Wage losses of displaced workers: the allocation of workers into firms and job titles

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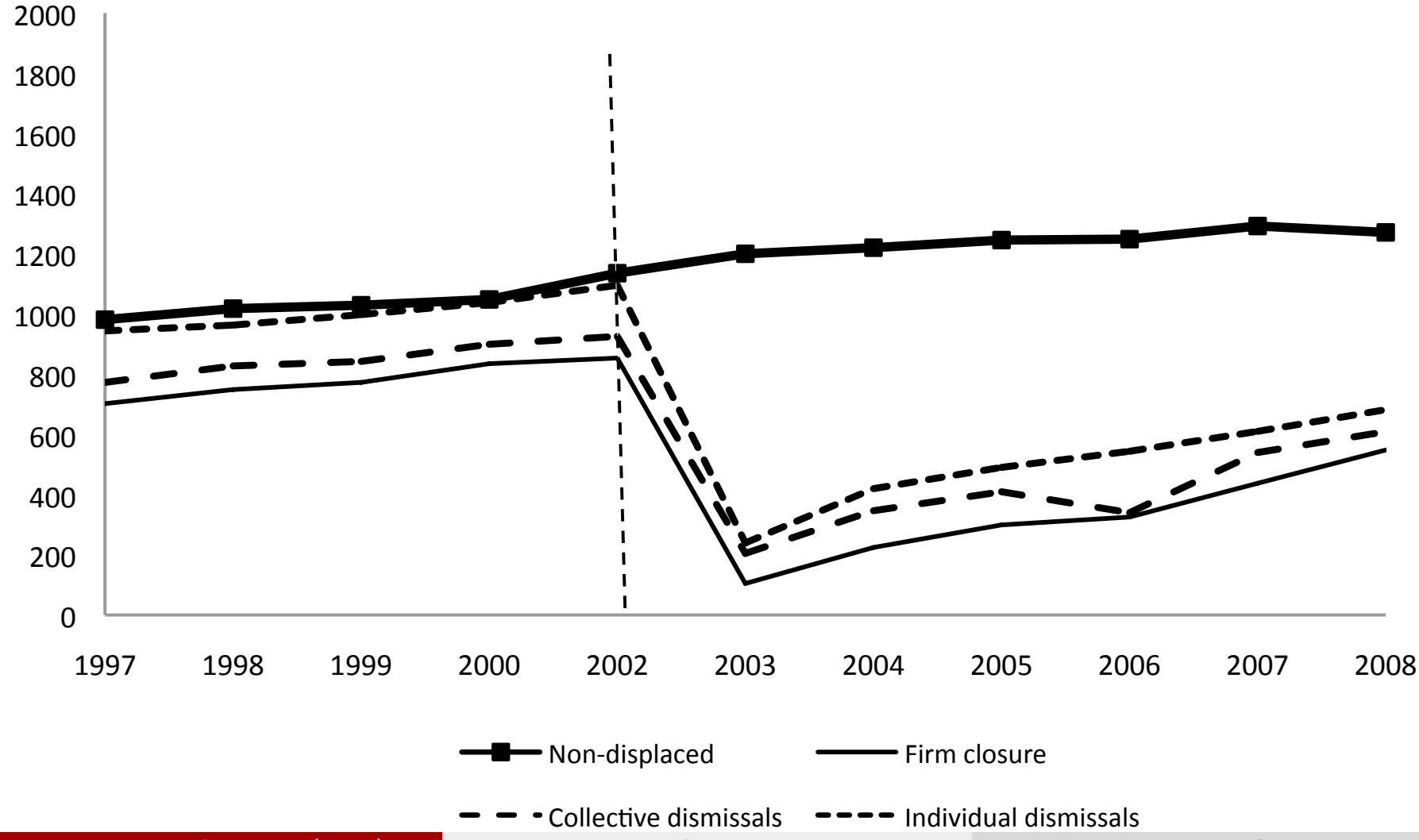
Monthly earnings of workers separating in year 2002 and non-displaced workers



Motivation

- Displaced workers experience substantial and persistent reductions in earnings - on the order of 8 to 25 percent for prime-aged workers, in comparison with their non-displaced counterparts (Couch and Placzek (2010) lasting over 15-20 years (Wachter (2010)).

- The contribution of human capital to the wage growth has been decomposed in several components
  - general human capital
  - firm human capital
  - job (or task) -specific human capital.

- Explain the sources of wage losses
  - Firm fixed effect
  - Job title fixed effect
  - Worker fixed effect

Our study

- We study the determinants of wage losses suffered by displaced workers
- We develop a new methodology that allows us to distinguish between four possible sources of heterogeneity:
  1. **Worker**: Are displaced workers the low-productivity ones?
  2. **Firm**: Are displaced workers switching to firms that pay less?
  3. **Job title**: Are displaced workers switching to lower-paid occupations?
  4. **Match (firm-worker)**: Are displaced workers switching to a firm that represents a better match?

