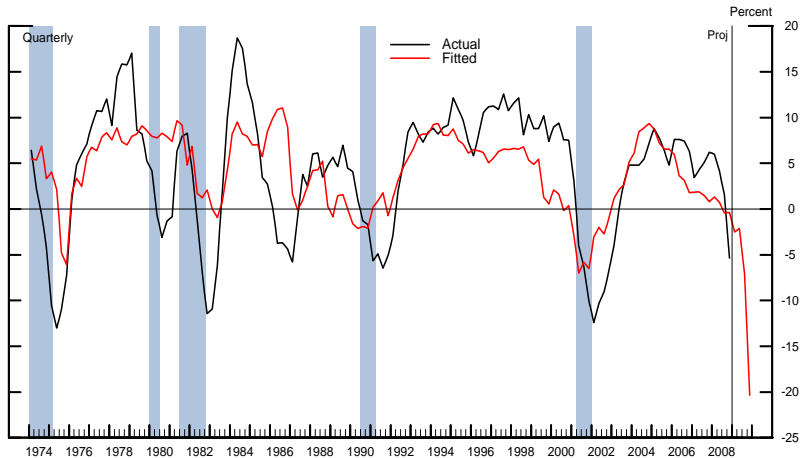
Estimated DSGE Model
Smets & Wouters (2007); Christiano, Motto & Rostagno (2009)

- Key features of the model:
  - Habit formation in consumption.
  - Higher-order adjustment costs to investment.
  - Variable capacity utilization.
  - Calvo-style price rigidities with partial indexation—New Keynesian Phillips curve.
  - Calvo-style wage rigidities with partial indexation.
  - Nominal interest rate rule responds to inflation, output gap, and output growth.

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Adding the BGG Financial Accelerator Mechanism

- Use medium-risk long-horizon credit spreads to measure external finance premium:

$$
\begin{aligned}
s_t &= -\chi \left(n_t - q_t - k_t \right) + \varepsilon_t^{fd} \\
n_t &= \frac{K}{N} r_t^K - \left(\frac{K}{N} - 1 \right) \left(s_{t-1} + r_{t-1} - \pi_t \right) + \theta n_{t-1} + \varepsilon_t^{nw}
\end{aligned}
$$

- Allow for credit-supply shocks:
  - ε_t^{fd}: disturbances to credit intermediation process
  - ε_t^{nw}: disturbances to asset values that serve as collateral

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Leverage in the U.S. Nonfinancial Corporate Sector
(1973:Q1–2009:Q1)

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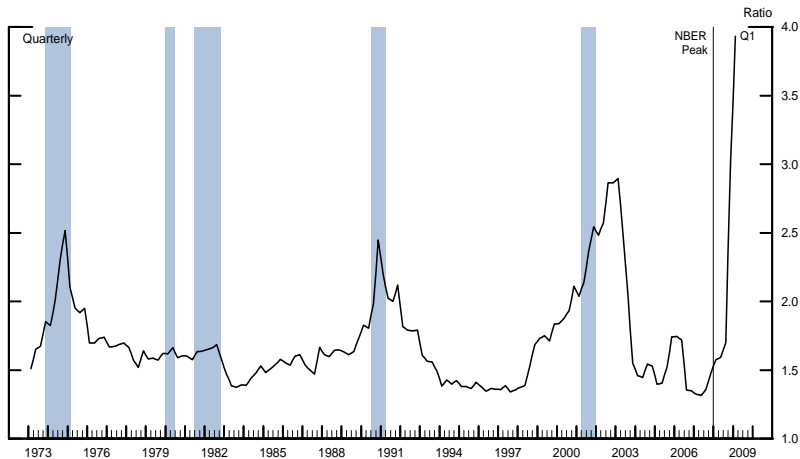
Contractionary Monetary Policy Shock
(1-standard-deviation shock to federal funds rate)

