

# The Rise of Superstar Firms and Wage Inequality

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# Motivation

- ▶ Increase in wage inequality due to increased between-firm wage differences (Card et al., 2013; Song et al., 2015; Barth et al., 2016; Helpman et al., 2017)
- ▶ Rise of superstar firms; increasing concentration in product and labor markets (Autor et al., 2017; Barkai, 2017; Kehrig and Vincent, 2017; Azar et al., 2017, 2018; Benmelech et al., 2018; De Loecker and Eeckhout, 2017)
- ▶ **This Paper:**
  - ▶ Is there a link between the growth of superstar firms and the increase in between-firm wage inequality?
  - ▶ *(Preliminary)* Are these patterns related to increased trade exposure?

# This Paper

- ▶ Link between the growth of **superstar firms** and the increase in between-firm **wage inequality**
  - ▶ Document aggregate patterns using administrative social security data from Germany (IAB)
  - ▶ Exploit heterogeneity across industries: Determine whether wage inequality increases more within industries that experience larger increases in concentration
  - ▶ Establishment-level patterns: Analyze underlying changes happening within and between establishments and how they account for the overall wage inequality and concentration changes
  
- ▶ Analyze changes in **trade exposure** as a potential driving force

## Overview of Findings

- ▶ Between-establishment inequality and employment concentration in superstar establishments increase strongly in Germany between 1995 and 2010
- ▶ Industries where concentration of employment in superstar establishments increased more also experienced a larger increase in inequality
- ▶ The same is true when focusing on measures of sales concentration within industries
- ▶ Employment reallocation contributes to wage inequality, but the increase in inequality is mainly due to wage changes within continuing establishments
- ▶ Preliminary evidence suggests link with increased trade exposure

# Data

# Data

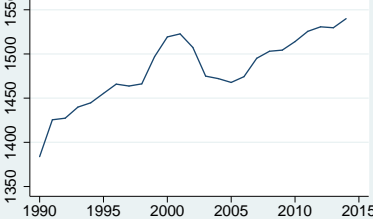
- ▶ Universe of German social security records from the Institute for Employment Research (IAB) of the German Federal Employment Agency (BA); focus on West Germany
- ▶ Years 1990–2014; data for June 30th of each year
- ▶ Covers all private-sector workers subject to social insurance contributions
- ▶ Individual records include establishment identifiers  $\Rightarrow$  can aggregate data to establishment level;  $\sim 1.25$  million estab/yr
- ▶ Part-time workers treated as 0.5 full-time workers; excluded from wage calculations
- ▶ Wage: average daily wage for the employment spell on June 30th
- ▶ Most of the analysis focuses on patterns within 3-digit industries

# Descriptive Statistics

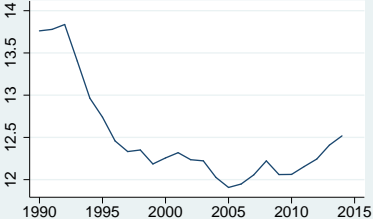
### Total Employment (millions)



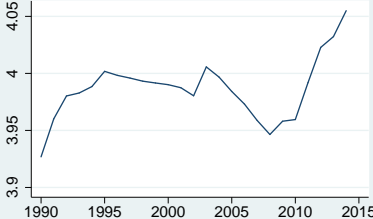
### Number of Establishments (thousands)



### Average Establishment Size



### Mean Establishment Log Real Wage



# Establishment-Level Wages

- ▶ We focus on the dispersion of wages between, rather than within establishments
- ▶ We consider two measures of establishment-level wages:
  1. Average log wages within the establishment
  2. Establishment fixed effects à la Helpman, Itskhoki, Muendler, and Redding (2017) [HIR]
    - ▶ controls for observable worker characteristics only
    - ▶ allows for worker sorting along unobservables to be captured in firm component
    - ▶ we compute our own estimates, year by year, controlling for education, age, nationality, gender and interactions
- ▶ Also show some results using firm fixed effects à la Abowd, Kramarz, and Margolis (1999) [AKM]

