Economics 742 Bonus Macro-Labor Lecture 4: The Scarring Effects of Job Loss

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The Scarring Effects of Job Loss

- What is the impulse response of earnings after job loss?
- DMP model:
  - Once you find a job, back to normal.
  - Unemployment exit probability is high, so relatively quick.
- But in the data, deep scar.
  - Dramatic wage drop.
  - Takes at least 3 years to get back to previous level, and many analyses show workers never return to previous level.
  - Huge failure of model.
  - Dramatically changes welfare effects of business cycles.
- What explains the scar? How does it change our view of unemployment?

The Scarring Effects of Job Loss

1. Scarring
   - 1.1 Jacobson, LaLonde, and Sullivan (1993)
   - 1.2 Couch and Placzek (2010)
   - 1.3 Von Wachter, Song, and Manchester (2009)
   - 1.4 Flaaen, Shapiro, and Sorkin (2017)
   - 1.5 Scarring in the DMP Model: Davis and Von Wachter (2011)
2. Learning:
   - 2.1 Jovanovic (1979)
   - 2.2 Pries (2004)
3. Job Security: Jarosch (2015)

Jacobson, LaLonde, and Sullivan (1993): Setup

- Administrative data from Pennsylvania in 1980s.
- Examine earnings of displaced high-tenure (6+ years) workers, focusing on "mass layoffs."
- Event study design:

$$y_{it} = \alpha_i + \gamma_t + \beta x_{it} + \sum_{k \geq -m} \delta_k D_{it}^k + \varepsilon_{it}$$

  - k is periods since layoff starting m periods ahead.
  - D_{it}^k is indicator for k periods since displacement.
  - x_{it} is time-varying observables.
  - Worker FE control for permanent unobservables.
  - Also add worker-specific linear trends.
- Davis and Von Wachter (2011) and Jarosch (2015) adopt a variant of this specification that adds in x_{it}:
  - A quadratic polynomial in age.
  - Average earnings for several periods pre-separation: $\bar{y}_t^{[t-6,t-1]}$.

JLS (1993): Concerns About Mass Layoff Design

1. Serial correlation in error term may bias results.
2. Mass layoffs could have quit or been discharged for cause.
    - Usually argue "most" discharged exogenously.
3. Mass layoffs include firms with sharp employment contractions that do not exit, which may lay off worst workers first.
4. Similarly, includes firms that were already doing badly, and best workers may have already quit.

- Concerns 3 and 4 limited by worker FE, but do not address time-varying unobservables.

JLS (1993): Main Result

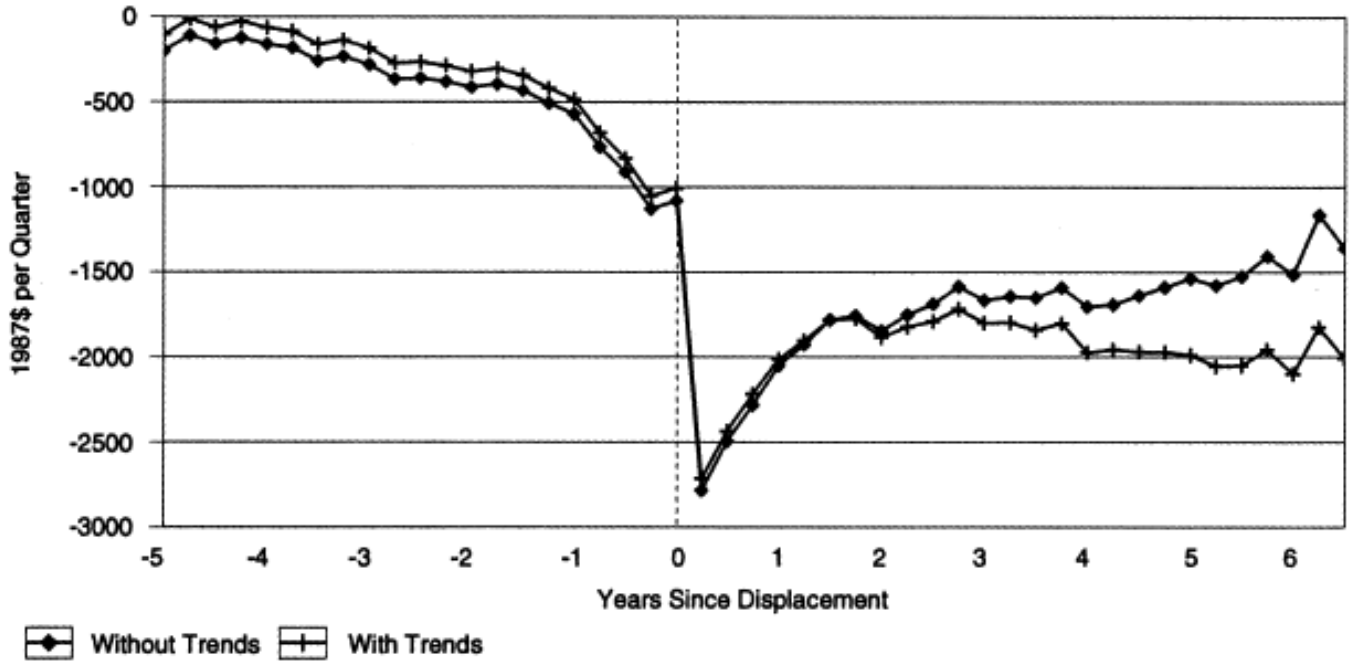


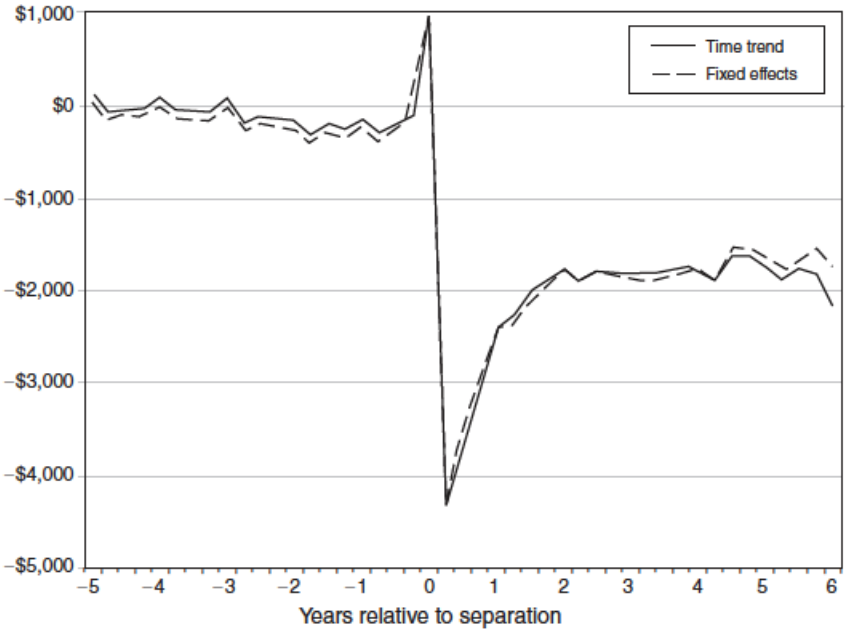
FIGURE 2. EARNINGS LOSSES FOR SEPARATORS IN MASS-LAYOFF SAMPLE

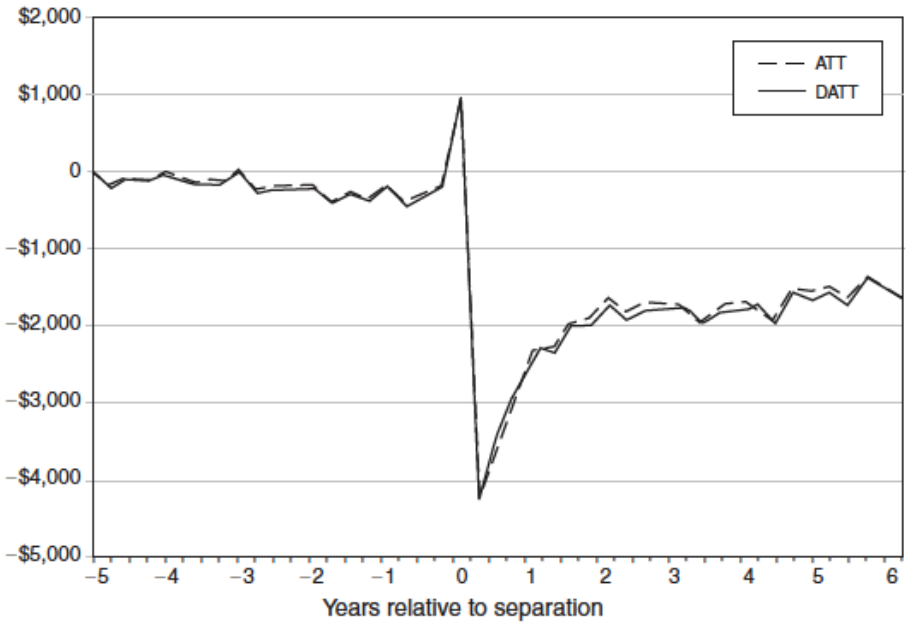
- Strength and persistence depend primarily on local labor market condition and former industries, but large across sectors and even for workers who find jobs at similar firms.

Couch and Placzek (2010): CT in 1990s

- JLS focus on Pennsylvania, "rust belt" state experiencing high unemployment particularly in manufacturing.
  - Are their results "normal?"
  - Do they apply in good times?
- JLS use fixed effects in event study design.
  - Do their results continue to hold with newer empirical techniques (e.g. propensity score matching)?
- To answer, Couch and Placzek study Connecticut 1993-2004.

Couch and Placzek (2010): Main Result



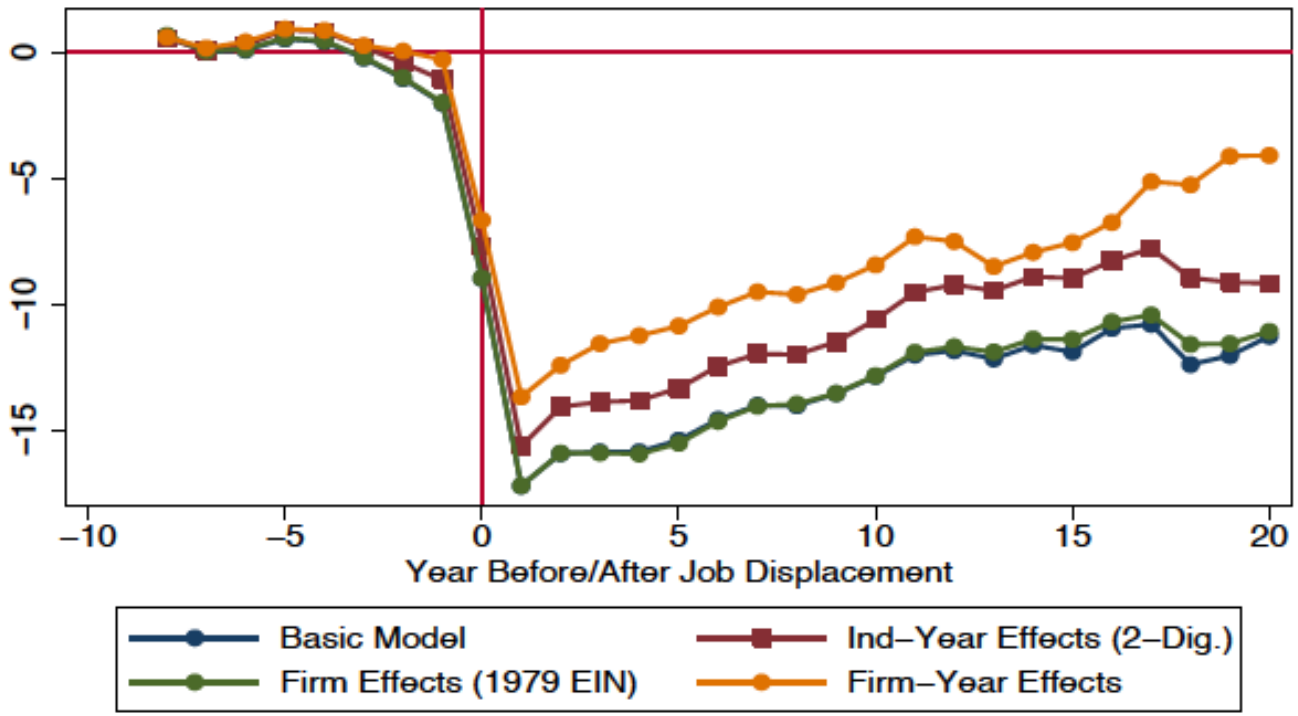


- Short-run effects 75% of JLS, long-run effects 50%.

Von Wachter, Song, and Manchester (2009)

- Use 30 years of Social Security data to assess scarring effects of 1982 recession.