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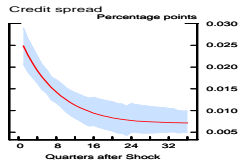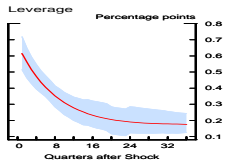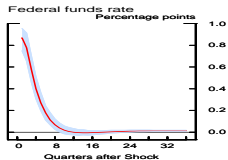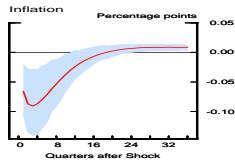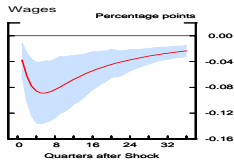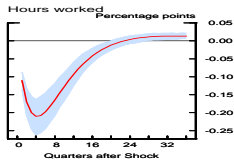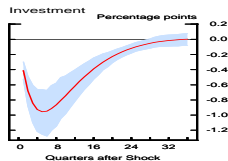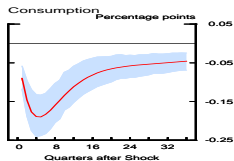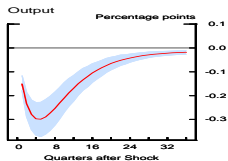
Adverse Credit Spread Shock
(1-standard-deviation shock to credit spreads)
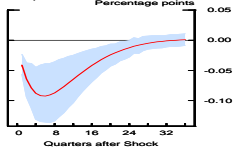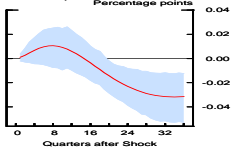
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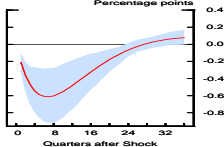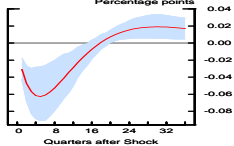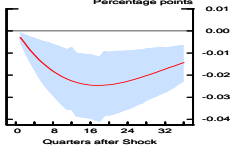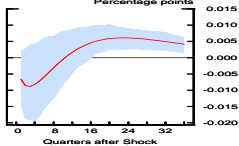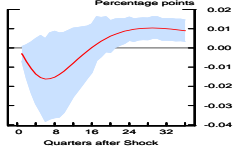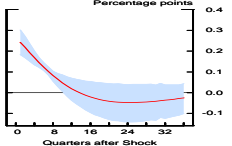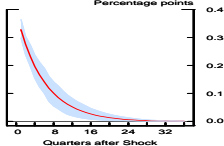
Adverse Net Worth Shock
(1-standard-deviation shock to net worth)

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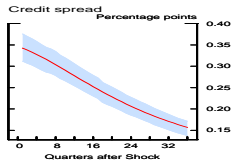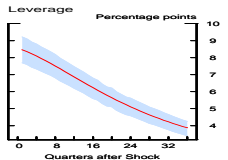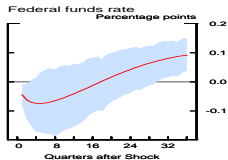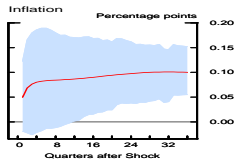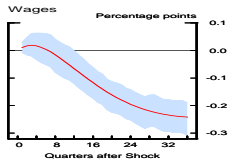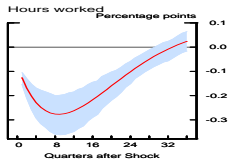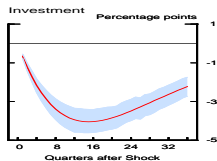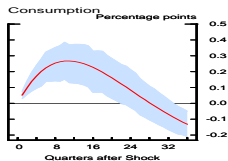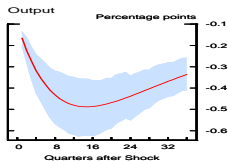
Decomposition of Investment Growth
(Percentage point deviation (annual rate) from steady state)

