The Long-Run Real Effects of Banking Crises: Firm-Level Investment Dynamics and the Role of Wage Rigidity

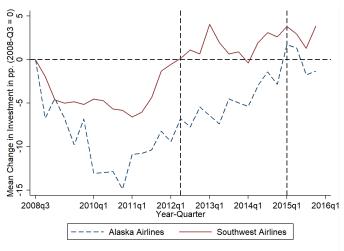
Carlo Wix Federal Reserve Board

August 31, 2023 EEA 2023 Barcelona

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Alaska Airlines vs. Southwest Airlines Investment Dynamics



Dan Richman, Seattle Post-Intelligencer, September 12, 2008

Alaska Airlines to cut flights, jobs

Up to 1,000 workers could be laid off

By DAN RICHMAN, P-I REPORTER Published 10:00 pm, Friday, September 12, 2008 ADVERTISEMENT

With the announcement that it will lay off up to 10 percent of its work force and make further cuts to its flight schedule, Alaska Airlines has joined the ranks of troubled airlines both here and abroad.

David Lewin, Op-Ed Wall Street Journal, February 06, 2009

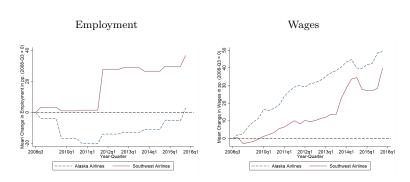
Share the economic pain: cut salaries, not employees

David Lewin | February 06, 2009

During that downturn, Southwest decided not to make any layoffs. Instead, the company cut bonuses, profit-sharing payments and salaries for executives, and also froze managerial pay. This let Southwest rebound strongly as the economy improved. The airline didn't have to incur new-employee hiring and training costs, and its highly-motivated employees performed exceptionally well.

Southwest's "cut pay rather than people" strategy provides a lesson for the current economic downturn: When employees are carefully selected and trained, work in self-managed teams, are customer-oriented and are highly loyal and committed to their organizations, they should be viewed as indispensable assets. They are integral to the process of rebounding from a downturn

Alaska Airlines vs. Southwest Airlines Employment and Wage Dynamics



Research Questions

- What are the effects of credit market disruptions on real firm outcomes in the long run?
 - Are the effects persistent or is there a full recovery?
 - To what extent is this relationship causal?
- How do these effects depend on nominal wage rigidities at the firm level?
 - Do firms with with more flexible wages recover faster?
 - Do wage rigidities amplify the negative effects of banking crises?



Empirical Strategy

Two ingredients:

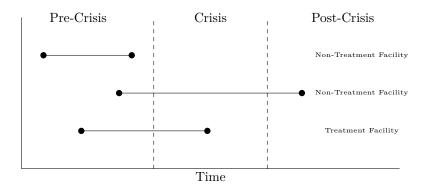
- Identifying a credit supply shock at the firm level
- Constructing a novel measure of wage rigidity at the firm level

Basic Identification Idea: Credit supply shock:

- Exploiting variation in firms' refinancing needs in the syndicated loan market during the 2008-09 banking crisis.
- \Rightarrow Quasi-experimental variation in how adversely firms were affected by the banking crisis.

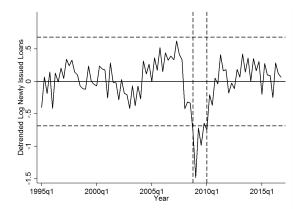


Illustration: Basic Identification Idea



2009 Lending Drop in the Syndicated Loan Market

Log Volume of Newly Issued Syndicated Loans by Quarter



Identification Assumptions

Assumption 1: Drop in lending not (purely) demand driven

- see e.g. Ivashina and Scharfstein (2010), Adrian, Colla and Shin (2012)
- Crisis also affected funding markets for corporate bonds (Adrian, Colla and Shin, 2012), commercial papers (Kacperczyk and Schnabl, 2010), equity issuances (Belo, Lin, and Yang, 2014)
- \Rightarrow Difficult for firms to refinance.

