A Quality Index for New Job Hires

Brad Hershbein

W.E. Upjohn Institute for Employment Research

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Much timely (monthly) government data on number of new jobs
  But by industry, not occupation or much else

There are also considerable wage data for workers
  But almost always for incumbents, not new hires

The result is that we don’t know much about the “quality” of new jobs
Motivation

- Understanding characteristics of new jobs, and workers in them, of key concern
  - An important coincident, and perhaps leading, indicator
  - Provides insight into cyclical labor markets
  - Can shed light on structural changes in skill demand

- But “quality” is always hard to define
  - Wage is often a useful summary statistic, but...
  - Other nuances important, especially volume of new hires
  - How much detail is possible? Useful?

- **Goal:** Create a new index of job hires quality
Economic literature has long recognized that what one does affects compensation more than where one does it

- Roy (1951); Houty (1958, 1961); Groshen (1991)
- And now task-based models of human capital: Spitz-Oener (2006); Gathmann & Schoenberg 2010; Acemoglu & Autor (2011); Autor (2013)

Mincer-style wage regressions show that occupations explain 2–4 times the variance of industries, even with additional controls

Despite this, armchair analysis on wages of new jobs is often based on industry, not occupation

- Unlike for industries, no high-frequency occupation-level releases...
- Result is lamp-post inference
The Low-Wage Recovery:

Industry Employment and Wages Four Years into the Recovery

Most jobs added in Boston since recession called low-paying

By Katie Johnston | GLOBE STAFF SEPTEMBER 22, 2015

Many of the job gains have come in low-paying sectors such as food service, home health care, and janitorial services, while higher-paying fields such as information services, have not grown as rapidly.

The Washington Post

The ‘low-wage recovery’ is a myth

To do this, she divided businesses into three groups by their pay. Today’s average hourly pay is $25. Low-paying employment is dominated by restaurant and hotel jobs (2015 average hourly rate: $14.12) and retail jobs ($17.21). Midlevel jobs include manufacturing ($23.90), health care and education ($24.97) and construction ($26.91). Finally, high-paying jobs included professional and business services ($29.59), finance ($31.10) and utilities ($36.02).
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Examples of New Hire “Job Quality” Lamp-post Inference

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The New York Times

The Upshot
EVERYDAY ECONOMICS
Justin Wolfers @JustinWolfers

There are many highly paid managers working in the low-paid retail trade sector, just as there are many low-paid janitors working in the high-paid professional services sector.

Figuring out whether the recovery is creating “good jobs” or “bad jobs” requires looking deeply into skill levels and job responsibilities.

Exactly. Why not do this?
New monthly index tracks “quality” of new job hires (2001 →)

Uses CPS to identify new hires: those switching in adjacent months from non-employment to employment or changing employers

Detailed occupation in CPS merged with OES occupational wage data via SOC crosswalks

- Overcomes some weaknesses of self-reported CPS wage data
- Automatically adjusts for inflation

Resulting index shows change in realized skill demand through changes in occupation mix

- Adjust for new-hire demographics, but not within-occupation skill changes
  - compare with self-reported wages to understand differences
- Also yields hire volume, and index for many subgroups
Hourly wage index is up nearly 5 percent from 2005
New Hires Quality Index: Hourly Wages

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data

Index (2005=100)

2001 2003 2005 2007 2009 2011 2013 2015 2017
Summary of findings

1. Hourly wage index is up nearly 5 percent from 2005

2. Occupational mix rose sharply during recession, was flat during recovery, and rose again from mid-2014 through 2015
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3. Volume of new hires has not recovered; wage bill has just barely; hires/person not at all
New Hires Quality Index: Monthly Volume

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data
SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data
New Hires Quality Index: Hires per capita

Hershein

SOURCE: Upjohn Institute New Hires Quality Index
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4. Women have had a stronger recovery than men
New Hires Quality Index: Women and Men

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data

Women index (2005=100)   Men Index (2005=100)
New Hires Quality Index: Women and Men, volume

SOURCE: Upjohn Institute New Hires Quality Index

NOTE: Wage index is based on a 12-month lagged moving average of monthly data.
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5. In 2005, college graduates accounted for one-fifth of all hires; in 2016, they accounted for one-fourth
New Hires Quality Index: Volume by education

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data
New Hires Quality Index: Wage bill by education

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data.
Summary of findings

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5. In 2005, college graduates accounted for one-fifth of all hires; in 2016, they accounted for one-fourth

6. Wage index gains have been comparable for newly employed and employer changers, but volume growth of former vastly outpaces that of latter
New Hires Quality Index: Index by Hire Type

