The Role of Labor Market Entry and Exports in Sorting: Evidence from West Germany

Benjamin S. Smith
Federal Trade Commission*

ASSA Conference, 1/7/2019

*The views expressed are those of the author and do not necessarily reflect those of the Federal Trade Commission.
Sorting accounts for a significant share of rising inequality

- Substantial rise of earnings inequality in developed economies.
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- Traditionally studied through returns to worker characteristics.

- Accounts for 30% of the rise in inequality: US & Germany.

Yet, how and why sorting is rising remains unclear.

RQ1: How did sorting rise?
- Worker flows

RQ2: Why did sorting rise?
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RQ2: Why did sorting rise? → International trade
Illustration of sorting and inequality

### Period 1:

<table>
<thead>
<tr>
<th>Firm L</th>
<th>Firm H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job A</td>
<td>Job B</td>
</tr>
<tr>
<td>Job C</td>
<td>Job D</td>
</tr>
</tbody>
</table>

Total wage
Illustration of sorting and inequality

**Period 1:**

<table>
<thead>
<tr>
<th>Firm L</th>
<th>Firm H</th>
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<tbody>
<tr>
<td><img src="job_a.png" alt="Job A" /></td>
<td><img src="job_d.png" alt="Job D" /></td>
</tr>
<tr>
<td><img src="job_b.png" alt="Job B" /></td>
<td><img src="job_c.png" alt="Job C" /></td>
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Worker wage component: \( \{l, h\} \)

Firm wage component: \( \{L, H\} \)
Illustration of sorting and inequality

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<tr>
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<table>
<thead>
<tr>
<th>Worker</th>
<th>Wage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm L</td>
<td></td>
</tr>
<tr>
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<td></td>
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Worker wage component: \(\{l, h\}\)

Firm wage component: \(\{L, H\}\)

Sorting \(\equiv\) Corr(Worker Wage, Firm Wage)

\[\Rightarrow\text{ No Sorting}\]
Illustration of sorting and inequality

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No Sorting
Illustration of sorting and inequality

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<th>Period 1:</th>
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No Sorting

Positive Sorting
Illustration of sorting and inequality

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↑ Var(wage)

Increased inequality
RQ1: How did sorting rise?

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Illustration
RQ1: How did sorting rise?

- Potential worker flow channels leading to sorting. [illustration]
  - Job-to-job transitions over the life-cycle:
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  - Use exogenous variation in trade exposure induced by:

    - fall of Soviet Union and rise of China.
Results from West Germany (1985-2009)

1.) How? Contribution of worker flow channels to sorting.

- Labor market entry is the dominant channel for rising sorting, accounting for about 1/2 of the rise in sorting.
- Limited role for job-to-job transitions: at most 1/4 of the rise.


- Export exposure causes a substantial increase in sorting.
- Trade with "East" accounts for 14% of the total rise in sorting.

3.) How (firm side)? Apply decomposition method to export-induced worker flows only.

- Goal: isolate the role of labor demand in sorting.
- Results: again, labor market entry ≈ 1/2 of rise in sorting.
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1.a.) Importance of sorting at labor market entry for lifetime inequality.

- Sources of lifetime inequality: Guvenen, Kaplan, Song, Weidner (2017), Huggett, Ventura, Yaron (2011)
- Persistence of entry conditions: Kahn (2010), Oreopoulos, von Wachter, and Heisz (2012)

1.b.) Small role of job-to-job transitions in reallocation.

- Theoretical: Shimer & Smith (2000); Eeckhout & Kircher (2011); Hagedorn, Law, & Manovskii (2016); Lopes de Melo (2017); Bagger & Lentz (2017)
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2.) Export exposure has a large effect on labor market sorting.

- New, important source of rising sorting.
  - Outsourcing: Goldschmidt & Schmieder (2017) - accounts for only 8%.
- Export exposure increases sorting through labor market entry.
  - Exports & sorting: Davidson et al. (2014); Bombardini, Orefice, & Tito (2017)
Outline

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   2.1.) Data
   2.2.) Definition of sorting

3.) Main Results
   3.1.) Decomposition of sorting into worker flows
   3.2.) Impact of trade on sorting
   3.3.) Decomposition of export-sorting into worker flows

4.) Implications of sorting at labor market entry

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- Administrative, employer-employee linked panel data.
  - *SIAB*: 2% worker-based sample of employment histories.
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- Administrative, employer-employee linked panel data.
  - *SIAB*: 2% worker-based sample of employment histories.

- Key features:
  - **Length**: covers *inequality trends* from 1985 to 2009.
  - **Worker panel**: track workers to identify *worker flows*.
  - **Firm identifiers**: compute worker-firm *sorting*.
    - Merge Card, Heining, & Kline (2013) fixed effects from 100% sample.
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- Import/export exposure instruments:
  - *UN Comtrade*: value of imports/exports to Eastern Europe/China.
  - *Establishment History Panel*: 50% sample of employment at industry-county level.
Agent types based on fixed effect wage components

- Estimate Abowd, Margolis, and Kramarz (AKM) wage equation:

\[
\log (w_{it}) = \alpha_i + \psi_{j(i,t)} + x_{it}'\beta + r_{it}, \quad \forall p \in \{1, 2, 3, 4\}
\]