Assumption 2: Exogenous Refinancing Needs

- Treatment Group: Firms which had a at least one syndicated loan facility maturing from 2008-Q4 to 2010-Q1
- Maturity of the median loan = 5 years
- \Rightarrow Unlikely that in 2004 firms were anticipating the 2008-09 crisis.

Anecdotal Evidence Summary Statistics Maturity Structure Able to Refinance?





Measuring Wage Rigidity at the Firm Level

Definition: Payroll of firm i in quarter t:

$$\mathrm{Payroll}_{i,t} = \mathrm{Employment}_{i,t} \times \overline{\mathrm{Wage}}_{i,t}$$

Firms can adjust their payroll along two margins (Pischke, 2016):

$$\Delta Log\left(\text{Payroll}_{i,t}\right) = \Delta Log\left(\text{Employment}_{i,t}\right) + \Delta Log\left(\overline{\text{Wage}}_{i,t}\right)$$

Wage rigidity measure: The wage share of payroll adjustment

$$\theta_{i} = \frac{1}{T} \sum_{t=1}^{T} \frac{\Delta Log\left(\overline{\text{Wage}_{i,t}}\right)}{\Delta Log\left(\text{Payroll}_{i,t}\right)}$$



Wage Data Caveat Payroll Measures Wage Share Distribution

Local Projection DID Matching Approach

- Estimation: Average treatment effect on the treated (ATT)
- Bias-corrected Abadie and Imbens (2006) matching estimator

$$\widehat{\tau}_{ATT}^{h} = \frac{1}{N_{T}} \sum_{i:T_{i}=1} \left[\Delta^{h} Y_{i} - \Delta^{h} \tilde{Y}_{i}(0) \right] \quad \forall h = 1, \cdots, 23$$

$$2008-Q3 \quad \bullet \qquad \qquad \bullet \quad 2010-Q2$$

$$\vdots$$

$$2008-Q3 \quad \bullet \qquad \qquad \bullet \quad 2015-Q4$$

- ⇒ Disentangle short-run from long-run effects
- ⇒ Trace out a treatment effect curve over time

Variables

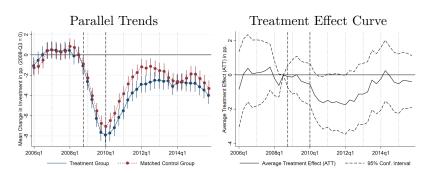


Matching Quality

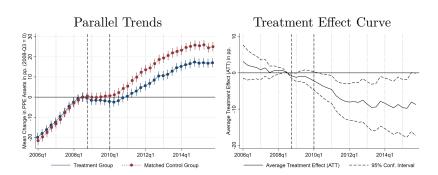
Post-Matching Summary Statistics

Matching Covariate	Treated	Control	%Bias	t-Stat
Size	21.62	21.64	-1.54	-0.28
Investment	5.79	5.49	7.78	1.43
Cash Holdings	7.88	7.72	1.67	0.31
Q	1.53	1.48	7.55	1.33
Cash Flow	8.04	9.18	-2.74	-0.49
Return on Assets	3.39	3.49	-3.96	-0.72
Long-Term Leverage	26.64	25.68	5.15	-0.72
Number of Firms	736	736		

Investment



Firm Growth



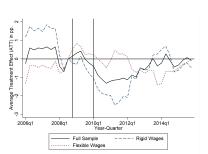


The Role of Wage Rigidity

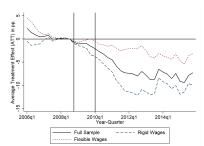
• Approach: Treatment group split by wage rigidity

$$\text{Rigid Wages}_i = \begin{cases} 1 & \text{if} \quad \text{Treatment}_i = 1 & \& \quad \theta_i < Q_{50}(\theta) \\ 0 & \text{if} \quad \text{Treatment}_i = 1 & \& \quad \theta_i \geq Q_{50}(\theta) \end{cases}$$

Investment



Accumulated Firm Growth



Within Treatment Group Matching

- However: Wage rigidity is negatively correlated with firm size.
- Solution: Matching within treatment group.

