# Aggregate Nominal Wage Adjustments: New Evidence from Administrative Payroll Data

John Grigsby, Erik Hurst and Ahu Yildirmaz
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**Paper is Preliminary and Evolving**

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- **Little work measuring nominal wage adjustments and their response to economic conditions.**

- Large and influential literature using micro data to measure **output price stickiness.**

- **Reason: Existing data sets not ideal to measure wage adjustment.**

  o Household data sets: Measurement error in both hours and earnings.

  o Administrative data sets: No measure of hours (and hard to measure hours of salaried individuals).

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  - Aggregate
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   - Business cycle, cross-industry, cross-region, and cross-firm variation
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    - ➢ Much more downward adjustment during recession

- Caveat: only discussing **realized adjustment**, not structural parameters

# Part 1:
# Data

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- **May 2008-December 2016**

- **15-20 million observations** every month  (about one-eight of US labor force has their payroll processed by ADP each month)

- Can **track individuals across firms (if migrate to another ADP firm)**

# Sample Representativeness

- **ADP has two data products:**

  o One marketed to "firms" with > 50 employees

  o One marketed to "firms" with < 50 employees

- **We have access to the data product for "firms" with > 50 employees.**

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- Restrict sample to **21-60 year olds (inclusive)**

- Draw **random sample of 1 million workers** for tractability

# Sample Description, Part 1

| | ADP Employee Sample | BDS Data |
|---|:---:|:---:|
| Number of Employees | 1,000,000 | |
| Number of Firms | 91,577 | |
| Number of Observations | 24,831,244 | |
| | | |
| % Firm Size: 50-499 | 37.8 | 29.5 |
| % Firm Size: 500-999 | 13.6 | 7.3 |
| % Firm Size: 1000-4999 | 25.1 | 17.5 |
| % Firm Size: 5000+ | 19.7 | 45.6 |

Note: We reweight ADP data so it is representative of BDS industry-size distribution by year. (Industry distribution is pretty representative).

# Sample Description, Part 2

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- **57% of CPS** respondents report being **hourly**

- Differences stem from two sources:

  o  Our ADP sample **excludes small firms**

  o  Some ADP firms classify workers as "hourly" although they behave as "salaried" in many respects.

# Administrative Measure of "Nominal Wage"

- Nominal wage measure:  **contracted per-period payment rate**

  o   Administratively reported (separate field for all employees)

  o   Contracted hourly wage for hourly workers (2/3 of sample)

  o   Contracted weekly/bi-weekly/monthly pay rate for salaried workers (~1/3 of sample)

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- All data is pre-tax and nominal.

- Refer to the per-period contract rate as a workers **"base wage"** or **"contract wage"**

- **Hourly wage matches CPS** in levels and trends

# Base Pay vs. Gross Earnings

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- **Define Residual Earnings = Gross Earnings – Base Pay**

  o Bonuses
  o Overtime
  o Commissions
  o Signing bonus/Severance pay
  o Cashed out vacation days
  o Other (e.g. tips, contracted performance pay, reimbursements, measurement error)

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- **Define bonus to be residual earnings that:**

  o Arrives in December, January, February, or March
  o Is at least 1% of annual earnings
  o Paid out 1-3 times per year (Narrow definition: once per year)

# Share of Earnings in Base Pay

| | All | Full-Year Employees | |
|---|---|---|---|
| | Monthly | Monthly | Annual |
| **Share Base pay out of Earnings** | | | |
| 10th Percentile | 78.6% | 78.3% | **80.3%** |
| 25th Percentile | 93.7% | 93.6% | **90.1%** |
| Median | 100% | 100% | **96.2%** |
| 75th Percentile | 100% | 100% | **99.4%** |
| 90th Percentile | 100% | 100% | **100%** |

- **Majority of earnings are in base pay**
- **Mass of workers receiving commissions, tips, etc. as large share**
- **25-35% of workers receive annual bonus, about 3% of earnings.**

# Part 2:
# Nominal Wage Adjustment for Job-Stayers

# Wage Setting on-the-Job

- Why focus on job-stayers?

    (1) Comparison with literature (mostly job-stayers)

    (2) Provide set of moments to use when relevant measure is on-the-job adjustments

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- Provide **summary measures** of **nominal wage adjustments on-the-job.**

- Evidence of **time dependence** in wage adjustment

- Show differences by **industry** and **firm size** (in paper)