- \(i\) - individual, \(t\) - year, \(j(i, t)\) - firm, \(p\) - estimation interval.
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- Sorting \( \equiv Corr(\hat{\alpha}_i, \hat{\psi}_{j(i,t)}) \)

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- **Figure:** Timeline of fixed effect estimation intervals

\[\text{Change period 1 (11 years)}\]

\[\text{Change period 2 (13 years)}\]
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Result 1: Worker flow contributions to aggregate sorting

**Table:** Decomposition of change in correlation of firm and worker effects

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<tr>
<td><strong>Labor market entry</strong></td>
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<td>33.5</td>
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<tr>
<td><strong>Job-to-job</strong></td>
<td>18.6</td>
<td>30.6</td>
</tr>
<tr>
<td><em>Between-LLM job-to-job</em></td>
<td>12.5</td>
<td>15.5</td>
</tr>
<tr>
<td><em>Within-LLM job-to-job</em></td>
<td>6.0</td>
<td>15.1</td>
</tr>
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<td><strong>Nonemployment to emp.</strong></td>
<td>11.6</td>
<td>14.1</td>
</tr>
<tr>
<td><em>Other to emp.</em></td>
<td>9.0</td>
<td>10.0</td>
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<tr>
<td><em>Unemp. to emp.</em></td>
<td>2.6</td>
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<tr>
<td><strong>Job Stayers</strong></td>
<td>12.8</td>
<td>21.8</td>
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Upper bound for job-to-job: job-to-job + “other” = 27.6%
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[details]  
[defs]  
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Result 1: Worker flow contributions to aggregate sorting

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Result 2: Export exposure increases labor market sorting

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<td># geo f.e.'s</td>
<td>0</td>
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**Magnitude:** 14% of total change in sorting from ‘85 to ‘09.
Result 3: Labor market entry most important export flow

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Upper bound for job-to-job: 26.7%
Result 3: Labor market entry most important export flow

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Upper bound for job-to-job: 26.7%
Result 3: Labor market entry most important export flow

Table: Decomposition of Export Sorting into Worker Flows

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1.) Introduction

2.) Background
   2.1.) Data
   2.2.) Background on sorting

3.) Main Results
   3.1.) Decomposition of sorting into worker flows
   3.2.) Impact of trade on sorting
   3.3.) Decomposition of export-sorting into worker flows

4.) Implications of sorting at labor market entry

5.) Conclusion
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Implications for inequality:
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Importance of initial conditions: education, childhood environment, occupational choice, etc.

Implications for efficiency:
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- Firm-, occupation-, or industry-specific skills may make reallocation of experienced workers difficult.
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RQ1: How did sorting rise?

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<th>Firm L</th>
<th>Worker</th>
<th>Wage</th>
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<tbody>
<tr>
<td>h</td>
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**Type of Reallocation:**

Worker H: Firm L → Firm H

**Job-to-job transitions?**
RQ1: How did sorting rise?

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Job-to-job transitions?
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**Type of Reallocation:**

- Retirement

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**Type of Reallocation:**

- Job A: Retirement
- Job B: School

**Labor market entry?**
RQ1: How did sorting rise?

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Firm L  
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Firm H  
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RQ1: How did sorting rise?

Job-to-job transitions or labor market entry?
Sample restrictions

- Main analysis:
  - Male only
  - Age 20-60
  - Full-time employment
  - Earnings from highest earning firm only
  - “Firm” is an establishment

- Excludes self-employed and civil servants: 80% coverage.

- Top 14% of earnings censored.

  - Apply a Tobit wage imputation.
Theories of labor market sorting

- Becker (1973)
  - Heterogenous productivity for workers and firms.
  - Worker-firm complementarity in production.
  - Optimal allocation: assortative matching.

- Factors that affect the value of complementarities:
  - Firm technology.
  - Worker skill distribution.
  - Search frictions. (Shimer & Smith 2000)
  - Product demand. (Bombardini, Orefice, & Tito 2017)

- Non-complementarity based explanations.
  - Preferences: e.g. workplace amenities (Card et al 2016).
  - Access: e.g. job referral networks (Schmutte 2014).
Theory for how trade increases sorting

- **Worker-firm productive complementarities** lead to *assortative matching*. (Becker 1973)

- **Search frictions** lead to deviations from optimal allocation within a *matching set*. (Shimer and Smith 2000)

- **Export markets** increase output of match, shrink matching set, approach assortative matching. (Bombardini, Orefice, Tito 2017)
Fit of AKM wage equation

  - Match effect residual:
    - Reduction in root mean squared error: 10-15%.
    - Stable over time, but variance of worker and firm effects growing.
    - No evidence for large average match effect residuals across the joint distribution of worker and firm effects.
  - Symmetry in wage change between different type firms.
    - Ordering firm by average wages or fixed effects.
    - No change in average residual before vs. after move.

  - Simplify firms to firm classes to directly estimate interaction of firm and worker types.
  - Find quantitatively insignificant match effects.
Two critiques of AKM wage component-based sorting

1.) **Theoretical critique**: firm fixed effect ≠ firm productivity
   - Opportunity cost of hiring ⇒ highest wage at optimal firm, each worker type paid differently.

   - **Empirical evidence**:
     - Firm effects correlated with observable measures of productivity.
     - Match effects appear to be small.

