

Online Appendix: Sources of Displaced Workers' Long-Term Earnings Losses

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Appendix A

Alternative Estimates, Additional Analyses, and Other Supporting Material

Appendixes A.1, A.3, A.4, A.5, A.6, and A.7 describe sensitivity tests of the estimates reported in the main text. Appendix Table A gives a tabular summary of these results.

Appendix A.2 compares the unemployment rates in Washington, Connecticut, Pennsylvania, and the United States for selected time periods relevant to displaced worker studies using administrative data.

Appendix A.8 describes estimates using the specification and sampling choices used by Schmieder, von Wachter, and Heining (2018).

Appendix A.9 presents inter-quintile employer fixed effects transitions, changes in earnings and work hours, and employer fixed effect changes for earnings and work hours.

Appendix A.10 presents an alternative decomposition of displaced workers' losses.

Appendix A.11 compares alternative estimates of displacement losses due to lost match effects.

Appendix A.12 is made up of four tables supporting Figures 2, 3, 5, and 6 in the main text.

Appendix A Summary Table
Summary of estimated quarterly losses due to displacement

	Earnings		Hours		Hourly wage rate	
	Q1	Q17–Q20	Q1	Q17–Q20	Q1	Q17–Q20
1. Displaced workers, UI claimant sample, full losses (Sections III.A and III.B of the main text)						
levels	–\$6,536	–\$2,026	–217	–14.2	–2.40	–2.87
	(–49.0%)	(–15.2%)	(–41.9%)	(–2.7%)	(–4.1%)	(–4.9%)
log points	–0.553	–0.164	–0.423	–0.047	–0.134	–0.115
2. Displaced workers, UI claimant sample, changes due to employer fixed effects (Section IV.A of the main text)						
log points	–0.033	–0.015	–0.018	0.005	–0.015	–0.020
3. Displaced workers, UI claimants with shorter job tenure (3–4 years), full losses (Appendix A.1)						
log points	–0.641	–0.153	–0.558	–0.139	–0.081	–0.017
4. Displaced workers, UI claimant sample including less strongly attached, full losses (Appendix A.3)						
log points	–0.530	–0.248	–0.424	–0.116	–0.115	–0.134
5. Displaced workers, UI claimant sample alternative comparison group, full losses (Appendix A.4)						
log points	–0.478	–0.080	–0.376	+0.002	–0.109	–0.081
6. Displaced workers, broadened sample, full losses (Appendix A.5)						
log points	–0.489	–0.233	–0.377	–0.090	–0.123	–0.147
7. Displaced workers, UI claimant sample, excluding NAICS industries 51–56, full losses (Appendix A.6)						
log points	–0.645	–0.166	–0.461	–0.076	–0.185	–0.091
8. Displaced workers, UI claimant sample, full losses from random trends model (Appendix A.7)						
log points	–0.543	–0.147	–0.410	–0.032	–0.135	–0.110
9. Displaced workers, UI claimant sample, full losses, Schmieder, von Wachter, and Heining (2018) setup (Appendix A.8)						
log points	–0.544	–0.069	–0.421	–0.044	–0.126	–0.029
10. Displaced workers, UI claimant sample, changes due to match effects (Section IV.C of the text and Appendix A.11)						
log points	–0.061	–0.085	–0.035	–0.019	–0.025	–0.066
11. Displaced workers, UI claimant sample, changes due to match effects (unadjusted) (Appendix A.11)						
log points	–0.075	–0.096	–0.032	–0.016	–0.043	–0.081

Note: Each entry gives the estimated displacement effect on the indicated outcome in either quarter 1 (Q1) or the average of quarters 17, 18, 19, and 20 (Q17–Q20) following displacement. For levels, implied percentage changes relative to the pre-displacement average are shown in parentheses. (For example, the estimated effect of displacement on average earnings in quarters 17–20 after displacement is –\$2,026, which is 15.2% less than the pre-displacement average earnings of displaced workers shown in Table 1.)

Appendix A.1

Estimated losses of short-tenure displaced workers

An implication of the specific human capital hypothesis is that longer pre-displacement job tenure will be associated with larger earnings losses (e.g., Topel 1990; Neal 1995; Carrington and Fallick 2017). Farber (1993) found that, on average, each additional year of pre-displacement job tenure was associated with an additional one percent drop in post-displacement earnings. In contrast, in a study using administrative data, von Wachter, Song, and Manchester (2009) found insubstantial differences between the earnings losses of workers with three years of tenure and workers with six or more years of tenure.

This appendix investigates the relationship between pre-displacement job tenure and losses resulting from displacement by examining the losses of workers with only 3–4 years of pre-displacement job tenure—“short-tenure” displaced workers. In Section A.1-1, we develop estimates of the earnings, hours, and wage rate losses of short-tenure displaced workers, then compare those losses with the losses of long-tenure displaced workers (the workers who are the focus of the main text). In Section A.1-2, we develop estimates of the sources of short-tenure displaced workers’ losses (employer effects, match effects, and direct effects), then compare the pattern of those sources of loss with the patterns for both long-term displaced workers and non-displaced job changers. As in Section IV.B of the main text, the discussion focusses on changes in wage rates; the analyses for changes in earnings and work hours yield similar conclusions.

To construct the sample of short-tenure displaced workers, we select workers who were displaced after 3–4 years of tenure according to the criteria described in Section I.A of the main text (other than the six-year tenure requirement). This generates a sample of 2,391 short-tenure displaced workers. We then estimate equation (1) in the main text using as the comparison group non-displaced workers with 6 or more years of tenure, so that comparisons between short- and

long-tenure displaced workers are made with respect to the same comparison group. This is a descriptive exercise, not an attempt to estimate the effect of job tenure on the outcomes of displaced workers.

A.1-1 Losses of short-tenure displaced workers

Appendix Figure A1-1 shows the estimated profiles of short-tenure displaced workers' earnings, work hours, and wage rates (in logs), and the estimated time path of the quarterly employment probability—see also row 3 of Appendix Table A. The earnings losses and employment probabilities of short-tenure displaced workers are similar to those of long-tenure displaced workers, consistent with the findings of von Wachter, Song, and Manchester (2009). However, the patterns of hours losses and wage rate reductions differ between the two groups. The hours losses of short-tenure displaced workers are larger than those of long-tenure displaced workers, but their wage rates losses are less, and those wage rate losses are minimal four years after displacement. This contrasts with the wage rate losses of long-tenure displaced workers, which plummet at the time of displacement and recover little if at all.

A possible interpretation of these estimates is that the reduced work hours of long-tenure displaced workers represent a labor supply response to their reduced wage rates, whereas the substantially reduced hours of short-tenure displaced workers, along with wage rates similar to those faced before displacement, suggests demand constraints faced by these workers. The implication is that short- and long-tenure displaced workers differ in ways that should not be attributed to previous job tenure alone.¹

¹ We have also examined losses due to displacement separately for workers younger than age 40 in the quarter of displacement, and for workers age 40 and older in the quarter of displacement. (To construct the non-displaced comparison groups, we use age in 2007:IV.) The estimated long-term earnings, hours, and wage-rate losses of the younger and older workers are quite similar, which is surprising because older workers have on average longer job tenure. However, the reemployment rates of older workers in the first two years after displacement are lower than those of younger workers, consistent with Farber's (2017) findings.

Appendix Figure A1-2 shows that employer fixed effects account for a negligible portion of the long-term reduced earnings, work hours, and wage rates of short-tenure displaced workers; this was also the case for long-tenure displaced workers. However, lost match effects, which are an important source of the long-term losses of long-tenure displaced workers, are less important in explaining the long-term losses of short-tenure displaced workers. For short-tenure displaced workers, the direct displacement effect—the effect of starting over—is the main source of wage loss for most of the five years following displacement.²

To summarize, the long-term earnings losses of short- and long-tenure displaced workers are similar in the Washington data, but for different reasons. Long-tenure displaced workers suffer greater wage rate losses, consistent with loss of an especially good worker-employer match and loss of accumulated specific human capital. Short-tenure displaced workers suffer greater hours reductions, consistent with constraints on the demand for their labor. For neither group are employer fixed effects an important source of losses following displacement.

A.1-2 Transitions of short-tenure displaced workers

To gain a better understanding of why employer fixed effects and match effects play a limited role in explaining the losses of short-tenure displaced workers, we apply the analysis developed in Section IV.B of the main text (“Transitions of displaced workers and non-displaced job changers”) to short-tenure displaced workers. Appendix Table A1-1 displays the transition matrix of changes in wage rates, employer fixed effects, match effects, and direct displacement effects associated with each inter-quintile employer wage effect transition for short-tenure workers. As in Section IV.B, these changes are computed as a difference between the pre-displacement average and the outcomes two years after displacement. Appendix Table A1-2

² Note that the match effects shown are adjusted for years of tenure; see Appendix A.11 for details. As a result, the direct effect embodies the effect of resetting the tenure clock.

shows sums and weighted averages of the below-diagonal, on-diagonal, and above-diagonal elements of Tables A1-1 and Table 5 of the main text.

Four main points are worth noting. First, the quintile-to-quintile transitions of short-tenure displaced workers resemble more closely those of non-displaced job changers than those of long-tenure displaced workers: roughly 30 percent of short-tenure displaced workers and non-displaced job changers moved to a lower-quintile employer, about 40 percent moved to an employer in the same quintile, and roughly 30 percent moved to a higher-quintile employer (Table A1-2). In contrast, among long-tenure displaced workers, 30 percent moved to a lower-quintile employer, 52 percent moved to a same-quintile employer, and only 18 percent moved to a higher-quintile employer (see Table 5 in the main text). The similarity of the inter-quintile employer transitions of short-tenure displaced workers and non-displaced job changers can be visualized by comparing Appendix Figure A1-3 (short-tenure displaced workers) with Figure 7 in the main text (non-displaced job changers).

Second, unlike long-tenure displaced workers—who experienced a wage loss irrespective of the direction of their employer-to-employer transition (Table 5)—short-tenure displaced workers tend to experience a wage loss only if they move to a lower-quintile employer or a same-quintile employer (Table A1-2). Short-tenure displaced workers who moved to a higher-quintile employer tend to experience a wage gain, a pattern also observed for non-displaced job changers (Table A1-2) and consistent with the symmetry predicted by the AKM model.

Third, for the 31 percent of short-tenure displaced workers who moved to lower-quintile employers, lost employer effects account for most of the wage loss: the average wage rate loss of these workers was 23.7 log points, of which 20.1 points could be attributed to employer effects (Table A1-2). The remainder was explained by the direct displacement effect (3.7 log points),

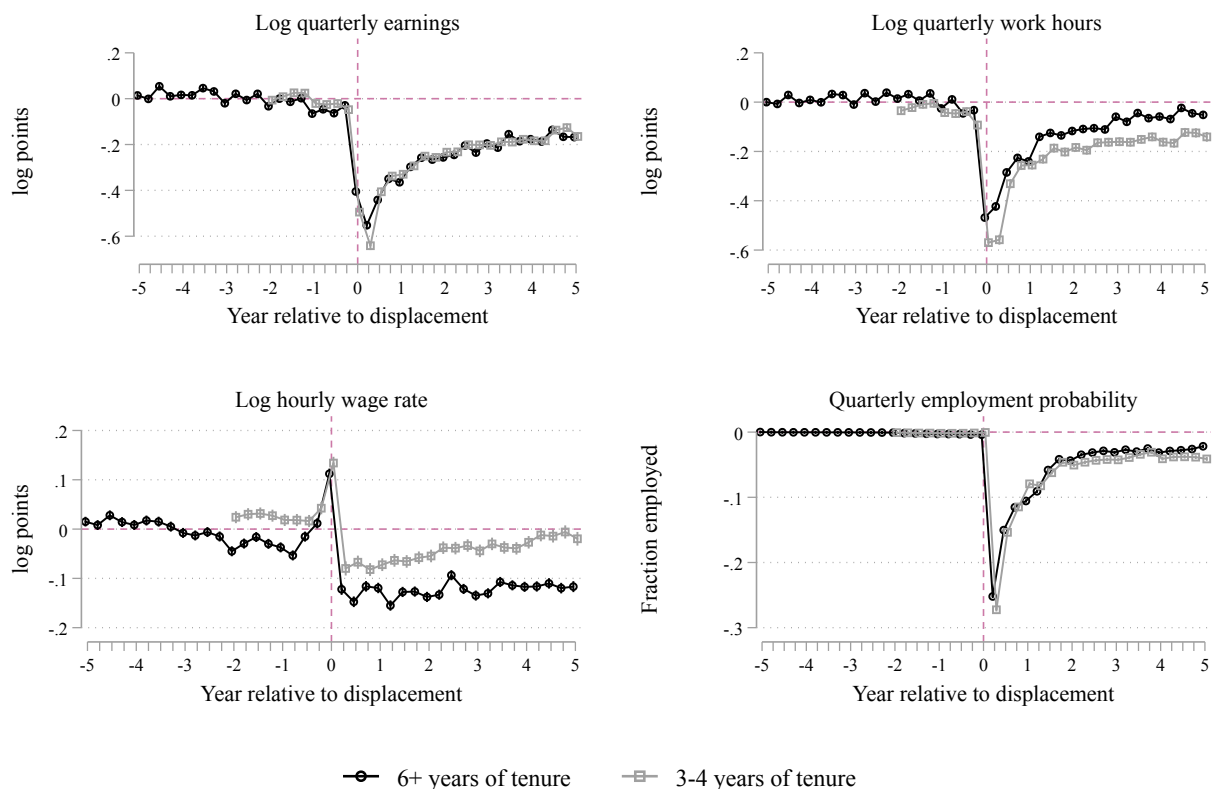
and the role of match effects was negligible. For short-tenure displaced workers who moved to *higher*-quintile employer, wage changes also tended to move in parallel with employer effect changes: the average wage rate gain of these workers was 11.6 log points, which was more than fully explained by employer effects (19.2 log points—see Table A1-2).

Hence, for short-tenure displaced workers, post-displacement wage changes parallel changes in employer effects; this is also true for non-displaced job changers. These parallel changes in wages and employer effects can be seen graphically in Figure A1-4, which differs from the analogous graph for long-tenure displaced workers (Figure 8A in the main text). Whereas for short-tenure displaced workers, the slope of the regression of wage changes on employer effect changes is approximately 1.0, for long-tenure displaced workers the slope is about 0.7 (so that wage changes move with employer effect changes only for workers who move to lower-quintile employers).

Finally, short-tenure displaced workers who moved to a same-quintile employer tended to experience a relatively small wage loss (3.4 log points), and none of that loss was accounted for by changes in employer effects or match effects; the direct effect of displacement accounted for virtually all of the loss.

To summarize, the dynamics of short-tenure displaced workers' job changes—that is, their inter-employer pattern of mobility, the changes in earnings, hours, and wage rates that accompany their job changes, and the contributions of employer and match effects to changes in earnings, hours, and wage rates—resemble those of non-displaced job changers and contrast with those of long-tenure displaced workers. It follows that the AKM model provides a reasonable description of the job change dynamics for short-term displaced workers, as it does for non-displaced job changers, but a less than satisfactory description for long-term displaced workers.

Appendix Figure A1-1
Estimated losses of short-tenure displaced workers

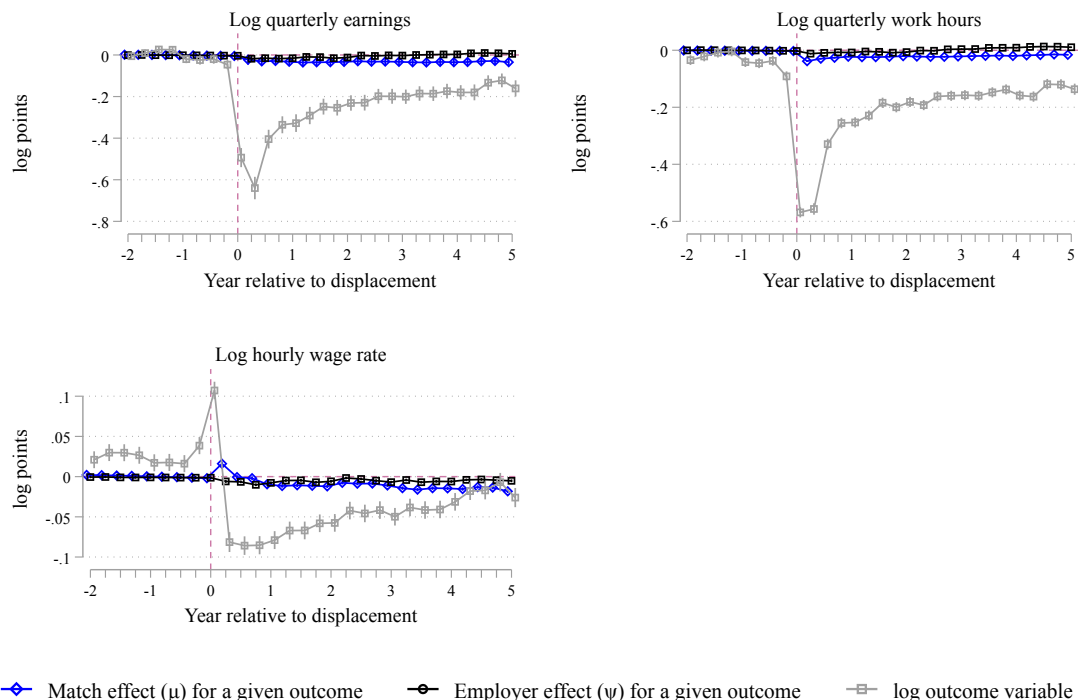


Notes: The figures show estimated displacement effects for workers with 3–4 years of job tenure at the time of displacement (squares), and 6 or more years of job tenure at the time of displacement (circles, repeated from Figures 2, 3, 5 in the main text for the first three panels). The reference time period for workers displaced with 3–4 years of tenure (and their comparison group) is 3 years before displacement. Each figure shows the profile of displacement effects for an outcome—quarterly log earnings, log hours, log wage rate (all from the primary employer), or the probability of employment (positive earnings or hours)—based on estimates of δ_k in equation (1) in the main text. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors’ calculations using Washington administrative wage and claims records. See Sections II.A, III.A, and III.B of the text for details.

Appendix Figure A1-2

Estimated losses of short-tenure displaced workers due to lost employer effects and lost match effects, Washington, 2008–2010



Notes: The figures show estimated displacement losses attributable to lost employer fixed effects ($\hat{\psi}$, shown as circles) and match effects ($\hat{\mu}$, shown as diamonds) estimated by Woodcock's (2015) method, compared with the full losses due to displacement for workers with 3–4 years of job tenure at the time of displacement (squares, repeated from Appendix Figure A1-1). Losses attributable to lost employer effects are estimates of δ_k from equation (3) in the main text. For example, to obtain the estimates of earnings lost due to lost employer effects, equation (3) was estimated with the AKM employer fixed effect ($\hat{\psi}_j$) for log earnings as the dependent variable. Losses attributable to lost match effects are estimates of δ_k from an equation like equation (3) with $\hat{\mu}_{ij}$ as the dependent variable. Estimated match effects are adjusted for years of job tenure; see Section II.C of the main text. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records. See Sections II.A, III.A, III.B, and IV.C of the text for details.

Appendix Table A1-1

Short-tenure displaced workers' inter-quintile employer transitions, wage rate changes, employer effect changes, match effect changes, and direct displacement effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of displaced workers in cell	5.6	3.8	2.0	1.4	0.9	13.7
	mean Δ wage	3.0	0.8	9.6	17.5	55.9	8.2
	mean Δ employer effect	-3.3	13.2	23.6	33.4	55.3	12.8
	mean Δ match effect	7.1	-1.0	-3.8	-11.7	4.8	1.1
	mean direct effect	-0.8	-11.4	-10.2	-4.3	-4.2	-5.7
2	% of displaced workers in cell	3.3	5.1	4.3	2.7	1.0	16.4
	mean Δ wage	-21.3	-10.6	-1.0	14.2	33.2	-3.5
	mean Δ employer effect	-15.7	-0.1	10.5	20.2	38.2	5.1
	mean Δ match effect	-5.3	-3.3	-5.0	-1.4	-1.5	-3.7
	mean direct effect	-0.3	-7.2	-6.4	-4.5	-3.5	-4.9
3	% of displaced workers in cell	4.1	4.2	7.8	4.4	3.0	23.4
	mean Δ wage	-28.2	-9.2	-9.9	0.6	24.3	-6.7
	mean Δ employer effect	-25.7	-11.8	-1.4	9.5	33.5	-1.1
	mean Δ match effect	0.2	6.4	-2.5	-1.5	-1.9	-0.2
	mean direct effect	-2.7	-3.7	-5.9	-7.3	-7.3	-5.4
4	% of displaced workers in cell	2.3	3.1	6.2	9.1	4.2	24.9
	mean Δ wage	-24.1	-26.0	-22.1	-5.3	19.8	-9.6
	mean Δ employer effect	-36.9	-22.8	-11.0	-0.6	19.7	-5.9
	mean Δ match effect	12.8	0.1	-2.9	-2.7	5.4	0.4
	mean direct effect	0.0	-3.3	-8.2	-1.9	-5.3	-4.1
5	% of displaced workers in cell	0.6	1.3	2.3	3.5	13.8	21.5
	mean Δ wage	-71.1	-35.0	-30.1	-22.3	1.6	-9.9
	mean Δ employer effect	-45.7	-37.7	-28.1	-14.2	2.9	-7.0
	mean Δ match effect	-21.6	-6.9	-2.3	2.9	0.9	-0.2
	mean direct effect	-3.7	9.6	0.2	-10.9	-2.2	-2.7
Column sums and weighted means	% of displaced workers	15.8	17.6	22.6	21.1	22.9	100.0
	mean Δ wage	-16.8	-12.3	-11.9	-2.8	11.3	-5.5
	mean Δ employer effect	-18.1	-6.9	-2.3	4.2	13.5	-0.6
	mean Δ match effect	2.5	-0.1	-3.2	-2.0	1.4	-0.5
	mean direct effect	-1.2	-5.3	-6.4	-5.0	-3.6	-4.4

Notes: This transition matrix shows the movement (and associated outcomes) of short-tenure displaced workers between employers with different fixed effects for wage rates. Employers are classified into quintiles by their AKM-estimated employer effects for wage rates. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all displaced workers making the given quintile-to-quintile transition, (ii) the mean log-point change in hourly wage rates of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after displacement. See the text for further discussion.

Source: Authors' calculations based on the short-tenure displaced worker sample described in this appendix, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A1-2

Below-, on-, and above-diagonal sums and weighted averages of inter-quintile transitions of short-tenure displaced workers and non-displaced job changers, 2008–2010, wage rates

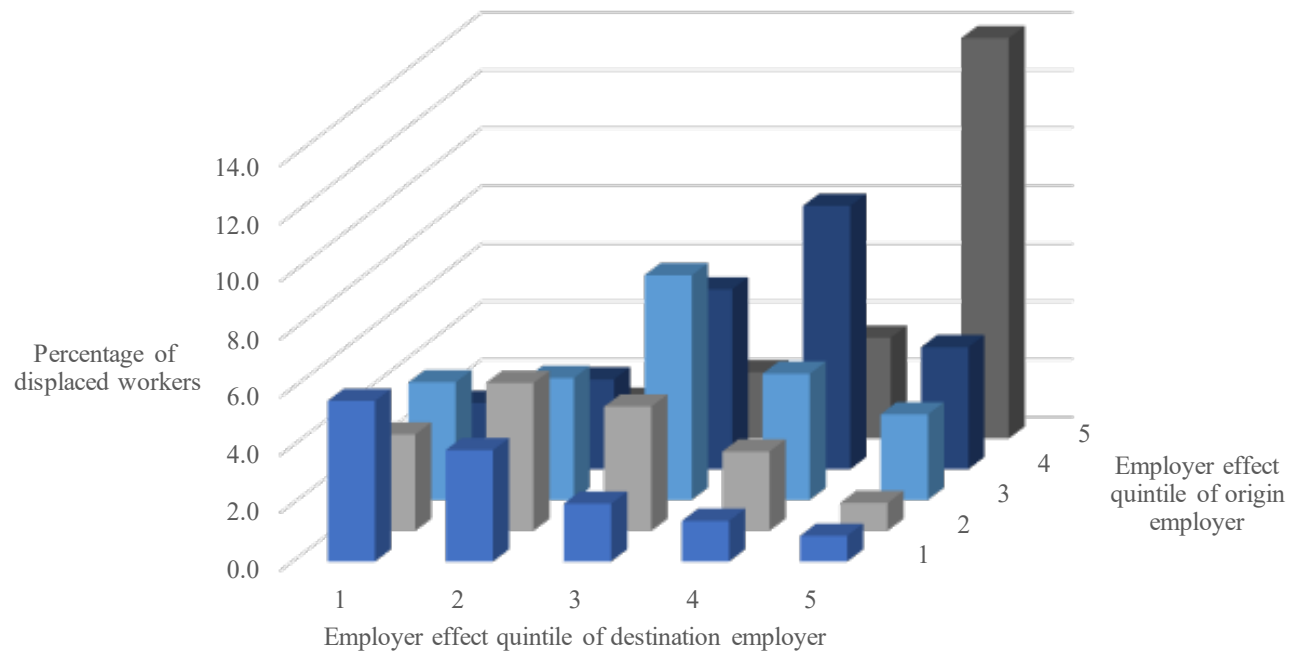
	Below-diagonal sums and means	On-diagonal sums and means	Above-diagonal sums and means
% of displaced workers	30.9	41.4	27.7
mean Δ wage	-23.7	-3.4	11.6
mean Δ employer effect	-20.1	0.1	20.0
mean Δ match effect	0.2	-0.2	-1.4
mean direct effect	-3.7	-3.3	-7.0
% of non-displaced job changers	25.7	42.0	32.4
mean Δ wage	-17.8	-1.2	16.7
mean Δ employer effect	-20.1	-0.5	20.5
mean Δ match effect	6.7	3.2	0.9
mean direct effect	-4.4	-3.9	-4.7

Notes: Figures in the “Below-diagonal sums and averages” column show sums (or weighted means) of cells in the transition matrices in Appendix Table A1-1 and Table 5 (in the main text) representing moves to an employer with a lower-quintile fixed effect for wage rates. Figures in the “On-diagonal” and “Above-diagonal” columns show sums or weighted means of the cells in the transition matrices representing moves to a same-quintile employer, or to a higher-quintile employer. Figures for both displaced workers and non-displaced job changers are based on a comparison of employment two years before and after displacement or job change.

Source: Authors’ calculations from data in Appendix Table A1-1 and Table 5 in the main text.

Figure A1-3

Inter-quintile employer transitions of short-tenure displaced workers, 2008–2010, wage rates

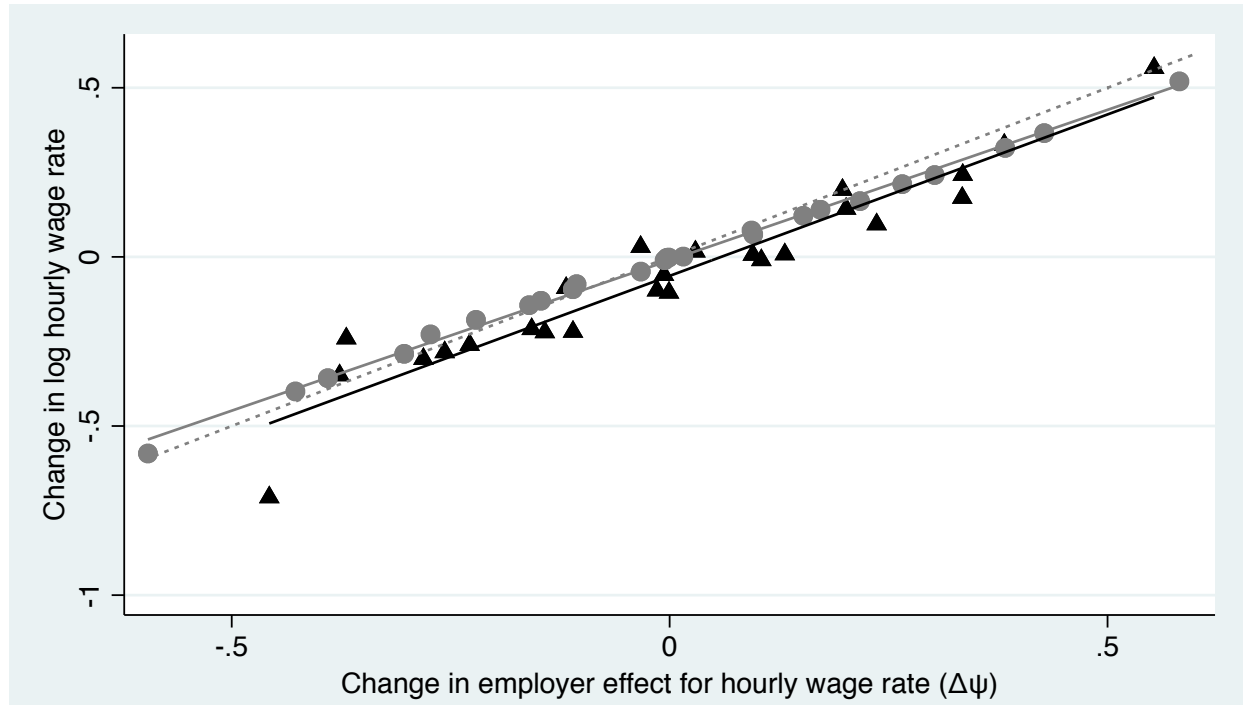


Notes: The histogram shows the percentage of short-tenure displaced workers making transitions among employer effect quintiles for wage rates.

Source: Data in Appendix Table A1-1.

Figure A1-4

Changes in hourly wage rates and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes: The dashed line is a 45° line.

For displaced workers the fitted equation is:

$$\Delta \ln(wage)^d = -0.056 + 0.955 \Delta \psi^d \quad R^2 = 0.910, \text{ RMSE} = 0.079, n = 25$$

(0.016) (0.062)

For non-displaced job changers the fitted equation is:

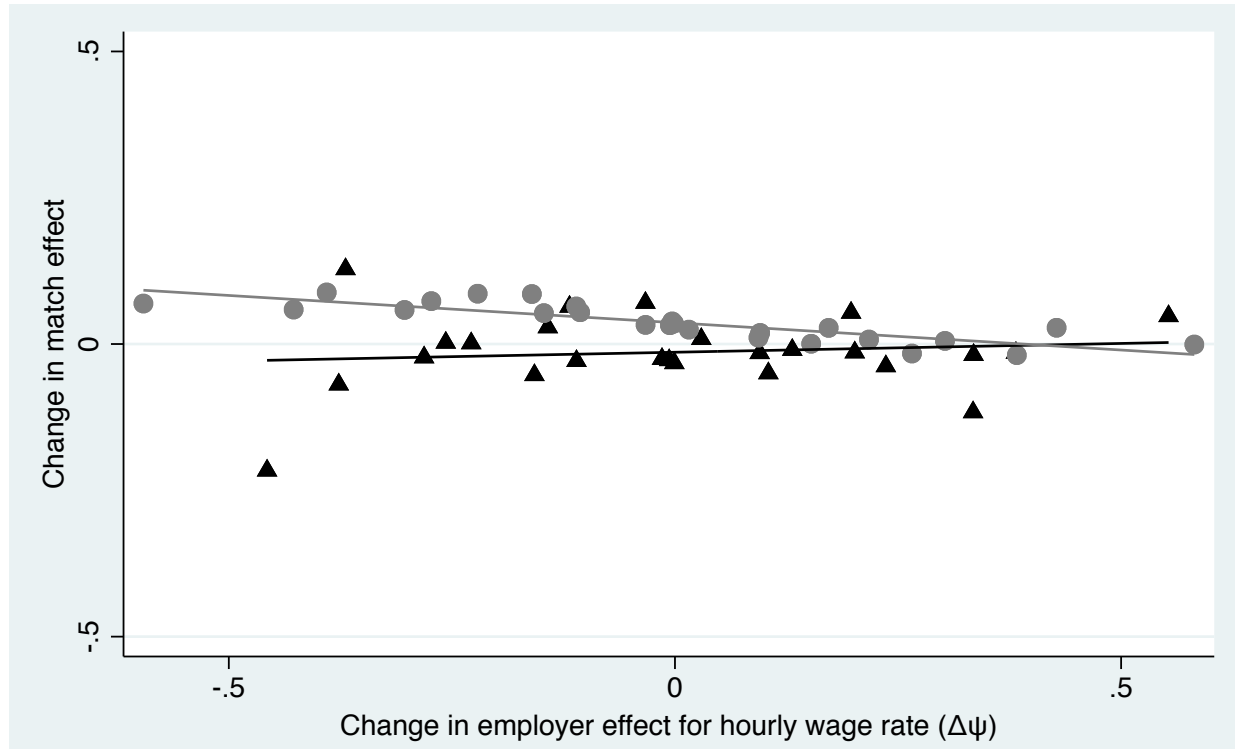
$$\Delta \ln(wage)^n = -0.010 + 0.889 \Delta \psi^n \quad R^2 = 0.997, \text{ RMSE} = 0.015, n = 25$$

(0.003) (0.011)

Source: Authors' calculations from the data in Appendix Table A1-1 and Table 5 in the main text.