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Historical Shock Decomposition
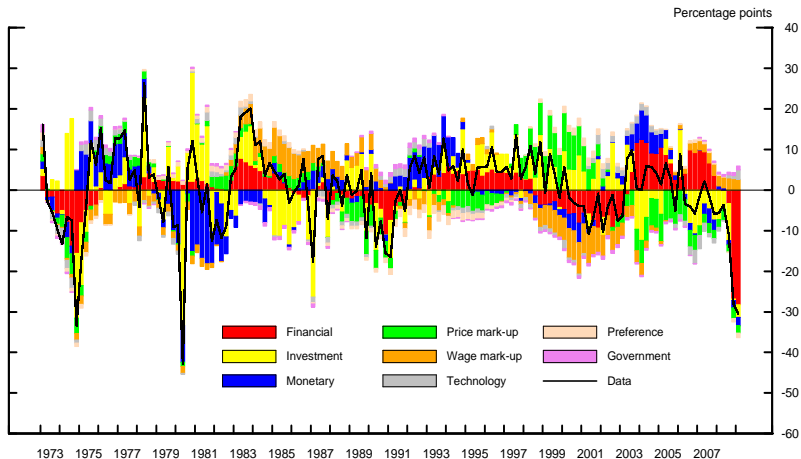
Decomposition of Output Growth
(Percentage point deviation (annual rate) from steady state)

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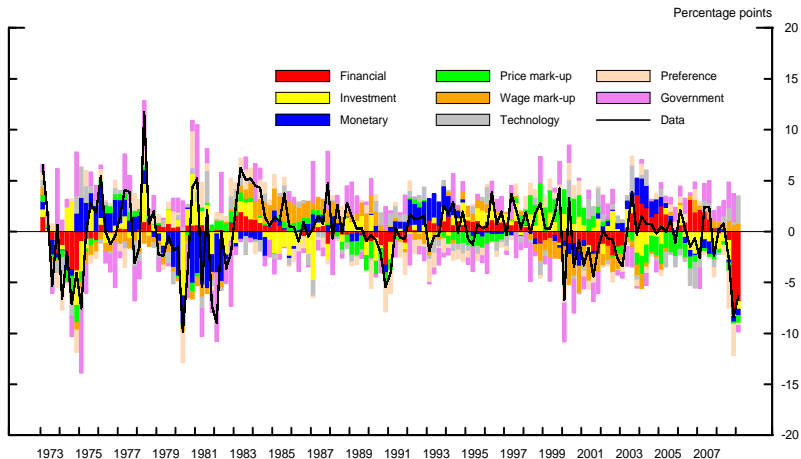
GZ (2009): Motivation

- Spreads on medium-risk, long-maturity corporate bonds have greatest predictive content for business cycle fluctuations.
- Cyclical variation in credit spreads on shorter-maturity corporate bonds most likely reflects cyclical movements in expected default risk.
- Cyclical variation in credit spreads on long-maturity corporate bonds most likely reflects variation in the price of default risk.

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GZ (2009): Methodology

- Credit spread decomposition:
  - Component attributable to expected default risk.
  - Excess bond premium: price of default risk.
- Analysis:
  - Predictive content of the excess bond premium for economic activity and excess stock returns.
  - VAR decomposition: Do shocks to the excess bond premium cause fluctuations in real activity and asset prices at business cycle frequencies?

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GZ (2009): Main Findings

- Predictive content of credit spreads for real activity variables entirely due to movements in the excess bond premium.
- Excess bond premium predicts the stock market as well as (or better) other financial variables (e.g., dividend-price ratio, "CAY," slope of the yield curve).
- Excess bond premium is closely related to conditions in credit markets as measured by the changes in bank lending standards.
- Shocks to the excess bond premium account for 40% of the variation in output growth and 20% of the variation in the excess market return at business cycle frequencies.

