Institut für Arbeitsmarkt- und Berufsforschung
Die Forschungseinrichtung der Bundesagentur für Arbeit

Occupational routine intensity and the adjustment to job loss

Evidence from mass layoffs

2019 IBS and the World Bank Conference: Globalization, work, and distributional tensions in Europe and Central Asia, Warsaw

Uwe Blien
University of Bamberg, IAB, IZA
Wolfgang Dauth
University of Würzburg, IAB, IZA
Duncan Roth
IAB

THIS PAPER
Overview

- How does a worker's **ability to adjust to economic shocks** vary with the occupational intensity of routine tasks?
  - Exposure to changing environment due to technological progress.
  - Employment share of routine-intensive occupations has been falling over the past decades.
  - Effect of job loss on future employment and wage earnings.
- To ensure an **exogenous source** of unemployment we use **data from mass layoffs**:
  - Compare workers with identical careers but who work in occupations with different degrees of routine intensity.
  - Use of a difference-in-differences approach.

THIS PAPER
Findings

- All workers affected by a mass layoff suffer from **persistent negative effects** on subsequent employment and earnings.
- These effects are **considerably more pronounced** for workers that were formerly employed in routine-intensive occupations.
- Negative earnings effects can be **decomposed** into similarly sized effects on employment duration and wages.
- Chance of **re-employment in higher-quality** jobs reduced.
- **Transitions into other occupations or industries** more likely.
- Adjustment more difficult in light of **falling employment shares** of routine-intensive occupations and **devaluation of human capital**.

Mass layoff sample

- Identification of mass layoff workplaces based on the **Establishment History Panel (BHP)**:
  - Annual dataset of all establishments in Germany.
  - Mass layoffs take place between 1980 and 2010.
- Match with the **full employment biographies** of affected workers:
  - Taken from Integrated Employment Biographies (IEB).
  - Only those with at least 3 years of tenure in the establishment.
  - 12 quarters before and up to 24 quarters after the mass layoff.
- In total **9,365 establishments** and **342,045 workers**.

DATA AND VARIABLES
Descriptive statistics

	1980-89		1990-99		2000-10	
	ML sample	Random	ML sample	Random	ML sample	Random
Manufacturing	73.41 *(44.18)*	48.37 *(49.97)*	65.68 *(47.48)*	39.27 *(48.83)*	56.25 *(49.61)*	37.58 *(48.43)*
Electricity, gas	0.34 *(5.80)*	1.75 *(13.11)*	2.81 *(16.54)*	1.72 *(13.02)*	0.89 *(9.38)*	1.28 *(11.22)*
Construction	2.64 *(16.04)*	6.44 *(24.54)*	1.20 *(10.87)*	7.23 *(25.90)*	1.40 *(11.74)*	3.83 *(19.20)*
Wholesale/retail trade	12.84 *(33.45)*	8.70 *(28.18)*	13.86 *(34.55)*	9.52 *(29.35)*	18.74 *(39.02)*	11.20 *(31.53)*
Hotels and restaurants	0.31 *(5.60)*	0.43 *(6.55)*	0.76 *(8.67)*	0.70 *(8.32)*	1.07 *(10.28)*	1.11 *(10.49)*
Transport, storage	3.10 *(17.34)*	4.58 *(20.91)*	8.77 *(28.29)*	4.83 *(21.45)*	6.85 *(25.27)*	5.95 *(23.66)*
Financial intermed.	1.41 *(11.79)*	5.11 *(22.01)*	1.51 *(12.18)*	5.88 *(23.52)*	3.03 *(17.15)*	5.52 *(22.83)*
Real estate, rental	5.95 *(23.65)*	3.48 *(18.33)*	5.41 *(22.63)*	4.92 *(21.62)*	11.77 *(32.23)*	10.35 *(30.47)*
50-99	25.09 *(43.36)*	16.59 *(37.20)*	28.08 *(44.94)*	21.28 *(40.93)*	32.20 *(46.72)*	22.71 *(41.90)*
100-199	24.90 *(43.24)*	14.49 *(35.20)*	26.60 *(44.19)*	16.71 *(37.31)*	25.97 *(43.85)*	18.93 *(39.18)*
200-499	28.60 *(45.19)*	19.84 *(39.88)*	25.54 *(43.61)*	21.03 *(40.75)*	21.15 *(40.83)*	22.23 *(41.58)*
500+	21.41 *(41.02)*	49.08 *(49.99)*	19.79 *(39.84)*	40.99 *(49.18)*	20.68 *(40.50)*	36.13 *(48.04)*
East	2.41 *(15.35)*	3.53 *(18.45)*	17.86 *(38.30)*	16.80 *(37.38)*	14.61 *(35.32)*	16.09 *(36.75)*

DATA AND VARIABLES
Routine-intensity measure

- Occupations differ with respect to their contents and specifically to the extent that they contain **routine components**:
  - Use of machines easier to implement in jobs characterised by routines.
- To obtain information on job contents we use data from an **employee survey** (*Erwerbstätigenbefragung*):
  - Information on job characteristics at the worker level.
  - Conducted by the Federal Institute for Vocational Education and Training (BIBB) and the Institute for Employment Research (IAB).
  - Use data from the waves 1985, 1991, 1999.

Routine-intensity measure

- Focus on **two items** in order to assess the extent of an occupation's routine intensity:
  - *Are the contents of your job minutely described by the employer?*
  - *Does your job sequence repeat itself regularly?*
  - Possible answers: '*almost always*', '*often*', '*occasionally*', '*rarely*', '*hardly anytime*'.
- The **routine-intensity variable** is defined as the fraction of workers reporting both items to be the case 'almost always'.