Figure A1-5

Changes in match effects (μ for hourly wages) and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



For displaced workers the fitted equation is:

$$\Delta\mu^d = -0.014 + 0.030\Delta\psi^d \quad R^2 = 0.014, \text{ RMSE} = 0.067, n = 25$$

(0.013) (0.053)

For non-displaced job changers the fitted equation is:

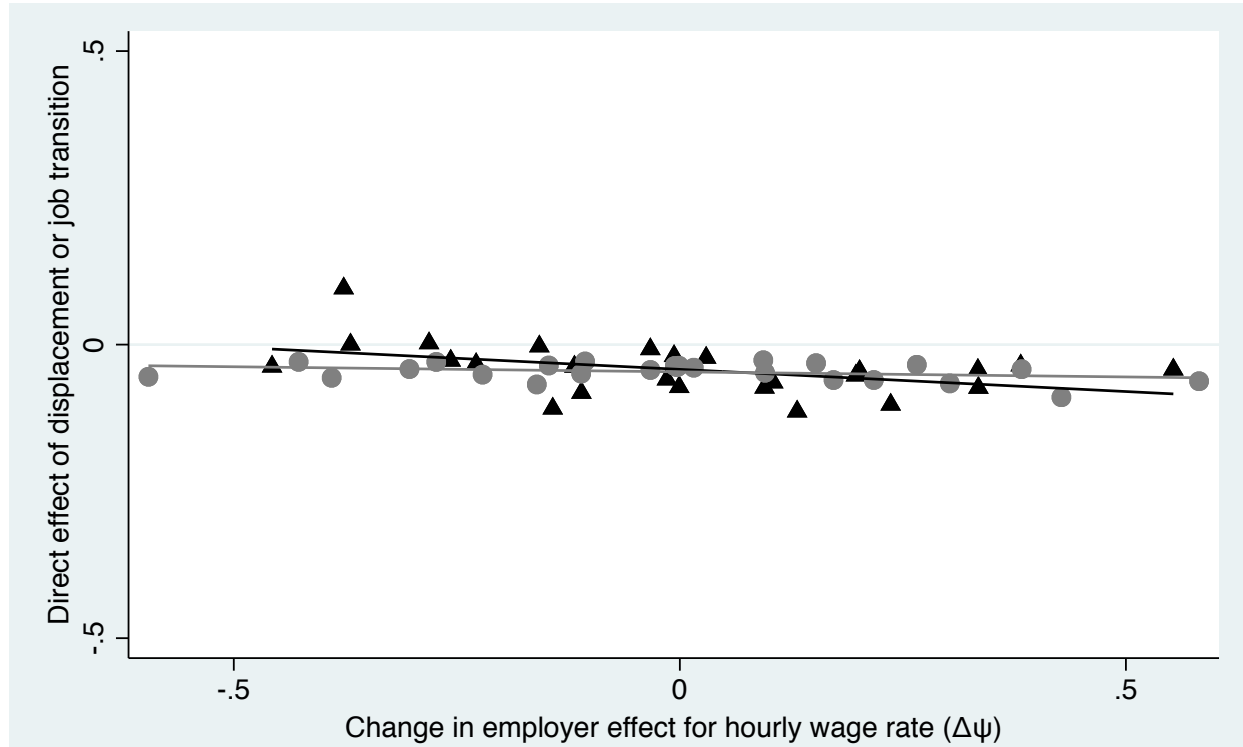
$$\Delta\mu^n = 0.036 - 0.093\Delta\psi^n \quad R^2 = 0.700, \text{ RMSE} = 0.018, n = 25$$

(0.004) (0.013)

Source: Authors' calculations from the data in Appendix Table A1-1 and Table 5 in the main text.

Figure A1-6

Changes in match effects (μ for hourly wages) and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



For displaced workers the fitted equation is:

$$\Delta\mu^d = -0.042 + 0.076\Delta\psi^d \quad R^2 = 0.202, \text{ RMSE} = 0.040, n = 25$$

(0.008) (0.031)

For non-displaced job changers the fitted equation is:

$$\Delta\mu^n = 0.046 - 0.017\Delta\psi^n \quad R^2 = 0.102, \text{ RMSE} = 0.015, n = 25$$

(0.003) (0.011)

Source: Authors' calculations from the data in Appendix Table A1-1 and Table 5 in the main text.

Appendix Table A1-3

Short-tenure displaced workers' inter-quintile employer transitions, earnings changes, employer effect changes, match effect changes, and direct displacement effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of displaced workers in cell	7.7	3.9	2.9	1.9	0.7	17.1
	mean Δ earnings	-21.5	-14.6	22.3	12.6	39.7	-6.1
	mean Δ employer effect	-0.3	28.9	45.9	65.0	84.4	25.0
	mean Δ match effect	2.1	-8.9	-10.7	-18.9	-33.4	-6.4
	mean direct effect	-23.4	-34.6	-12.9	-33.5	-11.3	-24.8
2	% of displaced workers in cell	2.1	6.3	1.9	1.1	0.7	12.1
	mean Δ earnings	-72.1	-20.2	-16.5	4.9	33.7	-23.5
	mean Δ employer effect	-44.8	1.4	21.1	33.4	54.0	2.1
	mean Δ match effect	2.3	-2.5	-12.1	-12.9	2.2	-3.8
	mean direct effect	-29.6	-19.0	-25.5	-15.6	-22.6	-21.8
3	% of displaced workers in cell	1.9	2.3	7.2	3.8	1.9	17.1
	mean Δ earnings	-86.5	-43.5	-17.4	-14.1	3.5	-25.5
	mean Δ employer effect	-53.8	-16.6	-1.2	12.7	33.6	-2.2
	mean Δ match effect	0.6	1.0	-2.1	-5.4	6.7	-1.1
	mean direct effect	-33.2	-27.9	-14.1	-21.3	-36.8	-22.2
4	% of displaced workers in cell	2.8	3.8	6.2	11.5	5.6	29.8
	mean Δ earnings	-85.5	-35.4	-38.4	-15.5	8.8	-24.8
	mean Δ employer effect	-60.4	-34.3	-15.4	-0.8	23.9	-9.0
	mean Δ match effect	14.4	1.5	-8.7	-0.9	-2.9	-1.1
	mean direct effect	-39.4	-2.5	-14.4	-13.8	-12.3	-14.6
5	% of displaced workers in cell	0.7	1.0	2.5	4.3	15.5	24.0
	mean Δ earnings	-149.1	-65.9	-53.1	-40.3	-18.5	-31.5
	mean Δ employer effect	-84.2	-51.7	-33.3	-16.7	3.5	-8.6
	mean Δ match effect	-11.1	6.0	2.2	2.6	0.5	1.0
	mean direct effect	-53.8	-20.1	-22.1	-26.2	-22.5	-23.9
Column sums and weighted means	% of displaced workers	15.2	17.2	20.6	22.6	24.4	100.0
	mean Δ earnings	-54.0	-27.9	-22.4	-16.6	-7.4	-23.2
	mean Δ employer effect	-27.9	-5.6	-0.7	5.6	14.3	-0.6
	mean Δ match effect	3.6	-2.1	-5.6	-3.1	-0.7	-1.9
	mean direct effect	-29.7	-20.1	-16.0	-19.2	-21.0	-20.7

Notes: This transition matrix shows the movement (and associated outcomes) of short-tenure displaced workers between employers with different fixed effects for earnings. Employers are classified into quintiles by their AKM-estimated employer effects for earnings. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all displaced workers making the given quintile-to-quintile transition, (ii) the mean log-point change in earnings of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after displacement. See the text for further discussion.

Source: Authors' calculations based on the short-tenure displaced worker sample described in this appendix, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A1-4

Below-, on-, and above-diagonal sums and weighted averages of inter-quintile transitions of short-tenure displaced workers and non-displaced job changers, 2008–2010, earnings

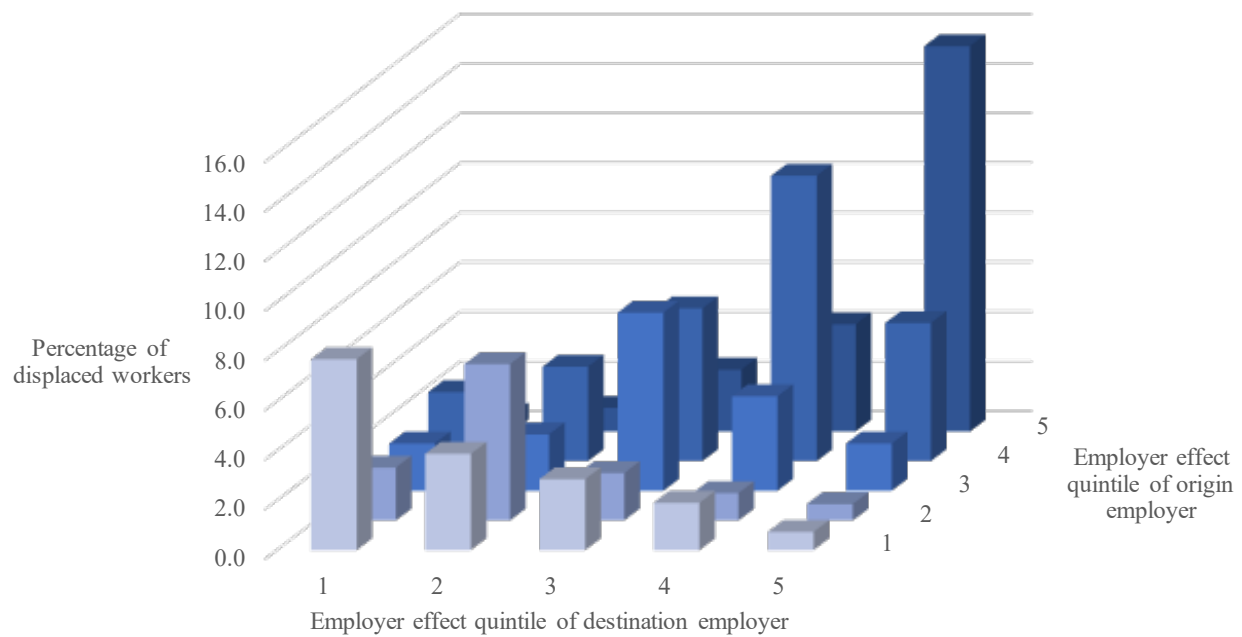
	Below-diagonal sums and means	On-diagonal sums and means	Above-diagonal sums and means
% of displaced workers	27.5	48.2	24.3
mean Δ earnings	-54.4	-18.3	2.4
mean Δ employer effect	-32.4	0.9	32.4
mean Δ match effect	0.6	-0.3	-7.6
mean direct effect	-22.6	-18.8	-22.4
% of non-displaced job changers	21.2	47.8	31.0
mean Δ earnings	-21.6	0.3	23.2
mean Δ employer effect	-27.8	0.7	29.9
mean Δ match effect	10.8	3.6	-1.1
mean direct effect	-4.4	-4.0	-6.6

Notes: Figures in the “Below-diagonal sums and averages” column show sums (or weighted means) of cells in the transition matrices in Appendix Tables A1-3 and A9-2 representing moves to an employer with a lower-quintile fixed effect for earnings. Figures in the “On-diagonal” and “Above-diagonal” columns show sums or weighted means of the cells in the transition matrices representing moves to a same-quintile employer, or to a higher-quintile employer. Figures for both displaced workers and non-displaced job changers are based on a comparison of employment two years before and after displacement or job change.

Source: Authors’ calculations from data in Appendix Tables A1-3 and A9-2.

Figure A1-7

Inter-quintile employer transitions of short-tenure displaced workers, 2008–2010, earnings



Notes: The histogram shows the percentage of short-tenure displaced workers making transitions among employer effect quintiles for earnings.

Source: Data in Table A1-3.

Figure A1-8

Changes in earnings and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes: The dashed line is a 45° line.

For displaced workers the fitted equation is:

$$\Delta \ln(\text{earnings})^d = -0.271 + 0.959\Delta\psi^d \quad R^2 = 0.901, \text{ RMSE} = 0.136, n = 25$$

(0.027) (0.066)

For non-displaced job changers the fitted equation is:

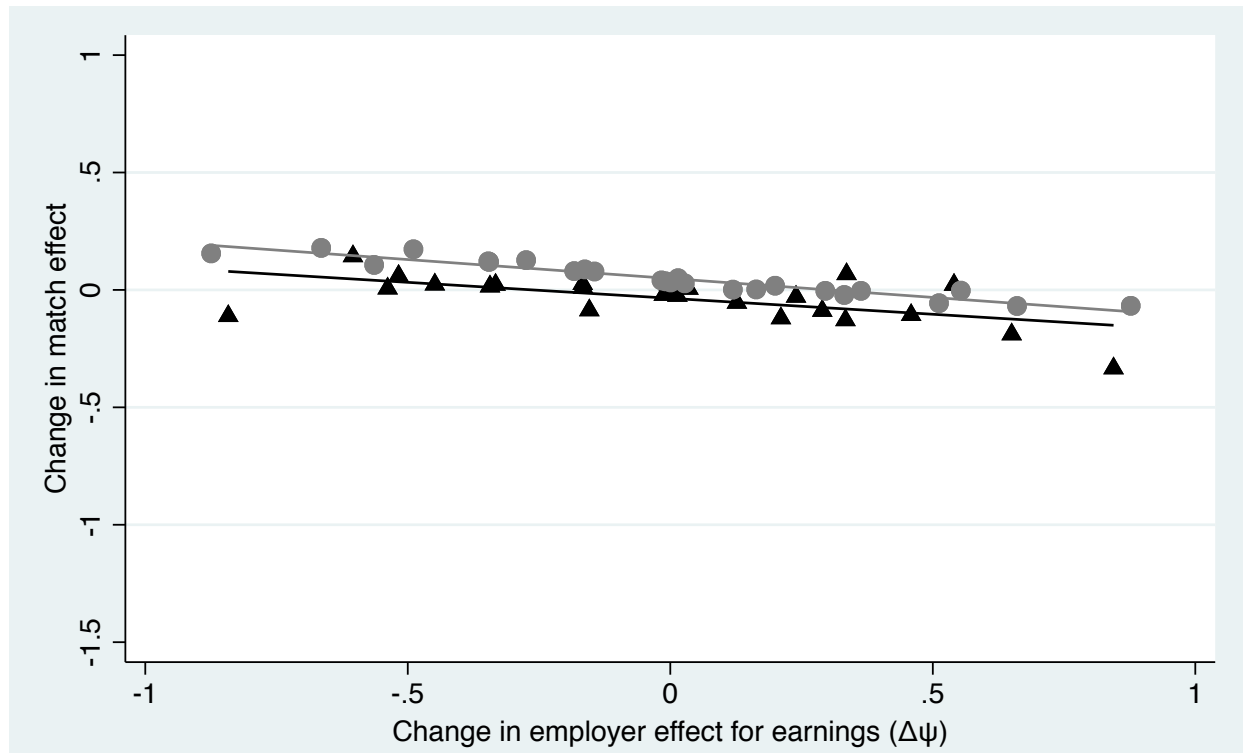
$$\Delta \ln(\text{earnings})^n = -0.011 + 0.804\Delta\psi^n \quad R^2 = 0.992, \text{ RMSE} = 0.031, n = 25$$

(0.006) (0.015)

Source: Authors' calculations from the data in Tables A1-3 and A9-2.

Figure A1-9

Changes in match effects (μ for earnings) and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



For displaced workers the fitted equation is:

$$\Delta\mu^d = -0.036 - 0.136\Delta\psi^d \quad R^2 = 0.349, \text{ RMSE} = 0.079, n = 25$$

(0.016) (0.039)

For non-displaced job changers the fitted equation is:

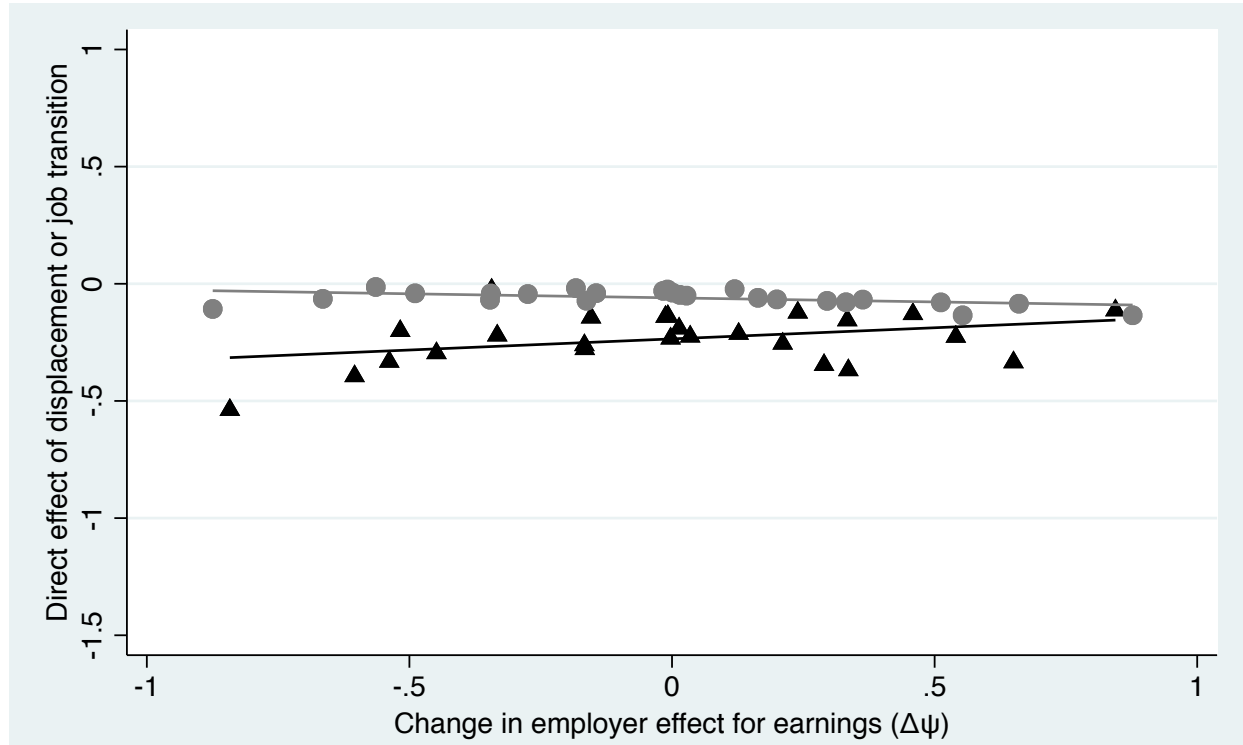
$$\Delta\mu^n = 0.049 - 0.161\Delta\psi^n \quad R^2 = 0.905, \text{ RMSE} = 0.023, n = 25$$

(0.005) (0.011)

Source: Authors' calculations from the data in Tables A1-3 and A9-2.

Figure A1-10

Direct effects of displacement or job transition (d for earnings) and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



For displaced workers the fitted equation is:

$$\Delta d^d = -0.235 + 0.095\Delta\psi^d \quad R^2 = 0.129, \text{ RMSE} = 0.105, n = 25$$

(0.021) (0.051)

For non-displaced job changers the fitted equation is:

$$\Delta d^n = -0.060 - 0.035\Delta\psi^n \quad R^2 = 0.568, \text{ RMSE} = 0.020, n = 25$$

(0.006) (0.014)

Source: Authors' calculations from the data in Tables A1-3 and A9-2.

Appendix Table A1-5

Short-tenure displaced workers' inter-quintile employer transitions, hours changes, employer effect changes, match effect changes, and direct displacement effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of displaced workers in cell	8.4	3.8	2.9	2.0	1.5	18.5
	mean Δ hours	-20.4	-4.9	-20.1	28.5	26.8	-8.1
	mean Δ employer effect	-2.3	20.7	33.7	41.0	51.2	17.0
	mean Δ match effect	-2.2	-3.8	-16.1	-12.3	-3.8	-5.9
	mean direct effect	-15.9	-21.8	-37.7	-0.2	-20.6	-19.2
2	% of displaced workers in cell	1.7	6.4	1.4	1.6	1.9	13.0
	mean Δ hours	-83.5	-25.0	-12.6	0.6	19.0	-21.9
	mean Δ employer effect	-29.1	-0.5	10.3	17.7	26.6	3.1
	mean Δ match effect	4.5	-1.2	1.0	-11.7	-11.9	-3.0
	mean direct effect	-58.9	-23.4	-23.8	-5.4	4.3	-21.9
3	% of displaced workers in cell	2.5	4.2	8.1	4.7	4.8	24.4
	mean Δ hours	-76.9	-31.3	-14.5	-13.9	-4.6	-21.8
	mean Δ employer effect	-34.3	-11.9	-0.2	7.0	14.5	-1.5
	mean Δ match effect	-5.4	5.7	0.3	-1.8	-7.0	-1.2
	mean direct effect	-37.1	-25.0	-14.5	-19.1	-12.1	-19.1
4	% of displaced workers in cell	1.2	2.0	4.2	7.6	5.1	20.1
	mean Δ hours	-63.2	-58.1	-20.7	-13.0	-5.8	-20.2
	mean Δ employer effect	-49.2	-19.5	-6.8	0.0	7.5	-4.4
	mean Δ match effect	3.0	2.5	3.0	-0.2	-1.8	0.5
	mean direct effect	-17.1	-41.1	-16.8	-12.7	-11.4	-16.3
5	% of displaced workers in cell	1.4	2.4	2.8	7.3	10.1	24.0
	mean Δ hours	-76.1	-42.9	-22.1	-14.6	-8.4	-19.3
	mean Δ employer effect	-50.1	-24.1	-12.5	-4.9	0.9	-7.9
	mean Δ match effect	21.7	-1.5	2.5	-0.4	-0.3	1.2
	mean direct effect	-47.7	-17.3	-12.1	-9.3	-9.0	-12.5
Column sums and weighted means	% of displaced workers	15.2	18.8	19.5	23.2	23.3	100.0
	mean Δ hours	-45.4	-28.2	-17.6	-9.2	-2.7	-18.4
	mean Δ employer effect	-18.7	-3.8	2.4	4.6	10.3	0.4
	mean Δ match effect	0.7	0.2	-1.2	-2.4	-3.2	-1.4
	mean direct effect	-27.3	-24.6	-18.8	-11.3	-9.8	-17.3

Notes: This transition matrix shows the movement (and associated outcomes) of short-tenure displaced workers between employers with different fixed effects for quarterly work hours. Employers are classified into quintiles by their AKM-estimated employer effects for hours. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all displaced workers making the given quintile-to-quintile transition, (ii) the mean log-point change in hours of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after displacement. See the text for further discussion.

Source: Authors' calculations based on the short-tenure displaced worker sample described in this appendix, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A1-6

Below-, on-, and above-diagonal sums and weighted averages of inter-quintile transitions of short-tenure displaced workers and non-displaced job changers, 2008–2010, hours

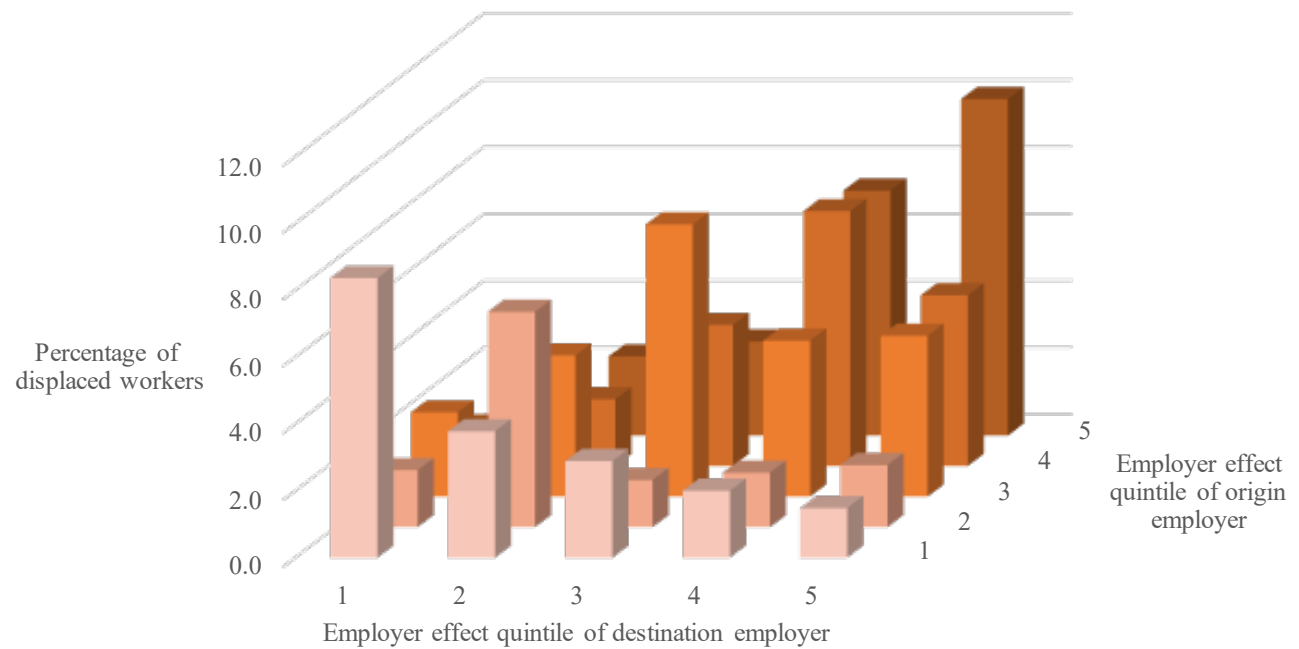
	Below-diagonal sums and means	On-diagonal sums and means	Above-diagonal sums and means
% of displaced workers	29.8	40.6	29.6
mean Δ hours	-37.8	-15.6	-2.6
mean Δ employer effect	-17.2	-0.4	19.1
mean Δ match effect	2.4	-0.7	-6.2
mean direct effect	-22.9	-14.5	-15.6
% of non-displaced job changers	23.9	41.4	34.7
mean Δ hours	-14.4	1.1	16.8
mean Δ employer effect	-17.0	0.6	18.9
mean Δ match effect	2.6	0.1	-1.4
mean direct effect	0.0	0.3	-0.7

Notes: Figures in the “Below-diagonal sums and averages” column show sums (or weighted means of) cells in the transition matrices in the Tables A1-5 and A9-5 representing moves to an employer with a lower-quintile fixed effect for quarterly work hours. Figures in the “On-diagonal” and “Above-diagonal” columns show sums or weighted means of the cells in the transition matrices representing moves to a same-quintile employer, or to a higher-quintile employer. Figures for both displaced workers and non-displaced job changers are based on a comparison of employment two years before and after displacement or job change.

Source: Authors’ calculations from data in Tables A1-5 and A9-5.

Figure A1-11

Inter-quintile employer transitions of short-tenure displaced workers, 2008–2010, hours

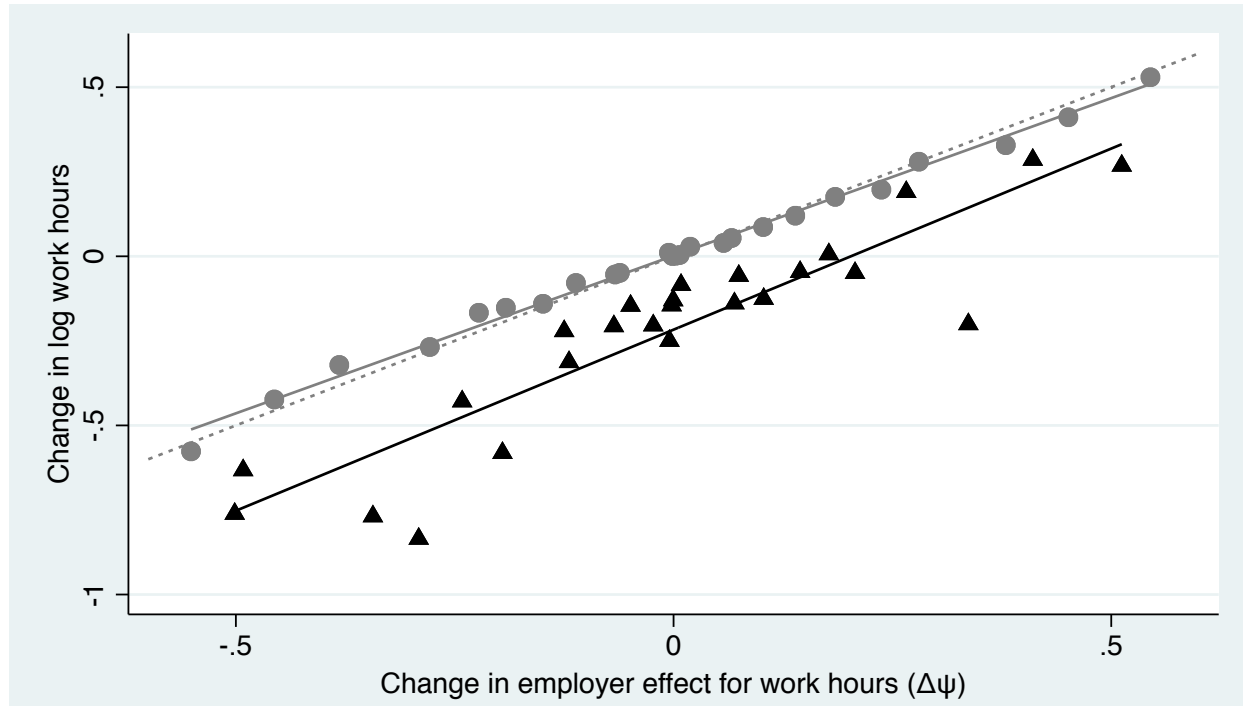


Notes: The histogram shows the percentage of short-tenure displaced workers making transitions among employer effect quintiles for quarterly work hours.

Source: Data in Table A1-5.

Figure A1-12

Changes in hours and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes: The dashed line is a 45° line.

