Job Displacement and Transferability of Human Capital

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Displaced workers

- 8.1% of workers are displaced per year (NLSY79); increasing displacement due to COVID19.
- Earnings losses are persistent; Jacobson et al. (1993): earnings remain 25% lower 5 years after displacement; Lachowska et al. (2020): 16% after 5 years.
- Unemployment duration of displaced workers is 16-20 weeks (Hovart 1992 and NLSY79)
- Wage loss at reemployment is 8%-10% (NLSY79 and Carrington and Fallick, 2017)

Job loss

- Empirically, job loss has highly persistent negative impact on future labor market outcomes (Jacobson et al. 1993; Rogerson and Schindler, 2002).
- Theoretically, when markets are incomplete, earnings uncertainty implies significant welfare losses.
- Earnings losses amplify the costs of business cycles and increase the persistence of unemployment (Ljungqvist and Sargent, 1998; Krebs, 2007; Krusell and Smith, 1999).
- Most popular models do not incorporate mechanisms for job loss after displacement (Davis and von Wachter, 2011; Jarosch, 2021)
- Not many attempts to analyse the welfare cost associated with the uncertainty induced by displacement.

Empirical Literature: displaced workers and human capital

Skills are not perfectly transferable:

1. Wages increase with tenure due to HC accumulation (Topel, 1991).

2. Displaced workers incur substantial wage losses upon reemployment, (Jacobson et al., 1993; Podgursky and Swaim, 1987; Topel, 1990; Kambourov and Manovskii, 2009; Carrington and Fallick, 2017).

3. Unemployment duration following displacement:
   - increases with the seniority in the previous job (Podgursky and Swaim, 1987; Seitchik and Zornitsky, 1989).
   - decreases with wage in previous job (Addison and Portugal,1987).

4. Wage loss upon reemployment:
   - increases with tenure (Topel, 1990; Seitchik and Zornitsky, 1989).
   - increases with wage in previous job (Podgursky and Swaim, 1987).

The model of job displacement and transferability of human capital

- Deviate from extremes where human capital is match-specific or perfectly transferable.
- Heterogeneous workers accumulate human capital which determines wage.
- Jobs disappear at an exogenous rate. Displaced workers search.
- Implications:
  - Match quality determines the transferability of human capital.
  - The decision rule determines wages, and together with job arrival rate – the duration of unemployment.
  - HC is determined by the history of prior employment spells, displacements, and the quality of the reemployment match.
- Empirical estimations
- Calibration

Preview of results

1. Reallocation of HC is central to the reemployment process.
2. The average match quality is 60%.
3. At displacement, a worker with 5 years of tenure suffers 8.4% wage loss; 6.7% due to match quality.
4. Wage losses are larger for workers with more HC and higher learning rate.
5. Unemployment duration increases with HC and declines with learning rate.

Macro Literature: wage and employment dynamics

- Pries (2004): models unemployment rate persistence using a recurring job loss mechanism.
- Job ladder models: low match quality at reemployment leads to repeated unemployment spells (Davis and von Wachter, 2011; Schmieder et al., 2009; Krolikowski, 2017; Jung and Kuhn, 2019)
- Burdett et al. (2020) incorporate (i) job ladder losses, (ii) human capital losses, and (iii) employment gap effects; and emphasise the importance of human capital.
- Jarosch (2021) introduces general human capital depreciation and heterogeneous destruction probabilities in a model with on-the-job and off-the-job search.

The model: the search problem

Consider the following infinite horizon model

- Building on Mortensen (1988) and Mortensen and Neumann (1988) search model.
- Employed workers with human capital k produce $f(k)$.
- While employed, human capital accumulates at rate δ.
- Job disappear at exogenous rate given by a Poisson process with parameter ρ.
- Unemployed workers produce $L(k)$.
- While unemployed, human capital depreciates at rate λ.
- While unemployed, job offers arrive according to a Poisson process with parameer α.
- A job offer is associated with a match-specific random variable $s \sim G(s)$.

The model: human capital

While employed, HC evolves as follows,

$$k' = (1 + \delta)k$$

For unemployed workers:
If unemployed worker accepts an offer,

$$k' = k_0 + s(k - k_0)$$

If remains unemployed,

$$k' = (1 - \lambda)k$$

$k_0 \geq 0$: general human capital, perfectly transferable; k is limited by k_0.
$s \in [0, 1]$: match quality between the worker and new job.

The model: Bellman equations

$V(k)$ - value function of currently employed worker:

$$rV(k) = f(k) + \rho\left[W(k) - V(k)\right] + V'(k)\delta k$$

$W(k)$ - value function of currently unemployed worker:

$$rW(k) = L(k) + \alpha \int_s \max\left(V(k_0 + s(k - k_0)) - W(k), 0\right) dG(s) - W'(k)\lambda k$$

The model: policy rule

Workers will accept job offers only if value exceeds the value of remaining unemployed.

