

# Downward Wage Rigidity in the United States: New Evidence from Linked Worker-Firm Data

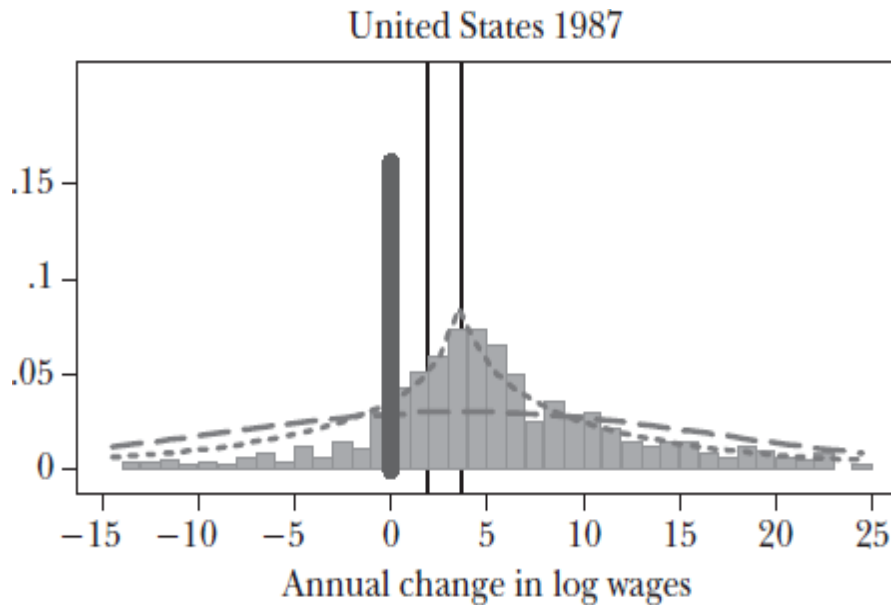
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12<sup>th</sup> Joint ECB/CEPR Labour Market Workshop  
ECB Frankfurt, December 13-14, 2016

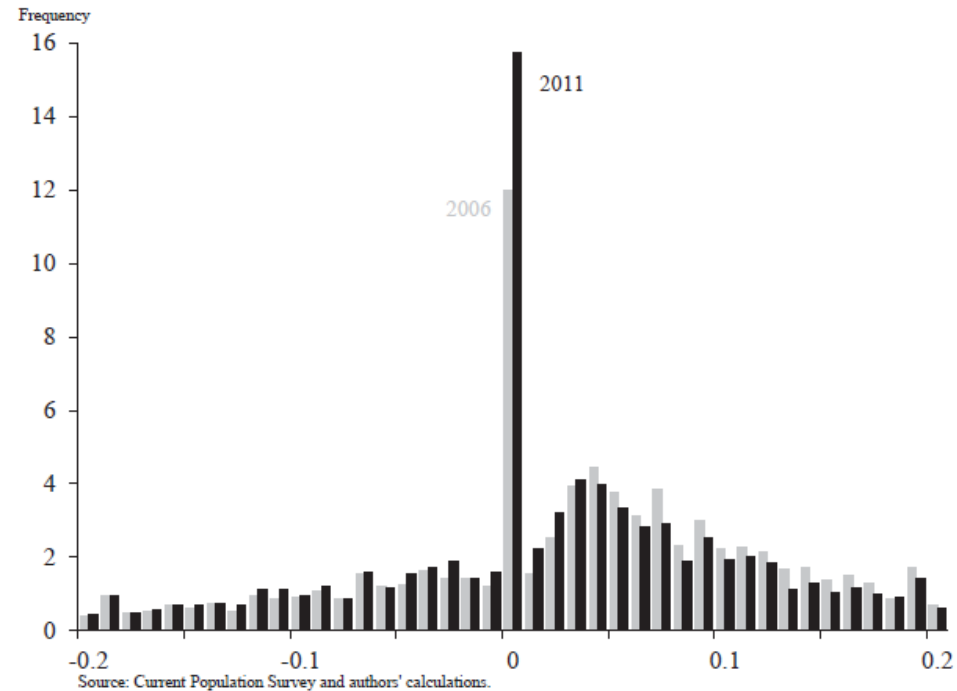
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# Stylized fact for the U.S.

- Distribution of job-stayers' nominal wage changes is asymmetric, with spike at zero and missing mass left of zero.



Dickens et.al. (2007)



Daly et.al. (2013)

# Stylized fact for the U.S.

- Asymmetric wage change distribution is commonly interpreted as evidence of Downward Wage Rigidity (DWR).
- DWR has potentially important consequences.
  - Large employment losses during Great Recession and slow recovery.
  - If DWR is nominal, optimal inflation rate is positive.
- Existing results for the U.S. are almost exclusively based on household survey data and case studies.
  - Results are subject to measurement error and limited earnings concept.
  - Data cannot be used to study wage change distributions at firm level / test relation between DWR indicators and firm employment decisions.

# This paper

- Use administrative data from the LEHD program of the U.S. Census Bureau to study the extent and consequences of DWR.
- Distinguish between hourly wage changes and earnings changes.
- Exploit worker-firm link of LEHD to assess whether indicators of DWR predict more job destruction during Great Recession.

# Results for today

1. Hourly wage change distribution of job-stayers has modest zero spike, is quite concentrated, and shows many wage cuts.
2. Earnings change distribution of job-stayers is more disperse and shows little asymmetry, especially during Great Recession.
3. Firms disproportionately cut hours to reduce labor cost.
4. Firms with zero spike in earnings change distribution have higher job destruction during Great Recession.