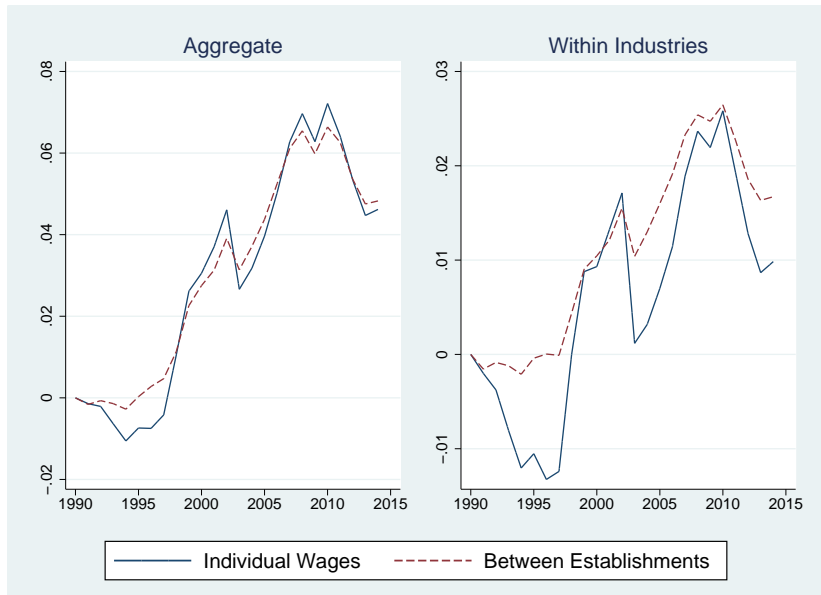


# Identifying Superstar Establishments

- ▶ Productivity not directly observable in the data
- ▶ Since we are interested in wage inequality, we characterize **superstar** establishments as those that pay **high wage premia**
- ▶ Specifically: An establishment is considered a superstar if the wage that it pays (based on its average wage or its estimated HIR fixed effect) would fall within the **top 5%** of the employment-weighted distribution of wage premia **within its 3-digit industry in 1990**

# Data Patterns

# Rising Inequality



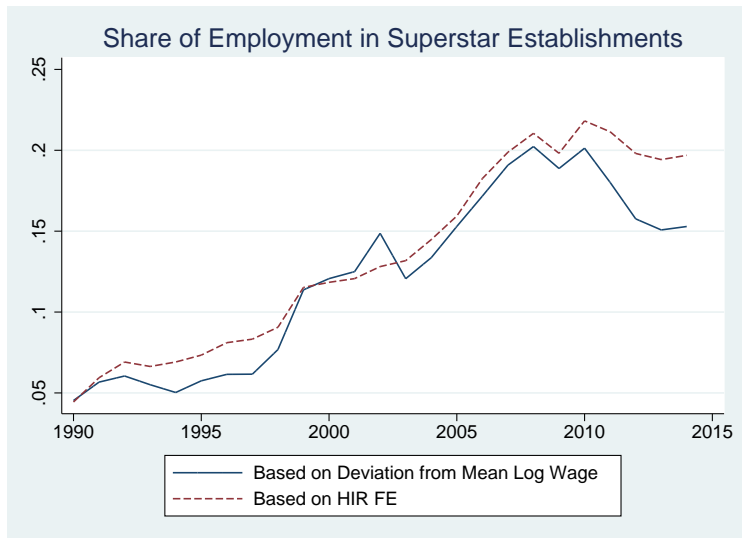
Note: Within-industry inequality is a weighted average of inequality within 3-digit industries, where the industrial composition is held constant based on employment shares in 1990.