The acceptance rule is given by a reservation value $z(k)$ which solves:

$$V(k_0 + z(k)(k - k_0)) = W(k)$$

The homogeneous case

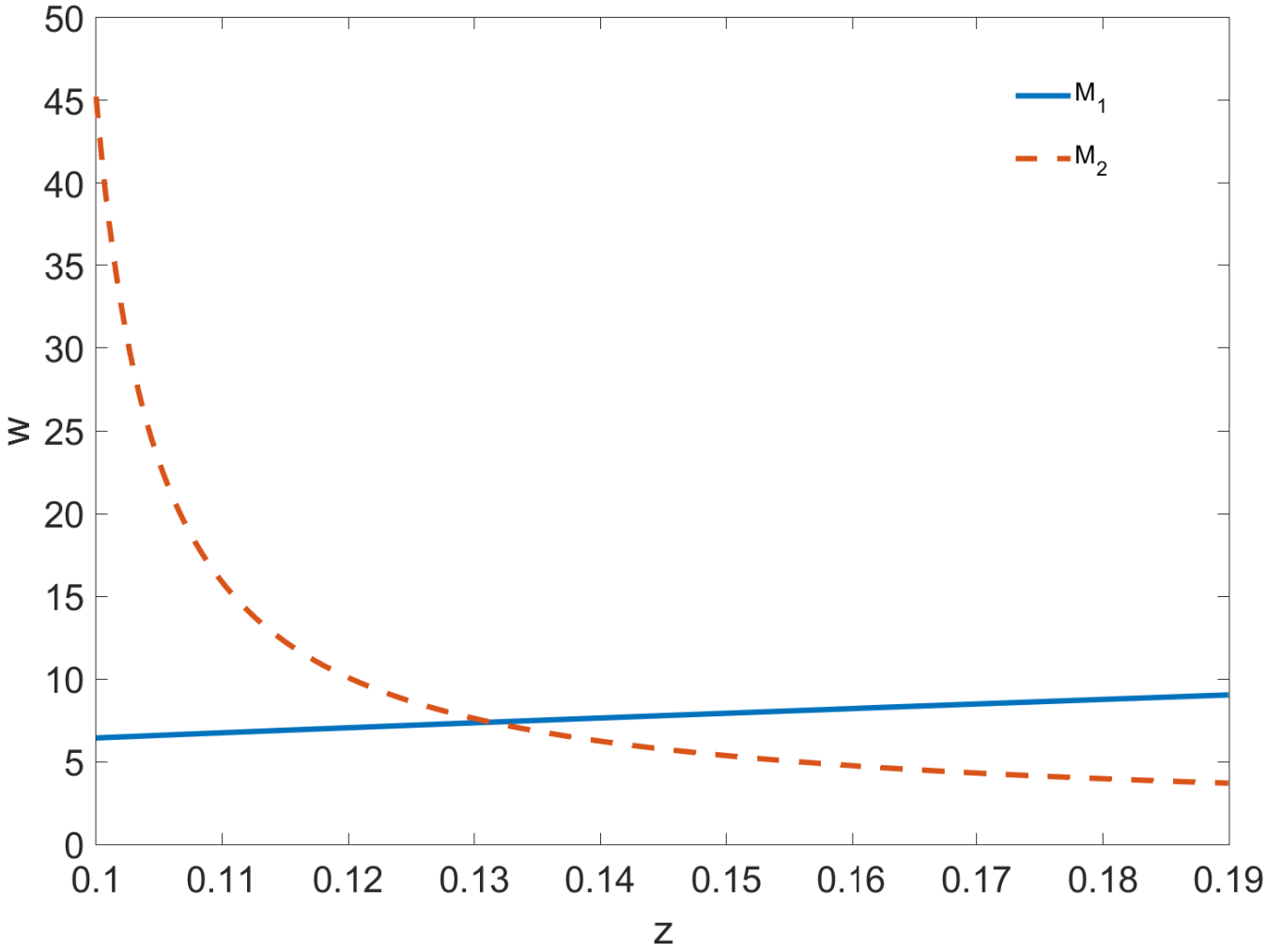
$k_0 = 0, f(k) = ak^\theta, L(k) = bk^\theta$.
Conjecture: $V(k) = vk^\theta$, and $W(k) = wk^\theta$.

Derive :

$$M1: \quad z^{-\theta} = \frac{\frac{a}{w} + \rho}{r + \rho - \delta\theta}$$

$$M2: \quad r + \lambda\theta - \frac{b}{w} = \alpha \int_z (z^{-\theta} s^\theta - 1) dG(s)$$

The homogeneous case



The homogeneous case: match quality reservation value

M1: $z^{-\theta} = \frac{\frac{a}{w}+\rho}{r+\rho-\delta\theta}$

M2: $r + \lambda\theta - \frac{b}{w} = \alpha \int_z (z^{-\theta} s^{\theta} - 1) dG(s)$

