Financial Shocks and Industrial Employment

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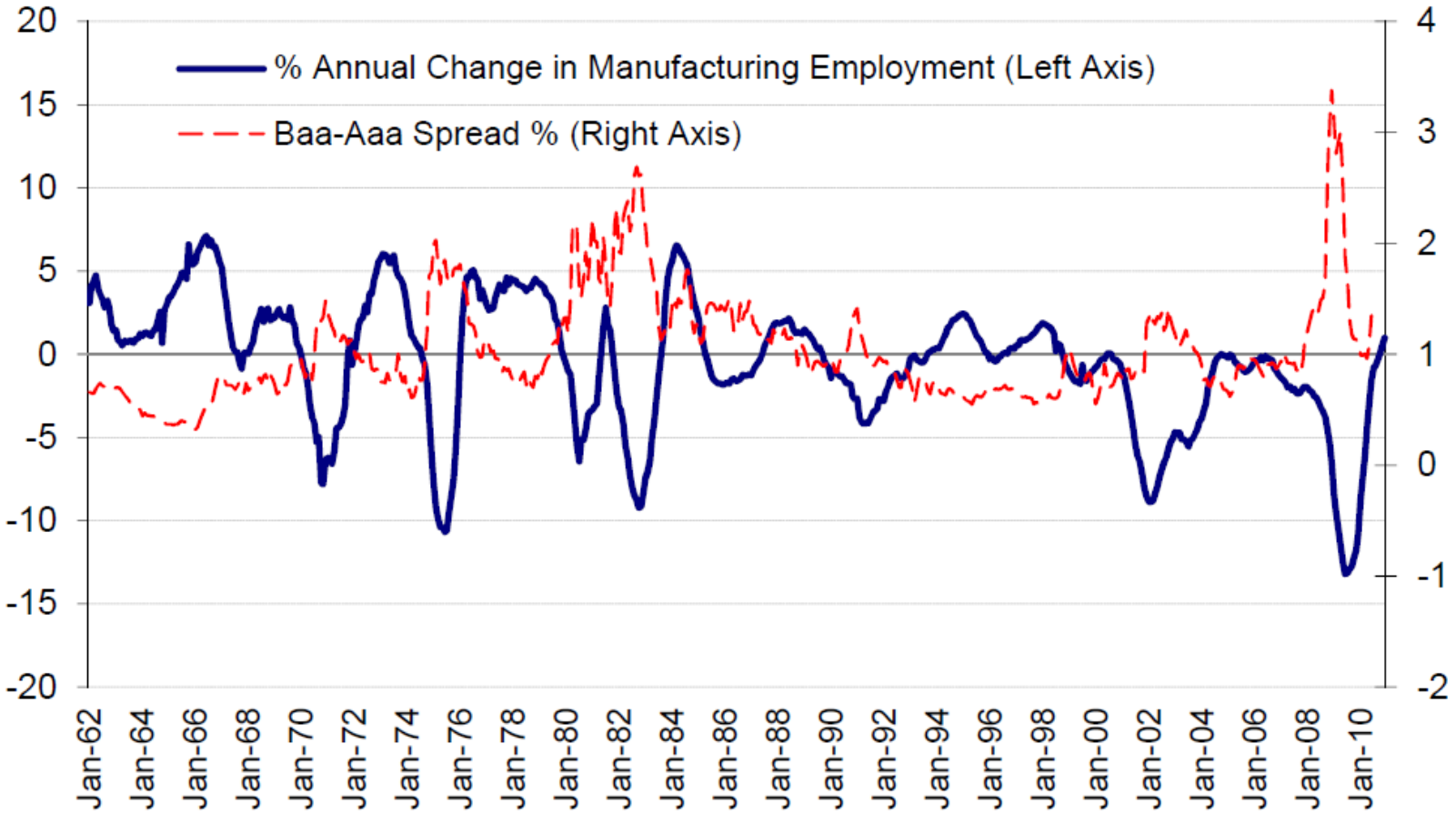
International Economic Association
Sixteenth World Congress
July 7, 2011
Beijing, China