Motivation: Worker heterogeneity

WORKER-SIDE explanations for the wage differentials:

- Perfect competition: wage differentials reflect differences in workers' productivity, which depends on:
  - Workers' skills (observed or not)
  - Motivation
  - Ability
  - Risk aversion
- Role of education and other human capital variables (seniority, experience, age, etc.): Becker (1962), Spence (1973),
- Over and under-education
- Mismatch
- Assessment by means of earnings Mincer-type regressions)

Motivation: Firm heterogeneity

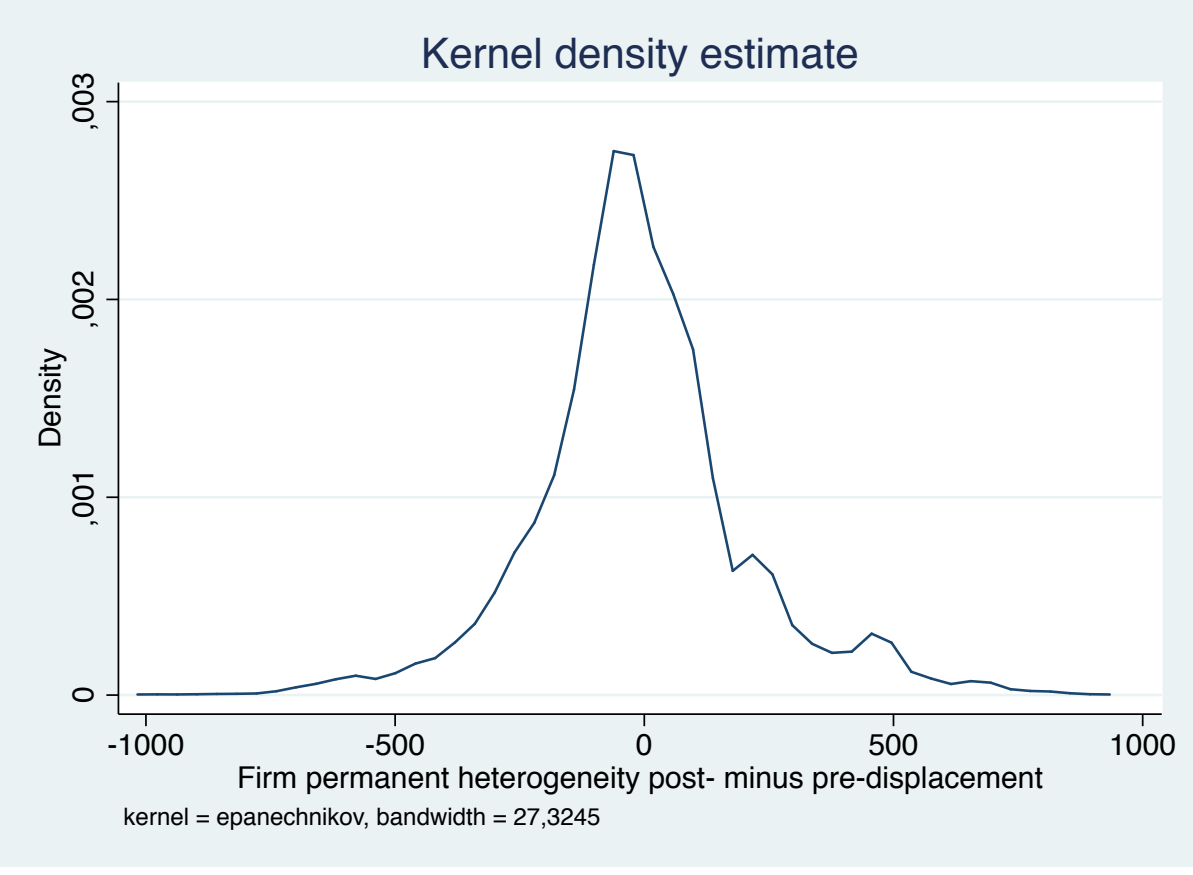
FIRM-SIDE explanations for the wage differentials:

- Theories that explain why firms find it profitable to pay non-competitive wages
- Firms design incentive schemes to retain their workers, attract better workers, and enhance their productivity (compensation and retention policies)
- Examples: implicit contracts, principal-agent, efficiency-wages, rent-sharing, and insider-outsider considerations
- Labor market frictions explanations for the wage differentials: job search and matching literature
- Third wave: longitudinal linked employer-employee data, to account for both workers and firms characteristics (observed and unobserved)