- Productivity: $\uparrow a \Rightarrow \uparrow M_1 \Rightarrow \downarrow z$
- Learning ability: $\uparrow \delta \Rightarrow \uparrow M_1 \Rightarrow \downarrow z$
- Distruction rate: $\uparrow \rho \Rightarrow \downarrow M_1 \Rightarrow \uparrow z$
- Replacement rate: $\uparrow b \Rightarrow \uparrow M_2 \Rightarrow \uparrow z$
- Depreciation rate: $\uparrow \lambda \Rightarrow \downarrow M_2 \Rightarrow \downarrow z$
- Arrival rate: $\uparrow \alpha \Rightarrow \uparrow M_2 \Rightarrow \uparrow z$

The model: implications

1. Displaced workers have capital loss upon reemployment.
2. Wage losses increase with human capital (high wage and tenure).
3. More productive and faster learning workers have lower reservation values and shorter unemployment spells.
4. Higher learning abilities imply higher wages before the displacement and larger wage loss.
5. Workers with higher learning abilities have higher wage growth after reemployment.
6. Unemployment $\uparrow$ with tenure in previous job.*
7. Match quality varies with human capital.*

Data: NLSY79

- Cohort study, 12K individuals, 1979 - present.
- Individuals who made transition to the labour market.
- Restrict to 21 - 60 years old, 8+ years of schooling, not in military, earn between 1-300 dollars per hour (deflated using the 2000 CPI).
- Work-history files: job transitions, wages, hours, unemployment spells, tenure and work experience, etc..
- Focus on displacements due to employment cutbacks (layoffs) and plant closures.
- Individual controls: education, ability (AFQT score), race, region, year, and region-year interactions.
- "Learning ability" - constructed using individual mean within job wage growth.

Empirical analysis

Unemployment duration

$$
\begin{aligned}
U_{j-1,i} = \quad & \beta_0 + X_{ij}\beta_1 + \beta_2\delta_i + \\
& \beta_3 Emp\_Ten_{j-1,i} + \beta_4 Emp\_Ten_{j-1,i}^2 + \\
& \beta_5 Occ\_Ten_{j-1,i} + \beta_6 Occ\_Ten_{j-1,i}^2 + \\
& \beta_7 Exp_{j-1,i} + \beta_8 Exp_{j-1,i}^2 + \beta_9 \log W_{j-1,i} + \xi_{j-1,i}^U
\end{aligned}
$$

Empirical analysis

Table 1: Unemployment duration, N=1220

	(1)	(2)	(3)	(4)
HC accumulation rate	-11.0889**	-14.2083***	-15.2391***	-15.3081***
	(5.256)	(4.771)	(5.425)	(5.694)
Previous Log(wage)		-0.2518	0.8990	1.5771
		(1.026)	(1.014)	(1.029)
Occ tenure	-0.0007	-0.0006	-0.0008	-0.0006
	(0.001)	(0.001)	(0.001)	(0.001)
Occ tenure sq	0.0000	0.0000	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)
Previous job tenure	0.0109*	0.0106*	0.0114*	0.0107*
	(0.006)	(0.006)	(0.006)	(0.006)
Previous job tenure sq	-0.0000*	-0.0000*	-0.0000**	-0.0000*
	(0.000)	(0.000)	(0.000)	(0.000)
Total experience	-0.0030	-0.0089**	-0.0386***	-0.0354***
	(0.003)	(0.004)	(0.010)	(0.009)
Total experience square	0.0000	0.0000*	0.0000**	0.0000*
	(0.000)	(0.000)	(0.000)	(0.000)
AFQT score				-0.9773
				(0.626)
Educ				0.3201
				(0.264)
Black			-0.3724	-0.5714
			(1.136)	(1.267)
Hispanic			0.3506	-0.0534
			(1.145)	(1.186)
Region, metro, year FE			yes	yes
Region FE x year FE			yes	yes

Empirical analysis

$$
\begin{aligned}
d \log W_{j,j-1,i} = \quad & \gamma_0 + X_{ij}\gamma_1 + \gamma_2 \delta_i + \\
& \gamma_3 Emp\_Ten_{j-1,i} + \gamma_4 Emp\_Ten^2_{j-1,i} + \\
& \gamma_5 Occ\_Ten_{j-1,i} + \gamma_6 Occ\_Ten^2_{j-1,i} + \\
& \gamma_7 Exp_{j-1,i} + \gamma_8 Exp^2_{j-1,i} + \gamma_9 \log W_{j-1,i} + \xi^W_{j-1,i}
\end{aligned}
$$

Empirical analysis

Table 2: Wage loss: Log(W_j) - Log(W_{j-1}), N=1127

	(1)	(2)	(3)	(4)
HC accumulation rate	-0.7780	-0.8604*	-1.0471***	-1.1153***
	(0.479)	(0.507)	(0.398)	(0.416)
Previous Log(wage)		-0.1942***	-0.1913***	-0.2044***
		(0.028)	(0.031)	(0.033)
Occ tenure	0.0000**	0.0000***	0.0000***	0.0000***
	(0.000)	(0.000)	(0.000)	(0.000)
Occ tenure sq	-0.0000**	-0.0000***	-0.0000**	-0.0000**
	(0.000)	(0.000)	(0.000)	(0.000)
Previous job tenure	-0.0007***	-0.0005***	-0.0005***	-0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)
Previous job tenure sq	0.0000***	0.0000***	0.0000***	0.0000***
	(0.000)	(0.000)	(0.000)	(0.000)
Total experience	0.0002	0.0002*	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)
Total experience square	0.0000	0.0000	0.0000	0.0000
	(0.000)	(0.000)	(0.000)	(0.000)
AFQT score				0.0006
				(0.016)
Educ				0.0157**
				(0.008)
Black			-0.0440	-0.0322
			(0.031)	(0.035)
Hispanic			-0.0331	-0.0179
			(0.033)	(0.036)
Region, metro, year FE			yes	yes
Region FE x year FE			yes	yes