Plan of the presentation

- Motivation and Literature Review
- Empirical Approach
- Results
- Conclusions

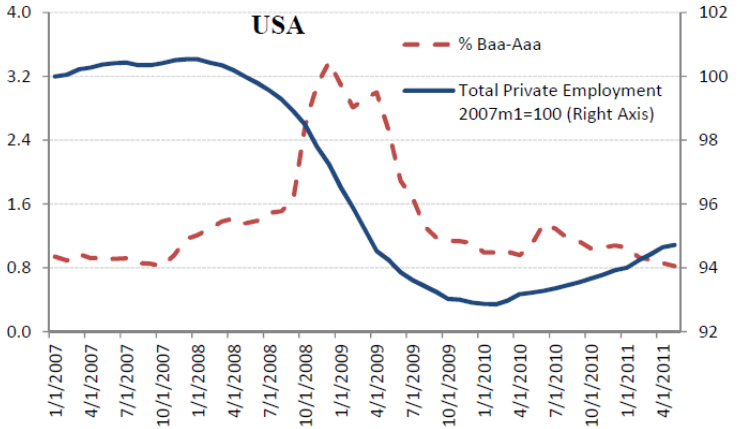
Motivation

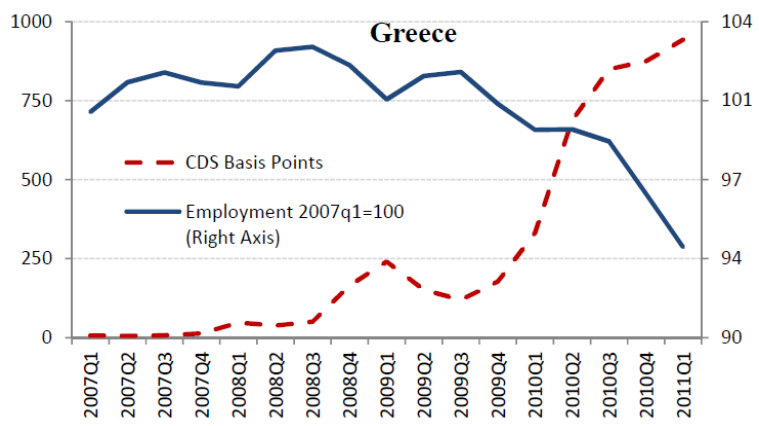
Bond Spreads and Manufacturing Employment in the USA

