

# Labor and Finance

CompNet Workshop, ECB 24-25 June 2013

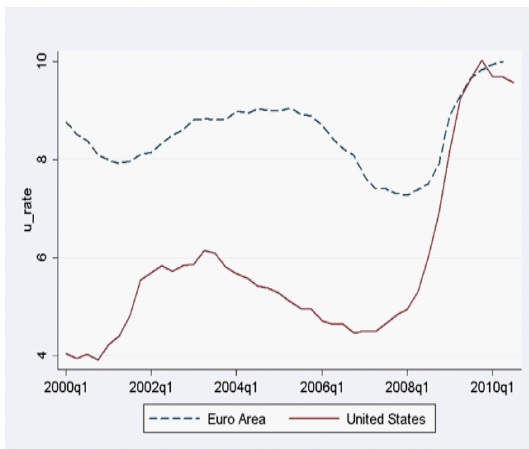
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June 2013

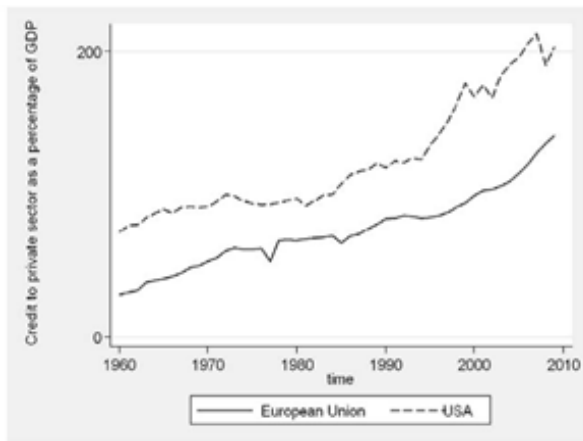
# Outline

- 1 Motivating Facts
- 2 Literature Review
- 3 Our contribution
- 4 Theory
- 5 Empirical Evidence

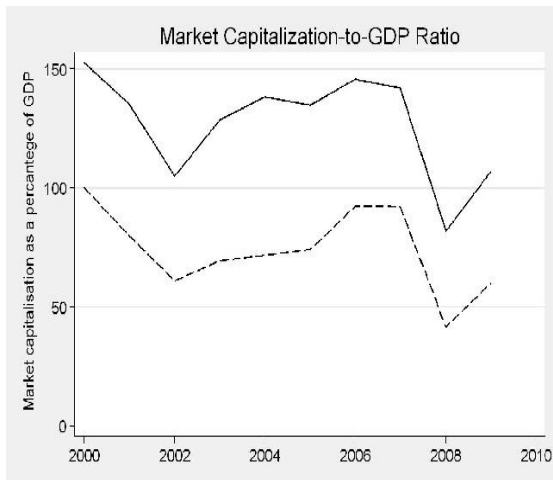
# Unemployment rate on the two sides of the Atlantic