# DWR literature

- Papers using either household- or firm-level data for U.S.
  - Baker, Gibbs and Holmstrom (1994); McLaughlin (1994); Akerlof, Dickens and Perry (1996); Kahn (1997); Card and Hyslop (1997); Altonji and Devereux (2000); Gottschalk (2005); Elsby (2009); Daly, Hobjin and Lucking (2012); Elsby, Shin and Solon (2013); Barrattieri, Basu and Gottschalk (2014)
  - Lebow, Saks and Wilson (2009); Fallick, Lettau and Wascher (2011, 2015)
- Papers using linked worker-firm data for other countries
  - Ehrlich and Montes (2014) – German administrative data
- Papers studying implications of DWR in modern macro models
  - Kim and Ruge-Murcia (2009); Benigno and Ricci (2011); Abbritti and Fahr (2013); Daly and Hobjin (2014); Eggertson and Mehrotra (2014); Schmitt-Grohe and Uribe (2013a, 2013b, 2014);...

# Longitudinal Employer Household Dynamics

- Massive database of administrative records based on state UI records covering 95% of private employment.
- **Advantages:**
  - millions of observations
  - no rounding/recall errors; no top-coding
  - worker-firm link means that wage rigidity indicators can be linked to employment outcomes at firm-level
- **Disadvantage:** only few states have reliable hours data
- **Advantage/Disadvantage:** earnings includes all monetary compensation paid during quarter

# Hourly wage and earnings of job-stayers

- Quarterly wage record

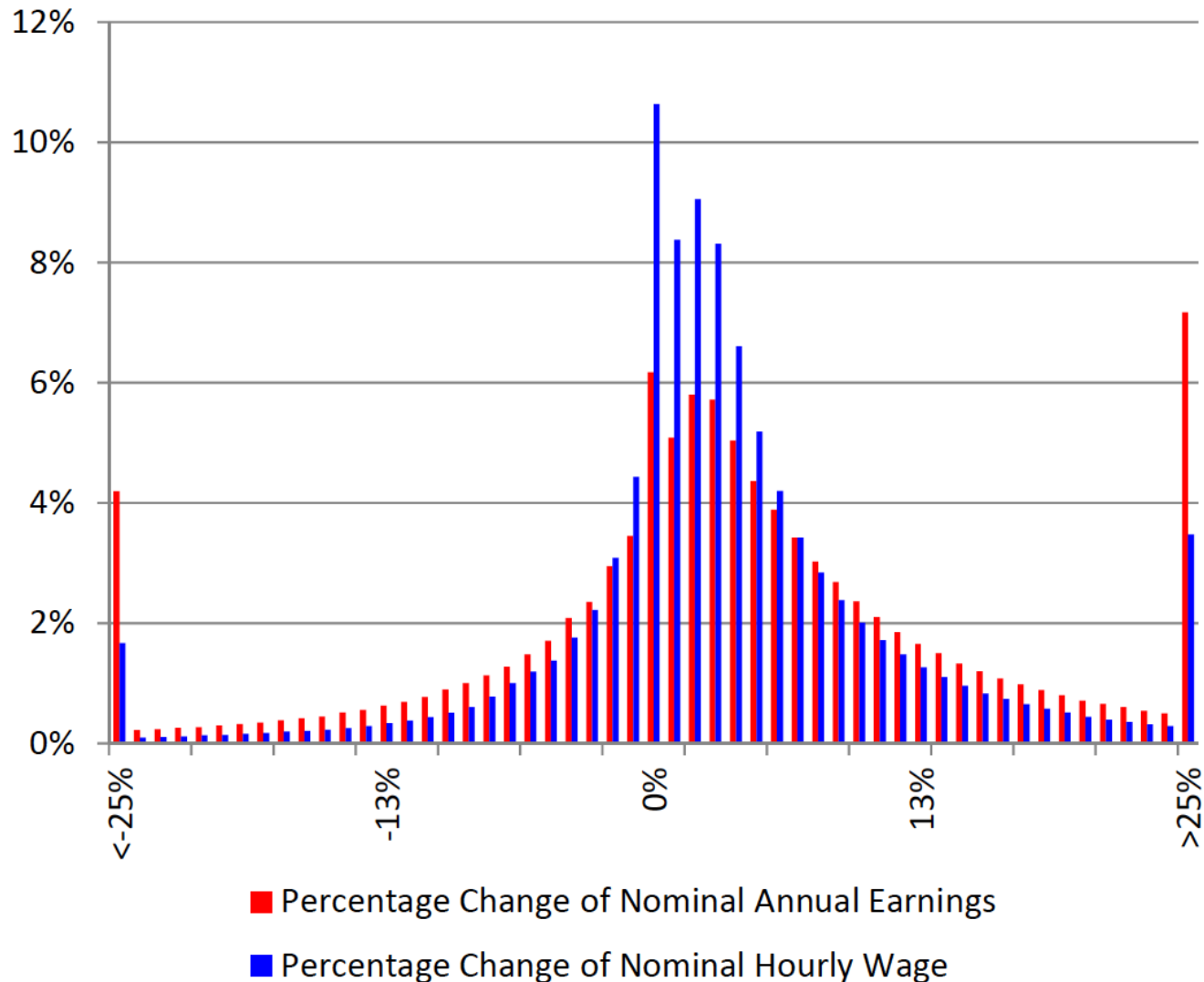
Person ID	Firm ID	Earn Q1	Earn Q2	Hours Q1	Hours Q2
Person1	Firm A	\$7,029	\$2,549	451	134
Person1	Firm B	0	\$6,051	0	327

- Average quarterly hourly wage =  $\text{Earn} / \text{Hours}$
- Annual earnings, hours = sum of quarterly earnings, hours
- Job stayer = individual who has earnings record with employer for at least 10 consecutive quarters