# Part 2a:
# Distribution of Wage Changes for Job-Stayers

# Distribution of 12 month Wage Change, Job Stayers
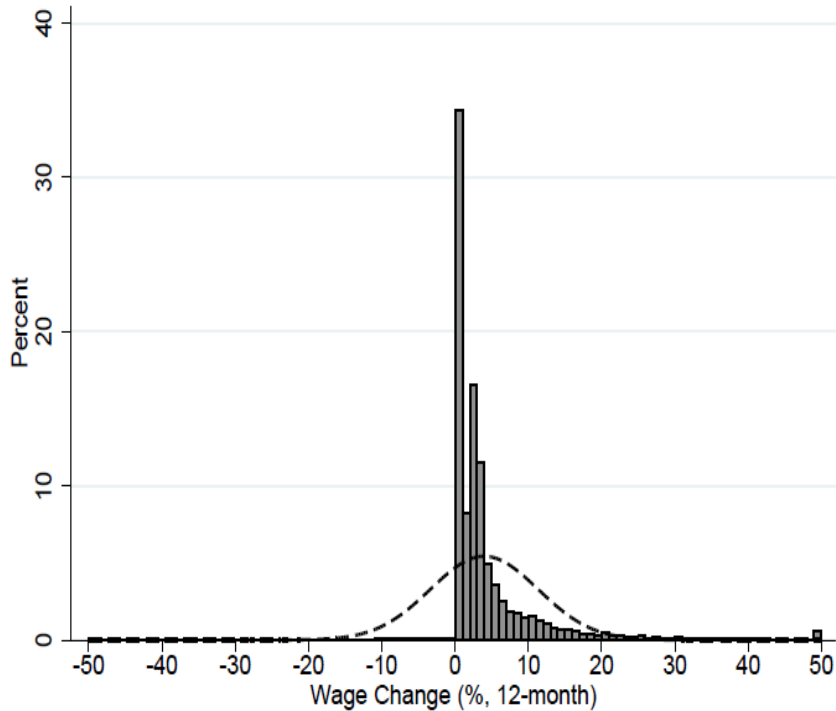
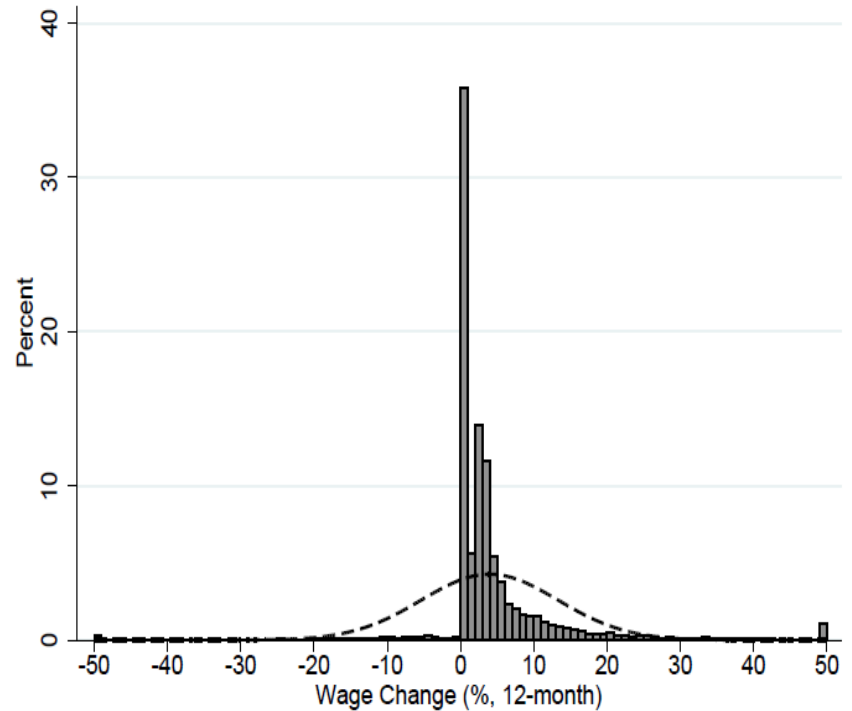## Hourly (hourly wage)          Salaried (per period earnings)
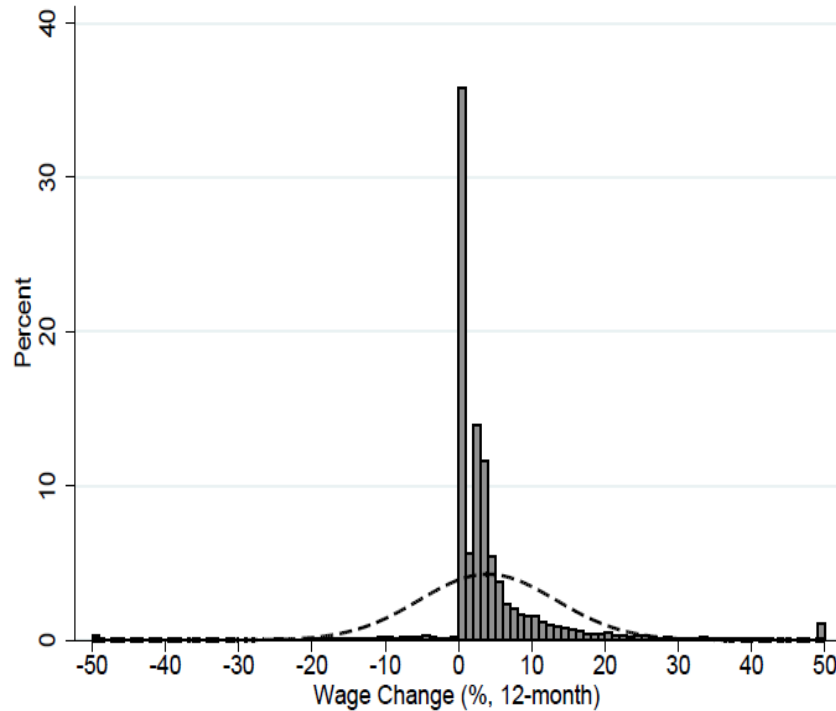
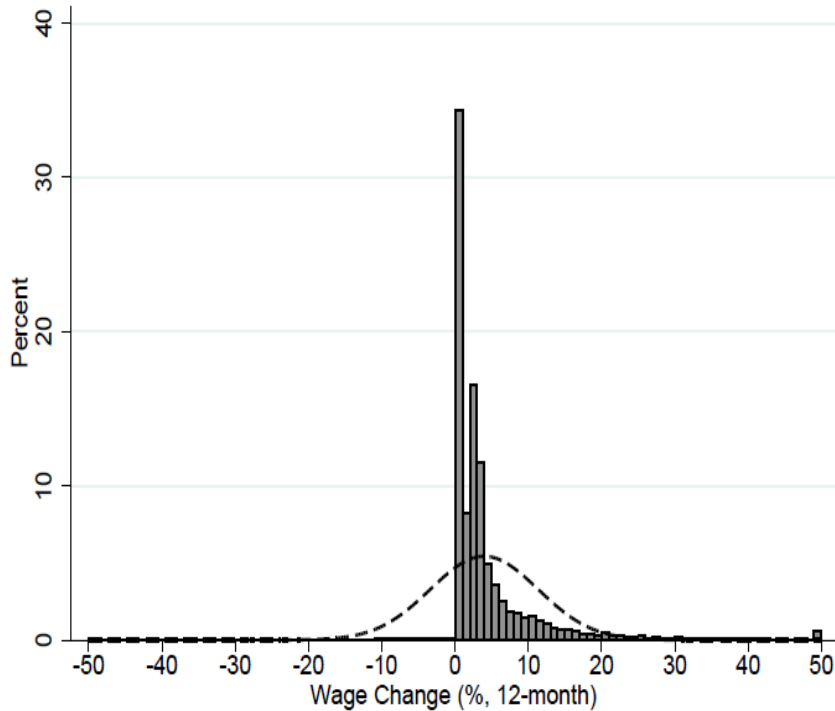# Distribution of 12 month Wage Change, Job Stayers
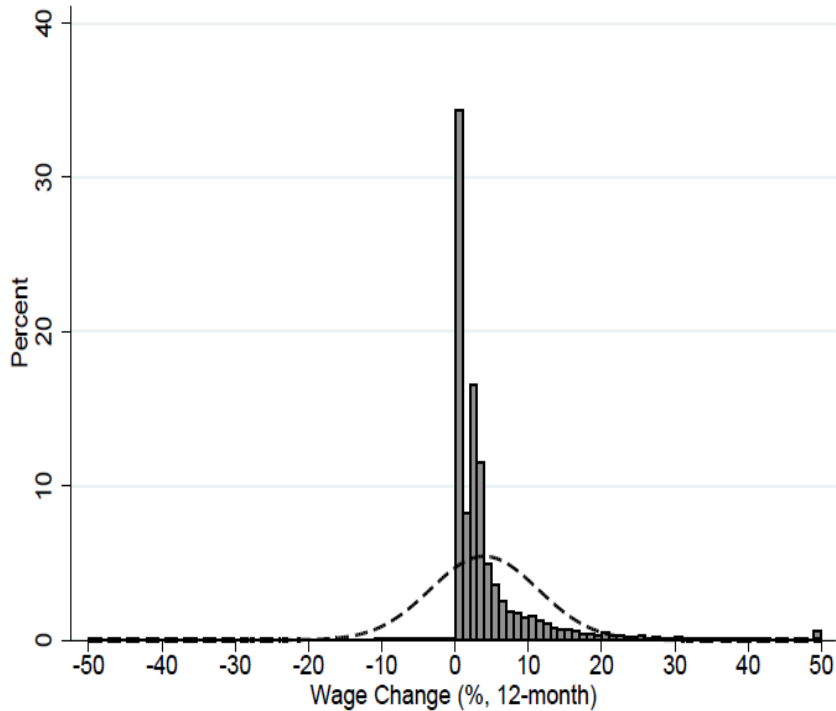
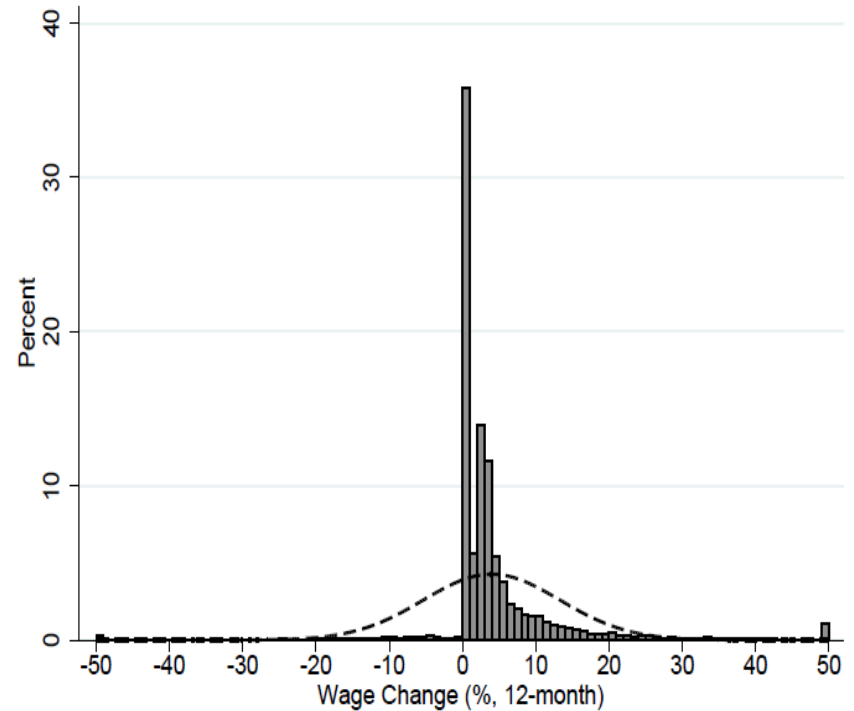## Hourly (hourly wage)          Salaried (per period earnings)