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Identifying the Excess Bond Premium

- Corporate bond pricing model:

$$\ln S_{it}^k = \beta_1 \ln[D/V]_{i,t-1} + \beta_2 \mu_{V_i,t-1} + \beta_3 \ln \sigma_{V_i,t-1} + \theta' \mathbf{x}_{it}^k + \epsilon_{it}^k$$

  - S_{it}^k = credit spread on bond k (issued by firm i) in month t
  - DD-model components: $D_{it}, V_{it}, \mu_{V_{it}}, \sigma_{V_{it}}$
  - $\mathbf{x}_{it}^k$ = bond/firm-specific control variables

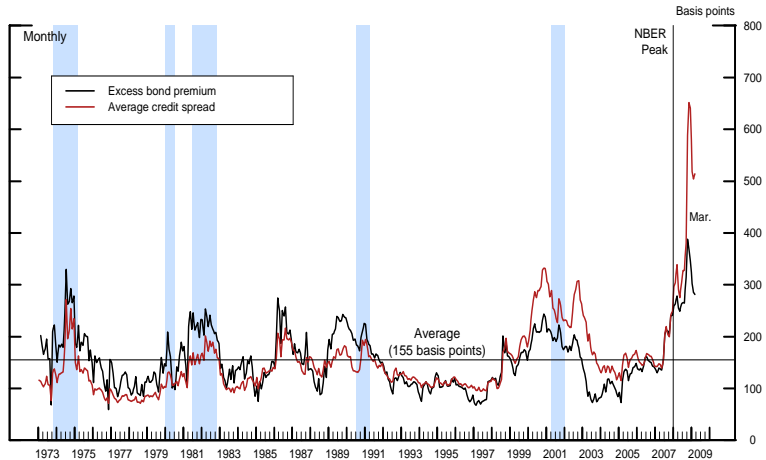- Excess bond premium: cross-sectional average of OLS residuals $\hat{\epsilon}_{it}^k$ in month t:

$$\text{EBP}_t = \frac{1}{M_t} \sum_k \hat{\epsilon}_{it}^k$$

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Estimated Corporate Bond Pricing Model
(Sample period: Feb1973–Mar2009)

Explanatory Variable	(1)	(2)	(3)	(4)
Constant	1.578	0.686	0.583	0.726
	(0.092)	(0.071)	(0.074)	(0.070)
$\ln(\text{PAR}_i^k)$	0.048	-0.007	0.002	0.002
	(0.014)	(0.010)	(0.009)	(0.008)
$\ln(\text{DUR}_{it}^k)$	-0.040	0.043	0.043	0.042
	(0.013)	(0.009)	(0.009)	(0.009)
$\ln(D/V)_{i,t-1}$	0.435	0.155	0.150	0.352
	(0.025)	(0.016)	(0.016)	(0.033)
$\mu_{V_{i,t-1}}$	-0.310	-0.439	-0.438	-0.412
	(0.043)	(0.030)	(0.030)	(0.030)
$\ln(\sigma_{V_{i,t-1}})$	0.796	0.458	0.448	0.451
	(0.037)	(0.027)	(0.026)	(0.025)
$[\ln(D/V)_{i,t-1}]^2$	-	-	-	0.063
				(0.008)
Adj. R^2	0.306	0.501	0.506	0.512
Ratings Effects	-	0.000	0.000	0.000
Industry Effects	-	-	0.000	0.000

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Excess Corporate Bond Premium
(Feb1973–Mar2009)

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Predictive Content of EBP for Economic Activity
(Sample period: Feb1973–Mar2009)

	Forecast Horizon (h months)					
	$h = 3$			$h = 12$		
Explanatory Variable	EMP	UEMP	IPM	EMP	UEMP	IPM
Term Spread	-0.021	0.073	-0.057	-0.189	0.315	-0.271
	[0.521]	[2.877]	[0.880]	[3.707]	[36.58]	[3.222]
Real Funds Rate	-0.039	0.030	-0.006	-0.100	0.039	-0.049
	[0.858]	[1.032]	[0.075]	[1.823]	[4.653]	[0.551]
Excess Bond Premium	-0.312	0.372	-0.472	-0.359	0.393	-0.427
	[7.914]	[16.61]	[6.339]	[10.14]	[69.55]	[6.057]
Adj. R^2	0.699	0.440	0.439	0.519	0.418	0.356