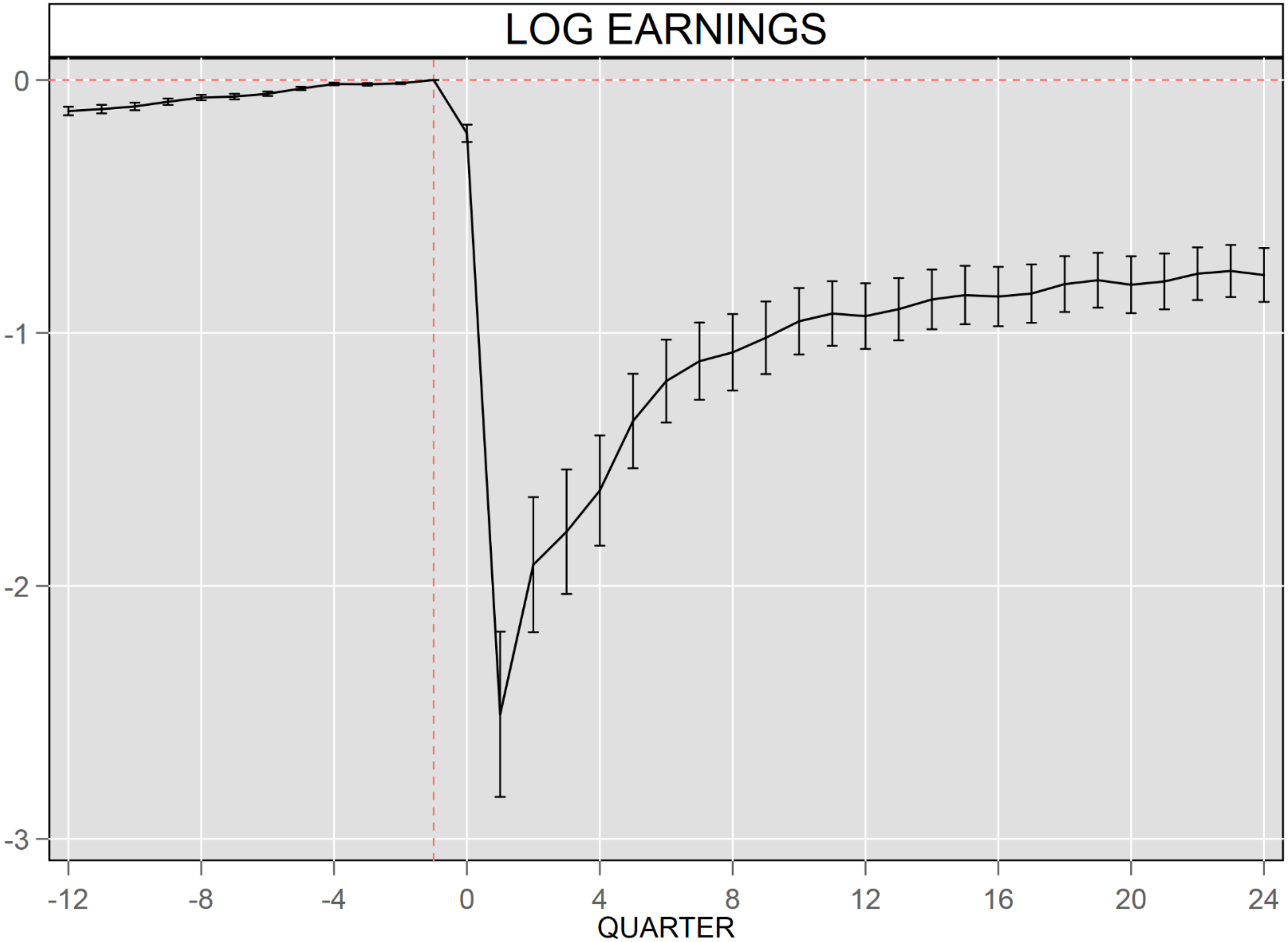
DATA AND VARIABLES
Descriptive statistics

	1980-89		1990-99		2000-10	
	ML sample	Random	ML sample	Random	ML sample	Random
Routine	12.03 *(9.69)*	11.56 *(9.73)*	13.48 *(11.61)*	13.03 *(11.18)*	12.33 *(10.66)*	12.33 *(10.87)*
Earnings	8,536.50 *(3,966.27)*	8,787.09 *(4,369.54)*	9,893.81 *(6,281.68)*	9,671.34 *(5,938.22)*	11,134.60 *(9,389.24)*	10,642.98 *(8,148.71)*
Duration	91.04 *(4.84)*	90.59 *(4.72)*	91.08 *(4.89)*	90.65 *(4.32)*	91.11 *(4.56)*	90.66 *(4.23)*
Wage	93.72 *(43.12)*	96.91 *(47.78)*	108.54 *(68.41)*	106.58 *(65.10)*	122.07 *(102.57)*	117.23 *(89.42)*
Female	27.79 *(44.80)*	30.80 *(46.17)*	30.54 *(46.06)*	33.56 *(47.22)*	27.18 *(44.49)*	29.21 *(45.47)*
Foreign	16.13 *(36.78)*	12.40 *(32.96)*	11.59 *(32.01)*	8.92 *(28.51)*	8.25 *(27.51)*	7.97 *(27.09)*
Low skill	28.45 *(45.12)*	26.39 *(44.08)*	15.98 *(36.65)*	13.80 *(34.49)*	13.22 *(33.87)*	9.39 *(29.17)*
Medium skill	68.15 *(46.59)*	68.41 *(46.49)*	75.93 *(42.75)*	77.08 *(42.03)*	75.17 *(43.20)*	75.65 *(42.92)*
High skill	3.40 *(18.13)*	5.19 *(22.19)*	8.08 *(27.26)*	9.13 *(28.80)*	11.60 *(32.03)*	14.96 *(35.67)*
Tenure	7.91 *(2.80)*	6.87 *(2.72)*	9.49 *(5.39)*	7.41 *(4.69)*	10.14 *(5.98)*	7.35 *(4.77)*
Observations	*95,529*	*191,058*	*137,929*	*275,858*	*108,587*	*217,174*

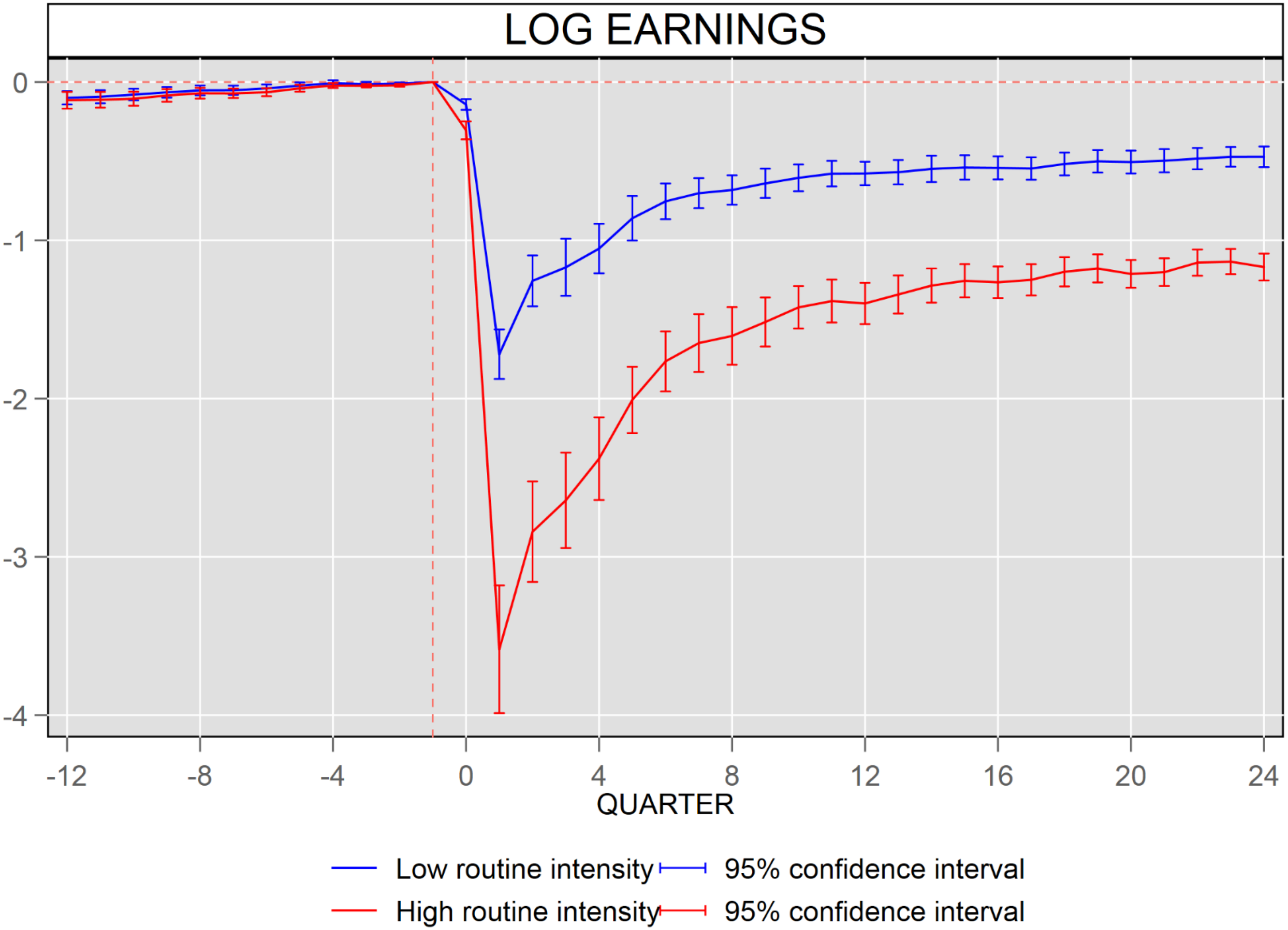
DESCRIPTIVE ANALYSIS
The effects of mass layoffs