For displaced workers the fitted equation is:

$$\Delta \ln(hours)^d = -0.217 + 1.070\Delta\psi^d \quad R^2 = 0.821, \text{ RMSE} = 0.130, n = 25$$

(0.026) (0.104)

For non-displaced job changers the fitted equation is:

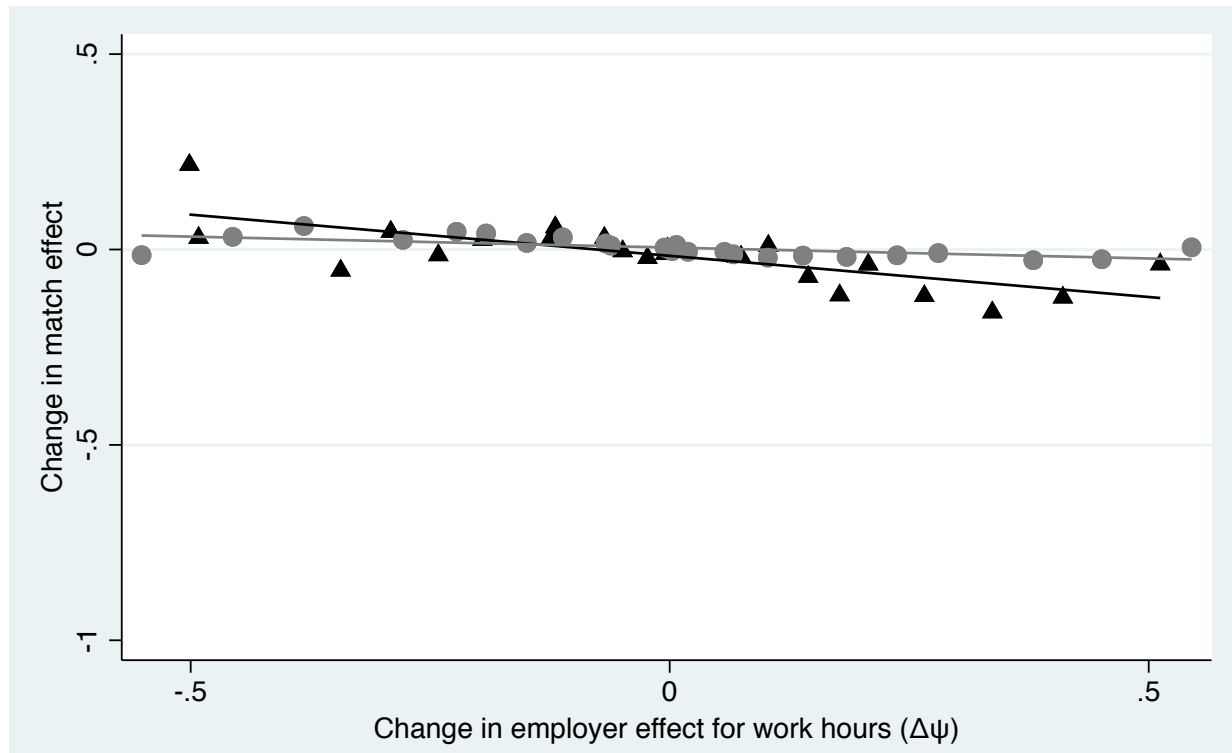
$$\Delta \ln(hours)^n = 0.002 + 0.932\Delta\psi^n \quad R^2 = 0.993, \text{ RMSE} = 0.022, n = 25$$

(0.004) (0.017)

Source: Authors' calculations from the data in Tables A1-5 and A9-5.

Figure A1-13

Changes in match effects (μ for hours) and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



For displaced workers the fitted equation is:

$$\Delta\mu^d = -0.016 - 0.211\Delta\psi^d \quad R^2 = 0.530, \text{ RMSE} = 0.052, n = 25$$

(0.010) (0.041)

For non-displaced job changers the fitted equation is:

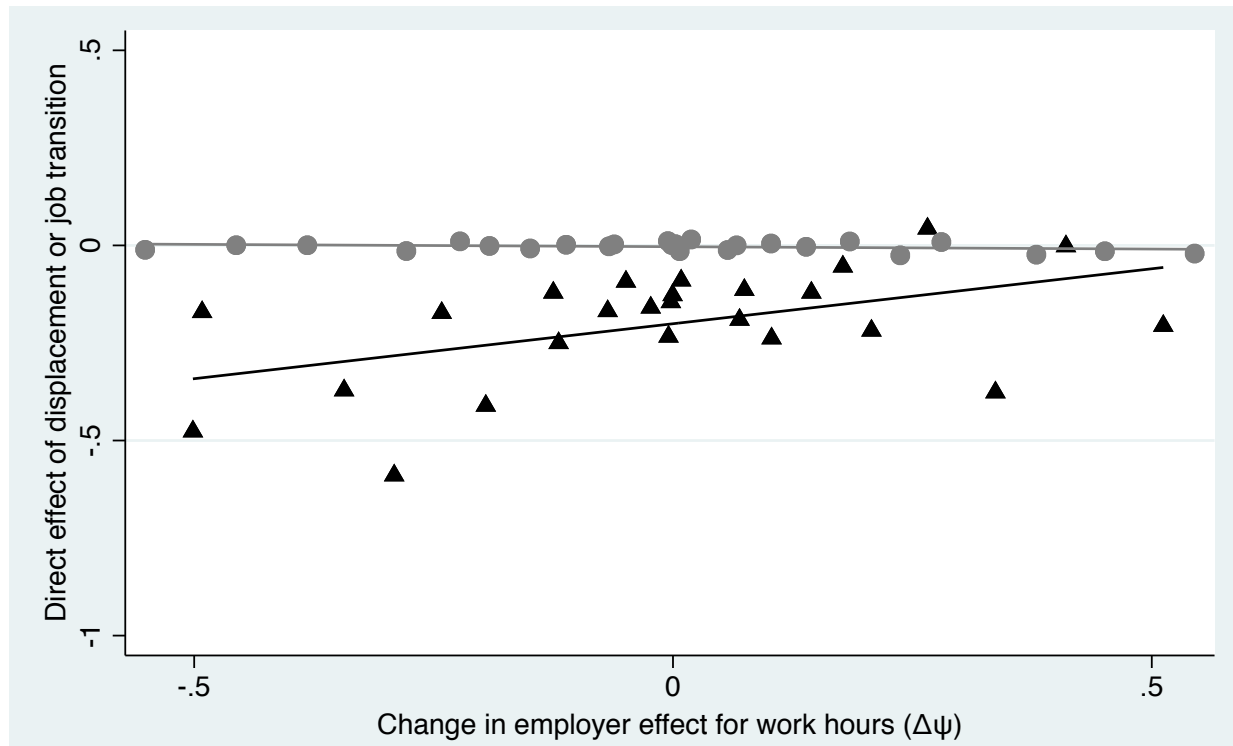
$$\Delta\mu^n = 0.005 - 0.056\Delta\psi^n \quad R^2 = 0.404, \text{ RMSE} = 0.019, n = 25$$

(0.004) (0.014)

Source: Authors' calculations from the data in Tables A1-5 and A9-5.

Figure A1-14

Direct effects of displacement or job transition (d for hours) and changes in employer effects (ψ) for short-tenure displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



For displaced workers the fitted equation is:

$$\Delta d^d = -0.201 + 0.282\Delta\psi^d \quad R^2 = 0.241, \text{ RMSE} = 0.130, n = 25$$

(0.026) (0.104)

For non-displaced job changers the fitted equation is:

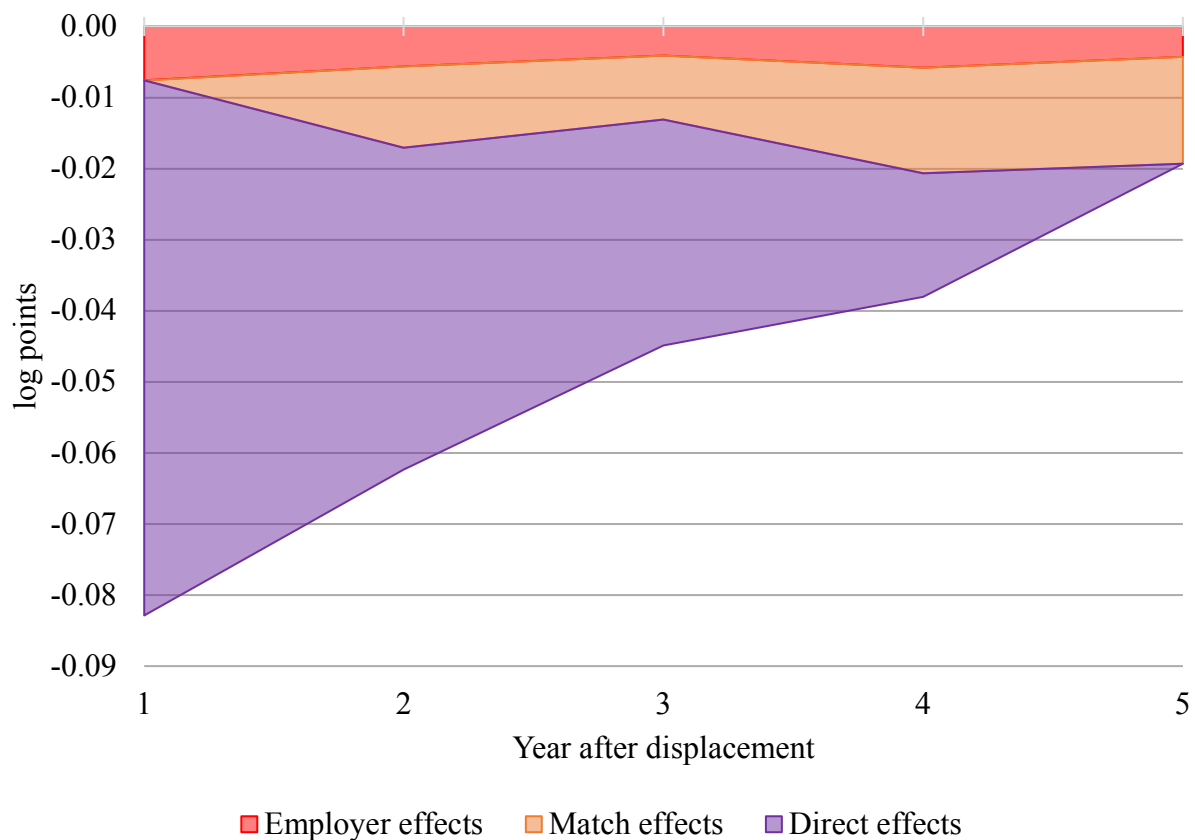
$$\Delta d^n = -0.003 - 0.012\Delta\psi^n \quad R^2 = 0.082, \text{ RMSE} = 0.011, n = 25$$

(0.002) (0.008)

Source: Authors' calculations from the data in Tables A1-5 and A9-5.

Figure A1-15

Decomposition of hourly wage rate reductions after displacement, short-tenure displaced workers



Notes: The figure illustrates the decomposition of short-tenure displaced workers' log hourly wage rate reductions following displacement into portions attributable to lost employer fixed effects, lost worker-employer match quality [estimated using Woodcock's (2015) method], and direct displacement effects. See Sections IV.C and V of the main text for further discussion. The losses are annual averages based on quarterly estimates.

Source: Authors' calculations based on data underlying Figures A1-1 and A1-2.

Appendix A.2

Unemployment rates in Washington, Connecticut, Pennsylvania, and the United States, selected time periods

This appendix compares the United States national unemployment rate with that in Washington in 2002–2014 (Appendix Figure A2-1), Connecticut in 1993–2004 (Appendix Figure A2-2), and Pennsylvania in 1974–1986 (Appendix Figure A2-3)—the states and years examined in this paper, by Couch and Placzek (2010), and by Jacobson, LaLonde and Sullivan (1993a, 1993b), respectively.

Appendix Figure A2-1 shows that the unemployment rate in Washington improved relative to the US national average in the recovery leading up to the 2008–2010 recession, then fell somewhat below the national average during the recession itself. However, the Washington unemployment rate peaked above the national rate and remained above the national rate until mid 2012. Overall, the Great Recession in Washington appears to have reflected the national experience with a lag of a few months.

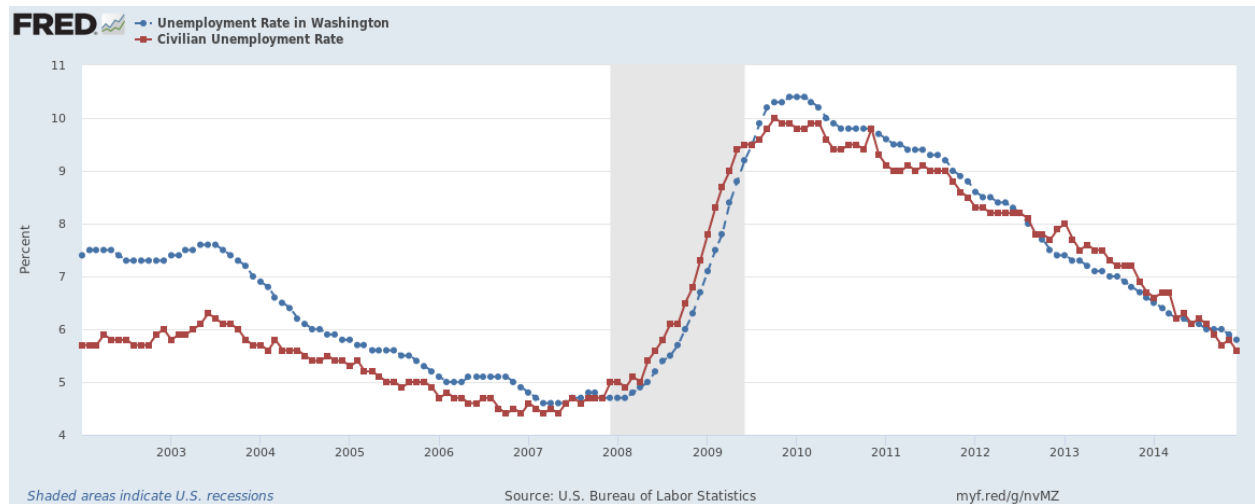
In contrast, the 2001 recession in Connecticut appears to have followed a different pattern than the national downturn—see Appendix Figure A2-2. Connecticut’s unemployment rate was 1–2 percentage points lower than the national average throughout the recession, then increased relative to the national average, peaking about 1 percentage point below the national average in 2003. Connecticut, then, started the recession in a substantially better position than the national labor market, then became more like the national labor market over the next two years.

Appendix Figure A2-3 shows that the double-dip recession of the early 1980s was especially severe in Pennsylvania, even compared with the national experience. Pennsylvania’s unemployment rate started the 1980 recession nearly one percentage point above the national

average, then increased by nearly an additional point relative to the national average—which itself increased by four percentage points.

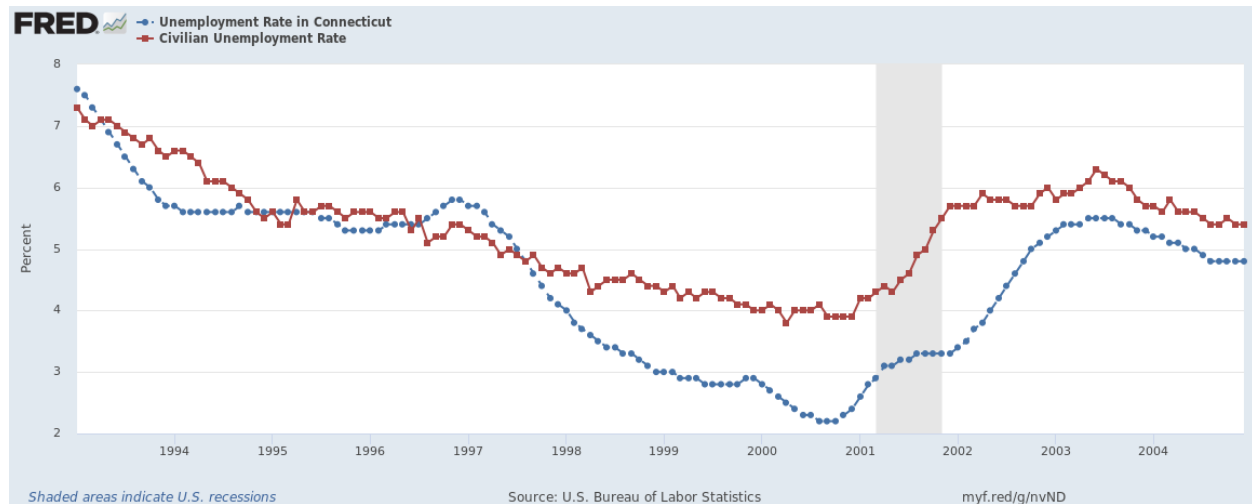
In summary, of the three recessions studied by us, Couch and Placzek (2010), and Jacobson, LaLonde, and Sullivan (1993a, 1993b), the Washington experience during the Great Recession appears to have reflected the national experience most closely, and the Pennsylvania experience during the double-dip recession of the early 1980s was the most severe both absolutely and relative to the national average.

Appendix Figure A2-1
Civilian monthly unemployment rate, Washington and United States, 2002–2014



Source: U.S. Bureau of Labor Statistics, Unemployment Rate in Washington [WAUR], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/WAUR>, April 29, 2020; U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/UNRATE>, April 29, 2020.

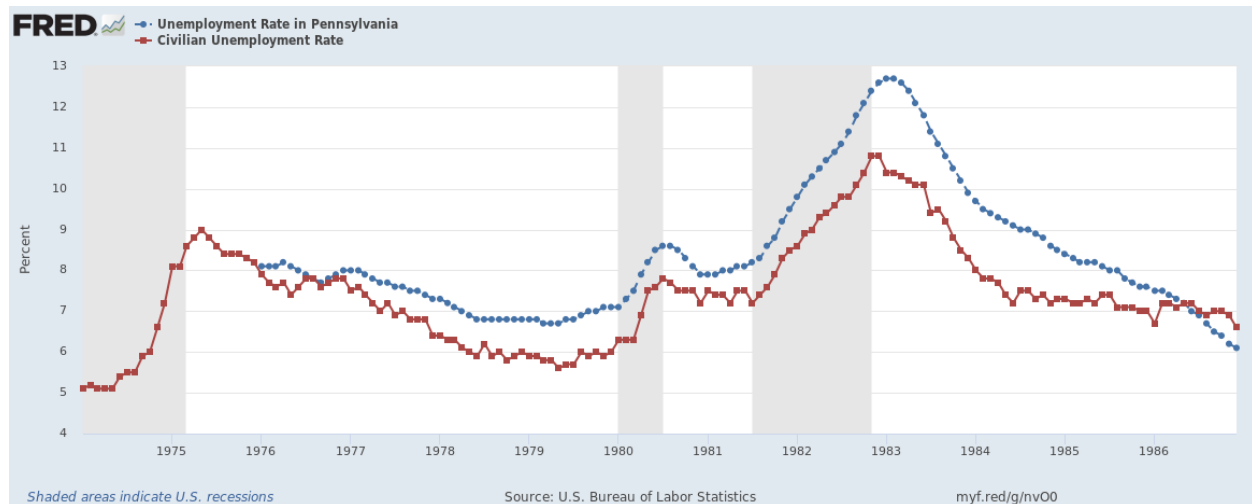
Appendix Figure A2-2
Civilian monthly unemployment rate, Connecticut and United States, 1993–2004



Source: U.S. Bureau of Labor Statistics, Unemployment Rate in Connecticut [CTUR], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/CTUR>, April 29, 2020; U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/UNRATE>, April 29, 2020.

Appendix Figure A2-3

Civilian monthly unemployment rates, Pennsylvania and United States, 1974–1986



Note: The unemployment rate in Pennsylvania is only available from 1976.

Source: U.S. Bureau of Labor Statistics, Unemployment Rate in Pennsylvania [PAUR], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/PAUR>, April 29, 2020. U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/UNRATE>, April 29, 2020.

Appendix A.3

Estimated losses of displaced workers including those less strongly attached to the labor force

The estimates in Figures 2, 3, and 5 of the main text are based on the UI claimant sample, which is restricted to displaced workers who were strongly attached to the labor force; that is, were employed in at least one quarter per calendar year in each year following displacement.

Relaxing the restriction of strong attachment, so that a displaced worker need not have positive earnings in at least one quarter per year after being displaced, results in an additional 1,511 displaced workers. These 1,511 displaced workers are assigned zero earnings and hours in quarters when their earnings and hours are missing and are then added to the UI claimant sample, yielding a total sample of 4,201. (Necessarily, zero values are dropped from the analysis when using outcomes in logarithmic form, resulting in an unbalanced panel.) To be clear, these 1,511 displaced workers claimed UI at some time during 2002–2014, so we observe their demographic characteristics.

Appendix Table A3-1 displays the descriptive statistics of both the 2,690 displaced workers in the UI claimant sample and the 1,511 additional displaced workers who were less strongly attached to the labor force. On average, the 1,511 less strongly attached displaced workers had higher pre-displacement earnings and wage rates than the UI claimant sample, and they were more likely to have a bachelor's or advanced degree. Of these 1,511 displaced workers, only 26 were **never** observed with positive earnings after being displaced. Compared with the UI claimant sample workers, these 26 workers also had higher pre-displacement earnings and wage rates, and again had higher educational attainment.³

³ That only 26 displaced workers never had any positive earnings after displacement may be surprising; however, these workers had at least six years of job tenure before displacement and were no older than 50 at the time of displacement, so they were strongly attached to the labor force. Jacobson, LaLonde, and Sullivan (1993b, p 16) also find that labor force withdrawal is rare among long-tenure prime-age workers.

Appendix Figure A3-1 plots the estimated time paths of lost log earnings, log hours, and log wage rates for the augmented sample, consisting of the main UI claimant sample plus the sample of less attached displaced workers (squares), along with the time paths of earnings, work hours, and wage rates for the main displaced worker sample (circles, repeated from Figures 2, 3, and 5 in the main text)—see also row 4 of Appendix Table A. The comparison group used to obtain the estimated losses of the augmented sample is the same 13,291 continuously employed workers who were used to obtain the main estimates.

Estimates based on the augmented sample differ in two main ways from those based on the main UI claimant sample. First, five years after displacement, work hours of the augmented sample were 11.6 log points lower than those of the comparison group, compared with 4.7 log points lower in the main UI claimant sample (compare rows 1 and 4 of Appendix Table A). Earnings losses were also larger by nearly 25 log points in the augmented sample, compared with 16.4 log points lower in the baseline sample.⁴ Second, relative to the comparison group, the probability of employment (positive earnings or hours in a quarter) five years after displacement was 18 percent less for the augmented sample, compared with 3 percent less for the main UI claimant sample.

Given the above differences, it is somewhat surprising that the average hourly wage rate losses are quite similar for the main UI claimant sample and the augmented sample—11.5 log points for the former, 13.4 log points for the latter.

⁴ When Couch and Placzek (2010, p. 579) relax the labor force attachment restriction, they find earnings losses that are greater by 15–18 percentage points, substantially larger than the 9 log-point increase we estimate.

Appendix Table A3-1

Sample descriptive statistics for UI claimant sample (2,690 workers), additional displaced workers who did not have positive earnings once per calendar year after being displaced (1,511 workers), and displaced workers who never had positive post-displacement earnings (26 workers)

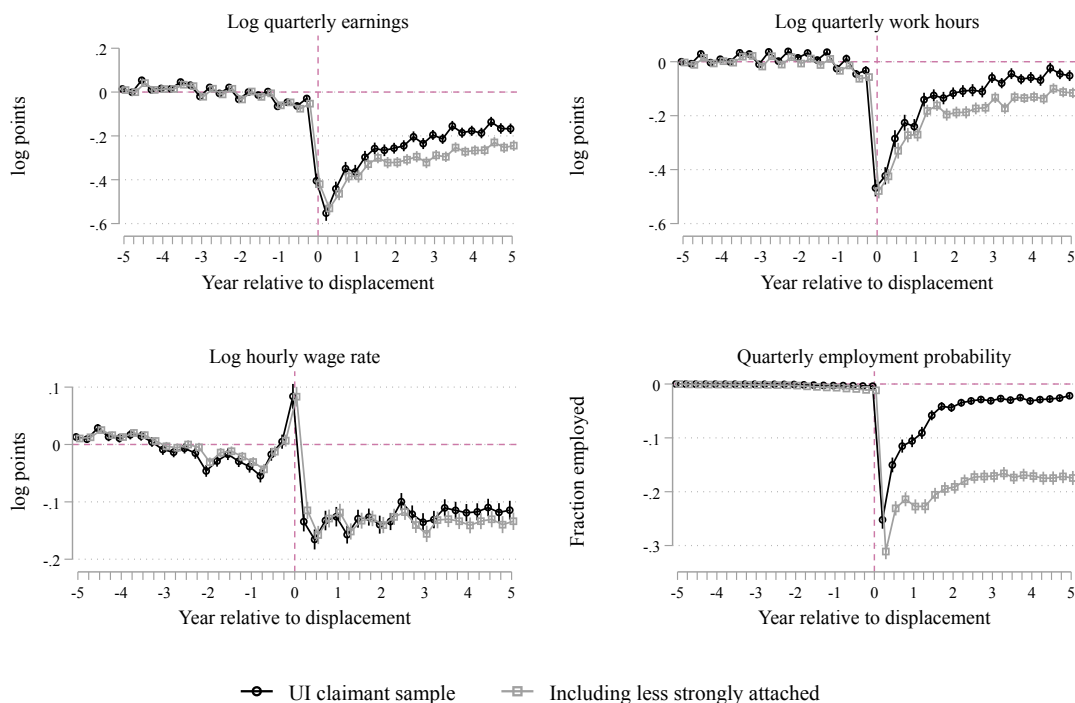
	(1)	(2)	(3)
	Displaced workers		
	UI claimant sample	Workers not required to have earnings > 0 at least one quarter per year post-displacement	Workers with no earnings > 0 post-displacement
<i>Quarterly average earnings, hours, and wage rates, 2002–2005</i>			
Earnings (2010 dollars)	13,349 (6,466)	14,575 (8,063)	14,861 (9,499)
Paid work hours	519 (82)	511 (82)	506 (66)
Hourly wage rate (2010 dollars/hour)	58.00 (43.12)	69.19 (47.21)	63.52 (47.63)
<i>Worker characteristics, 2007:IV</i>			
Female (proportion)	0.286	0.372	0.269
Race (proportions)			
White, not Hispanic	0.779	0.767	0.769
Black, not Hispanic	0.030	0.033	0.038
Hispanic	0.073	0.071	0.077
Asian/Pacific Islander	0.071	0.074	0.038
American Indian or Alaskan Native	0.013	0.016	0.038
Missing, unknown, or not available	0.035	0.040	0.038
Schooling (proportions)			
less than high school	0.080	0.060	0.154
GED	0.031	0.029	0.000
high school graduate	0.465	0.390	0.231
some college	0.149	0.154	0.115
associate's degree	0.124	0.130	0.154
bachelor's degree	0.125	0.162	0.269
master's/PhD	0.026	0.047	0.077
Age (years)	39.45 (6.46)	40.42 (6.36)	40.58 (6.09)
<i>Employer characteristics in 2007:IV</i>			
Employer size (number of workers)	2,042 (2,578)	1,971 (2,439)	1,244 (1,800)
NAICS Industry (proportions)			
11 agriculture, forestry, fishing	0.016	0.009	0.000
21–23 mining, utilities, construction	0.088	0.068	0.039
31–33 manufacturing	0.277	0.275	0.423
42–49 trade, transportation	0.160	0.144	0.192
51–56 information, finance, prof. services	0.377	0.427	0.269
61–62 educational and health care services	0.013	0.013	0.000
71–72 arts, recreation, hospitality services	0.055	0.052	0.077
81 other services	0.007	0.060	0.000
92–99 public administration and unclassified	0.007	0.053	0.000
Number of employers (pre- and post-displacement)	3,493	1,984	39
Number of workers	2,690	1,511	26

Notes: Standard deviations in parentheses. Categorical variables displayed in the table are mutually exhaustive, but due to rounding errors may not add to 100 percent. The 26 workers who were never observed with positive post-displacement earnings (column 3) are included with the 1,511 workers in column (2).

Source: Authors' tabulations of Washington administrative wage and claims records. See Section I.A of the main text for details of the UI claimant sample construction.

Appendix Figure A3-1

Estimated displacement effects, including workers less strongly attached to the labor force



Notes: The figures show estimated displacement effects for the UI claimant sample (circles, repeated from Figures 2, 3, and 5 of the main text, $N = 2,690$) and for the UI claimant sample augmented by displaced workers not required to be observed with positive earnings or hours after being displaced (squares, $N = 4,201$, the sum of the UI claimant sample and the displaced workers less strongly attached to the labor force). The whiskers denote 95-percent confidence intervals clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records. See Sections II.A, III.A, and III.B of the main text for details.

Appendix A.4

Estimates using an alternative comparison group

The comparison group used by Jacobson, LaLonde, and Sullivan (1993a, 1993b) included only workers continuously employed with their primary employer throughout the observation period (in our case, 2002–2014). As Krolikowski (2018) points, this could lead to an overstatement of displaced workers’ losses. Accordingly, we estimate equation (1) in the main text using a comparison group of long-tenure workers (employed by the same primary employer during 2002–2007) who continued with the same employer (were not displaced) during 2008–2010, but who may have changed employers or separated from their primary employer sometime after 2010. We interpret the estimates obtained using this alternative comparison group as a lower bound of the effects of displacement.

Appendix Figures A4-1–A4.3 show the results of estimating equation (1) for earnings, hours, and hourly wage rates, using this alternative comparison group—see also row 5 of Appendix Table A. The short-term losses are similar to those in Figures 2, 3, and 5: In the quarter after displacement, earnings dropped by 48 log points (compared with 55 log point using the continuously employed comparison group), hours dropped by 38 log points (compared with 42 log points using the continuously employed comparison group), and wage rates were lower by 11 log points (compared with about 13 log points using the continuously employed comparison group).

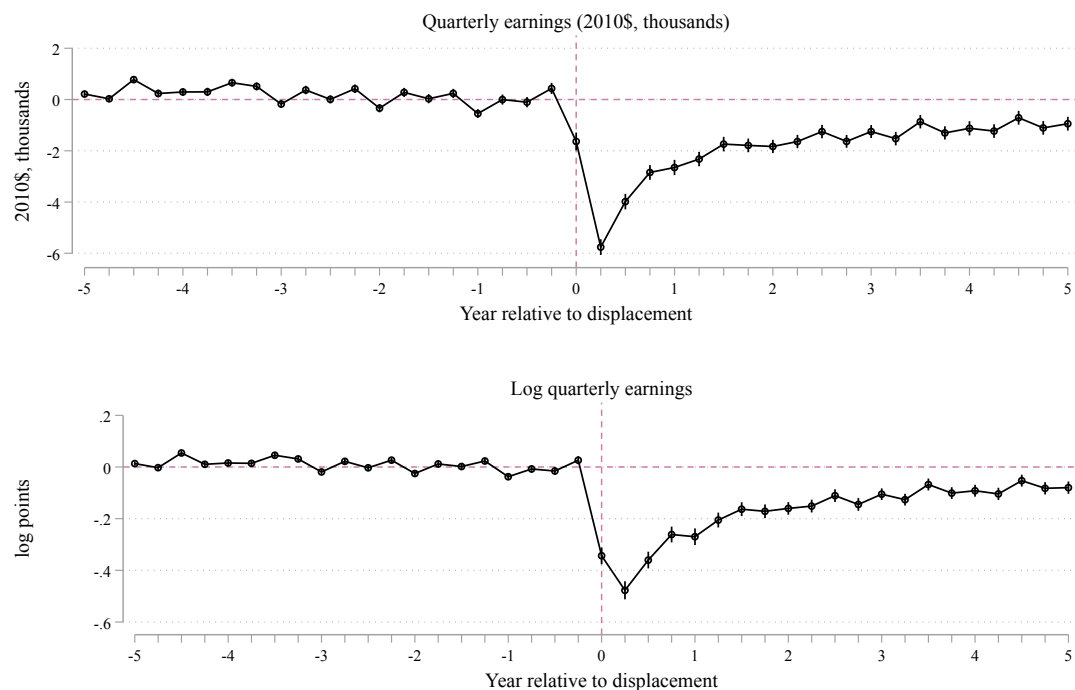
Long-term earnings and hours losses estimated using the alternative comparison group are substantially less than those estimated using the continuously employed comparison group: After five years, earnings were lower than the alternative comparison group’s by about 8 log points (compared with 16 log points using the continuously employed comparison group), and hours recovered completely (compared with a 5 log-point loss). However, the difference between

hourly wage rate losses using the different comparison groups is less striking: they were lower by 8 log points using the alternative comparison group (compared with 11.5 log points using the continuously employed group).

The three panels of Appendix Figure A4-4 show the estimated displacement losses due to employer fixed effects ($\hat{\psi}_j$) when using the alternative comparison group—see the time paths marked with circles. (For comparison, the estimated full effects of displacement using the alternative comparison group are also shown as light squares. These are repeated from Appendix Figures A4-1–A4-3.) As was true in the analysis using the continuously employed comparison group, lost employer fixed effects account for a minimal portion of the total losses following displacement.