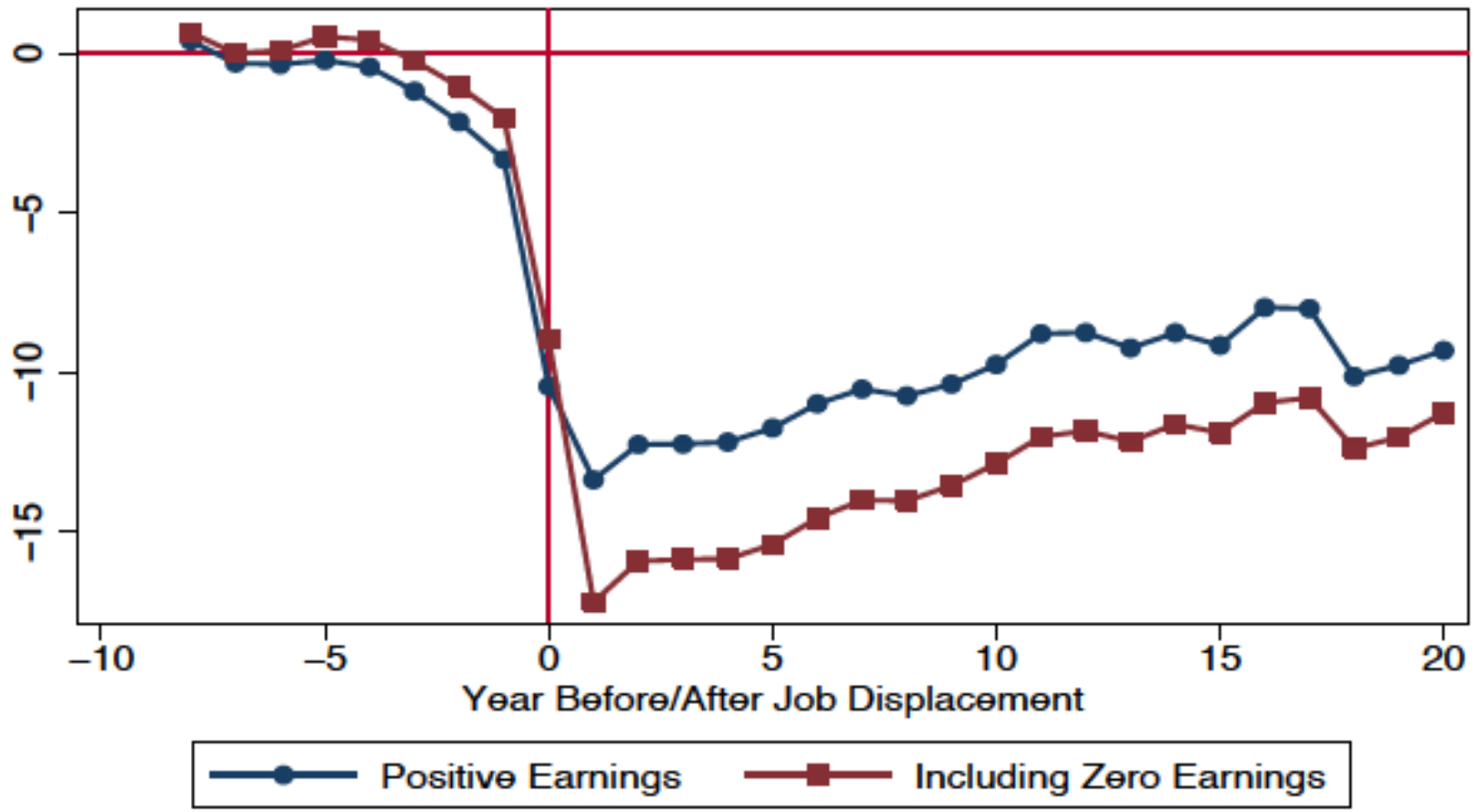
Figure 4: Earnings Losses at Job Separation 1980–1986 vs. Non–Separators
Earnings Including Zeros, Men in Stable Job 1974–1979 (in $1000)



Source: 1% Files of Social Security administrative data (see text). Earnings in 2000 Dollars.

VSM (2009): Not Explained By Zero Earnings

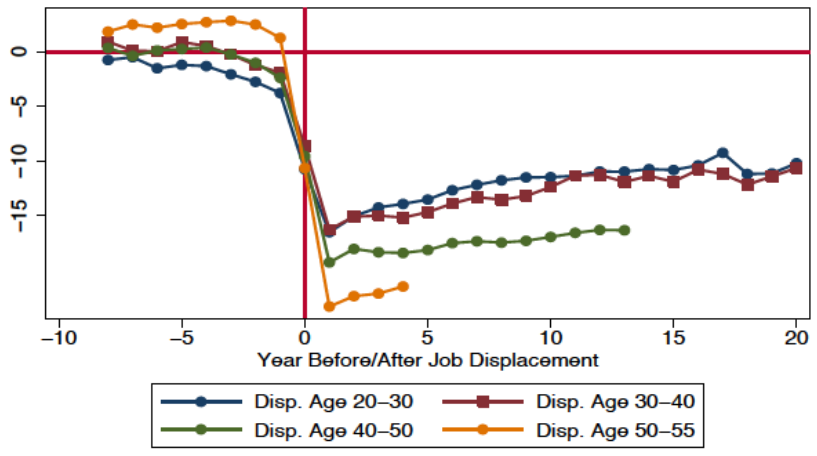
Figure 3: Earnings Losses at Job Separation 1980–1986 vs. Non–Separators
Earnings at All Jobs Including Zeros, Men in Stable Job 1974–1979 (in $1000)



Source: 1% Files of Social Security administrative data (see text). Earnings in 2000 Dollars.

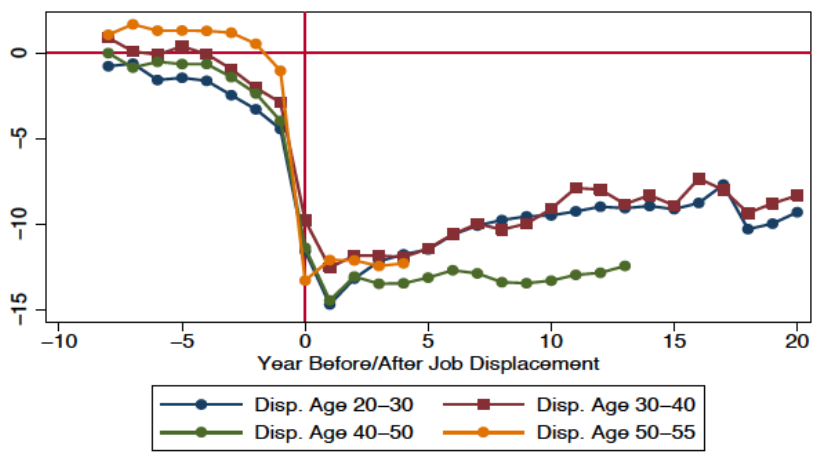
VSM (2009): Age Pattern Explained by Zero Earnings

Figure 7A: Earnings Losses at Job Separation By Age at Displacement
Earnings All Jobs Including Zeros, Men in Stable Job 1974–1979 (in $1000)



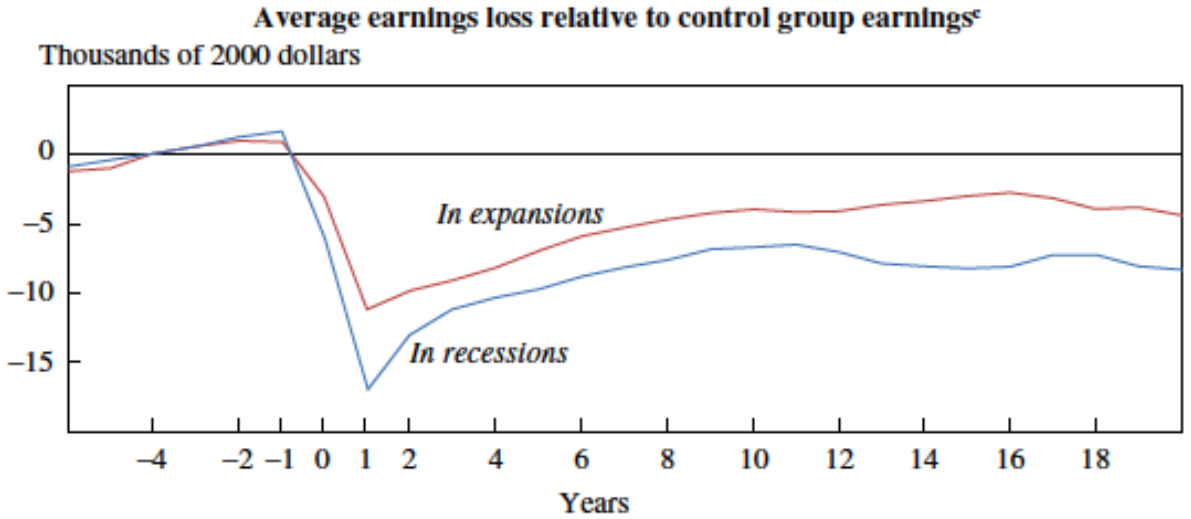
Source: 1% Files of Social Security administrative data (see text). Earnings in 2000 Dollars.

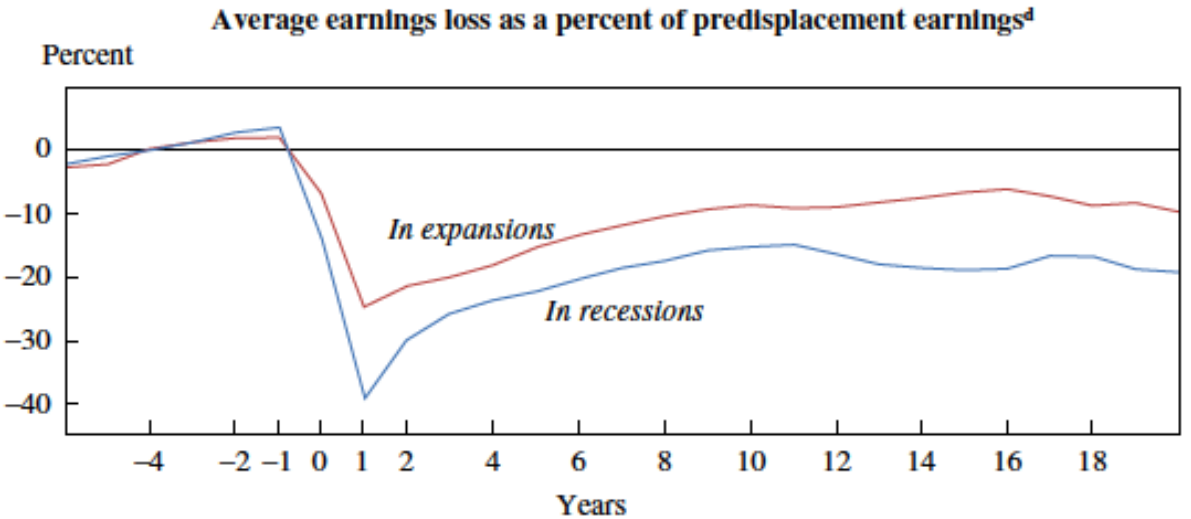
Figure 7B: Earnings Losses at Job Separation By Age at Displacement
Earnings All Jobs Without Zeros, Men in Stable Job 1974–1979 (in $1000)