2.) **Empirical critique**: limited mobility bias.
   - Few job switches per firm results in sampling error ⇒ negative correlation between firm and worker fixed effects.

   - **Solution**:
     - Use 100% sample + change in correlation of fixed effects.
     - Stable bias? Job switching rate and establishment size stable.
Identification of AKM wage equation

- Identified off of worker movements across firms.

- Exogenous mobility assumption: job switches uncorrelated with firm-worker specific match components.
Trend in regional sorting matches national trend
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Rise in Sorting = 0.231
Trend in regional sorting matches national trend

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Within-LLM Rise in Sorting = 0.229
Trend in regional sorting matches national trend

Rise in Sorting = 0.231

Within-LLM Rise in Sorting = 0.229

Use a within-region sorting measure to exploit trade variation.
**LLM sorting approximates the national change well**

**Table:** Corr(WFE,EFE) over time: national, within-LLM, within-industry

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<tr>
<th></th>
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<th>Int 2 '90-'96</th>
<th>Int 3 '96-'02</th>
<th>Int 4 '03-'09</th>
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<td>-0.05</td>
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Worker flow definitions

- Job-to-job transitions
  - FT employed at different firms in interval 1 and 2.
  - Within and across local labor markets.

- Labor market entry and exit
  - Entry: Interval 1: < 20, interval 2: ≥ 20 + FT employed
  - Exit: Interval 1: < 60 + FT employed, Interval 2: > 60

- Nonemployment transitions
  - Unemployment transitions.
  - “Other” transitions: out of the labor force, self employed, part-time/marginal jobs, employment in East Germany.

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Devise a decomposition method based on joint distribution

- **Goal**: Estimate total effect of a worker flow on the change in sorting.

- Challenge: Unlike variance, correlation is not additively separable.

- Solution:
  1. Estimate joint distribution of worker and firm effects. Approximate with quintiles.
  2. Compute sorting based on estimated joint distribution.
  3. Create counterfactual sorting, holding worker flows constant. Net worker flows: e.g. labor market entrants - labor market exiters.
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Step 1: Estimate joint dist. of worker and firm effects
Step 2: Compute sorting in each interval

**Interval 1**

Corr(worker effect, firm effect) = 0.035
Step 2: Compute sorting in each interval

Interval 2

Joint Distribution of Worker and Firm Fixed Effect: Second Period

Worker flow

Worker Fixed Effect Quintile

Percentage of Employment

Firm FE Q1  Firm FE Q2  Firm FE Q3  Firm FE Q4  Firm FE Q5

All flows

Worker flow

All flows
Step 2: Compute sorting in each interval

Corr(worker effect, firm effect) = 0.197
Step 2: Compute sorting in each interval

Interval 2

Corr(worker effect, firm effect) = 0.197

Approximation works well:
△ corr (total) = 0.155
△ corr (quintiles) = 0.163
Step 3: Compute counterfactual sorting
Step 3: Compute counterfactual sorting

Interval 1

Joint Distribution of Worker and Firm Fixed Effect: First Period

Worker flow
- Job-to-job
- Job stayer
- Emp to nonemp
- Exit labor market

Percentage of Employment

Worker Fixed Effect Quintile
Step 3: Compute counterfactual sorting

Interval 1

Joint Distribution of Worker and Firm Fixed Effect: First Period

Worker flow
- All other flows
- Exit labor market
Step 3: Compute counterfactual sorting

Interval 2

Joint Distribution of Worker and Firm Fixed Effect: Second Period

Worker flow
- All other flows
- Enter labor market

Percentage of Employment

Worker Fixed Effect Quintile

Firm FE Q1
Firm FE Q2
Firm FE Q3
Firm FE Q4
Firm FE Q5

All other flows
Enter labor market

back
Step 3: Compute counterfactual sorting

Interval 2

Joint Distribution of Worker and Firm Fixed Effect: Second Period

Change in sorting: actual = 0.163
Step 3: Compute counterfactual sorting

Counterfactual Interval 2

Change in sorting:
actual = 0.163
counterfactual = 0.079
Correlation decomposition method

- Notation:
  - $E_{ijk} :=$ employment in cell WFE $i$, EFE $j$, flow $k$.
  - $\pi_{ij} :=$ employment share in cell $i$, $j$.
  - $\overline{\alpha}_i :=$ average value of WFE’s in quintile $i$.
  - $\overline{\psi}_j :=$ average value of EFE’s in quintile $j$.

- Total change: $\triangle \rho = Corr \left( \pi_{ij}^{p+1} \overline{\alpha}_i^{p+1}, \pi_{ij}^{p+1} \overline{\psi}_j^{p+1} \right) - Corr \left( \pi_{ij}^p \overline{\alpha}_i^p, \pi_{ij}^p \overline{\psi}_j^p \right)$

- Share reformulation: $\pi_{ij}^{p+1} = \left[ \pi_{ij}^p + \frac{\Delta E_{ij}}{E^p} \right] \frac{E^p}{E^{p+1}}$

- Counterfactual share ($C_k$): $\pi_{ij}^{p+1, C_k} = \left[ \pi_{ij}^p + \frac{\sum_{\sim k} \Delta E_{ij}}{E^p} \right] \frac{E^p}{E^p + \sum_{\sim k} E_{\sim k}}$