$$T_i^{\text{Rigid vs. Flexible}} = \begin{cases} 1 & \text{if} \quad \text{Treatment}_i = 1 & \& \quad \theta_i < Q_{50}(\theta) \\ 0 & \text{if} \quad \text{Treatment}_i = 1 & \& \quad \theta_i \geq Q_{50}(\theta) \end{cases}$$

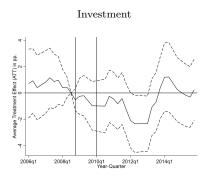


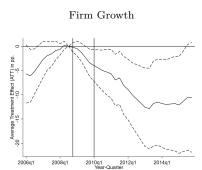
Treatment Group



Control Group

Treatment Effect Curves: The Role of Wage Rigidity





Employment and Wages

Conclusion

- Firms do not offset the temporary investment gap induced by a financial shock.
- ⇒ Banking crises cause persistent accumulated growth gaps.
 - Firms with more rigid wages recover slower from a financial shock.
- \Rightarrow Wage rigidities exacerbate the negative effects of banking crises.

Digression Germany



APPENDIX

The Big Picture

- Global Financial Crisis of 2008-09 followed by the Great Recession
- Slow recovery in the United States and many other advanced economies (Reinhart and Rogoff, 2014)
- Heterogeneity in recovery paths across firms (and countries)

Back

Literature

Growing literature: Effect of financial frictions on the real economy.

Corporate Finance

- Chava and Purnanandam (2011)
- Almeida et al. (2012)
- Chodorow-Reich (2014)

Macroeconomics

- Jermann and Quadrini (2012)
- Christiano, Motto, Rostango (2014)
- Ajello (2016)

Macro Literature on Recoveries

- Reinhart and Rogoff (2009, 2014)
- Fatás and Mihov (2013)
- Romer and Romer (2017)



Contribution

	Corporate Finance	Wix (2017)	Macroeconomics
Firm-Level Results	\checkmark	\checkmark	X
Quasi-Experimental Identification	✓	\checkmark	X
Long-Run Effects (Recovery Paths)	X	✓	\checkmark
Role of Wage Rigidity	X	\checkmark	✓

- \Rightarrow Bridging the gap between Corporate Finance and Macro.
 - Long-run effects of financial shocks (recovery paths)
 - Novel firm-level evidence
 - Role of wage rigidity in exacerbating financial shocks
 - Novel firm-level evidence





Data

- Dealscan: Loan-Level Data on Syndicated Loans
- Compustat: Firm Balance Sheet Data
- Quarterly Workforce Indicators: Wage Data



Anecdotal Evidence: Refinancing Risk

Moody's Investors Service, March 17, 2009, Analyst Report

"The study of 330 investment-grade non-financial corporate issuers in the U.S. with **debt maturing between 2009 and 2011** indicates that $[\cdots]$ refunding risk $[\cdots]$ is elevated at a time of tight credit markets $[\cdots]$ The broad financial crisis is elevating refunding risk for most companies."

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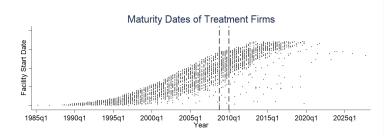
Loan-Level Data

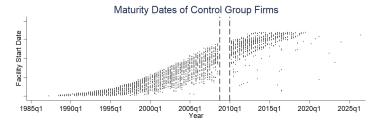
Summary Statistics: Syndicated Loans

		Treatment Facilities				Non-Treatment Facilities						
	#	Mean	SD	10th	50th	90th	#	Mean	SD	10th	50th	90th
Facility Volume (\$M)	1281	481	1173	25	200	1500	6018	581	1019	40	291	1468
Maturity (Months)	1281	50	24	12	60	70	6018	59	23	36	60	83
Term Loan Indicator		0.35	0.48					0.34	0.47			
Credit Line Indicator		0.65	0.48					0.66	0.47			

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Maturity Structure



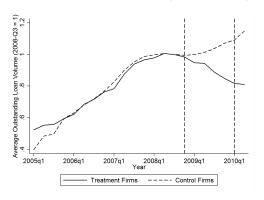






Were Treatment Firms Able to Refinance?

