Identifying Labor Market Sorting with Firm Dynamics

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Motivation

- Broad interest in how agents match in markets (Becker, 1973)
- Positive vs. negative sorting
  - Marriage markets
  - Labor markets
- Sorting crucial for understanding unobserved wage inequality
  - Worker heterogeneity
  - Differences in firm pay
  - Sorting amplifies or dampens unobserved wage inequality

Motivation II

- Inherently difficult to identify unobserved heterogeneity and sorting (Abowd, Kramarz, and Margolis (1999), Eeckhout and Kircher (2011))
- Conflicting evidence on sign and strength of sorting
- Current approaches assume fixed firm types
- Firm dynamics important feature of the labor market
- Firm dynamics impact incentives for sorting
- **This Paper:**
  Identification of sorting with changing firm types

This Paper

- Structural search and matching model with **changing firm types**
- Estimate model with indirect inference
  - German social security data
  - Info on $\sim$5000 establishments and all their employees
- Decompose sources of wage variation

Structural Model

- Workers differ in productivity x
- Firms differ in productivity y
- Production function $f(x,y) = f_1\left(x^{1/\rho} + y^{1/\rho}\right)^{\rho}$
- Higher types produce more $f_x(x,y) > 0$, $f_y(x,y) > 0$
- Cross-partial determines sorting: $f_{xy}(x,y) \gtreqless 0$
- $\Rightarrow$ Relative valuation of workers differs across firms
- Positive assortative matching (PAM) if $f_{xy}(x,y) > 0$
- Negative assortative matching (NAM) if $f_{xy}(x,y) < 0$

Search and Matching

- Discrete time and random search
- Agents meet each other at random with some probability
- Upon meeting, agents decide whether to match or search next period
- $\Rightarrow$ Both agents have opportunity cost of matching
- Workers search off and on-the-job

Firms

- Firms are subject to idiosyncratic productivity shocks
- Firms expand and contract employment
- After shocks: Some worker types better matched, some worse
- Which workers are better matched depends on complementarity parameter ρ

$$f(x,y) = f_1\left(x^{1/\rho} + y^{1/\rho}\right)^{\rho}$$

- $\rho > 1 \Rightarrow$ Positive sorting (high types match with high types)
- $\rho < 1 \Rightarrow$ Negative sorting (inputs substitutes)