Model Estimation and Simulation

Parameters			
a	wage function	1	normalized
b	leisure function	0.57	OECD
ρ	separation rate	8.1% pa	NLSY79
λ	depreciation rate	6.3% pa	literature
$G(\delta)$	learning dist.		NLSY79
α	arrival rate	17.6%	calibrated
θ	return to hc	0.579	calibrated
$F_{beta}(s) : \alpha^{beta}, \beta^{beta}$	match quality	(7.76,8.47)	calibrated

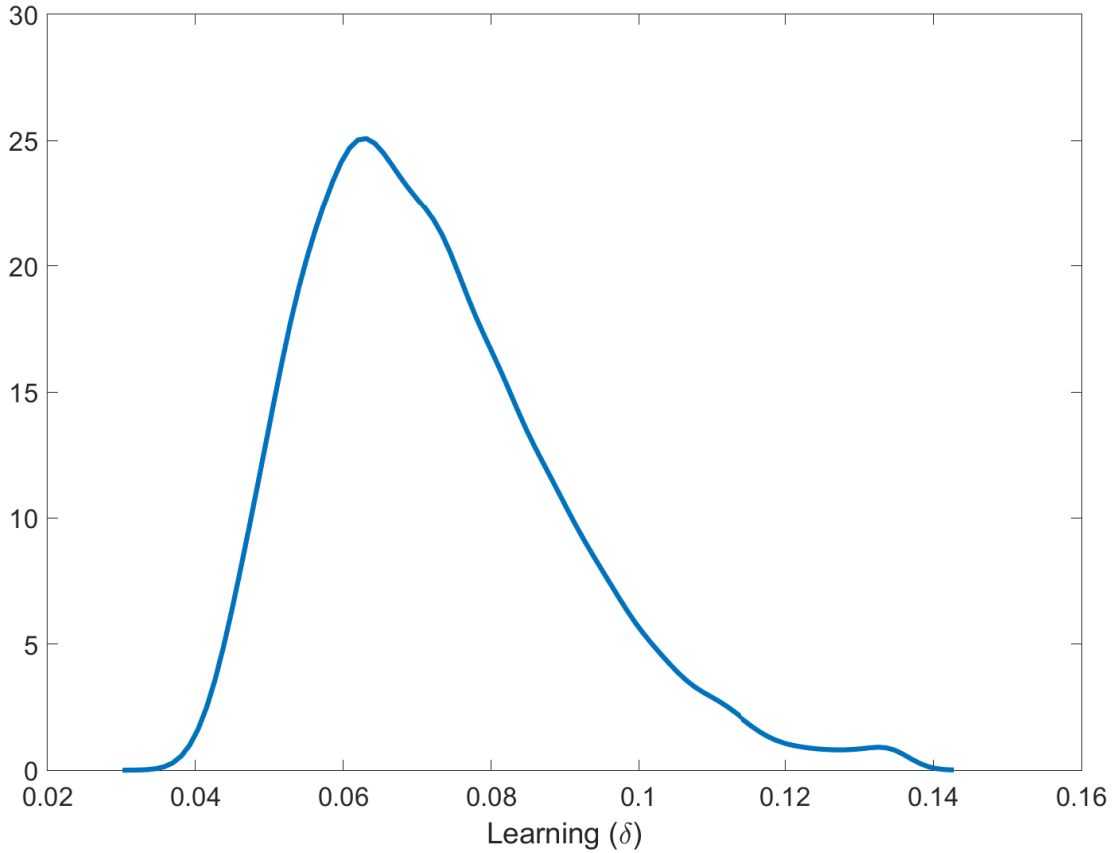
Model Estimation and Simulation

- Simulate the economy for 10,000 individuals for 15 years (period = week). Agents discount at 0.96 per year.
- Assume a *beta* distribution for match quality, $F_\beta(\tilde{s})$. (Calibrated parameters).
- Estimate distribution of wage growth ($\theta G(\tilde{\delta})$). Wage growth = $\theta log(1+\delta)$. Calibrate θ and set δ to match wage growth in the data.