Appendix Figure A4-1

Earnings losses due to displacement estimated using the alternative comparison group

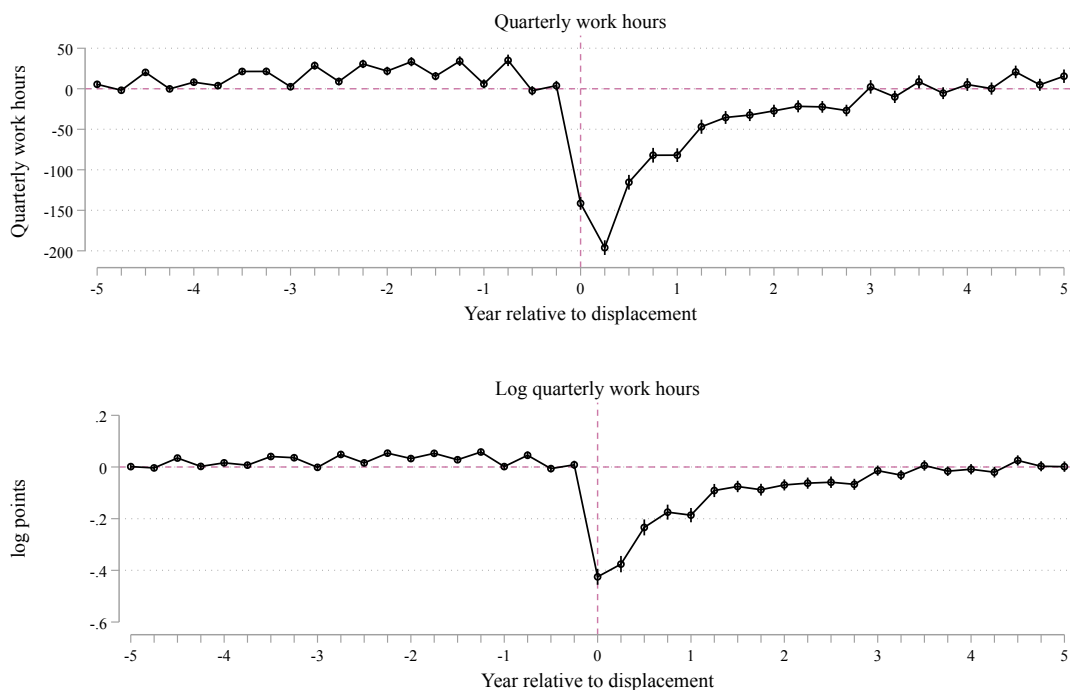


Notes: The figures show earnings losses estimated using a comparison group of long-tenure workers who were not displaced during 2008–2010, but who may have subsequently changed employers or separated from their primary employer (Krolikowski 2018). The top figure shows estimated δ_{ks} —quarterly unconditional earnings lost due to displacement (in constant 2010 \$1,000s)—based on equation (1) in the main text, with unconditional earnings from the primary employer as the dependent variable. The bottom figure shows estimated δ_{ks} —log of quarterly earnings lost due to displacement—based on equation (1), with the log of earnings from the primary employer as the dependent variable. Whiskers (which are very small) denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors’ calculations using Washington administrative wage and claims records. See Section I.A of the main text for details of the baseline comparison group, and see Figure 2 in the main text for estimates using the baseline comparison group.

Appendix Figure A4-2

Work hour losses due to displacement estimated using the alternative comparison group

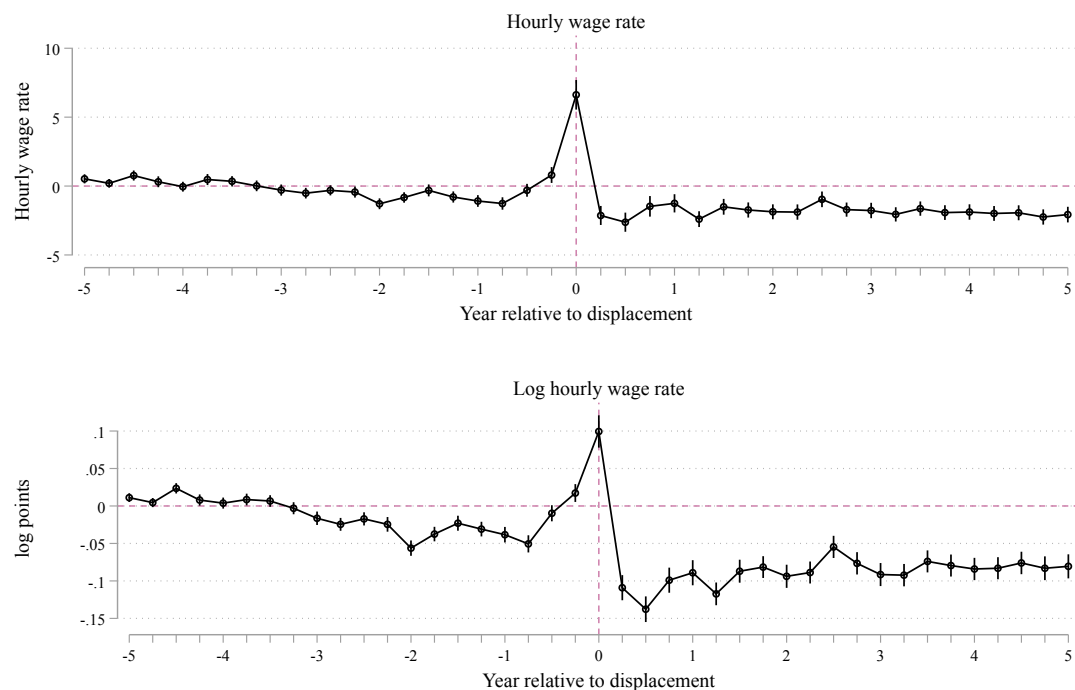


Notes: The figures show quarterly work hour losses estimated using a comparison group of long-tenure workers who were not displaced during 2008–2010, but who may have subsequently changed employers or separated from their primary employer (Krolikowski 2018). The top figure shows estimated δ_{ks} —quarterly unconditional hours lost due to displacement—based on equation (1) in the main text, with unconditional hours from the primary employer as the dependent variable. The bottom figure shows estimated δ_{ks} —log of quarterly hours lost due to displacement—based on equation (1), with the log of hours from the primary employer as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records. See Section I.A of the main text for details of the baseline comparison group, and see Figure 3 in the main text for estimates using the baseline comparison group.

Appendix Figure A4-3

Hourly wage rate losses due to displacement estimated using the alternative comparison group

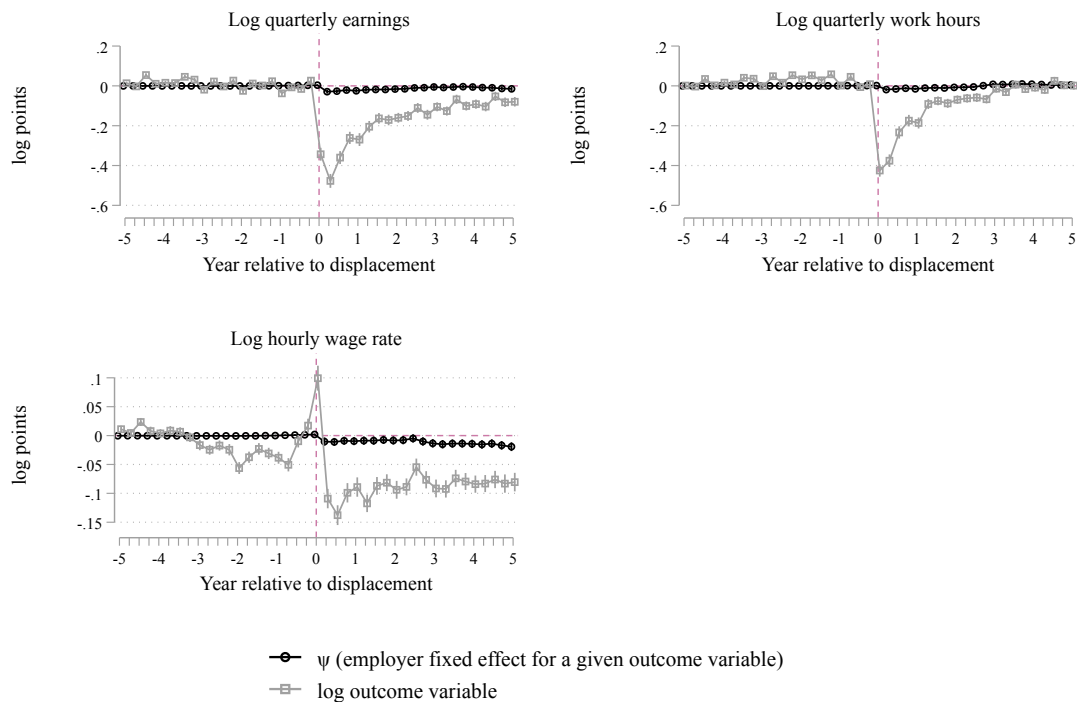


Notes: The figure shows hourly wage rate losses estimated using a comparison group of long-tenure workers who were not displaced during 2008–2010, but who may have subsequently changed employers or separated from their primary employer (Krolikowski 2018). The figure plots estimated δ_{ks} —the reduction in the log hourly wage rate due to displacement—based on equation (1) in the main text, with the log of the hourly wage rate at the primary employer (constant 2010 dollars per hour) as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records. See Section I.A of the main text for details of the baseline comparison group, and see Figure 5 in the main text for estimates using the baseline comparison group.

Appendix Figure A4-4

Estimated displacement losses due to lost employer fixed effects based on the alternative comparison group



Notes: The figures show estimated displacement losses attributable to lost employer fixed effects (circles) compared with the full losses due to displacement (squares, repeated from Appendix Figures A4-1, A4-2, and A4-3). Losses attributable to lost employer effects are estimates of δ_k from equation (3) in the main text. For example, to obtain the estimates of earnings lost due to lost employer effects, equation (3) was estimated with the AKM employer fixed effect ($\hat{\psi}$) for log earnings as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records. See Section I.A of the main text for details of the baseline comparison group, and see Figure 6 in the main text for estimates using the baseline comparison group.

Appendix A.5

Estimates from a broadened sample of displaced and non-displaced workers

The estimates in the text are based on a sample of workers who claimed UI at least once during 2002–2014.⁵ In this appendix, we present an analysis based on a broadened sample not restricted to UI claimants.

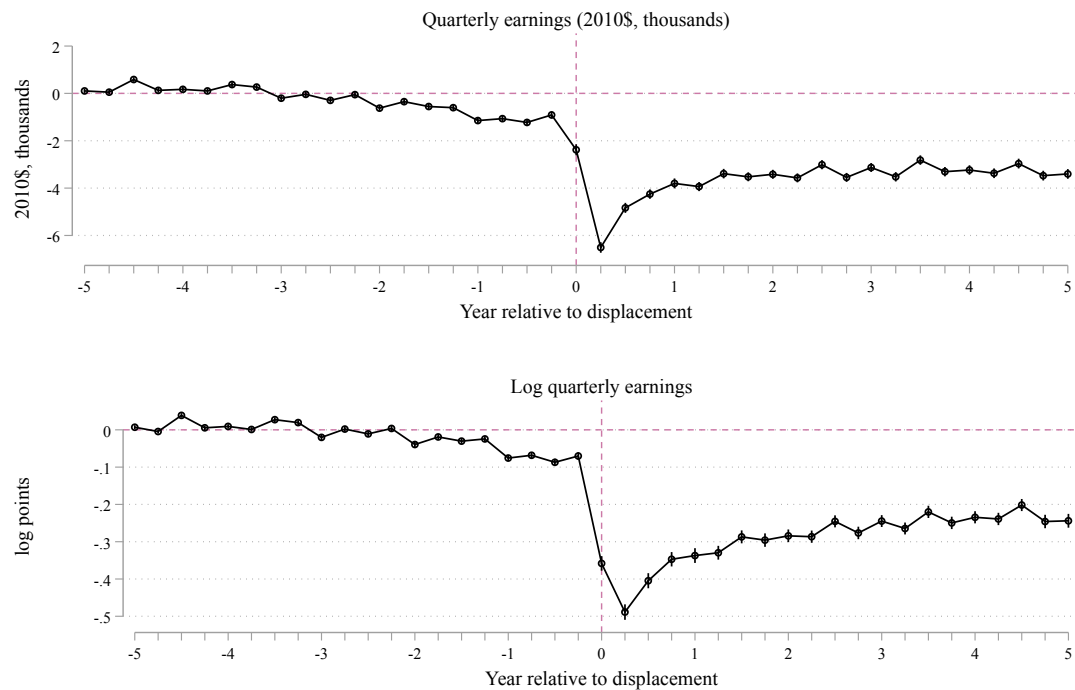
Appendix Figures A5-1, A5-2, and A5-3 repeat the analysis in the main text using all workers who satisfy the criteria for inclusion in the analysis sample described in Section I.A, except we no longer require them to have claimed UI at least once—see also row 6 of Appendix Table A. This results in a substantially larger sample (6,169 displaced workers, and 257,652 workers in the comparison group), although it does not materially change the conclusions. The pre-displacement Ashenfelter dip is more noticeable in the broadened sample, and the initial drops in earnings, hours, and wage rates are somewhat less than in the original sample (comparing Appendix Figures A5-1–A5-3 with Figures 2, 3, and 5). But long-term losses appear to be somewhat greater in the broadened sample (23 log points in the broadened sample versus 16 log points in the sample restricted to UI claimants). The larger long-term earnings losses in the broadened sample occur mainly because wage rates in the broadened sample show little if any recovery from their drop at the time of displacement.

As in the main analysis, employer fixed effects explain only small portions of long-term losses in the broadened sample—about 12 percent of earnings, about 21 percent of wages, and none of the change in hours.

⁵ As described in the text, this restriction is imposed on both the displaced workers and the comparison group for two reasons. First, we observe the individual characteristics of UI claimants, so we can restrict attention to displaced workers aged 20–50 at the time of displacement. Second, we can infer that non-displaced workers in the comparison group who claimed UI experienced at least one temporary layoff (an unemployment spell lasting less than one quarter and ending in recall to the same employer), creating a comparison group at greater risk of displacement and more comparable to the displaced treatment group.

Appendix Figure A5-1

Estimated earnings losses due to displacement, based on the broadened sample of displaced and non-displaced workers

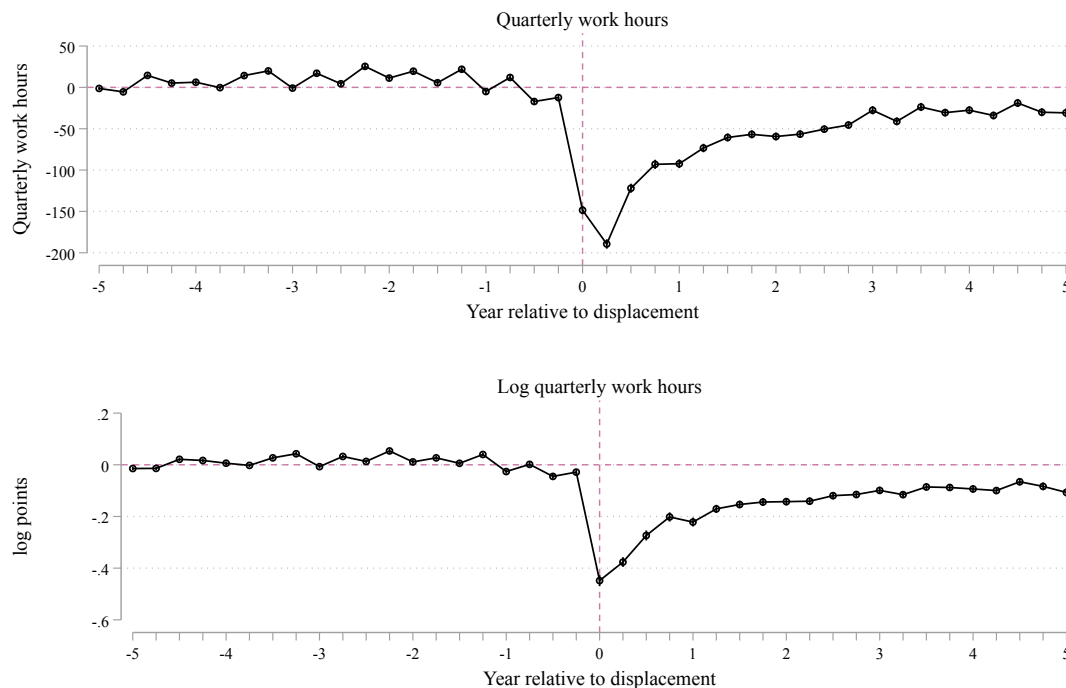


Notes: The figures show quarterly earnings losses estimated using the broadened sample of displaced and non-displaced workers—that is, without restricting the sample to workers who claimed UI at some time during 2002–2014. The top figure shows estimated δ_{ks} —quarterly unconditional earnings lost due to displacement (in constant 2010 \$1,000s)—based on equation (1) in the main text, with unconditional earnings from the primary employer as the dependent variable. The bottom figure shows estimated δ_{ks} —log of quarterly earnings lost due to displacement—based on equation (1), with the log of earnings from the primary employer as the dependent variable. Whiskers (which are very small) denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage records.

Appendix Figure A5-2

Estimated work hour losses due to displacement, based on the broadened sample of displaced and non-displaced workers

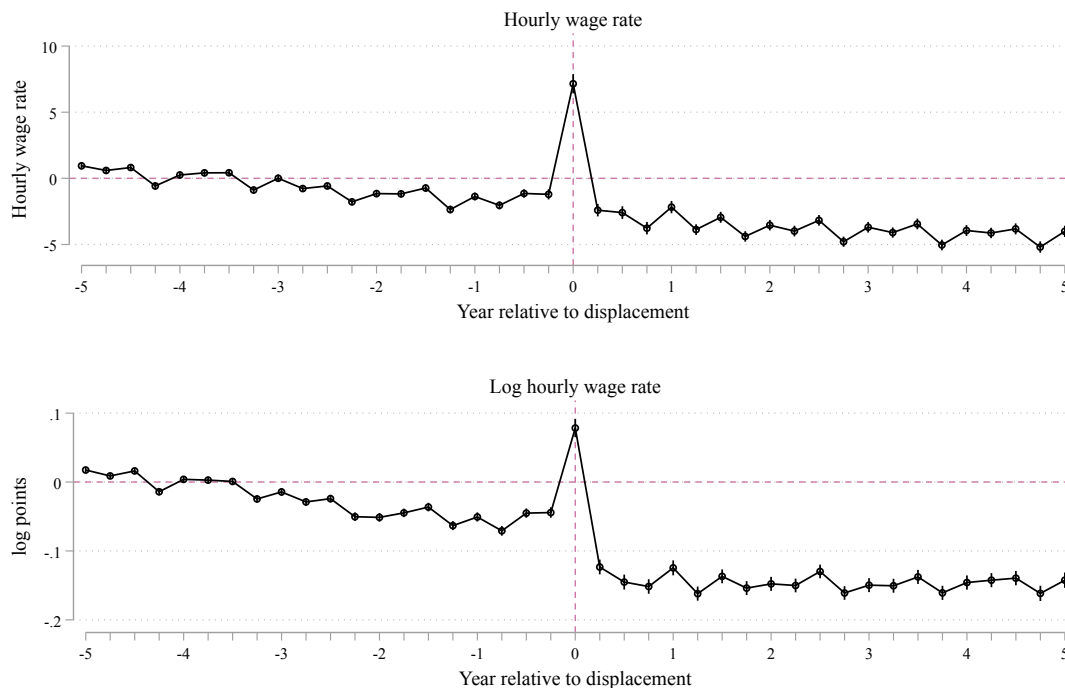


Notes: The figures show quarterly work hour losses estimated using the broadened sample of displaced and non-displaced workers—that is, without restricting the sample to workers who claimed UI at some time during 2002–2014. The top figure shows estimated δ_{ks} —quarterly unconditional hours lost due to displacement—based on equation (1) in the main text, with unconditional hours at the primary employer as the dependent variable. The bottom figure shows estimated δ_{ks} —log of quarterly hours lost due to displacement—based on equation (1), with the log of hours at the primary employer as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage records.

Appendix Figure A5-3

Estimated hourly wage rate losses due to displacement, based on the broadened sample of displaced and non-displaced workers

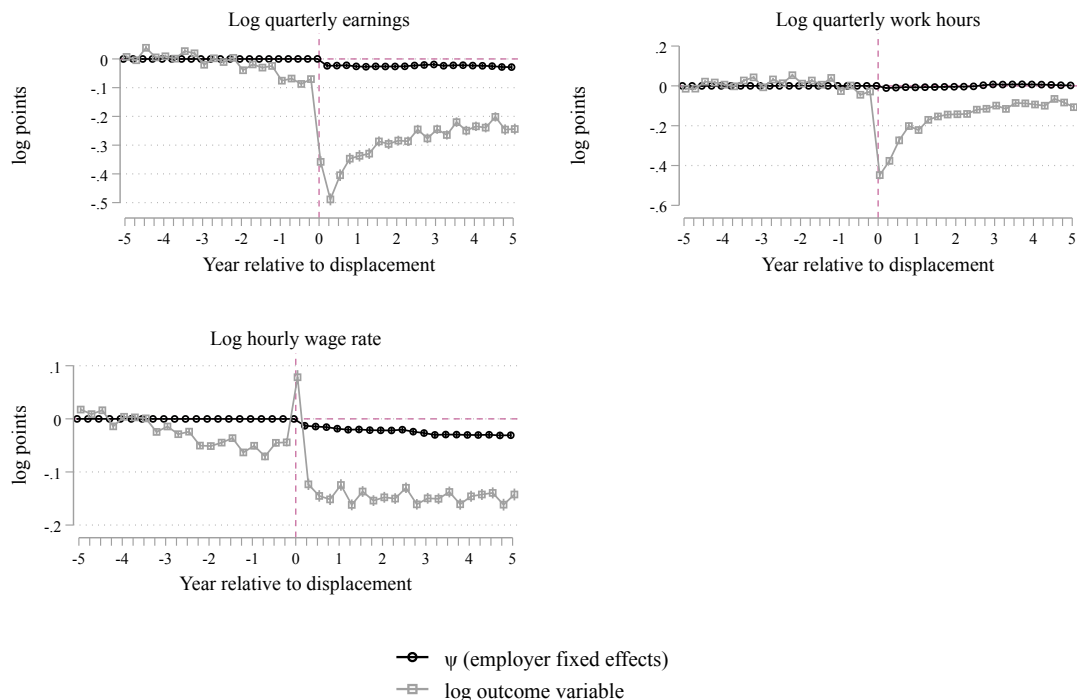


Notes: The figure shows hourly wage rate losses estimated using the broadened sample of displaced and non-displaced workers—that is, without restricting the sample to workers who claimed UI at some time during 2002–2014. The figure plots estimated δ_{ks} —reductions in the log hourly wage rate due to displacement—based on equation (1) in the main text, with the log of the hourly wage rate at the primary employer (constant 2010 dollars per hour) as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage records.

Appendix Figure A5-4

Estimated displacement losses due to lost employer fixed effects, based on the broadened sample of displaced and non-displaced workers



Notes: The figures show estimated displacement losses attributable to lost employer effects (circles) compared with the full losses due to displacement (squares, repeated from Figures A11, A12, and A13) for the broadened sample of displaced and non-displaced workers—that is, without restricting the sample to workers who claimed UI at some time during 2002–2014. Losses attributable to lost employer effects are estimates of δ_k from equation (3) in the main text. For example, to obtain the estimates of earnings lost due to lost employer effects, equation (3) was estimated with the AKM employer effect ($\hat{\psi}$) for log earnings as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage records.

Appendix A.6

Estimates excluding workers displaced from NAICS industries 51–56

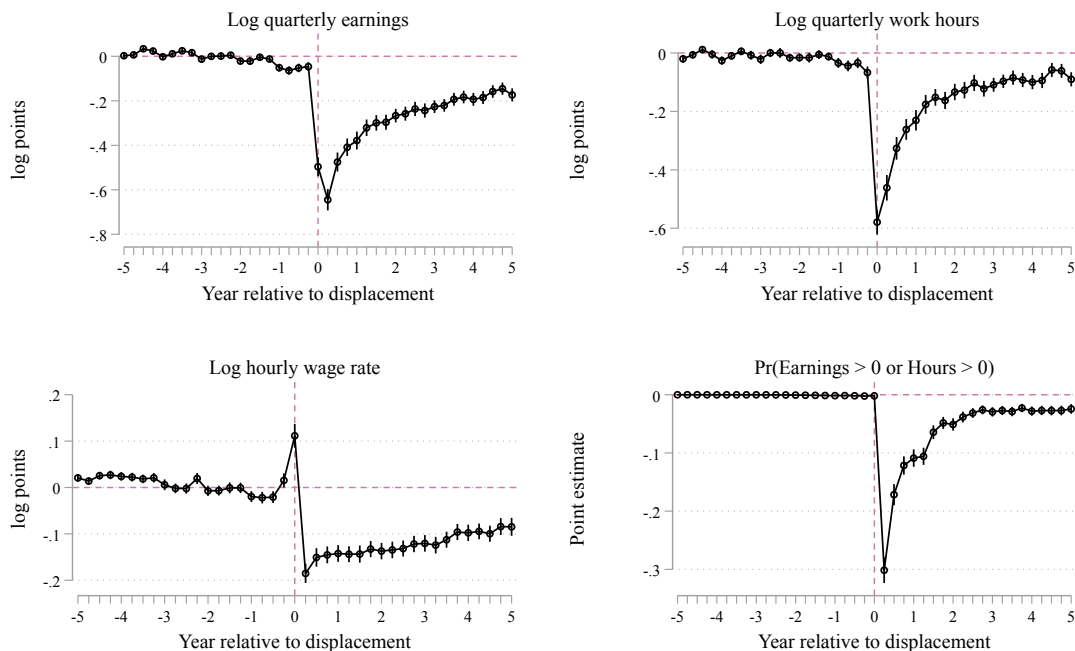
In this appendix, we repeat the main analysis *excluding* workers displaced from jobs in NAICS industries 51–56 (information, finance and insurance, real estate, professional, scientific, and technical services, management of companies; administrative, support, and waste management and remediation services). We do this for three reasons: first, as seen in Table 1 of the main text, workers in NAICS industries 51–56 have higher earnings and wage rates than other workers; second, the comparison sample for workers displaced from NAICS industries 51–56 is relatively thin, making inferences about the influence of displacement on these workers less convincing than for others; third, dropping NAICS industries 51–56 brings the industry composition of our analysis sample closer to the industry composition of the samples examined by Jacobson, LaLonde, and Sullivan (1993a, 1993b) and by Couch and Placzek (2010).

Appendix Figure A6-1 plots the losses of workers displaced from industries other than NAICS 51–56—see also row 7 of Appendix Table A. Immediate earnings losses are 65 log points, and long-term earnings losses (quarters 17–20) are 17 log points. For workers displaced from industries other than NAICS 51–56, then, both short- and long-term losses appear larger than for the full UI claimant sample. However, these long-term losses remain somewhat smaller than those estimated by Jacobson, LaLonde, and Sullivan (1993a, 1993b) and by Couch and Placzek (2010) for Pennsylvania and Connecticut.

Appendix Figure A6-1 shows that the long-term lost work hours of workers displaced from industries other than NAICS 51–56 also exceed those for workers overall. The long-term hours loss is about 8 log points (compared with 5 log points for the full UI claimant sample). The long-term wage reduction is about 10 log points (compared with 11 log points for the full UI claimant sample).

Appendix Figure A6-1

Estimated displacement effects for workers displaced from industries other than NAICS industries 51–56



Notes: The figures show estimated displacement effects for workers displaced from any industry *except* NAICS industries 51–56 (information, finance and insurance, real estate, professional, scientific, and technical services, management of companies; administrative, support, and waste management and remediation services). Each figure shows the profile of displacement effects for an outcome—log quarterly earnings, log quarterly hours, and log wage rate (all from the primary employer), or the probability of employment (positive earnings or hours)—based on estimates of δ_k in equation (1) in the main text. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.
Source: Authors’ calculations using Washington administrative wage and claims records.

Appendix A.7

Estimates from a model with worker-specific trends (random trends model)

As a robustness check of the parallel-trends assumption, we estimate a version of the worker fixed-effects difference-in-differences model with worker-specific trends (a random trend model):

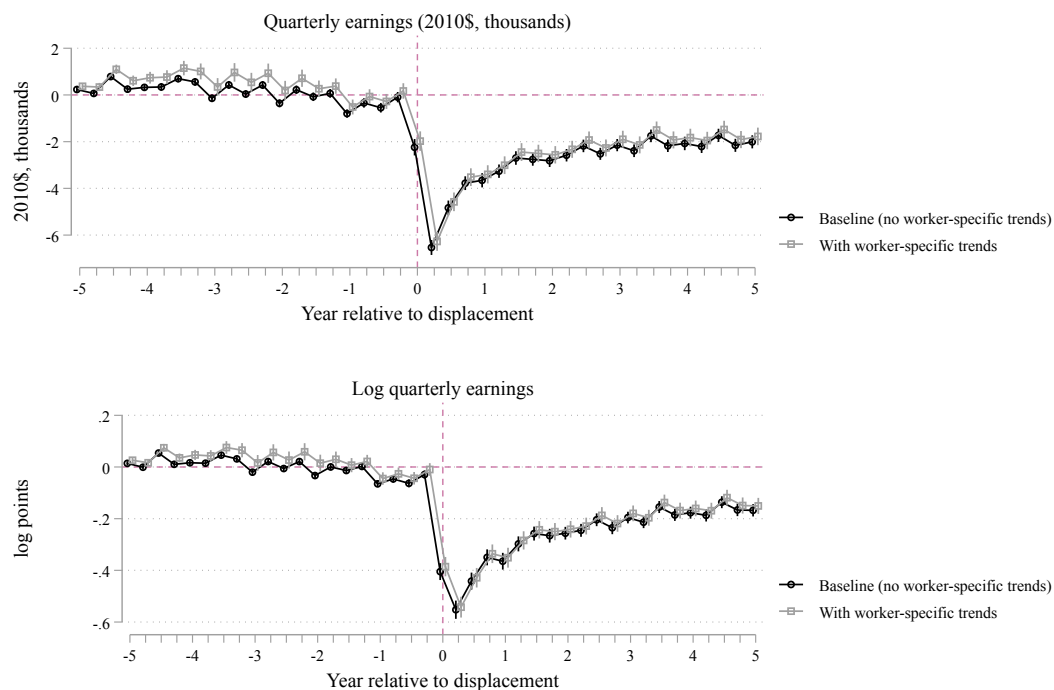
$$(A7.1) \ Y_{it} = c_i + \omega_i t + \gamma_t + \mathbf{Z}_{it} \boldsymbol{\theta}_1 + \mathbf{W}_{it} \boldsymbol{\theta}_2 + \mathbf{X}_{j(i,t)} + \sum_{k=-20}^{20} (\delta_k \cdot D_{itk}) + e_{it}$$

where t is a quarterly time trend, ω_i is a worker-specific quarterly growth rate over the period, and γ_t is a vector of calendar quarter indicators. [Other notation is the same as for equation (1) in the main text.] The worker-specific trends are included for the pre-displacement period, so as to account for any differential trends between displaced workers and the comparison group before displacement occurred.

The results are shown in Appendix Figures A7-1, A7-2, and A7-3—see also row 8 of Appendix Table A. The estimated profiles of earnings and hours are similar to those estimated using equation (1) and shown in Figures 2, 3, and 5 in the main text. The overall similarity of the estimates suggests that pre-displacement earnings, work hours, and wage rates of displaced and non-displaced workers evolve approximately in parallel. This is consistent with interpreting the estimated δ_k s in equation (1) as displacement effects.