## Changes in Between-Establishment Wage Variance Within Industries



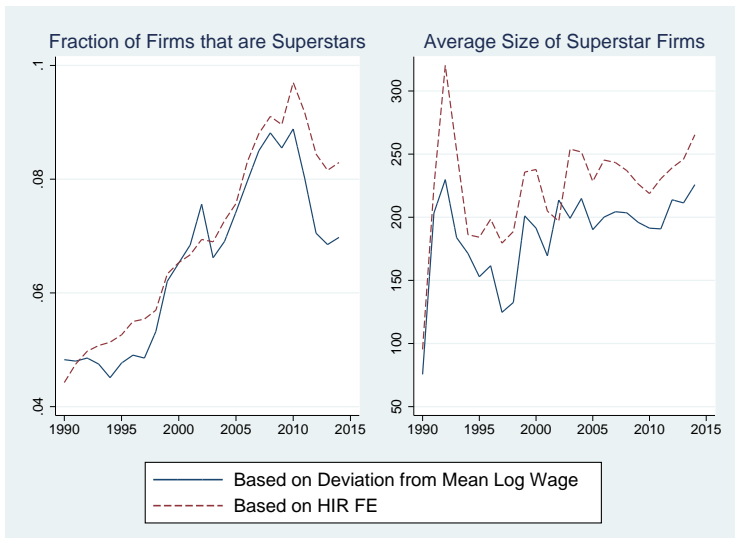
Note: Within-industry inequality is a weighted average of inequality within 3-digit industries, where the industrial composition is held constant based on employment shares in 1990.

# Rise of Superstar Establishments



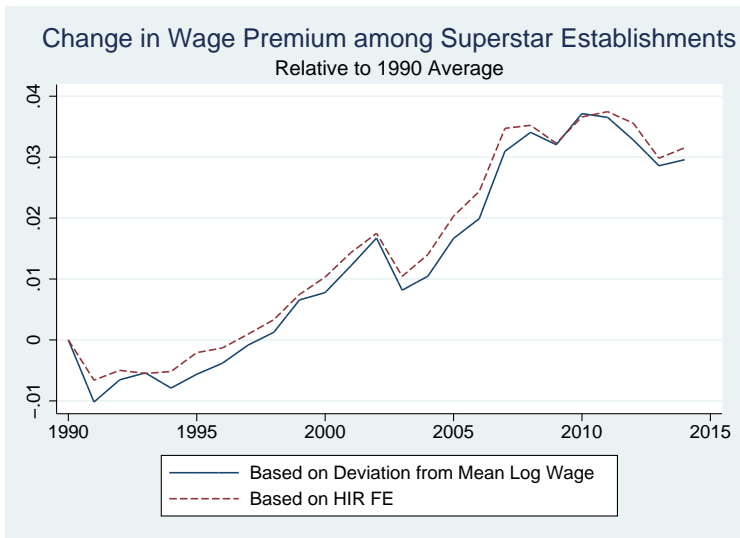
Note: An establishment is considered a superstar if its wage premium is within the top 5% of the employment-weighted distribution of wage premia within its industry in 1990.

# More or Bigger Establishments?



Note: An establishment is considered a superstar if its wage premium is within the top 5% of the employment-weighted distribution of wage premia within its industry in 1990.

# Superstar Establishments' Wage Premium



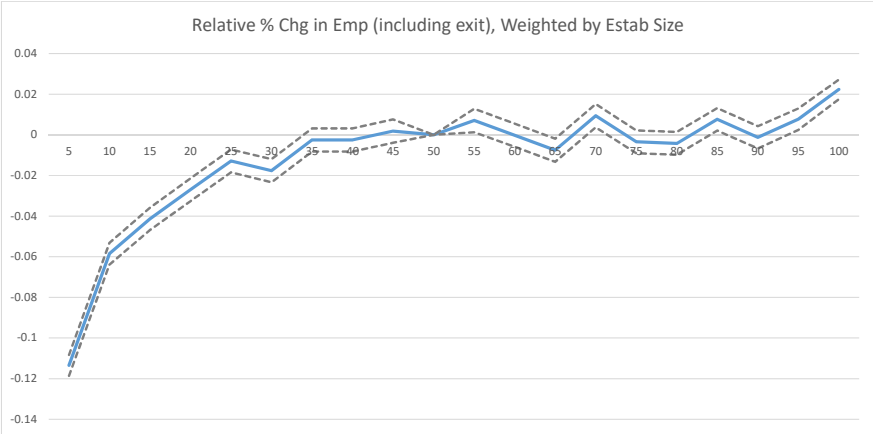
Note: An establishment is considered a superstar if its wage premium is within the top 5% of the employment-weighted distribution of wage premia within its industry in 1990.