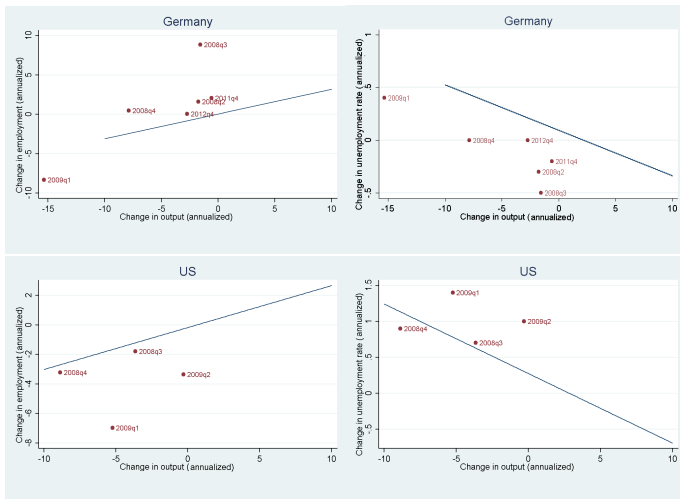
# Credit to the private sector over GDP



# Stock Market Capitalization over GDP



# Okun's law and the Great Recession



# Okun's Forecast Errors (I)

## EMPLOYMENT CHANGE

Country	Average Forecast Error of Previous Recessions	Average Forecast Error of Current Recession	Delta
France	2.02	3.02	0.99
Germany	1.44	3.99	2.55
Italy	2.92	2.89	-0.03
Japan	0.96	1.01	0.05
Spain	1.56	3.19	1.63
UnitedKingdom	1.48	2.31	0.83
UnitedStates	1.48	1.61	0.13

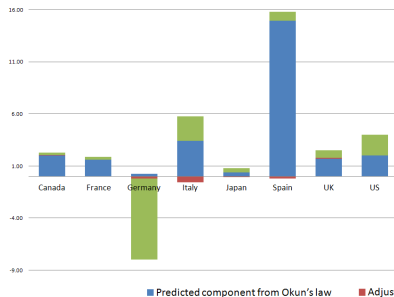
## UNEMPLOYMENT RATE CHANGE

Country	Average Forecast Error of Previous Recessions	Average Forecast Error of Current Recession	Delta
France	0.14	0.22	0.08
Germany	0.20	0.37	0.17
Italy	0.20	0.29	0.08
Japan	0.11	0.24	0.13
Spain	0.35	0.46	0.10
UnitedKingdom	0.30	0.32	0.02
UnitedStates	0.25	0.39	0.14

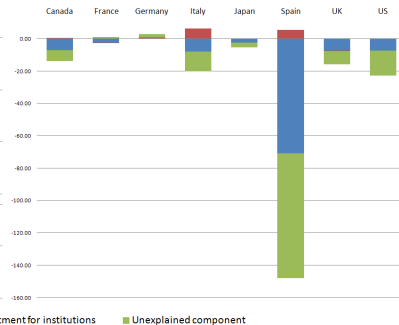
Notes: Forecast errors are given by the difference (in modules) between the actual variation in log employment and the change in the unemployment rate and the estimates from the following country specific Okun's law regression:  $\Delta x_t = \alpha + \beta^* \Delta y_t + \gamma^* RD_t + \delta^* RD_t^* \Delta y_t + \varepsilon_t$  where  $\Delta x_t$  is either the (annualized) change in unemployment rate or the variation in log employment,  $\Delta y$  is real output growth and  $RD$  a recession dummy allowed to affect both the intercept and the Okun's law coefficient, which was estimated on the period 1960q1-2013q1 excluding each time the quarters for which the forecast error is obtained.

# Explaining Employment/Unemployment response

Decomposition of the Cumulative Change in the Unemployment Rate during the Great Recession



Decomposition of the Cumulative Change in the Employment during the Great Recession