	Quarter -1 (before ML)	Quarter 1 (after ML)	% change
	Quarterly Earnings		
All	9,908.76	7,028.40	-29.07%
Low routine	13,367.68	10,623.45	-20.81%
High routine	7,217.33	3,960.71	-45.39%
	Quarterly Employment duration		
All	91.08	61.72	-32.23%
Low routine	91.21	71.42	-21.57%
High routine	90.83	48.76	-46.06%
	Average kalender daily wages		
All	108.69	82.03	-24.53%
Low routine	146.44	121.21	-17.53%
High routine	79.41	48.62	-39.10%

DESCRIPTIVE ANALYSIS
The effects of mass layoffs

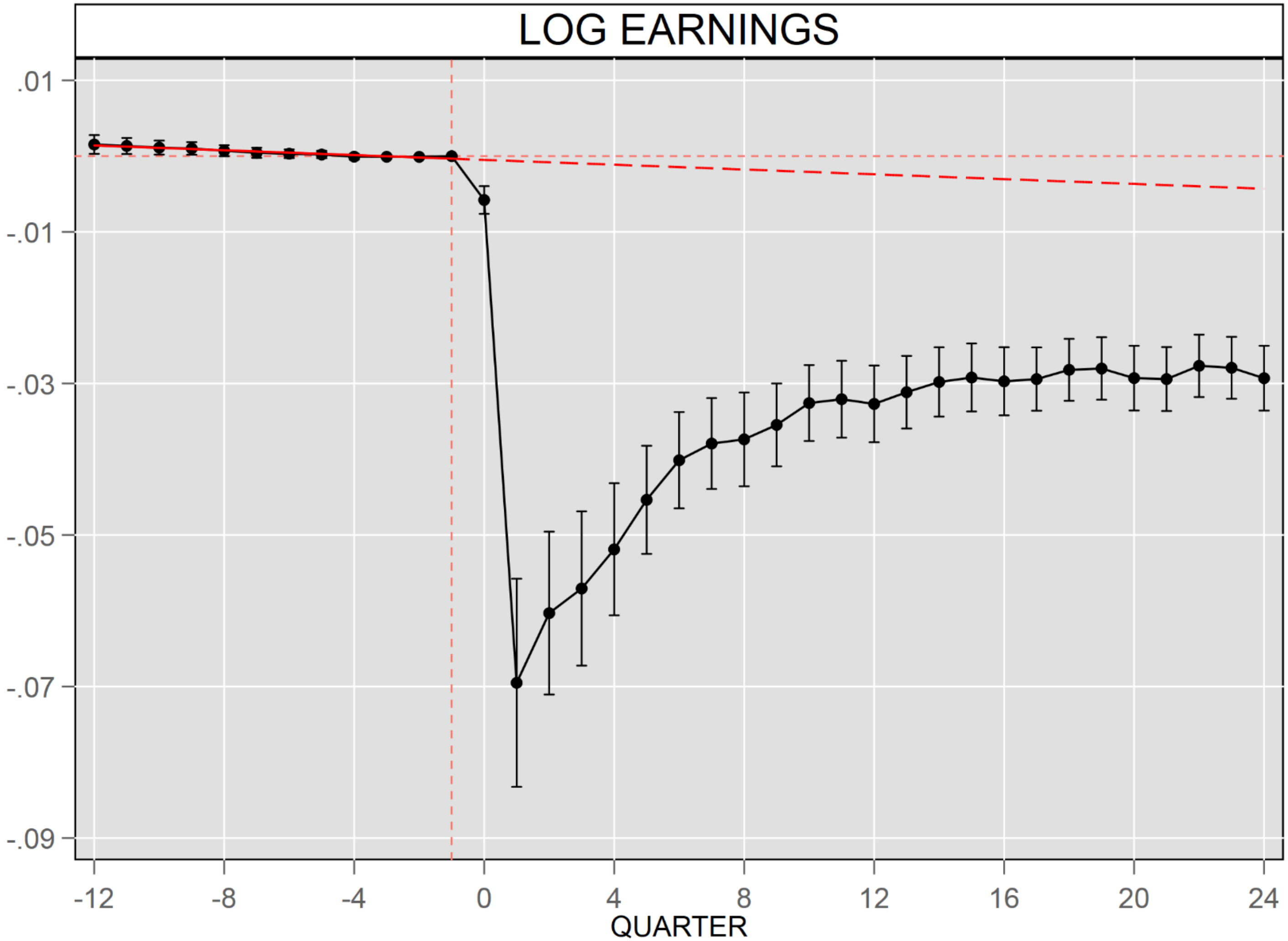


DESCRIPTIVE ANALYSIS
The effects of mass layoffs



- **Event-study approach**:
  - $y_{it} = \alpha + \sum_{k \neq -1} \left[\beta_k RI_i \times I[t = k] + \delta_k I[t = k] \right] + \mu_i + \varphi_t + w_{it}$
- **Outcome variables:**
  - Quarterly earnings (in logs).
  - Other outcomes: days in employment per quarter, average daily wage.
- **Standard errors** clustered at the occupational level.