# **Understanding the Rise of Superstars: Establishment-Level Patterns**



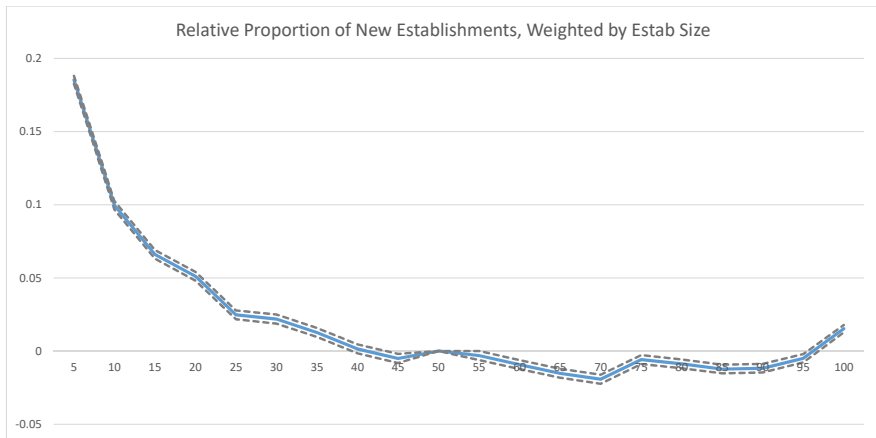
# Differential Employment Growth

within industry-year cells, over 6-year windows, 1990–2014, according to position in the 1990 distribution of wage premia



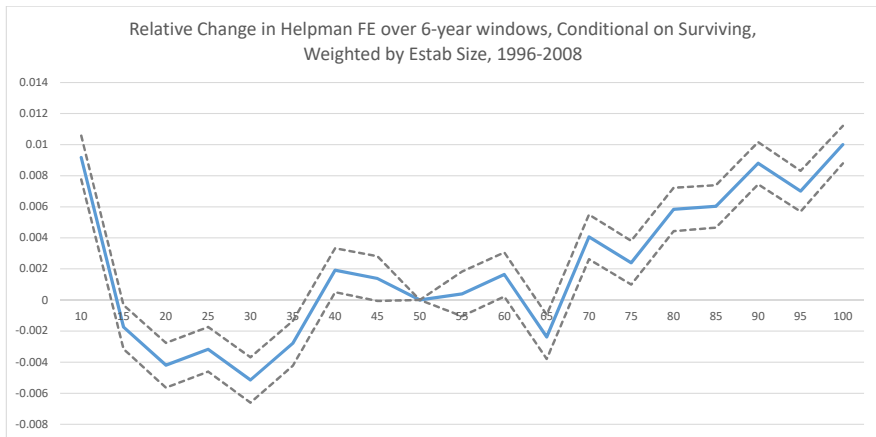
# New Establishments

within industry-year cells, over 6-year windows, 1990–2014, according to position in the 1990 distribution of wage premia



# Change in Wage Premium

within industry-year cells, over 6-year windows, 1996–2008, according to position in the 1990 distribution of wage premia



# **Link Between the Growth of Superstar Establishments and Wage Inequality: Industry-Level Analysis**

# Inequality and Superstars: Industry-Level Analysis

Exploit variation across industries:

$$\Delta INEQ_{it} = \alpha \Delta CONC_{it} + \tau_t + u_{it}$$

Does inequality increase more in 3-digit industries where employment concentration in superstar establishments increases more?