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- Note: Hardly any wage cuts – ~2% of hourly and salaried

# Distribution of 12 month Wage Change, Job Stayers

## Hourly (hourly wage)      Salaried (per period earnings)



- Note: Large mass at zero – ~35% of hourly and salaried unchanged
- Note: Hardly any wage cuts – ~2% of hourly and salaried
- **Note: Very few small positive wage changes:**
  - o **8.6%** **of workers received a wage change of 0-2%**
  - o **27.1% of workers received a wage change of 2-4%**

# Job-Stayer Adjustment Moments, 2008-2016

| | Job Stayers |
|---|---|
| **Annual** | |
| Probability No Change | 33.7% |
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| Probability of a Wage Increase | 63.9% |
| Std. Dev. of Wage Change | 6.5% |
| Conditional Std. Dev. | 6.9% |
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# Part 2b:
# Time Dependence in Wage Changes

Figure 6: Hazard Function of Wage Change, Pooled 2008-2016 Sample
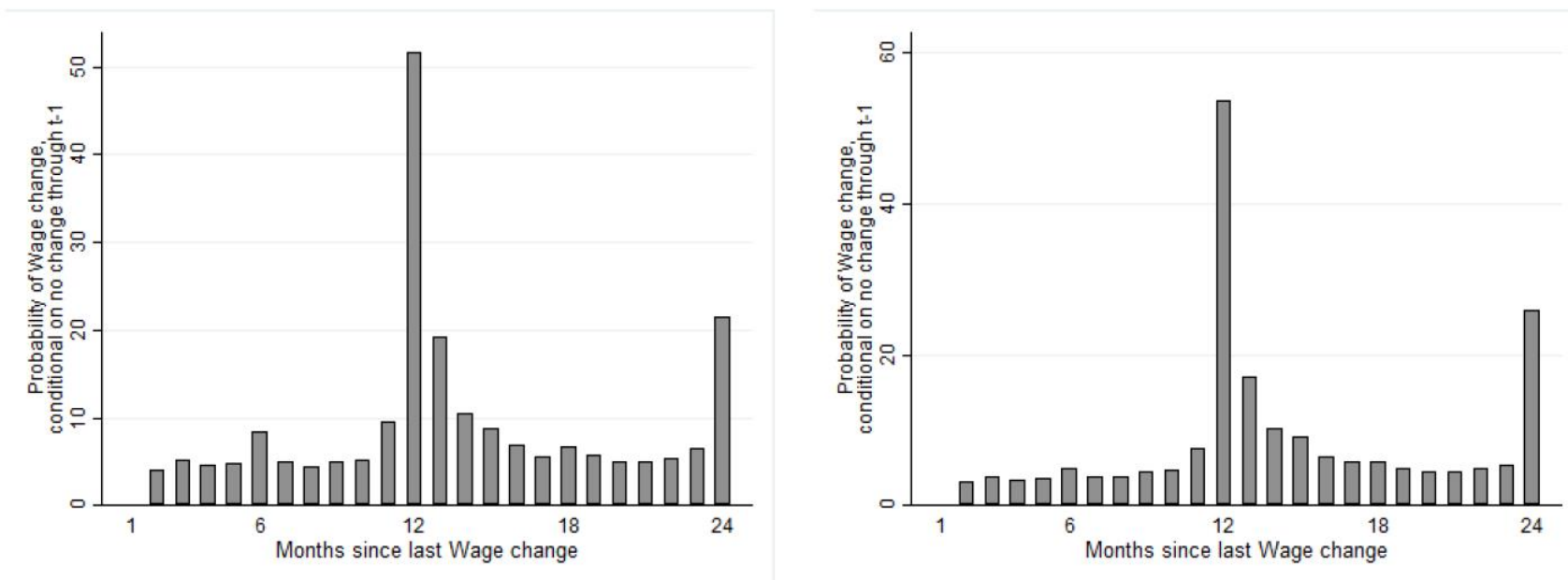


PANEL A: HOURLY WORKERS                    PANEL B: SALARIED WORKERS

Note: Figure shows the hazard rate of a wage change between $t-1$ and $t$ conditional on surviving to $t$. Sample only includes individuals with at least two wage changes.