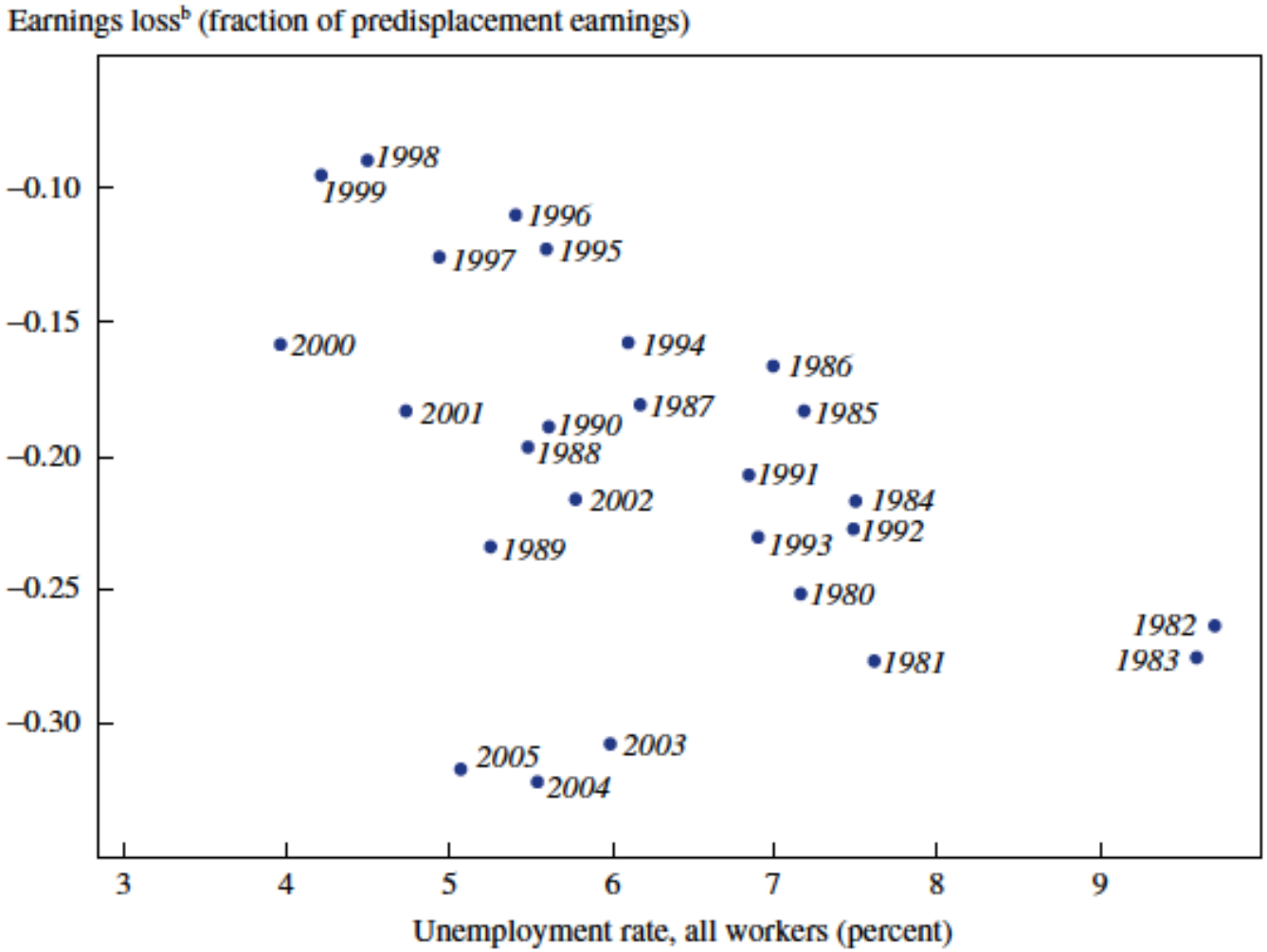
Source: 1% Files of Social Security administrative data (see text). Earnings in 2000 Dollars.

Davis and Von Wachter (2012): Recession vs. Boom





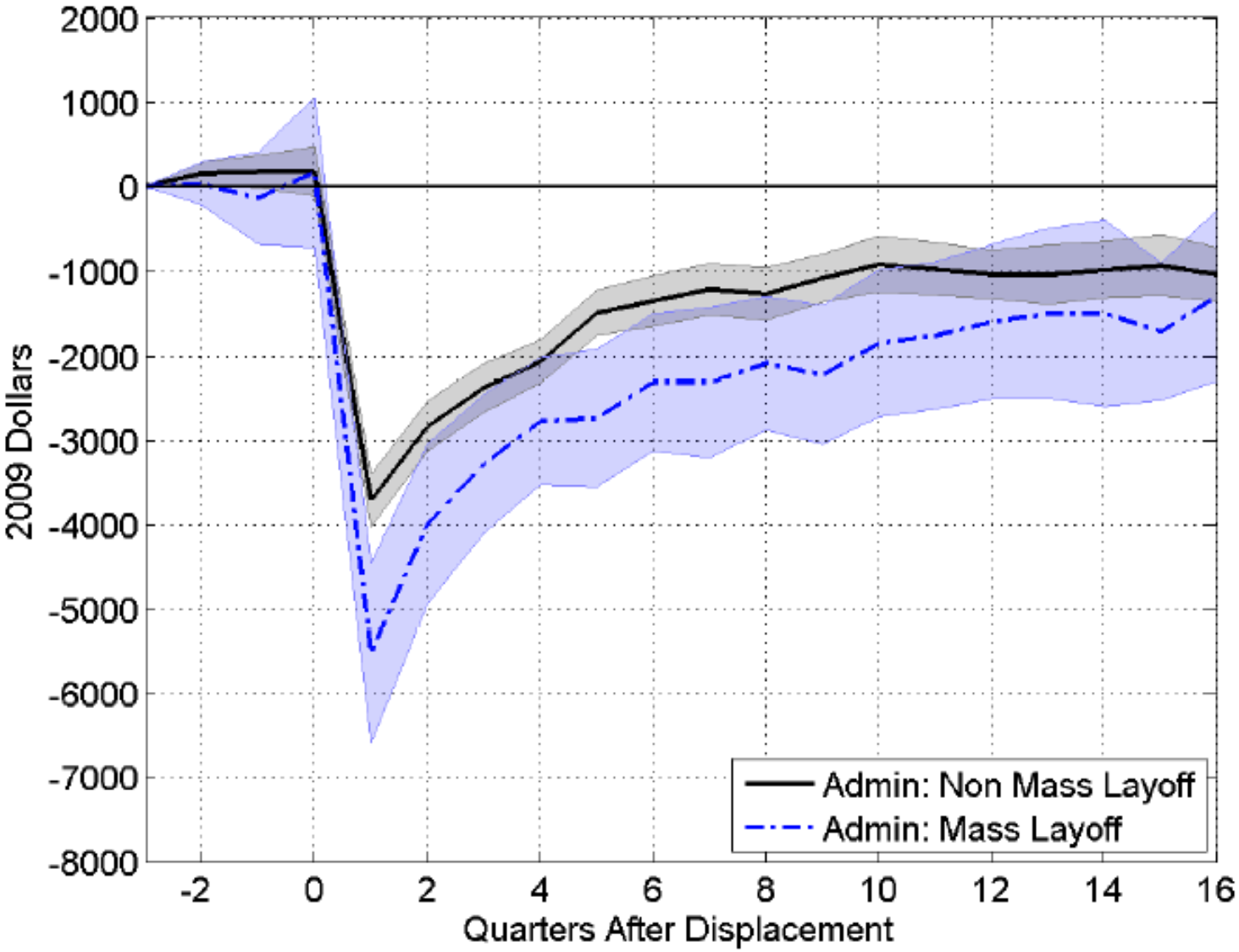
Davis and Von Wachter (2012): Loss vs. Unemp



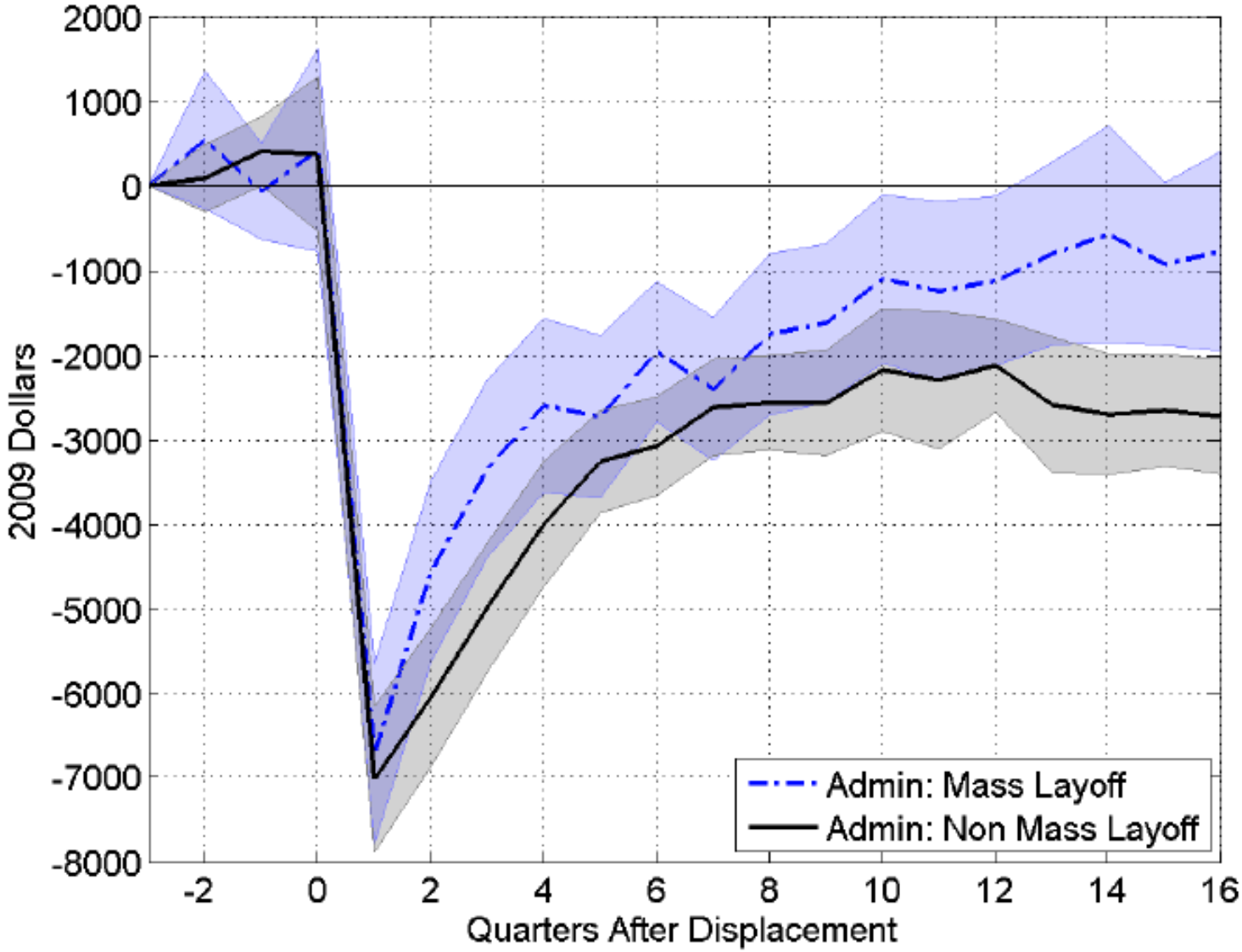
Flaaen, Shapiro, and Sorkin (2017): Survey and Admin

- Merge SIPP to LEHD.
  - LEHD is administrative data, can look at mass layoffs.
  - Worker surveys like SIPP ask reason for separation.
- Use survey reason for layoff to address concern that mass layoffs could have quit or been discharged for cause.
  - Turns out these do not line up as well as one might expect.
  - But does this throw out observations we should be using?

FSS (2017): Admin Data Mass Layoff (No Survey Used)



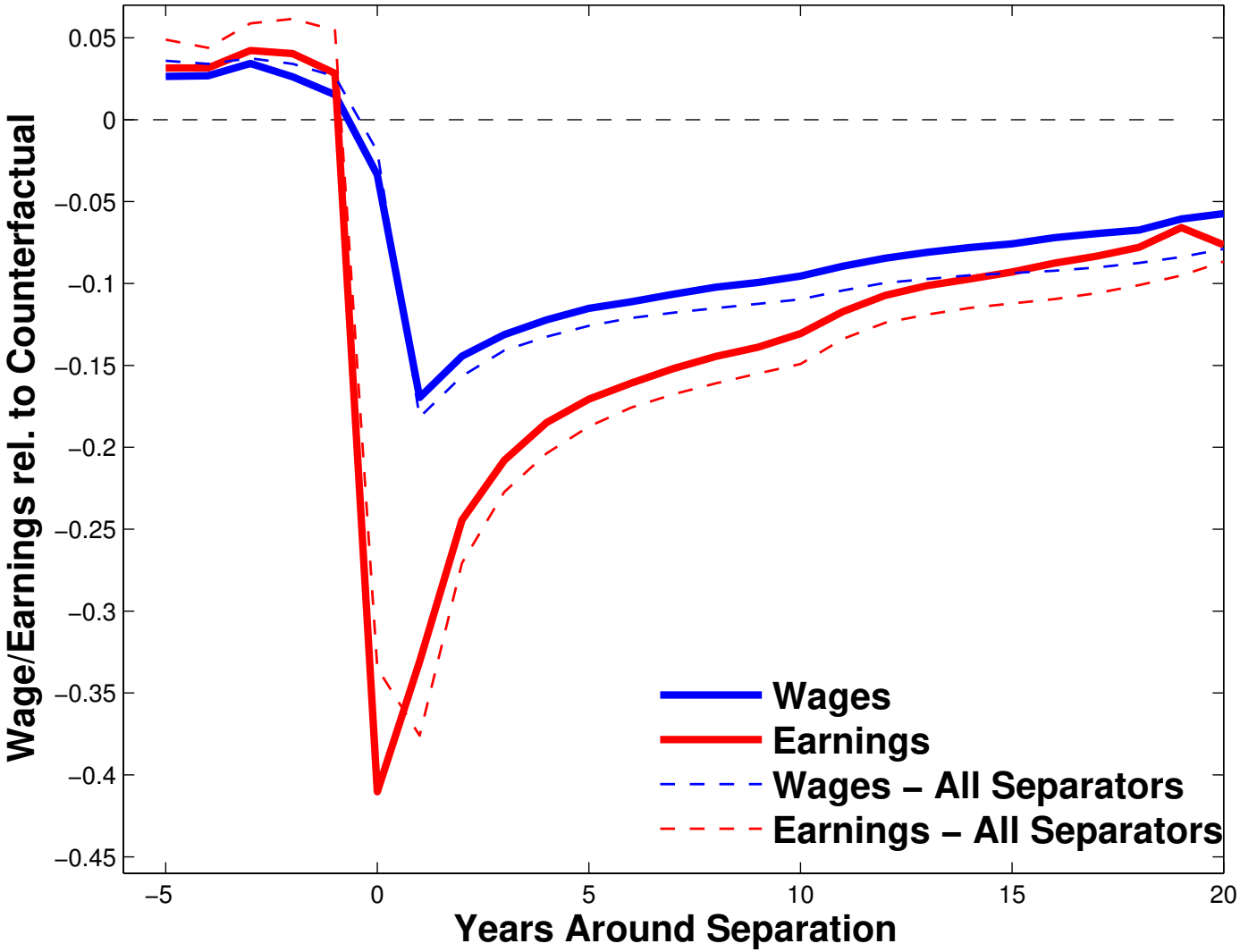
FSS (2017): Mass Layoff in Admin and Survey