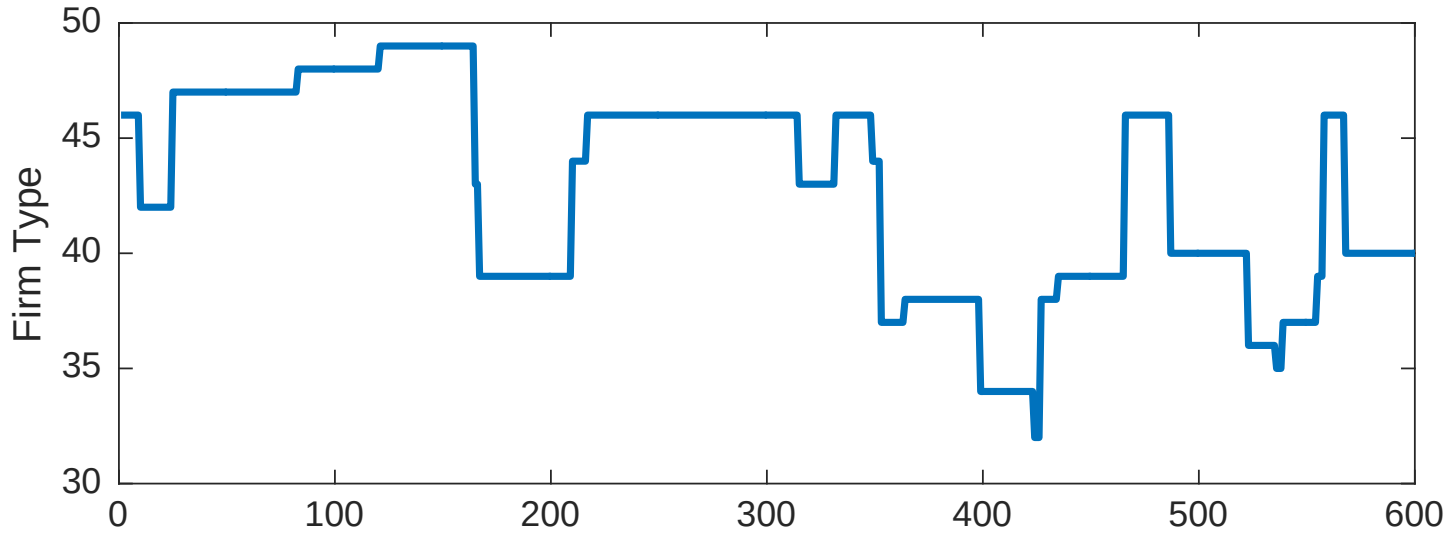
Firm Level Adjustments

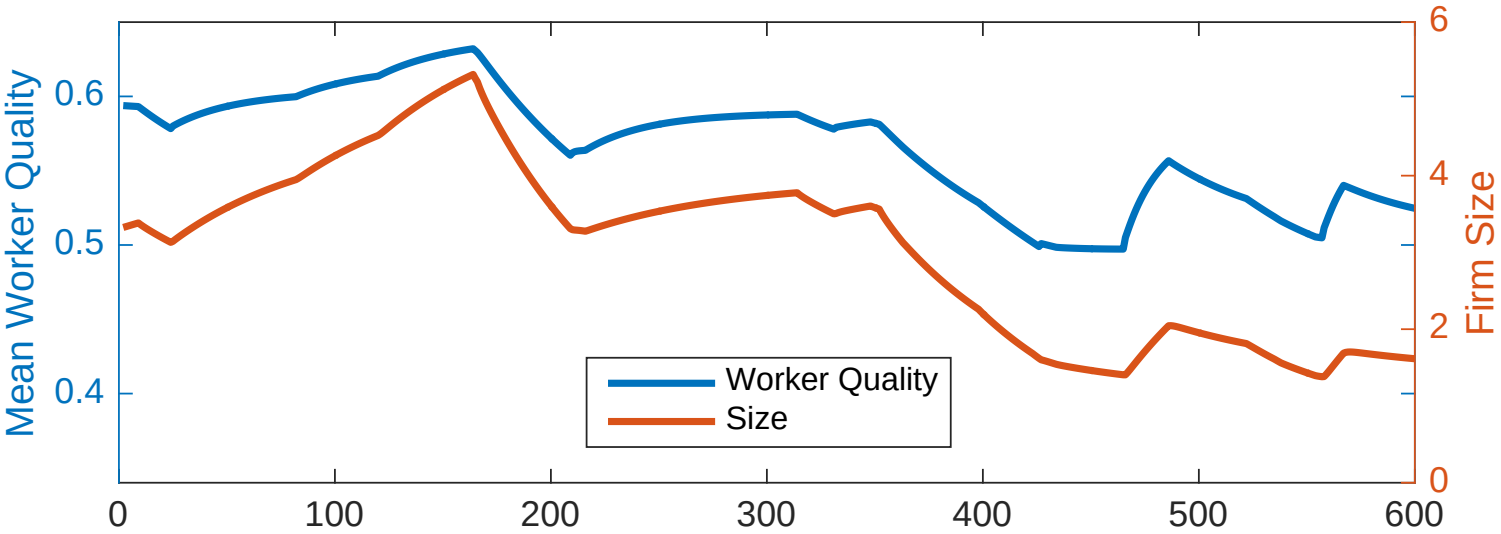
- Measure worker quality with their average incomes (worker fixed effect)
- Study firm dynamics to identify complementarities in production:

Positive Sorting:
Expanding firms:
$\Rightarrow$*upgrade* worker types

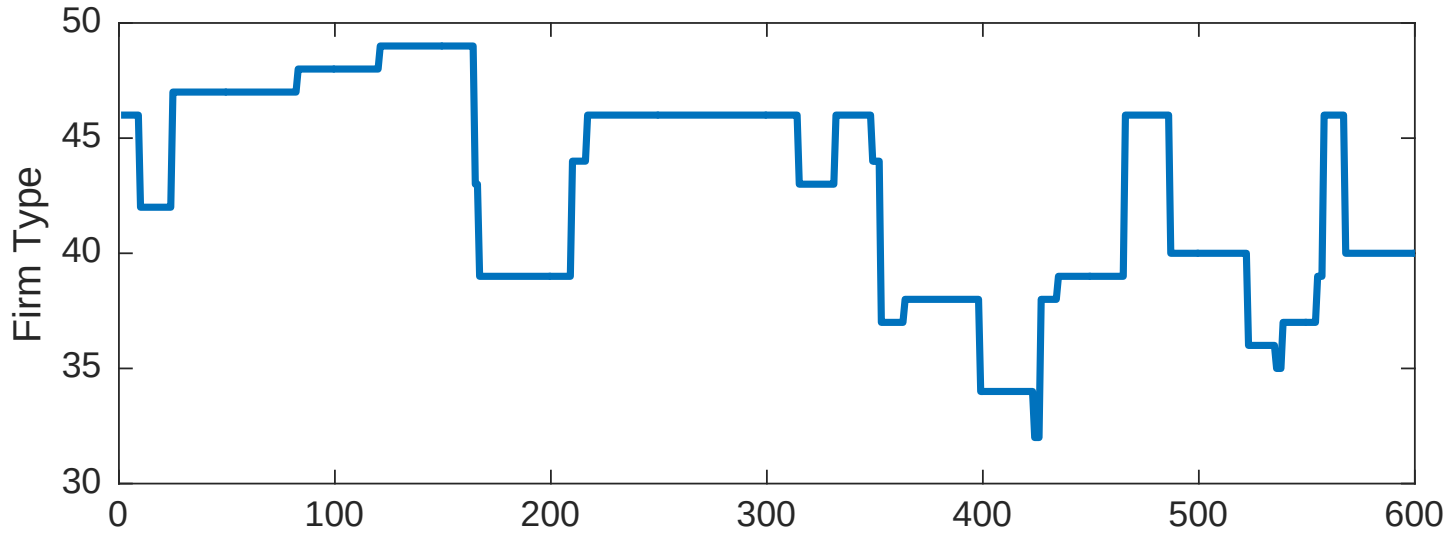
Negative Sorting:
Expanding firms:
$\Rightarrow$ *downgrade* worker types

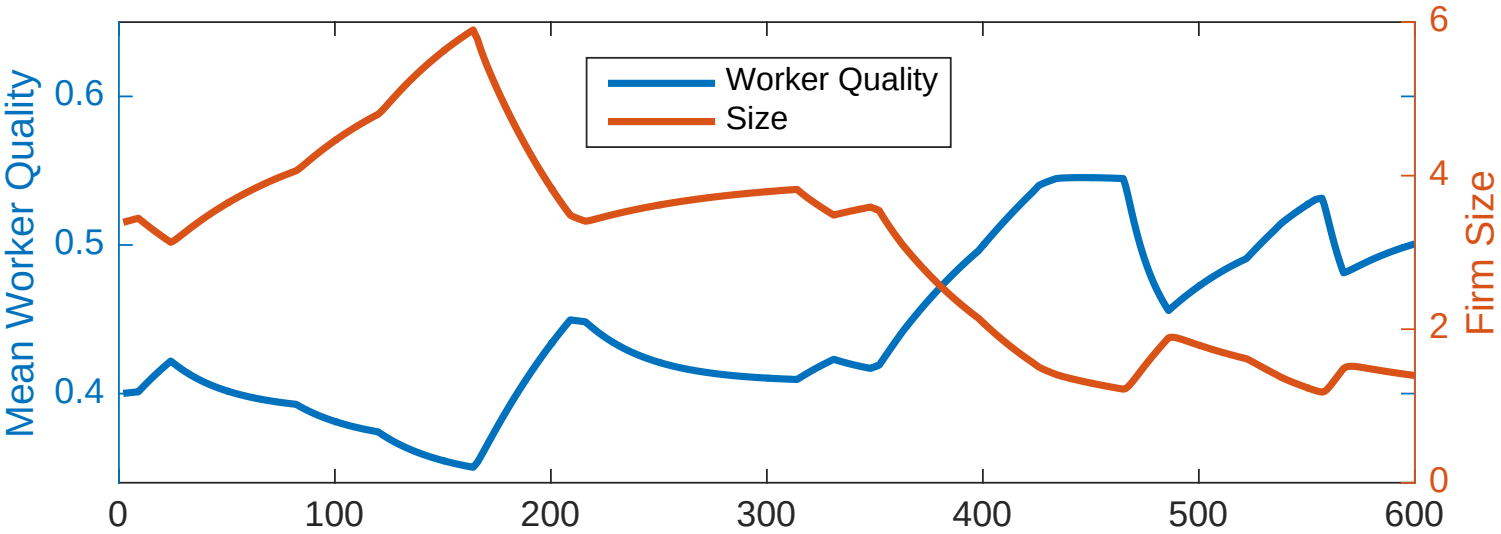
Firm Dynamics with Positive Sorting ($\rho = 2$)