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Predictive Content of EBP for Real GDP
(Sample period: 1973:Q1–2009:Q1)

	Forecast Horizon (h quarters)		
Explanatory Variable	$h = 1$	$h = 2$	$h = 4$
Term Spread	-0.091	-0.168	-0.331
	[0.953]	[1.563]	[2.638]
Real Funds Rate	-0.063	-0.103	-0.072
	[0.604]	[0.900]	[0.544]
Excess Bond Premium	-0.412	-0.446	-0.318
	[4.990]	[5.085]	[3.528]
Adj. R^2	0.286	0.379	0.327

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Predictive Content of EBP for Excess Stock Returns
(Sample period: 1973:Q1–2009:Q1)

	Forecast Horizon (h quarters)		
Explanatory Variable	$h = 1$	$h = 2$	$h = 4$
Log Dividend-Price Ratio	0.083	0.121	0.166
	[0.902]	[1.036]	[0.988]
Term Spread	0.104	0.054	-0.057
	[0.889]	[0.344]	[0.297]
Relative Interest Rate	-0.179	-0.122	-0.100
	[1.667]	[0.992]	[0.848]
"CAY"	0.155	0.197	0.261
	[2.045]	[2.156]	[2.116]
Excess Bond Premium	-0.272	-0.272	-0.256
	[2.526]	[1.872]	[1.604]
Adj. R^2	0.069	0.103	0.193

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"Great Moderation"
(Sample period: 1986:Q1–2009:Q1)

	Forecast Horizon (h quarters)		
Explanatory Variable	$h = 1$	$h = 2$	$h = 4$
Log Dividend-Price Ratio	0.140	0.184	0.172
	[0.926]	[0.992]	[0.601]
Term Spread	0.192	0.243	0.059
	[1.542]	[1.437]	[0.288]
Relative Interest Rate	-0.081	-0.076	0.086
	[0.628]	[0.512]	[0.579]
"CAY"	0.064	0.095	0.202
	[0.582]	[0.745]	[1.078]
Excess Bond Premium	-0.420	-0.585	-0.512
	[2.888]	[3.171]	[2.303]
Adj. R^2	0.119	0.280	0.364

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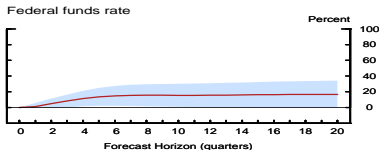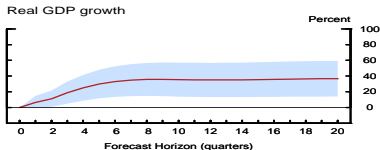EBP and the Stock Market
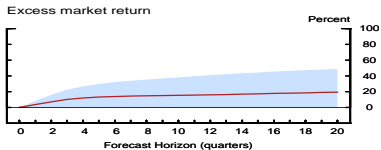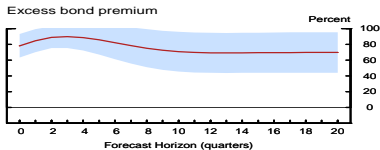Macroeconomic Implications

Shocks to the Excess Bond Premium

- Evidence suggests that movements in the EBP capture changes in the price of default risk, which are related to the willingness of financial intermediaries to supply credit.
- 6-variable VAR(2) specification:
    - log-difference of real GDP
    - log-difference of GDP price deflator
    - 10-year (nominal) Treasury yield
    - effective federal funds rate
    - excess (value-weighted) total market return
    - excess bond premium
- Estimation period: 1986:Q1–2009:Q1
- EBP shocks identified using the Cholesky decomposition.