- **Hazard is essentially flat in most months.**

- **Spikes at 1 year and 2 year (and smaller spikes at 6 months).**

- **On-cycle wage changes tend to be smaller**

# Seasonality of Wage Changes, Job-Stayers
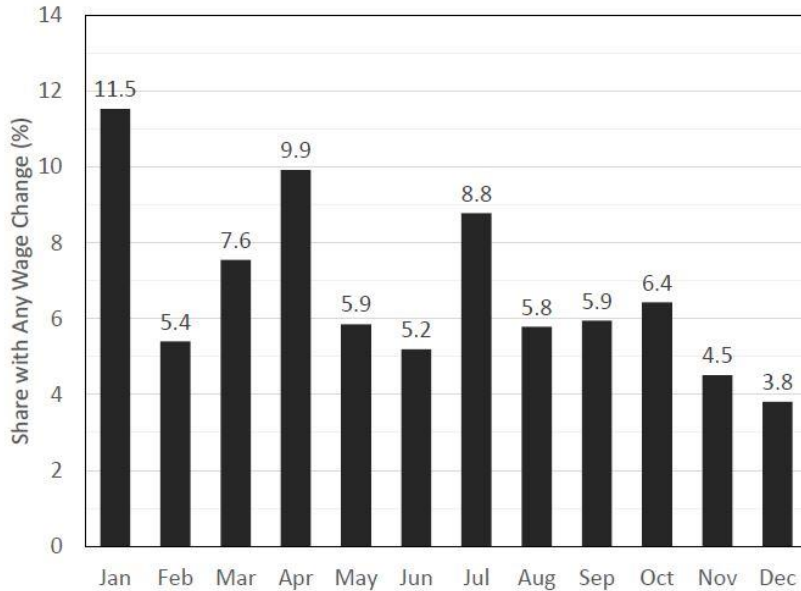


PANEL A: PR{CHANGE}
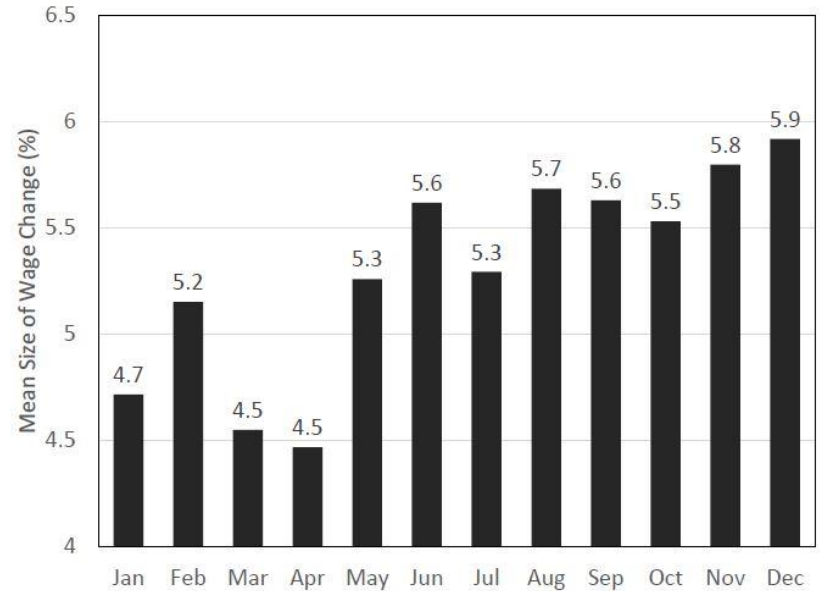


PANEL B: MEAN CHANGE SIZE

- **Monthly seasonality in wage setting.**
- **Little quarterly seasonality.**

# Summary – Wage Setting on the Job and When to Use Job-Stayer Rigidity

- Clear **time dependence** in data

    - Hazards spike at 12 months

    - Monthly, but not quarterly seasonality

    - Taylor style contracting

- **Strong asymmetry for job-stayers**

    - 66.3% receive wage change; just 2.4% is downward

- Other results (in paper)

    - **Large firms** more likely to adjust wages

    - **Manufacturing firms** more likely to adjust wages

    - **Firms synchronize** their wage changes

# Part 3:
# Aggregate Nominal Wage Rigidity

# Building an Aggregate Measure of Rigidity

- **Many macro models do not have clear notion of a *job***

    - Supply labor to a labor aggregating firm (e.g. CEE, 2005)

- **Much wage growth may come from job switching**

    - Posted wage rigidity (Hazell and Taska, 2018)

- Challenge is to **combine job-stayers and job-switchers** into one macro-economic wage adjustment measure

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- **Proceed in two steps:**

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  (2)   Aggregate using LEHD Job-to-Job Flows Data

- **Key takeaway: wages much more flexible for job-changers, and thus in aggregate, than inferred from studies of job-stayers.**

# Part 3a:
# Nominal Wage Adjustment for Job-Changers

# Wage Change Distribution, Job Changers
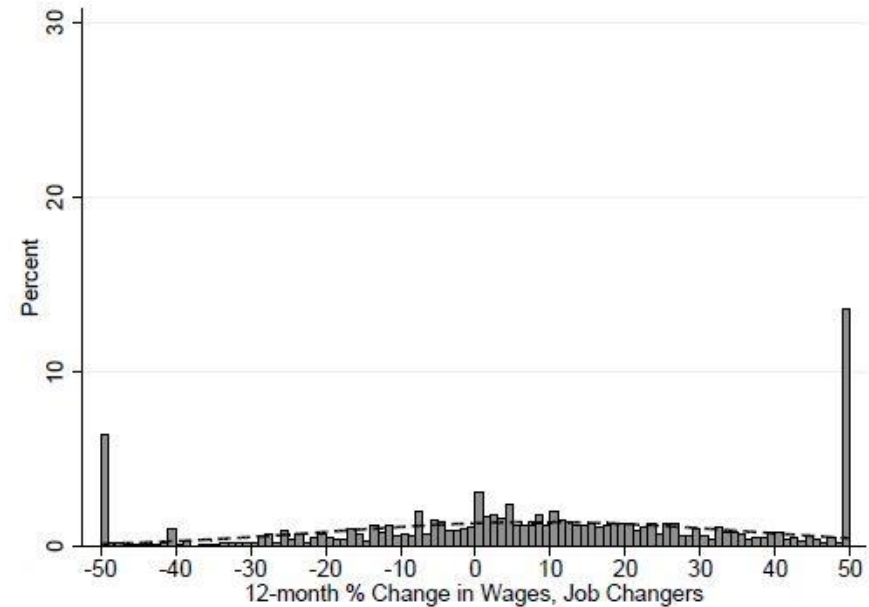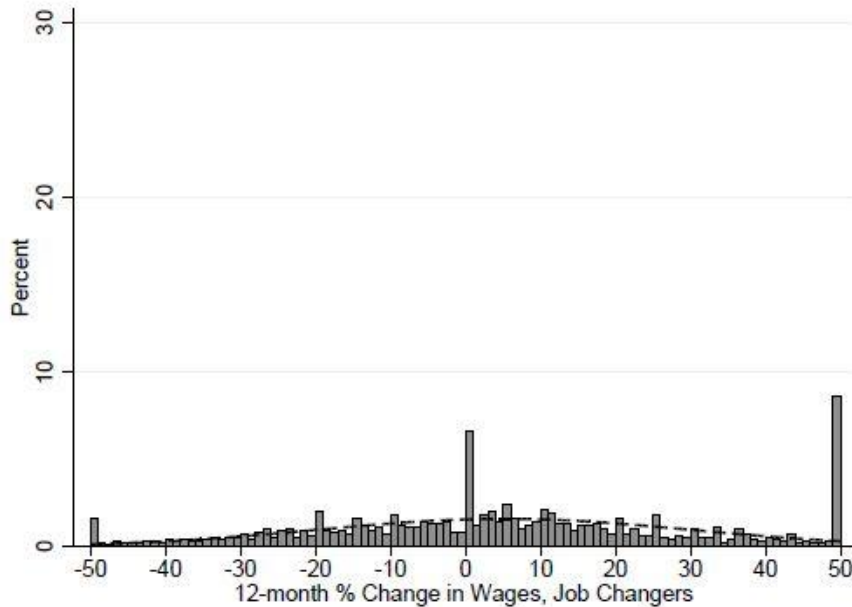


PANEL A: HOURLY-TO-HOURLY CHANGERS



PANEL B: SALARIED CHANGERS

- **Vast majority of job-changers receive wage change.**
- **Substantially more downward adjustment**
- **Much larger variance**

# Stayer vs Changer Comparison, 2008-2016

|  | Job Stayers | Job Changers |
|---|---|---|
| **Annual** | | |
| Probability No Change | 33.7% | 5.2% |
| Probability of a Wage Cut | 2.4% | 38.0% |
| Probability of a Wage Increase | 63.9% | 56.8% |
| Std. Dev. of Wage Change | 6.5% | 30.4% |
| Conditional Std. Dev. | 6.9% | 30.8% |
| **Quarterly** | | |
| Probability No Change | 80.6% | 9.7% |
| Probability of a Wage Cut | 0.9% | 37.6% |
| Probability of a Wage Increase | 18.5% | 52.7% |
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# Part 3b: Aggregation

# Aggregating Job Stayers and Changers

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    - 18.5% of workers switch jobs annually

- **Weight ADP data** so that **job-changers represent 4.8%** = 0.046/(1-0.046) of workers quarterly

- Substantially **upweight ADP changers**
    - We only observe switchers *between ADP firms*

# Aggregate Nominal Rigidity, 2008-2016

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| Conditional Std. Dev. | 6.9% | 15.7% |
| **Quarterly** | | |
| Probability No Change | 80.6% | 74.1% |
| Probability of a Wage Cut | 0.9% | 4.1% |
| Probability of a Wage Increase | 18.5% | 21.8% |
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# Comparing Aggregate vs Job-Stayer Rigidity

- **Job-Changers have much more flexible wages than job stayers**
    - 38.0% receive wage cut in given year (vs 2.4%)
    - 56.8% receive wage increase in given year (vs 56.8%)
    - Standard deviation of 30.4% (vs 6.5%)