- ▶ Remove fixed differences across industries by using changes over time
- ▶ Allow for aggregate shocks through time fixed effects
- ▶ Estimate over 6-year windows between 1990 and 2014
- ▶ Note: Similar to approach by Autor et al. (2017) to analyze link between superstars and labor share

## Inequality and Superstars: Industry-Level

*Δ within-ind ineq over 6-year windows based on:*

|                                 | Var of Mean<br>Estab Log Wages<br>(1) | Var of HIR<br>Estab FE<br>(2) | Var of AKM<br>Estab FE<br>(3) |
|---------------------------------|---------------------------------------|-------------------------------|-------------------------------|
| Δ Share of Emp<br>in Superstars | 0.0501<br>(0.0060)***                 | 0.0242<br>(0.0038)***         | 0.0103<br>(0.0034)***         |
| Year FE                         | X                                     | X                             | X                             |
| Obs.                            | 784                                   | 784                           | 784                           |
| $R^2$                           | 0.4264                                | 0.4499                        | 0.2824                        |
| Years                           | 1990-2014                             | 1990-2014                     | 1990-2014                     |
| Industries                      | 3-digit                               | 3-digit                       | 3-digit                       |

Note: Superstar establishments based on HIR FE.

# Inequality across Establishments (Not Employment-Weighted)

[▶ Graph](#)

*Δ within-ind ineq over 6-year windows based on:*

|                                 | Var of Mean<br>Estab Log Wages | Var of HIR<br>Estab FE | Var of AKM<br>Estab FE |
|---------------------------------|--------------------------------|------------------------|------------------------|
|                                 | (1)                            | (2)                    | (3)                    |
| Δ Share of Emp<br>in Superstars | 0.0875<br>(0.0118)***          | 0.0421<br>(0.0050)***  | 0.0266<br>(0.0060)***  |
| Year FE                         | X                              | X                      | X                      |
| Obs.                            | 784                            | 784                    | 784                    |
| $R^2$                           | 0.3317                         | 0.4401                 | 0.4066                 |
| Years                           | 1990-2014                      | 1990-2014              | 1990-2014              |
| Industries                      | 3-digit                        | 3-digit                | 3-digit                |

Note: Superstar establishments based on HIR FE.

## Inequality and Sales Concentration: Industry-Level

*Δ within-ind ineq over 6-year windows based on:*

|              | Var of Mean<br>Etab Log Wages | Var of HIR<br>Etab FE | Var of AKM<br>Etab FE |
|--------------|-------------------------------|-----------------------|-----------------------|
|              | (1)                           | (2)                   | (3)                   |
| $\Delta$ HHI | 0.2338<br>(0.0504)***         | 0.1659<br>(0.0442)*** | 0.1009<br>(0.0267)*** |
| Year FE      | X                             | X                     | X                     |
| Obs.         | 61                            | 61                    | 61                    |
| $R^2$        | 0.4700                        | 0.4523                | 0.4486                |
| Years        | 2000-2012                     | 2000-2012             | 2000-2012             |
| Industries   | 2-digit                       | 2-digit               | 2-digit               |

Note: HHI is the Herfindahl-Hirschman Index based on firms' shares of industry turnover from the Competitiveness Research Network (CompNet).