RESULTS
Baseline specification



RESULTS

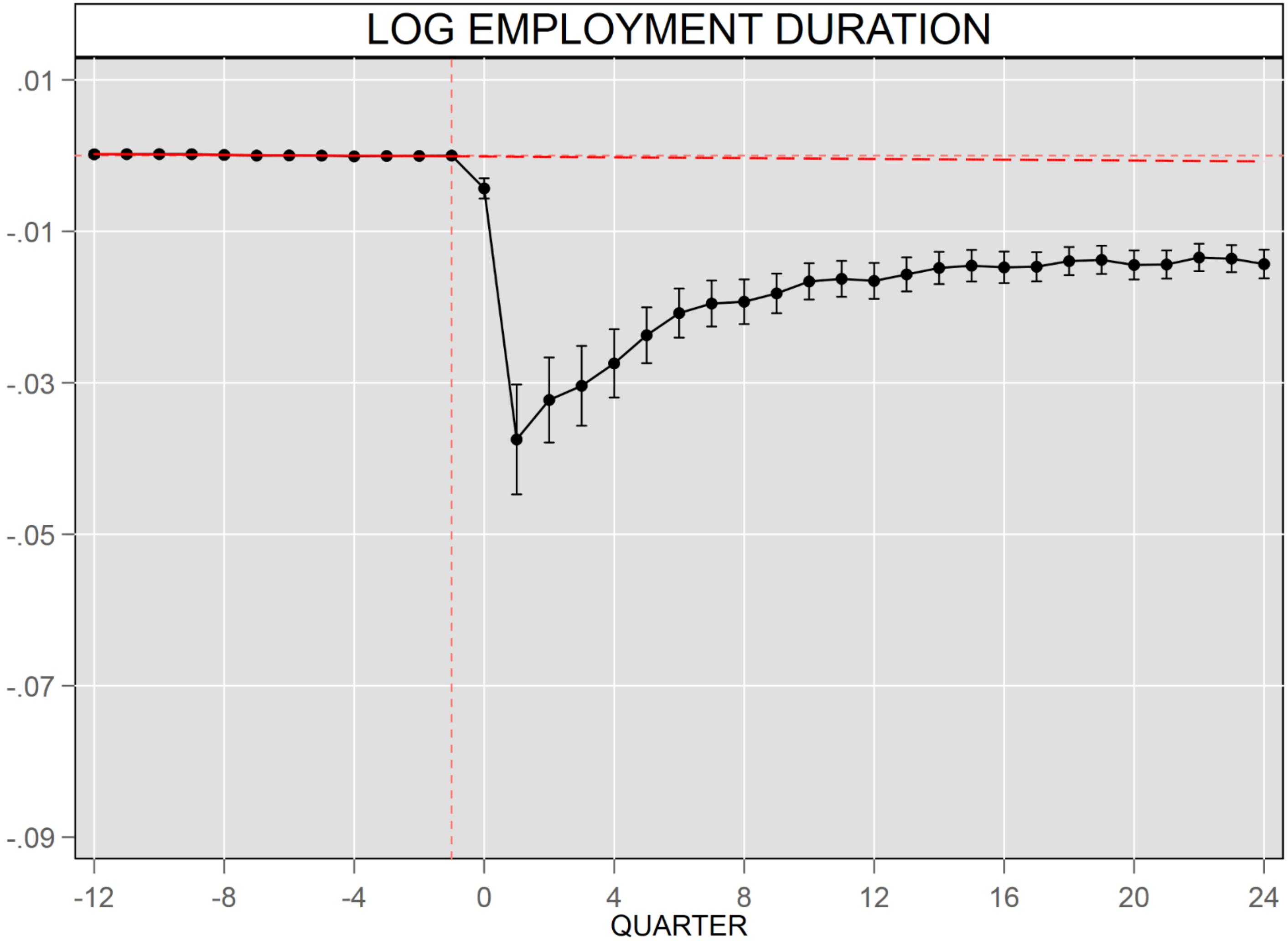
Baseline specification

∆RI	Relative (k=1)	Relative (average)	Absolute (cum.)
Earnings			
Percentage point	-0.07	-0.03	-3,226.17
Standard deviation	-0.53	-0.31	-29,797.25
Interdecile range	-0.84	-0.60	-43,262.00
Employment			
Percentage point	-0.04	-0.02	-24.79
Standard deviation	-0.33	-0.18	-244.72
Interdecile range	-0.63	-0.39	-443.35
Daily earnings			
Percentage point	-0.03	-0.02	
Standard deviation	-0.29	-0.16	
Interdecile range	-0.57	-0.35	