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- **Aggregate wages see much more downward adjustment than job-stayer wages**

  - 9.9% of workers receive wage cut in given year

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  - Standard deviation of 30.4% (vs 6.5%)

- **Aggregate wages see much more downward adjustment than job-stayer wages**
  - 9.9% of workers receive wage cut in given year

- **Aggregate rigidity appropriate in models**
  - With no clear notion of job
  - With wage growth both on-the-job and through search

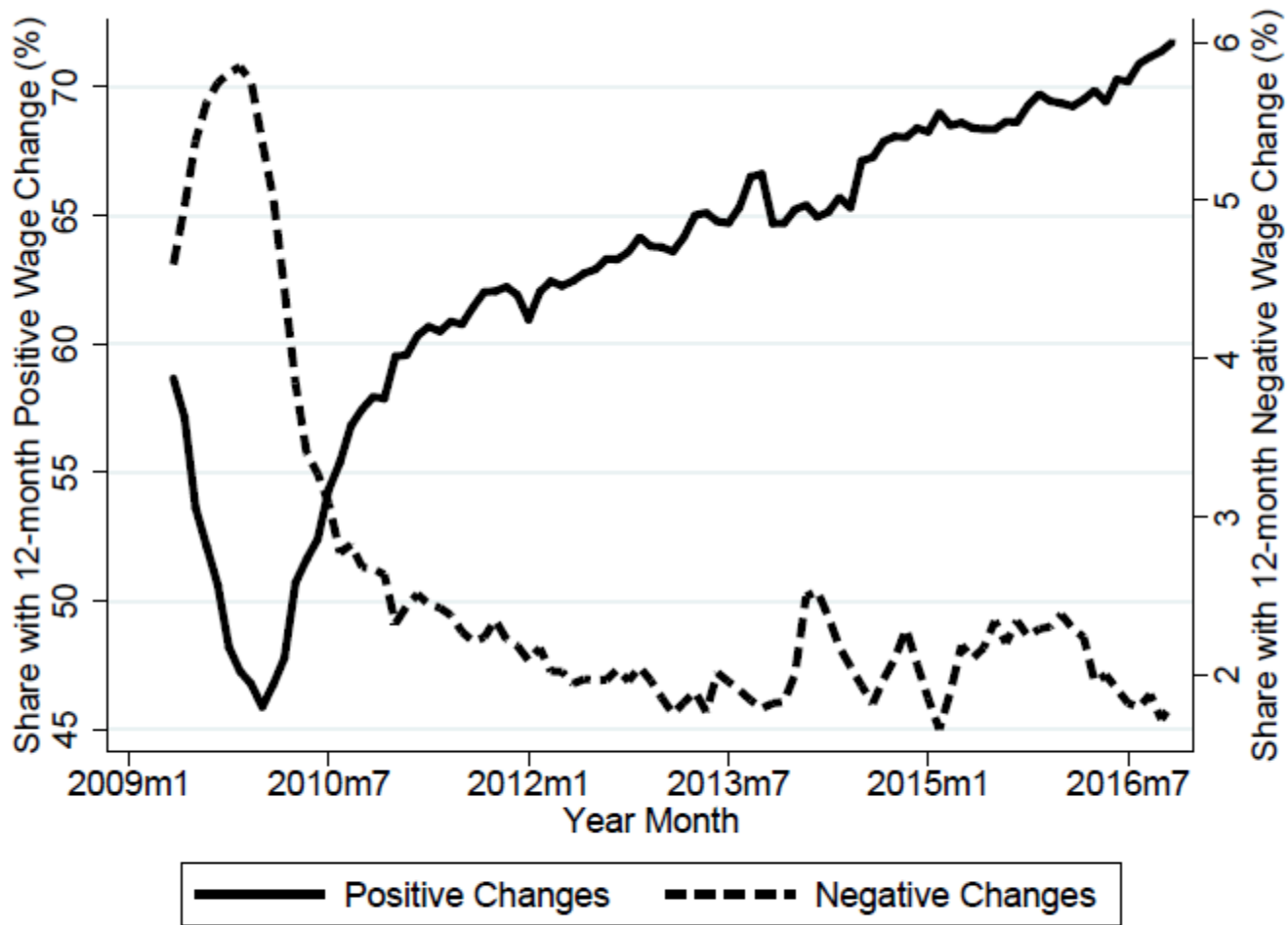- **New Keynesian models should generally use aggregate adjustment**

# Part 4:
# State Dependence in Wage Changes

# Time Series of Wage Changes
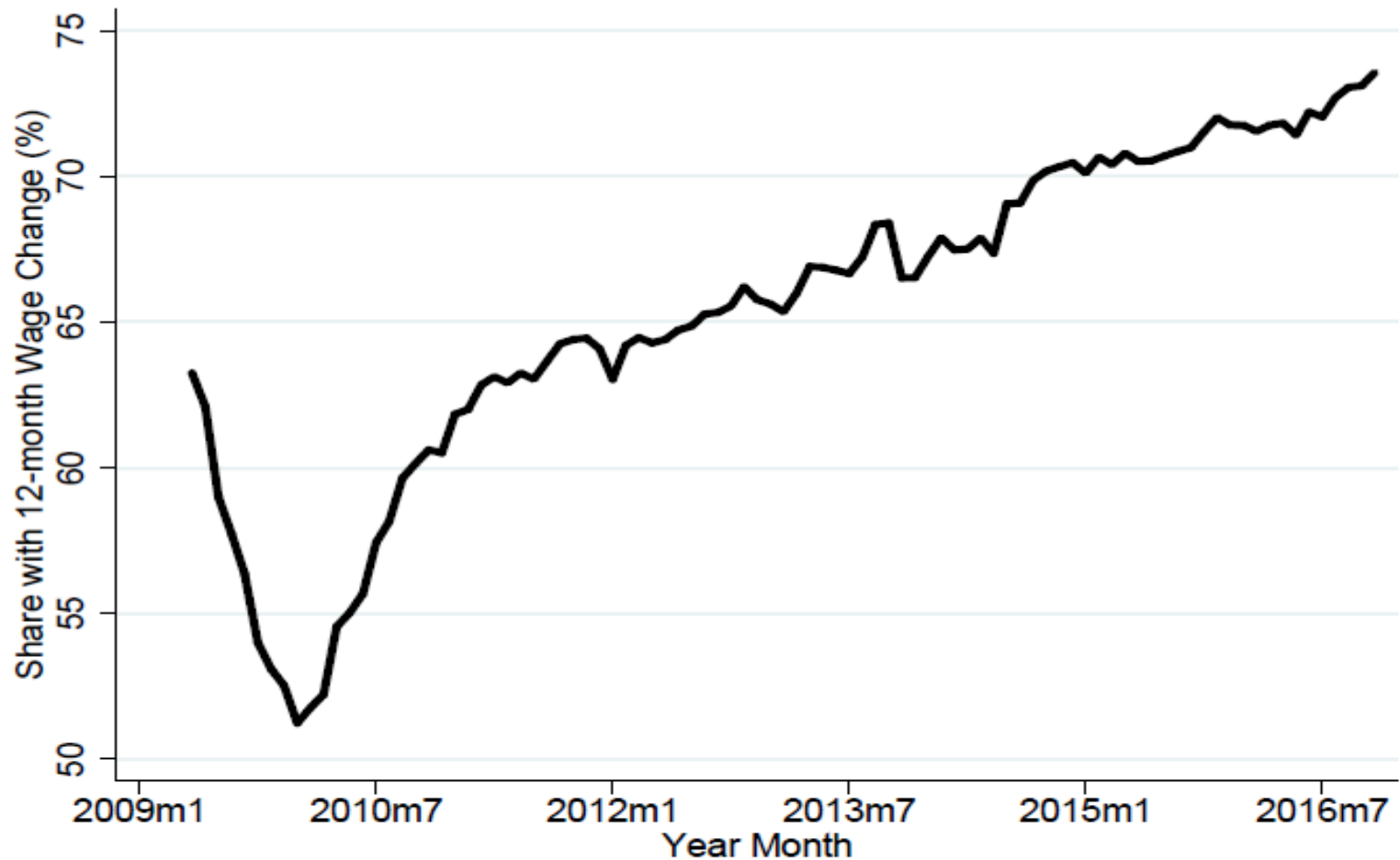


PANEL A: HAS WAGE CHANGE

# Time Series of Wage Cuts and Increases



PANEL B: HAS WAGE CHANGE: POS. VS NEG.