Outstanding Loan Volume (2008-Q3 = 1)

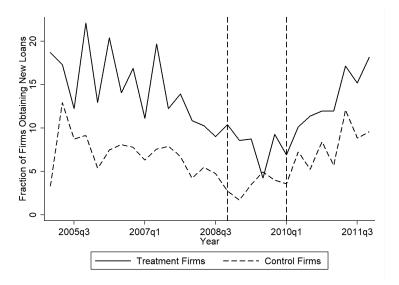


⇒ Treatment firms were unable to (fully) refinance.





Who Got Credit?







Wage Data and Payroll Calculation

- Source: Quarterly Workforce Indicators (QWI)
- \bullet Level of observation: State \times 4-Digit NAICS \times Firm Size
- Merging QWI and Compustat based on:
 - Headquarter State
 - 4-digit NAICS industry
 - Firm Size Bucket
 - \Rightarrow Similar to Tuzel and Zhang (2017) and Kuehn, Simutin, and Wang (2017)
- \bullet Calculating the payroll of firm i

$$\text{Payroll}_{i,t} = \text{Employment}_{i,t}^{\text{CS}} \times \text{Wage}_{i,t}^{\text{QWI}}$$



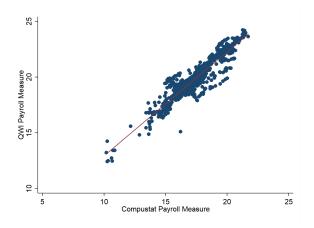


Use of Wage Data: Caveat

- Caveat: QWI data is at the establishment level
 - \Rightarrow Measurement error if production outside head quarter state
- But: Headquarters are a good proxy for firm location
 - Chaney, Sraer, and Thesmar (2012)
 - Tuzel and Zhang (2017)
- Also: QWI-Compustat payroll ≈ Compustat's staff expenses



Payroll Measure versus Compustat Staff Expenses

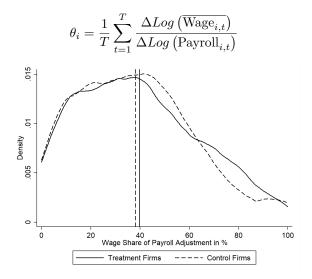


- $\beta = 0.93$
- Adjusted $R^2 = 0.88$





Wage Share of Payroll Adjustment



Local Projection DID Matching Approach: Variables

Outcome Variables:

- Δ Investment = Investment_{After} Investment_{Before}
- $\Delta \text{ Log PPE} = \text{Log PPE}_{\text{After}} \text{Log PPE}_{\text{Before}}$

Matching Covariates (as of 2008-Q3):

- Size, Investment Ratio, Cash Holdings, Tobin's Q, Cash Flow, Return on Assets, Leverage
- 1-digit SIC industry code

Time Horizon:

- Before Period = 2008-Q3
- After Period = $\{2010-Q2,...,2015-Q4\}$

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Matching Results: Investment and Firm Growth

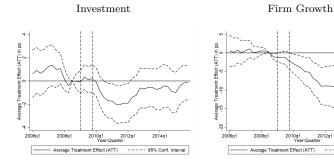
Dependent Variable	Δ Investment		Δ Log PPE Assets		
Post Period	ATT	S.E.	ATT	S.E.	
2010-Q2	-1.2 *	0.7	-2.9 **	1.5	
2010-Q3	-1.5 **	0.7	-3.6 **	1.6	
2010-Q4	-1.6 **	0.8	-4.1 **	1.8	
2011-Q1	-1.5 *	0.8	-4.6 **	2.0	
2011-Q2	-1.6 *	0.9	-6.3 ***	2.1	
2011-Q3	-1.6 *	0.8	-7.2 ***	2.3	
2011-Q4	-1.7 **	0.9	-7.9 ***	2.5	
2012-Q1	-1.7 **	0.9	-8.1 ***	2.6	
2012-Q2	-1.5 *	0.9	-7.9 ***	2.7	
2012-Q3	-1.6 *	0.9	-8.1 ***	2.8	
2012-Q4	-1.1	0.9	-7.5 **	3.0	
2013-Q1	-1.1	0.9	-8.6 ***	3.1	
2013-Q2	-1.0	0.9	-9.5 ***	3.3	
2013-Q3	-0.3	0.9	-9.4 ***	3.3	
2013-Q4	-0.5	0.9	-7.8 **	3.5	
2014-Q1	-0.2	0.9	-8.4 **	3.6	
2014-Q2	0.3	0.9	-9.0 **	3.7	
2014-Q3	-0.1	0.9	-9.6 **	3.7	
2014-Q4	-0.4	0.9	-8.7 **	3.9	
2015-Q1	-0.5	0.9	-9.6 **	3.9	
2015-Q2	-0.3	0.8	-9.8 **	4.0	
2015-Q3	-0.4	0.8	-8.0 *	4.1	
2015-Q4	-0.4	0.8	-8.7 **	4.4	
Observations	736		736		