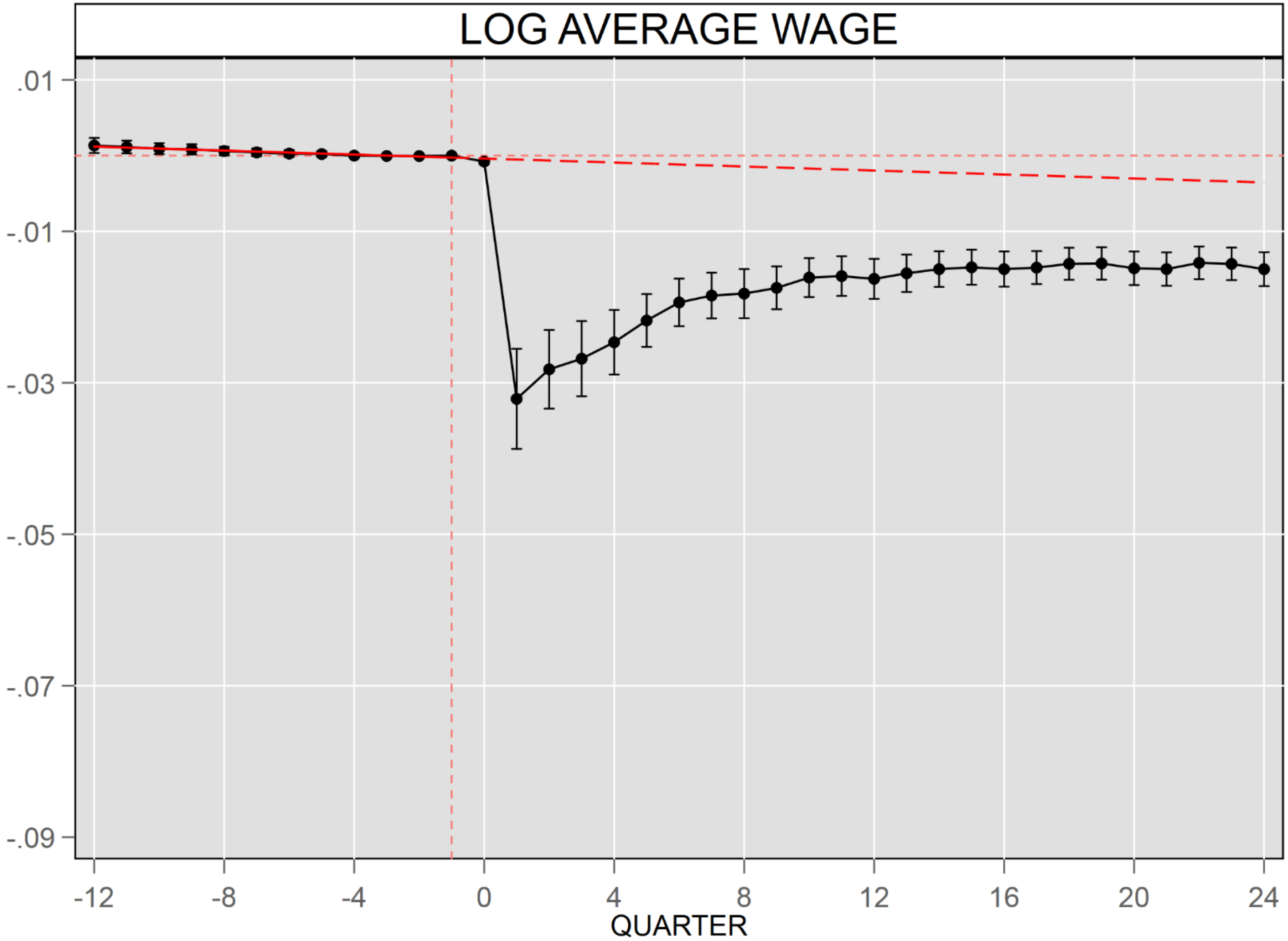
RESULTS
Decomposition I

- Can we say anything about the **source of these effects?**
  - Quarterly earnings are the product of days in employment and an average daily wage.
  - Estimate corresponding models for these variables (in logs).
  - The estimated coefficients add up to those from the earnings model.
- Both components appear **equally important** in magnitude:
  - Employees from routine-intensive occupations are on average less likely to find employment and are employed in jobs paying lower wages.
- **Differences in pre-treatment trends** are more pronounced for earnings and wages than for employment duration.