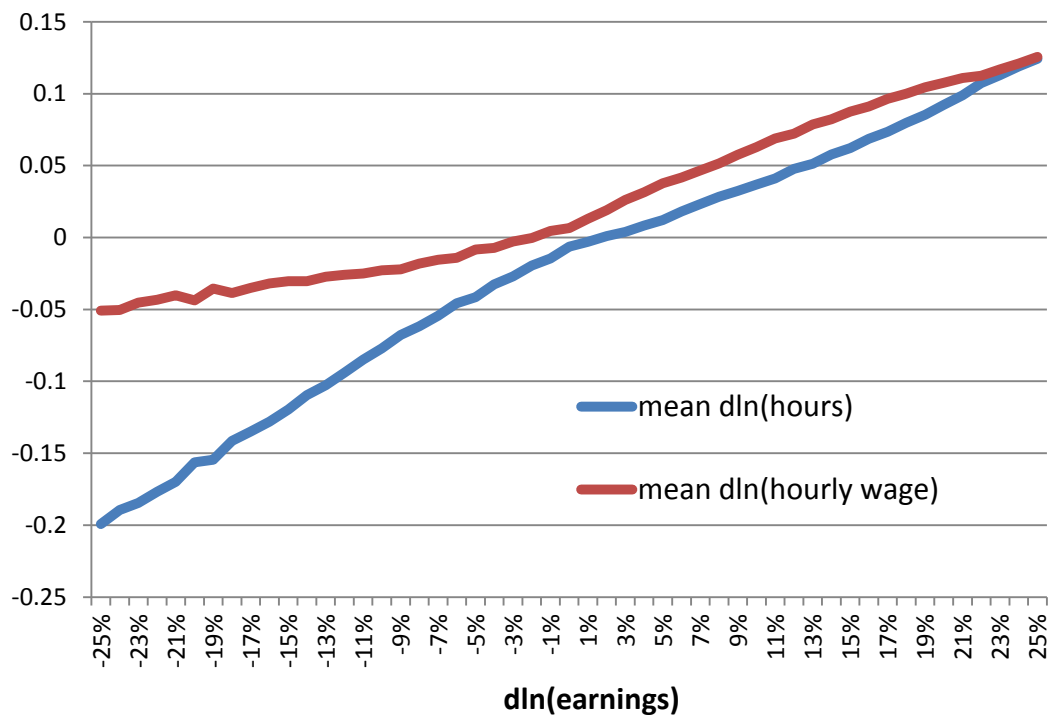
# Hourly wage vs. earnings change distribution

3-State sample (MN, RI, WA); 2010 – 2011



# Firms reduce earnings for job stayers largely through hours cuts

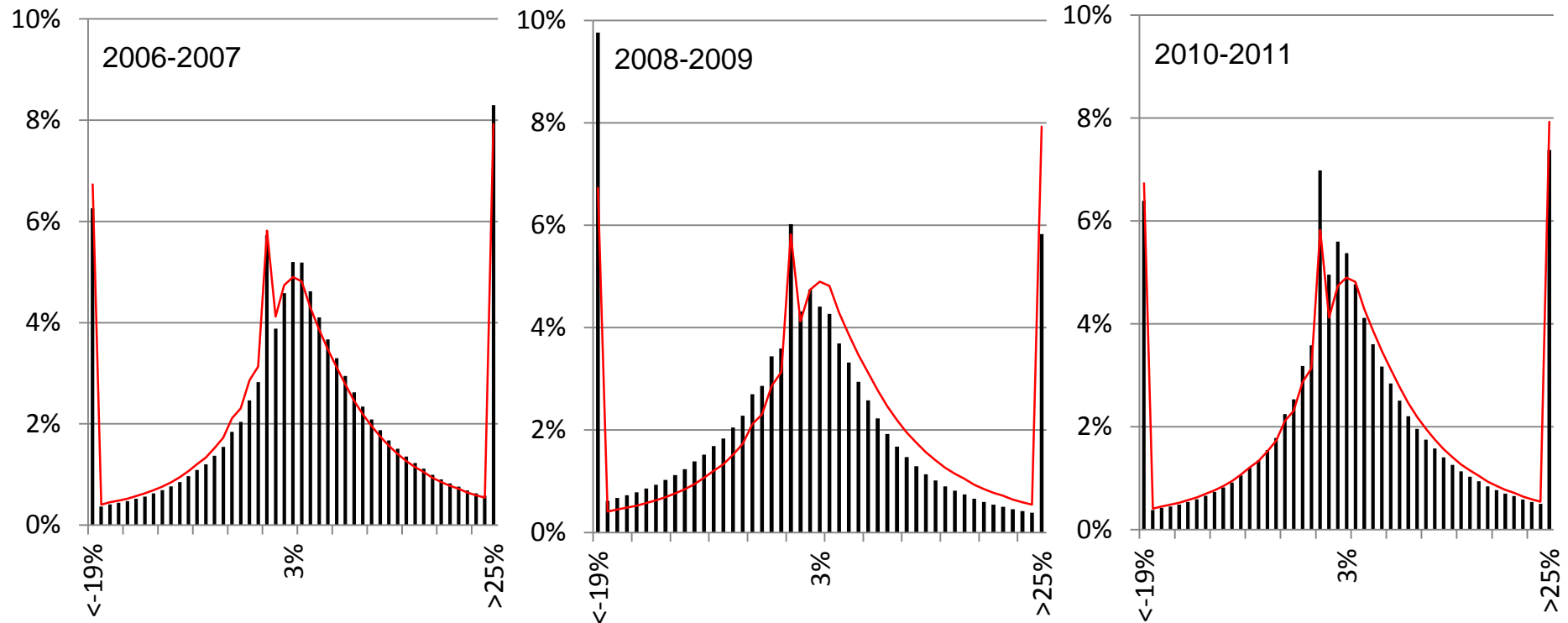
$$\Delta \ln(\text{earnings}) = \Delta \ln(\text{hours}) + \Delta \ln(\text{hourly wage})$$