Robustness Check 1: Alternative Treatment Period

- Baseline treatment period: 2008-Q4 2010-Q1
- Syndicated loan market bottomed out in 2009
- Alternative treatment period now: 2009-Q1 2009-Q4







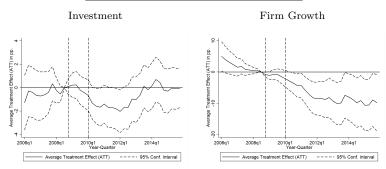
2014q1

95% Conf. Interval

Robustness Check 2: Alternative Treatment Definition

- Baseline treatment definition: Firms with at least one syndicated loan facility maturing during the period crisis.
- **Problem:** Might contain firms for which syndicated loans are only a small part of their overall funding.

Maturing Loans / Total Assets > 5%

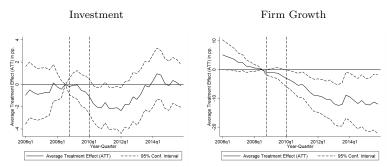




Robustness Check 2: Alternative Treatment Definition

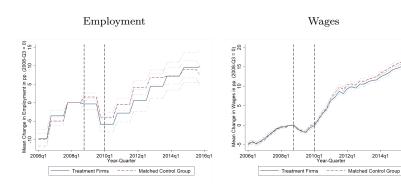
- Baseline treatment definition: Firms with at least one syndicated loan facility maturing during the period crisis.
- **Problem:** Might contain firms for which syndicated loans are only a small part of their overall funding.

Maturing Loans / Total Assets > 10%





Parallel Trends: Employment and Wages

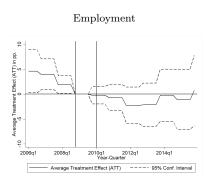




2014q1

2016q1

Treatment Effect Curves: Employment and Wages





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Matching Results: Employment and Wages

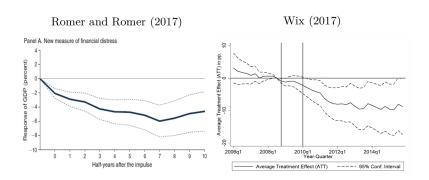
Dependent Variable	Δ Log E	mployment	Δ Log Wages		
Post Period	(1) ATT	(2) S.E.	(3) ATT	(4) S.E	
2010-Q2	-0.2	0.9	-0.1	0.6	
2010-Q3	-0.2	0.9	-0.2	0.6	
2010-Q4	-0.7	1.4	-0.2	0.6	
2011-Q1	-0.7	1.4	-0.7	0.6	
2011-Q2	-0.7	1.4	-1.1	0.6	
2011-Q3	-0.7	1.4	-1.2	0.7	
2011-Q4	-2.2	1.9	-1.0	0.6	
2012-Q1	-2.2	1.9	-1.0	0.6	
2012-Q2	-2.2	1.9	-0.5	0.6	
2012-Q3	-2.2	1.9	-0.7	0.7	
2012-Q4	-2.1	2.2	-0.9	0.7	
2013-Q1	-2.1	2.2	-0.9	0.7	
2013-Q2	-2.1	2.2	-0.7	0.7	
2013-Q3	-2.1	2.2	-0.6	0.7	
2013-Q4	-0.2	2.7	-0.7	0.8	
2014-Q1	-0.2	2.7	-0.7	0.8	
2014-Q2	-0.2	2.7	-1.0	0.8	
2014-Q3	-0.2	2.7	-1.1	0.8	
2014-Q4	-1.1	3.1	-1.0	0.8	
2015-Q1	-1.1	3.1	-1.3	0.8	
2015-Q2	-1.1	3.1	-1.4	0.8	
2015-Q3	-1.1	3.1	-1.5	0.9	
2015-Q4	0.7	3.6	-1.6	0.9	
Observations	736		736		