# Cyclicality of Job-Stayer and Job-Changer Wages

|  | May 2009 To Dec 2010 | Jan 2012 To Dec 2016 |
|---|---|---|
| **Job-Stayers** | | |
| Probability No Change | 43.3% | 30.6% |
| Probability of Wage Cut | 4.2% | 2.0% |
| Probability of Wage Cut, Salaried | 6.6% | 2.8% |
| **Job-Changers** | | |
| Probability No Change | 6.4% | 5.0% |
| Probability of a Wage Cut | 47.2% | 37.0% |
| Probability of a Wage Cut, Salaried | 56.3% | 31.7% |

# Cyclicality of Job-Stayer and Job-Changer Wages

|  | May 2009 To Dec 2010 | Jan 2012 To Dec 2016 |
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# Distribution of <u>Annual</u> Nominal Wage Changes
## Over Business Cycle, Aggregate

| | Quarterly | | Annual | |
|---|---|---|---|---|
| | March 09-<br>Dec. 10 | Jan. 12-<br>Dec. 16 | March 09-<br>Dec. 10 | Jan. 12 -<br>Dec. 16 |
| **Probability of Wage Change** | | | | |
| Share Positive Wage Change (%) | 17.7 | 23.5 | 51.2 | 66.3 |
| Share Negative Wage Change (%) | 5.1 | 3.9 | 11.8 | 9.7 |
| | | | | |
| **Unconditional Size of Wage Change** | | | | |
| Mean Wage Change(%) | 0.7 | 1.6 | 2.7 | 5.2 |
| Median Wage Change(%) | 0.0 | 0.0 | 1.0 | 2.8 |
| Stan. Deviation of Wage Change (%) | 8.1 | 8.2 | 12.7 | 14.2 |
| | | | | |
| **Conditional Size of Any Wage Change** | | | | |
| Mean Wage Change(%) | 3.3 | 6.0 | 4.4 | 6.9 |
| Median Wage Change(%) | 3.0 | 3.3 | 3.2 | 3.5 |
| Stan. Deviation of Wage Change (%) | 16.8 | 15.0 | 15.8 | 16.0 |

- **Many more wage cuts in aggregate during recession**

- **Over 1 in 10 workers received cut year-over-year in recession**

# Summary of State Dependence

- **Wage adjustment moves** substantively over the **business cycle**, **across regions** during the Great Recession, and in response to **firm level shocks**.

- **Additional source of downward flexibility** during the recession

- New addition to literature

  o One related recent paper: Sigurdsson and Sigurdardottir (2016) who document some state dependence in wage setting in Iceland.

- Mechanism for **state dependence needed** in models of wage adjustments.
  - **Asymmetries**
  - **Menu costs**

# Part 5:
# Benefits of Payroll Data

# Comparison with Literature – Household Dataset

- **Question:  How do these results compare with existing literature?**

- **Answer:   Qualitatively similar.  Quantitatively very different.**

**Some recent papers**

Daly, Hobijn and Lucking (2012) and Daly and Hobijn (2014)  - Use matched CPS data.  **Find roughly 85% of job stayers receive an annual wage change over our entire sample period.**
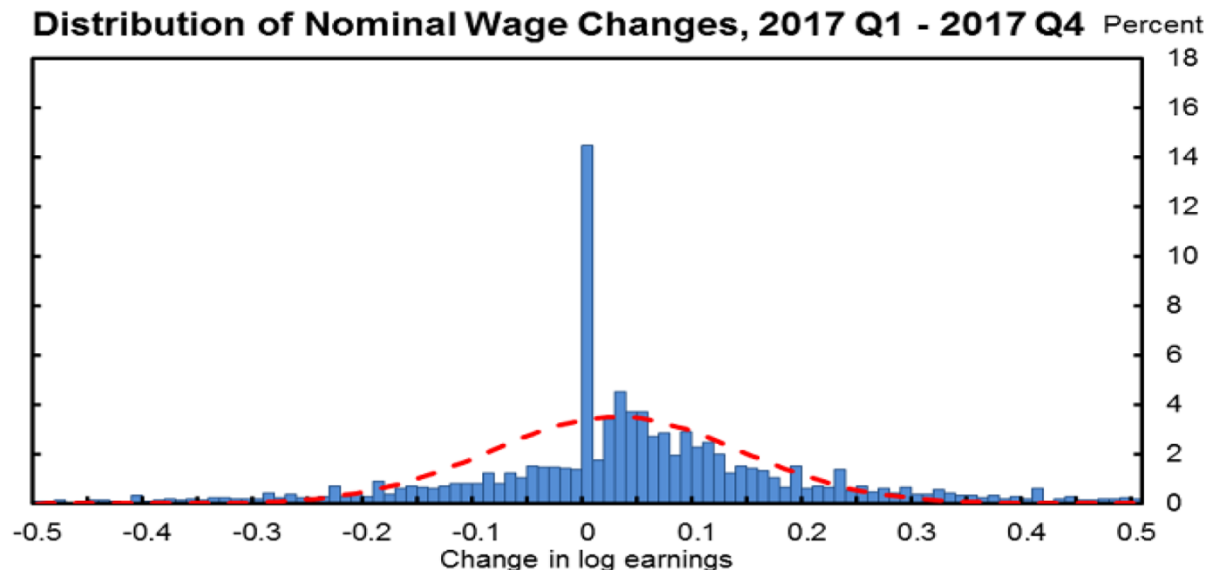


Distribution of Nominal Wage Changes, 2017 Q1 - 2017 Q4

# Comparison with Literature – Household Dataset

- **Question:  How do these results compare with existing literature?**

- **Answer:   Qualitatively similar.  Quantitatively very different.**

## Some recent papers

Barattieri, Basu and Gottschalk (2014) - Use SIPP data.  Try to adjust for measurement error using structural breaks.

- o   Find quarterly frequency of wage adjustment for job stayers of about 15-22% (we get 20%).

- o   However, they estimate 12% of all quarterly wage changes for job-stayers are cuts.  We estimate that 4.6% (0.9/19.4).

- o   They find no difference across occupations and industries (and no seasonality).