RESULTS
Decomposition I



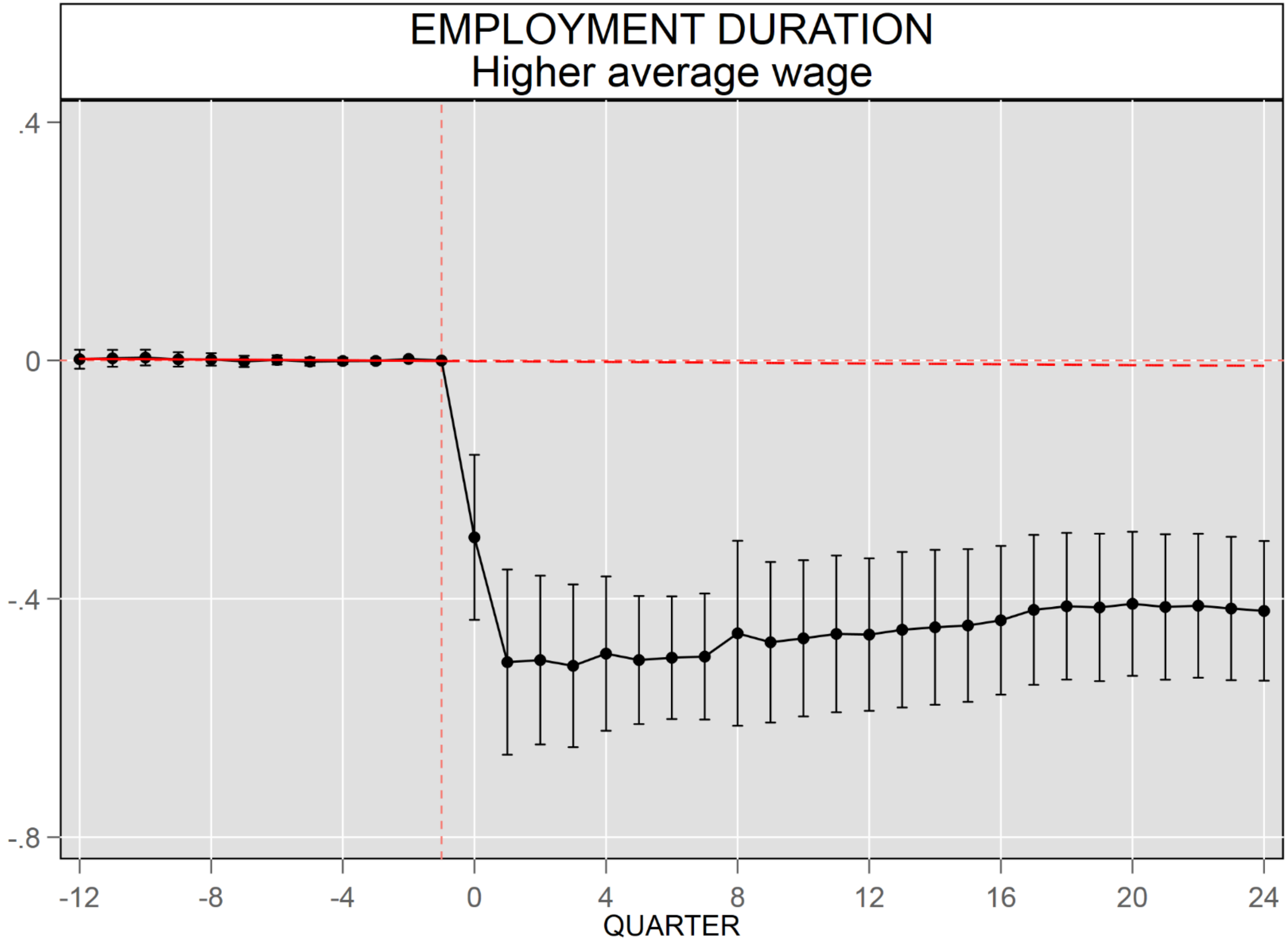
RESULTS
Decomposition I



RESULTS
Decomposition II

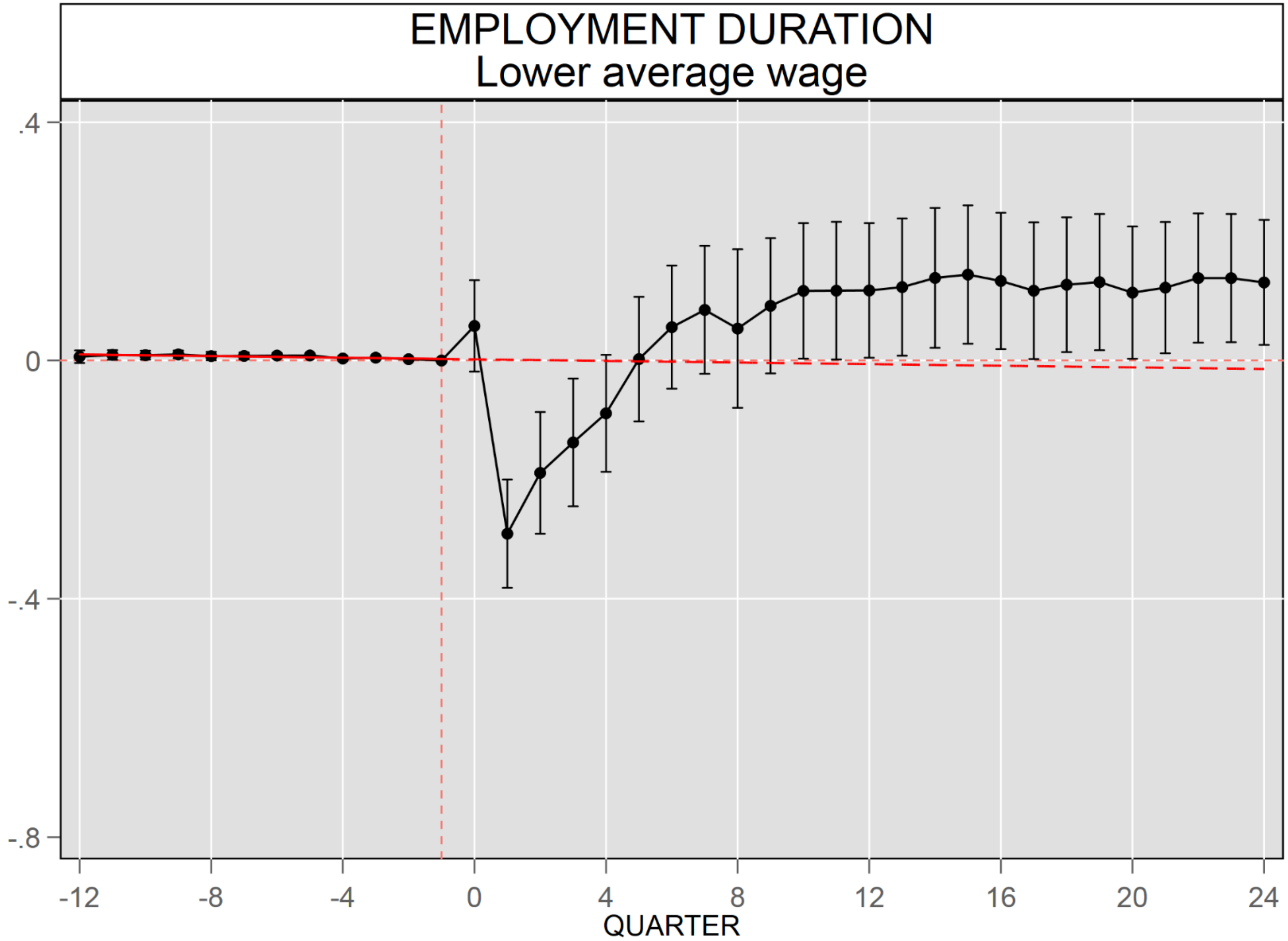
- How do the careers of workers develop **after the mass layoff?**
  - Does the initial degree of routine intensity affect the type of jobs that are subsequently found?
- **Differentiate subsequent employment** according to average wages as well as regional and occupational mobility.
- Initial employment in routine-intensive occupations **decreases the chance** of entering higher-paying jobs.
- It leads to higher **occupational**, but lower **regional mobility**.
- Moving into other occupations potentially associated with costs due to **loss of human capital**.