## Long Differences: 1995–2012

|  | <i>Δ Inequality based<br/>on Var of HIR FE</i> |                      | <i>Δ Share of Emp<br/>in Superstars</i> |
|--|--|----------------------|---|
|  | (1)  | (2)                  | (3)                                     |
| $\Delta$ Share of Emp<br>in Superstars | 0.0205<br>(0.0066)***                          | 0.0164<br>(0.0074)** |   |
| Tradable<br>Sector                     |  | 0.0030<br>(0.0024)   |   |
| $\Delta$ Premium<br>among Superstars   |  |                      | 1.3497<br>(0.2961)***                   |
| Obs.<br>$R^2$                          | 196<br>0.0477                                  | 196<br>0.0550        | 195<br>0.0972                           |
| Industries                             | 3-digit  | 3-digit              | 3-digit                                 |

# Decomposing the Changes in Wage Inequality

## Decomposing changes in inequality

There are three channels through which the between-establishment wage variance may increase within an industry:

1. Selection (establishment entry and exit)
2. Differential Employment Growth
3. Differential Wage Growth

We perform two decompositions to determine the relative importance of each of these three channels

# Decomposition 1

The total change in establishment-level wage variance over a 6-year window can be written as:

$$\sum_j s_{jt} (w_{jt} - \bar{w}_t)^2 - \sum_j s_{jt-6} (w_{jt-6} - \bar{w}_{t-6})^2$$

where:

- ▶  $s_{jt}$  is the employment share of establishment  $j$  within its industry, at time  $t$
- ▶  $w_{jt}$  is the HIR fixed effect for establishment  $j$
- ▶  $\bar{w}_t$  is the average HIR fixed effect across establishments in a given industry, at time  $t$

This variance change can be decomposed into:

$$\begin{aligned} & \sum_j s_{jt} (w_{jt} - \bar{w}_t)^2 - \sum_j s_{jt-6} (w_{jt-6} - \bar{w}_{t-6})^2 \\ &= \underbrace{\sum_{j \in con} s_{jt}^{con} (w_{jt} - \bar{w}_t^{con})^2 - \sum_{j \in con} s_{jt-6}^{con} (w_{jt-6} - \bar{w}_{t-6}^{con})^2}_{\text{1. Change in Variance among Continuing Establishments}} \\ &+ \underbrace{\sum_{j \in con} s_{jt-6}^{con} (w_{jt-6} - \bar{w}_{t-6}^{con})^2 - \sum_j s_{jt-6} (w_{jt-6} - \bar{w}_{t-6})^2}_{\text{2. Selection Effect from Establishment Exit}} \\ &+ \underbrace{\sum_j s_{jt} (w_{jt} - \bar{w}_t)^2 - \sum_{j \in con} s_{jt}^{con} (w_{jt} - \bar{w}_t^{con})^2}_{\text{3. Selection Effect from Establishment Entry}} \end{aligned}$$

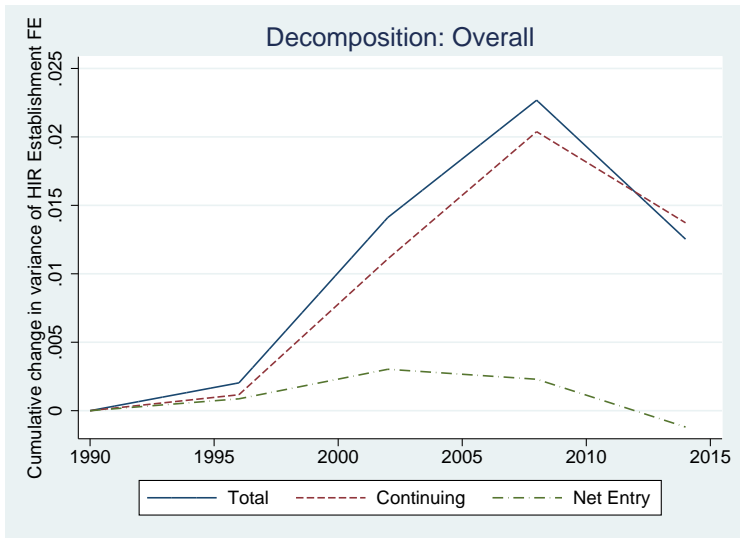
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# Decomposition 1: Changes in the Variance of Establishment HIR Fixed Effects within Industries



Note: The figure shows weighted averages of the decomposition results over 6-year windows, where 3-year industries are weighted according to their employment share in each base year.