- ▶ **75%** of annual earnings cuts are due to decreases in hours
- ▶ **25%** are due to decreases in hourly wage
- ▶ Earnings increases are **50/50** hours increases and hourly wage increases

# Annual earnings changes

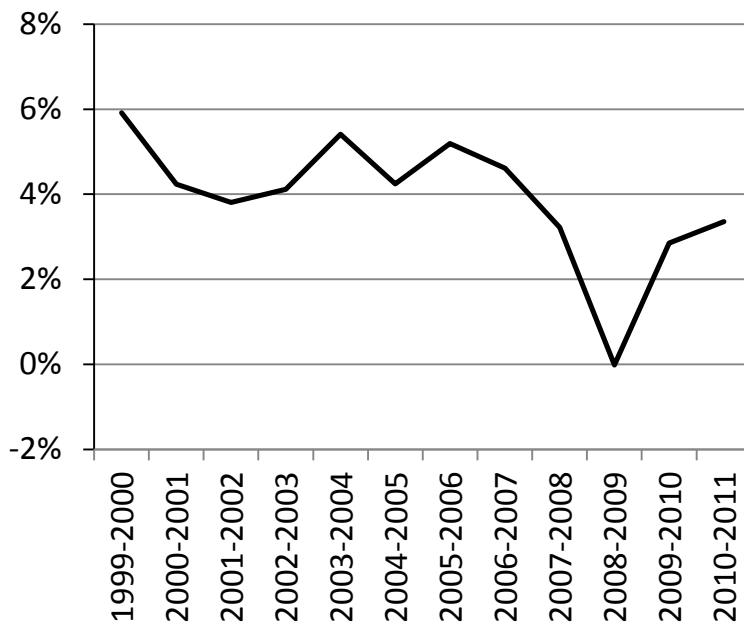
LEHD 30-State sample, all firms pooled



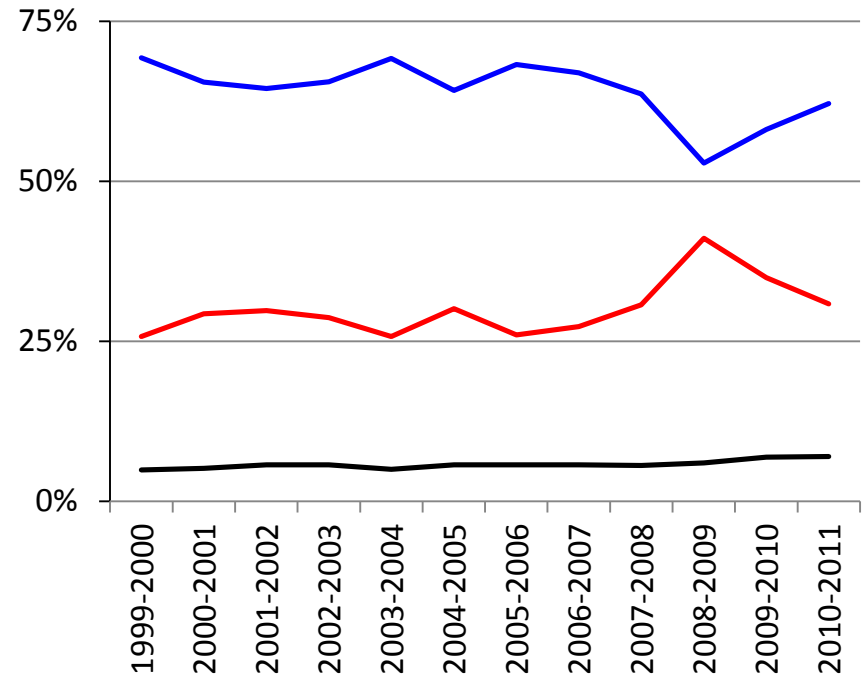
All years pooled distribution in red

# Annual earnings changes

LEHD 30-State sample, all firms pooled



— Mean Earnings Growth



— % > 0 (bin) — % = 0 (bin) — % < 0 (bin)