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Adverse EBP Shock
(1-standard-deviation shock to EBP)

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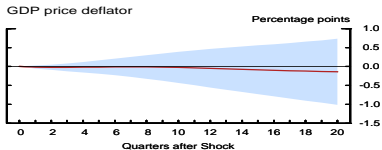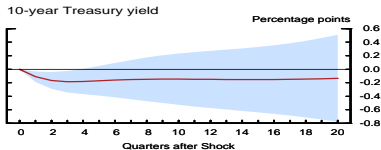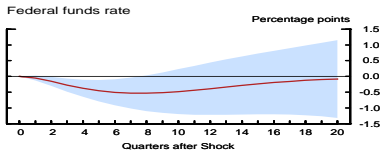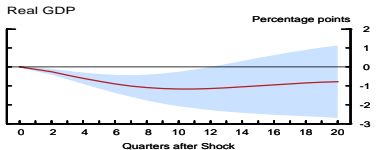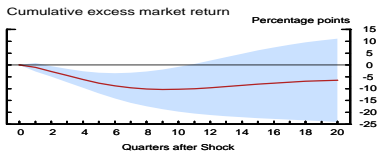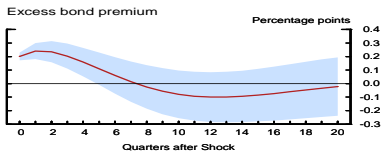
Forecast Error Variance Decomposition
(1-standard-deviation shock to EBP)

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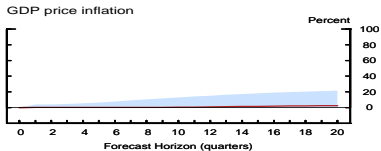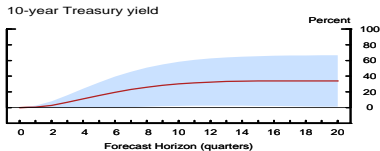
EBP & Changes in Business Lending Policies at Banks
(1973:Q1–2009:Q1)
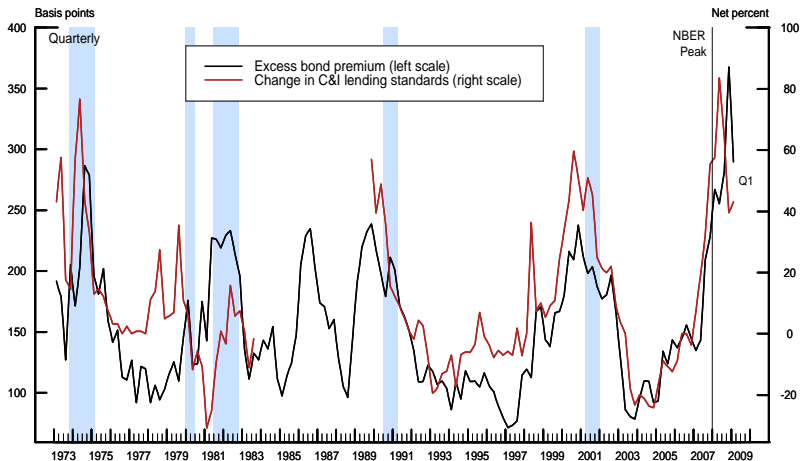
Summary of Results

- Medium-risk long-maturity (M-R/L-M) credit spreads have substantial predictive power for economic activity.
- Estimation of a DSGE model that uses M-R/L-M credit spreads to identify financial market distortions implies important role for credit-supply shocks for investment and output at business cycle frequencies.
- Information content of credit spreads reflects movements in the excess bond premium.

Concluding Remarks

- Interpretation:
  - Corporate bond spreads reflect downside risk not well captured by variation in stock returns.
  - Corporate bond spreads reflect "risk-aversion" of financial intermediaries.
- In both cases, disruptions in credit markets have important consequences for macroeconomic outcomes.
- Integrating asset pricing with macroeconomic models used in policy analysis is a necessary step to understanding the interaction between the financial sector and the real economy.