RESULTS
Decomposition II

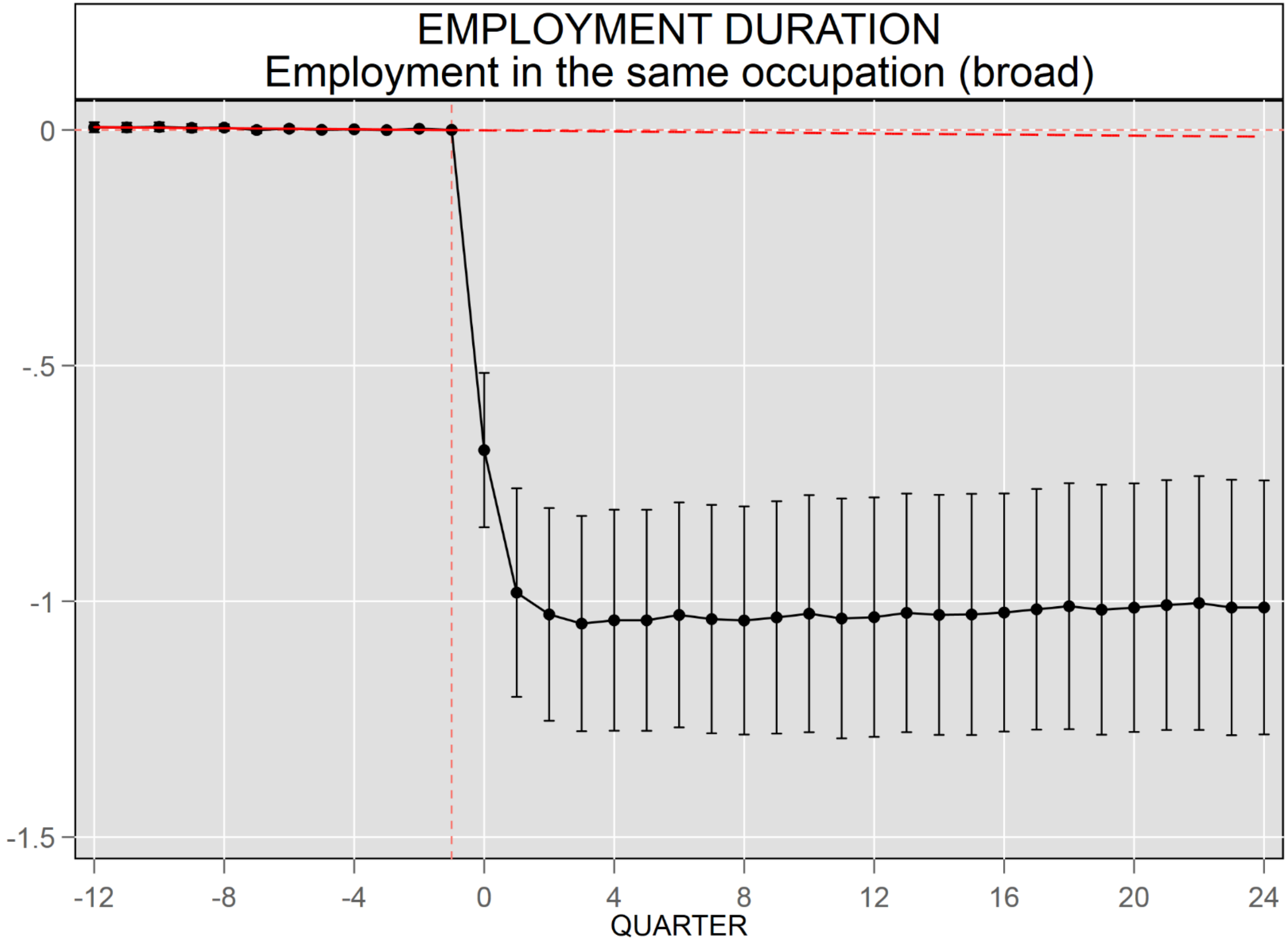


RESULTS

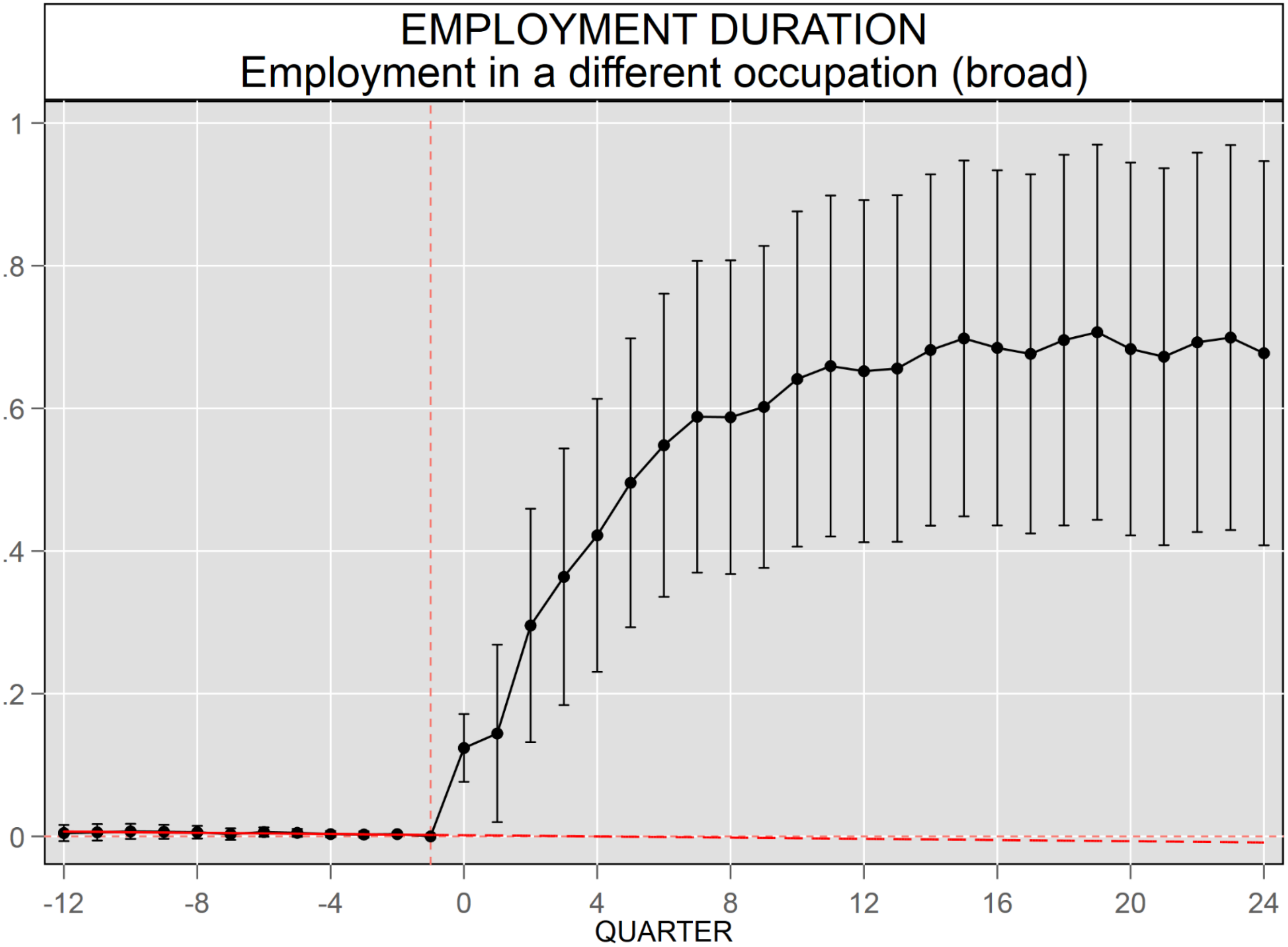
Decomposition II



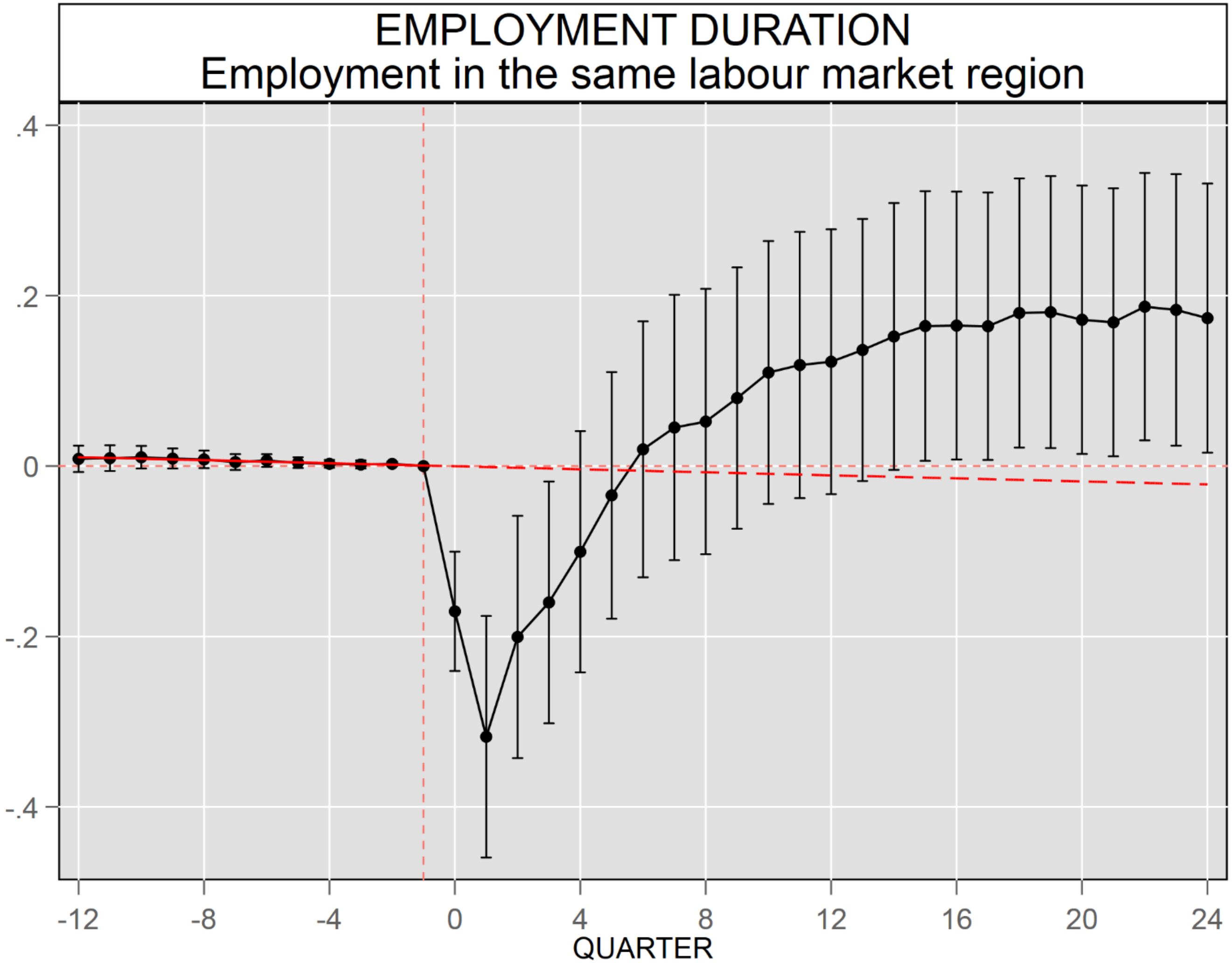
RESULTS
Decomposition II



RESULTS
Decomposition II

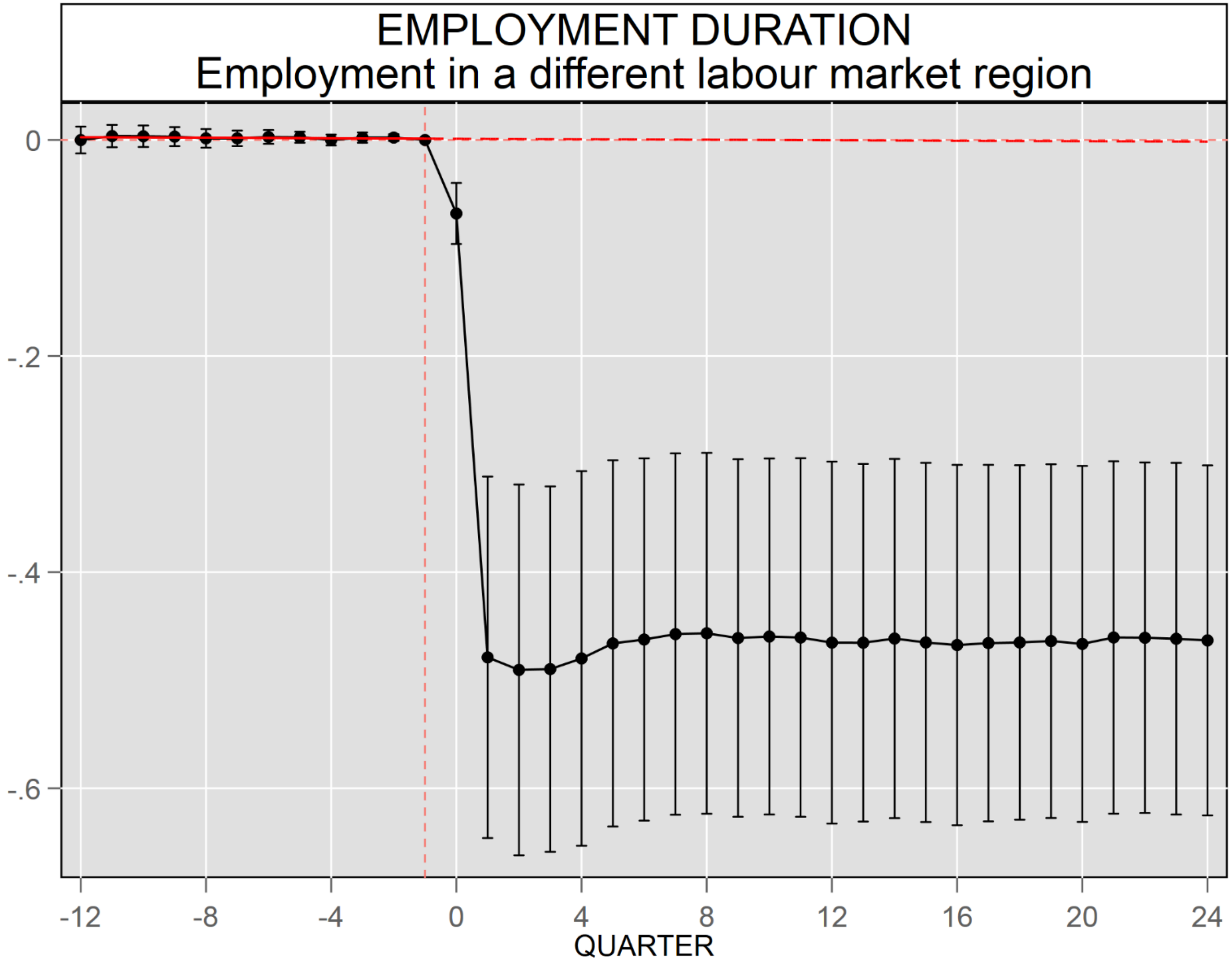


RESULTS
Decomposition II



RESULTS

Decomposition II



RESULTS
Effect heterogeneity

Earnings	Relative (k=1)	Relative (average)	Absolute (cum.)
Baseline	-0.07 (0.01)	-0.03	-3,226.17
Unskilled	-0.04 (0.01)	-0.03	-698.46
Vocational	-0.05 (0.01)	-0.02	-2,347.83
College	-0.04 (0.02)	-0.02	-7,109.84
23-29 years	-0.06 (0.01)	-0.03	-2,410.99
30-44 years	-0.07 (0.01)	-0.03	-3,395.97
45-51 years	-0.07 (0.01)	-0.04	-2,883.65
Manufacturing	-0.06 (0.00)	-0.03	-2,710.34
Non-manufacturing	-0.04 (0.02)	-0.03	-4,010.17
Less than 90%	-0.07 (0.01)	-0.04	-3,476.72
More than 90%	-0.06 (0.01)	-0.03	-2,623.26

CONCLUSION

- How does recovery from job loss vary with an occupation's routine intensity?
- Employment share of routine-intensive occupations declining.
- Use of mass layoffs to identify exogenous shock.
- Persistent negative effects in terms of subsequent employment duration and earnings.
- Substantially larger for individuals formerly employed in routine-intensive occupations.
- Adjustment to shocks more difficult for this group of individuals.
- This form of human capital has become less valuable, potentially due to technological progress.

