The LEHD Infrastructure Files

and the Creation of the Quarterly Workforce Indicators

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- The first 21st century statistical system

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- identifi es EARNINGS, EMPLOYER, TIME PERIOD

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- some limited other state-dependent information available
- in particular, for Minnesota, the ESTABLISHMENT is reported

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  - geographic information

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- fundamental unit: 'reporting unit' ($\approx$ establishment)

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- collects from employers covered by state unemployment insurance programs:
  - employment
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- fundamental unit: 'reporting unit' ($\approx$ establishment)
- One report per establishment per quarter is fi led

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  - one record for each employee-employer combination – a job
  - earnings and employment patterns

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  - QCEW-based employment-activity history for every SEIN (employer) and SEINUNIT (establishment)

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  - earnings and employment patterns
- Employer and establishment-level employment history
  - QCEW-based employment-activity history for every SEIN (employer) and SEINUNIT (establishment)
- Comparison of employment and activity of SEINs between UI and QCEW fi les is done for QA purposes, and in preparation of weighting.

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- 30-40% of state-wide employment in multi-establishment fi rms

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- Solution: probability model for employment location and imputation

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- Key elements are:

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- Solution: probability model for employment location and imputation
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  1. distance between place-of-work and place-of-residence

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- Solution: probability model for employment location and imputation
- Key elements are:
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  2. distribution of employment across establishments of multi-establishment fi rms.

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- Solution: probability model for employment location and imputation
- Key elements are:
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  2. distribution of employment across establishments of multi-establishment fi rms.
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Conclusion

- Goal: achieve a high level of accuracy and detail
- Problem:
- 30-40% of state-wide employment in multi-establishment fi rms
- Solution: probability model for employment location and imputation
- Key elements are:
  1. distance between place-of-work and place-of-residence
  2. distribution of employment across establishments of multi-establishment fi rms.
- Important practical aspects:
  - Non-ignorable missing data imputation

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  1. distance between place-of-work and place-of-residence
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- Important practical aspects:
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  - Several million imputations every quarter

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- workers $i = 1, ..., I$

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- y_{ijt} establishment at which i was employed

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- $\mathcal{R}^i_{jt} \subset \mathcal{R}_{jt}$ set of active establishments that are feasible for worker i.

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Conclusion

$$p_{ijrt} = \Pr\left(y_{ijt} = r\right)$$

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Conclusion

$$p_{ijrt} = \Pr\left(y_{ijt} = r\right)$$

(1)
$$p_{ijrt} = \frac{e^{\alpha_{jrt} + x'_{ijrt}\beta}}{\sum_{s \in \mathcal{R}_{jt}^{i}} e^{\alpha_{jst} + x'_{ijst}\beta}}$$

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α_{jrt} establishment- and quarter-specifi c effect

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α_{jrt} establishment- and quarter-specifi c effect

x_{ijrt} time-varying vector, worker and establishment

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β effect on probability of being employed at a particular establishment

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Currently:

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α_{jrt} establishment- and quarter-specifi c effect

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β effect on probability of being employed at a particular establishment

Currently:

- x_{ijrt} is linear spline in distance between residence and establishment

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$$p_{ijrt} = \Pr\left(y_{ijt} = r\right)$$

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α_{jrt} establishment- and quarter-specifi c effect

x_{ijrt} time-varying vector, worker and establishment

β effect on probability of being employed at a particular establishment

Currently:

- x_{ijrt} is linear spline in distance between residence and establishment
- α_{jrt} is a hierarchical Bayesian model based on N_{jrt} is

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Using Minnesota data,

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Conclusion

Using Minnesota data,

compute posterior modal value of α_{jrt}

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Conclusion

Using Minnesota data,

compute posterior modal value of α_{jrt}

evaluate the posterior mode of $p(\beta|\alpha, x, y)$

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Conclusion

Using Minnesota data,

compute posterior modal value of α_{jrt}

evaluate the posterior mode of $p(\beta|\alpha, x, y)$

maximize

$$\log p\left(\beta|\alpha, x, y\right) \propto \sum_{t=1}^{T} \sum_{j \in \mathcal{J}_t} \sum_{i \in \mathcal{I}_{jt}} \sum_{r \in \mathcal{R}_{jt}^{i}} d_{ijrt} \left(\alpha_{jrt} + x'_{ijrt}\beta - \log \left(\sum_{s \in \mathcal{R}} \right. \right. \tag{2}$$

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Conclusion

- use mean and variance of β from Minnesota data

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Conclusion

- use mean and variance of β from Minnesota data
- take 10 draws of β from the normal approximation (at the mode) to $p\left(\beta|\alpha, x, y\right)$.