Model Estimation and Simulation

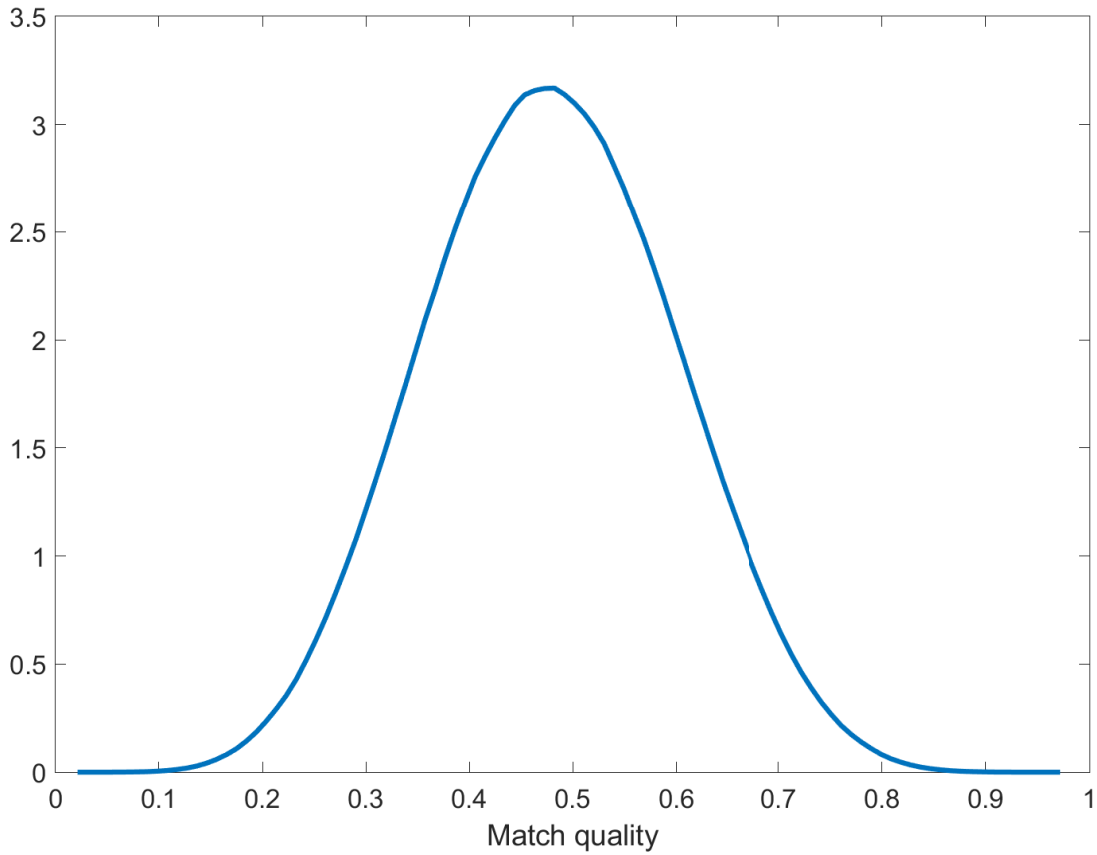
Model Outcomes	Data	Model
Targeted moments		
average unemployment duration	20.17	20.03
average wage loss (W_{loss})	-0.077	-0.083
corr (une dur, wage growth | ten$_{pj}$, wage$_{-1}$)	-0.062	-0.057
wage loss Q1(wage growth)	-0.036	-0.067
wage loss Q2(wage growth)	-0.072	-0.078
wage loss Q3(wage growth)	-0.083	-0.085
wage loss Q4(wage growth)	-0.109	-0.102
Non-targeted moments		
corr(W_{loss}, δ)	-0.073	-0.304
corr(W_{loss}, une dur)	-0.101	-0.596
corr(W_{loss}, tenure pj)	-0.156	-0.729
corr(une dur, tenure pj)	0.094	0.352