# Summary of descriptive results

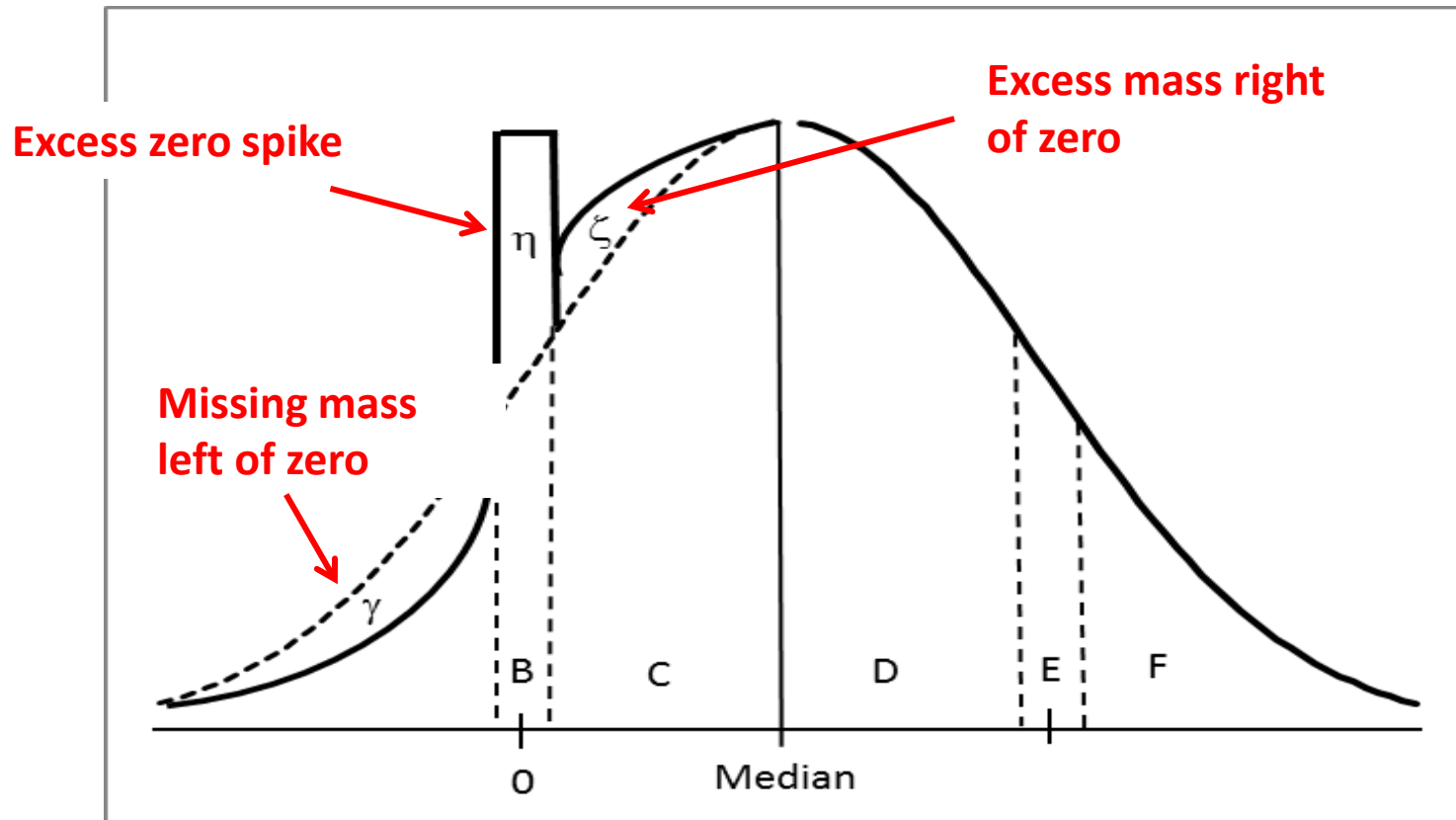
1. LEHD wage change distribution is less asymmetric and more concentrated than distributions based on household data.
  2. Earnings change distribution of job-stayers is more disperse and shows little asymmetry, especially during Great Recession.
  3. Firms disproportionately cut hours to reduce labor cost.
- Results are suggestive of modest degree of DWR at intensive (hours) margin.
  - Earnings change distribution may be better metric to assess consequences of DWR for extensive (employment) margin.

# Inference about employment effects of DWR

- Exploit worker-firm link of LEHD to quantify employment consequences of DWR.
- 2 important questions:
  - 1) Is asymmetry in wage change distribution necessarily a good indicator of DWR?
  - 2) Do DWR-constrained firms necessarily lay off more workers on average than unconstrained firms?

# Asymmetry indicators of DWR

- Literature has typically considered three asymmetry indicators.



# Is asymmetry a good indicator of DWR?

- We use simple model of DWR to show that asymmetry indicators are subject to **selection effect from separations**; e.g.
  - Negative productivity shock makes DWR constraint more binding.
  - But negative productivity shock also increases separation rate which, by itself, renders distribution more symmetric.
  - Provides potential explanation for why earnings change distribution became more symmetric during Great Recession.
- Generally, shocks have non-monotonic effect on asymmetry.
  - Non-monotonicity makes controlling for selection effects difficult.
  - Asymmetry indicators are not necessarily a good indicator of DWR.