- Counterfactual change in correlation holding $k$ constant:
  $$\triangle \rho^{C_k} = Corr \left( \pi_{ij}^{p+1, C_k} \overline{\alpha}_i^{p+1}, \pi_{ij}^{p+1, C_k} \overline{\psi}_j^{p+1} \right) - Corr \left( \pi_{ij}^p \overline{\alpha}_i^p, \pi_{ij}^p \overline{\psi}_j^p \right)$$

- Contribution of $k$ to total change: $\triangle \rho - \triangle \rho^{C_k}$
## Aggregate worker flow decomp details

**Table:** Decomposition of change in correlation of firm and worker effects

<table>
<thead>
<tr>
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<th>III. Average across intervals</th>
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<tbody>
<tr>
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Measuring export-induced worker flows

- Estimate for all $i, j, k$:

$$\frac{\Delta E_{ijkl}}{E_{lj}^p} = \beta_1^{ijk} \Delta EXP_{lp} + \beta_2^{ijk} \Delta IMP_{lp} + \gamma^{ijk} X_{lp} + \lambda^{ijk}_{r(l)} + \delta_{lp}^{ijk} + \epsilon_{lp}^{ijk}$$

- $\Delta E_{ijkl}$ - change in employment for:
  - joint-distribution employment cell $i, j$
  - worker flow $k$

- $E_{lj}^p$ - total employment

- $\pi_{ij}$ - employment share

- Counterfactual, export-induced change in employment share:

$$\tilde{\pi}_{ij}^{p+1,C_k} = \left[\pi_{ij}^p + \sum_{k} \hat{\beta}_{1\sim k}^{ij} \right] \left(\frac{1}{1+\sum_{k} \hat{\beta}_{1\sim k}^{ij}}\right)$$
Previous findings on employment and wages

▶ Employment

▶ Germany (Dauth et al. 2014): €1,000 per worker increase in:
  ▶ exports increases total employment by 0.63 log pts.
  ▶ imports decreases total employment by 0.32 log pts.

▶ US (Autor et al. 2012): $1,000 per worker increase in imports reduces manufacturing employment 4.23 log pts.

▶ Wages

▶ Germany (Dauth et al. 2014): €1,000 per worker increase in:
  ▶ exports increases median wages by 0.11 log pts.
  ▶ imports insignificantly decreases median wages.

▶ US (Autor et al. 2012): $1,000 per worker increase in imports has an insignificant effect on manufacturing wages, but decreases non-manufacturing wages.
Use trade variation to isolate effect of firm demand

- Apply decomposition method to export-induced changes in employment only.

Idea: compare worker flows in exposed versus non-exposed local labor markets.

Change in export exposure randomly assigned.

Change in worker composition held constant.

e.g. differences in composition between entrants and retirees.

Exclusion restriction: trade liberalization only affects worker composition through changes in labor demand.

Q: For a given distribution of workers, does trade liberalization increase sorting?

Understand firm factors driving sorting.
Use trade variation to isolate effect of firm demand

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- Idea: compare worker flows in exposed versus non-exposed local labor markets.
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Trade shock details

- **LLM export exposure:** $\triangle EXP^{GER}_{lt} = \sum_j \frac{E_{lkt}}{E_{kt}} \frac{\triangle EXP^{GER \rightarrow EAST}_{kt}}{E_{lt}}$
  - $E_{lkt} :=$ employment in LLM $l$, industry $k$, and year $t$.
  - $\triangle EXP^{GER \rightarrow EAST}_{kt} :=$ change in the value of German exports to the “East” from $t$ to $t + 10$ in industry $k$.

- **Estimate:**
  
  $\triangle Corr \left( \hat{\alpha}_i, \hat{\psi}_j \right)_{lt} = \beta_1 \triangle EXP_{lt} + \beta_2 \triangle IMP_{lt} + \gamma X_{lt} + \lambda_{r(l)} + \delta_t + \epsilon_{lt}$

  - $l$, local labor market, 325 in West Germany, average pop $\approx 200,000$
Estimation details

- Estimation equation:

\[ \Delta Corr^P_i \left( \hat{\alpha}_i, \hat{\psi}_{j(i,t)} \right) = \beta_1 \Delta EXP_{lp} + \beta_2 \Delta IMP_{lp} + \gamma X_{lp} + \lambda_{r(l)} + \delta_p + \epsilon_{lp} \]

- \( l \) - local labor market, \( p \) - period of change.

- \( \Delta EXP_{lp}, \Delta IMP_{lp} \): change in export/import exposure.

- Controls:
  - \( \lambda_{r(l)}, \delta_p \) - regional and time trends.
  - \( X_{lp} \): initial LLM emp, % emp in manufacturing, % high-skill, % foreign-born, % female, and % routine occ.
Results of sorting on trade for females

Est eqn: \( \Delta Corr_{lp} \left( \hat{\alpha}_i, \hat{\psi}_{j(i,t)} \right) = \beta_1 \Delta EXP_{lp} + \beta_2 \Delta IMP_{lp} + \gamma X_{lp} + \lambda_{r(l)} + \delta_p + \epsilon_{lp} \)

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<th>Region fixed effect</th>
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<th>IV: None</th>
<th>IV: State</th>
<th>IV: LMR1</th>
<th>IV: LMR2</th>
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</table>
First stage: trade to Germany on trade to other countries

