Sorting Between and Within Industries: A Testable Model of Assortative Matching in the Labor Market

John M. Abowd
Cornell University

Francis Kramarz
CREST (ENSAE)

Sébastien Pérez-Duarte
European Central Bank

Ian M. Schmutte
University of Georgia

SOLE/EALE 2015
Montreal, Canada
26 June 2015

- **Frictionless Assignment:**
  With full information, more able workers are perfectly sorted to more productive employers (Becker 1973)

- **Stylized facts:**
  Employer-employee matched data show high-wage workers do not systematically work for high-wage employers

- **Frictional Assignment:**
  Wage correlation $\neq$ Productivity correlation

This Paper

- Fit Shimer's (2005) general equilibrium assignment model with coordination frictions
  - **Data:** U.S. matched employer-employee data (LEHD)

- **Question 1:**
  Given the model, is matching positively assortative?

This Paper

- Existing work overlooks variation between and within industrial sectors

- **Question 2:**
  Can this single index model explain variation between and within sectors?

Results

1. **Question 1:** Is matching positively assortative?
   - High-ability workers matched to high-productivity sectors
   - This correlation is masked by non-monotone relationship between wages and worker ability

2. **Question 2:** Variation between and within sectors?
   - Industries are the loci of labor market sorting
   - Shimer's model does not explain within-industry wage variation

Model Summary

Summary of Shimer (2005)

- **Primitives**
  - Workers: μ_m of ability type $m = 1, \ldots, M$
  - Employers: ν_n of productive type $n = 1, \ldots, N$
  - Output: $x_{m,n}$, strictly increasing in m and n

- **Equilibrium**
  - Wage offers, $w_{m,n}$
  - Applicant queues, $q_{m,n}$
  - Realized matching, $\lambda_{m,n}$

- **Key Implications**
  - Mismatch
  - Wages monotone in employer type
  - Wages non-monotone in worker type