Appendix Figure A7-1

Estimated earnings losses due to displacement, based on the random-trends model

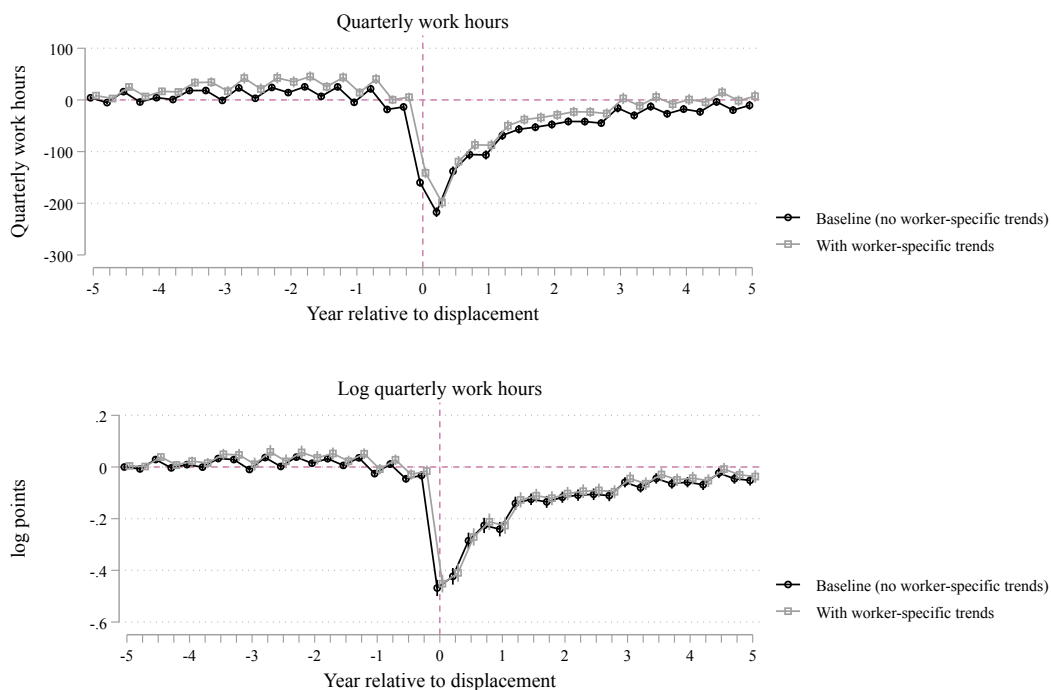


Notes: The top figure shows estimated δ_{ks} —quarterly unconditional earnings lost due to displacement (in constant 2010 \$1,000s)—based on the random trend model [equation (A7.1)], with unconditional earnings from the primary employer as the dependent variable. The bottom figure shows estimated δ_{ks} —log of quarterly earnings lost due to displacement—based on equation (A7.1), with the log of earnings from the primary employer as the dependent variable. Whiskers (which are very small) denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records.

Appendix Figure A7-2

Estimated work hour losses due to displacement, based on the random-trends model

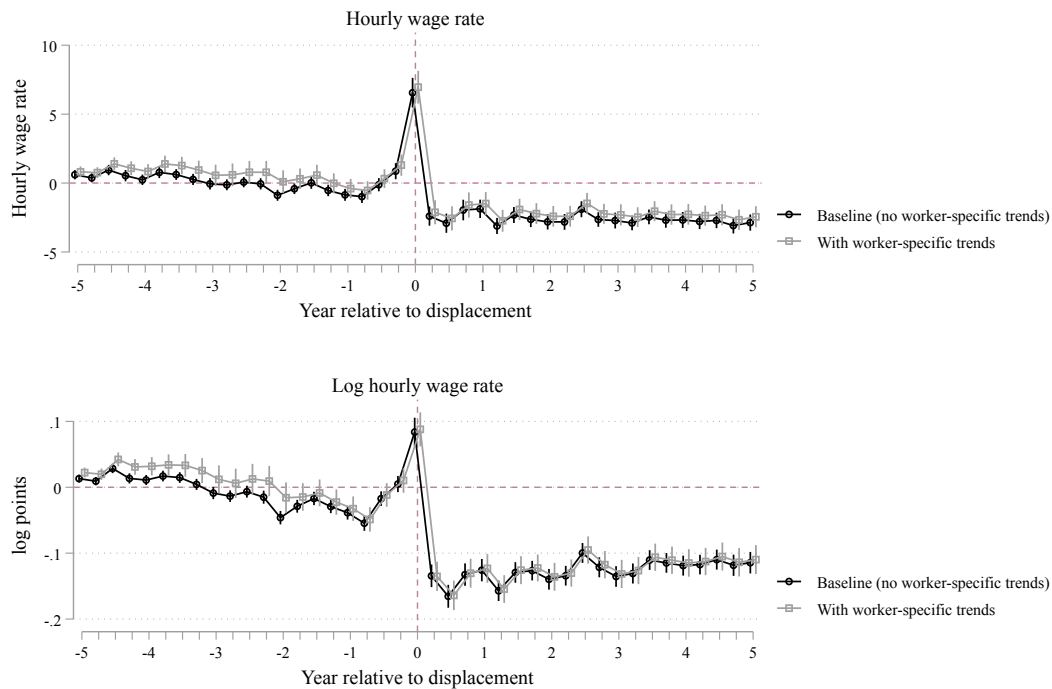


Notes: The top figure shows estimated δ_{ks} —quarterly unconditional hours lost due to displacement—based on the random trend model [equation (A7.1)], with unconditional hours at the primary employer as the dependent variable. The bottom figure shows estimated δ_{ks} —log of quarterly hours lost due to displacement—based on equation (A7.1), with the log of hours at the primary employer as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records.

Appendix Figure A7-3

Estimated hourly wage rate losses due to displacement, based on the random-trends model



Notes: The figure shows estimated δ_{ks} —the reduction in the log hourly wage rate due to displacement—based on the random trend model [equation (A7.1)], with the log of the hourly wage rate at the primary employer (constant 2010 dollars per hour) as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records.

Appendix A.8

Estimates using the specification and sampling choices of Schmieder, von Wachter, and Heining (2018)

As noted in the main text (Section IV.A), our finding that employer effects play such a limited role in displaced workers' losses is surprising in light of contrary findings by Schmieder, von Wachter, and Heining (2018) for Germany. In this appendix, we examine whether differences between their and our model specifications and sampling choices (definitions of the displaced workers and comparison groups) can explain the differences. Specifically, we make the following changes so as to conform with Schmieder, von Wachter, and Heining (2018):

- Include workers with three or more years of job tenure in both the displaced worker sample and the comparison group (rather than restricting the sample to workers with six or more years of job tenure)
- Include only full-time workers in the pre-displacement period (rather than part-time and full-time)
- Include only men (rather than women and men)
- Include workers aged 24–50 at displacement (rather than aged 20–50)
- Exclude workers in public administration and mining
- Include in the comparison group workers who separated from their employer (rather than require the comparison group to be continuously employed by the same employer)
- Use 1-1 closest-neighbor matching without replacement on the following pre-displacement characteristics: employer size (in 2007), average wage in $t-2$ (in 2006) and $t-1$ (in 2007), tenure, age, and education levels) within each one-digit pre-displacement industry
- Restrict the estimation sample to one control group worker for each displaced worker

- Add controls for age and education level to equations (1) and (3) in the main text

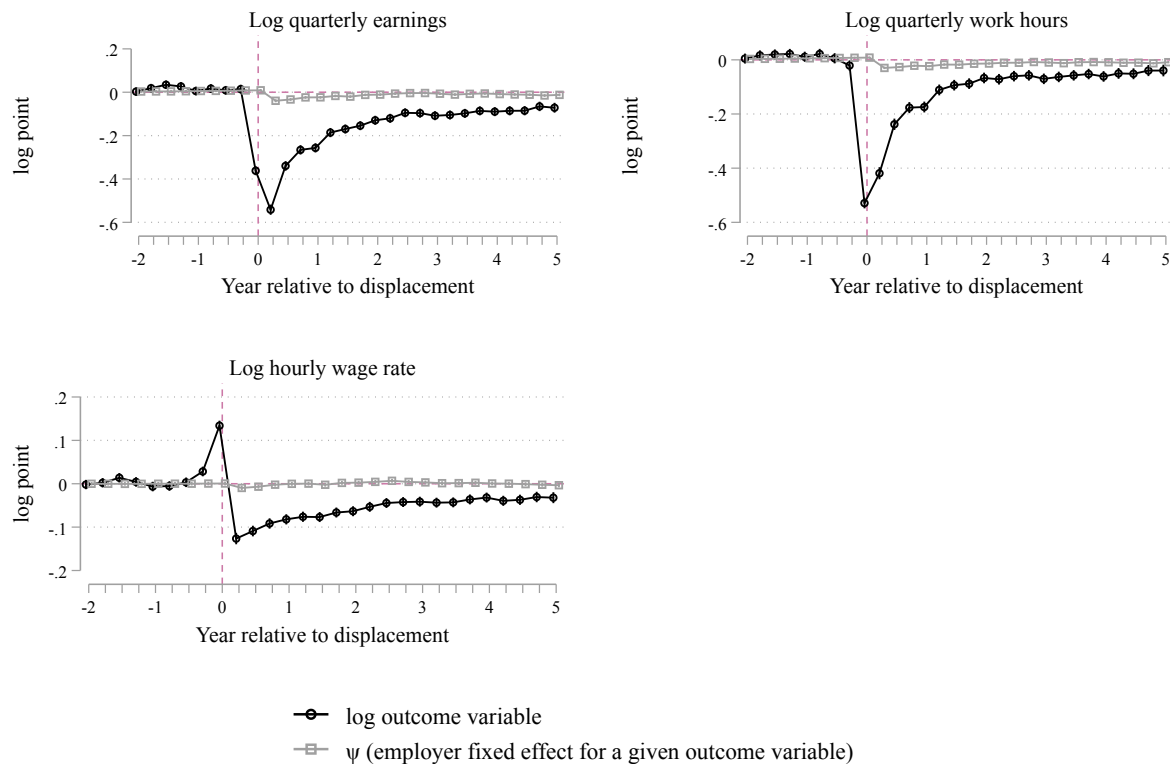
After making the above modifications in the sample used to estimate displaced workers' losses in Washington, we obtain the results displayed in Appendix Figure A8-1 (see also row 9 of Appendix Table A). The three panels of Appendix Figure A8-1 show that employer fixed effects remain a negligible factor in explaining the losses of displaced workers. It follows that differences in model specification and sampling choices do not appear to underlie the different conclusions drawn by Schmieder, von Wachter, and Heining (2018) and by us.

As we note in Section IV.A, the disparities are likely attributable to institutional differences between Germany and Washington State, including markedly different wage-setting policies such as sectoral bargaining with administrative extension in Germany, as well as greater union density and greater importance of formal occupational training in Germany (Acemoglu and Pischke 1998). These institutional differences could also help explain why employer effects account for more of the variation in wages in Germany than in Washington: Whereas 18 percent of daily wage variation among full-time workers is explained by establishment effects in Germany (Card, Heining, and Kline 2013, Table III), about 13 percent of hourly wage variation is explained by employer effects in Washington (see Appendix Table B2).

Also, as we note in Section IV.C, the correspondence between wage changes and employer effects is closer for displaced workers who move to lower-quintile employers than for those who move laterally or to higher-quintile employers. It follows that if displaced workers in Germany are more likely than those in Washington to move to lower- ψ employers, then lost employer premiums would explain a larger share of displaced workers' losses in Germany. We do not know whether this is in fact the case.

Appendix Figure A8-1

Estimated displacement losses due to lost employer fixed effects: Model specifications and sampling choices of Schmieder, von Wachter, and Heining (2018) applied to the Washington data



Notes: The figures show estimated displacement losses attributable to lost employer fixed effects (squares) compared with the full losses due to displacement (circles), using Schmieder, von Wachter, and Heining's (2018) model specifications and sampling choices. Losses attributable to lost employer effects are estimates of δ_k from equation (3) in the main text. For example, to obtain the estimates of earnings lost due to lost employer effects, equation (3) was estimated with the AKM employer fixed effect ($\hat{\psi}$) for log earnings as the dependent variable. Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records. See Section II.B of the main text and the text of this appendix for details.

Appendix A.9

Changes in earnings and hours associated with inter-quintile employer effect transitions

Section IV.B of the main text presents a discussion of how changes in hourly wage rates are associated with transitions made by displaced workers and non-displaced job changers among employers with different employer effects (ψ) for wage rates. The discussion is built around Tables 4, 5, and 6, and Figures 7, 8A, 8B, and 8C. In the main text, we focused on wage rates because they play a central role in explaining displaced workers' long-term earnings losses.

For completeness, this appendix includes tables and figures analogous to those in the main text, but pertaining to earnings and hours. Appendix Table A9-1 and Appendix Figures A9-1, A9-2, A9-3, and A9-4 describe the changes in earnings (and associated changes in match effects and direct effects) of displaced workers and non-displaced job changers as they transition among employers with different fixed effects *for earnings*. Appendix Table A9-4 and Appendix Figures A9-5, A9-6, A9-7, and A9-8 do the same for transitions among employers with different fixed effects *for hours*.

The conclusions to be drawn from the tables and figures in this appendix pertaining to earnings and work hours are similar to those pertaining to wage rates that are described in Section IV.B:

- The distributions of transition probabilities for displaced workers and non-displaced job changers differ markedly. The only notable difference from the results discussed in Section IV.B on wages rates pertains to work hours: Displaced workers have a greater tendency to move to employers with lower fixed effects for hours than for either wage rates or earnings (compare Appendix Table A9-6 with Appendix Table A9-3 and Table 6 in the main text)

- For both displaced workers and non-displaced job changers, within-quintile transitions were more common than moves to higher- or lower-quintile employers. Again, the only notable difference from the results in Section IV.B pertains to hours, for which the modal move for displaced workers is from a fifth-quintile to a fourth-quintile employer (see the top panel of Appendix Figure A9-5).
- Changes in employer effects for earnings and hours explain most of the changes in earnings and hours of non-displaced job changers as they move among employers with different fixed effects for earnings and hours. This again suggests that the AKM model gives a reasonable description of the overall labor market—in this case of changes in earnings and hours that accompany job mobility.
- In contrast, changes in employer effects for earnings and hours do a relatively poor job explaining the changes in earnings and hours of displaced workers—see Appendix Tables A9-1 and A9-4. Appendix Figures A9-2 and A9-6 highlight the limited ability of changes in employer effects to explain displaced workers’ reduced earnings and hours.
- Figure 8B showed that lost wage rate match effects tend to be more significant for the majority of displaced workers who move to employers paying similar or higher premiums than for the relatively few who move downward. Appendix Figures A9-3 and A9-7 show the same is true for both earnings match effects and hours match effects.
- In contrast, the slope of the relationship between $\Delta\mu$ for earnings and hours and $\Delta\psi$ is weaker for non-displaced job changers than for displaced workers (this was also true for wage rates). In short, for non-displaced job changers, employer effects—not match effects—play a dominant role in explaining earnings changes and hours changes, as they do in explaining wage changes.

- The direct effects of displacement (d) on displaced workers' earnings show little systematic variation with moves across employers paying different premium levels ($\Delta\psi$)—see Appendix Figure A9-4. (The same was true for wage rates.) For hours, direct displacement losses tend to be greater for displaced workers who move to lower-quintile employers than for those who move to higher-quintile employers, although the relationship between d and $\Delta\psi$ is noisy—see Appendix Figure A9-8.
- Most non-displaced job changers face a significant direct earnings penalty when they move (Appendix Figure A9-4), but no direct hours penalty (Appendix Figure A9-8). It follows that the earnings penalty derives entirely from the direct wage rate penalty illustrated in Figure 8C of the main text.

Appendix Table A9-1

Displaced workers' inter-quintile employer transitions, earnings changes, employer effect changes, match effect changes, and direct displacement effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of displaced workers in cell	4.9	1.7	1.3	0.9	0.7	9.6
	mean Δ earnings	-21.2	-43.4	-32.6	-19.1	13.2	-24.1
	mean Δ employer effect	2.7	28.6	48.8	65.3	84.6	25.6
	mean Δ match effect	-13.7	-39.5	-45.2	-47.2	-57.6	-29.1
	mean direct effect	-10.1	-32.4	-36.2	-37.3	-13.9	-20.5
2	% of displaced workers in cell	1.7	3.6	1.3	0.9	0.1	7.5
	mean Δ earnings	-55.0	-36.1	-19.1	-25.4	25.3	-35.2
	mean Δ employer effect	-26.9	0.6	17.5	31.8	74.0	2.3
	mean Δ match effect	-1.5	-6.9	-13.0	-26.5	6.1	-8.9
	mean direct effect	-26.6	-29.8	-23.6	-30.7	-54.8	-28.6
3	% of displaced workers in cell	1.2	2.2	6.8	3.4	1.2	14.8
	mean Δ earnings	-82.8	-46.7	-30.6	-18.5	2.3	-31.7
	mean Δ employer effect	-47.8	-15.7	-1.1	12.9	35.6	-0.9
	mean Δ match effect	-2.0	-14.0	-7.7	-16.2	-20.3	-11.1
	mean direct effect	-33.0	-17.0	-21.8	-15.1	-13.1	-19.7
4	% of displaced workers in cell	1.7	1.9	5.4	9.1	4.9	23.0
	mean Δ earnings	-83.0	-55.6	-37.9	-24.6	-0.8	-29.5
	mean Δ employer effect	-64.2	-34.4	-14.8	0.0	25.7	-5.6
	mean Δ match effect	-3.7	1.0	-7.7	-5.5	-8.5	-6.0
	mean direct effect	-15.2	-22.2	-15.4	-19.1	-18.0	-18.0
5	% of displaced workers in cell	0.6	0.9	3.2	9.6	30.8	45.1
	mean Δ earnings	-154.8	-110.6	-49.2	-26.1	-20.8	-27.6
	mean Δ employer effect	-76.5	-57.3	-35.2	-14.9	-1.9	-9.2
	mean Δ match effect	-48.8	-11.5	6.1	0.8	-3.7	-2.8
	mean direct effect	-29.5	-41.7	-20.1	-11.9	-15.2	-15.6
Column sums and weighted means	% of displaced workers	10.1	10.3	18.0	23.9	37.7	100.0
	mean Δ earnings	-52.7	-49.7	-35.5	-24.1	-16.7	-28.9
	mean Δ employer effect	-24.3	-9.8	-6.3	-0.5	4.7	-2.9
	mean Δ match effect	-10.9	-12.8	-8.4	-6.8	-5.8	-7.7
	mean direct effect	-17.6	-27.2	-20.8	-16.8	-15.6	-18.2

Notes: This transition matrix shows the movement (and associated outcomes) of displaced workers between employers with different fixed effects for quarterly earnings. Employers are classified into quintiles by their AKM-estimated employer effects for earnings. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all displaced workers making the given quintile-to-quintile transition, (ii) the mean log-point change in earnings of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after displacement. See Sections IV.B and IV.C of the main text for further discussion.

Source: Authors' calculations based on the displaced worker sample described in the text, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A9-2

Non-displaced job changers' inter-quintile employer transitions, earnings changes, employer effect changes, match effect changes, and direct transition effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of non-displaced job changers	8.9	4.7	2.9	2.0	1.0	19.6
	mean Δ earnings	1.8	21.9	37.6	50.7	67.5	20.4
	mean Δ employer effect	1.5	29.5	51.2	66.0	87.7	26.8
	mean Δ match effect	5.0	-0.4	-5.6	-6.8	-6.8	0.3
	mean direct effect	-4.7	-7.3	-7.9	-8.5	-13.4	-6.7
2	% of non-displaced job changers	3.6	8.6	4.0	2.4	1.2	19.7
	mean Δ earnings	-19.1	-0.7	10.6	23.1	41.6	3.6
	mean Δ employer effect	-27.5	-1.7	16.4	33.1	55.3	4.8
	mean Δ match effect	12.7	4.1	0.2	-2.1	-0.3	3.8
	mean direct effect	-4.4	-3.0	-6.0	-7.9	-13.4	-5.1
3	% of non-displaced job changers	1.6	3.3	6.4	6.2	2.1	19.7
	mean Δ earnings	-35.7	-12.1	0.4	9.8	29.2	1.4
	mean Δ employer effect	-48.9	-18.3	-0.9	11.9	36.3	0.3
	mean Δ match effect	17.3	8.0	3.7	0.1	-0.4	4.0
	mean direct effect	-4.1	-1.8	-2.4	-2.3	-6.7	-2.9
4	% of non-displaced job changers	0.8	1.6	4.1	10.3	4.5	21.3
	mean Δ earnings	-55.0	-26.7	-10.6	-0.5	15.1	-3.2
	mean Δ employer effect	-66.5	-34.5	-14.4	0.1	20.0	-3.7
	mean Δ match effect	17.9	11.9	7.9	3.2	1.8	5.0
	mean direct effect	-6.4	-4.1	-4.0	-3.7	-6.7	-4.5
5	% of non-displaced job changers	0.4	0.7	1.4	3.7	13.6	19.8
	mean Δ earnings	-82.6	-47.1	-29.3	-14.8	0.5	-7.7
	mean Δ employer effect	-87.5	-56.4	-34.7	-16.3	2.8	-7.3
	mean Δ match effect	15.6	10.7	12.2	8.7	2.8	5.1
	mean direct effect	-10.7	-1.4	-6.8	-7.2	-5.0	-5.6
Column sums and weighted means	% of non-displaced job changers	15.4	18.8	18.8	24.6	22.4	100.0
	mean Δ earnings	-12.2	-0.8	3.6	6.5	11.4	2.8
	mean Δ employer effect	-16.5	-1.5	5.2	9.2	16.0	4.0
	mean Δ match effect	9.1	4.5	3.1	1.9	1.7	3.7
	mean direct effect	-4.8	-3.9	-4.7	-4.7	-6.3	-4.9

Notes: This transition matrix shows the movement (and associated outcomes) of non-displaced job changers between employers with different fixed effects for quarterly earnings. Employers are classified into quintiles by their AKM-estimated employer effects for earnings. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all non-displaced job changers making the given quintile-to-quintile transition, (ii) the mean log-point change in earnings of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after a job change. See Sections IV.B and IV.C of the main text for further discussion.

Source: Authors' calculations based on the primary job changes taking place during 2008–2010 in the AKM sample described in Appendix B, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A9-3

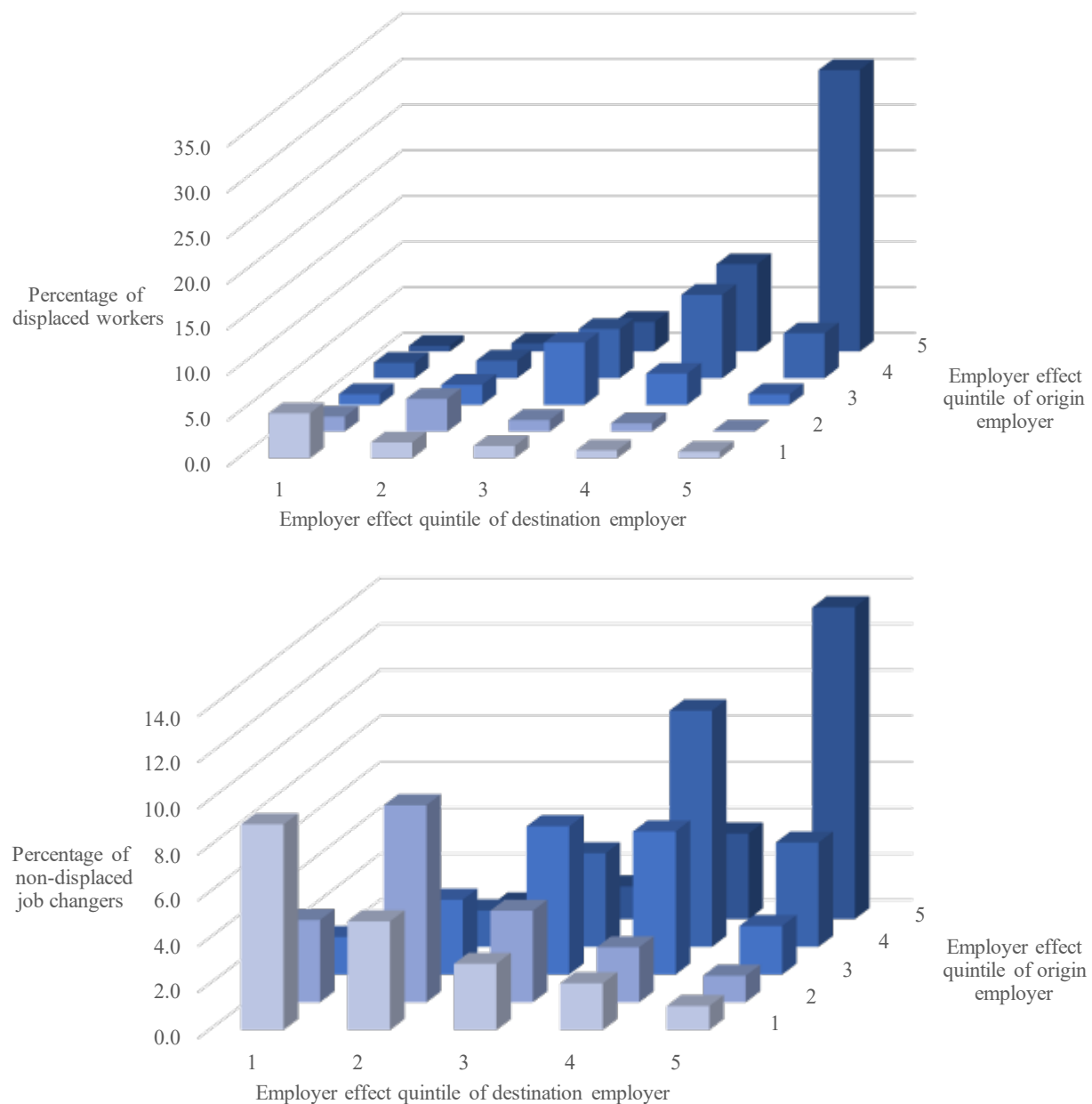
Below-, on-, and above-diagonal sums and weighted averages of inter-quintile transitions of displaced workers and non-displaced job changers, 2008–2010, earnings

	Below-diagonal sums and means	On-diagonal sums and means	Above-diagonal sums and means
% of displaced workers	28.4	55.2	16.4
mean Δ earnings	-47.6	-23.6	-14.3
mean Δ employer effect	-26.3	-0.9	30.6
mean Δ match effect	-3.4	-5.6	-22.6
mean direct effect	-17.9	-17.2	-22.3
% of non-displaced job changers	21.2	47.8	31.0
mean Δ earnings	-21.6	0.3	23.2
mean Δ employer effect	-27.8	0.7	29.9
mean Δ match effect	10.8	3.6	-1.1
mean direct effect	-4.4	-4.0	-6.6

Notes: Figures in the “Below-diagonal sums and averages” column show sums (or weighted means) of cells in the transition matrices in Appendix Tables A9-1 and A9-2 representing moves to an employer with a lower-quintile fixed effect for earnings. Figures in the “On-diagonal” and “Above-diagonal” columns show sums or weighted means of the cells in the transition matrices representing moves to a same-quintile employer, or to a higher-quintile employer. Figures for both displaced workers and non-displaced job changers are based on a comparison of employment two years before and after displacement or job change.

Source: Authors’ calculations from data in Appendix Tables A9-1 and A9-2.

Appendix Figure A9-1
Inter-quintile employer transitions of displaced workers (top) and non-displaced job changers (bottom), 2008–2010, earnings



Note: The histograms show percentages of displaced workers (top) and non-displaced job changers (bottom) making each quintile-to-quintile transition among employers in various earnings effect quintiles.

Source: Data in Appendix Tables A9-1 and A9-2.

Appendix Figure A9-2

Changes in earnings and changes in employer effects (ψ) for displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes: The dashed line is a 45° line.

For displaced workers the fitted equation is:

$$\Delta \text{earnings}^d = -0.393 + 0.777\Delta\psi^d \quad R^2 = 0.725, \text{RMSE} = 0.206, n = 25$$

(0.041) (0.010)

For non-displaced job changers the fitted linear equation is:

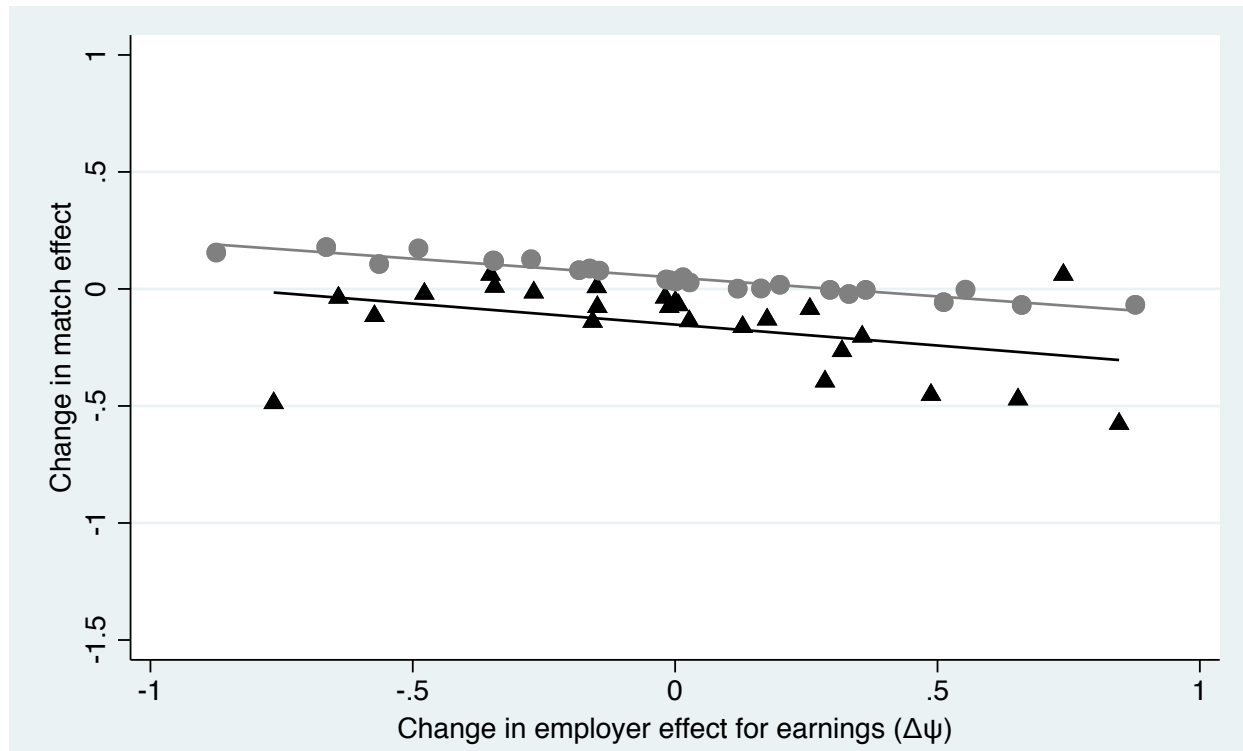
$$\Delta \text{earnings}^n = -0.011 + 0.804\Delta\psi^n \quad R^2 = 0.992, \text{RMSE} = 0.031, n = 25$$

(0.006) (0.015)

Source: Authors' calculations based on data in Table A9-1.