<table>
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<td>△ export exp other</td>
<td>0.6492***</td>
<td>0.4878***</td>
<td>0.5128***</td>
<td>0.5576***</td>
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<tr>
<td>△ import exp other</td>
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<td>0.0141</td>
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<td>F-stat</td>
<td>167.9</td>
<td>90.5</td>
<td>104.5</td>
<td>91.8</td>
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</table>

Dep. var.: △ export exp to the “East”

| △ export exp other     | 0.2924*** | 0.2733*** | 0.2626*** | 0.2421*** |
| △ import exp other     | 0.2286*** | 0.0961**  | 0.1014**  | 0.0933    |
| F-stat                 | 76.2      | 32.4      | 30.3      | 16.1      |

| Labor market controls  | N         | Y         | Y         | Y         |
| Region fixed effect    | None      | State     | LMR1      | LMR2      |

Notes: All 2SLS regressions are weighted by the initial size of the regional labor force. Standard errors are clustered at the LRC 2 level. Labor market controls include: % employment in manufacturing, % high skilled employment, % foreign born employment, % female employment, and % routine occupation employment.
Robustness of the effect of trade on sorting

<table>
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<th>Second Interval '93-'06 (2)</th>
<th>Control for Job Flows (3)</th>
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<th>Net Exposure EE vs.CH (6)</th>
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<td>214</td>
<td>214</td>
<td>214</td>
<td>214</td>
<td></td>
</tr>
<tr>
<td>Adj R²</td>
<td>0.266</td>
<td>0.346</td>
<td>0.443</td>
<td>0.436</td>
<td>0.440</td>
<td>0.446</td>
<td></td>
</tr>
<tr>
<td>N (county-periods)</td>
<td>325</td>
<td>325</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
</tr>
</tbody>
</table>

Notes: All 2SLS regressions are weighted by the initial size of the regional labor force. Standard errors are clustered at the LMR2 level. Standard errors in parentheses. Result are with respect to men only.
Quantifying the effect of trade on sorting

- Back of the envelope calculation.

  - Average $\triangle$ in county trade exposure from 1988 to 2008: $\triangle_{\text{export}} = 7.61$, $\triangle_{\text{import}} = 6.25$

  - Net effect of trade on sorting: $7.61 \times 0.0080 - 6.25 \times 0.0017 = 0.0503$

  - Total change in within-county Corr(EFE,WFE) = 0.230

  - $0.0503/0.2290 = 21.9\%$ of total change.

- Using only exogenous part: $0.032/0.230 = 14.0\%$ of total change.

- Scale by IV’s share of total variation in trade exposure.

- **Relative magnitude.** Goldschmidt & Schmeider (2017) find outsourcing responsible for about 8% of total change.
Identification of the effect of trade on sorting

- Estimate: change in sorting = \( f(\text{change in exports + imports}) \).
Identification of the effect of trade on sorting

- Estimate: change in sorting = f(change in exports + imports).
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- Exogenous variation: fall of the Soviet Union and rise of China.
  - Events largely based on internal dynamics.
  - Both regions join WTO around 2001.

- Shift-share instrument measures trade exposure for each local labor market based on initial industrial composition.
  - Follow Autor, Dorn, Hanson (2013); Dauth et al. (2016)

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# Export-sorting worker flow decomp details

## Table: Decomposition of Export Sorting into Worker Flows

<table>
<thead>
<tr>
<th>Labor market entry</th>
<th>0.0045</th>
<th>47.7</th>
<th>33.5</th>
<th>0.35</th>
<th>57.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between-LLM job-to-job</td>
<td>0.0016</td>
<td>16.6</td>
<td>15.5</td>
<td>0.18</td>
<td>12.1</td>
</tr>
<tr>
<td>Within-LLM job-to-job</td>
<td>0.0000</td>
<td>0.0</td>
<td>15.1</td>
<td>0.00</td>
<td>5.7</td>
</tr>
<tr>
<td>Job-to-Job</td>
<td>0.0016</td>
<td>16.6</td>
<td>30.6</td>
<td>0.18</td>
<td>17.8</td>
</tr>
<tr>
<td>Other to emp.</td>
<td>0.0009</td>
<td>9.8</td>
<td>10.0</td>
<td>0.20</td>
<td>8.9</td>
</tr>
<tr>
<td>Unemp. to emp.</td>
<td>0.0000</td>
<td>0.3</td>
<td>4.1</td>
<td>0.17</td>
<td>2.6</td>
</tr>
<tr>
<td>Nonemployment to emp.</td>
<td>0.0009</td>
<td>10.1</td>
<td>14.1</td>
<td>0.37</td>
<td>11.5</td>
</tr>
<tr>
<td>Job Stayers</td>
<td>0.0023</td>
<td>25.0</td>
<td>21.8</td>
<td>0.00</td>
<td>12.8</td>
</tr>
</tbody>
</table>
Export shock as a demand shock

<table>
<thead>
<tr>
<th></th>
<th>△ emp (1)</th>
<th>△ wage (2)</th>
<th>△ EFE (3)</th>
<th>△ WFE (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export exposure</td>
<td>1.358***</td>
<td>0.334**</td>
<td>-0.072</td>
<td>0.435***</td>
</tr>
<tr>
<td></td>
<td>(0.430)</td>
<td>(0.160)</td>
<td>(0.157)</td>
<td>(0.116)</td>
</tr>
<tr>
<td>Import exposure</td>
<td>-1.519***</td>
<td>-0.098</td>
<td>0.000</td>
<td>-0.042</td>
</tr>
<tr>
<td></td>
<td>(0.585)</td>
<td>(0.230)</td>
<td>(0.126)</td>
<td>(0.180)</td>
</tr>
</tbody>
</table>
1.) Introduction