## Decomposition 2

The change in the variance among **continuing establishments** can be further decomposed into:

$$\begin{aligned} & \sum_{j \in \text{con}} s_{jt}^{\text{con}} (w_{jt} - \bar{w}_t^{\text{con}})^2 - \sum_{j \in \text{con}} s_{jt-6}^{\text{con}} (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2 \\ &= \underbrace{\sum_{j \in \text{con}} \Delta s_{jt}^{\text{con}} (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2}_{\text{1. Differential Employment Growth}} \\ &+ \underbrace{\sum_{j \in \text{con}} s_{jt-6}^{\text{con}} \left[ (w_{jt} - \bar{w}_t^{\text{con}})^2 - (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2 \right]}_{\text{2. Differential Wage Growth}} \\ &+ \underbrace{\sum_{j \in \text{con}} \Delta s_{jt}^{\text{con}} \left[ (w_{jt} - \bar{w}_t^{\text{con}})^2 - (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2 \right]}_{\text{3. Interaction}} \end{aligned}$$

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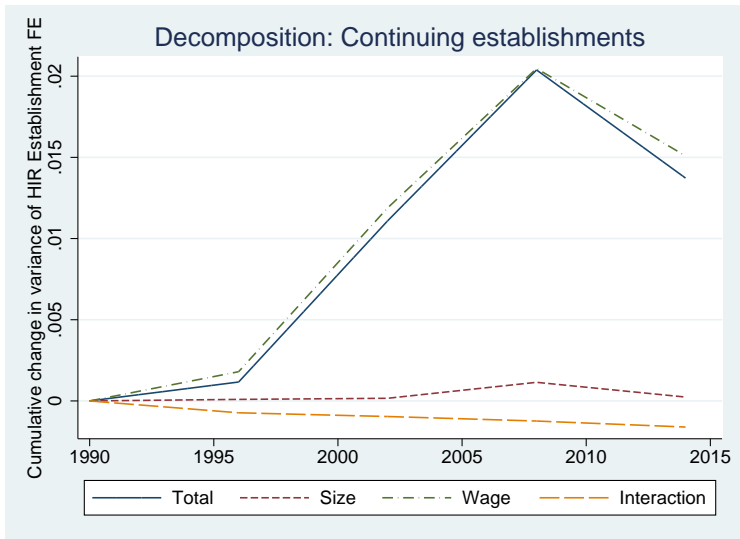
$$\begin{aligned} & \sum_{j \in \text{con}} s_{jt}^{\text{con}} (w_{jt} - \bar{w}_t^{\text{con}})^2 - \sum_{j \in \text{con}} s_{jt-6}^{\text{con}} (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2 \\ &= \underbrace{\sum_{j \in \text{con}} \Delta s_{jt}^{\text{con}} (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2}_{\text{1. Differential Employment Growth}} \\ &+ \underbrace{\sum_{j \in \text{con}} s_{jt-6}^{\text{con}} \left[ (w_{jt} - \bar{w}_t^{\text{con}})^2 - (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2 \right]}_{\text{2. Differential Wage Growth}} \\ &+ \underbrace{\sum_{j \in \text{con}} \Delta s_{jt}^{\text{con}} \left[ (w_{jt} - \bar{w}_t^{\text{con}})^2 - (w_{jt-6} - \bar{w}_{t-6}^{\text{con}})^2 \right]}_{\text{3. Interaction}} \end{aligned}$$

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## Decomposition 2: Changes among Continuing Establishments



Note: The figure shows weighted averages of the decomposition results over 6-year windows, where 3-year industries are weighted according to their employment share in each base year.