Appendix Figure A9-3

Changes in match effects (μ for earnings) and changes in employer effects (ψ) for displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes:

For displaced workers the fitted equation is:

$$\Delta\mu^d = -0.152 - 0.179\Delta\psi^d \quad R^2 = 0.172, \text{ RMSE} = 0.170, n = 25$$

(0.034) (0.082)

For non-displaced job changers the fitted equation is:

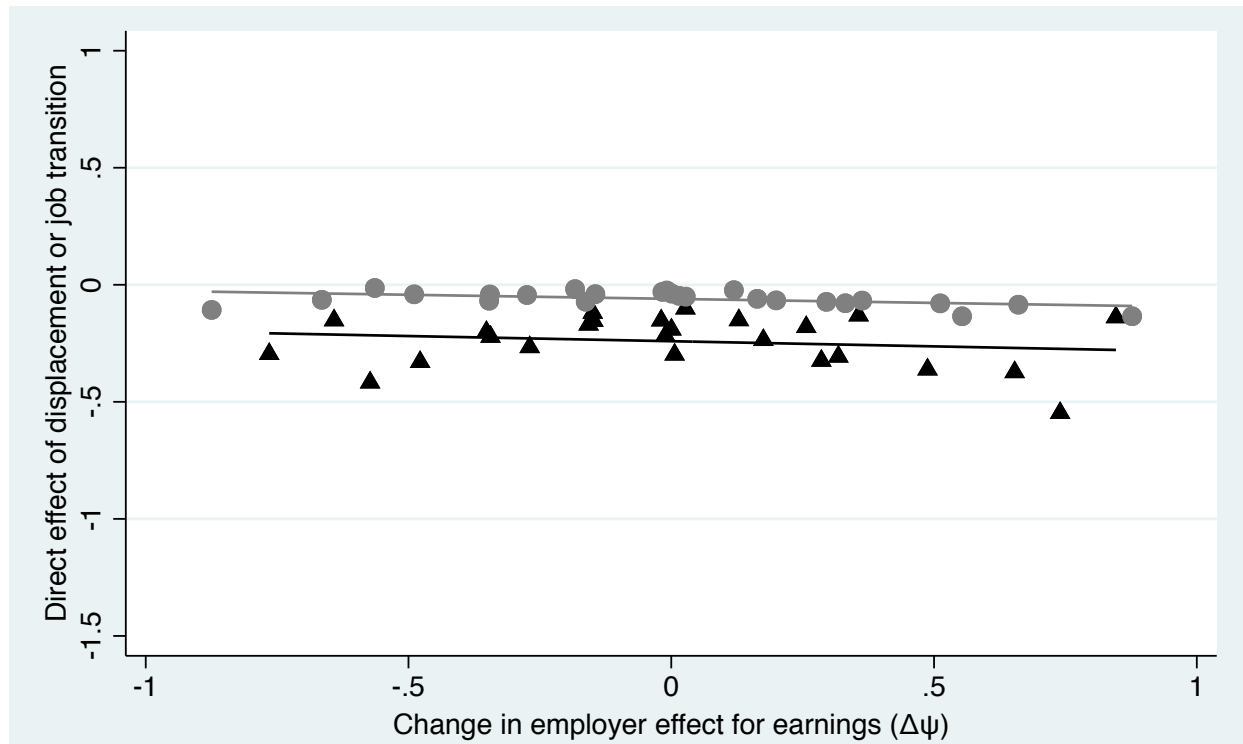
$$\Delta\mu^n = 0.049 - 0.161\Delta\psi^n \quad R^2 = 0.905, \text{ RMSE} = 0.023, n = 25$$

(0.005) (0.011)

Source: Authors' calculations based on data in Table A9-1.

Appendix Figure A9-4

Direct effects of displacement or job transition (d for earnings) and changes in employer effects (ψ) for displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes:

For displaced workers the fitted equation is:

$$\Delta d^d = -0.241 - 0.044\Delta\psi^d \quad R^2 = 0.029, \text{ RMSE} = 0.110, n = 25$$

(0.022) (0.053)

For non-displaced job changers the fitted equation is:

$$\Delta d^n = -0.060 - 0.035\Delta\psi^n \quad R^2 = 0.212, \text{ RMSE} = 0.029, n = 25$$

(0.006) (0.014)

Source: Authors' calculations based on data in Table A9-1.

Appendix Table A9-4

Displaced workers' inter-quintile employer transitions, work hour changes, employer effect changes, match effect changes, and direct displacement effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of displaced workers in cell	4.9	2.5	1.0	1.1	1.2	10.6
	mean Δ hours	-20.0	-12.8	-11.1	5.9	5.2	-12.1
	mean Δ employer effect	-2.5	19.4	32.4	39.3	50.6	16.0
	mean Δ match effect	-6.6	-16.9	-25.7	-25.1	-31.8	-15.5
	mean direct effect	-10.8	-15.3	-17.8	-8.3	-13.6	-12.6
2	% of displaced workers in cell	0.9	3.3	1.8	0.9	1.0	8.0
	mean Δ hours	-23.7	-16.2	-5.2	-23.1	37.1	-8.8
	mean Δ employer effect	-24.9	-0.4	9.6	17.4	27.9	4.7
	mean Δ match effect	1.3	-0.7	-8.9	-11.2	-11.5	-4.9
	mean direct effect	-0.1	-15.1	-6.0	-29.4	20.7	-8.6
3	% of displaced workers in cell	1.6	2.6	7.7	4.3	3.1	19.3
	mean Δ hours	-51.8	-26.7	-15.9	-8.3	3.0	-15.6
	mean Δ employer effect	-37.9	-12.4	-0.4	7.0	13.7	-1.2
	mean Δ match effect	4.4	2.2	0.2	-2.3	0.3	0.3
	mean direct effect	-18.4	-16.6	-15.6	-13.0	-11.0	-14.6
4	% of displaced workers in cell	0.7	1.2	3.1	6.0	4.8	15.8
	mean Δ hours	-71.4	-30.4	-29.2	-11.9	-18.1	-21.4
	mean Δ employer effect	-41.7	-18.1	-6.2	0.9	8.6	-1.6
	mean Δ match effect	25.2	7.7	-0.3	0.7	-5.2	0.4
	mean direct effect	-54.9	-19.9	-22.8	-13.5	-21.5	-20.2
5	% of displaced workers in cell	1.4	1.6	4.1	26.8	12.5	46.3
	mean Δ hours	-85.0	-29.7	-27.6	-14.7	-8.2	-16.7
	mean Δ employer effect	-44.1	-23.8	-12.2	-4.8	0.9	-5.7
	mean Δ match effect	-5.4	4.9	0.9	-3.1	-0.2	-1.7
	mean direct effect	-35.5	-10.9	-16.4	-6.9	-8.9	-9.2
Column sums and weighted means	% of displaced workers	9.5	11.2	17.6	39.1	22.6	100.0
	mean Δ hours	-39.2	-21.3	-19.6	-13.2	-6.1	-16.1
	mean Δ employer effect	-19.7	-3.9	-1.3	-0.9	8.1	-1.1
	mean Δ match effect	-1.3	-2.0	-2.1	-3.2	-3.3	-2.7
	mean direct effect	-18.1	-15.4	-16.2	-9.1	-10.8	-12.3

Notes: This transition matrix shows the movement (and associated outcomes) of displaced workers between employers with different fixed effects for quarterly work hours. Employers are classified into quintiles by their AKM-estimated employer effects for hours. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all displaced workers making the given quintile-to-quintile transition, (ii) the mean log-point change in hours of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after displacement. See Sections IV.B and IV.C of the main text for further discussion.

Source: Authors' calculations based on the displaced worker sample described in the text, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A9-5

Non-displaced job changers' inter-quintile employer transitions, work hour changes, employer effect changes, match effect changes, and direct transition effects, 2008–2010

Fixed-effect quintile of origin employer		Fixed-effect quintile of destination employer					Row sums and weighted means
		1	2	3	4	5	
1	% of non-displaced job changers	8.5	4.5	2.5	2.0	1.5	19.1
	mean Δ hours	0.4	19.7	32.9	41.1	52.9	17.7
	mean Δ employer effect	0.7	23.7	38.0	45.1	54.5	20.0
	mean Δ match effect	1.2	-1.5	-2.7	-2.5	0.6	-0.4
	mean direct effect	-1.5	-2.5	-2.4	-1.5	-2.1	-1.9
2	% of non-displaced job changers	3.4	5.7	4.4	3.1	2.3	19.0
	mean Δ hours	-16.7	1.1	8.7	17.6	28.0	5.7
	mean Δ employer effect	-22.2	-0.5	10.2	18.5	28.0	4.8
	mean Δ match effect	4.5	0.5	-2.1	-1.9	-0.9	0.1
	mean direct effect	1.0	1.1	0.5	1.0	0.9	0.9
3	% of non-displaced job changers	1.5	3.3	9.3	5.1	3.4	22.6
	mean Δ hours	-32.1	-7.9	0.2	5.4	12.0	-0.1
	mean Δ employer effect	-38.2	-11.2	0.3	6.6	13.9	-0.4
	mean Δ match effect	6.0	3.1	-0.4	-1.2	-1.5	0.2
	mean direct effect	0.0	0.2	0.3	0.0	-0.3	0.1
4	% of non-displaced job changers	1.0	1.9	3.8	6.7	5.8	19.2
	mean Δ hours	-42.3	-15.2	-5.4	0.1	4.0	-3.5
	mean Δ employer effect	-45.6	-19.2	-6.7	-0.1	5.7	-3.9
	mean Δ match effect	3.2	4.1	1.5	0.1	-0.6	0.7
	mean direct effect	0.0	-0.1	-0.2	0.1	-1.2	-0.4
5	% of non-displaced job changers	0.6	1.1	2.4	4.9	11.1	20.1
	mean Δ hours	-57.7	-26.8	-14.0	-4.9	2.8	-4.5
	mean Δ employer effect	-55.1	-27.8	-14.9	-6.1	1.9	-5.5
	mean Δ match effect	-1.4	2.5	1.7	1.0	-0.6	0.2
	mean direct effect	-1.1	-1.4	-0.8	0.3	1.5	0.7
Column sums and weighted means	% of non-displaced job changers	15.0	16.5	22.4	22.0	24.1	100.0
	mean Δ hours	-11.9	0.6	3.0	6.5	10.0	2.8
	mean Δ employer effect	-13.7	0.0	3.6	6.9	10.3	2.8
	mean Δ match effect	2.4	1.0	-0.4	-0.5	-0.7	0.2
	mean direct effect	-0.6	-0.4	-0.2	0.1	0.3	-0.1

Notes: This transition matrix shows the movement (and associated outcomes) of non-displaced job changers between employers with different fixed effects for quarterly work hours. Employers are classified into quintiles by their AKM-estimated employer effects for hours. (Thresholds for quintiles are obtained by sorting on worker-year records.) The elements of each five-element cell show (i) the percentage of all non-displaced job changers making the given quintile-to-quintile transition, (ii) the mean log-point change in hours of those making that transition, (iii) the mean employer effect change associated with that transition; (iv) the mean match effect change associated with that transition, and (v) the mean direct displacement effect associated that transition. Figures are based on a comparison of employment two years before and after a job change. See Sections IV.B and IV.C of the main text for further discussion.

Source: Authors' calculations based on the primary job changes taking place during 2008–2010 in the AKM sample described in Appendix B, employer effects described in Appendix B, and match effects described in Section II.C of the main text.

Appendix Table A9-6

Below-, on-, and above-diagonal sums and weighted averages of inter-quintile transitions of displaced workers and non-displaced job changers, 2008–2010, work hours

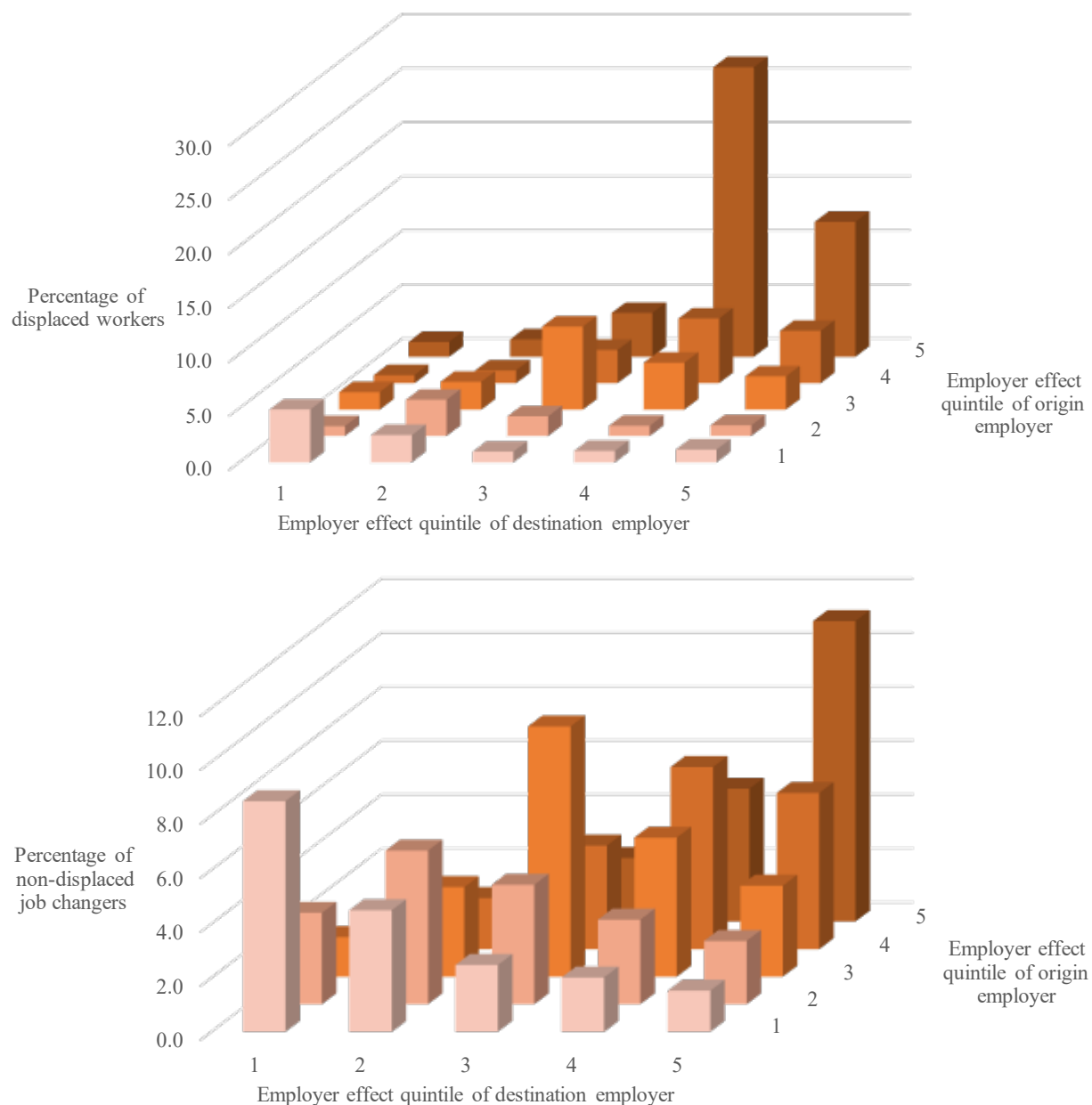
	Below-diagonal sums and means	On-diagonal sums and means	Above-diagonal sums and means
% of displaced workers	43.9	34.4	21.7
mean Δ hours	-23.3	-13.0	-6.5
mean Δ employer effect	-10.6	0.0	16.4
mean Δ match effect	-0.8	-0.9	-9.4
mean direct effect	-11.9	-12.1	-13.5
% of non-displaced job changers	23.9	41.4	34.7
mean Δ hours	-14.4	1.1	16.8
mean Δ employer effect	-17.0	0.6	18.9
mean Δ match effect	2.6	0.1	-1.4
mean direct effect	0.0	0.3	-0.7

Notes: Figures in the “Below-diagonal sums and averages” column show sums (or weighted means) of cells in the transition matrices in Appendix Tables A9-4 and A9-5 representing moves to an employer with a lower-quintile fixed effect for work hours. Figures in the “On-diagonal” and “Above-diagonal” columns show sums or weighted means of the cells in the transition matrices representing moves to a same-quintile employer, or to a higher-quintile employer. Figures for both displaced workers and non-displaced job changers are based on a comparison of employment two years before and after displacement or job change.

Source: Authors’ calculations from data in Appendix Tables A9-4 and A9-5.

Appendix Figure A9-5

Inter-quintile employer transitions of displaced workers (top) and non-displaced job changers (bottom), 2008–2010, hours

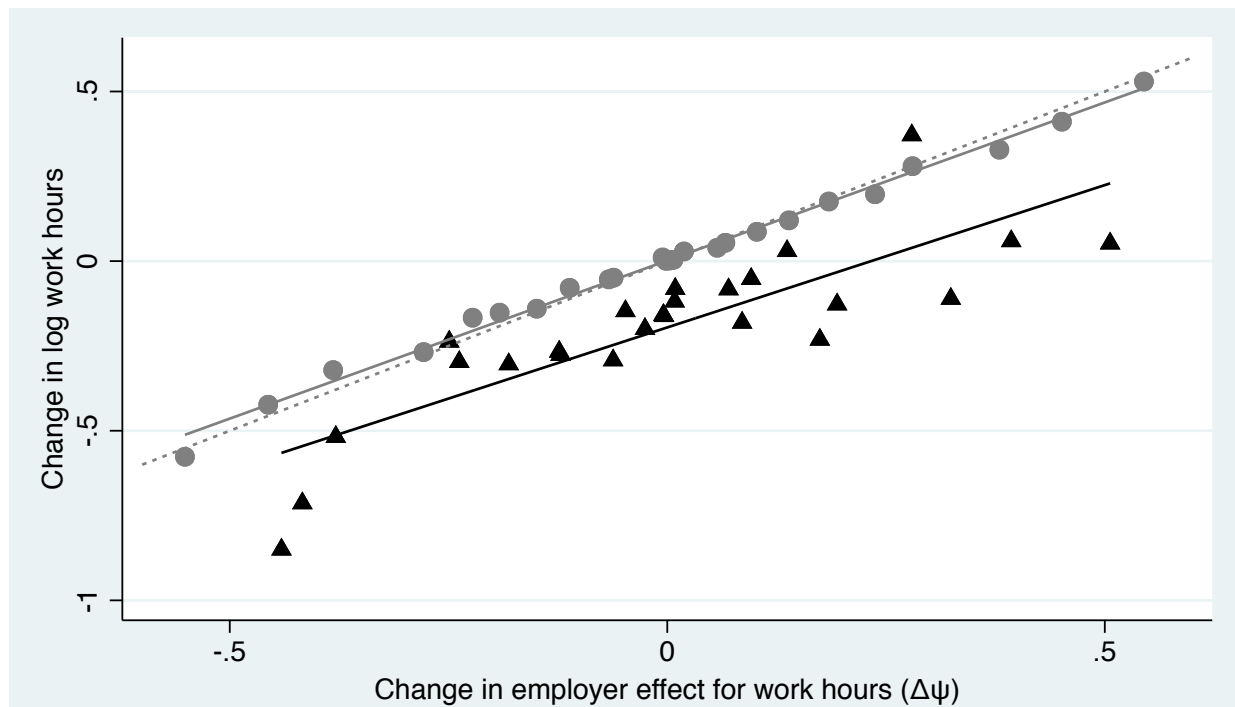


Note: The histograms show percentages of displaced workers (top) and non-displaced job changers (bottom) making each quintile-to-quintile transition among employers in various hours effect quintiles.

Source: Data in Appendix Tables A9-4 and A9-5.

Appendix Figure A9-6

Changes in work hours and changes in employer effects (ψ) for displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes: The dashed line is a 45° line.

For displaced workers the fitted equation is:

$$\Delta hours^d = -0.195 + 0.839\Delta\psi^d \quad R^2 = 0.698, \text{ RMSE} = 0.136, n = 25$$

(0.027) (0.115)

For non-displaced job changers the fitted linear equation is:

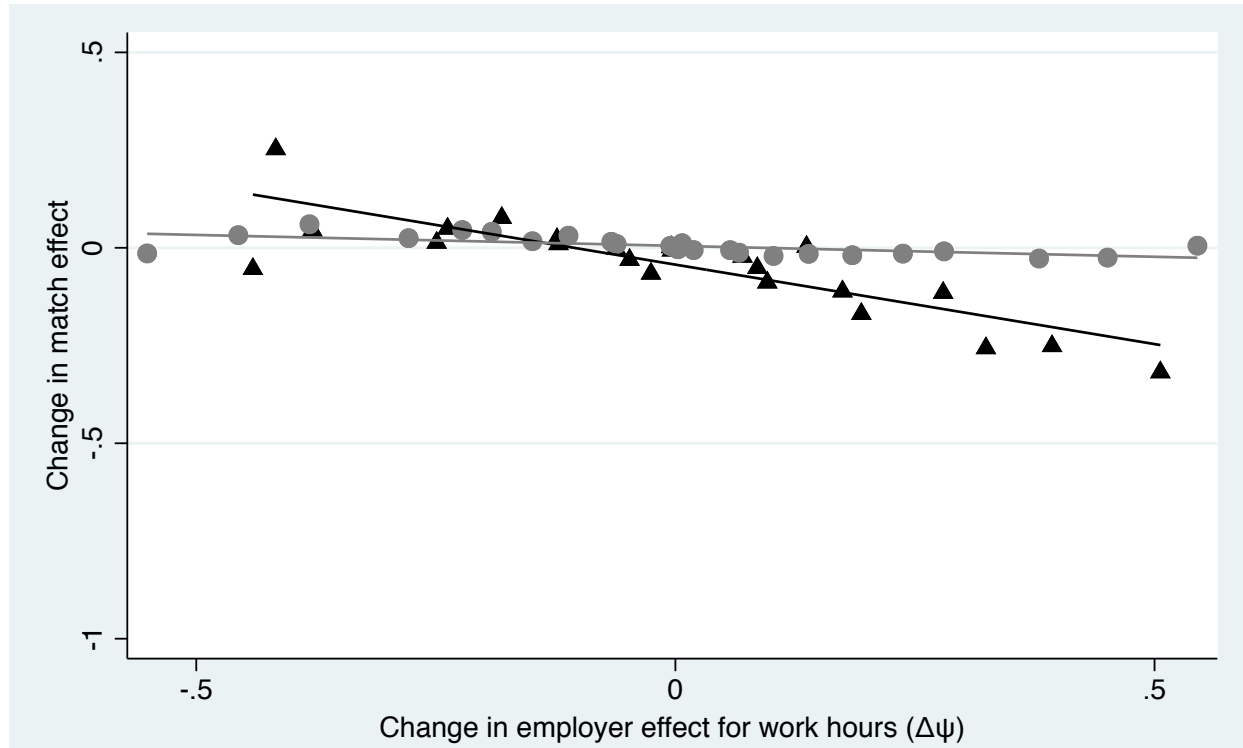
$$\Delta hours^n = -0.002 + 0.932\Delta\psi^n \quad R^2 = 0.993, \text{ RMSE} = 0.022, n = 25$$

(0.004) (0.017)

Source: Data in Appendix Tables A9-4 and A9-5.

Appendix Figure A9-7

Changes in match effects (μ for work hours) and changes in employer effects (ψ) for displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes:

For displaced workers the fitted equation is:

$$\Delta\mu^d = -0.043 - 0.407\Delta\psi^d \quad R^2 = 0.695, \text{ RMSE} = 0.066, n = 25$$

(0.013) (0.056)

For non-displaced job changers the fitted equation is:

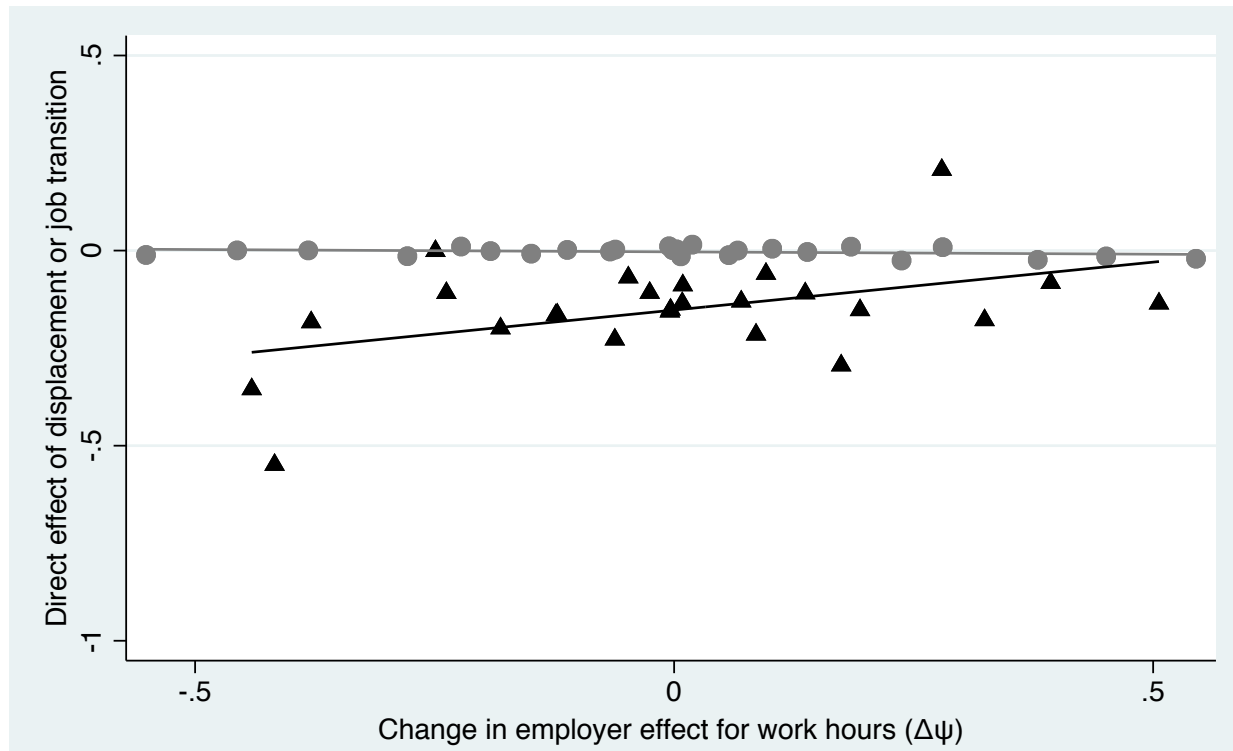
$$\Delta\mu^n = 0.005 - 0.056\Delta\psi^n \quad R^2 = 0.404, \text{ RMSE} = 0.019, n = 25$$

(0.004) (0.014)

Source: Data in Appendix Tables A9-4 and A9-5.

Appendix Figure A9-8

Direct effects of displacement or job transition (d for work hours) and changes in employer effects (ψ) for displaced workers (triangles) and non-displaced job changers (circles): scatterplots with fitted regression lines



Notes:

For displaced workers the fitted equation is:

$$\Delta d^d = -0.152 + 0.246\Delta\psi^d \quad R^2 = 0.204, \text{ RMSE} = 0.120, n = 25$$

(0.024) (0.101)

For non-displaced job changers the fitted equation is:

$$\Delta d^n = -0.003 - 0.012\Delta\psi^n \quad R^2 = 0.082, \text{ RMSE} = 0.011, n = 25$$

(0.002) (0.008)

Source: Data in Appendix Tables A9-4 and A9-5.

Appendix A.10
Decomposing displaced workers' losses

It is helpful to use the data in Tables 4 and 5 (quintile-to-quintile transition probabilities, along with associated changes in wage rates and employer effects) to decompose displaced workers' average wage losses into portions attributable to (i) changes tied to employer effects accompanying transitions between quintile- i and quintile- j employers and (ii) losses not explained by employer effects following a quintile- i to quintile- j transition. Begin by writing the mean log change in the hourly wage rate of displaced workers as:

$$(A10.1) \quad \overline{\Delta w}^d = \sum_i \sum_j m_{ij}^d \Delta w_{ij}^d$$

where m_{ij}^d and Δw_{ij}^d denote transition probabilities and mean wage rate changes of displaced workers moving from quintile- i to quintile- j employers. This mean change can be decomposed by first adding then subtracting $\sum_i \sum_j m_{ij}^d \Delta \psi_{ij}^d$ on the right-hand side of equation (A10.1):

$$(A10.2) \quad \overline{\Delta w}^d = \sum_i \sum_j m_{ij}^d \Delta \psi_{ij}^d + \sum_i \sum_j m_{ij}^d (\Delta w_{ij}^d - \Delta \psi_{ij}^d)$$

where $\Delta \psi_{ij}^d$ denotes the mean change in employer effects for wage rates of displaced workers moving from quintile- i to quintile- j employers. (Analogous decompositions can be written for changes in earnings and work hours; the data needed to calculate the decompositions appear in Appendix A.9. See Fortin, Lemieux, and Firpo [2011] for a comprehensive discussion of similar decompositions.)

The first term of the decomposition in equation (A10.2) will be larger, the larger is the tendency of displacement to move workers from higher-quintile to lower-quintile employers—moves accompanied by lost employer effects. The second term will be larger, the larger are the gaps between the actual wage changes of displaced workers and the employer effect changes accompanying a given quintile- i to quintile- j move.

Results of the decompositions are summarized in Appendix Table A10-1. Consider the mean hourly wage loss of displaced workers two years after displacement—13.0 log points. If displaced workers’ hourly wage changes had reflected only the differences between the wage premiums paid by their origin and destination employers, their hourly wages would have been lower by only 1.9 log points (less than 15 percent of the total).⁶ The remaining loss of more than 11 log points represents an “excess” wage rate loss—greater than expected following transitions to employers paying different wage premiums than the origin employers. Movements to employers with different fixed effects can explain even less of displaced workers’ earnings losses (10 percent) and work hour losses (less than 7 percent).

To summarize, employer fixed effects play a limited role in displaced workers’ losses in part because the tendency of displaced workers to move to employers with lower fixed effects is modest: Fully 70 percent of displaced workers find reemployment with an employer in the same or a higher fixed effect quintile (see again Figure 7). The decompositions in Appendix Table A10-1 suggests that 85 percent of displaced workers’ wage rate losses (and an even larger percentage of earnings and hours reductions) stem from losses exceeding those explainable by changes in employer effects associated with job transitions.

⁶ Note that, five years after displacement, the mean hourly wage loss is slightly smaller and equals 11.5 log points; see Table 2. Table 2 also indicates that five years after displacement, employer effects account for a slightly larger share, 17. percent, of the losses ($= 2.00/11.5$).

Table A10-1

Displaced workers' losses two years after displacement decomposed into portions attributable to (i) fixed effect changes from transitions to new employers and (ii) losses exceeding those expected due to fixed effect changes

Outcomes (log points)	Mean loss of displaced workers	Portion attributable to:		Percentage attributable to transitions
		fixed effect changes from job transitions	losses exceeding fixed effect changes	
earnings	-28.9	-2.9	-26.0	10.0
work hours	-16.1	-1.1	-15.0	6.8
hourly wage rates	-13.0	-1.9	-11.2	14.6

Notes: The table decomposes the mean losses of displaced workers into portions attributable to (i) transitions to employers with different fixed effects and (ii) differences (larger losses or smaller gains) between the changes actually experienced by displaced workers and the employer fixed effect changes that would be expected based on the transitions they made. For example, displaced workers experienced an average wage rate loss of 13.0 log points, of which 1.9 log points (14.6 percent) occurred because displaced workers tended to move to employers with lower fixed effects. The remaining 11.2 points of the average loss occurred because displaced workers had larger losses (or smaller gains) than would be expected based on their transitions to new employers.

Source: Authors' calculations based on data in Tables A9-1 and A9-2 (for earnings), Tables A9-4 and A9-5 (for work hours) 4 and 5 (for hourly wage rates).

Appendix A.11

Alternative estimates of displacement losses due to lost match effects

This appendix shows that, if we do not adjust the Woodcock match effects for job tenure, the estimated role of match effects in explaining displaced workers' losses is somewhat larger than if we do adjust (see footnote 31 in Section II.C of the main text). This is consistent with our expectations.

Section II.C of the main text outlined Woodcock's (2015) fixed effects match estimator, and Section IV.C described the resulting estimates. The residualized outcome variables ($\overline{\log Y_{ij}}$) used to obtain these estimates netted out both calendar-year effects and the effects of job tenure, but because job tenure is endogenous with respect to worker, employer, and match quality, it seems wise to check whether the estimates are sensitive to this adjustment. Accordingly, we compute the average outcome variable ($\overline{\log Y_{ij}}$) for each unique worker-employer match, adjusted for calendar year, but without netting out the contribution of job tenure.