2.) Background

  2.1.) Data
  2.2.) Background on sorting

3.) Methods and Main Results

  3.1.) Decomposition of sorting into worker flows
  3.2.) Impact of trade on sorting
  3.3.) Decomposition of export-sorting into worker flows

4.) Further Findings and Implications

  4.1.) Sorting effects across sectors
  4.2.) Implications of sorting at labor market entry

5.) Conclusion
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- Trade liberalization as a shock to product demand.
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- Trade liberalization as a shock to product demand.
  - Expect an increase in employment and wages.
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- Between-industry effects: classic Heckscher-Ohlin models.
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- Approach the optimal allocation of assorative matching.
- Prediction: exports increase within-industry sorting, productive firms react the most.
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  ▶ Demand shock: increase in employment and wages.

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  ▶ Within-industry sorting: export coef = 0.0083* (0.0050).

  ▶ Driven by high-wage and large firms.

  ▶ Worker flow decomposition: 60% job stayers, 40% job-to-transitions.

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Labor market entry into non-manufacturing sector

Note: Bars show change in employment in each WFE-EFE cell as a percentage of initial LLM employment.

- Low-wage worker to low-wage firms: 72%.
- High-wage worker to high-wage firms: 26%.
Why effects on entry in other industries?

- Hypothesis:
  - Firms invest as new markets open: scale effect.
  - Technology complementarity to high skill labor.
  - Shift away from low-skill workers.

- Prior evidence that trade liberalizations induce tech upgrading:
  - Lileeva & Trefler (2010), Bustos (2011)

- Estimate effect of export exposure on investment
  - Firm survey: smaller sample, simplified design.
  - Coefficient on export exposure: 1.107*** (0.425).

- Consistent with long term-trend of manufacturing.
  - Increasing output, decreasing employment.
  - (But long-term outcome, i.e. next generation).
Worker flow decomposition for Manufacturing

<table>
<thead>
<tr>
<th></th>
<th>I. Change in Export Sorting</th>
<th>II. Employment Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comp (1)</td>
<td>Share (2)</td>
</tr>
<tr>
<td>Labor market entry</td>
<td>0.0002</td>
<td>2.4</td>
</tr>
<tr>
<td>Between-LLM job-to-job</td>
<td>0.0008</td>
<td>8.4</td>
</tr>
<tr>
<td>Within-LLM job-to-job</td>
<td>0.0003</td>
<td>3.1</td>
</tr>
<tr>
<td>Job-to-job</td>
<td>0.0011</td>
<td>11.5</td>
</tr>
<tr>
<td>Other to emp.</td>
<td>0.0007</td>
<td>8.0</td>
</tr>
<tr>
<td>Unemp. to emp.</td>
<td>-0.0002</td>
<td>-2.1</td>
</tr>
<tr>
<td>Nonemployment</td>
<td>0.0005</td>
<td>5.8</td>
</tr>
<tr>
<td>Job Stayers</td>
<td>0.0029</td>
<td>30.7</td>
</tr>
<tr>
<td>Industry total</td>
<td>0.0047</td>
<td>50.5</td>
</tr>
</tbody>
</table>

▶ Mostly through job stayers.

▶ Change in skill prices (WFEs)
## Sorting through labor market entry in Non-Manufacturing

<table>
<thead>
<tr>
<th></th>
<th>I. Change in Export Sorting</th>
<th>II. Employment Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comp (1)</td>
<td>Share (2)</td>
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<tr>
<td>Labor market entry</td>
<td>0.0042</td>
<td>45.7</td>
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<tr>
<td>Between-LLM job-to-job</td>
<td>0.0008</td>
<td>8.3</td>
</tr>
<tr>
<td>Within-LLM job-to-job</td>
<td>-0.0003</td>
<td>-3.1</td>
</tr>
<tr>
<td>Job-to-job</td>
<td>0.0005</td>
<td>5.2</td>
</tr>
<tr>
<td>Other to emp.</td>
<td>0.0002</td>
<td>1.9</td>
</tr>
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<td>Unemp. to emp.</td>
<td>0.0002</td>
<td>2.4</td>
</tr>
<tr>
<td>Nonemployment</td>
<td>0.0004</td>
<td>4.3</td>
</tr>
<tr>
<td>Job Stayers</td>
<td>-0.0005</td>
<td>-5.6</td>
</tr>
<tr>
<td>Industry total</td>
<td>0.0046</td>
<td>49.5</td>
</tr>
</tbody>
</table>

- Mostly low-wage and new firms.
- Increase in the level of entry. Shift away from manufacturing
### Table: Decomposition of Export Sorting into Worker Flows by Industry