Motivation: JOB TITLE heterogeneity

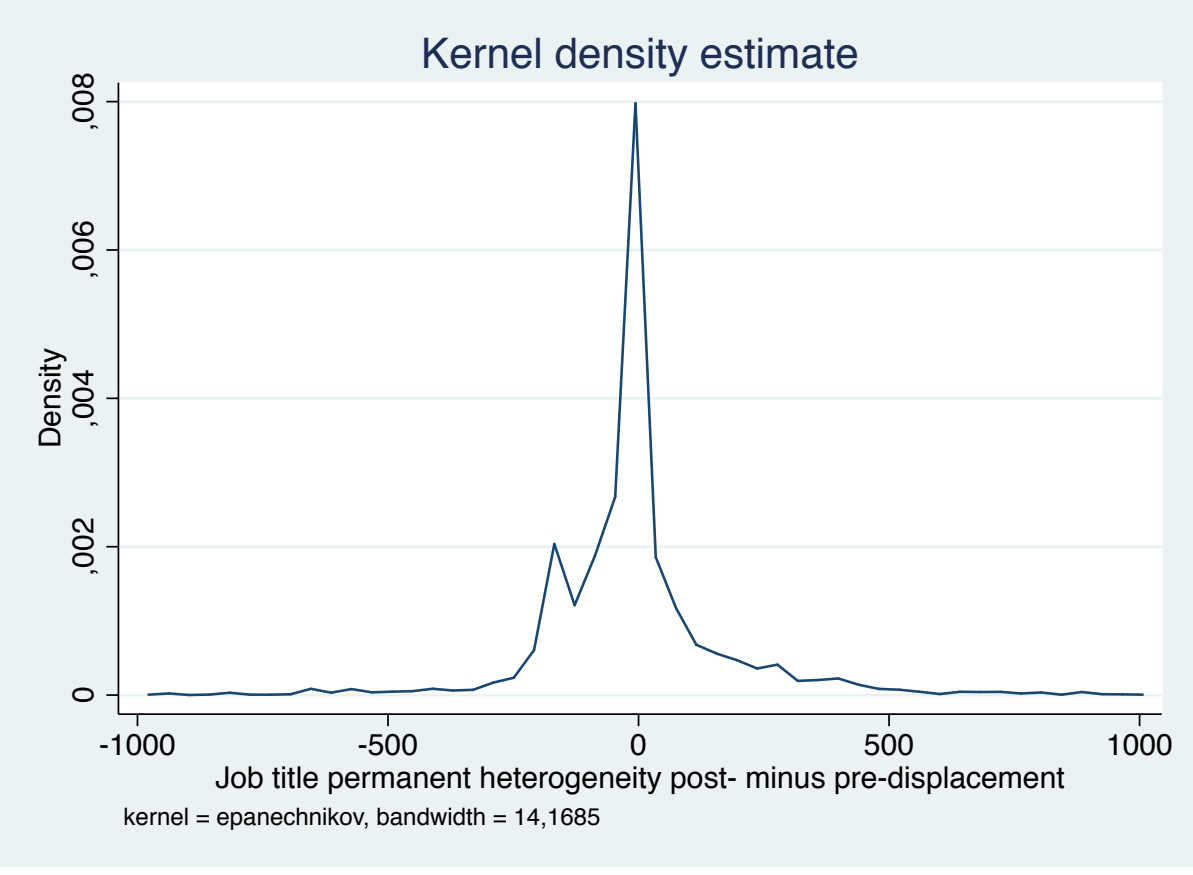
- Third important dimension of wage formation: JOB TITLE HETEROGENEITY
- There are compensating differentials for certain occupations involving:
  - Risks of accidents/injuries
  - Stressful working conditions
  - Complexity of tasks (requiring specific training or unusual skills)
  - Excess labour demand
  - Possibility to inflict losses on employers/society (unions; industrial action)
  - Entry barriers
- Detailed information required on the kind of jobs being undertaken by individuals $\rightarrow$ Even very detailed information on occupations not enough for this purpose (why?)
- Advantages of including job title fixed effects in the wage regression:
  - Evaluation of the contribution of job title heterogeneity, alongside with worker and firm heterogeneity, to the wage variation
  - Production of refined estimates of worker and firm fixed effects, as they are filtered from the job title fixed effects

The empirical distribution of wages of displaced workers: post- minus pre-displacement



Firm permanent heterogeneity

The empirical distribution of wages of displaced workers: post- minus pre-displacement



Job title permanent heterogeneity

Previous Literature

- Earnings losses (JLS, 1993: high-tenure displaced workers long-term earnings losses averaging 25 % per year six years after displacement).
- Couch and Placzek (2010): estimates are roughly half those found for Pennsylvania. Greater among unemployment insurance recipients.
- Farber(2011): full-time job losers who find new full-time jobs earned 11 percent less.

Previous Literature: Heterogenous workers and firms - heterogeneous effects

- Hijzen et al (2010): In contrast to JLS, income losses are driven mainly by non-employment spells rather than by wage losses.
- von Wachter et al, 2009 (in California, in the 1990s, workers with a college degree had smaller earnings losses)
- Old have larger losses (ChanStevens, 2001); Young have similar long-term earnings losses (Kletzer and Fairlie, 2003)
- Europe: large earnings losses (Bender et al ,2002 and Lefranc, 2003); reduced earnings losses (Burda Mertens (2001), Lehmann et al (2005) and Hijzenetal(2010) but... A long period of non-employment will have a large penalty in earnings (Gregory Jukes (2001), Bender et al (2002) and Abbring et al (2002).

Previous Literature: transferability of human capital

- Most losses result from the loss of accumulated firm-specific human capital (Lefranc, 2003).
- Unskilled workers benefit from being attached to a particular firm while skilled workers benefit from the acquisition of transferable skills (Dustmann and Meghir ,2005).
- Impact of general skills and firm-specific skills to the wage growth. This allows them to find that longer lasting matches are characterized by high wage growth in the first five years and higher wages on average (Amann and Klein, 2012).
- The task-specific human capital explains up to 52% of overall wage growth over the career. Wage losses of displaced workers will be 10 percentage points larger for workers reemployed in a very distant occupation (Gathmann and Schonberg, 2010).

Data used: Quadros de Pessoal

- Rich set of information available in the longitudinal matched employer-employee dataset for Portugal, on:
  - The collective agreement that regulates the employment contract applicable to each worker (300 negotiated per year, on average)
  - Detailed occupational categories defined for each collective agreement (100 categories defined by each collective agreement, on average)
- Job title: combination of collective agreement and professional category (around 30,000 per year)
- All the population - covers all personnel working for an establishment
- Very rich in worker and firm specific information (gender, age, schooling, region, industry, firm size)
- Period: 1997-2008

Data used: Variables and definitions

- Displaced: all workers who separate from a dying in a given year. Such workers are unlikely to have left as a result of their own poor performance and therefore it reduces the importance of the selectivity bias.
- Non-displaced workers (the control group) includes all individuals that were employed at year t in a firm that did not close in year t+1 and the firm's employment did not drop 30 percent or more and they were not subject to an individual dismissal.
- A firm closure is observed if the identification number of one firm appeared in period t but did not appear in t+1 and t+2.
- Monetary variables deflated with the Consumer Price Index (2008 prices)
- Monthly wage = sum of 5 components of wages

Data used: Sample

Reference year: 2002

- Workers with at least three years of tenure by the time of the reference year (all years between 2002 and 2006).
- Full-time wage earners in the private non-farm sector
- Aged between 20 and 49 years
- Employed in a firm with at least 20 employees.