Model Estimation and Simulation: learning ability



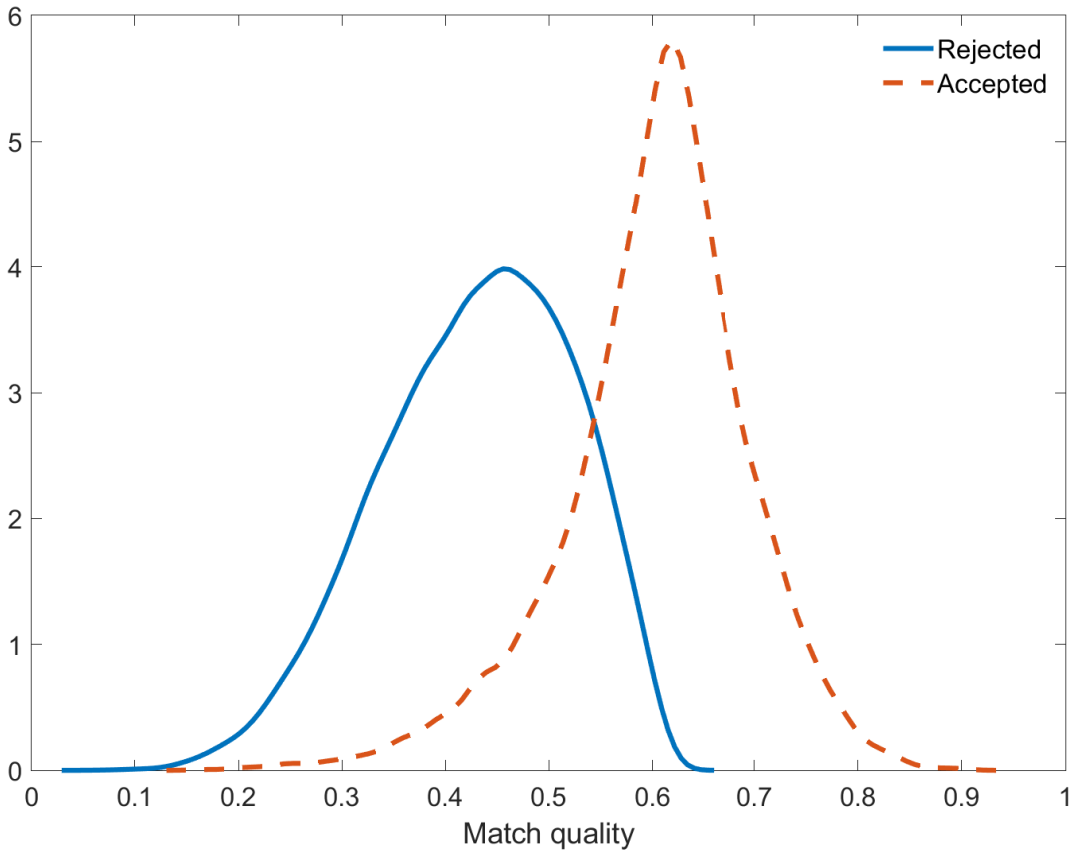
Model Estimation and Simulation: match quality

Average match quality 48%



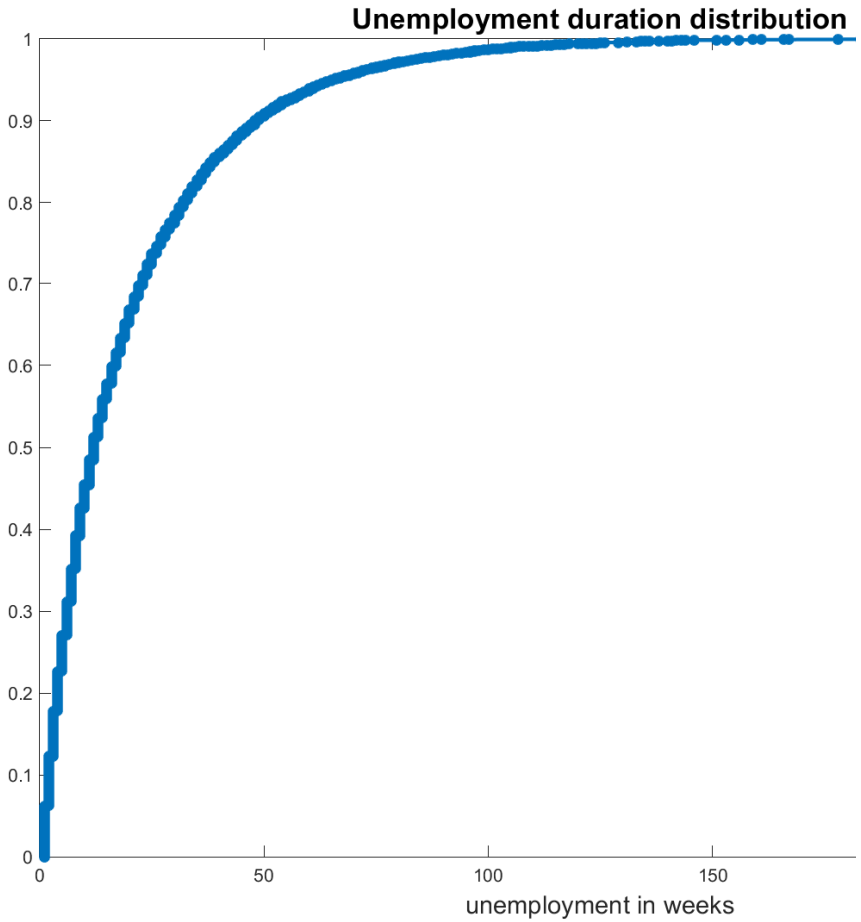
Model Estimation and Simulation: match quality

Average accepted match quality 60.4%
Average rejected match quality 43.0%
Fraction of accepted matches 27.3%