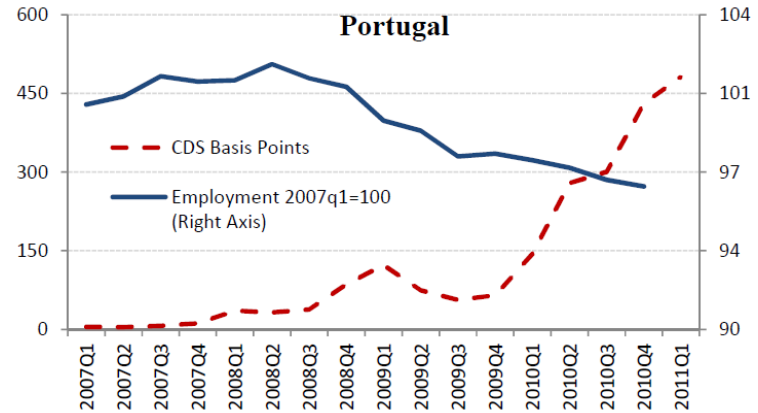


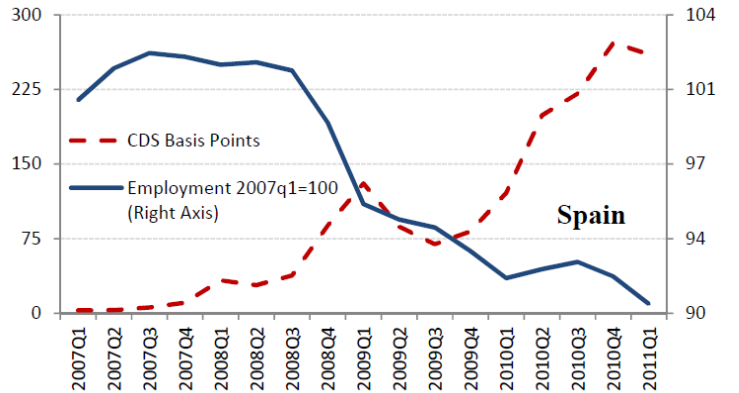
Motivation

Spreads and Employment in USA, Greece, Portugal and Spain









Motivation

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- A particular interest is how the financial conditions affect the firms' demand for inputs, such as physical capital and employment.

Literature Review

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- In contrast, limited number of studies focusing on the effects of financial conditions on employment.
  - Sharpe (1994) and Gilchrist et al (2009) for US, Nickell and Wadwhani (1991) and Nickell and Nicolitsas (1999), Funke et al. (1999) and Ogawa (2003), Caggese and Cunat (2008) for UK, Japan, Germany, Spain, Italy.

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- With industry-level data, we estimate the employment response to exogenous variations in the spreads using a standard labor demand equation augmented with the inclusion of borrowing costs in the economy.
    - When firms face working capital constraints on their wage bill, interest rates on the working capital directly affects the employment decision (Christiano and Eichenbaum (1992), Neumeyer and Perri (2005)).
- We also focus on whether the employment response of industries to financial shocks differ with respect to their External Finance Dependence (EFD: ratio of capital expenditures minus cash flow from operations divided by capital expenditures) as measured by Rajan and Zingales (1998).

Data

- NBER-CES Manufacturing Industry Database covering 1958-2005 period. Includes data on 459 4-digit manufacturing industries.
- The spread between corporate bonds with Aaa and Baa ratings is obtained from Moody's.
- EFD index by industries is provided by Rajan and Zingales (1998).
- The uncertainty index based on exogenous economic and non-economic events, used to exploit exogenous variations in spreads, is taken from Bloom (2009).

Model

Consider a standard labor demand equation for estimation of labor demand elasticities suggested by Hamermesh (1986, 1993):

$$\ln(L_{j,t}) = \alpha + \sum_i \beta_i \ln(w_{i,j,t}) + \gamma Y_{j,t} + \varepsilon_{j,t}$$

$L_{j,t}$: Labor input used in sector j,
$w_{i,j,t}$: Factor price for i^{th} input in j^{th} industry at time t
$Y_{j,t}$: Output of industry j
$\varepsilon_{j,t}$: Error term.

β_i gives the constant-output elasticity of labor demand with respect to factor price of input i.

Model

- A potential determinant of the input demands is the financial constraints faced by firms.
- Assume $\theta \in [0,1]$ is the fraction of firms' wage bills that need to be paid in advance to labor before production takes place.
- Profit function becomes:

$$\Pi_t = K_t^{\eta} L_t^{1-\eta} - W_t L_t - R_t^k K_t - (R_{t-1} - 1)\theta W_t L_t$$

- Labor demand in log-deviations form from the corresponding steady state values:

$$\hat{L}_t = \hat{K}_t - \frac{1}{\eta}\hat{W}_t - \xi \hat{R}_{t-1}$$

Methodology

- Augmented labor demand function becomes:

$$\ln(L_{j,t}) = \alpha + \sum \beta_i \ln(w_{j,i,t}) + \gamma Y_{j,t} + \delta \ln(R_{t-1}) + \varepsilon_{j,t}$$

Methodology

- **Practical Issue 1:** All the factor prices (other than wages) in the dataset reflect the nominal indices, rather than the actual levels of factor prices.