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Conclusion

- use mean and variance of β from Minnesota data
- take 10 draws of β from the normal approximation (at the mode) to $p\left(\beta|\alpha, x, y\right)$.
- use QCEW employment counts, compute 10 values of α_{jt}

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Conclusion

- use mean and variance of β from Minnesota data
- take 10 draws of β from the normal approximation (at the mode) to $p\left(\beta|\alpha, x, y\right)$.
- use QCEW employment counts, compute 10 values of α_{jt}
- The drawn values of α and β are used to draw 10 imputed values of place of work from to the posterior predictive distribution

$$(3)\; p\left(\tilde{y}|x, y\right) = \int\int p\left(\tilde{y}|\alpha, \beta, x, y\right) p\left(\alpha|N\right) p\left(\beta|\alpha, x, y\right) d\alpha d\beta$$

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- $\longrightarrow$ 10 establishment identifi ers associated with a job spell

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▲ We now have:

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Conclusion

- We now have:
  - Jobs identifi ed

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Conclusion

- We now have:
  - Jobs identifi ed
  - Jobholder's demographics (age, gender)

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Conclusion

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  - Jobs identifi ed
  - Jobholder's demographics

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Conclusion

- We now have:
  - Jobs identifi ed
  - Jobholder's demographics
  - Establishment's characteristics (geography and industry)

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Conclusion

- We now have:
  - Jobs identifi ed
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  - Establishment's characteristics

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Conclusion

- We now have:
  - Jobs identifi ed
  - Jobholder's demographics
  - Establishment's characteristics
- Now compute

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Conclusion

- We now have:
  - Jobs identifi ed
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  - Establishment's characteristics
- Now compute
  1. For each job, the relevant variables, defi ned at the person-level (indicators)

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- We now have:
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- Now compute
  1. For each job, the relevant variables, defi ned at the person-level (indicators)
  2. Aggregate (typically sum) to the establishment level

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  2. Aggregate (typically sum) to the establishment level
  3. → establishment-level statistics, available in RDC

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  2. Aggregate (typically sum) to the establishment level
  3. $\longrightarrow$ establishment-level statistics, available in RDC
  4. Attach weights to each establishment

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  2. Aggregate (typically sum) to the establishment level
  3. $\longrightarrow$ establishment-level statistics, available in RDC
  4. Attach weights to each establishment
  5. Attach 'fuzz' factors to each establishment

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- Attaching establishment characteristics to jobs
- Attaching establishment characteristics to jobs
- Probability Model
- Implementation
- Implementation
- Computing the statistics

Disclosure-proofing the QWI

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Conclusion

- We now have:
  - Jobs identifi ed
  - Jobholder's demographics
  - Establishment's characteristics
- Now compute
  1. For each job, the relevant variables, defi ned at the person-level (indicators)
  2. Aggregate (typically sum) to the establishment level
  3. $\longrightarrow$ establishment-level statistics, available in RDC
  4. Attach weights to each establishment
  5. Attach 'fuzz' factors to each establishment
  6. Final aggregation to desired geography-industry-demographic detail

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- First layer: workplace-level aggregation

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  - infusion of specially constructed noise:

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$$(4)\ p(\delta_j) = \begin{cases} (b-\delta)\Big/(b-a)^2,\ \delta \in [a,b] \\ (b+\delta-2)\Big/(b-a)^2,\ \delta \in [2-b,2-a] \end{cases}$$

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  - Result: random noise factor centered around 1 with distortion of at least $a-1$ and at most $b-1$.

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- Important properties:
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  - Result: random noise factor centered around 1 with distortion of at least $a-1$ and at most $b-1$.
- Important properties:
  1. for a given workplace, distortion is always distorted in the same direction (increased or decreased) by the same percentage amount in every period.
  2. when estimates are aggregated, the effects of the distortion cancel out for the vast majority of the estimates.

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- Second layer: after aggregations

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- Second layer: after aggregations
  - Some estimates are based on fewer than three persons or fi rms.

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  - $\longrightarrow$ suppression of these estimates
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