# Financial Recessions are Different

Unemployment and hours adjustment during financial recessions

Country	Type of recession	du	du/u	dHW (thousands)	dHW/HW	dy/y
France	Financial rec	1.40	19%	-225	-2.2%	-4.3%
	Other rec	1.00	11%	-181	-1.9%	-1.2%
	<i>Difference</i>	<i>0.40</i>	<i>8%</i>	<i>-44</i>	<i>-0.4%</i>	<i>-3.1%</i>
Germany	Financial rec	-0.40	-5%	-306	-2.1%	-6.8%
	Other rec	0.54	8%	-240	-1.5%	-1.1%
	<i>Difference</i>	<i>-0.94</i>	<i>-13%</i>	<i>-66</i>	<i>-0.6%</i>	<i>-5.7%</i>
Italy	Financial rec	1.30	15%	-540	-5.2%	-1.5%
	Other rec	0.43	6%	-16	0.0%	-2.2%
	<i>Difference</i>	<i>0.88</i>	<i>9%</i>	<i>-524</i>	<i>-5.2%</i>	<i>0.7%</i>
Japan	Financial rec	0.47	13%	-421	-1.6%	-1.8%
	Other rec	0.20	6%	-500	-2.1%	-5.9%
	<i>Difference</i>	<i>0.27</i>	<i>7%</i>	<i>79</i>	<i>0.5%</i>	<i>4.1%</i>
Spain	Financial rec	9.80	107%	-584	-6.8%	-5.0%
	Other rec	3.30	20%	-	-	-1.6%
	<i>Difference</i>	<i>6.50</i>	<i>87%</i>	<i>-</i>	<i>-</i>	<i>-3.4%</i>
UK	Financial rec	2.10	36%	-882	-2.5%	-3.2%
	Other rec	0.50	7%	-1413	-2.9%	-3.1%
	<i>Difference</i>	<i>1.60</i>	<i>28%</i>	<i>531</i>	<i>0.4%</i>	<i>0.0%</i>
US	Financial rec	2.65	50%	-8693	-3.6%	-3.0%
	Other rec	1.93	33%	-1667	-1.0%	-2.6%
	<i>Difference</i>	<i>0.72</i>	<i>17%</i>	<i>-7026</i>	<i>-2.6%</i>	<i>-0.4%</i>

France: from 1978q1; GDP 1970; Germany: from 1991q1; Italy: unempl. from 1983q1; HW 1992q1; GDP 1970; Spain: unempl. from 1986q2; HW 1995q1; GDP 1970; UK: unempl. from 1983q1; GDP and HW yearly data 1970; US: unempl. from 1970q1; GDP and HW yearly data 1970. Sources: OECD, Eurostat, Statistics Canada, Statistic Bureau of Japan, US Bureau of Labor Statistics. Episodes of recessions with financial crises: France 2008; Germany 2008/09; Italy 1992; Japan 1993, 1987/98, 2001; Spain 2008; UK 1975, 1990, 2008; US 1990, 2008.

# Number of financial recession in different countries

Country	Financial Recessions		Financial Crises	Other Recessions	
	av. Lenght (qrt)	nr. Of Episodes	nr Of Episodes	av. Lenght (qrt)	nr. Of Episodes
Australia	5	1	1		
Canada				3	1
Finland	13	1	1	2.5	2
France			1	3.5	2
Germany			1	4.5	3
Italy	6	1	1	3	5
Netherlands	3	1	-		
Norway			-	3.5	2
Portugal			-	3.5	2
Spain			-	4	1
Sweden			-	4	1
UK	4.5	2	4		
US	4	1	2	3.5	6

Source: NBER and Reinhart & Rogoff (2008)

# Financial Recessions/Shocks and Employment Adjustment

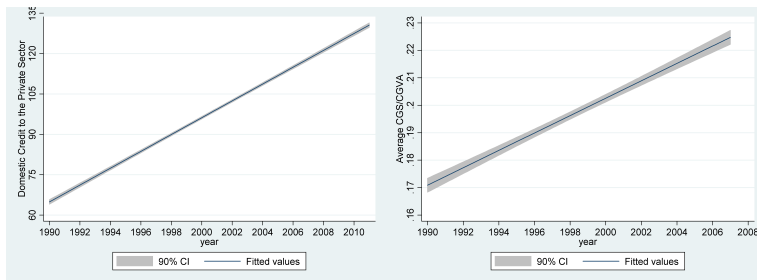
VARIABLES	(1) $\Delta e$	(2) $\Delta e$	(3) $\Delta e$	(4) $\Delta e$
$\Delta y$	0.103*** (0.027)	0.103*** (0.027)	0.110*** (0.027)	0.103*** (0.027)
Recession	-0.009*** (0.001)	-0.009*** (0.001)	-0.006*** (0.001)	-0.009*** (0.001)
Financial Crisis	-0.004** (0.002)	-0.004** (0.002)		-0.004** (0.002)
Financial Recession			-0.007*** (0.002)	
Country dummies	YES	YES	YES	YES
Sector dummies	NO	YES	YES	YES
Country*Sector	NO	NO	NO	YES
Observations	5,270	5,270	5,270	5,270
R-squared	0.029	0.057	0.059	0.065