Firm Dynamics with Negative Sorting ($\rho = 0.5$)

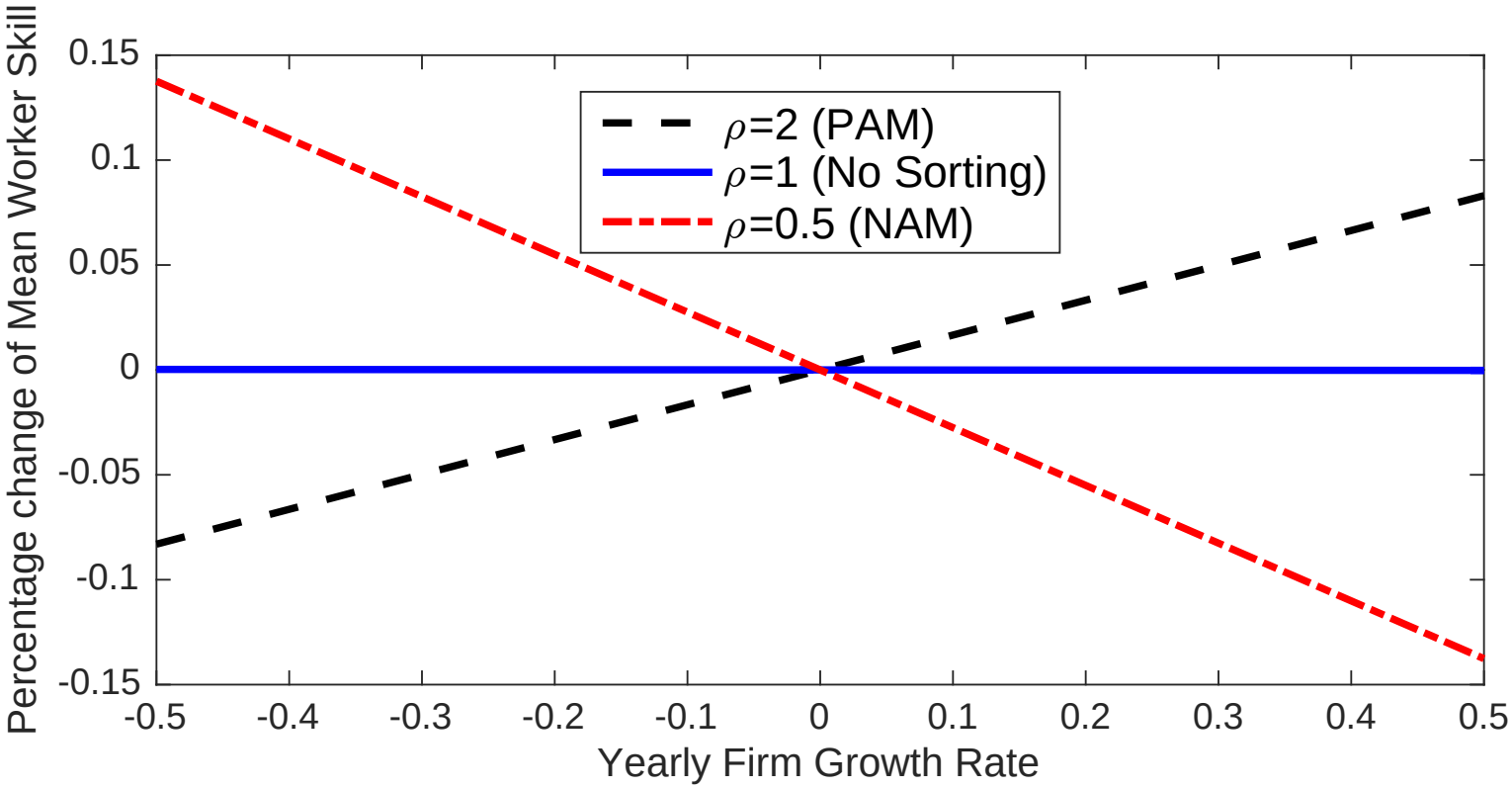




Estimation

$$\Delta_{\%}\overline{Wquality}_{jt} = \alpha + \gamma * firm\_growth_{jt} + \epsilon_{jt}$$