# Do DWR-constrained firms lay off more workers?

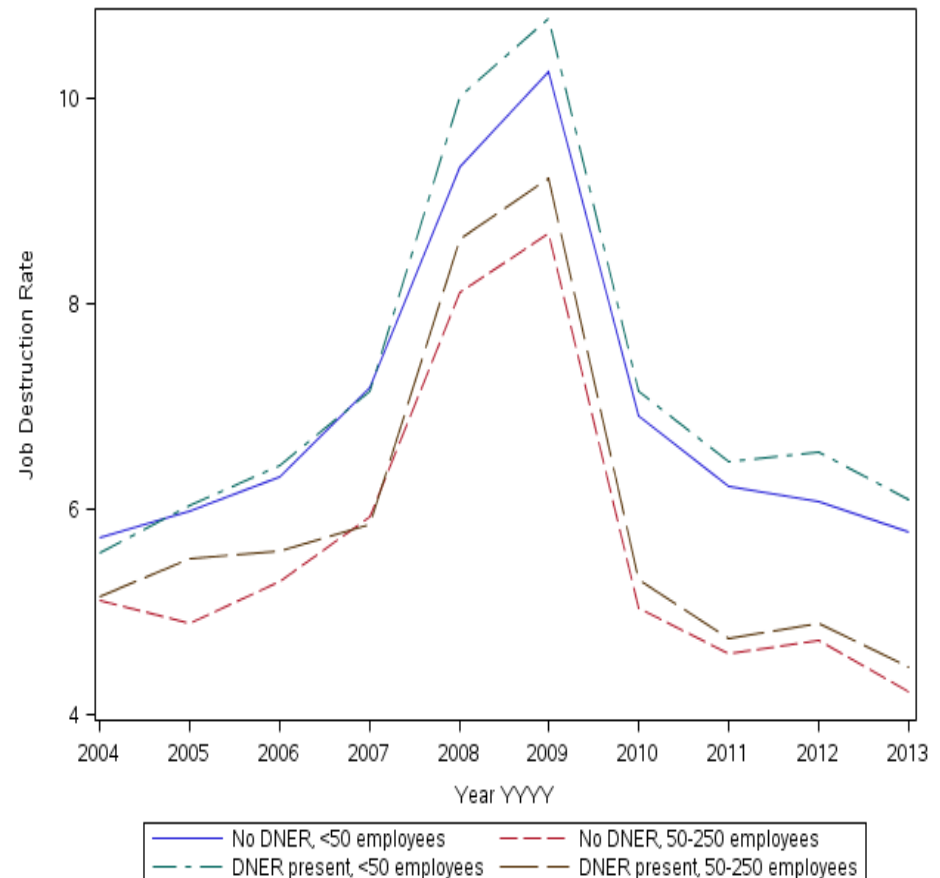
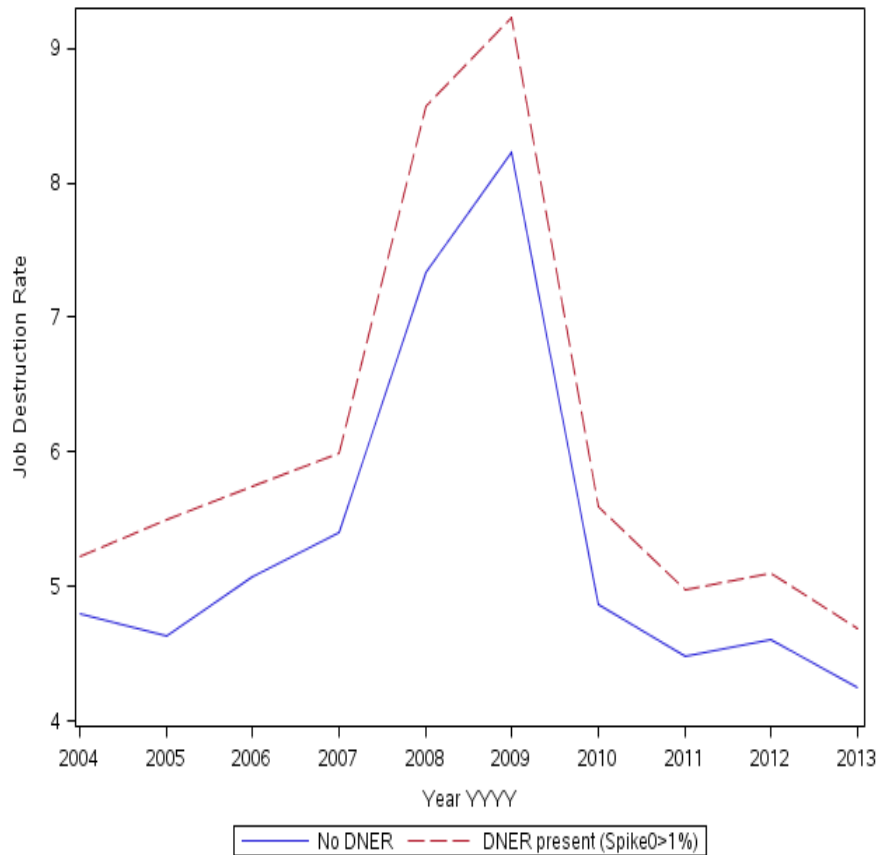
- DWR-constrained workers have a higher productivity threshold to get hired than unconstrained workers.
- DWR-constrained firms hire on average more productive workers.
- This **selection effect from hiring** implies that on average, DWR-constrained firms do not lay off more workers than unconstrained firms.
- DWR-constrained firms will, however, lay off more workers in response to large unexpected negative shock.

# Firm-level inference

- Strategy
  - Use average zero spike during pre-recession years (2003-07) as DWR indicator, controlling for employment and earnings growth.
  - Study difference in job-destruction rates across firms during Great Recession (= a large unexpected negative shock).
- Sample: firms with at least 50 job-stayers and positive median earnings change in pre-recession period
  - Earnings change distributions are not meaningful for smaller firms.
  - Asymmetry statistics are well defined only if median is positive.

# Do firms with pre-recession zero spikes have more job destruction during the Great Recession?

Job destruction rates: firms with evidence of a zero spike in the pooled 2003-2007 earnings distribution vs. firms without zero spike



# Do firms with pre-recession zero spikes have more job destruction during the Great Recession?

Coefficient on firm-level asymmetry in earnings distribution in 2003-2007  
 Dependent variable is establishment job destruction rate

Model	M1	M2	M1 (balanced panel)	M2 (balanced panel)
<b>Excess zero spike</b>	<b>-0.058</b>	<b>-0.381</b>	<b>-0.080</b>	<b>-0.322</b>
	(0.024)	(0.022)	(0.020)	(0.213)
<b>Excess zero spike * [year is 2008 or 2009]</b>	<b>0.381</b>	<b>0.528</b>	<b>0.390</b>	<b>0.491</b>
	(0.036)	(0.036)	(0.036)	(0.036)
Weighted by employment	N	Y	N	Y

*Includes controls for industry sector, establishment size, year fixed effects, firm average employment growth 2003-2007, median earnings change 2003-2007*

# Caveats

- Although we control for employment and earnings growth in 2003-2007 when computing DWR indicator and focus on job destruction during Great Recession period, unclear whether this appropriately addresses selection effects.
- Earnings change distributions may be asymmetric (incl. zero spike) for reasons other than DWR; e.g.
  - implicit contracting motives
  - infrequent wage contracting (without DWR)

# Conclusion

- Use worker-firm linked data from the LEHD to examine the extent and consequences of DWR in U.S. firms.
- Descriptive results
  - Hourly wage change distribution from LEHD shows some of asymmetries of household data, although to a lesser extent.
  - Firms disproportionately use hours margin to reduce labor costs.
  - Earnings change distribution shows relatively little zero spike and asymmetry – especially during Great Recession.
- Regression results suggest that DWR contributed to large employment losses during Great Recession.
  - Job destruction rates overall increased 2% points in 2008.
  - But for firms with evidence of DWR in earnings distribution, almost another .5% points more.