Reference Period: 2002-2006

Sample construction

Table: Sample composition, 1997-2008

Year	Non-displaced	Displaced
1997	222576	7379
1998	242560	7764
1999	274808	9249
2000	308367	9547
2002	308006	11312
2003	247774	7621
2004	241190	7374
2005	242018	7576
2006	235030	6903
2007	226502	8012
2008	262536	8810
Total	2,811,367	91,547

Descriptives

	Non-displaced	Displaced
Age (years)	38	37
Tenure (years)	13	7
Female	39	44
Total monthly wage (real euros)	1180	818
Hourly wage (2008 euros)	1.95	1.32
Firm size (no. co-workers)	1507	367
Industry (percentages):		
Manufacturing	39	60
Construction	7	13
Commerce	21	17
Transports	11	2
Financial services	14	7
Education/health	8	1
No. Observations	2,811,367	91,547

Empirical strategy

- JLS(1993)

$$w_{it} = \alpha_i + \gamma_t + \beta X_{it} + \sum_{k \geq -m}^{m} D_{it}^k \delta_k + \epsilon_{it}$$

- JLS(1993) detrend estimator (with worker-specific time trends):

$$w_{it} = \alpha_i + \omega_i t + \gamma_t + \beta X_{it} + \sum_{k \geq -m}^{m} D_{it}^k \delta_k + \epsilon_{it}$$

Empirical framework: 1. Linear wage equation with worker, firm, and job title fixed effects

$$w_{ijft} = \alpha_i + \theta_f + \lambda_j + \gamma_t + \beta X_{ift} + \epsilon_{ijft} \quad (1)$$

- w_{ijft} represents the monthly wage for each individual i, in job j, working for firm f in year t
- X_{fit} are observed time-varying characteristics of individual i in year t
  - Workers time-varying characteristics (age, age squared)
- α_i is a worker fixed effect
- θ_f is a firm fixed effect
- λ_j is a job title fixed effect
- γ_t are 18 year dummies
- ϵ_{ijft} is assumed to follow the conventional assumptions

Estimation algorithm, Guimarães and Portugal (2010)

C. *Estimation Strategy*

Controlling simultaneously for worker, firm, and job title-specific effects requires the introduction of three high-dimensional fixed effects in the linear regression model. To illustrate our estimation strategy, consider the following linear regression model in matrix form:

$$\mathbf{Y} = \mathbf{Z}\beta + \mathbf{D}_1\lambda + \mathbf{D}_2\theta + \mathbf{D}_3\gamma + u, \tag{2}$$

where $\mathbf{Z}$ is a matrix of time-varying explanatory variables and $\mathbf{D}_1$, $\mathbf{D}_2$, and $\mathbf{D}_3$ are high-dimensional matrices for the fixed effects. The normal equations may be rewritten as

$$\begin{bmatrix} \beta = (\mathbf{Z}'\mathbf{Z})^{-1}\mathbf{Z}'(\mathbf{Y} - \mathbf{D}_1\lambda - \mathbf{D}_2\gamma - \mathbf{D}_3\theta) \\ \lambda = (\mathbf{D}_1'\mathbf{D}_1)^{-1}\mathbf{D}_1'(\mathbf{Y} - \mathbf{Z}\beta - \mathbf{D}_2\gamma - \mathbf{D}_3\theta) \\ \theta = (\mathbf{D}_3'\mathbf{D}_3)^{-1}\mathbf{D}_3'(\mathbf{Y} - \mathbf{Z}\beta - \mathbf{D}_1\lambda - \mathbf{D}_2\gamma) \\ \gamma = (\mathbf{D}_2'\mathbf{D}_2)^{-1}\mathbf{D}_2'(\mathbf{Y} - \mathbf{Z}\beta - \mathbf{D}_1\lambda - \mathbf{D}_3\theta) \end{bmatrix},$$

suggesting an iterative solution that alternates between estimation of β, λ, θ, and γ.

Gelbach's decomposition

1. base model with no fixed effects:

$$w_{it} = \gamma_t^{base} + \beta^{base} X_{it} + \sum_{k \geq -m}^{m} D_{it}^k \delta_k^{base} + \epsilon_{it}^{base}$$

   This equation has omitted variables bias.