Romer and Romer (2017) vs. Wix (2023)

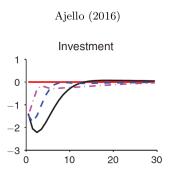
 Romer and Romer (2017) suggest that: "the most fruitful approach to establishing causation [of financial crises] may lie in combining natural experiments with detailed cross-section evidence".

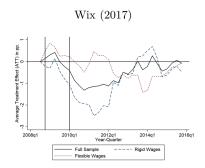




Ajello (2016) vs. Wix (2017)

• Ajello (2016) finds that: "wage rigidities are a necessary feature [...] to create amplification of financial shocks".





Matching Quality

Panel A: Affected Firms with Rigid Wages vs. Affected Firms with Flexible Wages (Unmatched Sample)

Matching Covariate	Rigid	Flexible	%Bias	t-Stat
Size	21.39	21.99	-37.95	-4.87***
Investment	6.27	5.20	25.49	3.25***
Cash Holdings	8.28	7.21	10.85	1.39
Q	1.52	1.55	-4.72	-0.58
Cash Flow	-2.17	10.31	-24.37	-2.32**
Return on Assets	3.21	3.58	-13.57	-1.69*
Long-Term Leverage	28.35	25.31	15.84	2.03**
Number of Firms	334	325		

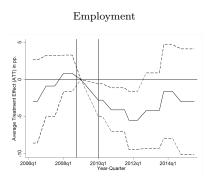
 $Panel\ B:\ Affected\ Firms\ with\ Rigid\ Wages\ vs.\ Affected\ Firms\ with\ Flexible\ Wages\ (Matched\ Sample)$

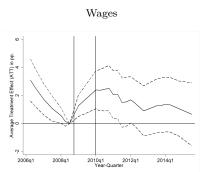
Matching Covariate	Rigid	Flexible	%Bias	t-Stat
Size	21.39	21.59	-12.47	-1.61
Investment	6.27	5.65	14.99	1.93*
Cash Holdings	8.28	8.39	-1.10	-0.14
Q	1.52	1.52	0.03	0.00
Cash Flow	-2.17	1.49	-4.34	-0.55
Return on Assets	3.21	3.78	-20.16	-2.55**
Long-Term Leverage	28.35	24.31	18.76	2.42**
Number of Firms	334	334		





Treatment Effect Curves: The Role of Wage Rigidity





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Digression: The German "Labor Market Miracle"

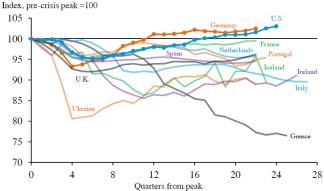
- Germany's "Labor Market Miracle"
 - Steep drop in GDP, but little rise in unemployment.
- Short-time work ("Kurzarbeit") programs in Germany
 - Government short-time work support for firms in "unavoidable" financial difficulties
 - Firms refrain from layoffs, but reduce employees' hours and pay them 60-67% for the hours not demanded ("Kurzarbeitergeld").
 - Firms are reimbursed for this "Kurzarbeitergeld" by the BA
- Expansion of short-time work programs during the crisis.
- ⇒ Injection of wage flexibility into the German labor market.





GDP Recovery from the 2008 Banking Crisis

Figure 1-4
Real GDP Per Working-Age Population
in 2007–2008 Banking Crisis Countries, 2007–2013



Source: U.S. Council of Economic Advisors, Statistical Office of the European Communities