Source: Upjohn Institute New Hires Quality Index
Note: Wage index is based on a 12-month lagged moving average of monthly data.
New hires quality index: Volume by hire type

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data.
Outline

1. Methodology
2. Robustness
3. What about actual reported wages?
4. Subgroups
5. Conclusions
Methodology: CPS1

- Longitudinally link CPS (adult civilian) respondents in adjacent months (Madrian and Lefgren 2000)

- In theory, can do this for \(\frac{3}{4}\) of sample (rotation groups 1–3 and 5–7)

- Will necessarily miss individuals who leave the household or move (or die)
  - Drew, Flood, and Warren (2014) show match rates of 95% of theoretical max
  - 96% successful links; 1 pp don’t match age/race/sex

- Still, will check SIPP(?) to gauge magnitude of new hires who change residences
  - Probably positively selected...
Methodology: CPS2

- How to identify new hires (excluding self-employed)?

- For NE → E transitions, straightforward to observe change from unemployed/NILF to employed using labor recode.

- For E → E new job transitions, exploit post-1994 variable (puiodp1) on whether employer is same as last month’s.
  - Will not count occupation changes with same employer (ignore internal labor market); too arbitrary and problematically measured.

- Weighted aggregates compare reasonably well with JOLTS, but less cyclical.
  - Conceptual differences, and JOLTS undercounts relative to QWI.
CPS New Hires Volume vs JOLTS

SOURCE: Upjohn Institute New Hires Quality Index; JOLTS (BLS)
NOTE: Both measures based on a 12-month lagged moving average of NSA monthly data
Methodology: CPS2

- How to identify new hires (excluding self-employed)?
  - For NE → E transitions, straightforward to observe change from unemployed/NILF to employed using labor recode.
  - For E → E new job transitions, exploit post-1994 variable (puiodp1) on whether employer is same as last month’s.
    - Will not count occupation changes with same employer (ignore internal labor market); too arbitrary and problematically measured.

- Weighted aggregates compare reasonably well with JOLTS, but less cyclical.

- Simple correlation is 0.92, and some conceptual differences in samples (reference period, unpaid leave, informal work).
Methodology: CPS3

- Need to harmonize occupation codes over time
  - From 1994 through 2002 → 1990 Census codes
  - From 2003 through 2010 → 2000 Census codes
  - From 2011 to current → 2010 Census codes

- Goal is to map to 2010 SOC codes (what OES now uses)

- For 2010 Census codes, Census crosswalk maps 532 occ codes to 532 SOC codes (out of 820)
  - Occ codes are coarser than SOCs, so some occs maps to 4- or 5-digit SOCs

- The 2011 → period is straightforward…
Methodology: CPS4

- For 2000 Census codes, IPUMS crosswalk maps 505 occ codes to 505 SOC codes (out of 801)

- Again, occ codes are coarser than SOCs, so some occs maps to 4- or 5-digit SOCs

- But need to map 2000 SOCS → 2010 SOCS
  - Some simple 1:1 recodes or combinations, but also several splits
  - For splits, randomly assign based on empirical shares from ACS over 2010–2012

- These adjustments are minor, as most splits are into similarly paid occupations
  - Many splits into same 5-digit SOC, a few into same 4-digit SOC
For pre-2003 period (1990 Census codes), crosswalking is a problem.

1990 to 2000 change was very significant, reflected evolution to service-based economy.
- Census “crosswalks” show almost every occupation split into others in both directions.

IPUMS provides crosswalk between 1990 and 2010 occ codes.
- But it uses majority-split rule, not stochastic assignment.
- As a result, 499 1990 occ codes are mapped to only 352 2010 occ codes.

Partial solution: CPS extracts.

Thus, focus on 2000 → period.
Methodology: CPS6

- Also need to harmonize industries, but only at 2-digit level

- Much easier than trying detailed NAICS crosswalk

- Census industry codes map into 3-digit NAICS easily in 2003 → period

- In pre-2003 period, mapping isn’t exact, but still quite good
  - And CPS extracts solve 2000–2002 period
Methodology: OES

- Occupational Employment Statistics (OES) provides annual occupation-level wage data
- At national level, available at cross of 6-digit SOC and 2-6 digit NAICS
- Also available at MSA, state, and some state-industry levels
- Provides wage distribution (hourly or annual) at key quantiles and mean
- Merge 25th percentile occupational wages using SOC to CPS new hires
  - This quantile better approximates wages of new hires
- Merge on 6-digit SOC by 2-digit NAICS
  - Hierarchical process; use coarser SOCs for unsuccessful matches
Methodology: Demographic Adjustment

- Assigning wages by occupation means wages will be the same for a 20-year-old LPN on her first job as for a 35-year-old LPN switching hospitals.