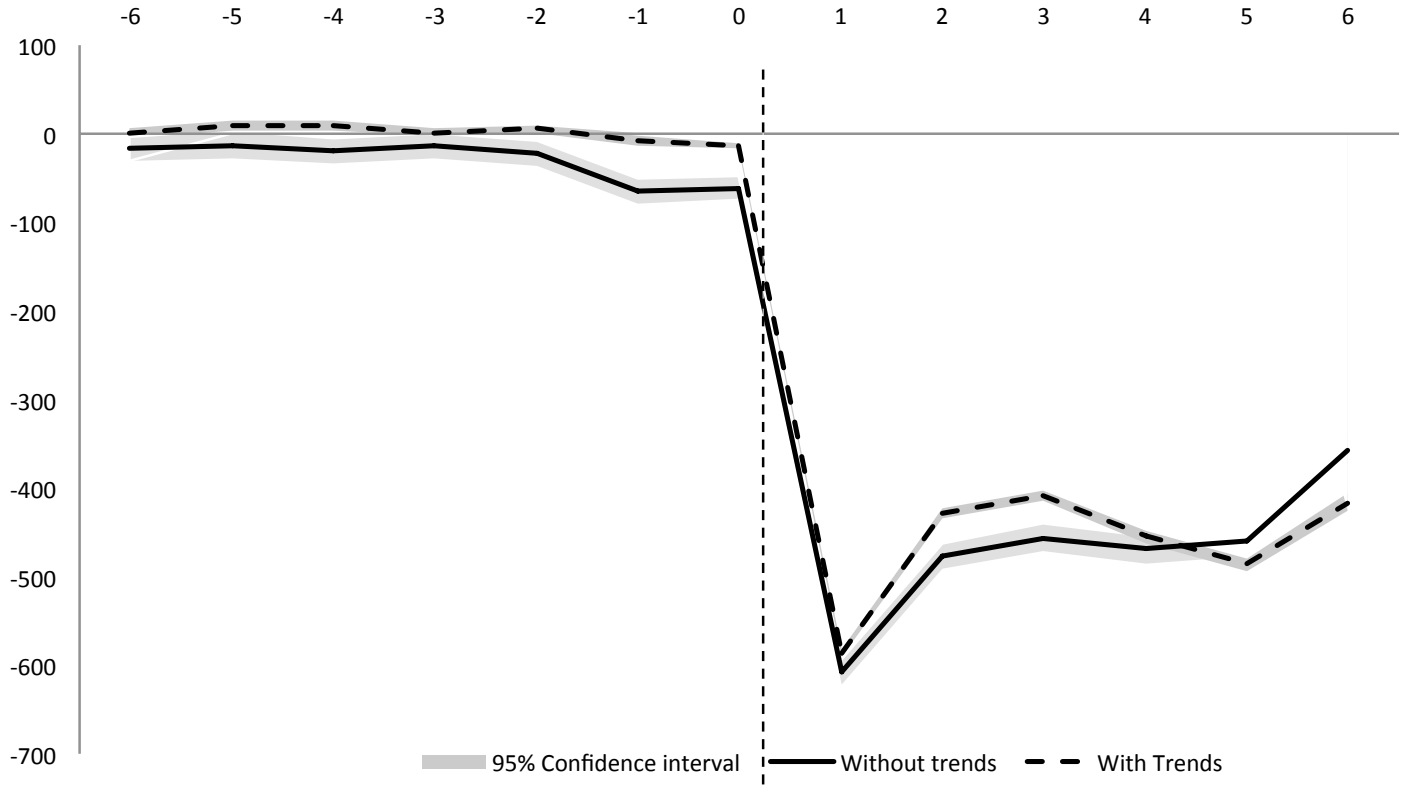
2. Full model with the three fixed effects:

$$w_{ijft} = \hat{\alpha}_i + \hat{\theta}_f + \hat{\lambda}_j + \gamma_t^{full} + \beta^{full} X_{it} + \sum_{k \geq -m}^{m} D_{it}^k \delta_k^{full} + \epsilon_{ijft}^{full}$$

3. Use ordinary least squares to estimate the vector of coefficients on each covariate in the base model in a set of auxiliary models with each of the three covariates $\hat{\alpha}_i$, $\hat{\theta}_f$, and $\hat{\lambda}_j$ acting as the dependent variable
4. This algorithm results in decomposing the difference $\delta_k^{base} - \delta_k^{full} = \hat{\tau}_k^{\alpha} + \hat{\tau}_k^{\theta} + \hat{\tau}_k^{\lambda}$, for each time period k.