# Extra slides

# We use three LEHD samples

- **Sample 1:** Three states (MN, RI, WA) with both earnings and hours data
  - Allows us to decompose earnings changes into hours and wage changes
  - Limitation: data available only for 2009:Q4 – 2012:Q1
  - About 2 million job stayers
- **Sample 2:** 30 states with earnings data for 1998:Q4 – 2012:Q1
  - No hours data
  - 12 year-to-year changes in job stayers' annual earnings 1999-2000, 2000-2001, ..., 2010-2011
  - About 30 million job stayers per year
- **Sample 3:** Subset of Sample 2 firms with  $\geq 50$  job stayers and positive median earnings change
  - About 16 million job stayers per year



# Hourly wage changes (sample 1)

- For 3-state sample, we have both quarterly earnings and hours
  - Average hourly wage:  $w = \text{earnings} / \text{hours}$
- We compute annual hourly wage change for all job stayers
  - Requires 10 consecutive quarters working for the same employer

Year t-2 Q4	Year t-1 Q1	Year t-1 Q2	Year t-1 Q3	Year t-1 Q4	Year t Q1	Year t Q2	Year t Q3	Year t Q4	Year t+1 Q1
Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X

$\bar{w}_{t-1}$                        $\bar{w}_t$

$$\text{Annual hourly wage change} = \ln(\bar{w}_t) - \ln(\bar{w}_{t-1})$$

# Earnings changes (samples 2 & 3)

- For 30-state samples, we compute annual earnings change for all job stayers

Year t-2 Q4	Year t-1 Q1	Year t-1 Q2	Year t-1 Q3	Year t-1 Q4	Year t Q1	Year t Q2	Year t Q3	Year t Q4	Year t+1 Q1
Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X	Job X

*earnings*<sub>t-1</sub>                      *earnings*<sub>t</sub>

$$\text{Annual earnings change} = \ln(\overline{\text{earnings}}_t) - \ln(\overline{\text{earnings}}_{t-1})$$

# A simple model of DWR

- Firms and workers match in frictional market and live for 2 periods.
- Worker has stochastic productivity  $z \sim F(Z)$  in period 1 and  $z' \sim F(Z'/Z)$  in period 2.
- If worker is hired, firm pays fixed cost  $c$  and pays

- period 1 wage  $w(z) = \varphi z + (1 - \varphi)b$

- period 2 wage if worker is not DWR-constrained

$$w'(z') = \varphi z' + (1 - \varphi)b$$

- period 2 wage if worker is DWR-constrained

$$w'_{DWR}(z', w) = \max[\varphi z' + (1 - \varphi)b, w/\pi]$$

# A simple model of DWR

- Firm hires worker in period 1 if  $V(z) \geq 0$  where

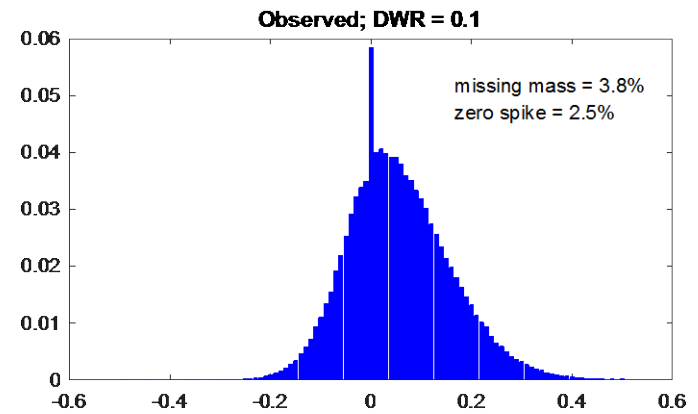
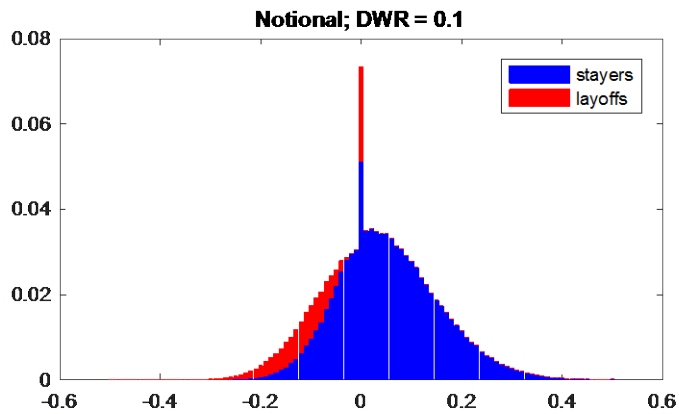
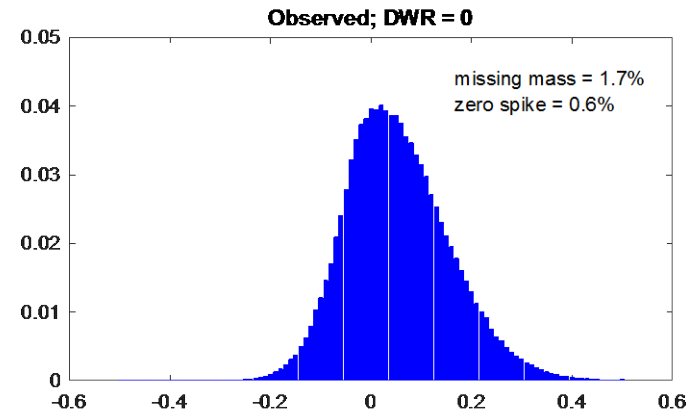
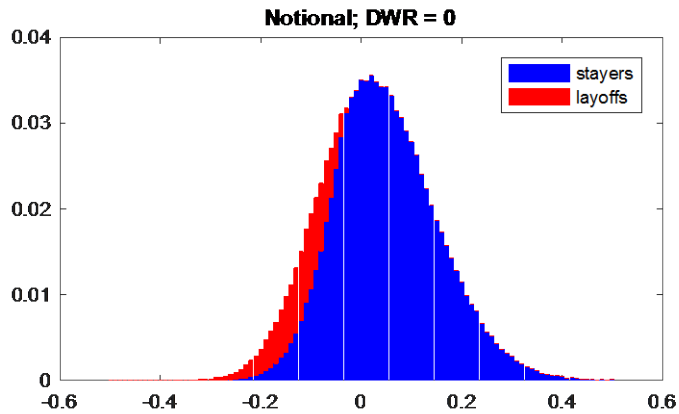
$$V(z) = \max[-c + (z - w(z)) + E(\max[z' - w', 0]|z), 0]$$