# Quarterly Earnings Change, Job Stayers
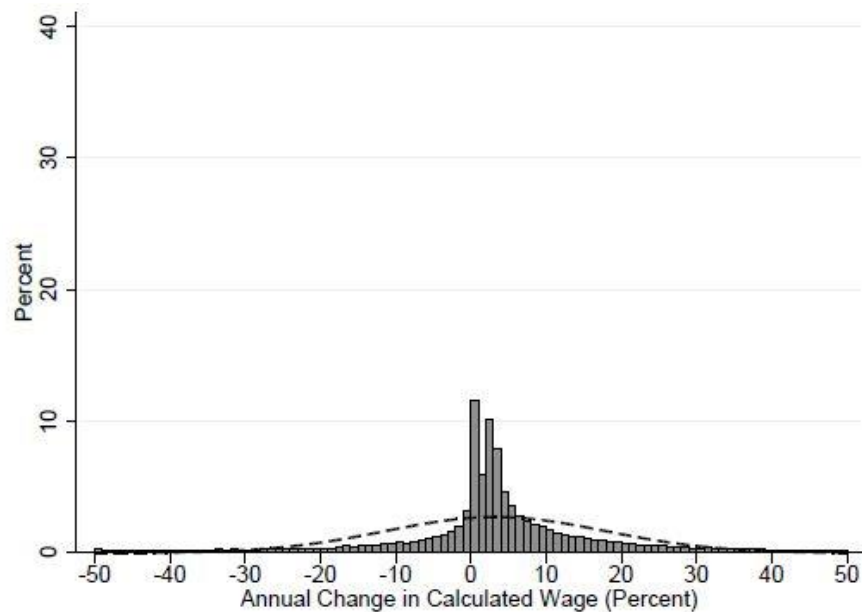## (akin to some admin data sources)
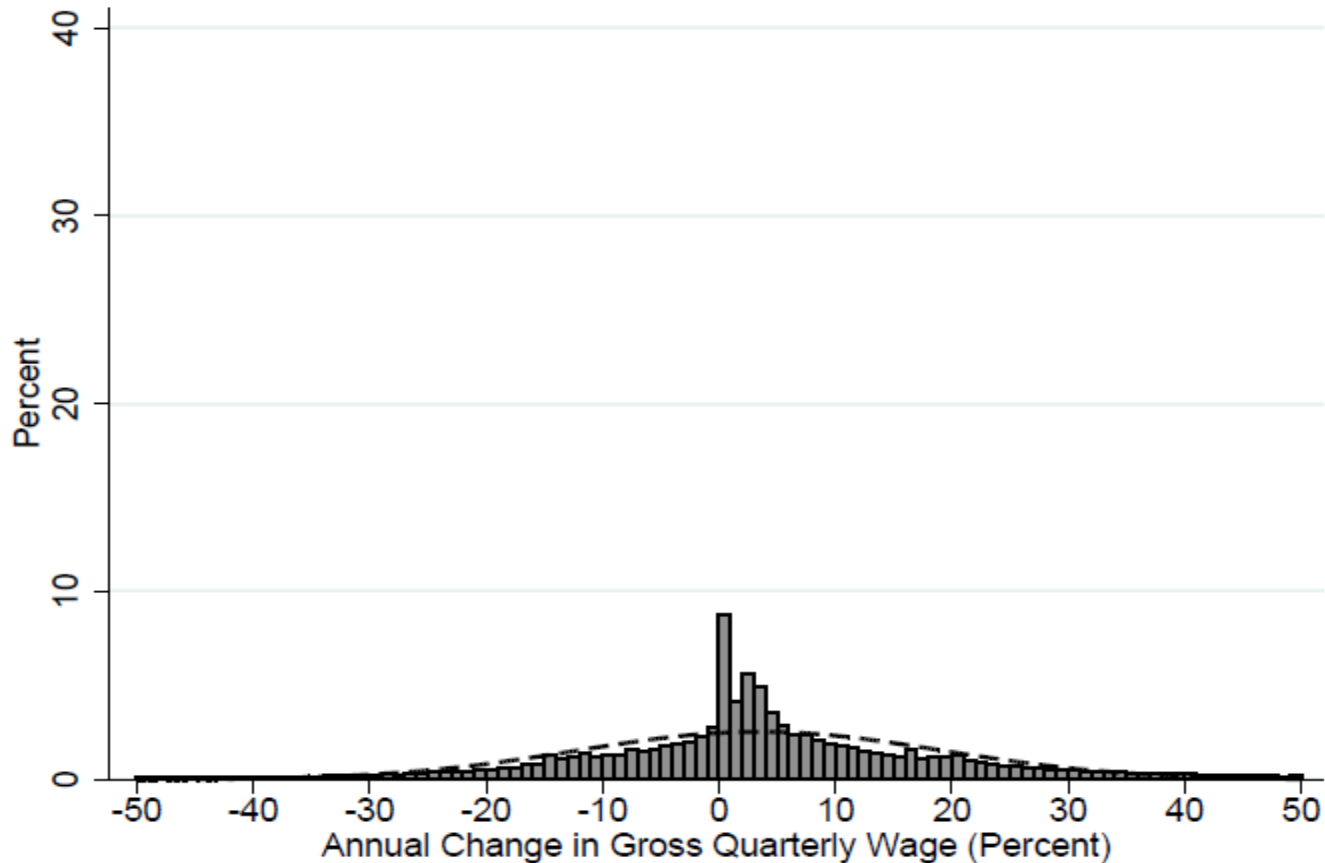