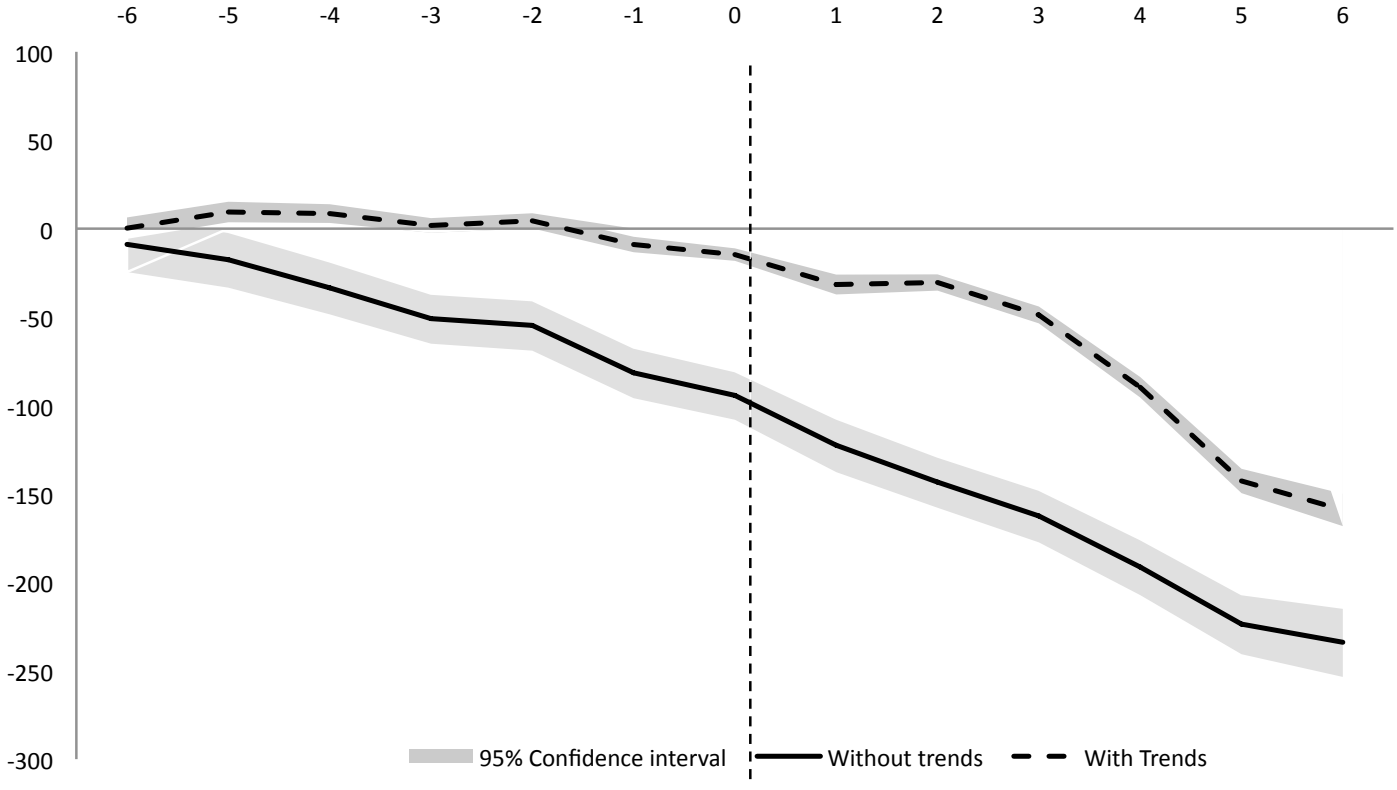
Empirical results

Figure: **Monthly earnings loss of displaced workers due to firm closure**

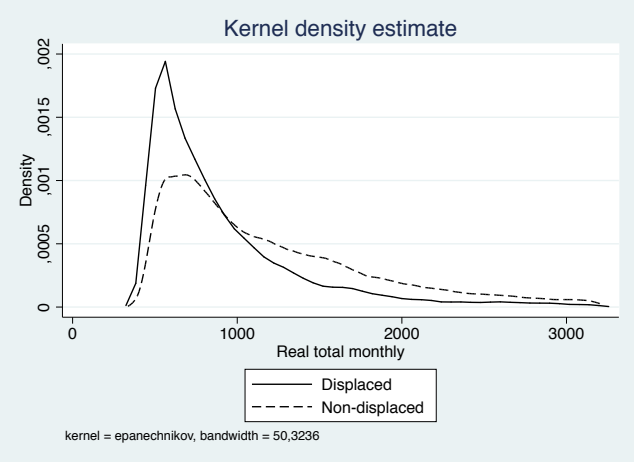


Empirical results

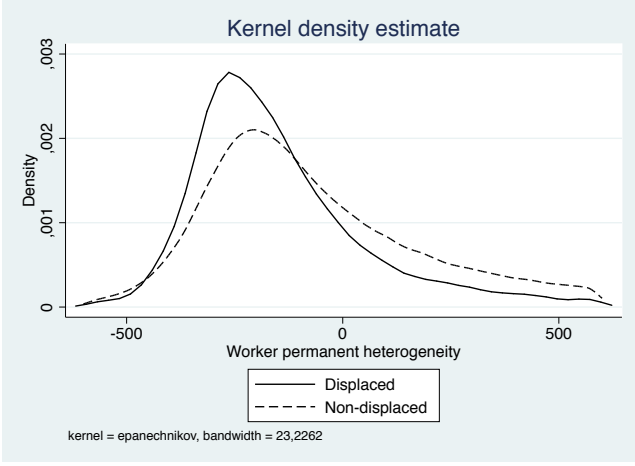
Figure: **Monthly wage loss of displaced workers due to firm closure**



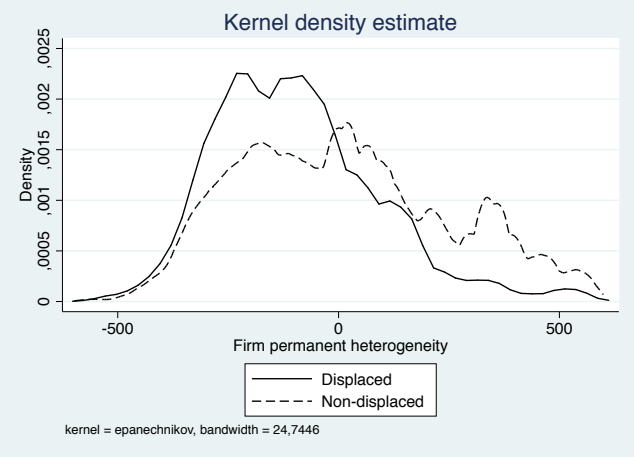
Empirical results: The empirical distribution of wages pre-displacement (reference year D_0)