- Firm keeps workers in period 2 if  $V'(z') \geq 0$  where

$$V'(z') = \max[z' - w'(z'), 0]$$

- $V(z)$  and  $V'(z')$  depend on whether worker is DWR-constrained in period 2 or not.
  - Hiring threshold in period 1 and layoff threshold in period 2 are higher for DWR-constrained workers

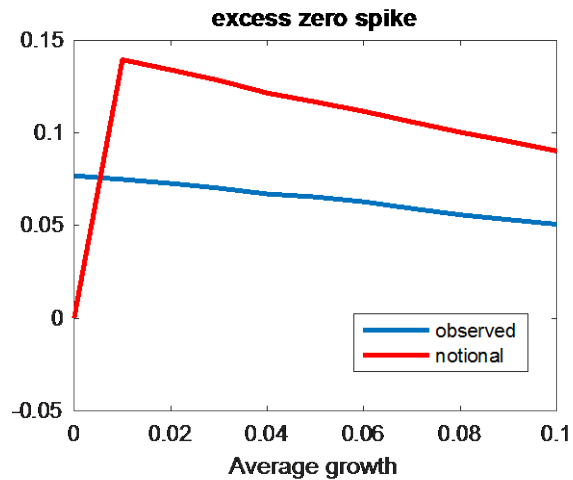
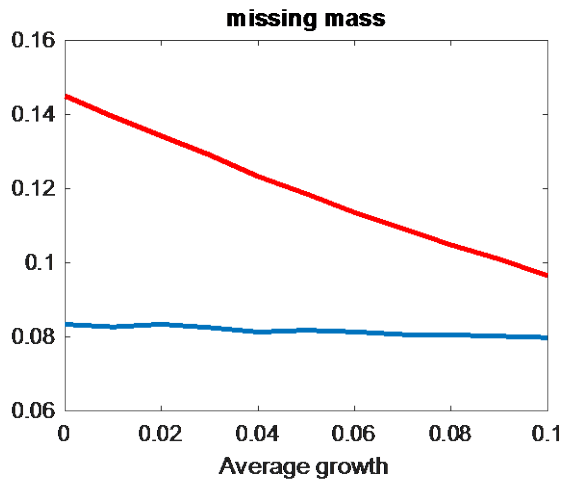
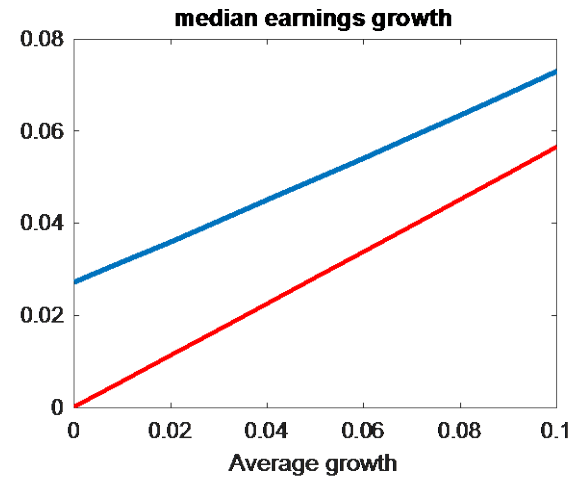
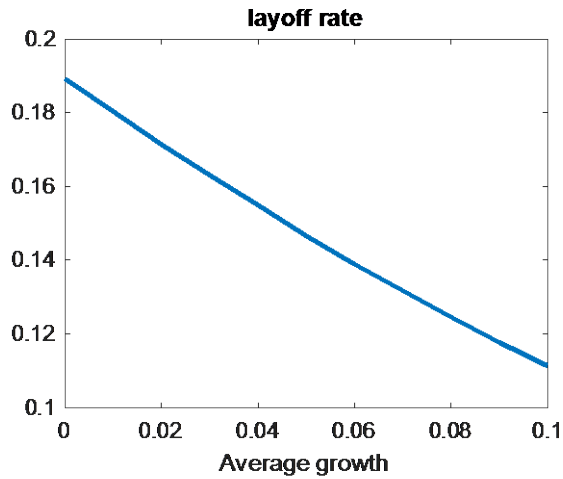
# Selection effect from separations



# Selection effect from separations

- Separations and therefore asymmetry indicators depend on many factors (e.g. average productivity growth)
  - Effects of higher productivity growth on zero spike indicator
    - DWR-constraint ↓ => zero spike ↓
    - Separations ↓ => median wage growth ↓ => zero spike ↑
  - Effects of higher productivity growth on missing mass indicator
    - DWR-constraint ↓ => missing mass ↓
    - Separations ↓ => median wage growth ↓ => missing mass ↑ or ↓
- ⇒ Selection effect from separations has potentially ambiguous effects on asymmetry indicators.

# Average growth effects (DWR = 0.3)



# Average growth effects (DWR = 0.1)