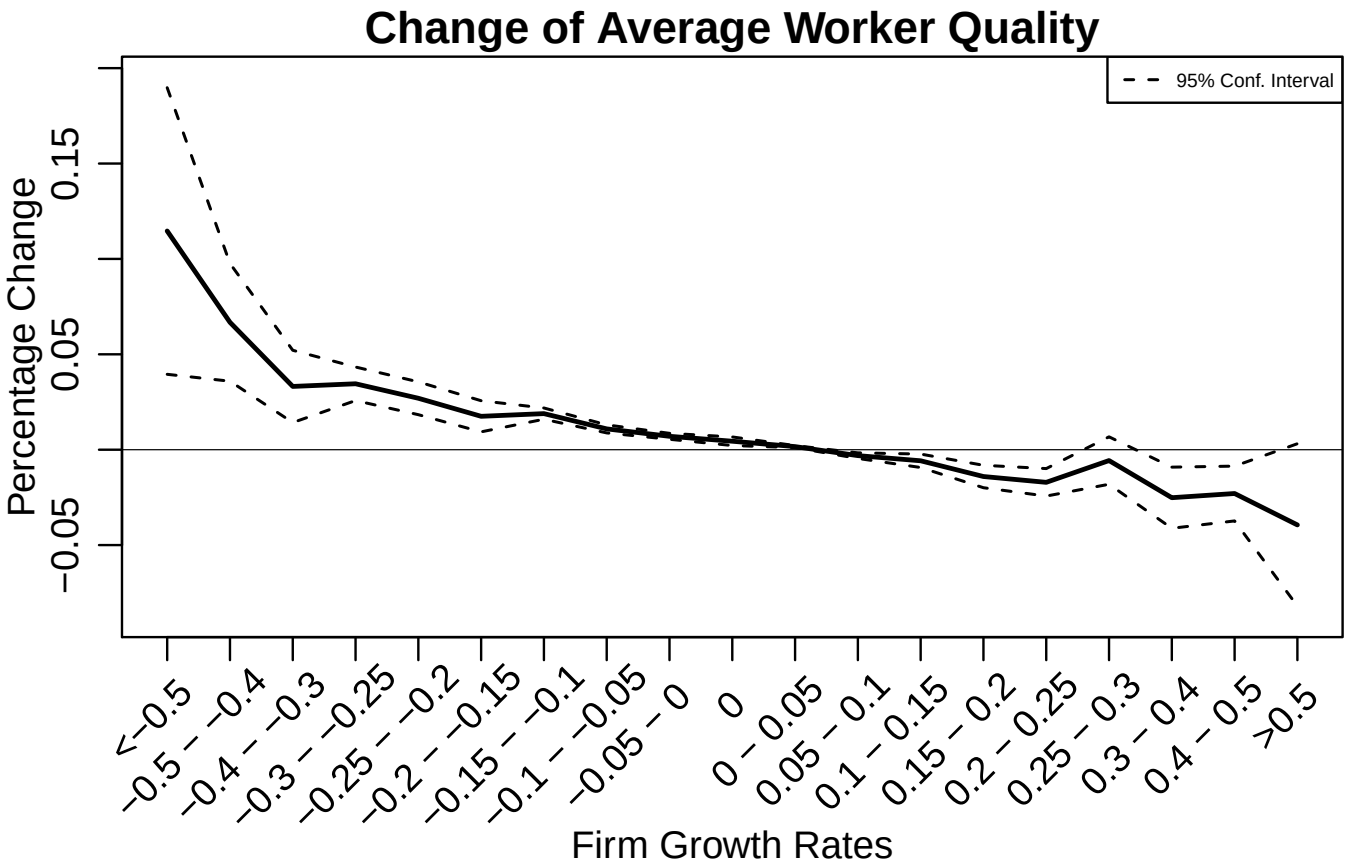
$\Delta_{\%}\overline{Wquality}_{jt}$: Percentage change in average workforce quality in firm j during year t