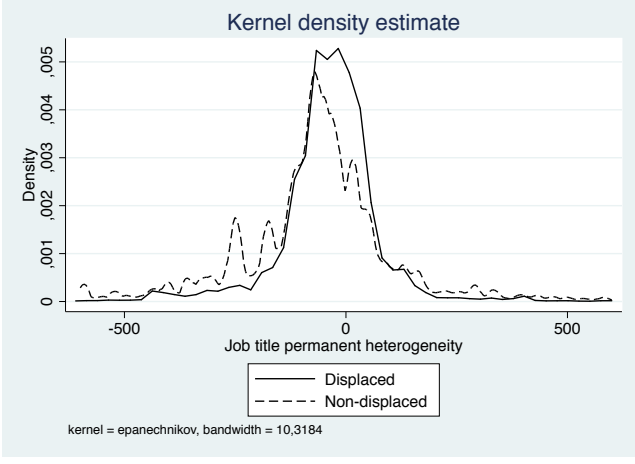
(a) Monthly wage distribution



(b) Worker permanent heterogeneity

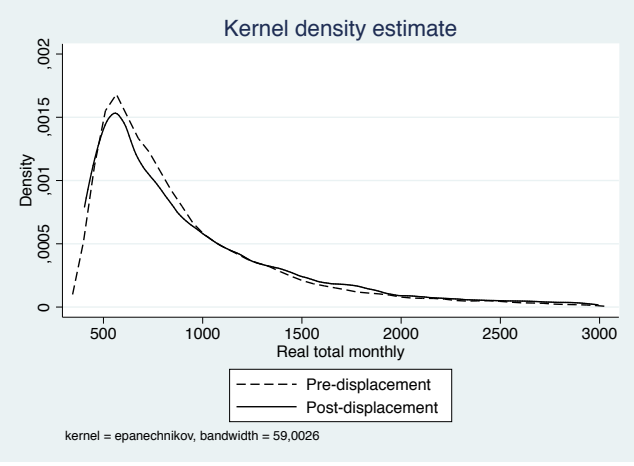


(c) Firm permanent heterogeneity

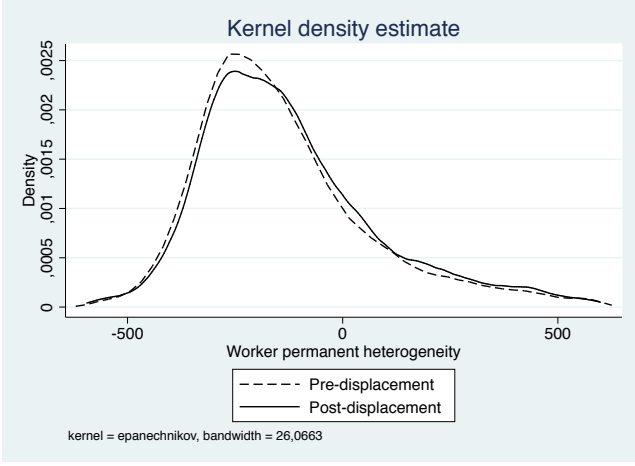


(d) Job title permanent heterogeneity

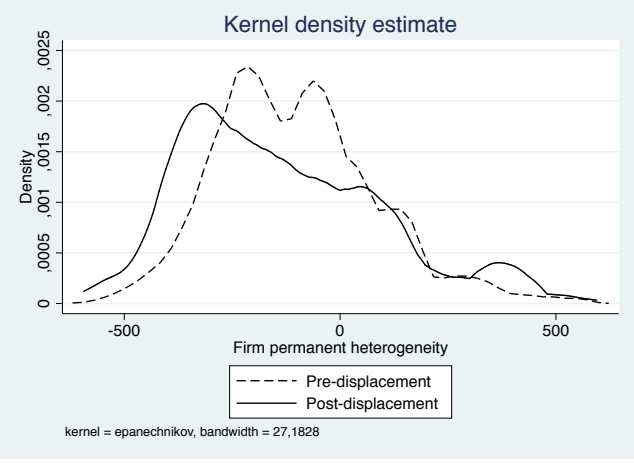
Empirical results: The empirical distribution of wages of displaced workers: pre- and post-displacement



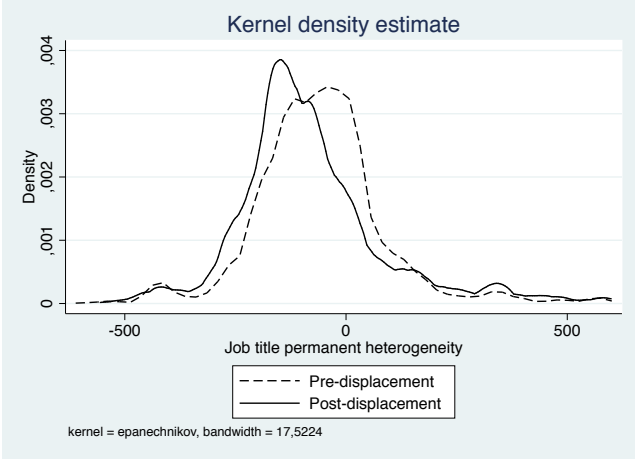
(a) Monthly wage



(b) Worker permanent heterogeneity



(c) Firm permanent heterogeneity



(d) Job title permanent heterogeneity

Empirical results: Gelbach's decomposition

Table: **Decomposition of the wage loss - displaced workers due to firm closure**