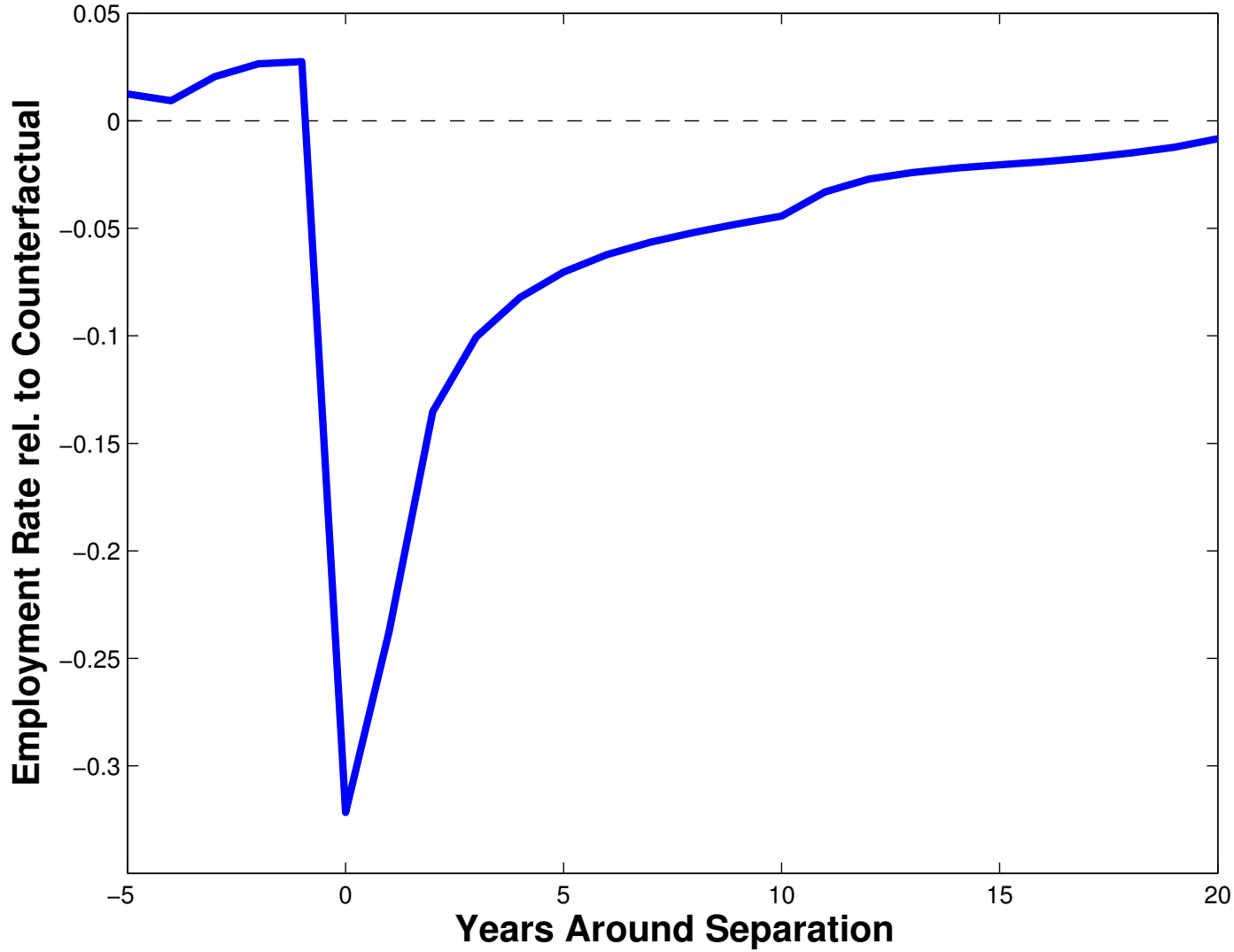
Hazard Rate of Job Loss

- What explains persistent effects and scarring?
- Decline in wages, or increased hazard of job loss?
- Some initial evidence for hazard.
  - Hall (1995) and Pries (2004), among others, point to decreasing hazard of separation as function of tenure.
  - Stevens (1997): Analyzes PSID and finds 9% permanent scar on earnings and wages. However, if only single job loss in 6 years after displacement, earnings loss is only 1%.
  - Anecdotal evidence on types of jobs people take after displacement: temporary or short term jobs.
- Jarosch (2015) uses German Social Security data from 1974-2010 that allow him to decompose earnings losses into wages and reduced employment.

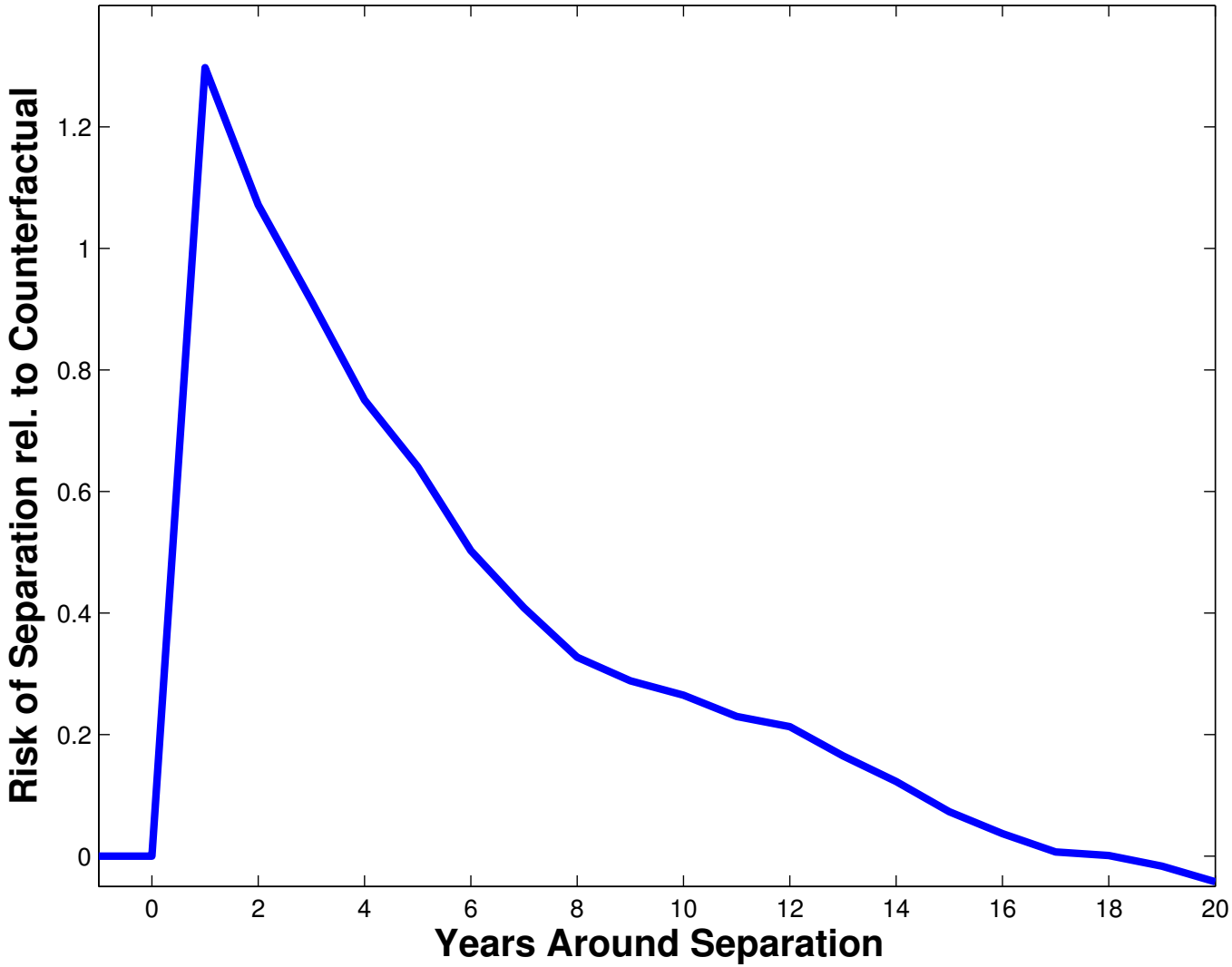
Jarosch (2015): Wages vs. Earnings



Jarosch (2015): Employment Rates



Jarosch (2015): Prob of Additional Layoff



Scarring in DMP: Davis and Von Wachter (2012)

- DMP models have little scarring:
  - Homogenous job finding rate, separation rate, wage.
  - No "wage premium" of good match to lose.
  - Unemployment spells brief, followed by return to employment and common wage.
- Davis and Von Wachter (2012) show job loss is inconsequential in DMP by calculating mean decline in PDV of income:
  - Standard Nash, Hall and Milgrom: 0.2%.
  - Hagedorn and Manovskii: .04%.
  - MP 94 extension with on-the-job search: 0.3% to 0.4%.
  - Data: 15-25%.
- "Job ladder" models (e.g. Burdett and Mortensen, 1998) move in right direction, but still limited scar.
  - Employment recovers immediately upon reemployment.
  - Wage converges rapidly because climb ladder quickly.

What Explains Scarring?

1. Jovanovic (1979), Pries (2004): Matches are *experience goods*. Gradually learn match quality.
    - "Try and try again" process of advancing to better position.
    - Cycle through many bad matches before get to good match.
    - Consistent with Topel and Ward (1992) evidence that average young man has 7 jobs – over 2/3 of career total – in first 10 years in labor market.
2. Jarosch (2015): Security- *and* Productivity-Based Job Ladder.
    - Unemployed take short-term stopgap jobs to make ends meat.
    - Then search on job for better *and* more stable jobs.
    - Job ladder with *endogenously slippery lower rungs*.

- Both explain why wages rise and quits fall with tenure.
    - Decreasing hazard of separation is key.

Jovanovic (1979): Partial Equilibrium With Learning

- Jovanovic version is continuous time with Brownian motion.
- Here simpler version from Ljungqvist and Sargent textbook that extends partial equilibrium search model presented before.
- When match, draw productivity $\theta \sim N\left(\mu, \sigma_0^2\right)$.
  - In first period, worker and firm only observe $y = \theta + u$, $u \sim N\left(0, \sigma_u^2\right)$.
  - Firm offers to pay $E\left[\theta | \theta + u\right]$ and worker accepts or rejects.
  - In second period, worker and firm observe true θ.
- 3 stages: "Pre-draw," first stage, second stage.

Jovanovic (1979): Partial Equilibrium With Learning

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- Here simpler version from Ljungqvist and Sargent textbook that extends partial equilibrium search model presented before.
- When match, draw productivity $\theta \sim N\left(\mu, \sigma_0^2\right)$.
  - Worker and firm initially observe $y = \theta + u$, $u \sim N\left(0, \sigma_u^2\right)$.
  - Firm offers $E\left[\theta|y\right]$ and worker accepts or rejects. Kallman:

$$E\left[\theta|y\right] \sim N\left(\mu + \frac{\sigma_0^2}{\sigma_0^2 + \sigma_u^2}\left(y - \mu\right), \frac{\sigma_0^2}{\sigma_0^2 + \sigma_u^2}\sigma_u^2\right) = F\left(\theta|y\right)$$

  - In second period, worker and firm observe true θ.
- 3 stages: "Pre-draw" Q, first stage $V\left(y\right)$, second stage $J\left(\theta\right)$.
  - Work by backwards induction.