Reorganization of Worker Quality

$$\Delta_{\%}\overline{Wquality}_{jt} = \alpha + \sum_{i=2}^{19} \gamma_i * D^i_{growthbin_{jt}} + \beta X_{jt} + \epsilon_{jt}$$

X_{jt}: Year, 3-digit industry and year $\times$ industry



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Reorganization of Worker Quality

$$\Delta_{\%}\overline{Wquality}_{jt} = \alpha + \gamma * firm\_growth_{jt} + \beta X_{jt} + \epsilon_{jt}$$

$\hat{\gamma}$ consistently **negative** $\Rightarrow$ negative assortative matching

firm_growth	-0.099	-0.100	-0.061	-0.062	-0.084	-0.077
SE	0.016	0.016	0.015	0.013	0.009	0.010
Controls:						
Industry	x	x	x	x	x	x
Year	x	x	x	x	x	x
Industry x Yr.	x	x	x	x	x	x
Size		x				
Age		x				
Sample	Baseline	Baseline	Size>190	Age>15	3 Yr. Chg.	5 Yr. Chg.
N	19981	19981	6437	10060	15590	11756
Adj. R^2	0.380	0.383	0.573	0.650	0.347	0.271

Reorganization by Industry: here

Estimation Result

- $\Rightarrow$ Weak negative sorting: Corr(x,y) = -0.078
- Hiring high type workers is expensive
- If firms can substitute technology for worker productivity
  $\Rightarrow$ Negative sorting to be expected
- $\rho = 0.644 \Rightarrow$ Worker and firm types are substitutes

Sources of Wage Variation

- Wages are determined by 4 factors:
  i) Worker type x
  ii) Firm productivity y (At the time of bargaining)
  iii) Bargaining Position b (At the time of bargaining)
  iv) Sorting
- Compute counterfactual economies without these source
- $\Rightarrow$ Estimate contribution of each source taking general equilibrium effects into account

Variance Decomposition

Table: Sources of Wage Dispersion

	Only firm heterogeneity	+bargaining positions	+ Worker heterogeneity
Stdev.	0.071	0.186	0.444
Contribution	19.6	31.7	71.3

Conclusion

- Develop approach to identify sorting with changing firm types
- Use structural estimation to study wage inequality in Germany
- Estimate negative sorting in Germany
- Worker heterogeneity plays the largest role in wage variation
- Sorting significantly dampens wage dispersion