Period relative to displacement	Base OLS monthly wage	Full OLS monthly wage	$\delta_k^{base} - \delta_k^{full}$	Worker fixed effect	Firm fixed effect	Job title fixed effect
$D_{-6} - D_0$	-319.4	5.4	-324.9	-150.4	-207.9	34.2
$D_1 - D_6$	-500.6	-6.8	-493.7	-166.8	-274.8	-52.2
Δ	-181.1	-12.3	-168.8	-16.4	-66.9	-86.3
Results in percentage						
$D_{-6} - D_0$	-39.0	0.7	-39.7	-18.4	-25.4	4.2
$D_1 - D_6$	-61.1	-0.8	-60.3	-20.4	-33.6	-6.4
Δ	-22.1	-1.5	-20.6	-2.0	-8.2	-10.5

Empirical results: Assessing the role of match quality

BASELINE MODEL

$$w_{ijft} = \alpha_i + \theta_f + \lambda_j + \gamma_t + \beta X_{it} + \sum_{k \geq -m} D_{it}^k \delta_k + \epsilon_{it} \quad (2)$$

OVERPARAMETERIZED MODEL

$$w_{ijft} = \alpha_i + \theta_f + \psi_{if} + \lambda_j + \gamma_t + \beta X_{it} + \sum_{k \geq -m} D_{it}^k \delta_k + \epsilon_{it} \quad (3a)$$

SOLUTION

$$w_{ijft} = \omega_{if} + \lambda_j + \gamma_t + \beta X_{it} + \sum_{k \geq -m} D_{it}^k \delta_k + \epsilon_{it} \quad (3b)$$

Empirical results: Gelbach's decomposition

Table: **Decomposition of the wage loss - worker-firm match and job title**

Period relative to displacement	Base OLS monthly wage	Full OLS monthly wage	$\delta_k^{base} - \delta_k^{full}$	Worker and Firm fixed effect	Job title fixed effect
$D_6 - D_0$	-319.4	2.6	-322.1	-351.5	29.4
$D_1 - D_6$	-500.6	20.0	-520.5	-475.6	-44.9
Δ	-181.1	17.4	-198.5	-124.2	-74.3
Results in percentage					
$D_6 - D_0$	-39.0	0.3	-39.3	-42.9	3.6
$D_1 - D_6$	-61.1	2.4	-63.6	-58.1	-5.5
Δ	-22.1	2.1	-24.2	-15.2	-9.1

Robustness checks

- Sensitivity of losses to definition of displacement: Firm closure; Collective dismissals and Individual dismissals
- Sensitivity of losses to comparison group

Conclusions

- There are severe and persistent earnings losses of workers displaced due to firm closure (51 percent of the pre-displacement wages for firm closures), six years after the separation event.
- The allocation into lower-paid job titles plays the most important role in explaining the wage losses of displaced workers, accounting for half of the total average wage loss in the case of firm closure.
- Sorting into firms also plays a significant role for workers displaced through firm closures, accounting for 40 percent.
- The worker-firm match explains nearly one forth of the total average wage loss.

  Retraining programs: Severe losses in the returns to the job-title may represent a job downgrading due to depreciation of specific human capital

  Job search assistance programs and mandatory pre-notification: Losses related with the firm fixed effect may mean that a worker is moving from a "good" match to a "bad" match

Thank you!

Sample construction

Table: Displacement events in the reference period, 2002-2006

Year	Firm closure
2002	2591
2003	2121
2004	2008
2005	3100
2006	1579
Total	11,399

Empirical results: Gelbach's decomposition

Table: **Decomposition of the wage loss - displaced workers due to firm closure**

Period relative to displacement	Base OLS monthly wage	Full OLS monthly wage	$\delta_k^{base} - \delta_k^{full}$	Worker fixed effect	Firm fixed effect	Job title fixed effect	checksum
D_{-6}	-270.2	17.6	-287.9	-135.7	-212.9	62.3	-1.6
D_{-5}	-278.2	8.8	-287.0	-130.4	-213.4	58.0	-1.2
D_{-4}	-295.4	-2.5	-292.8	-152.8	-181.0	41.7	-0.7
D_{-3}	-298.7	-18.4	-280.3	-141.9	-184.0	46.2	-0.7
D_{-2}	-322.0	11.1	-333.1	-151.0	-214.8	33.2	-0.5
D_{-1}	-395.5	-10.5	-384.9	-168.1	-220.5	4.0	-0.3
D_0	-376.1	32.1	-408.2	-172.8	-229.1	-6.1	-0.1
D_1	-421.2	-12.7	-408.5	-137.4	-237.8	-33.2	-0.1
D_2	-492.6	-6.1	-486.5	-178.8	-253.0	-54.6	0.0
D_3	-514.6	3.9	-518.4	-185.8	-264.8	-67.9	0.0
D_4	-574.7	-10.1	-564.6	-198.8	-300.5	-65.4	0.1
D_5	-508.0	19.3	-527.3	-180.5	-290.6	-56.5	0.3
D_6	-492.3	-35.4	-456.9	-119.3	-302.3	-35.4	0.1
$D_{-6} - D_0$	-319.4	5.4	-324.9	-150.4	-207.9	34.2	-0.7
$D_1 - D_6$	-500.6	-6.8	-493.7	-166.8	-274.8	-52.2	0.1
Δ	-181.1	-12.3	-168.8	-16.4	-66.9	-86.3	0.8
Results in percentage							
$D_{-6} - D_0$	-39.0	0.7	-39.7	-18.4	-25.4	4.2	-0.1
$D_1 - D_6$	-61.1	-0.8	-60.3	-20.4	-33.6	-6.4	0.0
Δ	-22.1	-1.5	-20.6	-2.0	-8.2	-10.5	0.1