Jovanovic (1979): Partial Equilibrium With Learning

- At second stage:

$$J(\theta) = \max\left\{\frac{\theta}{1-\beta}, \beta Q\right\} \Rightarrow \frac{\bar{\theta}}{1-\beta} = \beta Q$$

- At first stage:

$$V(y) = \max\left\{\mu + \frac{\sigma_0^2}{\sigma_0^2 + \sigma_u^2}(y-\mu) + \beta \int J(\theta')\, dF(\theta'|y), \beta Q\right\}$$

  which implicitly defines a reservation $\bar{\mu} = E[\theta|y]$.

- At pre-draw,

$$Q = \int V(y)\, dG(y), G \sim N\left(\mu, \frac{\sigma_0^2}{\sigma_0^2 + \sigma_u^2}\sigma_0^2\right)$$

Jovanovic (1979): Partial Equilibrium With Learning

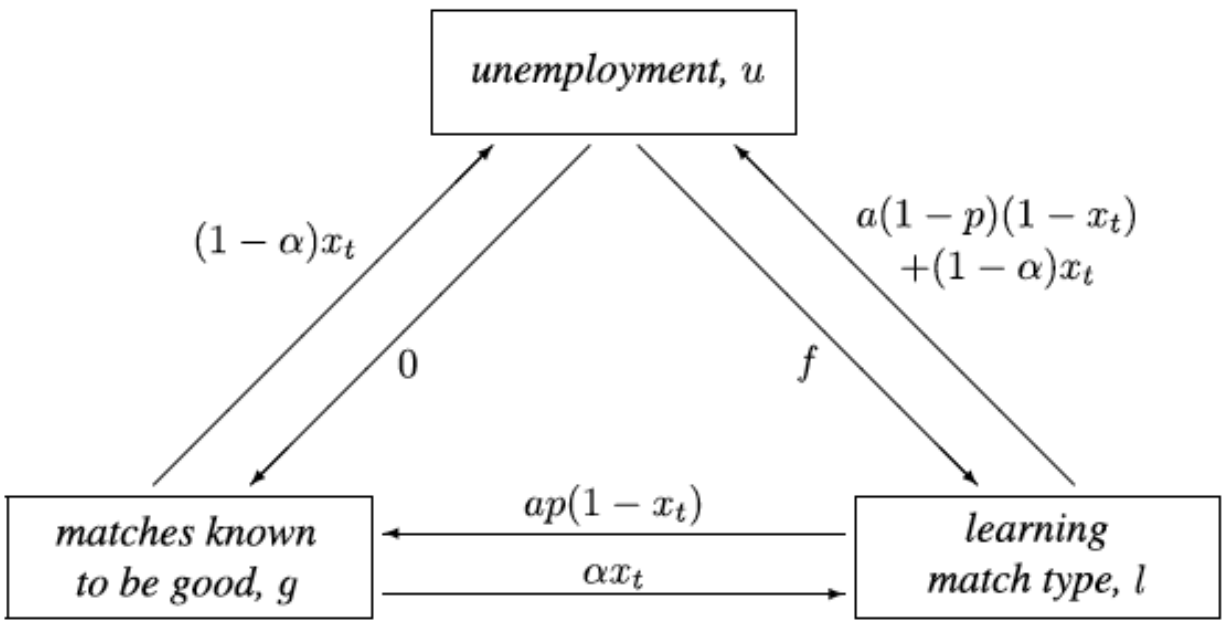
- Combining all three into a single value function $V(y)$ gives a functional operator that satisfies Blackwell's sufficient conditions and thus has a unique solution.
- One can prove that $\bar{\theta} > \bar{\mu}$.
  - Accepting has an "option value."
  - Quit rates fall with tenure (here to zero).
- One can also prove that the average wage rises with tenure.
  - Selection and employer knows you are good type.
- Probability of a quit is declining in the initial wage, as in data.
- Result is model with repeated "trying out" of jobs.
  - Nagypal (2007) provides evidence that learning is important.

Pries (2004): Jovanovic Meets DMP

- Simplified setup for filtering problem in GE.
  - Two types of matches $y_g > y_b$. Good with probability p.
  - Calibrate so known bad matches terminated.
  - Noisy observation with noise distributed uniformly on $[-\omega, \omega]$.
- "All or nothing" learning.
  - If observe less than $y_g - \omega$, bad with certainty.
  - Greater than $y_b + \omega$, good with certainty.
  - In between no information is revealed.
- Shocks with probability x_t, which is shock variable.
  - Leads to separation with probability $1 - \alpha$.
  - Draw new y and restart of learning with probability α.

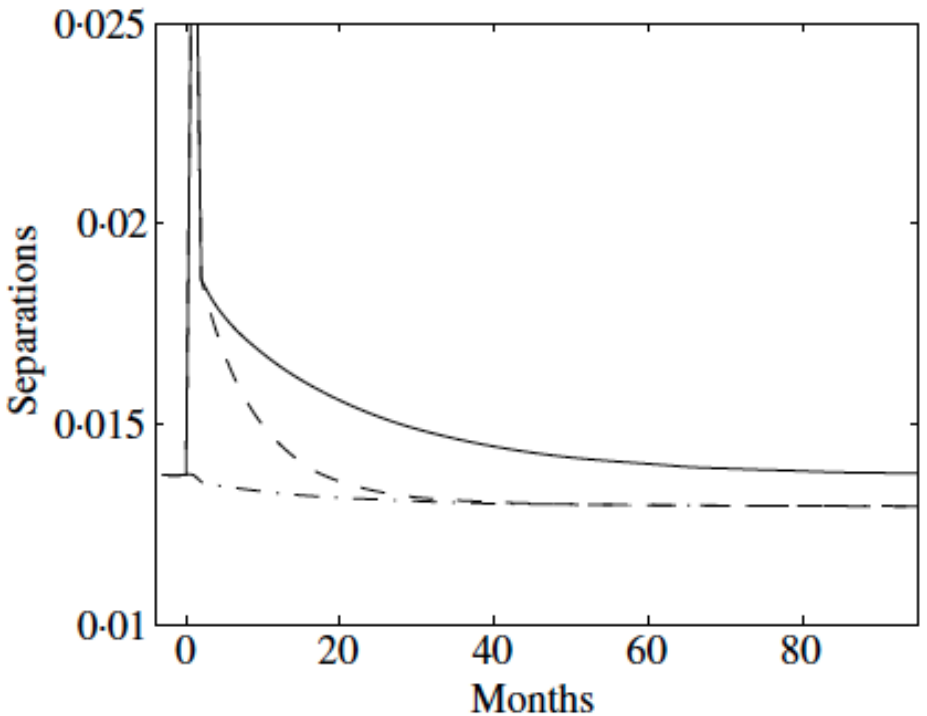
Pries (2004): Jovanovic Meets DMP

- Standard DMP model with two modifications.
  - Value of worker has two versions: known good match and unknown match. Straightforward.
  - Modify law of motion accordingly. Leads to three-state transition below.



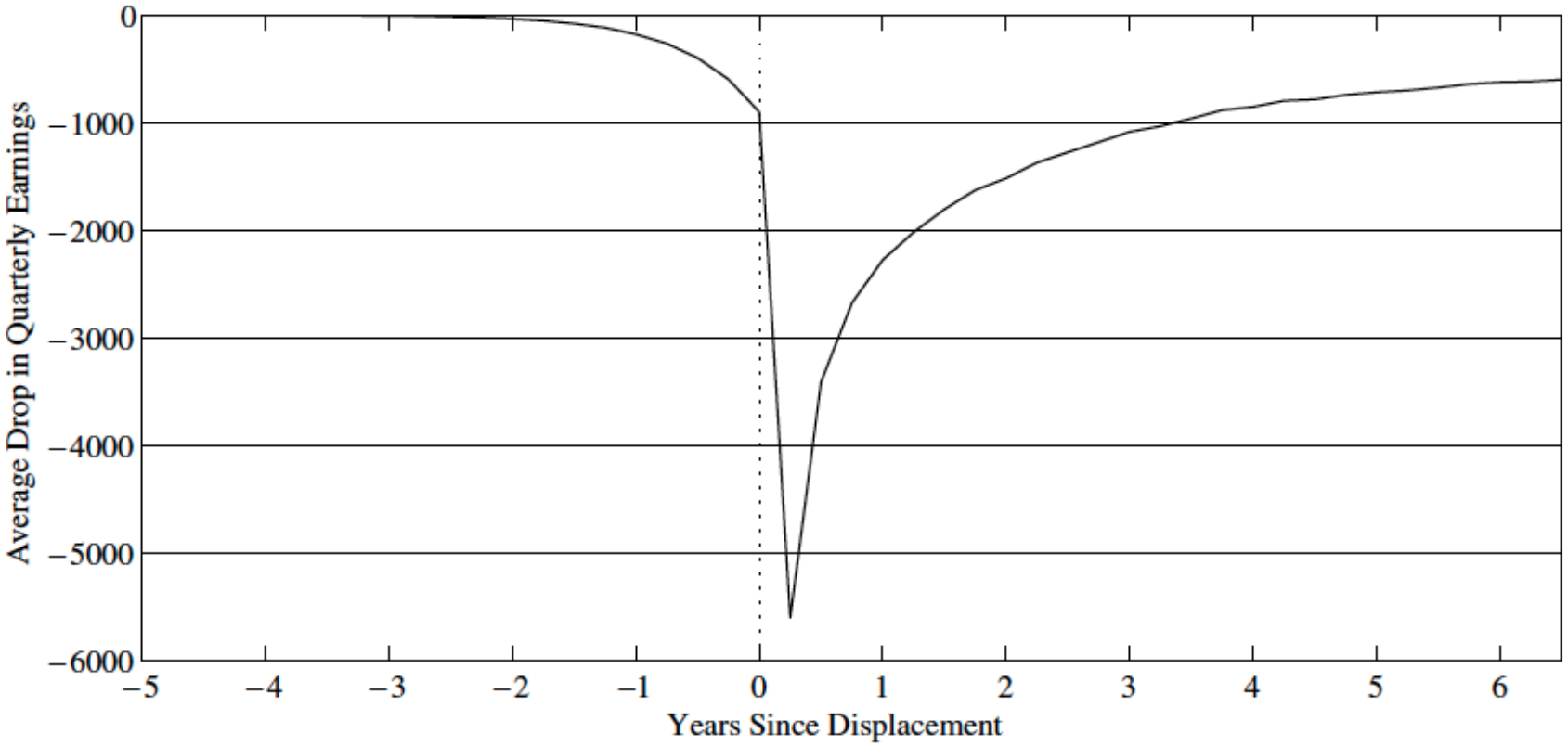
Pries (2004): Jovanovic Meets DMP

- Solution can be represented as ARMA(2,1) for u_t.
  - Two autoregressive terms because u_{t-2} affects l_{t-1} and g_{t-1}, which feed back onto u_t. Leads to additional persistence.
- IRF to separation shock: total separations is solid, primary separations dashed:



Pries (2004): Jovanovic Meets DMP

- Earnings loss following primary separations:



Menzio and Shi (2010): Experience vs. Inspection

- In directed search model with a job ladder, consider cases where jobs are an experience good and an inspection good.
  - Experience: No info on match quality when meet. All matches lead to transition. If match is bad, become unemployed. If medium, search for better job. If high, stop searching.
  - Inspection: See match quality upon meeting before decide whether to take job.

- With search on job, match heterogeneity, and jobs as experience goods, model does well in matching facts.
  - Explains co-movement of U-E and E-E in data, unemployment volatility is close to data (no unemp vol puzzle).
  - Not true with inspection.
  - Partially due to parameter values, partially due to learning.

Jarosch (2015): Outline[1]

1. Facts about job scar with German SI data (above).
2. Model to capture unemployment scar.
   - Model of directed on-the-job-search with job ladder.
   - Jobs differ in terms of *both* productivity and job security.
   - Job ladder with endogenously slippery lower rungs. Job loss generates future job loss, leading to long-lasting consequences.
   - Lose human capital when unemployed.
3. Estimation of model
   - Captures scarring effects of job loss quantitatively.
   - Allows for "decomposition" of scar into underlying mechanisms.
4. Normative Implications.
   - New justification for unemployment insurance.

[1] These slides borrow heavily from on Gregor Jarosch's excellent slide deck, which is gratefully acknowledged.

Jarosch (2015): Model Setup

- Discrete time, single good.
- Heterogenous firms $\theta = (\theta_y, \theta_\delta)$.
  - Produce output θ_y when matched.
  - Job disappears with exogenous probability θ_δ.
- Workers infinitely lived, linear preferences.
  - Flow utility of unemployment z.
  - Sample jobs at rate λ_0 when unemployed and λ_1 when employed iid from $F(\theta)$.
  - Denote outside offer by $\hat{\theta}$.