# Rationalizing the Results: Trade Exposure

# Rationalizing the Results

- ▶ Employment has reallocated towards top establishments
- ▶ This has been associated with an increase in between-firm wage inequality
- ▶ Models of heterogeneous firms with heterogeneous wages can generate these patterns through a **reduction of trade costs**

## Heterogeneous Firm Models: Intuition

- ▶ Starting from Melitz (2003): monopolistically competitive product market with heterogeneous productivity across firms
- ▶ Extensions allow for wage differences between firms, e.g. Egger and Kreickemeier (2012) fair-wage model:
  - ▶ Mechanism first discussed by Akerlof and Yellen (1990)
  - ▶ Workers condition effort on wage they are paid relative to wage they consider fair
  - ▶ Managers use wage offer to elicit desired level of effort; no incentive to pay less than the fair wage under profit maximization
- ▶ Implication: More productive firms pay higher wages
- ▶ Note: Same implications from other models such as Helpman et al. (2010)

## Heterogeneous Firms and Trade: Intuition

- ▶ Fixed cost of exporting: only the most productive firms export
- ▶ A lowering of trade costs benefits the most productive firms – they can access the foreign market at a lower cost
- ▶ Unproductive firms are unable to compete and must exit
- ▶ Implications of trade:
  1. Employment reallocates towards the more productive firms
  2. Revenues increase at top firms, so wages for workers at these firms increase (rent-sharing)

⇒ Wage inequality increases
- ▶ Note: Other shocks that reallocate consumer demand towards the more productive firms would generate similar implications



# Empirical Exercise

- ▶ Use industry-level data on trade with the East: China and Eastern Europe
- ▶ Data from Dauth, Findeisen, and Suedekum (2017)
- ▶ Instrument using trade with other high-income countries

## Empirical Exercise

- ▶ How to think about import vs export shocks?
- ▶ Different effect on overall industry employment, wages
- ▶ But expect similar distributional effects:
  - ▶ Export shock: Most productive firms benefit disproportionately
  - ▶ Import shock: Only the most productive firms survive
- ▶ For now: OLS results using total trade (imports plus exports)
- ▶ We also control for changes in the fraction of workers covered by industry-level collective bargaining agreements

# Trade Exposure: Empirical Evidence

|                                   | <i>Within-ind <math>\Delta</math> share of employment in<br/>superstars between 1995–2012</i> |                        |
|-----------------------------------|---|------------------------|
|                                   | (1)   | (2)                    |
| $\Delta$ Total Trade<br>with East | 0.0920<br>(0.0439)**  | 0.1131<br>(0.0507)**   |
| Decentralization                  |   | -0.3242<br>(0.0804)*** |
| Baseline Controls                 | Y   | Y                      |
| Obs.                              | 86  | 84                     |
| $R^2$                             | 0.2257  | 0.3819                 |

Note: Baseline controls are the share of workers in firms that are part of industry-level collective bargaining agreements, and the share of medium and high-educated workers in the industry at baseline. The trade exposure measure is the change in the industry's total trade with China and Eastern Europe between 1995 and 2012. The decentralization measure is the change in the fraction of employment in the industry that is in firms that are part of industry-level collective bargaining agreements.

# Conclusions

## Conclusions

- ▶ Employment in Germany is increasingly concentrated in superstar, high-wage-premium establishments
- ▶ The increase in between-establishment wage inequality can be linked to the rise of superstar establishments
- ▶ Both phenomena are consistent with a shock that reallocates demand towards more productive firms, such as increased globalization (lower trade costs)
  - ▶ Theoretical models predict that the reallocation of demand towards superstar firms increases their relative employment shares as well as their relative wages, thus increasing wage inequality across firms and across workers within the industry
- ▶ We are planning to investigate whether the rise of superstar firms and the increase in between-establishment wage inequality in Germany can be linked to increased trade exposure with China and Eastern Europe

**Thank You!**

# Importance of Employment-Weighting

[Return](#)

## Changes in Between-Establishment Wage Variance Within Industries; Based on HIR FE



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