Thanks for your attention.

Uwe Blien (uwe.blien@iab.de)
Wolfgang Dauth (wolfgang.dauth@iab.de)
Duncan Roth (duncan.roth@iab.de)

EMPIRICAL ANALYIS

Identification strategy and model

- **Potential-outcomes framework:**
  - Treatment: mass layoff.
  - Treatment measure: routine intensity in the quarter before the layoff.
- The **expected marginal effect** of the treatment measure on the outcome is:
  - $E[dy_t{}^1|t \geq z] = E[\beta_t dT|t \geq z]$
  - β_t is a quarter-specific parameter.
- **Problem of identification:**
  - What would have been the marginal effect of the treatment measure in the absence of treatment?
  - $E[dy_t{}^0|t \geq z]$ is not observable.

EMPIRICAL ANALYIS
Identification strategy and model

- The marginal effect of the treatment measure can be estimated for the **pre-treatment period** (given that treatment is not active):
  - $E[dy_t{}^0|t < z] = E[\beta_t dT|t < z]$
  - Assume that the marginal treatment effect **interacts linearly** with time.
- Regress **the estimated year effects** on a linear time trend:
  - $\hat{\beta}_t = \gamma_0 + \gamma_1 t + v_t$
- The **counterfactual marginal effect** of the treatment measure is:
  - $E[dy_t{}^0|t \geq z] = E[\gamma_0 + \gamma_1 t|t \geq z]dT$
- Accordingly, the **treatment effect** is given by:
  - $E[dy_t{}^1|t \geq z] - E[dy_t{}^0|t \geq z] = E[\beta_t - \gamma_0 - \gamma_1 t]dT$