Cahuc, Postel-Vinay, and Robin (2006): Sequential Auctions

- Bargaining protocol based on Postel-Vinay and Robin (2002) and Cahuc, Postel-Vinay, and Robin (2006).
  - Frequently used in structurally-estimates job ladder models models due to tractability. Microfounded in Cahuc et al.
  - Useful for your toolbox.
- Firms make take-it-or-leave it offers; employees search on job.
  - Wages fixed until worker gets new outside offer. Firm can then make counter-offer. Looks like Bertrand competition.
  - Model of academia.
- All transitions are efficient.
- Value functions are independent of aggregate labor market conditions as in Menzio and Shi (2011).
  - Intuition: Value functions depend on distributions, but joint surplus does not. See Lise and Robin (2017).

Jarosch (2015): Bargaining Protocol

- When exiting unemployment, workers receive a share α of the joint surplus, $S(\theta) = W(\cdot) - U(\cdot) + J(\cdot)$:

$$W(\cdot) - U(\cdot) = \alpha S(\theta)$$

- On the job search has three cases:
  - Case 1 (set $M_1(\theta)$): Poacher wins. Wage is:

$$W(.) - U(.) = S(\theta) + \alpha\left(S\left(\hat{\theta}\right) - S(\theta)\right)$$

  - Case 2 (set $M_2\left(\theta, \hat{\theta}\right)$): Incumbent wins. Wage is:

$$W(.) - U(.) = S\left(\hat{\theta}\right) + \alpha\left(S(\theta) - S\left(\hat{\theta}\right)\right)$$

  - Case 3: Incumbent wins. Wage is unchanged, because $S(\theta) < S\left(\hat{\theta}_{old}\right)$.

- Workers build *negotiation capital*.

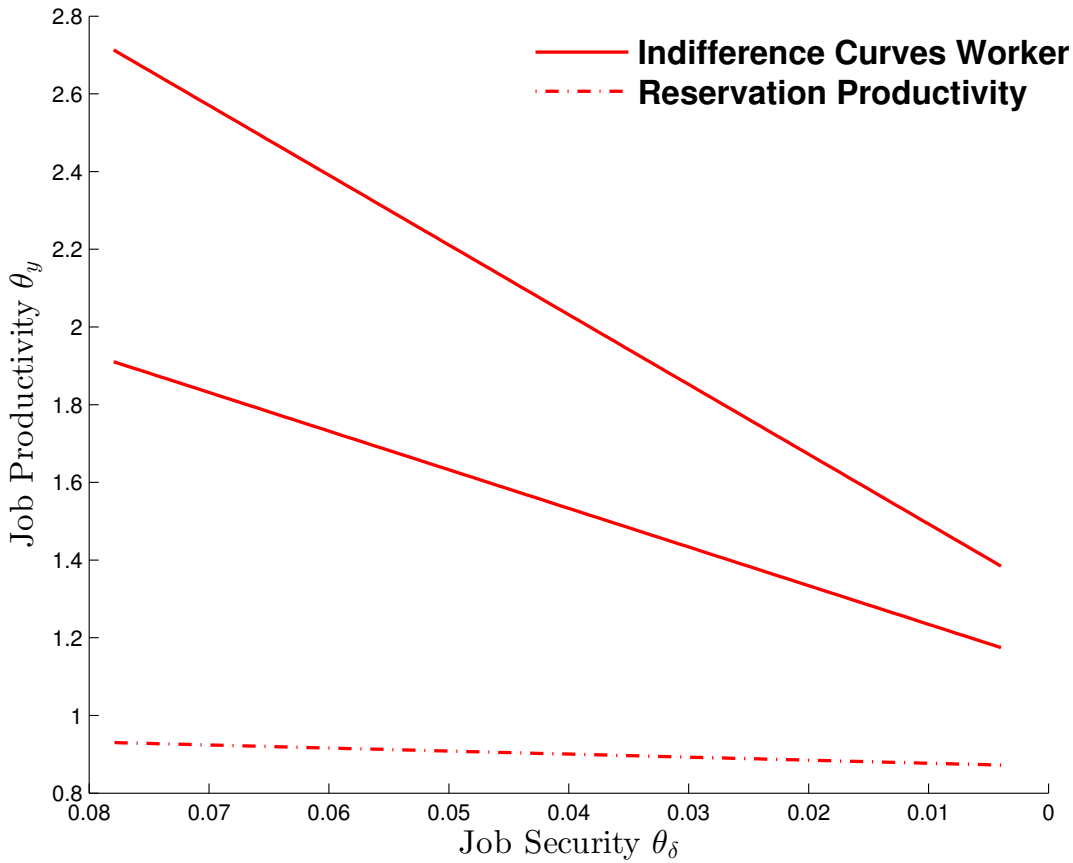
Jarosch (2015): Surplus

$$
\begin{aligned}
S(\theta) &= \max\{0,\ \theta_y - z + \beta \\
&\quad \left[(1-\theta_\delta)\left(S(\theta) + \lambda_1\alpha \int_{x\in M_1(\theta)} (S(x) - S(\theta))\, dF(x)\right)\right. \\
&\quad \left. -\lambda_0\alpha \int_{x\in M_1(\theta)} S(x)\, dF(x)\right]\Bigg\} \\
U &= z + \beta\left(U + \lambda_0\alpha \int_{x\in M_1(u)} \max\{S(x), 0\}\, dF(x)\right)
\end{aligned}
$$

- If worker meets firm in $M_2\left(\theta, \hat{\theta}\right)$, surplus is unchanged.
- $S(\theta)$ determines all mobility decisions and hierarchy of firms.
- Does not depend on distribution of workers across states.

Jarosch (2015): Endogenous Safety-Productivity Trade-Off

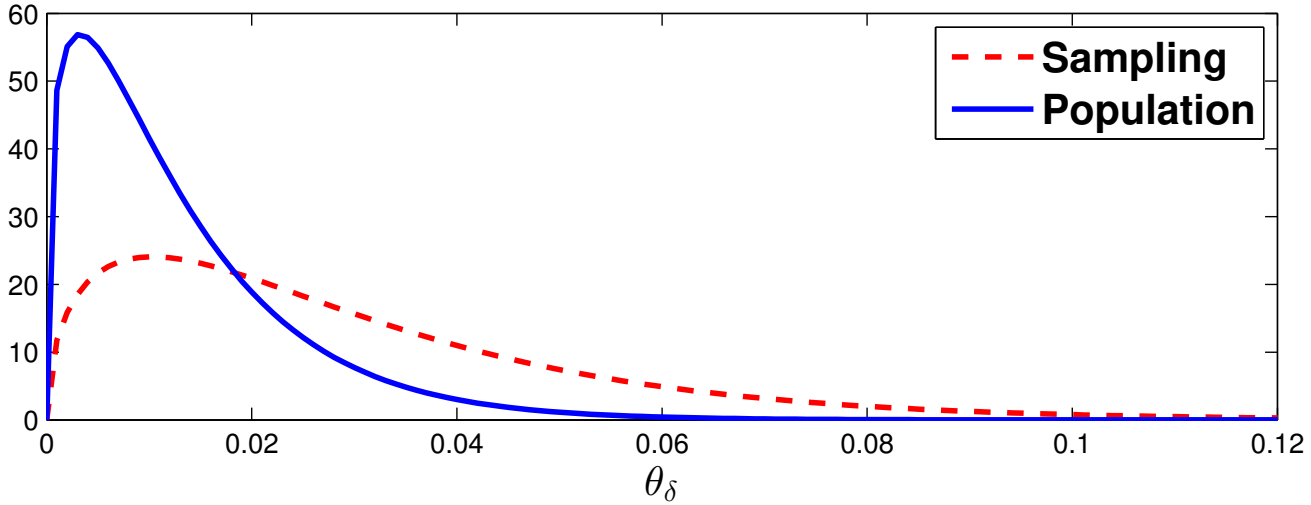
- Surplus implicitly defines indifference curve of worker as to whether to take or accept job in $(\theta_y, \theta_\delta)$ space.

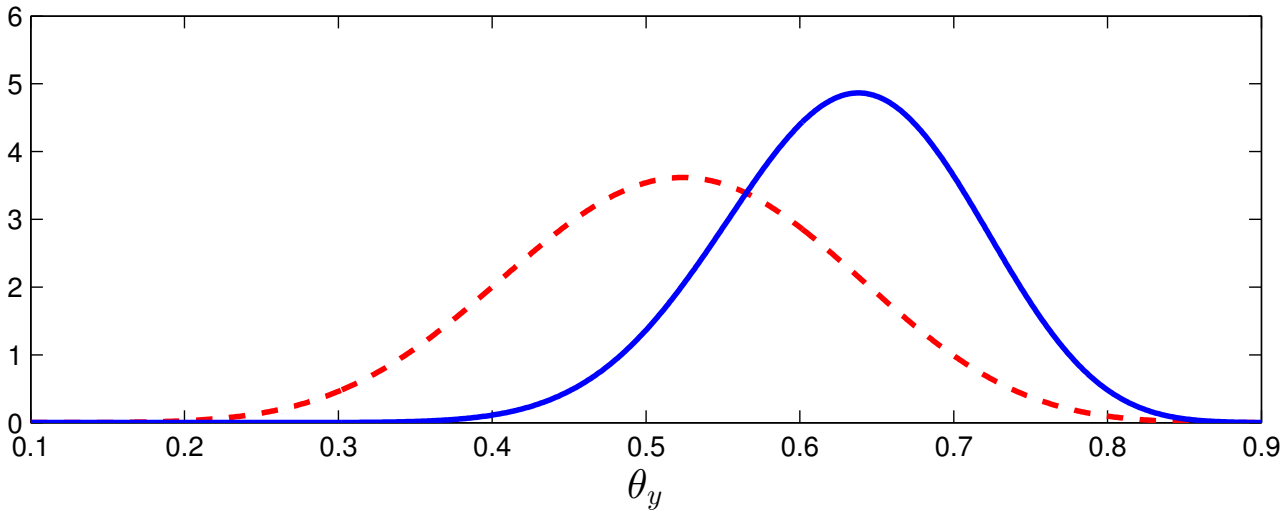


Jarosch (2015): Endogenously Slippery Job Ladder

- Assumption: $\mathbf{E}(\theta_\delta|\theta_y)$ is nonincreasing in θ_y and $\mathbf{E}(\theta_y|\theta_\delta)$ is nonincreasing in θ_δ in the job offer distribution $F(\theta)$.
  - Backed up by data (see below).
- Proposition 1: In expectation, both job security $1-\theta_\delta$ and job productivity θ_y are strictly increasing in employment tenure τ^E and job tenure τ^J.
  - Surplus defines endogenous output-security trade-off.
  - As take jobs with higher surplus, on average higher θ_δ and θ_y.
- Corollary: The hazard from employment to unemployment is strictly decreasing in employment tenure and job tenure.
  - Intuition: Bottom rungs of the career ladder are "slippery."

Jarosch (2015): Equilibrium Marginal Dists of θ_y and θ_d





Jarosch (2015): Full Equilibrium

- Solve $S(\theta)$ numerically. This determines all policy functions.
- Then define value functions and wages. Back out from $S(\theta)$.
  - Wage $W\left(\theta, \hat{\theta}\right)$ depends on employer's θ and $\hat{\theta}$ of benchmark firm (best prior outside offer).
    - $\hat{\theta}$ related to negotiation capital.
  - Wage is increasing in value of worker's benchmark firm $S(\theta)$.
  - Wages increasing in θ_δ due to compensating differentials.
  - However, in cross section, low θ_δ may have higher wage because of accrued negotiation capital.
- Laws of motion $\Rightarrow$ no need to forecast so just updating rule.

Contrasting Jarosch and Jovanovic/Pries

- Job Security
  - Probability of separation constant within job.
  - Probability of separation falls after job-to-job transition.
- Learning
  - Probability of separation falls within job.
  - Probability of separation rises after job-to-job transition.
- Not aware of evidence that differentiates.
  - Old problem of differentiating unobserved heterogeneity and duration dependence in estimating hazard rates arises (here on the separation margin).
  - My prior is a bit of both.