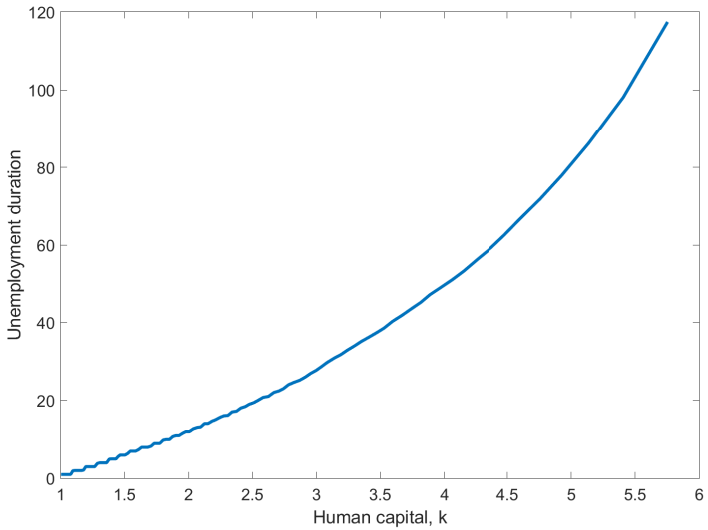


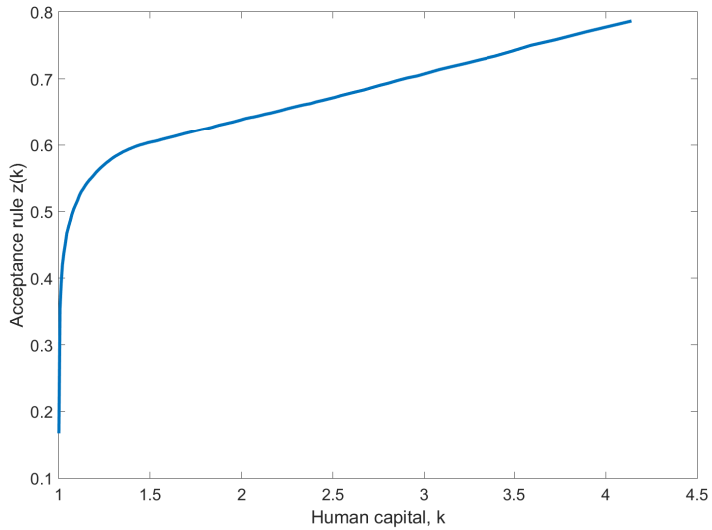
Model Estimation and Simulation: unemployment duration