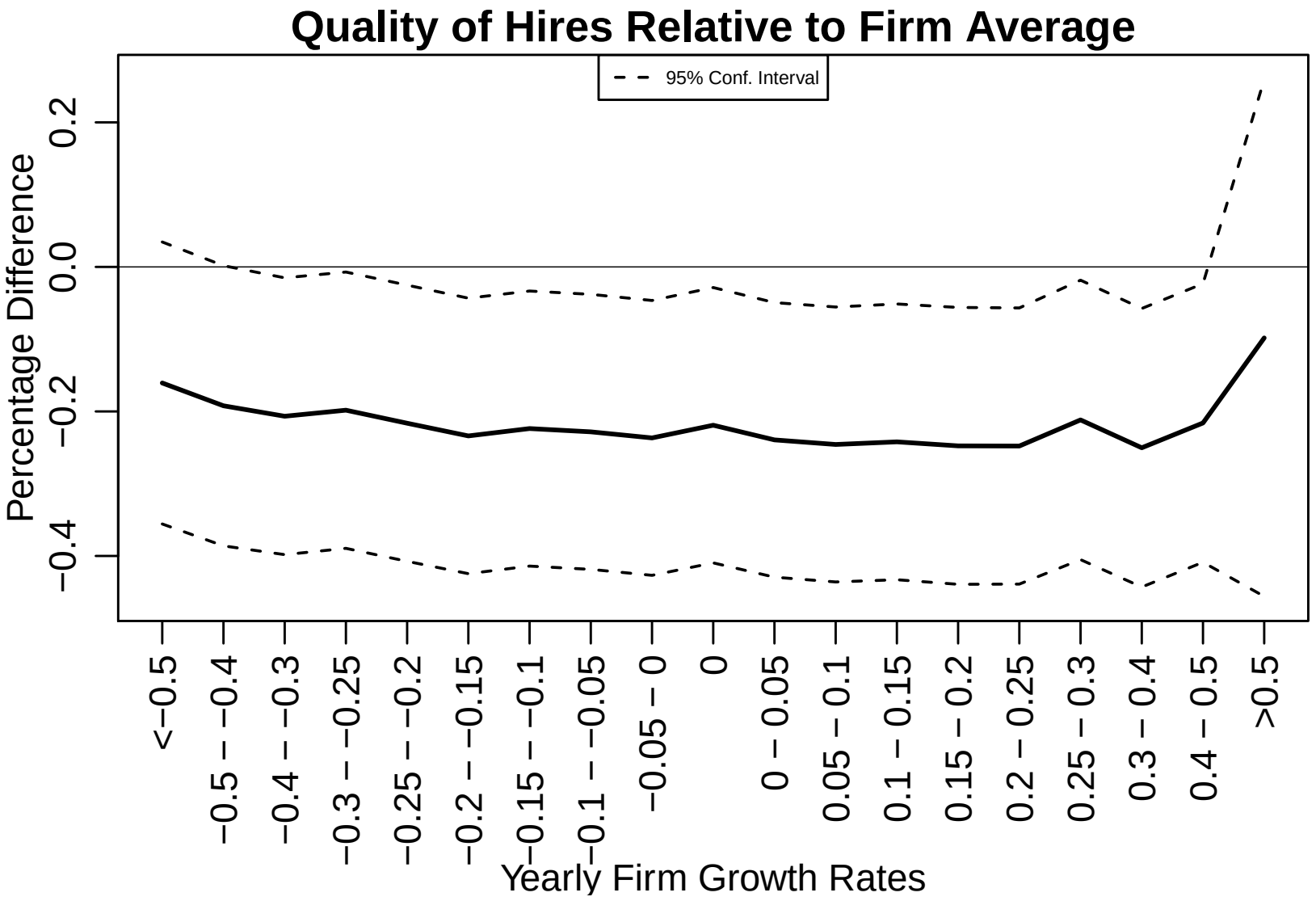
Bibliography

John M Abowd, Francis Kramarz, and David N Margolis. High wage workers and high wage firms. Econometrica, 67(2):251–333, 1999.

Gary S Becker. A theory of marriage: Part i. The Journal of Political Economy, pages 813–846, 1973.