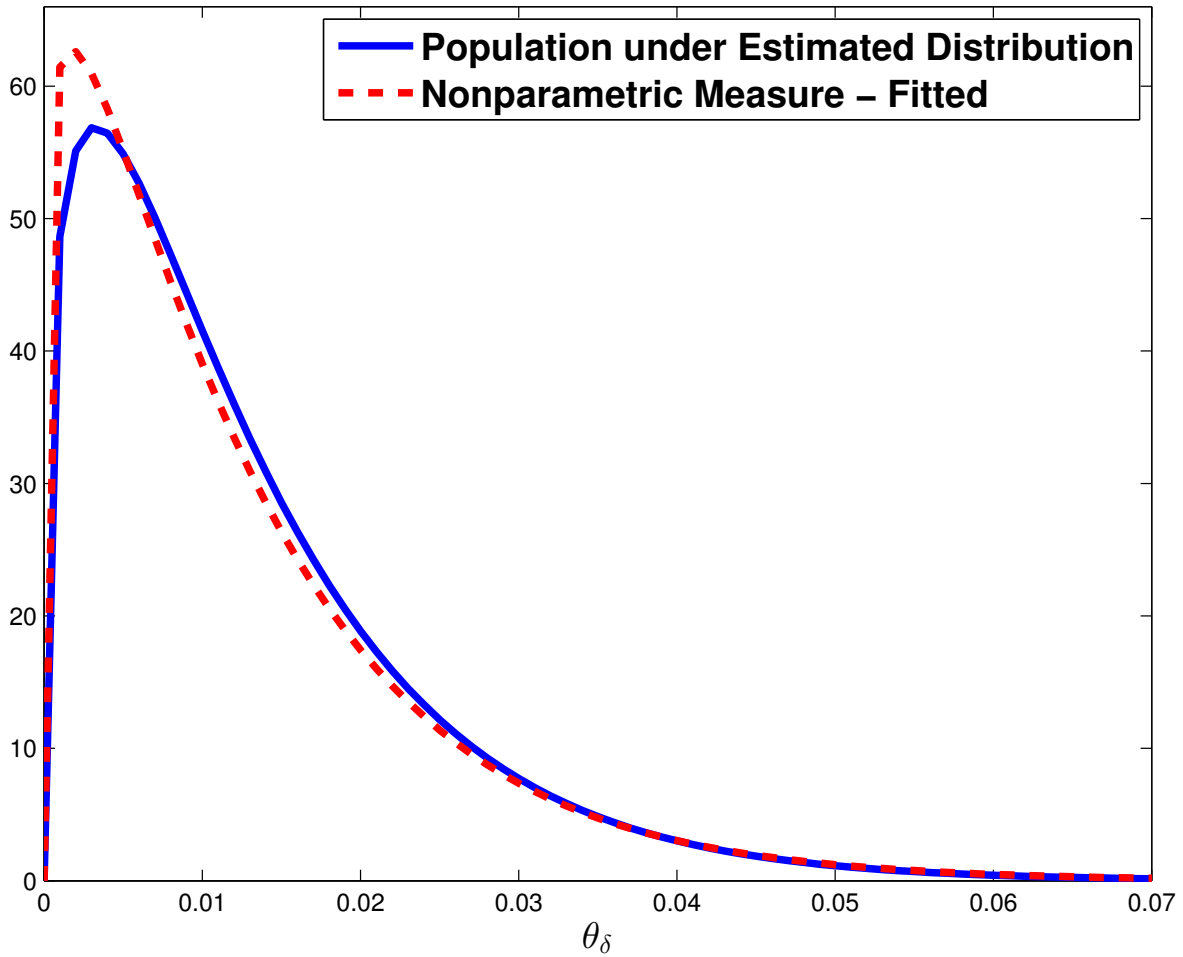
Jarosch (2015): Skill Depreciation When Unemployed

- Extension for quantitative exercise.
  - Creates interaction between job loss and skill depreciation.
  - Needed to quantitatively match data.
- Heterogenous workers with skill $s \in \{\underline{s}, ..., \bar{s}\}$.
  - Transitions:
$$\begin{cases} s' = \min\{s+1, \bar{s}\} & \text{with prob. } \psi_e \text{ if emp} \\ s' = \max\{s-1, \underline{s}\} & \text{with prob. } \psi_u \text{ if unemp} \\ s' = s & \text{otherwise} \end{cases}$$
- Surplus is slightly modified version of before.
  - Must take expectations over $s'|s$ given state.
  - Extra term for change in value of unemployment as s changes.

Jarosch (2015): Estimation

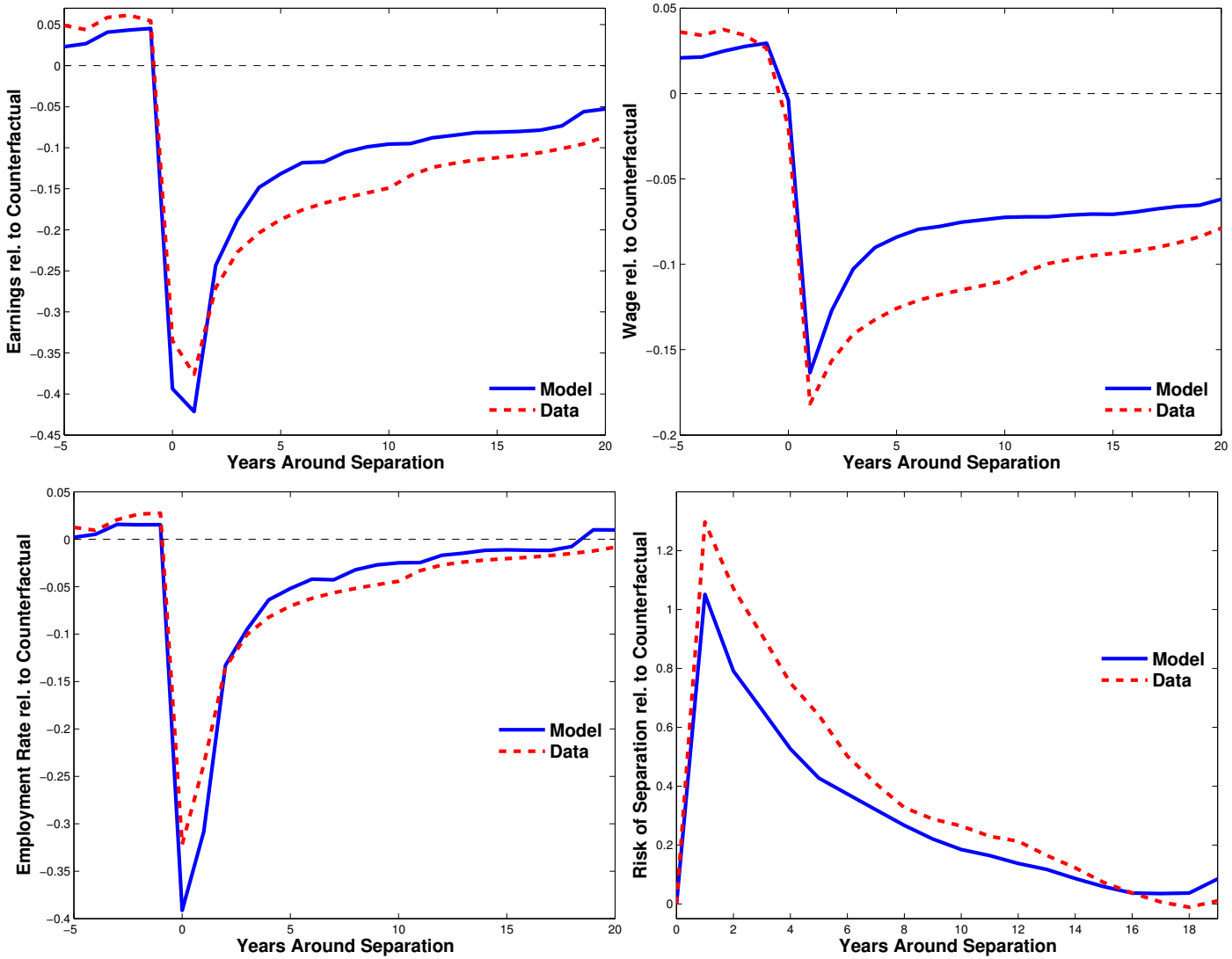
- Estimate using SMM / Indirect Inference using MCMC (Chernozhukov & Hong 03).
  - See paper for details.
- Fully parametric estimation of structural model.
  - But has clear heuristic explanation for what moments and regressions pin down each parameter.
- Note on structural estimation: This is *CRITICAL*.
  - Good structural estimation does not feel black-boxy.
  - Researcher can explain "identification" of what pins down what.
- See paper for details.

Jarosch (2015): Importance of Heterogeneity in θ_δ



- Direct, nonparametric measure of θ_δ at establishment level.
- Average E-E transition reduces θ_δ by 2.8%.

Jarosch (2015): Model Fit



Jarosch (2015): Decomposing Wage Loss

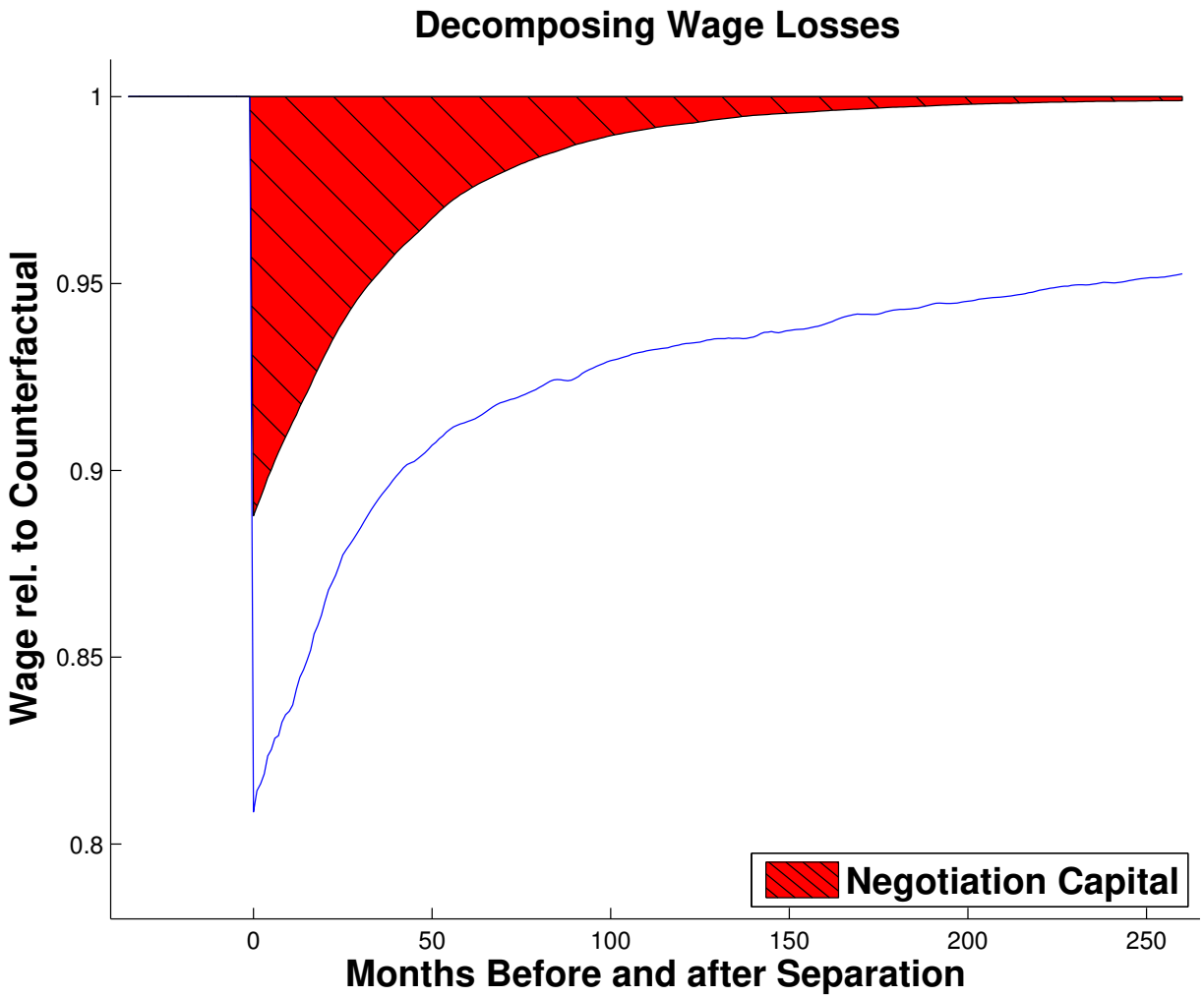
- Simulate counterfactual histories for treatment group.
- Consider four sequential cases:

1. No Job Loss Counterfactual: Baseline.
2. No Negotiation Capital: Don't lose job, but benchmark firm becomes unemployment at time 0. Thus lose accumulated $\hat{\theta}$.
3. No Employer Capital: Lose job and $\hat{\theta}$. Importantly, loss in job security. But no human capital loss.
4. Estimated Model: Adds human capital loss.