- Therefore, their distribution across industries at a particular time does not correspond to their actual cross-sectional distribution.

- Follow Slaughter (2001): take first differences and use $\ln(R_{t-1}) \approx r_{t-1}$:

$$\Delta \ln(L_{j,t}) = \alpha + \phi_j + \sum \beta_i \Delta \ln(w_{j,i,t}) + \gamma \Delta Y_{j,t} + \delta \Delta r_{t-1} + u_{j,t}$$

Methodology

- **Practical Issue 2:** For Δr_{t-1} we want to use spreads ΔBaa_Aaa_{t-1}. However due to lack of cross-sectional variation in Baa_Aaa_{t-1}, we cannot include in this regression time fixed effects to account for unobserved variations in the employment growth common to all industries.

- As a solution, we use $\triangle Baa\_Aaa_{t-1} \times EFD_j$, where EFD is taken from Rajan and Zingales (1998).

- New labor demand equation:

$$\begin{aligned}\Delta \ln(L_{j,t}) &= \alpha + \phi_j + \eta_t + \sum \beta_i \Delta \ln(w_{j,i,t}) + \gamma \Delta Y_{j,t} \\ &\quad + \delta(\triangle Baa\_Aaa_{t-1}) \times (EFD_j) + u_{j,t}\end{aligned}$$

OLS Results

Table 2: Determinants of Annual Rate Of Change In Industry's Employment - OLS Results

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment
Lag of Annual Percentage Points Change in Baa-Aaa Spread	-0.005	-0.006	-	-	-
	(0.002)***	(0.002)***	-	-	-
Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i	-	-	-0.011	-0.012	-0.005
	-	-	(0.004)***	(0.004)***	(0.006)
Annual Rate of Change in Industry's Average Wage	-0.632	-0.626	-0.634	-0.628	-0.657
	(0.024)***	(0.025)***	(0.024)***	(0.025)***	(0.027)***
Annual Rate of Change in Industry's Cost of Capital	0.083	0.083	0.083	0.083	0.092
	(0.011)***	(0.011)***	(0.011)***	(0.011)***	(0.010)***
Annual Rate of Change in Value of Real Output	0.556	0.552	0.557	0.552	0.522
	(0.016)***	(0.014)***	(0.016)***	(0.014)***	(0.015)***
Annual Rate of Change in Price of Materials	0.216	0.187	0.216	0.188	0.135
	(0.019)***	(0.017)***	(0.019)***	(0.017)***	(0.019)***
Annual Rate of Change in Price of Energy	0.042	0.053	0.042	0.052	0.001
	(0.009)***	(0.008)***	(0.009)***	(0.008)***	(0.012)
Industry Fixed Effects	No	Yes	No	Yes	Yes
Year Fixed Effects	No	No	No	No	Yes
Impact Factor %	-0.14	-0.17	-0.07	-0.08	-0.03
Observations	19660	19660	19660	19660	19660
R-squared	0.60	0.62	0.60	0.62	0.65

OLS Results

- A particular difficulty in estimating the effect of spreads on employment is the endogenous changes in spreads.

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  - For example, a deterioration in expectations about future economic activity can lead to an increase in spreads and a decline in employment at the same time.
  - Alternatively, periods of expansion might be associated with investment and employment expansions by firms with lower credit rating, which would increase bond supply at the lower end, and hence widen the spread between bonds with high credit rating and low credit rating.

List of Events used as an Instrument for Exogenous Changes in Spreads

Use 16 exogenous events in Bloom (2009) to capture the exogenous variations in the spreads.