Standard errors in parentheses  
 \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The equation that we estimate is as follows:  $\Delta e_{jct} = \alpha_j + \alpha_c + \beta \Delta y_{ct} + \gamma^* RD_{ct} + \gamma_1 FC_{ct} + \epsilon_{cjt}$

# More Leverage and More Liquidity

**Figure:** Domestic Credit to Private Sector and Gross Corporate Savings as ratio of Value Added



Source: Neiman & Karabarbounis (2012) and IMF(2013)

# Open Issues

- During the Great Recession (2008-2009), initially larger labor market response in the US (and UK) than in the Euro area.
- Labour market institutions (usual suspects) not enough to understand these dynamics.
- As it was a (global) financial recession, the new suspect is finance, the links between financial shocks and labor market dynamics.
- Evidence that financial crises are particularly bad for employment.

# Research Questions

- Which are the relevant links between financial shocks and labor market dynamics?
- Do they mainly operate along the job creation or the job destruction margin?
- How does finance interact with labor market frictions? And unemployment with financial frictions?
- Can finance be bad for employment during a (financial) crisis and be good instead in normal times?
- How does a credit crunch translate into job destruction and unemployment?

# Labor and Finance within firms

- *Almost every Firm*
  - hires labor
  - holds liquid assets not invested internally (external use of funds)
- Two key decisions
  - optimal employment level: *hiring and firing*
  - optimal mix between internal and external financing: *leverage*

# Two separate avenues of research

- Corporate finance: external use of funds by firms. No focus on hiring and firing.  
*Holmstrom and Tirole, 2011*
- Macro labor: hiring, firing and equilibrium with friction unemployment but no focus on external use of funds *Mortensen-Pissarides, 1994*



# Missing Links

- More funding allow firms to invest more
- More indebted firms likely to be more vulnerable to financial shocks
- Labor market frictions (wage setting, search costs and sunk costs) likely to be important to understand financial frictions and constraints
- A need for
  - Archetype model of labor and financial frictions
  - Understanding interplay between financial frictions, lending and labor market outcomes

# Finance and Labor: Existing Work/Channels

- *Risk adjustment effect* Greenwoud-Stiglitz (1983)  
capital imperfections increase risk aversion of frism and reduce marginal product of labor
- *Quasi Fixed effect of labor demand* Financing of quasi-fixed cost (Oi, 1962) in imperfect capital markets. Farmer (1985) on links between interest rate shocks and labor demand
- *Sticky bank borrower relationship.* Asymmetric information (Adverse selection, Sharpe 1990); moral hazard (Holmstrom and Tirole, 1997). Wasmer and Weil (2004): double frictions,no shocks

# Finance and Labor: Financial Crisis and Employment

- Pagano Piga (2010) no labor market frictions
- Gatti et al. (2010), Monacelli, Quadrini and Trigari (2010): finance and collective bargaining
- Pure empirical work (Bentolila-Portugal 2013) etc..

# Our contribution: Bridging HT and MP

- Imperfections
  - *labor*: standard matching model with wage posting
  - *finance*: funding from pledgeable income
- Equilibrium interplay
  - Probability of obtaining refinancing and share of pledgeable income affect equilibrium unemployment
  - ..and vice/versa.. search frictions affect optimal leverage
  - use of funds crucially depend on labor market imperfections
- Implications
  - At times of adverse financial conditions, more leveraged firms are more likely to liquidate and destroy jobs.