- Desirable to adjust for these types of demographic differences in new hires, within occupation.

- Use data on actual, valid self-reported (log hourly) wages to estimate adjustment factors:
  - 1st: regress wages on non-demographics (time, worker type, hire type, occupation, industry).
  - 2nd: regress residuals, separately by 4-digit SOC, on sex, race, education, and quartic in age.
  - 3rd: Use predicted values to adjust OES wages.
Process

- Calculate means, overall and for subgroups, each month

- To smooth out noise and seasonals, take 12-month lagged moving average
  - Straightforward, intuitive, and easy to implement
  - Generally yields results similar to X-13 ARIMA SA process or HP filter
New Hires Quality Index: Sample Size Over Time

Source: Upjohn Institute New Hires Quality Index; CPS
New Hires Quality Index: Sample Size, by group

Source: Upjohn Institute New Hires Quality Index; CPS
Process

- Calculate means, overall and for subgroups, each month

- To smooth out noise and seasonals, take 12-month lagged moving average
  - Straightforward, intuitive, and easy to implement
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- Taking means weights right-tail occupations more heavily
  - Could look at quantiles, too
Robustness: Demographic adjustment

- Adjustment is mostly a level shift up, overall, and again after recession
- Hires in highly paid occupations are older and more educated
- Also permanent(?) shift in hiring demographics after GR (Hershbein and Kahn 2017)
NHQI: Robust to Demographic Adjustment

**SOURCE:** Upjohn Institute New Hires Quality Index

**NOTE:** Wage index is based on a 12-month lagged moving average of monthly data
Robustness: Robust to Demographic Adjustment

Source: Upjohn Institute New Hires Quality Index

Note: Wage index is based on a 12-month lagged moving average of monthly data

- With demo adj
- Without demo adj

Source: Upjohn Institute New Hires Quality Index

Note: Wage index is based on a 12-month lagged moving average of monthly data
Robustness: Median vs Mean

- Adjustment is mostly a level shift up, overall, and again after recession
  - Hires in highly paid occupations are older and more educated
  - Also permanent(?) shift in hiring demographics after GR (Hershbein and Kahn 2017)

- Can also take *median* instead of mean of new hires
  - Without demo adjustment, not very interesting...
  - Captures *only* change in median occupation hired
  - Even with demo adjustment, misses rest of distribution
Robustness: Median

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data

$11.50  $11.75  $12.00  $12.25  $12.50
2001 2003 2005 2007 2009 2011 2013 2015 2017

With demo adj  Without demo adj

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data
Robustness: Quantiles

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- Can also take median instead of mean of new hires
  - Without demo adjustment, not very interesting...
  - Captures only change in median occupation hired
  - Even with demo adjustment, misses rest of distribution

- Growth is concentrated in right-tail occupations
Robustness: Quantiles

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data
Robustness: Quantiles (Index: 2005=1)

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data

0.96 0.98 1.00 1.02 1.04 1.06 1.08 1.10
2001 2003 2005 2007 2009 2011 2013 2015 2017
p10 p25 p50 p75 p90

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data
Occupational Distribution at 90th percentile

SOURCE: Upjohn Institute New Hires Quality Index; CPS
NOTE: Data are for 89th–91st percentile of wage index for years shown.
What about self-reported wages?

- Individuals report hourly (weekly) wages in ORG months... and consistent since 1994... why not use them?

- Three issues:
  1. Much smaller sample size: ORG restriction cuts to 1/4 size, from about 2,500 to 625 per month
  2. Growing imputation problem: Imputed share of wages rises from 1/4 in 1998 to 2/5 by 2016, lowering sample size to \( \approx 400 \) today
  3. Composition and selection: Imputation may cause valid wages to cover different population than all new hires

- But also conceptual difference: \( Xs \) vs. \( \beta s \)
What about self-reported wages?

- Reduced sample sizes, when averaged, sufficient for index…
  - … but not so much for subgroups
  - … and overall index still volatile, even when averaged
NHQI and CPS self-reports

![Chart showing NHQI and CPS mean and median wages from 1999 to 2017.](chart)

**Source**: Upjohn Institute New Hires Quality Index; CPS

**Note**: Wage index is based on a 12-month lagged moving average of monthly data.
NHQI and CPS self-reports (2005=1)

CPS mean NHQI median
NHQI mean CPS median

SOURCE: Upjohn Institute New Hires Quality Index; CPS
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What about self-reported wages?