Jarosch (2015): Decomposing Wage Loss

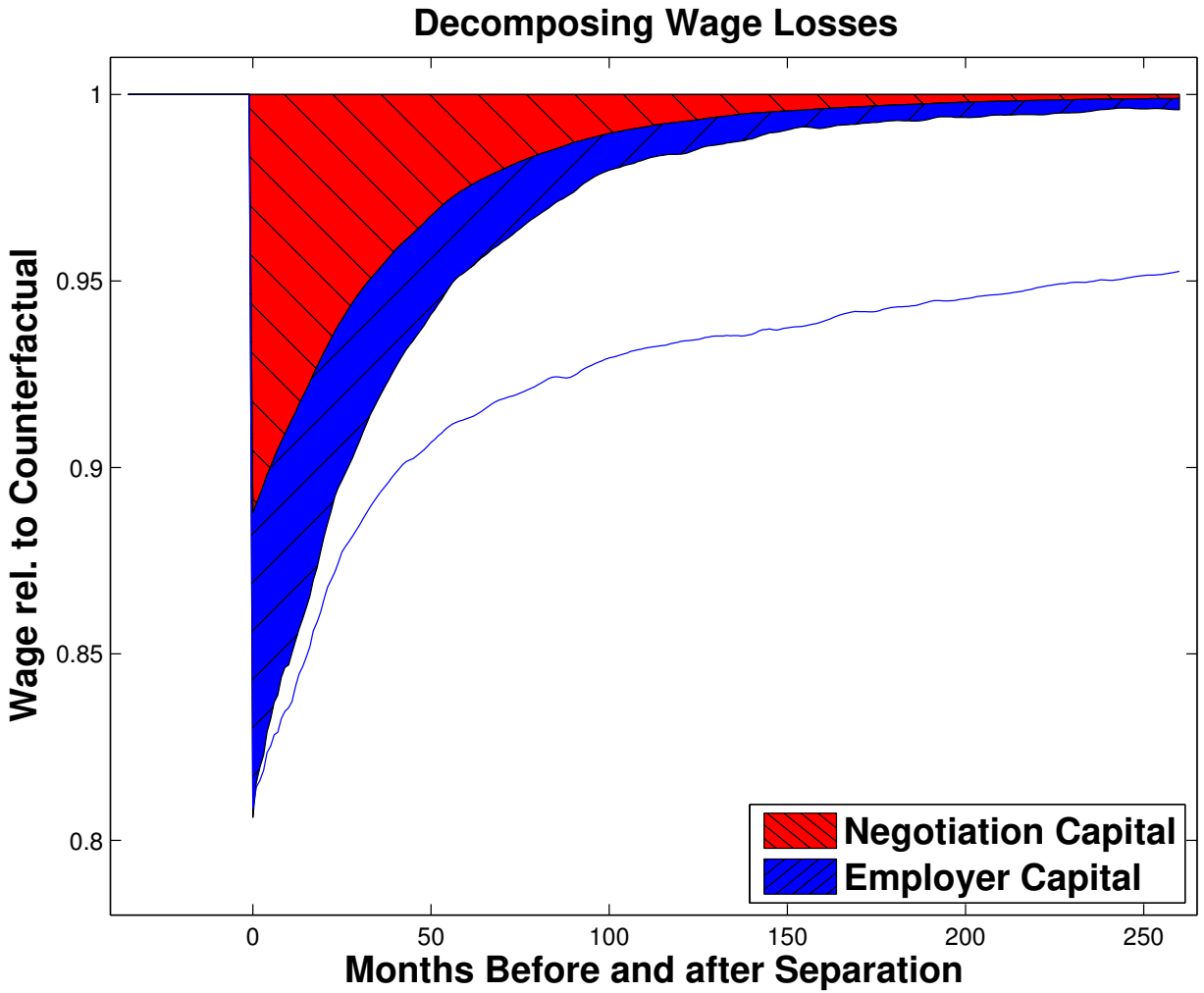
- In the long run...

Jarosch (2015): Decomposing Wage Loss



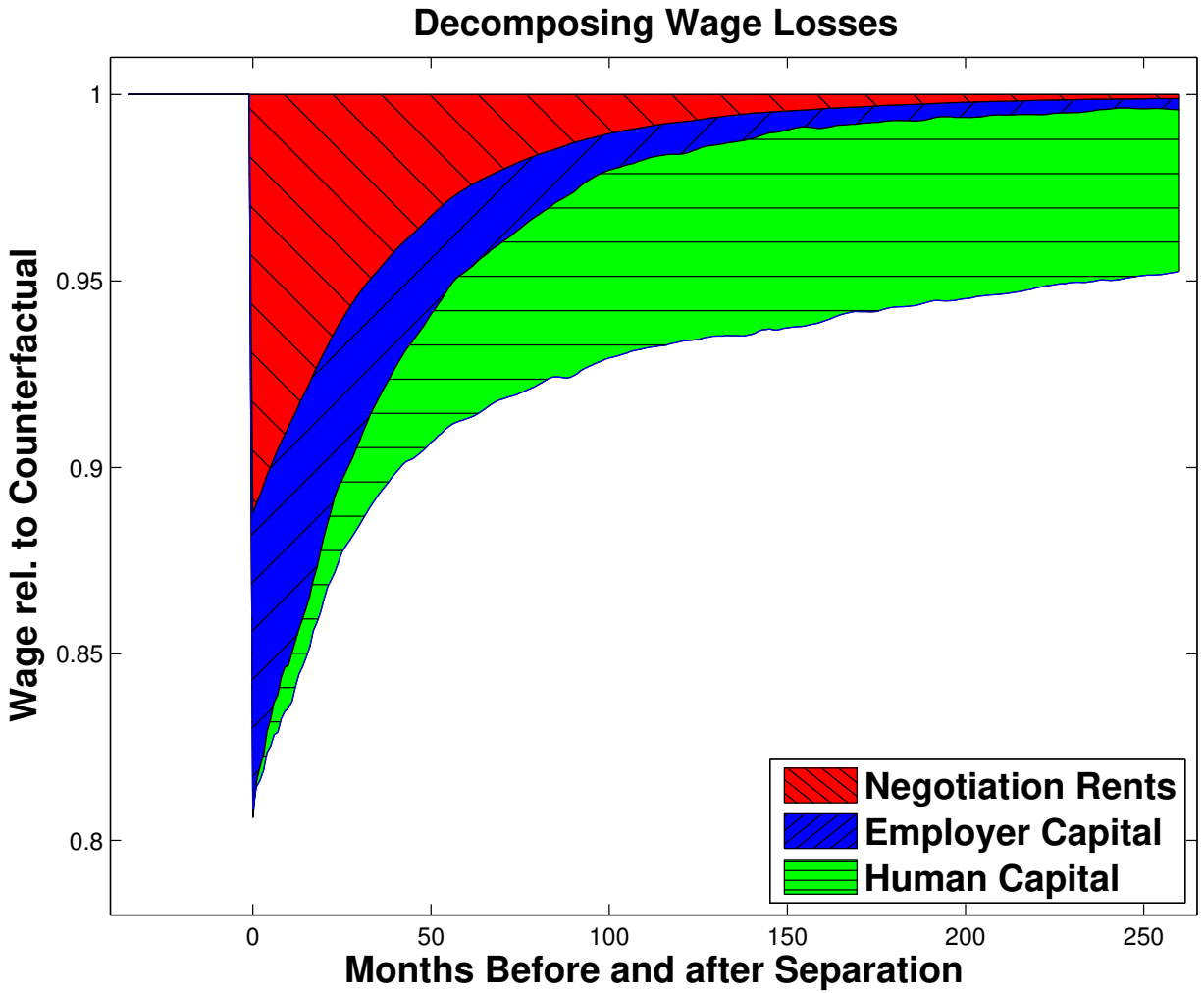
- Long run 22% negotiation capital. Dominates in short run.

Jarosch (2015): Decomposing Wage Loss



- Long run 25% employer capital. Dominates in medium run.

Jarosch (2015): Decomposing Wage Loss



- Long run 52% human capital. Approximately zero in short run.

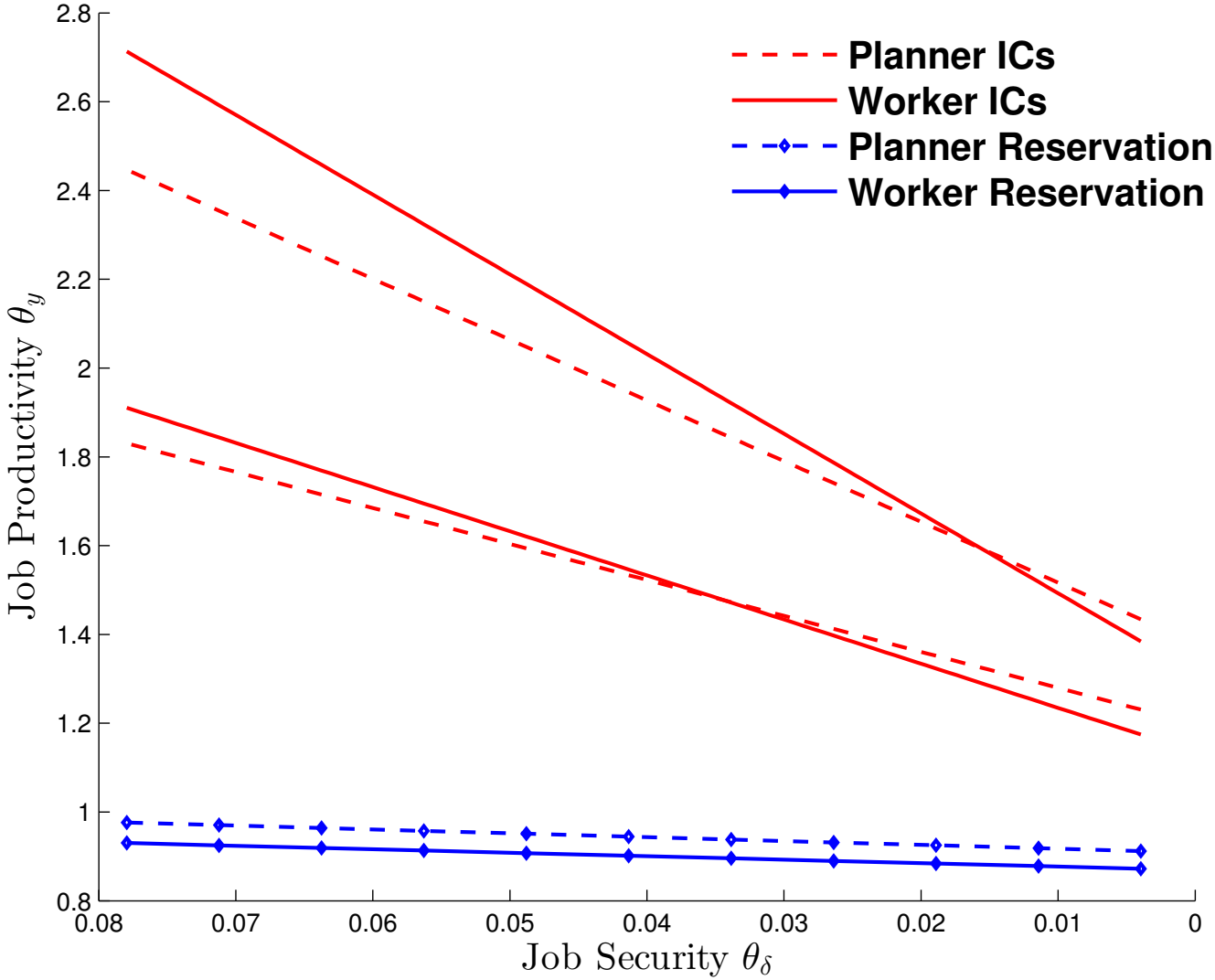
Jarosch (2015): Normative Implications

- Write down social planner's surplus, superscript with p.
  - Assume $\lambda_1 < \lambda_0$ as in simulation.

$$S^P(\theta) = \theta_y - z + \beta(1-\theta_\delta)\left(\begin{array}{c} S^P(\theta) + \lambda_1 \times \\ \int \max\left\{S^P(x) - S^P(\theta), 0\right\} dF(x) \end{array}\right) - \beta\lambda_0 \int \max\left\{S^P(x), 0\right\} dF(x)$$

$$S(\theta) = \theta_y - z + \beta(1-\theta_\delta)\left(\begin{array}{c} S(\theta) + \alpha\lambda_1 \times \\ \int \max\left\{S(x) - S(\theta), 0\right\} dF(x) \end{array}\right) - \beta\alpha\lambda_0 \int \max\left\{S(x), 0\right\} dF(x)$$

Jarosch (2015): Indifference Curves of Agent vs. Planner



Jarosch (2015): Efficiency Intuition and UI Benefits

- Workers get full benefit of job security, but only a fraction of the surplus when move to a new job.
  - Drives a wedge between social planner and worker surpluses.
  - Workers overvalue job security.
  - Reservation productivities are inefficiently low.
- Jarosch shows that this creates a justification for a moderate unemployment benefit.
  - Induces workers to care less about job security.
  - Flat unemployment benefit can get most of way to social planners optimum.
    - Higher unemployment rate.
    - But higher wages, less scarring from job loss.
  - Caveat: No free entry, which would change things.

Jarosch (2015): Evaluation and Future Directions

- Amazing paper.
- No aggregate shocks.
  - Jarosch speculates model could explain bigger scar in recessions.

  1. Human capital lost as unemployment spells lengthen.
  2. Wages fixed with no outside offers, so employers rather than control group workers bear brunt of recession.

- Adding free entry possible, but requires taking stance on why employers create jobs with different security.
- Interesting mechanism to incorporate simply into frameworks designed to answer other questions.