# Our contribution: Evidence on Leverage and Job Destruction

- Empirically:
  - causal link between firm leverage and job destruction during the great recession.
  - leverage is endogenous, instrumented by access to third part collateral.
  - no effect of leverage on job creation

# Key Concepts



$$\text{Firms' Use of Funds} = \tilde{I} + A + C(.)A$$

$\tilde{I}$  liquid funds held by the firms,  $A$  measures the size of investment/machine, and  $C(.)A$  total labor costs

- Firms Pledgeable income. A fraction  $\rho$  of the PDV of the surplus can be pledged. If the joint firm-worker surplus of an investment  $A$  with liquid fund  $\tilde{I}$  is  $S(A, \tilde{I})$ ,

$$\text{Total Funding} = P = Y_o + \rho S(A, \tilde{I})$$

where  $Y_o$  is the entrepreneur private wealth that can be fully pledged.

# Model (I)

- 1 Entrepreneurs set up firm at effort cost  $K$
- 2  $A$  is firm size or capacity. Irreversible.
- 3 Output is  $f(A) = yA$ .
- 4 The entrepreneur has a flow private revenue  $y_0$
- 5 At rate  $\lambda$ , the project needs refinancing of the same amount  $A$ .
- 6  $\tau$  is the probability that the project will not receive refinancing.

# Model (II)

- 1 The firm can hold liquid reserves (deposits) that yield  $r$  and ensure that- conditional on  $\lambda$ , a funding of size  $I$  is available for reinvestment.  $I$  is a *war chest*.
- 2 A second  $\lambda$  shock kills the firm
- 3 The refinancing shock eliminates collateral, and ends the initial financial contract.

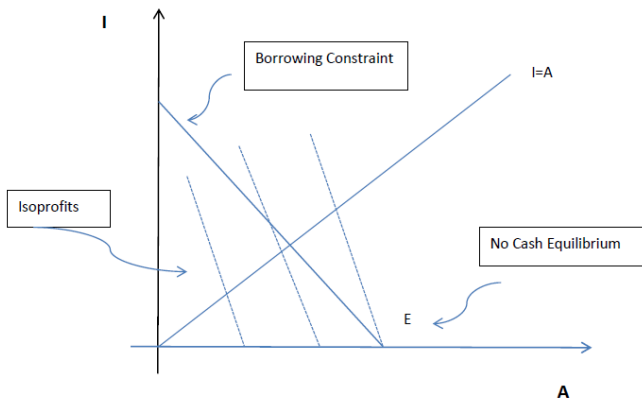


# Cash (Warchest) and No-Cash equilibria

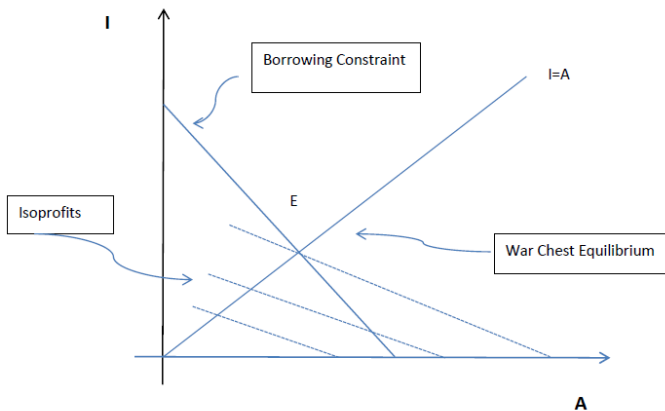
The firm optimization problem has two possible outcomes.

- In the No cash Equilibrium the firm maximizes capacity and does not use any cash ( $I = 0; A = A^{max}$ ).
- In the Warchest equilibrium the firm holds cash in equilibrium so that  $I = A$

# The No cash equilibrium



# The Warchest equilibrium



# The Trade-off Between Cash and no Cash

- Increase in Profits along the borrowing constraint

$$\left[ \frac{y - rU}{r + \lambda} - 1 \right] (1 + \tilde{\lambda}(1 - \tau)) - C - \tilde{\lambda}\tau \left[ \frac{y - rU}{r + \lambda} - 1 \right] \frac{1}{k\tilde{\lambda}}$$

- internal return on  $A$  depends on probability  $(1 - \tau)$
- search costs to be paid upon investing  $A$  and not by increasing  $I$
- $I$  useful only if you do not get refinancing  $\tau$
- opportunity cost of  $I$  depends on size of the financial multiplier