<table>
<thead>
<tr>
<th></th>
<th>I. Components of Change in Sorting through Exports</th>
<th>II. Employment Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Manufacturing</td>
<td>Non-Manufacturing</td>
</tr>
<tr>
<td></td>
<td>$\Delta \rho_k$ (1) $\Delta \rho_k$ (%) (2)</td>
<td>$\Delta \rho_k$ (3) $\Delta \rho_k$ (%) (4)</td>
</tr>
<tr>
<td>Labor market entry</td>
<td>0.0002 2.4</td>
<td>0.0042 45.7</td>
</tr>
<tr>
<td></td>
<td>13.7 -0.14</td>
<td>19.8 0.49***</td>
</tr>
<tr>
<td>Between-LLM job-to-job</td>
<td>0.0008 8.4</td>
<td>0.0008 8.3</td>
</tr>
<tr>
<td></td>
<td>5.5 0.18***</td>
<td>9.9 0.00</td>
</tr>
<tr>
<td>Within-LLM job-to-job</td>
<td>0.0003 3.1</td>
<td>-0.0003 -3.1</td>
</tr>
<tr>
<td></td>
<td>6.6 0.00</td>
<td>8.5 0.00</td>
</tr>
<tr>
<td>Job-to-job</td>
<td>0.0011 11.5</td>
<td>0.0005 5.2</td>
</tr>
<tr>
<td></td>
<td>12.1 0.18</td>
<td>18.5 0.00</td>
</tr>
<tr>
<td>Other to emp.</td>
<td>0.0007 8.0</td>
<td>0.0002 1.9</td>
</tr>
<tr>
<td></td>
<td>3.4 0.13</td>
<td>6.5 0.07</td>
</tr>
<tr>
<td>Unemp. to emp.</td>
<td>-0.0002 -2.1</td>
<td>0.0002 2.4</td>
</tr>
<tr>
<td></td>
<td>1.9 0.20***</td>
<td>2.3 -0.04**</td>
</tr>
<tr>
<td>Nonemployment to emp.</td>
<td>0.0005 5.8</td>
<td>0.0004 4.3</td>
</tr>
<tr>
<td></td>
<td>5.3 0.33</td>
<td>8.8 0.04</td>
</tr>
<tr>
<td>Job Stayers</td>
<td>0.0029 30.7</td>
<td>-0.0005 -5.6</td>
</tr>
<tr>
<td></td>
<td>11.6 0.00</td>
<td>10.2 0.00</td>
</tr>
<tr>
<td>Industry total</td>
<td>0.0047 50.5</td>
<td>0.0046 49.5</td>
</tr>
<tr>
<td></td>
<td>42.7 0.37</td>
<td>57.3 0.52</td>
</tr>
</tbody>
</table>

Notes: “$\Delta \rho_k$” presents the component of the change in the correlation of worker and establishment fixed that can be attributed to a given worker flow through export exposure. “$\Delta \rho_k$ (%)” presents the contribution of a given worker flow as a share of the total export-induced change in sorting. “$E_k^p$ (%)” presents the initial share of a given worker flow relative to total LLM employment. “$%\Delta E_k$” presents estimates of the *export-induced* change in employment of a given worker flow divided by initial total LLM employment.
Table: Decomposition of Export Sorting into Worker Flows by Industry and Establishment Fixed Effect

<table>
<thead>
<tr>
<th></th>
<th>I. Share of Change in Sorting through Exports by Industry &amp; EFE Distribution</th>
<th>II. Initial Employment Shares by Industry &amp; EFE Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Manufacturing</td>
<td>Non-Manufacturing</td>
</tr>
<tr>
<td></td>
<td>Low (1)</td>
<td>Mid (2)</td>
</tr>
<tr>
<td>Labor market entry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-LLM job-to-job</td>
<td>2.9</td>
<td>-3.8</td>
</tr>
<tr>
<td>Within-LLM job-to-job</td>
<td>0.2</td>
<td>-0.5</td>
</tr>
<tr>
<td>Reallocation</td>
<td>1.0</td>
<td>-0.5</td>
</tr>
<tr>
<td>Other to emp.</td>
<td>1.3</td>
<td>-0.5</td>
</tr>
<tr>
<td>Unemp. to emp.</td>
<td>-0.2</td>
<td>-0.4</td>
</tr>
<tr>
<td>Nonemployment</td>
<td>1.1</td>
<td>-0.9</td>
</tr>
<tr>
<td>Job Stayers</td>
<td>-0.2</td>
<td>1.9</td>
</tr>
<tr>
<td>Industry total</td>
<td>5.1</td>
<td>-3.8</td>
</tr>
</tbody>
</table>
### Table: Decomposition of Export Sorting into Worker Flows by Industry and Firm Size