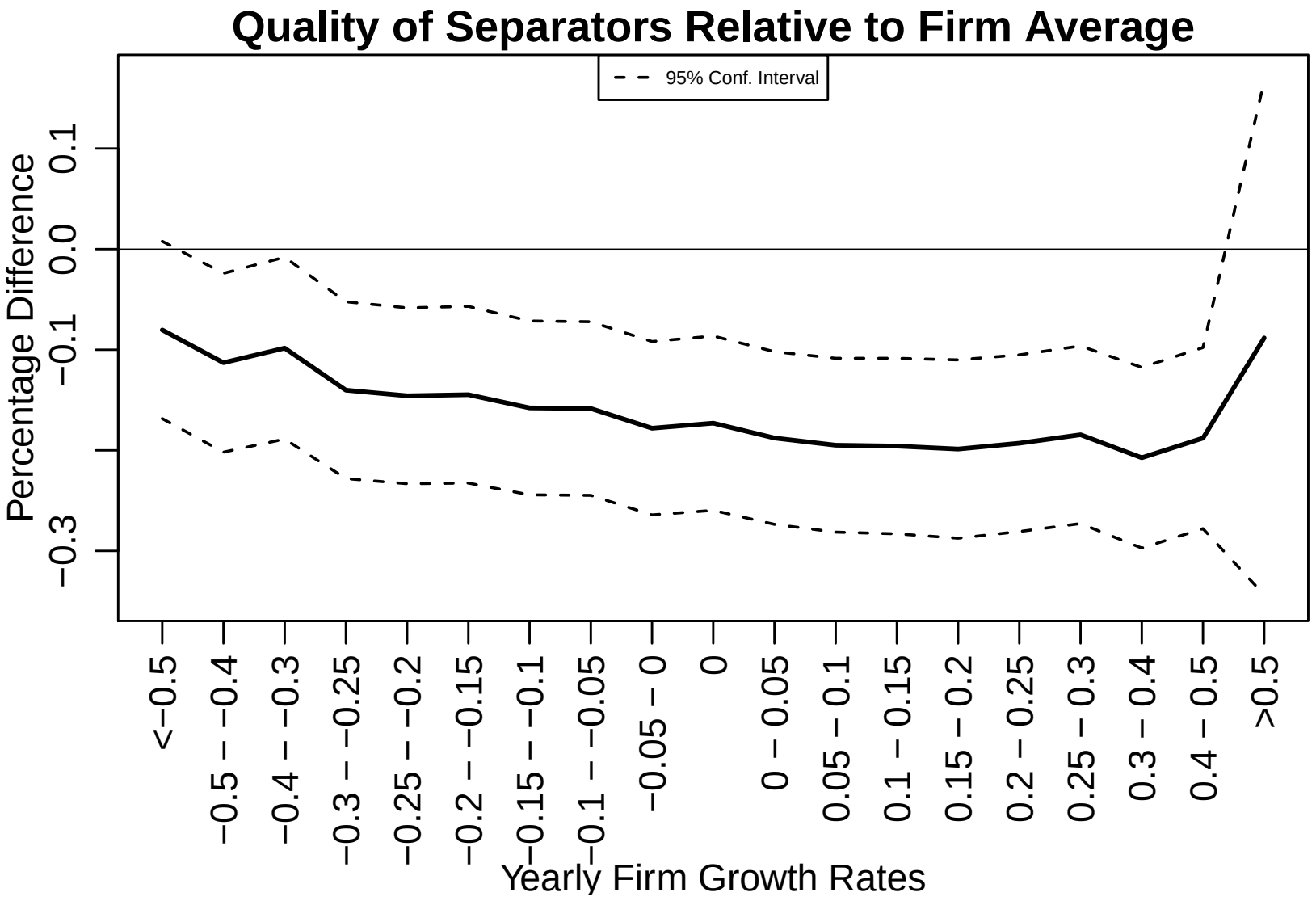
Jan Eeckhout and Philipp Kircher. Identifying sorting in theory. The Review of Economic Studies, page rdq034, 2011.

Worker Flows - Hires



Back to Reorganization

Worker Flows - Separators



Back to Reorganization

Worker Quality Adjustments by Industry

Table: Worker Quality Adjustments by Industry

Industry	Point Estimate	Standard Error
Agriculture, hunting, forestry	-0.169	0.034
Mining, quarrying	-0.062	0.025
Manufacturing	-0.097	0.008
Construction, Utilities	-0.071	0.013
Wholesale & retail, hotels	-0.085	0.025
Transport, communications, finance	-0.059	0.011
Real Estate, renting, business activities	0.076	0.121
Education	-0.063	0.013
Community, social, personal service	-0.202	0.022

Back to Reorganization