# Propositions

- **Proposition 2** The firm will choose to hold cash and establish a warchest equilibrium as long as

$$\left[ \frac{y - rU}{r + \lambda} - 1 \right] (1 + \tilde{\lambda}(1 - \tau)) \leq C + \tilde{\lambda}\tau \left[ \frac{y - rU}{r + \lambda} - 1 \right] \frac{1}{k\tilde{\lambda}}$$

- **Proposition 3** An increase in the probability of distress  $\tau$  makes the warchest equilibrium more likely
- **Proposition 4** An increase in the pledgeability parameter  $\rho$  makes the warchest equilibrium less likely

# Stocks

- $n_1$  and  $n_2$  the share of workers employed in firms holding cash  $n_1$  and no cash  $n_2$ .
- If firms do not hold cash, they fire workers when refinancing fails

$$u = \omega \frac{\lambda}{\lambda + 2\theta q(\theta)} + (1 - \omega) \frac{\lambda}{\lambda + (1 + (1 - \tau))\theta q(\theta)}$$

$$n_1 = \omega \frac{\theta q(\theta)}{\lambda + 2\theta q(\theta)} + (1 - \omega) \frac{\theta q(\theta)}{\lambda + (1 + (1 - \tau))\theta q(\theta)}$$

$$n_2 = \omega \frac{\theta q(\theta)}{\lambda + 2\theta q(\theta)} + (1 - \omega) \frac{\theta q(\theta)(1 - \tau)}{\lambda + (1 + (1 - \tau))\theta q(\theta)}$$

# Labor Market Frictions in General Equilibrium

- *Fundamental Limit Theorem*
- **When labor become frictionless  $c \rightarrow 0$  firms never use cash**
- It is labor market frictions that makes warchest relevant
- intuition 1: trade-off between invest now ( $A$ ) or invest for a longer period ( $\tilde{I}$ )
- labor Rents  $C$  are paid upfront and give ex-post incentive to preserve them ( $\tilde{I}$ )

# Characterization Cash Equilibrium

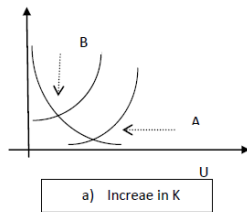
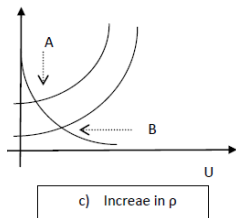
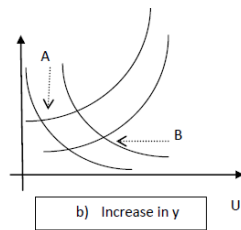
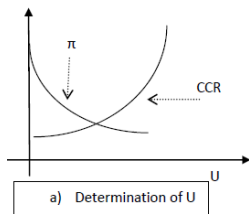
$$\left[ \frac{y - rU}{r + \lambda} - 1 \right] (1 + \tilde{\lambda}(1 - \tau)) \leq C + \tilde{\lambda}\tau \left[ \frac{y - rU}{r + \lambda} - 1 \right] \frac{1}{k\tilde{\lambda}}$$

$$\frac{K}{Y_0 \left( \frac{1}{k(U)} + \tilde{\lambda} \right)} = \frac{y - rU}{r + \lambda} (1 + \tilde{\lambda}) - (1 + C(U))$$

- Cost Capacity Ratio=Profit per Worker
- $I(U) = Y_0 \left( \frac{1}{k(U) + \tilde{\lambda}} \right)$
- $\tau$  does not enter second equation because cash equilibrium