Table 1:

Exogenous Events Used for Extracting Exogenous Changes in Spreads Between Baa-Aaa Rated Bonds (1962-2005)

Event	Date	Type of Event
Cuban Missile Crises	October 1962	Terror
Assasination of J.K. Kennedy	November 1963	Terror
Vietnam Buildup	August 1966	War
Cambodia and Kent State	May 1970	War
OPEC I, Arab-Israel War	December 1973	Oil
Franklin National	October 1974	Economic
OPEC II	November 1978	Oil
Afghanistan, Iran Hostages	March 1980	War
Monetary Policy Cycle Turning Point	October 1982	Economic
Black Monday	November 1987	Economic
Gulf War I	November 1990	War
Asian Crises	November 1997	Economic
Russian Crises	September 1998	Economic
9/11 Terrorist Attack	September 2001	Terror
Worldcom and Enron	September 2002	Economic
Gulf War II	February 2003	War

Source: Bloom (2009), p.676

First Stage Regression for the IV-Results (Using All 16 Events)

Table 3a: First Stage Regressions for Instrumental Variables

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Lag of Annual Percentage Points Change in Baa-Aaa Spread	Lag of Annual Percentage Points Change in Baa-Aaa Spread	Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i	Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i	Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i
One Year Lag of Exogenous Events Documented by Bloom (2009)	0.15	0.15	-	-	-
	(0.001)***	(0.001)***	-	-	-
Interaction between One Year Lag of Exogenous Events Documented by Bloom (2009) and External Financial Dependence of Sector i	-	-	0.118	0.151	0.153
	-	-	(0.001)***	(0.001)***	(0.000)***
Annual Rate of Change in Industry's Average Wage	0.828	0.837	0.248	0.249	0.004
	(0.048)***	(0.049)***	(0.023)***	(0.024)***	(0.014)
Annual Rate of Change in Industry's Cost of Capital	0.004	0.008	0.021	0.015	0.013
	(0.022)	(0.023)	(0.007)***	-0.008	(0.006)**
Annual Rate of Change in Value of Real Output	-0.152	-0.161	-0.087	-0.072	-0.025
	(0.025)***	(0.029)***	(0.010)***	(0.011)***	(0.008)***
Annual Rate of Change in Price of Materials	-0.53	-0.552	-0.127	-0.148	0.029
	(0.048)***	(0.051)***	(0.015)***	(0.017)***	(0.013)**
Annual Rate of Change in Price of Energy	0.333	0.34	0.085	0.092	0.00
	(0.028)***	(0.029)***	(0.009)***	(0.010)***	(0.016)
Industry Fixed Effects	No	Yes	No	Yes	Yes
Year Fixed Effects	No	No	No	No	Yes
Observations	19660	19660	19660	19660	19660
R-squared	0.10	0.10	0.07	0.08	0.55

First Stage Regression for the IV-Results (Using 10 non-economic events)

Table 3b: First Stage Regressions for Instrumental Variables:

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Lag of Annual Percentage Points Change in Baa-Aaa Spread	Lag of Annual Percentage Points Change in Baa-Aaa Spread	Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i	Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i	Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread and External Financial Dependence of Sector i
One Year Lag of Exogenous Non-economic Events Doc. by Bloom (2009)	0.088	0.088	-	-	-
	(0.001)***	(0.001)***	-	-	-
Interaction between One Year Lag of Exogenous Noneconomic Events Doc. by Bloom (2009) and External Financial Dependence of Sector i	-	-	0.078	0.088	0.088
	-	-	(0.001)***	(0.001)***	(0.000)***
Annual Rate of Change in Industry's Average Wage	0.875	0.883	0.262	0.264	0.006
	(0.050)***	(0.051)***	(0.025)***	(0.025)***	-0.015
Annual Rate of Change in Industry's Cost of Capital	-0.018	-0.012	0.01	0.01	0.014
	(0.021)	(0.023)	(0.007)	(0.008)	(0.006)**
Annual Rate of Change in Value of Real Output	-0.178	-0.191	-0.083	-0.082	-0.027
	(0.026)***	(0.029)***	(0.010)***	(0.012)***	(0.008)***
Annual Rate of Change in Price of Materials	-0.491	-0.511	-0.124	-0.135	0.03
	(0.049)***	(0.052)***	(0.015)***	(0.016)***	(0.013)**
Annual Rate of Change in Price of Energy	0.316	0.321	0.083	0.086	0.002
	(0.029)***	(0.030)***	(0.009)***	(0.009)***	(0.017)
Industry Fixed Effects	No	Yes	No	Yes	Yes
Year Fixed Effects	No	No	No	No	Yes
Observations	19660	19660	19660	19660	19660
R-squared	0.05	0.05	0.03	0.04	0.53