- **Probability of Earnings Cut: 32.2%**
- **Standard Deviation: 20.0%**

# Quarterly Earnings Per Hour Change, Job Stayers
## (akin to some admin data sources with hours data)
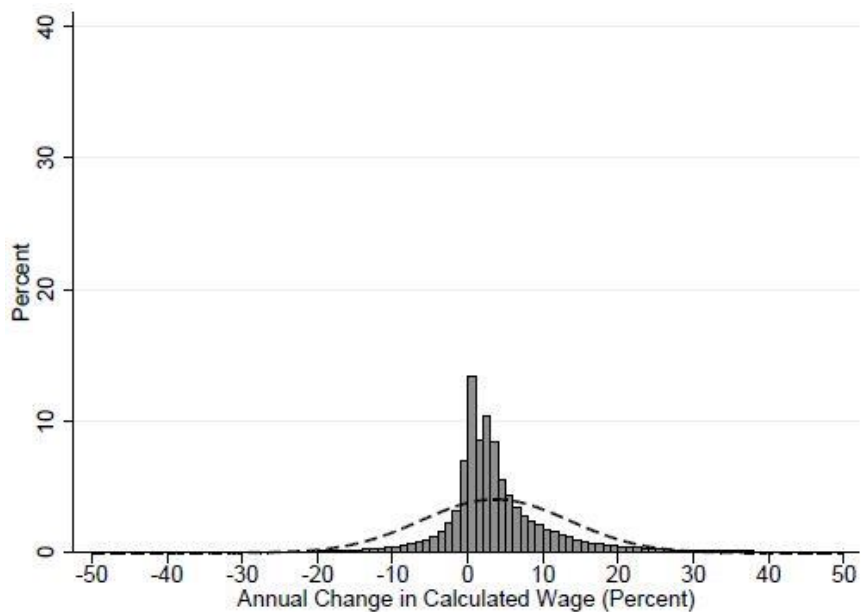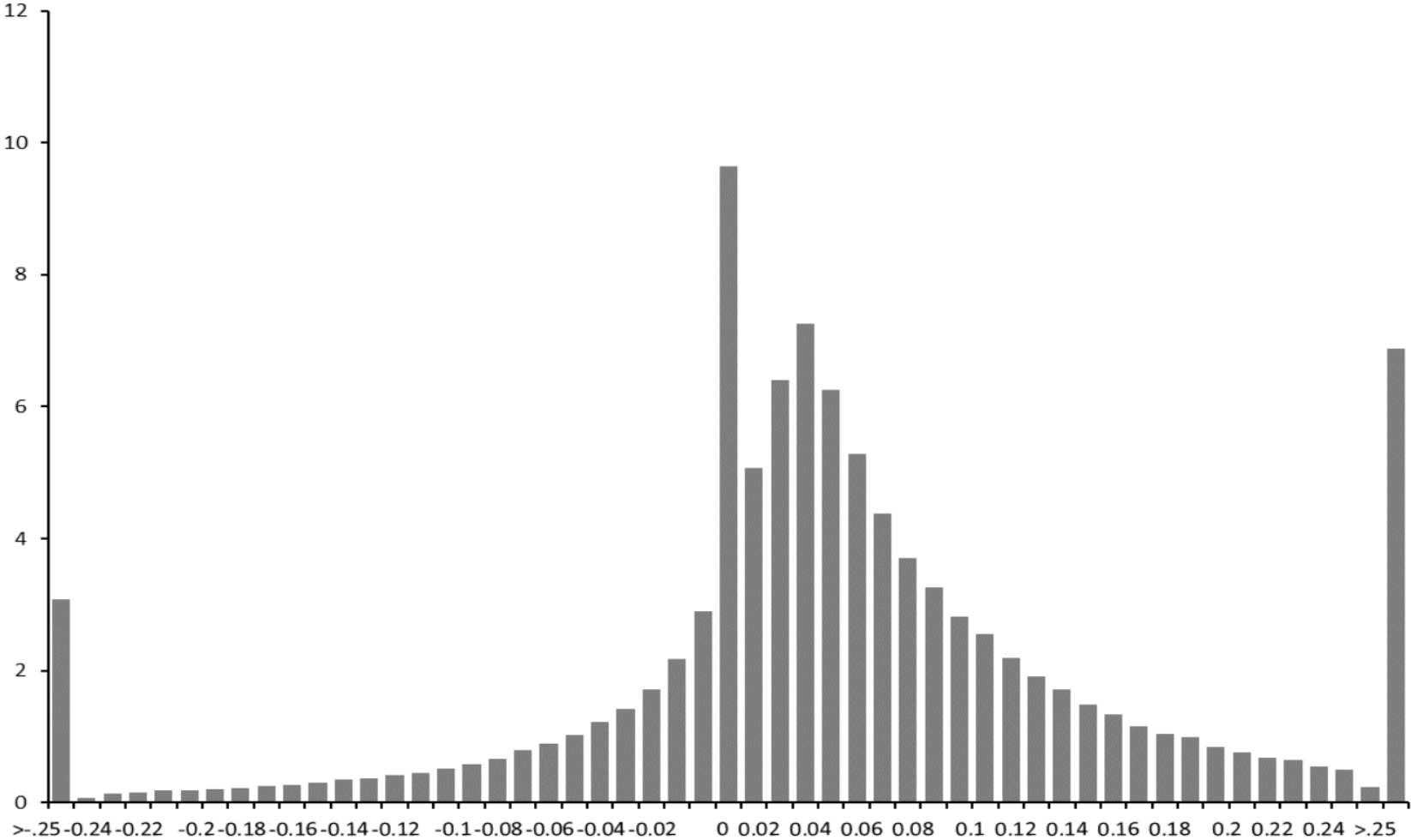


Panel A: Hourly

Panel B: Salaried

- **Probability of No Change: 12-15%**

- **Probability of Cut: 21.2% (Hourly), 25.3% (Salaried)**

- **Standard Deviation: 15.9% (Hourly), 19.2% (Salaried)**

# Kurmann and McEntarfer (2017)
## Two Year Earnings-Per-Hour Change, Washington State, LEHD

Figure 1: Distribution of hourly wage changes of job stayers. Washington State, 1998:2-2013:2

# Why the Difference

1. **Workers receive many other forms of compensation in their paychecks.**

   o Overtime earnings (**formulaically determined**)

   o Commission/tips (**vary with both effort and economic conditions**)

   o Bonuses

   o Cashed out sick and vacation days (**tradeoff with labor supply**)

   o Signing bonus/Severance pay

2. **Hours are measured with noise for salaried workers**

# Quarterly Base Earnings per Base Hour Change, Job Stayers
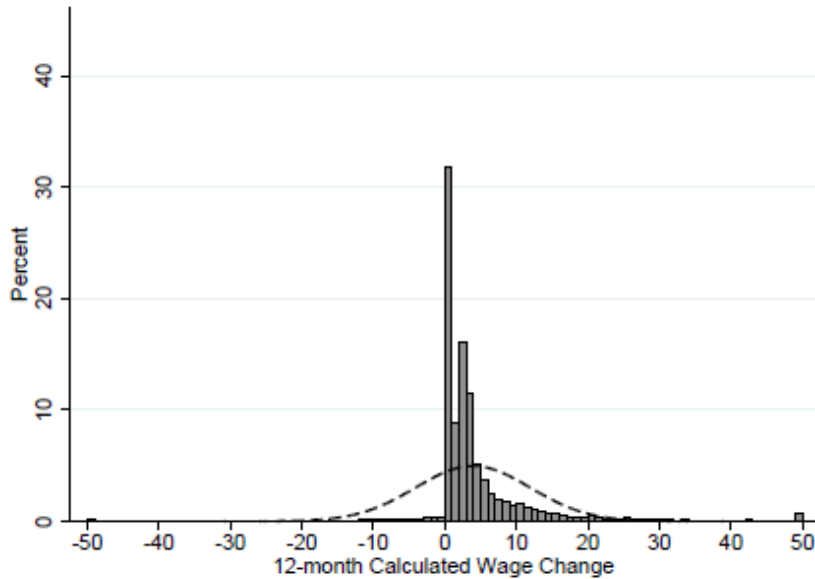


PANEL A: HOURLY WORKERS
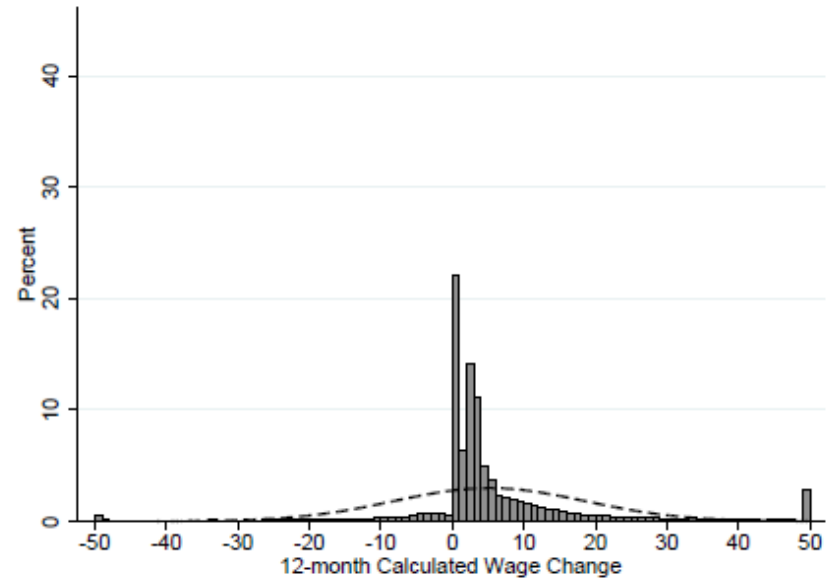
PANEL B: SALARIED WORKERS

- Only ~½ of all salaried workers have reported hours worked

- Salaried worker patterns quite different than our main results because hours are mis-measured for those that do report them.

- Standard Deviation for Salaried: 19.7% (vs 6.5%)

# Conclusion

# Conclusion

- **Exciting new data** that allows a careful measurement of wage adjustments over the last decade.

    o   Large samples ; Administrative data ; spans recession and non-recession periods ; worker and firm characteristics

- During non-recessionary periods, essentially **no nominal wage cuts for job-stayers**

- **Job-changers have much more wage adjustment**

- Thus **aggregate flexibility higher than amongst stayers**

- **Future Work:**
    - Heterogeneity
    - Fringe Benefits