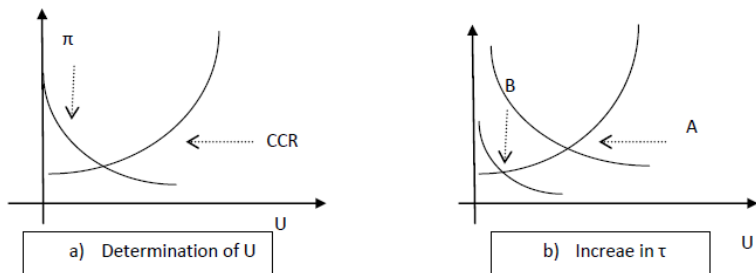


# Comparative Static: Warchest



# Comparative Static: No Cash

**Figure:** The General Equilibrium Effects of an increase in  $\tau$ , when the firm uses no cash



# Heterogeneous $\tau$

- **Proposition 6** There exists a unique  $\tau^*$  ( $0 \leq \tau^* \leq 1$ ) so that firms have cash if and only if  $\tau > \tau^*$
- Model with heterogeneous  $\tau$

$$\tau^h > \tau^* > \tau^l,$$

- Probability  $\alpha$  that  $\tau = \tau^h$
- Firms behave very differently if their specific value of  $\tau$  is  $\tau^h$  or  $\tau^l$ .

# Empirical Implications

- 1 leveraged firms are larger;
- 2 firms that are less leveraged are less exposed to refinancing risks
- 3 leveraged firms fire workers when refinancing fails

# From Theory to the Data

- Within country variation: we consider economies with a coexistence of high-credit and low-credit sectors and firms
  - 1 high credit firms destroy more jobs at time of financial distress
  - 2 low credit firms should be less hit by the financial shock

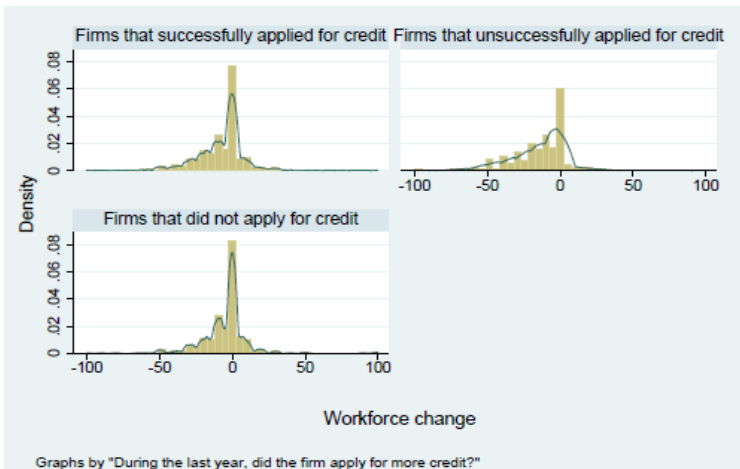
# Firm-level response and leverage during the GR

- Firm-level response and leverage during the GR  
An EFIGE-Amadeus matched dataset
- Mainly a cross-section (some retrospective info, series limited to some variables)
- 14,759 firms, 7 countries, 11 sectors
- Variables covering the 2007-9 period
- Detailed info on firms' characteristics, employment and financial conditions

# Key Variables

- Employment variation during the Great Recession:
- $\Delta e$ : During the last year (2009) did you experience a reduction or an increase/decrease of your workforce in comparison with 2008?
- Those reporting a change are also requested to specify percentage variation
- Imputed value 0 of  $\Delta e$  to firms reporting no change
- $\Delta y$ : measured through operational revenue growth in 2008-2009

# Firm Level Reponse and Leverage during the GR





# Frame Measures of Financial Leverage

- **Gearing:** Debt to equity ratio (creditor's vs. owner's funds)
- **Solvency Ratio:** Ratio of after tax net profit (plus depreciation) over debt (company's ability to meet long-term obligations)
- **Long-term debt to assets ratio:** Loans and financial obligations lasting more than one year.