IV-Results for Effects of Exogenous Changes in Spreads on Employment (Using All 16 Events)

Table 5a: Determinants of Annual Rate Of Change In Industry's Employment - IV Results exogenous events documented by Bloom(2009)

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment
Lag of Annual Percentage Points Change in Baa-Aaa Spread	-0.079	-0.077	-	-	-
	(0.006)***	(0.006)***	-	-	-
Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread at t and External Financial Dependence of Sector i	-	-	-0.141	-0.162	-0.058
	-	-	(0.023)***	(0.018)***	(0.024)**
Annual Rate of Change in Industry's Average Wage	-0.564	-0.559	-0.598	-0.586	-0.657
	(0.026)***	(0.026)***	(0.025)***	(0.026)***	(0.027)***
Annual Rate of Change in Industry's Cost of Capital	0.081	0.082	0.083	0.084	0.093
	(0.011)***	(0.010)***	(0.011)***	(0.010)***	(0.010)***
Annual Rate of Change in Value of Real Output	0.543	0.538	0.547	0.54	0.521
	(0.016)***	(0.014)***	(0.016)***	(0.014)***	(0.015)***
Annual Rate of Change in Price of Materials	0.188	0.159	0.204	0.174	0.137
	(0.018)***	(0.016)***	(0.019)***	(0.017)***	(0.019)***
Annual Rate of Change in Price of Energy	0.063	0.073	0.051	0.064	0.001
	(0.009)***	(0.009)***	(0.009)***	(0.008)***	(0.012)
Industry Fixed Effects	No	Yes	No	Yes	Yes
Year Fixed Effects	No	No	No	No	Yes
Impact Factor %	-2.23	-2.17	-0.95	-1.10	-0.39
Observations	19660	19660	19660	19660	19660
R-squared	0.56	0.58	0.58	0.59	0.65

IV-Results for Effects of Exogenous Changes in Spreads on Employment (Using 10 Non-Economic Events)

Table 5b: Determinants of Annual Rate Of Change In Industry's Employment - IV Results with Exogenous Non-economic Events Documented by Bloom (2009)

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment	Annual Rate of Change in Employment
Lag of Annual Percentage Points Change in Baa-Aaa Spread	-0.107	-0.102	-	-	-
	(0.013)***	(0.013)***	-	-	-
Interaction between Lag of Annual Percentage Points Change in Baa-Aaa Spread at t and External Financial Dependence of Sector i	-	-	-0.206	-0.231	-0.104
	-	-	(0.042)***	(0.035)***	(0.050)**
Annual Rate of Change in Industry's Average Wage	-0.537	-0.536	-0.58	-0.567	-0.657
	(0.029)***	(0.029)***	(0.028)***	(0.028)***	(0.027)***
Annual Rate of Change in Industry's Cost of Capital	0.08	0.081	0.083	0.085	0.093
	(0.011)***	(0.010)***	(0.011)***	(0.011)***	(0.010)***
Annual Rate of Change in Value of Real Output	0.538	0.533	0.542	0.534	0.52
	(0.016)***	(0.014)***	(0.016)***	(0.014)***	(0.015)***
Annual Rate of Change in Price of Materials	0.177	0.149	0.198	0.167	0.138
	(0.018)***	(0.016)***	(0.018)***	(0.016)***	(0.019)***
Annual Rate of Change in Price of Energy	0.071	0.081	0.056	0.069	0.001
	(0.009)***	(0.009)***	(0.009)***	(0.008)***	(0.012)
Industry Fixed Effects	No	Yes	No	Yes	Yes
Year Fixed Effects	No	No	No	No	Yes
Impact Factor %	-3.02	-2.88	-1.39	-1.56	-0.70
Observations	19660	19660	19660	19660	19660
R-squared	0.52	0.55	0.55	0.56	0.64