Average unemployment duration 20 weeks



Match quality rule, unemployment duration and HC

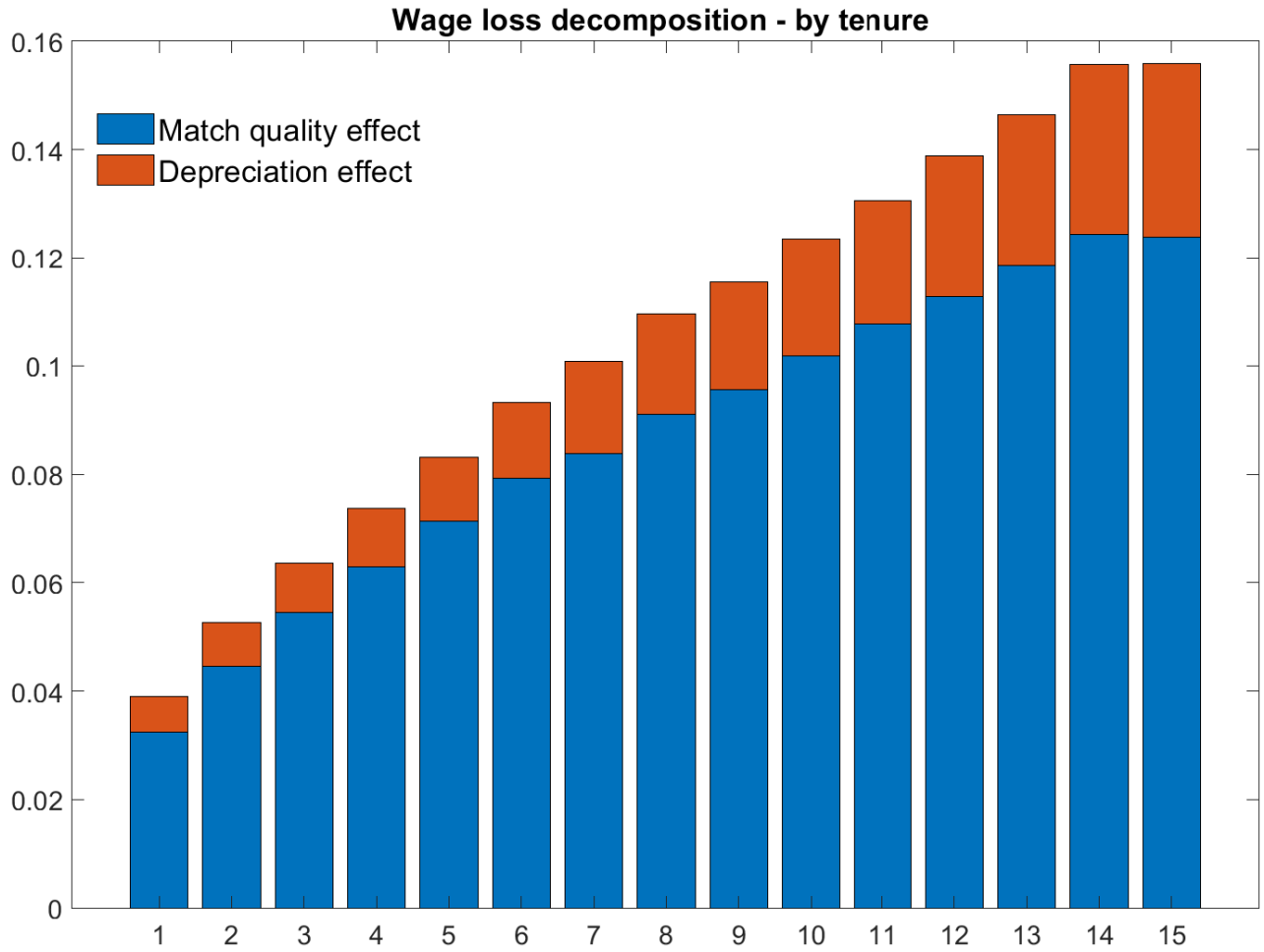




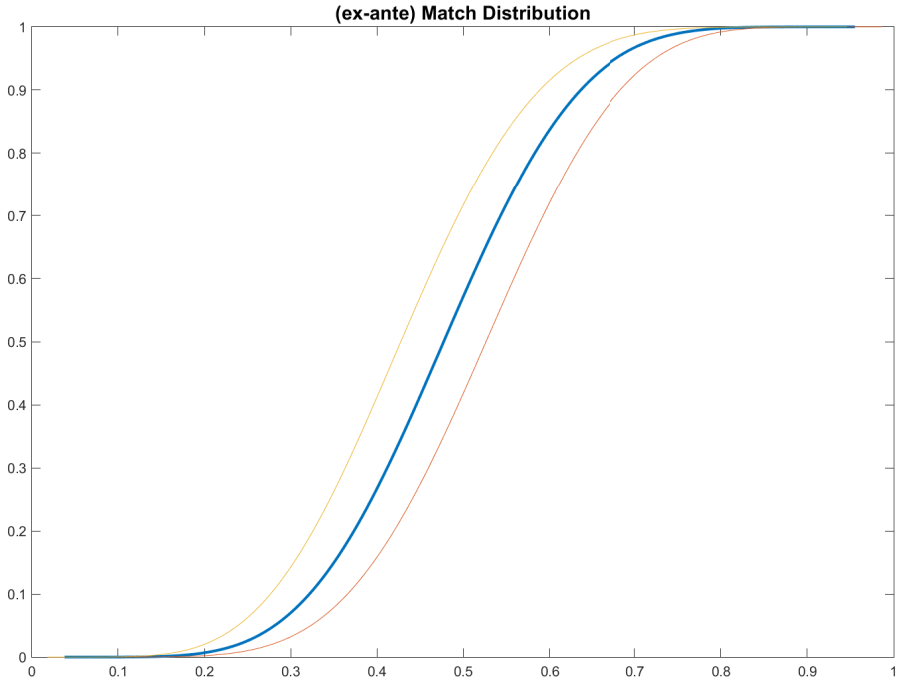
Model Estimation and Simulation

Average wage loss 8.3%

Wage loss decomposition - By tenure



Shifts in match quality distribution



	Mean	Accepted	Rejected
Benchmark	48%	60.4%	43.0%
right shift	53%	62.7%	45.7%
left shift	43%	58.5%	40.0%

Shifts in match quality distribution

Unemployment duration	Average	Q1 (δ)	Q2 (δ)	Q3 (δ)	Q4 δ)
benchmark	20.03	17.84	20.34	20.38	21.46
right shift	14.10	13.15	13.84	14.38	14.95
left shift	30.58	27.46	30.72	30.37	33.67
Wage loss					
benchmark	-8.35%	-6.72%	-7.89%	-8.55%	-10.18%
right shift	-7.67%	-6.20%	-7.17%	-7.88%	-9.35%
left shift	-8.54%	-6.92%	-8.07%	-8.69%	-10.42%

Change in the return to human capital (θ)

	Average	Q1 (δ)	Q2 (δ)	Q3 (δ)	Q4 (δ)
			Unemployment duration		
benchmark	20.03	17.84	20.34	20.38	21.46
–10%	20.46	18.59	20.92	20.62	21.63
+10%	19.58	17.32	19.80	19.96	21.14
			Wage loss		
benchmark	-8.35%	-6.72%	-7.89%	-8.55%	-10.18%
–10%	-8.12%	-6.56%	-7.69%	-8.31%	-9.86%
+10%	-8.56%	-6.88%	-8.08%	-8.78%	-10.47%

Summary

Our framework:

- We propose a novel framework where match quality determines the transferability of human capital of displaced workers.
- The model makes a number of predictions.
- HC and wages are determined by the history of prior employment spells, displacements, and the quality of the reemployment match.
- We show empirically that these predictions hold in the data.
- We calibrate the model and show that:
  - The average match quality is 60%.
  - Most wage loss is explained by match quality.
  - Wages losses increase with HC and higher learning rate.
  - Unemployment duration increases with HC and declines with learning rate.