# Empirical Framework

We estimate the following equation

$$\Delta e_{ijc} = \alpha + \alpha_j + \alpha_c + \alpha_j * \alpha_c \beta \Delta y_{jc} + \gamma Lev_{ijc} + \delta S_{ijc} + \epsilon_{ijc}$$

where  $\Delta e$  is the reported employment growth rate *during* the period 2008-9,  $i$  denotes the firm,  $j$  the sector and  $c$  the country,  $S$  is set of size dummies (employment or turnover) and  $Lev$  is either the Gearing Ratio, the Solvency Ratio or the Long-term Debt to Asset ratio all measured *before* the Great Recession (according to 2007 balance sheet data). We also include country and sector dummies as well as interactions between the two sets of dummies.

Simple OLS and 2SLS using third party collateral as **instrument**. Identification

assumption: involvement in consortium affects leverage in normal times

(risk-aversion), but not directly employment adjustment during the crisis.

# $\Delta e$ , All Firms

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Method	OLS	IV	OLS	IV	OLS	IV
Second stage						
$\Delta \bar{y}$	1.107 (0.910)	-57.31 (133.3)	1.049 (0.901)	98.56 (169.1)	1.040 (0.910)	727.4 (1533)
Gearing	-0.004*** (0.001)	-0.029** (0.012)				
Solvency			0.04*** (0.006)	0.603*** (0.213)		
LT DA					-0.133 (0.607)	-346.4 (630.0)
Constant	-8.123*** (2.594)	-13.09 (17.11)	-10.73*** (2.630)	-13.19 (20.69)	-10.02*** (2.555)	108.8 (243.5)
Country	YES	YES	YES	YES	YES	YES
Sector	YES	YES	YES	YES	YES	YES
Country*Sector	YES	YES	YES	YES	YES	YES
Size	YES	YES	YES	YES	YES	YES
First stage						
Third party collateral		Gearing 108.24*** (16.476)		Solvency -6.846*** (1.686)		LT DA 0.012 (0.022)
Observations	8596	2358	9649	2900	8064	2324

Standard errors in parentheses  
 \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

# $\Delta e$ , Only Firms Downsizing

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Method	$\Delta e(\%)$ OLS	$\Delta e(\%)$ IV	$\Delta e(\%)$ OLS	$\Delta e(\%)$ IV	$\Delta e(\%)$ OLS	$\Delta e(\%)$ IV
Second stage						
$\Delta \bar{y}$	0.547 (1.243)	-95.87 (132.8)	1.322 (1.209)	14.79 (179.7)	1.378 (1.243)	-181.8 (739.2)
Gearing	-0.003** (0.001)	-0.034* (0.017)				
Solvency			0.057*** (0.009)	0.748** (0.314)		
LT DA					-2.449* (1.474)	-343.7 (669.0)
Constant	-20.23*** (3.314)	-24.75 (16.62)	-23.08*** (3.324)	-31.40 (21.79)	-21.95*** (3.268)	-38.91 (91.39)
Country	YES	YES	YES	YES	YES	YES
Sector	YES	YES	YES	YES	YES	YES
Country*Sector	YES	YES	YES	YES	YES	YES
Size	YES	YES	YES	YES	YES	YES
First stage						
Third party collateral		Gearing 88.366*** (21.310)		Solvency -5.928*** (1.989)		LT DA 0.012 (0.024)
Observations	4151	1195	4677	1458	3783	1091

Standard errors in parentheses

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

# Conclusions

- Model of labor/finance frictions and interactions
- Highlights mechanism linking financial *shocks* to labor adjustments
- Firms can have a war chest of cash at the equilibrium. If so, they are less efficient, but less vulnerable to refinancing shocks
- Deep financial markets good for employment in normal times
- but adverse financial shocks lead to job destruction in highly leveraged environments

# Conclusions (cont.)

- Empirically, conditional on a financial shock,
- More leveraged *firms* destroy more jobs
- The effect is non-negligible: 100 basis points more of Gearing Ratio mean JD of 5 per cent
- 10 basis points of solvency ratio mean less JD of 2.5 per cent
- More leveraged *sector/countries* experience larger employment adjustment during FC than non-financial recessions
- Causal effect of leverage on job destruction