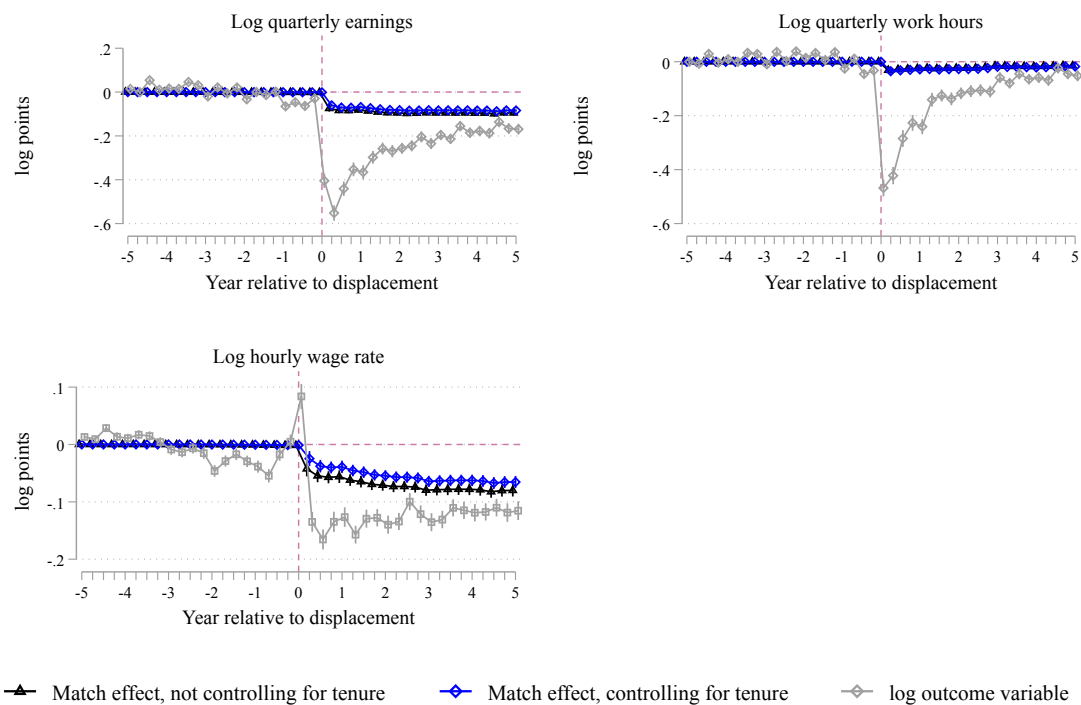
The three panels of Appendix Figure A11-1 display estimated displacement losses attributable to lost worker-employer match effects that adjust for years of job tenure ($\hat{\mu}$, denoted by diamonds and repeated from Figure 9 in the main text) and match effects that do not adjust for years of job tenure (denoted by triangles). For comparison, the three panels also display the full effects of displacement on log earnings, log hours, and log hourly wage rate (denoted by circles and repeated from the lower panels of Figures 2, 3, and 5 in the main text).

For hourly wage rates and earnings, the estimates that do not adjust for job tenure suggest a somewhat larger role for match effects than those that do—compare rows 10 and 11 of Appendix Table A. For example, the long-term wage rate loss due to match effects is about 6.5 log points after adjusting for job tenure, versus about 8 log points without the adjustment. This is

expected because long-tenure workers have better matches, so not accounting for job tenure tends to overstate the role of match effects (and understate the role of the direct displacement effect) in explaining displaced workers' losses. In contrast, for work hours the estimates that do not adjust for job tenure suggest a somewhat smaller role for match effects than those that do, suggesting little relationship between job tenure and work hours.

Appendix Figure A11-1

Estimated displacement losses attributable to lost worker-employer match effects (with and without controls for years of job tenure)



Notes: The figures show estimated displacement losses attributable to lost worker-employer match effects that adjust for years of job tenure ($\hat{\mu}$, denoted by diamonds and repeated from Figure 9 in the main text) and match effects that do not adjust for years of job tenure (denoted by triangles), compared with the full losses due to displacement (light circles). Whiskers denote 95-percent confidence intervals based on standard errors clustered by worker. The vertical lines denote the quarter of displacement.

Source: Authors' calculations using Washington administrative wage and claims records.

Appendix A.12

Tables supporting Figures 2, 3, 4, and 6 in the main text

Appendix Table A12-1 displays the estimates underlying Figure 2 in the main text. Column 1 corresponds to the upper panel of Figure 2 (earnings from the primary employer), and column 3 corresponds to the lower panel (log earnings from the primary employer). Columns 2 and 4 show estimates based on earnings from all employers, which are similar.

Appendix Table A12-2 displays the estimates underlying Figure 3 in the main text. Column 1 corresponds to the upper panel of Figure 3 (hours with the primary employer), and column 3 corresponds to the lower panel (log hours with the primary employer). Columns 2 and 4 show estimates based on hours from all employers, which are again similar to those based only on earnings from the primary employer.

Appendix Table A12-3 displays the estimates underlying Figure 4 in the main text. Column (1) shows estimated displacement effects on the probability of working a positive number of hours in a given quarter, based on estimates of equation (1) in the main text. Columns (2)–(6) show estimated displacement effects on unconditional hours quantiles, obtained using the re-centered influence function approach (Firpo, Fortin, and Lemieux 2009).

Appendix Table A12-4 displays the estimates underlying Figure 6 in the main text. For each post-displacement quarter, the estimates in the odd-numbered columns give the total log-point losses of earnings (column 1), hours (column 3), and hourly wages (column 5) attributable to displacement, and the even-numbered columns give the log-point changes in earnings (column 2), hours (column 4), and hourly wages (column 6) attributable to the effect of displacement on moving to an employer with a different fixed effect for earnings, hours, or hourly wages.

Appendix Table A12-1

Estimated effects of displacement on unconditional earnings and log earnings (from primary employer and all employers), UI claimant sample

Quarter relative to displacement	(1)	(2)	(3)	(4)
	Quarterly earnings (constant 2010 dollars, thousands)		Log quarterly earnings	
	From primary employer only	From all employers	From primary employer only	From all employers
-20	0.234*** (0.059)	0.237*** (0.060)	0.014*** (0.004)	0.015*** (0.004)
-19	0.064 (0.066)	0.063 (0.067)	-0.001 (0.005)	-0.001 (0.005)
-18	0.788*** (0.072)	0.791*** (0.073)	0.054*** (0.005)	0.054*** (0.005)
-17	0.248*** (0.078)	0.250*** (0.078)	0.010** (0.005)	0.011** (0.005)
-16	0.325*** (0.073)	0.324*** (0.074)	0.016*** (0.005)	0.017*** (0.005)
-15	0.341*** (0.085)	0.344*** (0.086)	0.015*** (0.005)	0.015*** (0.005)
-14	0.698*** (0.079)	0.697*** (0.080)	0.046*** (0.005)	0.046*** (0.005)
-13	0.558*** (0.082)	0.557*** (0.082)	0.031*** (0.006)	0.032*** (0.006)
-12	-0.144* (0.081)	-0.142* (0.082)	-0.020*** (0.006)	-0.019*** (0.006)
-11	0.430*** (0.087)	0.433*** (0.088)	0.021*** (0.006)	0.023*** (0.006)
-10	0.037 (0.082)	0.062 (0.083)	-0.006 (0.006)	-0.003 (0.006)
-9	0.426*** (0.088)	0.441*** (0.088)	0.021*** (0.006)	0.024*** (0.006)
-8	-0.359*** (0.086)	-0.348*** (0.086)	-0.033*** (0.006)	-0.031*** (0.006)
-7	0.225** (0.091)	0.238*** (0.092)	0.000 (0.007)	0.003 (0.007)
-6	-0.081 (0.093)	-0.065 (0.094)	-0.014** (0.006)	-0.012* (0.006)
-5	0.071 (0.094)	0.088 (0.094)	0.002 (0.006)	0.005 (0.006)
-4	-0.799*** (0.090)	-0.780*** (0.090)	-0.065*** (0.007)	-0.062*** (0.007)
-3	-0.340*** (0.103)	-0.306*** (0.104)	-0.046*** (0.007)	-0.041*** (0.008)
-2	-0.548*** (0.105)	-0.516*** (0.105)	-0.063*** (0.008)	-0.059*** (0.008)
-1	-0.094 (0.113)	-0.039 (0.114)	-0.029*** (0.008)	-0.022*** (0.008)
0	-2.236***	-1.220***	-0.405***	-0.312***

	(0.179)	(0.188)	(0.017)	(0.017)
1	-6.536***	-5.793***	-0.553***	-0.450***
	(0.163)	(0.174)	(0.018)	(0.018)
2	-4.835***	-4.618***	-0.442***	-0.410***
	(0.160)	(0.163)	(0.017)	(0.017)
3	-3.776***	-3.584***	-0.350***	-0.321***
	(0.150)	(0.152)	(0.016)	(0.016)
4	-3.655***	-3.477***	-0.365***	-0.338***
	(0.155)	(0.158)	(0.017)	(0.016)
5	-3.263***	-3.091***	-0.298***	-0.272***
	(0.146)	(0.147)	(0.015)	(0.015)
6	-2.719***	-2.571***	-0.258***	-0.235***
	(0.147)	(0.148)	(0.014)	(0.013)
7	-2.740***	-2.617***	-0.265***	-0.245***
	(0.140)	(0.140)	(0.014)	(0.013)
8	-2.817***	-2.687***	-0.256***	-0.236***
	(0.136)	(0.137)	(0.013)	(0.012)
9	-2.597***	-2.457***	-0.246***	-0.226***
	(0.135)	(0.136)	(0.013)	(0.013)
10	-2.158***	-2.010***	-0.204***	-0.181***
	(0.138)	(0.138)	(0.013)	(0.012)
11	-2.524***	-2.098***	-0.235***	-0.188***
	(0.131)	(0.132)	(0.013)	(0.012)
12	-2.156***	-2.025***	-0.196***	-0.177***
	(0.133)	(0.133)	(0.011)	(0.011)
13	-2.388***	-2.199***	-0.214***	-0.189***
	(0.138)	(0.138)	(0.012)	(0.011)
14	-1.754***	-1.588***	-0.155***	-0.136***
	(0.137)	(0.139)	(0.012)	(0.012)
15	-2.175***	-2.005***	-0.185***	-0.166***
	(0.136)	(0.137)	(0.012)	(0.012)
16	-2.078***	-1.943***	-0.177***	-0.157***
	(0.147)	(0.147)	(0.012)	(0.011)
17	-2.208***	-2.033***	-0.187***	-0.163***
	(0.141)	(0.142)	(0.012)	(0.012)
18	-1.732***	-1.575***	-0.136***	-0.117***
	(0.144)	(0.144)	(0.012)	(0.012)
19	-2.157***	-2.017***	-0.166***	-0.148***
	(0.142)	(0.143)	(0.012)	(0.012)
20	-2.008***	-1.879***	-0.168***	-0.149***
	(0.143)	(0.143)	(0.012)	(0.012)
Number of worker-quarter observations	811,193	811,193	808,110	808,110
Number of workers	15,981	15,981	15,981	15,981
R^2	0.095	0.091	0.086	0.081

Notes: Columns (1) and (3) show the coefficients (and standard errors clustered by worker) underlying Figure 2 in the main text. These are estimated δ_{ks} from equation (1) in the main text, with the log of earnings from the primary employer as the dependent variable. Each regression controls for a worker-specific fixed effect; a vector of quarterly dummies; worker's age and age squared; a vector of gender, race, and education dummies interacted with the

worker's age; logarithm of pre-displacement employer size and one-digit NAICS code in 2007:IV interacted with a vector of yearly dummies; a simple average of pre-displacement earnings with the primary employer and an average of pre-displacement hours with the primary employer, each interacted with a vector of yearly dummies. Earnings are expressed in 2010-constant dollars.

Source: Authors' calculations using Washington administrative wage and claims records. See Sections II.A, III.A, and III.B of the main text for details.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Appendix Table A12-2

Estimated effects of displacement on unconditional hours and log hours (from primary employer and all employers), UI claimant sample

	(1)	(2)	(3)	(4)
	Quarterly work hours		Log quarterly work hours	
Quarter relative to displacement	From primary employer only	From all employers	From primary employer only	From all employers
-20	4.224** (1.777)	4.111** (1.841)	-0.000 (0.005)	0.000 (0.005)
-19	-5.194*** (1.773)	-5.639*** (1.848)	-0.007 (0.005)	-0.009* (0.005)
-18	16.011*** (2.084)	16.134*** (2.182)	0.029*** (0.005)	0.030*** (0.005)
-17	-3.966* (2.024)	-3.751* (2.125)	-0.003 (0.006)	-0.003 (0.006)
-16	4.385** (2.126)	4.195* (2.220)	0.009 (0.006)	0.009 (0.006)
-15	0.742 (2.070)	0.590 (2.155)	-0.001 (0.006)	-0.001 (0.006)
-14	18.186*** (2.230)	18.488*** (2.336)	0.033*** (0.006)	0.033*** (0.006)
-13	18.217*** (2.354)	18.092*** (2.429)	0.029*** (0.006)	0.029*** (0.006)
-12	-0.916 (2.293)	-0.765 (2.398)	-0.010 (0.006)	-0.009 (0.006)
-11	23.352*** (2.485)	23.677*** (2.581)	0.037*** (0.006)	0.037*** (0.006)
-10	3.167 (2.434)	5.128** (2.568)	0.002 (0.006)	0.005 (0.006)
-9	24.174*** (2.619)	25.429*** (2.740)	0.038*** (0.006)	0.041*** (0.006)
-8	14.175*** (2.725)	14.877*** (2.837)	0.014** (0.006)	0.015** (0.006)
-7	25.397*** (2.813)	26.217*** (2.917)	0.032*** (0.007)	0.033*** (0.007)
-6	6.881*** (2.573)	8.047*** (2.693)	0.006 (0.006)	0.007 (0.006)
-5	25.223*** (2.949)	26.859*** (3.061)	0.036*** (0.006)	0.038*** (0.006)
-4	-4.612 (2.809)	-2.252 (2.955)	-0.026*** (0.007)	-0.022*** (0.007)
-3	21.606*** (3.589)	24.530*** (3.721)	0.011 (0.008)	0.015* (0.008)
-2	-18.420*** (2.968)	-16.084*** (3.087)	-0.046*** (0.007)	-0.042*** (0.007)
-1	-13.467*** (3.124)	-9.386*** (3.302)	-0.032*** (0.008)	-0.028*** (0.008)
0	-159.794*** (4.057)	-112.453*** (4.392)	-0.468*** (0.016)	-0.341*** (0.015)

1	-217.325*** (4.747)	-191.853*** (5.206)	-0.423*** (0.016)	-0.336*** (0.016)
2	-138.092*** (4.768)	-130.240*** (4.911)	-0.285*** (0.016)	-0.255*** (0.015)
3	-105.653*** (4.749)	-96.433*** (4.907)	-0.226*** (0.015)	-0.196*** (0.015)
4	-106.377*** (4.460)	-98.563*** (4.635)	-0.241*** (0.014)	-0.218*** (0.014)
5	-68.597*** (4.557)	-59.572*** (4.719)	-0.141*** (0.013)	-0.118*** (0.013)
6	-56.772*** (4.136)	-49.595*** (4.280)	-0.125*** (0.011)	-0.104*** (0.011)
7	-52.812*** (3.911)	-46.090*** (4.041)	-0.135*** (0.012)	-0.116*** (0.012)
8	-47.519*** (3.977)	-40.522*** (4.110)	-0.117*** (0.011)	-0.098*** (0.011)
9	-41.519*** (3.858)	-33.944*** (4.061)	-0.109*** (0.011)	-0.090*** (0.011)
10	-41.856*** (3.772)	-32.734*** (3.915)	-0.106*** (0.011)	-0.080*** (0.011)
11	-44.948*** (3.722)	-21.564*** (3.933)	-0.110*** (0.011)	-0.061*** (0.011)
12	-15.857*** (4.258)	-8.200* (4.323)	-0.060*** (0.010)	-0.040*** (0.010)
13	-29.929*** (3.849)	-20.064*** (3.980)	-0.080*** (0.010)	-0.056*** (0.010)
14	-12.787*** (3.994)	-4.777 (4.106)	-0.044*** (0.010)	-0.027*** (0.010)
15	-26.694*** (3.722)	-18.269*** (3.856)	-0.065*** (0.010)	-0.044*** (0.009)
16	-17.778*** (3.918)	-9.679** (4.057)	-0.059*** (0.010)	-0.039*** (0.010)
17	-22.912*** (3.817)	-12.913*** (3.952)	-0.068*** (0.011)	-0.046*** (0.010)
18	-3.750 (3.887)	5.088 (4.029)	-0.024** (0.010)	-0.007 (0.010)
19	-19.654*** (3.783)	-12.604*** (3.917)	-0.045*** (0.010)	-0.029*** (0.010)
20	-10.506** (4.136)	-2.596 (4.269)	-0.052*** (0.010)	-0.032*** (0.010)
Number of worker-quarter observations	811,193	811,193	804,489	804,739
Number of workers	15,981	15,981	15,981	15,981
R^2	0.109	0.097	0.056	0.051

Notes: Columns (1) and (3) show the coefficients (and standard errors clustered by worker) underlying Figure 3 in the main text. These are estimated δ_{kS} from equation (1) in the main text, with the log of hours from the primary employer as the dependent variable. Each regression controls for a worker-specific fixed effect; a vector of quarterly dummies; worker's age and age squared; a vector of gender, race, and education dummies interacted with the worker's age; logarithm of pre-displacement employer size and one-digit NAICS code in 2007:IV interacted with a

vector of yearly dummies; a simple average of pre-displacement earnings with the primary employer and an average of pre-displacement hours with the primary employer, each interacted with a vector of yearly dummies.

Source: Authors' calculations using Washington administrative wage and claims records. See Sections II.A, III.A, and III.B of the main text for details.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Appendix Table A12-3

Estimated displacement effects on the probability of positive work hours and the distribution of quarterly work hours, UI claimant sample

Quarter relative to displacement	(1)	(2)	(3)	(4)	(5)	(6)
	Pr(hours > 0)	Hours quantile				
		10th	25th	50th	75th	90th
-20	0.002 (0.001)	-11.19 (5.07)	-1.90 (2.59)	2.89 (1.00)	11.04 (2.17)	20.34 (4.45)
-19	0.003 (0.001)	13.44 (5.08)	-4.90 (2.84)	-3.40 (1.04)	-15.14 (2.14)	-18.03 (3.82)
-18	0.004 (0.002)	6.98 (5.45)	7.51 (2.64)	9.25 (1.08)	20.05 (2.35)	32.59 (4.76)
-17	-0.001 (0.002)	2.48 (5.66)	-1.50 (2.70)	0.15 (1.08)	-4.21 (2.36)	-19.28 (4.27)
-16	-0.002 (0.002)	-13.78 (5.90)	-5.53 (2.89)	1.84 (1.10)	14.03 (2.36)	27.67 (4.94)
-15	0.004 (0.002)	0.32 (5.73)	1.68 (2.83)	1.88 (1.07)	1.22 (2.46)	-5.75 (4.62)
-14	0.002 (0.002)	8.26 (5.60)	14.92 (2.75)	7.97 (1.14)	18.89 (2.58)	45.65 (5.43)
-13	0.003 (0.002)	4.16 (5.71)	8.82 (2.78)	7.01 (1.10)	23.25 (2.57)	44.81 (5.65)
-12	0.002 (0.002)	-8.43 (5.86)	3.75 (2.82)	-1.75 (1.18)	-3.35 (2.60)	-2.29 (4.97)
-11	0.001 (0.002)	-0.59 (5.93)	13.45 (2.85)	9.23 (1.13)	25.74 (2.62)	52.04 (5.69)
-10	-0.000 (0.002)	-1.10 (6.01)	5.07 (2.88)	-2.76 (1.21)	-0.94 (2.72)	6.89 (5.27)
-9	-0.001 (0.002)	-5.94 (6.24)	10.91 (2.91)	5.54 (1.14)	22.54 (2.66)	58.92 (5.79)
-8	0.000 (0.002)	-10.67 (6.19)	1.75 (2.97)	-1.46 (1.23)	7.58 (2.75)	39.98 (5.69)
-7	-0.001 (0.002)	1.40 (5.99)	8.78 (2.98)	7.19 (1.21)	22.01 (2.68)	47.64 (5.62)
-6	-0.001 (0.002)	0.13 (6.15)	4.25 (3.07)	-3.18 (1.25)	-1.15 (2.64)	16.18 (4.98)
-5	-0.001 (0.002)	-6.39 (6.47)	9.37 (3.06)	4.36 (1.20)	16.29 (2.58)	48.51 (5.64)
-4	-0.003 (0.002)	-23.80 (6.85)	-15.63 (3.31)	-8.66 (1.26)	-8.34 (2.62)	19.32 (5.25)
-3	-0.005 (0.002)	-27.37 (6.90)	-5.22 (3.31)	1.54 (1.24)	14.98 (2.71)	44.14 (5.74)
-2	-0.009 (0.003)	-41.05 (7.69)	-17.88 (3.56)	-11.14 (1.32)	-14.81 (2.58)	-4.09 (4.60)
-1	-0.019 (0.003)	-64.01 (8.64)	-14.55 (3.68)	0.55 (1.28)	6.97 (2.67)	13.98 (5.02)
0	-0.074 (0.005)	-502.38 (13.15)	-165.22 (4.09)	-31.69 (1.23)	-34.70 (2.28)	-15.77 (4.23)
1	-0.256 (0.009)	-590.95 (13.35)	-206.87 (3.93)	-38.83 (1.17)	-32.73 (2.22)	-17.62 (3.99)
2	-0.155 (0.008)	-378.88 (13.10)	-109.00 (4.40)	-22.32 (1.32)	-25.75 (2.36)	-7.23 (4.42)
3	-0.120 (0.007)	-315.06 (12.75)	-75.49 (4.38)	-10.92 (1.34)	-26.31 (2.40)	-12.69 (4.47)

4	-0.107 (0.006)	-288.06 (12.39)	-92.97 (4.37)	-22.68 (1.34)	-21.11 (2.54)	-5.13 (4.68)
5	-0.092 (0.006)	-211.49 (11.78)	-48.87 (4.33)	-3.87 (1.38)	-9.46 (2.56)	8.83 (4.82)
6	-0.056 (0.005)	-171.51 (11.28)	-48.63 (4.27)	-7.96 (1.37)	-15.99 (2.60)	-0.28 (4.81)
7	-0.039 (0.005)	-155.62 (10.96)	-43.78 (4.15)	-10.40 (1.37)	-14.27 (2.66)	-2.02 (4.92)
8	-0.040 (0.005)	-152.16 (10.76)	-37.58 (4.09)	-6.34 (1.38)	-17.09 (2.64)	-2.64 (4.96)
9	-0.034 (0.004)	-132.13 (10.41)	-48.29 (4.10)	-9.44 (1.35)	-6.19 (2.77)	9.00 (5.33)
10	-0.032 (0.004)	-128.84 (10.25)	-44.72 (4.12)	-9.85 (1.39)	-11.34 (2.76)	-2.55 (5.19)
11	-0.030 (0.004)	-148.76 (10.39)	-44.12 (4.07)	-9.24 (1.37)	-9.44 (2.82)	4.85 (5.54)
12	-0.031 (0.004)	-132.48 (10.01)	-29.52 (3.95)	-2.61 (1.38)	8.64 (2.83)	40.06 (5.96)
13	-0.027 (0.004)	-126.71 (10.08)	-47.73 (4.00)	-10.01 (1.39)	-5.83 (2.85)	20.94 (5.71)
14	-0.031 (0.004)	-106.32 (9.80)	-22.19 (3.89)	-1.26 (1.37)	9.25 (2.83)	38.51 (5.89)
15	-0.026 (0.004)	-112.37 (9.90)	-35.59 (3.90)	-8.56 (1.39)	-2.55 (2.91)	22.25 (5.97)
16	-0.030 (0.004)	-120.51 (9.92)	-25.37 (3.85)	-1.78 (1.37)	7.82 (2.88)	32.18 (5.79)
17	-0.028 (0.004)	-107.91 (9.86)	-32.18 (3.97)	-5.78 (1.39)	0.32 (2.91)	29.13 (5.97)
18	-0.026 (0.004)	-82.56 (9.45)	-21.36 (3.91)	-0.31 (1.40)	13.55 (2.99)	40.60 (6.04)
19	-0.025 (0.004)	-81.70 (9.75)	-34.13 (4.10)	-8.00 (1.45)	-6.44 (3.03)	17.69 (6.03)
20	-0.019 (0.004)	-102.63 (10.36)	-27.50 (4.16)	-3.34 (1.49)	0.36 (3.10)	31.91 (6.28)
Baseline (pre-disp.) quantile of displaced workers	--	418	480	525	580	649

Notes: Column (1) shows estimated displacement effects on the probability of working a positive number of hours in a given quarter, based on estimates of equation (1) in the main text. Columns (2)–(6) show estimated displacement effects on unconditional hours quantiles, obtained using the re-centered influence function approach (Firpo, Fortin, and Lemieux 2009). Standard errors clustered by worker are shown in parentheses. The estimates are based on a sample of 811,193 worker-quarter observations of 15,981 workers.

Source: Authors' calculations using Washington administrative wage and claims records. See Section III.B of the text for further discussion.

Appendix Table A12-4

Estimated displacement effects on log earnings, log hours, log wage rates: full losses and losses due to employer fixed effects (ψ), UI claimant sample

Quarter relative to displacement	(1)	(2)	(3)	(4)	(5)	(6)
	Log earnings		Log hours		Log hours wage rate	
	full loss	ψ effect	full loss	ψ effect	full loss	ψ effect
0	-0.405*** (0.017)	0.001** (0.001)	-0.468*** (0.016)	0.002*** (0.000)	0.084*** (0.011)	-0.000 (0.001)
1	-0.553*** (0.018)	-0.033*** (0.005)	-0.423*** (0.016)	-0.018*** (0.003)	-0.134*** (0.009)	-0.015 (0.004)
2	-0.442*** (0.017)	-0.031*** (0.005)	-0.285*** (0.016)	-0.015*** (0.003)	-0.166*** (0.009)	-0.016 (0.004)
3	-0.350*** (0.016)	-0.026*** (0.005)	-0.226*** (0.015)	-0.012*** (0.003)	-0.133*** (0.009)	-0.014 (0.004)
4	-0.365*** (0.017)	-0.030*** (0.005)	-0.241*** (0.014)	-0.015*** (0.003)	-0.126*** (0.009)	-0.016 (0.004)
5	-0.298*** (0.015)	-0.026*** (0.005)	-0.141*** (0.013)	-0.011*** (0.003)	-0.157*** (0.008)	-0.015 (0.004)
6	-0.258*** (0.014)	-0.025*** (0.005)	-0.125*** (0.011)	-0.009*** (0.003)	-0.130*** (0.008)	-0.015 (0.004)
7	-0.265*** (0.014)	-0.024*** (0.005)	-0.135*** (0.012)	-0.010*** (0.003)	-0.126*** (0.008)	-0.014 (0.004)
8	-0.256*** (0.013)	-0.022*** (0.005)	-0.117*** (0.011)	-0.007** (0.003)	-0.140*** (0.008)	-0.015 (0.004)
9	-0.246*** (0.013)	-0.021*** (0.005)	-0.109*** (0.011)	-0.007** (0.003)	-0.135*** (0.008)	-0.014 (0.004)
10	-0.204*** (0.013)	-0.016*** (0.005)	-0.106*** (0.011)	-0.006* (0.003)	-0.099*** (0.008)	-0.010 (0.004)
11	-0.235*** (0.013)	-0.015*** (0.005)	-0.110*** (0.011)	0.001 (0.003)	-0.121*** (0.008)	-0.015 (0.004)
12	-0.196*** (0.011)	-0.011** (0.005)	-0.060*** (0.010)	0.008** (0.003)	-0.135*** (0.008)	-0.018 (0.004)
13	-0.214*** (0.012)	-0.014*** (0.005)	-0.080*** (0.010)	0.006* (0.003)	-0.131*** (0.008)	-0.019 (0.004)
14	-0.155*** (0.012)	-0.011** (0.005)	-0.044*** (0.010)	0.007** (0.003)	-0.110*** (0.008)	-0.018 (0.004)
15	-0.185*** (0.012)	-0.009* (0.005)	-0.065*** (0.010)	0.009*** (0.003)	-0.115*** (0.008)	-0.018 (0.004)
16	-0.177*** (0.012)	-0.010** (0.005)	-0.059*** (0.010)	0.008*** (0.003)	-0.119*** (0.008)	-0.018 (0.004)
17	-0.187*** (0.012)	-0.012** (0.005)	-0.068*** (0.011)	0.006** (0.003)	-0.117*** (0.008)	-0.019 (0.004)
18	-0.136*** (0.012)	-0.013*** (0.005)	-0.024** (0.010)	0.004 (0.003)	-0.110*** (0.008)	-0.017 (0.004)
19	-0.166*** (0.012)	-0.017*** (0.005)	-0.045*** (0.010)	0.004 (0.003)	-0.118*** (0.008)	-0.020 (0.004)
20	-0.168*** (0.012)	-0.018*** (0.005)	-0.052*** (0.010)	0.004 (0.003)	-0.114*** (0.008)	-0.023 (0.004)

Number of worker- quarter observations	808,110	807,475	804,489	807,475	804,481	807,475
Number of workers	15,981	15,981	15,981	15,981	15,981	15,981
R^2	0.086	0.027	0.056	0.020	0.080	0.027

Notes: Columns (1), (3), and (5) show the coefficients (and standard errors clustered by worker) underlying in Figures 2, 3, and 5 in the main text. These are estimated δ_{ks} from equation (1) in the main text, with the log of earnings, log of hours, and log of the wage rate from the primary employer as the dependent variables. Columns (2), (4), and (6) show the coefficients (and standard errors clustered by worker) underlying Figure 6. These are estimated δ_{ks} from equation (3), with employer fixed effects (ψ_{ijt}) for log of earnings, log of hours, and log of the wage rate from the primary employer [estimated by equation (2)] as the dependent variables.

Source: Authors' calculations using Washington administrative wage and claims records. See Sections II, III, and IV.A of the main text for details.

Appendix B: Estimation of employer fixed effects for earnings, hours, and wage rates

This appendix describes estimation of the AKM employer fixed effects for earnings, hours, and hourly wages used in the main text. Raw data for the analysis come from quarterly administrative earnings records of Washington State. The records available to us provide information on the earnings and paid work hours of virtually all workers employed in Washington during 2002–2014,⁷ as well as information on all UI-covered employers in the state.⁸ A record appears for each employer-worker-quarter combination, so a worker has as many earnings records as he or she has employers in a given quarter. Each record includes a year-quarter indicator; the ID and NAICS industry code of the reporting employer; and the worker ID, earnings, and work hours of the worker with that employer in the specified quarter. The availability of both quarterly earnings and hours allows us to calculate the hourly wage rate by quarter, and the availability of quarterly hours for each employer allows us to include both full-time and part-time jobs in the analysis.

⁷ Exemptions from coverage are limited to the self-employed, including outside sales workers paid solely by commission and independent contractors meeting exemption tests specified in Washington’s UI law (Revised Code of Washington, Title 50). Nonprofit religious organizations are also exempt.

⁸ The employer is the entity from which the state collects UI payroll taxes and to which the state “charges” UI benefits (for the purpose of experience rating the UI payroll tax). Typically, the employer is the set of establishments operating in Washington under a single owner, so for a company operating entirely in Washington (with a single or multiple addresses) the employer is a firm, and for a company with one address in Washington, the employer is also an establishment.

Appendix B.1 Construction of the analysis sample

We use the raw administrative records to construct a linked employer-employee panel similar to a procedure developed by Sorkin (2018). First, for each quarter, we identify each worker's primary employer, defined as the employer from whom the worker earned the largest share of his/her earnings in that quarter.⁹ We then define an employment spell as a series of at least five consecutive quarters during which a worker has earnings from the same primary employer. For each of these spells, we drop the first quarter (to avoid making inferences about earnings and hours based on a partial quarter of employment) and the last two quarters (to avoid making inferences based on earnings and hours in the quarter before a job loss and the quarter of a job loss).

We next annualize the remaining quarterly data within each calendar year, conditional on the calendar year including at least two consecutive quarters of earnings from the same primary employer. Earnings are defined as annualized earnings in a given year with the primary employer, and similarly for hours and wage rates.

Appendix Figure B1 illustrates the process and gives some examples, described in the figure notes. Ultimately, the unit of observation is the worker-year, with a focus on the primary employer in a year.¹⁰

We impose several restrictions on the sample, dropping the following:

- workers with more than 9 employers in a year (this affects 1 percent of the sample)

⁹ In most cases, a worker has only one employer during the quarter, but multiple employers appear for about 27 percent of the worker-quarter observations.

¹⁰ By removing the first quarter and the last two quarters of any worker-primary-employer spell and by including at least two consecutive quarters of earnings from the same primary employer in a calendar year, we lose about 27 percent of all worker-primary-employer spells. If we only remove the first quarter and the last two quarters of any worker-primary-employer spell (without requiring at least two consecutive quarters of earnings from the same primary employer in a calendar year), we lose about 23 percent of all worker-primary-employer spells.