- Reduced sample sizes, when averaged, sufficient for index...
  - ... but not so much for subgroups
  - ... and overall index still volatile, even when averaged

- Strong real wage growth before 2002 (well known) and over 2015–2016 (not well known)

- Wages flat or falling even as positive occupation shift during GR

- Ocular evidence suggests roles for within-occupation and cross-occupation change at different times
  - But need to address composition bias
## Composition Bias: All new hires and valid wages

**SOURCE:** Upjohn Institute New Hires Quality Index; CPS

**NOTE:** Wage index is based on a 12-month lagged moving average of monthly data.

<table>
<thead>
<tr>
<th></th>
<th>1999 All</th>
<th>Wage</th>
<th>Diff</th>
<th>2007 All</th>
<th>Wage</th>
<th>Diff</th>
<th>2016 All</th>
<th>Wage</th>
<th>Diff</th>
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<tr>
<td><strong>Age</strong></td>
<td>33.4</td>
<td>32.4</td>
<td>-1.1</td>
<td>35.2</td>
<td>34.0</td>
<td>-1.2</td>
<td>36.9</td>
<td>35.6</td>
<td>-1.3</td>
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<td>White</td>
<td>0.682</td>
<td>0.695</td>
<td>0.012</td>
<td>0.628</td>
<td>0.651</td>
<td>0.024</td>
<td>0.572</td>
<td>0.588</td>
<td>0.016</td>
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<td>Black</td>
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<td>0.140</td>
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<td>0.058</td>
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<td>Hispanic</td>
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<td>0.137</td>
<td>0.003</td>
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<td>0.205</td>
<td>0.209</td>
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<td>&lt; HS</td>
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<td>0.006</td>
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<td>Grad degree</td>
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<td>0.062</td>
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<td><strong>Sector</strong></td>
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<td>Goods</td>
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<td>0.167</td>
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<td>0.806</td>
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<td>Newly employed</td>
<td>0.581</td>
<td>0.560</td>
<td>-0.021</td>
<td>0.646</td>
<td>0.614</td>
<td>-0.032</td>
<td>0.675</td>
<td>0.617</td>
<td>-0.058</td>
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<td>Change employer</td>
<td>0.419</td>
<td>0.440</td>
<td>0.021</td>
<td>0.354</td>
<td>0.386</td>
<td>0.032</td>
<td>0.325</td>
<td>0.383</td>
<td>0.058</td>
</tr>
</tbody>
</table>

**SOURCE:** Upjohn Institute New Hires Quality Index; CPS

**NOTE:** Wage index is based on a 12-month lagged moving average of monthly data.
Composition bias

- On most observables, seems small
  - Valid-wage sample is younger, less Black, and more E→E
- Tried reweighting valid wage sample to all new hires, but did not work well
  - Insufficient predictors

- Can back out expected bias (from observables)
  - Run (valid) wage regression on $\mathbf{X}$ and adjust for $\Delta \mathbf{X}$
  - Results imply about 1% negative bias, mostly from age
  - Adding occupation and industry to $\mathbf{X}$ increases bias slightly, to 2.7%
  - Stable over time, for offsetting reasons
Self-reported wages?

- Could potentially use for index
  - Bias is apparently small
- But $n$ is too small for subgroups, even when averaging
- Tradeoff between simplicity and breadth of applicability
NHQI heterogeneity

- Index is currently calculated for 26 subgroups
  - Sex, age, education, sector, region, hire type

- But could do for others:
  - Ethnicity, marital status, occupation or industry groups

- In each case, calculate level and index of wage, volume, and wage bill

- For age, also calculate per-capita volume
NHQI: Per-capita volume, by age (2005=100)

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Per-capita volume is based on a 12-month lagged moving average of monthly data
NHQI: Index, by age (2005=100)

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Wage index is based on a 12-month lagged moving average of monthly data

2001 2003 2005 2007 2009 2011 2013 2015 2017
16 to 24 25 to 34 35 to 44

Hershbein

New Hires Quality Index 62/ 66
NHQI: Index, by age (2005=100)

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NOTE: Wage index is based on a 12-month lagged moving average of monthly data.
NHQI: Volume index, by education (2005=100)

SOURCE: Upjohn Institute New Hires Quality Index
NOTE: Volume index is based on a 12-month lagged moving average of monthly data

HSD BA

Hershbein New Hires Quality Index 65/66
Conclusion

- Monthly index of new hires is possible with CPS
- Can easily create metrics for volume, overall and for subgroups
- Hourly wage is also possible, with more caveats
  - OES-occupation wages allow matches for all new hires per month (subgroup trends), but miss within-occupation changes and available only from 2001
  - Self-reported wages capture total wage change and available longer, but smaller sample sizes limit subgroups and stability
- Both measures show increases since 2005 and sharply since 2015, but demographics play a role