<table>
<thead>
<tr>
<th></th>
<th>Manufacturing</th>
<th>Non-Mnfctr</th>
<th>Manufacturing</th>
<th>Non-Mnfctr</th>
<th>Manufacturing</th>
<th>Non-Mnfctr</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NC</td>
<td>Sml</td>
<td>Lrg</td>
<td>NC</td>
<td>Sml</td>
<td>Lrg</td>
</tr>
<tr>
<td><strong>Labor market entry</strong></td>
<td>5.4</td>
<td>2.2</td>
<td>-5.2</td>
<td>28.8</td>
<td>6.6</td>
<td>10.2</td>
</tr>
<tr>
<td>Between-LLM job-to-job</td>
<td>2.5</td>
<td>1.1</td>
<td>4.8</td>
<td>9.7</td>
<td>1.3</td>
<td>-2.7</td>
</tr>
<tr>
<td>Within-LLM job-to-job</td>
<td>0.9</td>
<td>-0.5</td>
<td>2.6</td>
<td>1.3</td>
<td>1.5</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Reallocation</strong></td>
<td>3.4</td>
<td>0.6</td>
<td>7.3</td>
<td>11.0</td>
<td>2.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Other to emp.</td>
<td>0.5</td>
<td>-1.2</td>
<td>8.7</td>
<td>2.6</td>
<td>1.7</td>
<td>-2.4</td>
</tr>
<tr>
<td>Unemp. to emp.</td>
<td>0.6</td>
<td>-1.3</td>
<td>-1.4</td>
<td>0.4</td>
<td>0.8</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Nonemployment</strong></td>
<td>1.1</td>
<td>-2.5</td>
<td>7.3</td>
<td>2.9</td>
<td>2.5</td>
<td>-1.1</td>
</tr>
<tr>
<td><strong>Job Stayers</strong></td>
<td>0.0</td>
<td>0.2</td>
<td>30.5</td>
<td>0.0</td>
<td>-3.4</td>
<td>-2.2</td>
</tr>
<tr>
<td>Industry total</td>
<td>9.9</td>
<td>0.5</td>
<td>39.9</td>
<td>42.8</td>
<td>8.4</td>
<td>7.9</td>
</tr>
<tr>
<td></td>
<td>11.7</td>
<td>11.6</td>
<td>20.6</td>
<td>25.3</td>
<td>9.6</td>
<td>18.9</td>
</tr>
</tbody>
</table>
## Table: Decomposition of the Change in Sorting into Between- and Within-Group Components

<table>
<thead>
<tr>
<th>Group definition</th>
<th>Change in correlation between worker and establishment fixed effects</th>
<th>I. Aggregate</th>
<th>II. Export-induced</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BT-Group</td>
<td>WI-Group</td>
<td>BT-Group</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Industry</td>
<td>0.002</td>
<td>0.148</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(1.57)</td>
<td>(98.43)</td>
<td>(0.06)</td>
</tr>
<tr>
<td>Firm Size</td>
<td>0.004</td>
<td>0.144</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>(2.89)</td>
<td>(97.11)</td>
<td>(5.81)</td>
</tr>
<tr>
<td>Worker Flow</td>
<td>-0.002</td>
<td>0.149</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>(-1.12)</td>
<td>(101.12)</td>
<td>(3.51)</td>
</tr>
<tr>
<td>Industry*Firm Size</td>
<td>0.007</td>
<td>0.142</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(4.86)</td>
<td>(95.14)</td>
<td>(4.58)</td>
</tr>
<tr>
<td>Industry*Worker Flow</td>
<td>0.001</td>
<td>0.129</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.51)</td>
<td>(99.49)</td>
<td>(-4.87)</td>
</tr>
<tr>
<td>Firm Size*Worker Flow</td>
<td>0.003</td>
<td>0.126</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>(2.17)</td>
<td>(97.83)</td>
<td>(6.04)</td>
</tr>
<tr>
<td>Industry<em>Firm Size</em>Worker Flow</td>
<td>0.006</td>
<td>0.143</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td>(4.28)</td>
<td>(95.72)</td>
<td>(-3.38)</td>
</tr>
</tbody>
</table>

Notes: The contribution of each component as a percentage of the total change is in parentheses. “Industry” consists of two groups: manufacturing and non-manufacturing. “Firm Size” consist of three groups: non-continuing firms, small continuing firms, and large continuing firms.
## Table: Descriptive Stats of Worker Flow Decomposition Across Sequences

<table>
<thead>
<tr>
<th></th>
<th>I. Aggregate</th>
<th>II. Export-Induced</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (1)</td>
<td>S.E. (2)</td>
</tr>
<tr>
<td>Unemployment to Employment</td>
<td>0.0031</td>
<td>0.00024</td>
</tr>
<tr>
<td></td>
<td>(1.93)</td>
<td>(0.15)</td>
</tr>
<tr>
<td>“Other” to Employment</td>
<td>0.0152</td>
<td>0.00025</td>
</tr>
<tr>
<td></td>
<td>(9.61)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Labor Market Entry</td>
<td>0.0883</td>
<td>0.00090</td>
</tr>
<tr>
<td></td>
<td>(55.71)</td>
<td>(0.57)</td>
</tr>
<tr>
<td>Job Stayers</td>
<td>0.0203</td>
<td>0.00076</td>
</tr>
<tr>
<td></td>
<td>(12.79)</td>
<td>(0.48)</td>
</tr>
<tr>
<td>Job-to-Job Between Region</td>
<td>0.0216</td>
<td>0.00036</td>
</tr>
<tr>
<td></td>
<td>(13.63)</td>
<td>(0.23)</td>
</tr>
<tr>
<td>Job-to-Job Within Region</td>
<td>0.0101</td>
<td>0.00034</td>
</tr>
<tr>
<td></td>
<td>(6.35)</td>
<td>(0.21)</td>
</tr>
</tbody>
</table>

Notes: The contribution of each component as a percentage of the total change is in parentheses. The total change in correlation for aggregate (export-induced) employment changes is 0.158 (0.0093). There are 32 different sequences by which the six worker flows can be ordered to compute counterfactual employment distributions. “S.E.” denotes the standard error across the 32 sequences.