- workers with annual earnings less than \$2,850 (in 2005 dollars) and workers with calculated hourly wage rates \leq \$2.00/hour (in 2005 dollars) (Sorkin 2018; Card, Heining, and Kline 2013)
- workers who worked fewer than 400 hours in the year
- workers who worked more than 4,800 hours in the year
- employers with fewer than 5 employees in the year (Song, Price, Guvenen, Bloom, and von Wachter 2019)
- all displaced workers and all non-displaced comparison workers

The last restriction is imposed because including displaced workers and the non-displaced comparison group in estimating the AKM model could create a mechanical relationship between the employer fixed effects and displaced workers' earnings, hours, and wage rate losses, potentially overstating the role of employer fixed effects.

The first column of Appendix Table B1 ("Full annualized panel") shows summary statistics for the annualized linked employer-employee panel—that is, after processing the quarterly records as illustrated in Appendix Figure B1 and imposing the sample restrictions described above.

The employer effects are identified only within the "connected set" of employers that are linked by worker transitions between those employers, so the AKM estimation is necessarily restricted to the largest connected set of employers. This consists of 64 percent of employers in the full annualized panel, 79 percent of workers in the panel, and 90 percent of worker-year observations in the panel.

The second column of Appendix Table B1 shows descriptive statistics for the largest connected set. Because identification of employer fixed effects comes from workers moving

between primary employers, it is important to know how much mobility there is in the sample. The table shows that the largest connected set includes about 3.5 million unique workers, and about 42 percent of those workers changed primary employer at least once during 2002–2014. The question is whether the extent of mobility in this sample is adequate for AKM to be an unbiased estimator of the variance of employer fixed effects, or if instead “limited mobility” bias is likely to be a problem (Andrews et al. 2012).

Three factors suggest that limited mobility is unlikely to pose a problem in the Washington data. First, the average number of movers per employer in sample we use to estimate the AKM model is about 10. (For employers of the displaced workers, the average number of movers is 211). The analysis in Andrews et al. (2012) suggests that limited mobility bias is unlikely to be a problem with an average of more than 6 movers per employer.

Second, the rate of mobility in the Washington data appears quite high compared with the German data used by Card, Heining, and Kline (CHK) (2013), Fackler, Mueller, and Stegmaier (2017), and Schmieder, von Wachter, and Heining (2018). We can compute a measure of mobility in the German data using data reported in CHK, specifically by calculating the ratio of total moves in their event study analysis to the number of person-year or person observations. CHK report that there were 3,002,557 moves during the 2002–2009 interval (calculated from Appendix Table A.3 in CHK). In the same interval, there were 90,615,841 person-year observations and 15,834,602 persons (Table 3 in CHK). Dividing the number of moves by person-years (persons) gives a mobility rate of 0.03 (0.19).

In the Washington data there 2,220,457 moves and 22,941,254 person-years and 3,508,810 persons (Appendix Table B1). Dividing the number of moves by person-years

(persons) gives a mobility rate of 0.097 (0.63). Hence, the mobility rates in the Washington sample we use to estimate the AKM model appear to be relatively high.

Third, Lachowska, Mas, Saggio, and Woodbury (2020) have estimated variance decompositions of earnings and wage rates using the “leave-one-out” bias correction proposed by Kline, Saggio, Sølvesten (2019) (KSS). The KSS-corrected variance decompositions are very similar to the simple AKM variance decompositions used here; see Lachowska, Mas, Saggio, and Woodbury (2020) for details.¹¹

¹¹ Other approaches for unbiased estimation of variance components have been proposed—see for example Bonhomme, Lamadon, and Manresa (2019).

Appendix B.2 Estimation and variance decompositions

We estimate the AKM model [equation (2) in the main text] using the linked employer-employee panel for each of the three outcomes: log earnings, log hours worked, and log wage rates.

Appendix Table B2 displays the resulting variance decompositions. The variance of each outcome is decomposed into five components: one each for worker effects, employer effects, year effects, the covariance between worker and employer effects (sorting of workers and employers), and a residual. (To conserve space, we do not show the worker-year or employer-year covariances. Together, these two covariances explain about one percent of the variation in each outcome.) The numbers in italics below each variance-covariance term show the share of the total variance of each outcome attributable to that component.

Worker fixed effects explain a large share of the variation in all three outcomes: 52 percent of the variation in earnings, 45 percent of the variation in work hours, and 60 percent of the variation in hourly wage rates. This compares with worker fixed effects explaining 51 percent of the variation in earnings in Sorkin (2018) (see his Table 1, U.S., 2000–2008) and 51–61 percent of daily earnings in CHK (Table 3, Germany, 1985–2009).

Employer effects are also important: They explain about 20 percent of the variation in earnings, 35 percent of the variation in work hours, and 13 percent of the variation in hourly wage rates. This compares with employer fixed effects explaining about 14 percent of the variation in earnings in Sorkin (2018) and 18–21 percent in CHK (Table 3, Germany, 1985–2009).

The rightmost columns of Appendix Table B2 show adjusted- R^2 s and RMSEs from a model in which each outcome variable is regressed on (i) an indicator for each worker-employer spell and (ii) year effects. CHK (2013, p. 990) suggest that the explanatory power of this model,

compared with the explanatory model of the AKM model, provides a test of the importance of idiosyncratic worker-employer matches, hence we refer to it as the “CHK match effects model” (to distinguish it from the match effects model described in Appendix A.11). The adjusted- R^2 from the AKM model for earnings is 0.872, whereas the adjusted- R^2 from the CHK match effects model for earnings is about 0.925.¹² Although the fit is somewhat better for the CHK match effects model, the roughly 5 percentage-point difference between the R^2 s of the AKM and CHK match-effects models suggests that the AKM model specification of earnings as the sum of worker and employer fixed effects is not greatly off the mark.

¹²These estimates are similar to those in Sorkin (2018), who obtains an adjusted- R^2 of 0.86 for the AKM model of earnings, and an adjusted- R^2 of 0.92 for the CHK match effects model of earnings.

Appendix B.3 Event studies of inter-employer mobility

OLS estimation of the AKM model will be biased for the employer effects (ψ) if worker mobility among employers is endogenous, or correlated with time-varying components of the residual in equation (2) in the main text. This problem would arise, for example, if workers moved to take advantage of good specific employer-employee matches, or if workers developed specific human capital within a job over time.¹³ To examine the importance of endogenous mobility, CHK developed an event study analysis of the movement of earnings when workers move among employers. If the AKM model is a correct description of earnings determination, then workers who move from low- ψ to high- ψ employers should on average see their pay rise, and conversely. Further, workers who move from low- ψ to high- ψ employers should receive (on average) pay increases equal and opposite those of workers who move from high- ψ to low- ψ employers. In contrast, the presence of specific employer-employee match effects would lead to average pay increases for workers moving in any direction, as they take advantage of opportunities for favorable specific matches.

Following CHK, we conduct event study analyses of how earnings, work hours, and wage rates change when workers move between employers of different types in the Washington linked employer-employee panel. For example, we can follow a group of workers who start with an employer whose fixed effect (ψ) is in the fourth quartile, and who then move to other employers. Some of these “destination” employers will have a high ψ , others will have a low ψ , and observing how workers’ earnings, hours, and wage rates change with these moves provides information about employers’ influence on earnings, hours, and wage rates.

¹³ Card, Heining, and Kline (2013) and Card, Cardoso, Heining, and Kline (2018) provide clear discussions of the assumptions needed for unbiased estimation of employer fixed effects in the AKM model, with several examples of situations that do and do not violate those assumptions.

The procedure for constructing these event studies is as follows. For each outcome (earnings, hours, or wage rates) we classify employers into quartiles by their AKM-estimated employer effect (ψ). Next, for a given year t , we select workers in each ψ quartile who have been with the employer at least two years, change employers (i.e., are observed with a different primary employer in year $t+1$), and remain with the subsequent employer for at least two years. Finally, we calculate the average outcome before and after the move for each possible type of interquartile move ($1 \rightarrow 1$, $1 \rightarrow 2$, ..., $4 \rightarrow 3$, and $4 \rightarrow 4$).

Appendix Figure B2 shows the results for eight of interquartile transitions ($4 \rightarrow 4$, $4 \rightarrow 3$, $4 \rightarrow 2$, $4 \rightarrow 1$, $1 \rightarrow 4$, $1 \rightarrow 3$, $1 \rightarrow 2$, and $1 \rightarrow 1$) for log earnings. Appendix Figures B3 and B4 show same transitions for log work hours and log wage rates. Appendix Table B3 displays the data underlying these figures.

We note two main points about Appendix Figure B2. First, workers who move from lower- ψ to higher- ψ employers tend to improve their earnings, and conversely. For example, workers who start with a low- ψ (quartile 1) employer and move to a high- ψ (quartile 4) employer experience a 70 log point increase in their earnings. (This $1 \rightarrow 4$ change falls to 60 log points when adjusted by the $1 \rightarrow 1$ within-quartile change, which is 10 log points—see the “Adjusted change from year -2 to year 1 ” column in Appendix Table B3.) Conversely, workers who start with a high- ψ (quartile 4) employer and move to a low- ψ (quartile 1) employer experience a 54 log point decrease in their earnings (63 log points if adjusted by the $4 \rightarrow 4$ within-quartile change, which is 9 log points). Consistent with the AKM model, the pay of workers who move from low- ψ to high- ψ employers increases on average, and conversely. Appendix Figures B3 and B4 show similar patterns.

Second, the approximate symmetry of gains and losses suggests that idiosyncratic match effects are not of great importance (CHK, p. 990). If employer-employee match effects were important, we would observe average pay increases for workers moving in any direction, but this is not the case. The symmetry of earnings changes for workers moving from low- ψ to high- ψ employers and those moving from high- ψ to low- ψ employers is consistent with the specification of the AKM model, with its additive worker and employer effects. For the Washington labor market overall, the AKM model appears to be a reasonable fit.

Appendix B.4 Estimating the AKM model using random subsamples of employers

Because the available data come from a single state, any worker who moves out of Washington and takes a job in another state cannot be observed. To examine the extent to which this attrition affects the estimated AKM employer fixed effects, we have re-estimated the AKM model after dropping random subsamples of 30 percent and 50 percent of employers from the AKM sample described in Appendix B.1. The idea is to approximate a situation where Washington workers move to out-of-state employers who cannot be observed in the Washington data.

The resulting employer fixed effects, presented in Appendix Figures B5 and B6, correlate very strongly with those obtained in the original full AKM sample analysis, suggesting that interstate migration does not bias the AKM results to a large extent.

Appendix Table B1

Summary statistics for the overall sample and the largest connected set (AKM dataset)

	Full annualized panel	Largest connected set
Number of worker/year observations	25,577,995	22,941,254
Number of unique workers	4,450,784	3,508,810
Number of unique employers	341,555	218,593
Number of unique movers	1,546,095	1,463,029
Number of mover/year observations	2,394,155	2,220,457
Log earnings (mean)	10.321	10.432
Log hours (mean)	7.338	7.453
Log hourly wage rate (mean)	3.063	3.052

Source: Authors' tabulations of Washington administrative wage records, 2002–2014. See Appendix Section B.1.

Appendix Table B2

Variance decompositions of log earnings, log hours, and log hourly wage rates, Washington, 2002–2014

(variance shares accounted for by each component in italics)

Outcome	Variance of outcome and decomposition into components						AKM model fit		CHK match effects model fit	
	Total variance	Worker FEs (α)	Employer FEs (ψ)	Year FEs (θ)	$2\text{cov}(\alpha, \psi)$	Residual	Adj. R^2	RMSE	Adj. R^2	RMSE
Log earnings	0.596	0.309 <i>0.519</i>	0.123 <i>0.207</i>	0.004 <i>0.006</i>	0.101 <i>0.169</i>	0.064 <i>0.107</i>	0.872	0.253	0.925	0.211
Log hours	0.129	0.058 <i>0.449</i>	0.045 <i>0.352</i>	0.000 <i>0.001</i>	−0.013 <i>−0.104</i>	0.039 <i>0.303</i>	0.638	0.197	0.754	0.178
Log hourly wage rate	0.411	0.247 <i>0.601</i>	0.053 <i>0.128</i>	0.022 <i>0.054</i>	0.065 <i>0.159</i>	0.040 <i>0.096</i>	0.885	0.199	0.932	0.167

Source: Authors' tabulations of Washington administrative wage records, 2002–2014.*Notes:* The decompositions include covariances between worker and employer fixed effects and year fixed effects. Because these covariances explain only about 1 percent of the variation, they are omitted from the table. The CHK match effects model is estimated by regressing each outcome variable on worker-employer indicators and year indicators. See Appendix Section B.2.

Appendix Table B3

Mean outcomes, classified by quartile of employer fixed effect

Panel A: Mean log earnings of movers, classified by quartile of employer earnings fixed effect at origin (year = -1) and destination (year = 0) employer

Origin/destination quartile	Year -2	Year -1	Year 0	Year 1	Change from year -2 to year 1	Adjusted change from year -2 to year 1 ^a	Number of observations
1 to 1	9.79	9.79	9.88	9.89	0.10	0.00	123,976
1 to 2	9.83	9.83	10.12	10.14	0.31	0.21	60,318
1 to 3	9.80	9.81	10.27	10.30	0.50	0.40	37,467
1 to 4	9.88	9.89	10.54	10.58	0.70	0.60	19,245
2 to 1	10.16	10.13	10.03	10.03	-0.12	-0.18	40,287
2 to 2	10.29	10.28	10.35	10.35	0.06	0.00	86,614
2 to 3	10.36	10.35	10.54	10.55	0.19	0.13	58,460
2 to 4	10.39	10.39	10.75	10.78	0.38	0.33	28,595
3 to 1	10.36	10.32	10.02	10.02	-0.34	-0.40	14,582
3 to 2	10.52	10.50	10.46	10.46	-0.07	-0.12	42,109
3 to 3	10.65	10.64	10.70	10.71	0.06	0.00	117,347
3 to 4	10.73	10.73	10.92	10.94	0.21	0.15	61,038
4 to 1	10.72	10.70	10.18	10.18	-0.54	-0.63	6,551
4 to 2	10.77	10.74	10.51	10.51	-0.25	-0.34	13,991
4 to 3	10.87	10.86	10.81	10.81	-0.06	-0.15	42,487
4 to 4	11.15	11.15	11.21	11.24	0.09	0.00	156,551
							909,618

Panel B: Mean log hours of movers, classified by quartile of employer hours fixed effect at origin (year = -1) and destination (year = 0) employer

Origin/destination quartile	Year -2	Year -1	Year 0	Year 1	Change from year -2 to year 1	Adjusted change from year -2 to year 1 ^a	Number of observations
1 to 1	7.24	7.22	7.27	7.26	0.02	0.00	110,627
1 to 2	7.27	7.24	7.49	7.47	0.20	0.18	62,295
1 to 3	7.22	7.18	7.56	7.55	0.33	0.32	34,579
1 to 4	7.21	7.17	7.65	7.64	0.43	0.42	27,646
2 to 1	7.45	7.41	7.29	7.28	-0.18	-0.17	39,023
2 to 2	7.51	7.48	7.52	7.50	-0.01	0.00	84,551
2 to 3	7.50	7.47	7.58	7.57	0.07	0.08	71,055
2 to 4	7.49	7.46	7.66	7.65	0.16	0.16	41,815
3 to 1	7.54	7.50	7.25	7.23	-0.31	-0.31	16,368
3 to 2	7.57	7.54	7.51	7.49	-0.09	-0.08	45,242
3 to 3	7.58	7.55	7.58	7.57	-0.01	0.00	94,543
3 to 4	7.59	7.57	7.66	7.65	0.05	0.06	72,139
4 to 1	7.65	7.61	7.21	7.20	-0.45	-0.44	10,651
4 to 2	7.66	7.63	7.50	7.48	-0.18	-0.17	23,646
4 to 3	7.65	7.63	7.60	7.58	-0.07	-0.07	57,815
4 to 4	7.67	7.66	7.68	7.67	0.00	0.00	117,623
							909,618

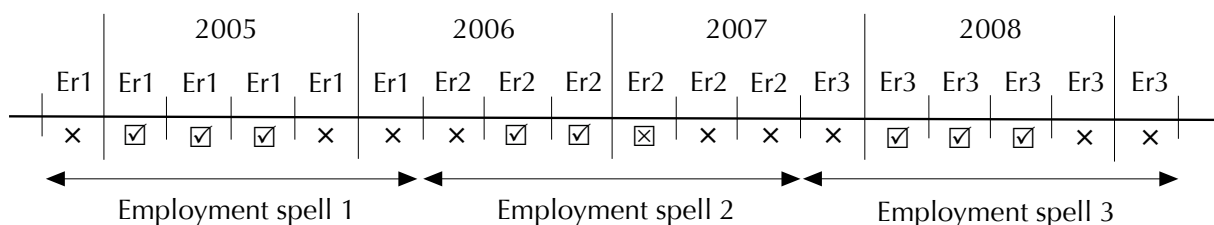
Note: a. The adjusted change is the change from year -2 to year 1, minus the within-quartile change from year -2 to year 1.

Panel C: Mean log hourly wage rate of movers, classified by quartile of AKM employer wage effects at origin (year = -1) and destination (year = 0) employer

Origin/destination quartile	Year -2	Year -1	Year 0	Year 1	Change from year -2 to year 1	Adjusted change from year -2 to year 1 ^a	Number of observations
1 to 1	2.46	2.49	2.53	2.57	0.12	0.00	112,835
1 to 2	2.54	2.59	2.75	2.80	0.26	0.15	60,529
1 to 3	2.57	2.64	2.90	2.96	0.39	0.27	41,330
1 to 4	2.65	2.71	3.17	3.23	0.59	0.47	22,593
2 to 1	2.72	2.76	2.69	2.73	0.01	-0.12	48,973
2 to 2	2.86	2.90	2.95	2.99	0.13	0.00	82,195
2 to 3	2.91	2.96	3.09	3.14	0.23	0.10	63,578
2 to 4	2.93	2.98	3.27	3.33	0.40	0.27	30,556
3 to 1	2.91	2.94	2.75	2.79	-0.13	-0.27	22,026
3 to 2	3.03	3.07	3.04	3.07	0.04	-0.10	50,045
3 to 3	3.12	3.17	3.22	3.27	0.14	0.00	97,699
3 to 4	3.22	3.27	3.45	3.50	0.29	0.14	60,740
4 to 1	3.17	3.21	2.78	2.82	-0.35	-0.51	8,619
4 to 2	3.29	3.33	3.12	3.16	-0.14	-0.30	20,262
4 to 3	3.37	3.41	3.33	3.37	0.00	-0.16	47,581
4 to 4	3.59	3.64	3.68	3.75	0.16	0.00	140,057
							909,618

Note: a. The adjusted change is the change from year -2 to year 1, minus the within-quartile change from year -2 to year 1.

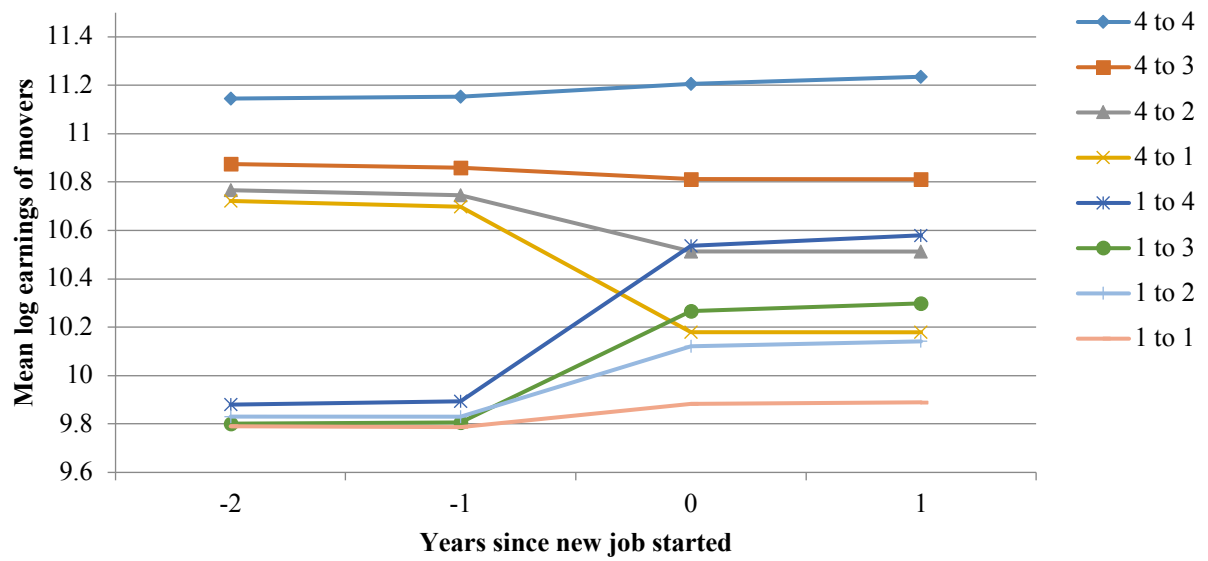
Appendix Figure B1
Construction of the analysis sample for the AKM dataset



Notes: The figure shows three hypothetical employment spells with three different employers (Er1, Er2, and Er3), each of which has the minimum five quarters required to be included in the analysis sample. The first quarter and last two quarters of each employment spell (denoted by ×) are dropped from the analysis, and outcomes from the remaining quarters are then annualized for each calendar year, conditional on the calendar year including at least two consecutive quarters of earnings from the same primary employer. For example, outcomes for 2005 (Employment spell 1) and 2008 (Employment spell 3) are obtained by averaging the outcomes for the first, second, and third quarters of 2005 (or 2008) and multiplying by four. (The quarters used in the calculations are denoted by ☑.) Outcomes for 2006 (Employment spell 2) are obtained by averaging the outcomes for the third and fourth quarters of 2006 and multiplying by four. Outcomes for 2007 (part of Employment spell 2) are excluded because 2007 does not include two consecutive quarters that can be used under the selection criteria (that is, after excluding the first quarter and last two quarters of each employment spell). As a result, the data from 2007:I (denoted by ☒) are not used.

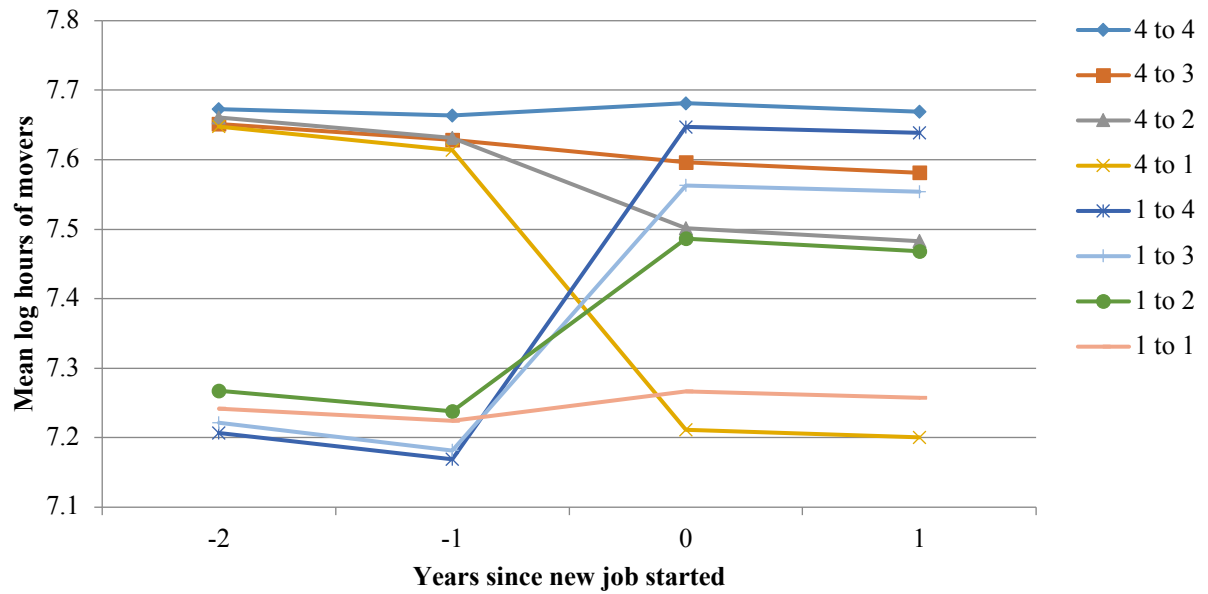
Appendix Figure B2

Mean log earnings of movers, classified by quartile of AKM employer earnings effects (ψ) at origin (year = -1) and destination (year = 0) employer



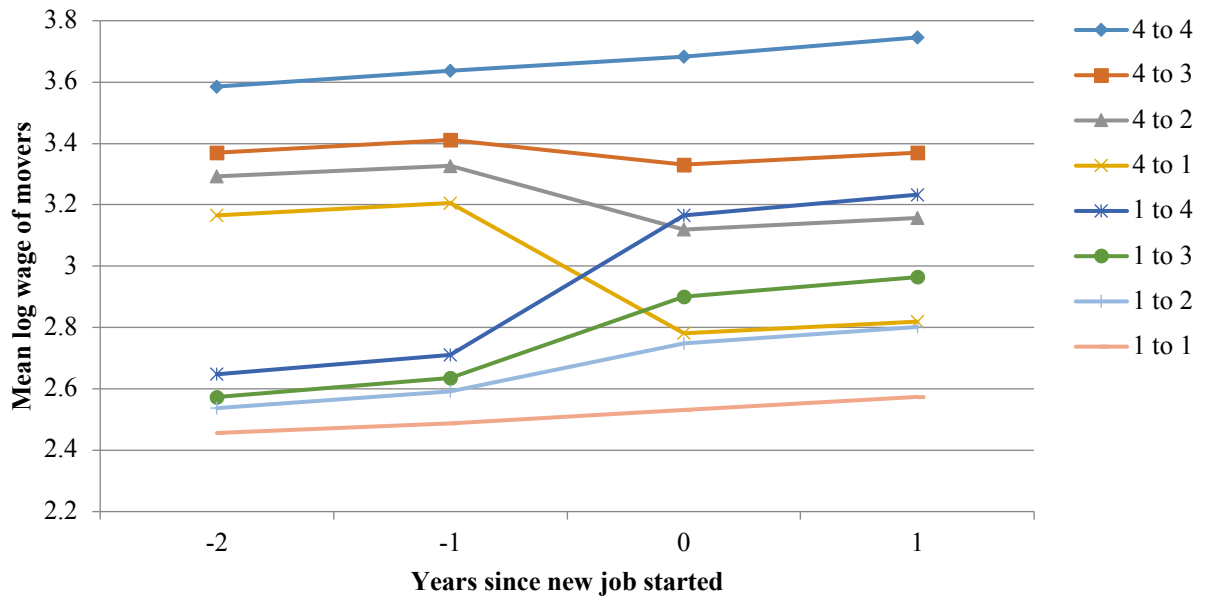
Appendix Figure B3

Mean log hours of movers, classified by quartile of AKM employer hours effects (ψ) at origin (year = -1) and destination (year = 0) employer



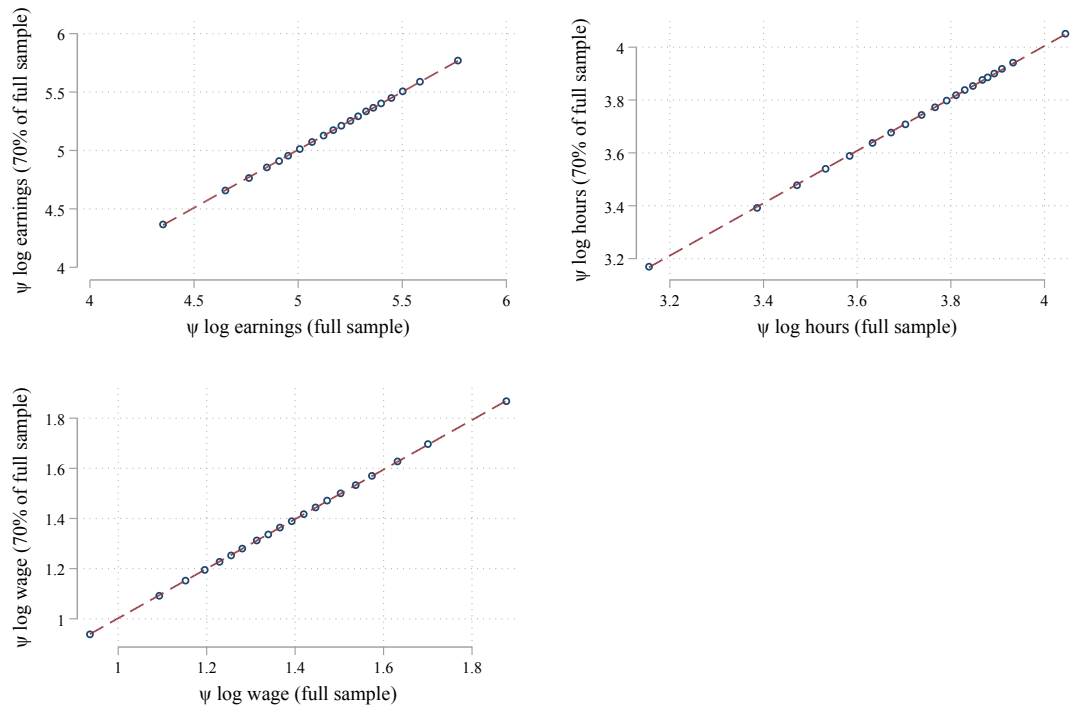
Appendix Figure B4

Mean log hourly wage rates of movers, classified by quartile of AKM employer wage rate effects (ψ) at origin (year = -1) and destination (year = 0) employer



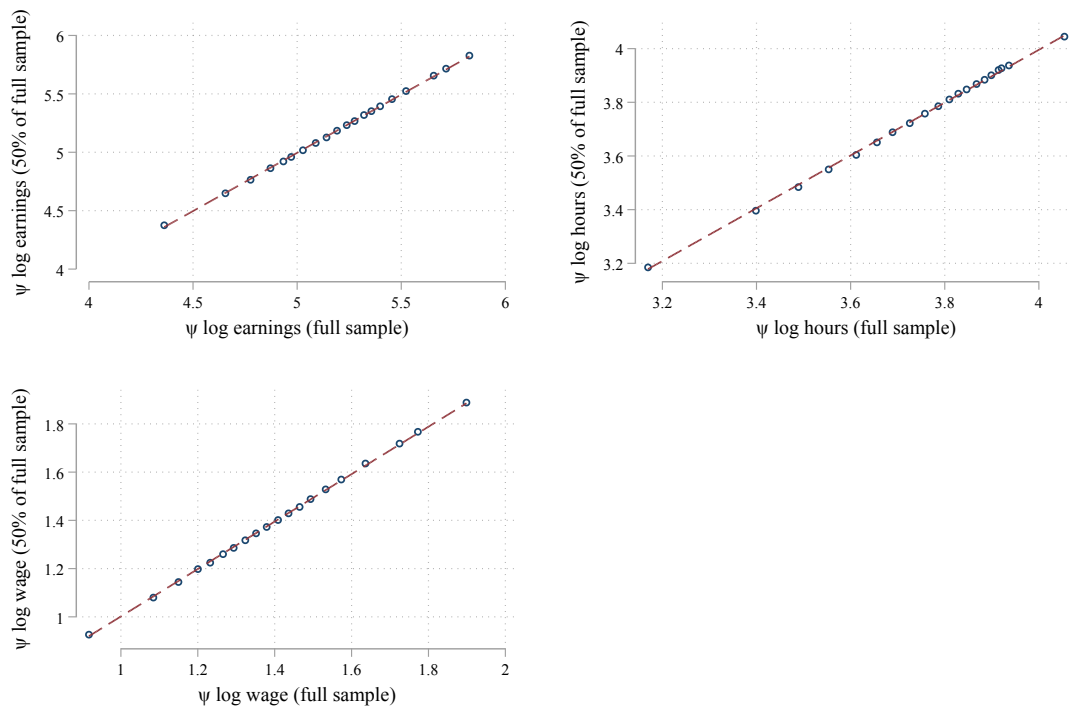
Appendix Figure B5

Correlation of estimated employer fixed effects for the full AKM sample and a random 70 percent sample of employers



Appendix Figure B6

Correlation of estimated employer fixed effects for the full AKM sample and a random 50 percent sample of employers



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