Magnitude of the Effect Based on Column 5

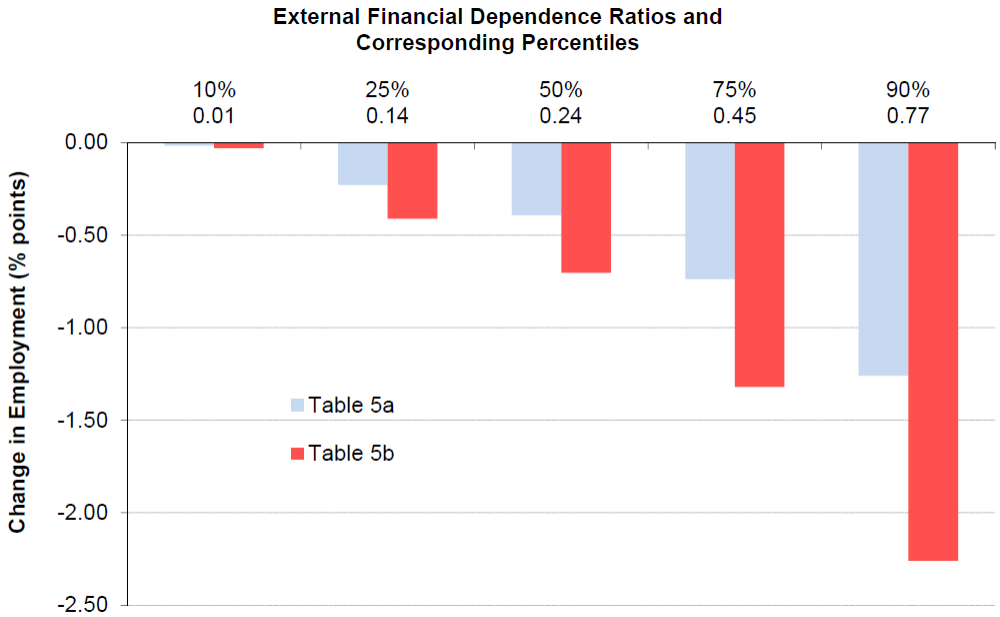
- For the median industry at the EFD distribution, decline in employment growth rate in response to 1 standard deviation increase in spreads is 0.39 percentage points with IVs based on 16 events and 0.70 percentage points with IVs based 10 events.

- Using 1.87 percentage-point increase in spread from 1.51 to 3.38 between August 2008 and December 2008, employment decline in 2009 is predicted as 4.67 and 5.78 percentage points for industries at the median and mean of EFD distribution. (Actual decline in 2009 was 11.4 percentage points.)

Differential Effect of Exogenous Changes in Spreads with Respect to EFD

Effects of changes in spreads varies by external finance dependence :

$$\frac{\partial \Delta \ln(L_{j,t})}{\partial \triangle Baa\_Aaa_{t-1}} = \delta \times EFD_j$$



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- This effect is higher for industries with more reliance on external financial resources. For example, 7.3 percentage point slow down for the industries at the 90^{th} percentile of EFD distribution.

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- This effect is higher for industries with more reliance on external financial resources. For example, 7.3 percentage point slow down for the industries at the 90^{th} percentile of EFD distribution.
- These highlight the potential for policymakers to limit employment losses during financial turmoils by mitigating the deterioration in credit conditions.

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