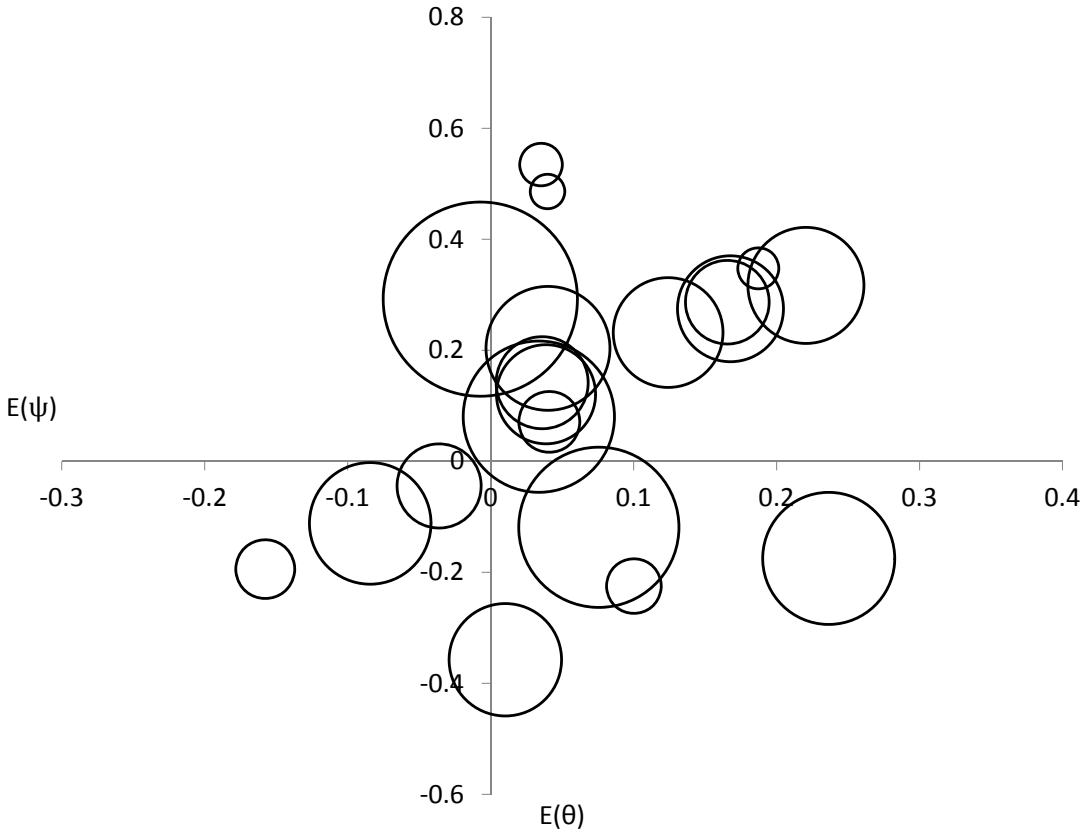
Data Summary

Data Summary

- **LEHD data**: AKM wage decomposition estimated for U.S. workers
  - Worker effects: θ
  - Firm effects: ψ
  - First and second moments disaggregated by 20 NAICS sectors
- **JOLTS:** Sector-specific vacancy rates
- **BEA:** Sector-specific value-added per worker
- All data are publicly available from the authors

Sector	$\mathrm{E}(\theta)$	$\mathrm{E}(\psi)$	$\mathrm{Var}(\theta)$	Cov (θ, ψ)	$\mathrm{Var}(\psi)$	Emp. Share	Vac. Rate	Val. Add.	Corr (θ, ψ)
Agr. and related	-0.158	-0.194	0.533	0.016	0.188	0.015	0.016	0.066	0.052
Administration	-0.084	-0.112	0.483	0.053	0.198	0.064	0.039	0.037	0.170
Other Services	-0.036	-0.044	0.451	-0.042	0.234	0.031	0.032	0.051	-0.129
Manufacturing	-0.007	0.292	0.293	0.007	0.079	0.164	0.016	0.069	0.047
Accommodation	0.010	-0.358	0.468	-0.009	0.099	0.055	0.038	0.031	-0.044
Health	0.034	0.080	0.422	0.008	0.082	0.099	0.046	0.057	0.041
Utilities	0.035	0.535	0.210	-0.019	0.092	0.008	0.021	0.316	-0.135
Transportation	0.036	0.142	0.334	-0.014	0.113	0.037	0.021	0.068	-0.070
Govt. Services	0.039	0.121	0.318	-0.015	0.107	0.043	0.019	0.065	-0.083
Mining	0.040	0.486	0.334	0.005	0.088	0.005	0.016	0.461	0.027
Construction	0.040	0.204	0.334	-0.005	0.106	0.067	0.019	0.097	-0.027
Real Estate	0.041	0.071	0.436	-0.012	0.160	0.016	0.023	0.652	-0.043
Retail	0.076	-0.119	0.391	-0.007	0.106	0.111	0.024	0.044	-0.036
Arts	0.100	-0.225	0.569	-0.004	0.248	0.013	0.031	0.063	-0.012
Wholesale	0.124	0.232	0.361	0.002	0.118	0.052	0.021	0.086	0.010
Information	0.166	0.287	0.462	0.001	0.234	0.030	0.028	0.113	0.030
Finance	0.168	0.275	0.358	0.005	0.088	0.049	0.032	0.129	0.026
Management	0.187	0.348	0.379	0.014	0.087	0.007	0.039	0.121	0.078
Professions	0.221	0.317	0.408	0.017	0.214	0.058	0.039	0.103	0.057
Education	0.236	-0.175	0.455	-0.027	0.087	0.076	0.019	0.047	-0.137

Between-Sector Correlation



NOTE: Each bubble represents one sector, with size proportional to the employment share.

Estimation Details

Model AKM Decomposition

Equilibrium wage offers, $w_{m,n}$, and matching sets, $\lambda_{m,n}$ are sufficient to:

1. Derive equilibrium AKM decomposition

$$\Lambda^* \log w = \Lambda^*(D\theta + F\psi)$$

2. Construct model analogue to first and second moments of (θ, ψ)

- This method is generalizable

Empirical Specification

- **Workers:**
  - $M = 5$ types. Type m brings ability, $h_m \in (0, 1)$.

- **Employers:**
  - $N = 60$: 20 sectors (s) with 3 latent job types (ℓ).
    Job-specific capital $k_n = k_{s,\ell}$

$$k_{s,\ell} = \phi \chi^{(s)} + (1 - \phi)\, \varepsilon^{(s)} k_j$$

$k_j \in \{0.1, 0.5, 0.9\}$ is a grid over latent capital levels.

- **Production**

$$x_{m,n} = A \left(\beta h_m^{\rho^{(s)}} + (1 - \beta)\, k_n^{\rho^{(s)}} \right)^{1/\rho^{(s)}}$$

Estimation and Identification

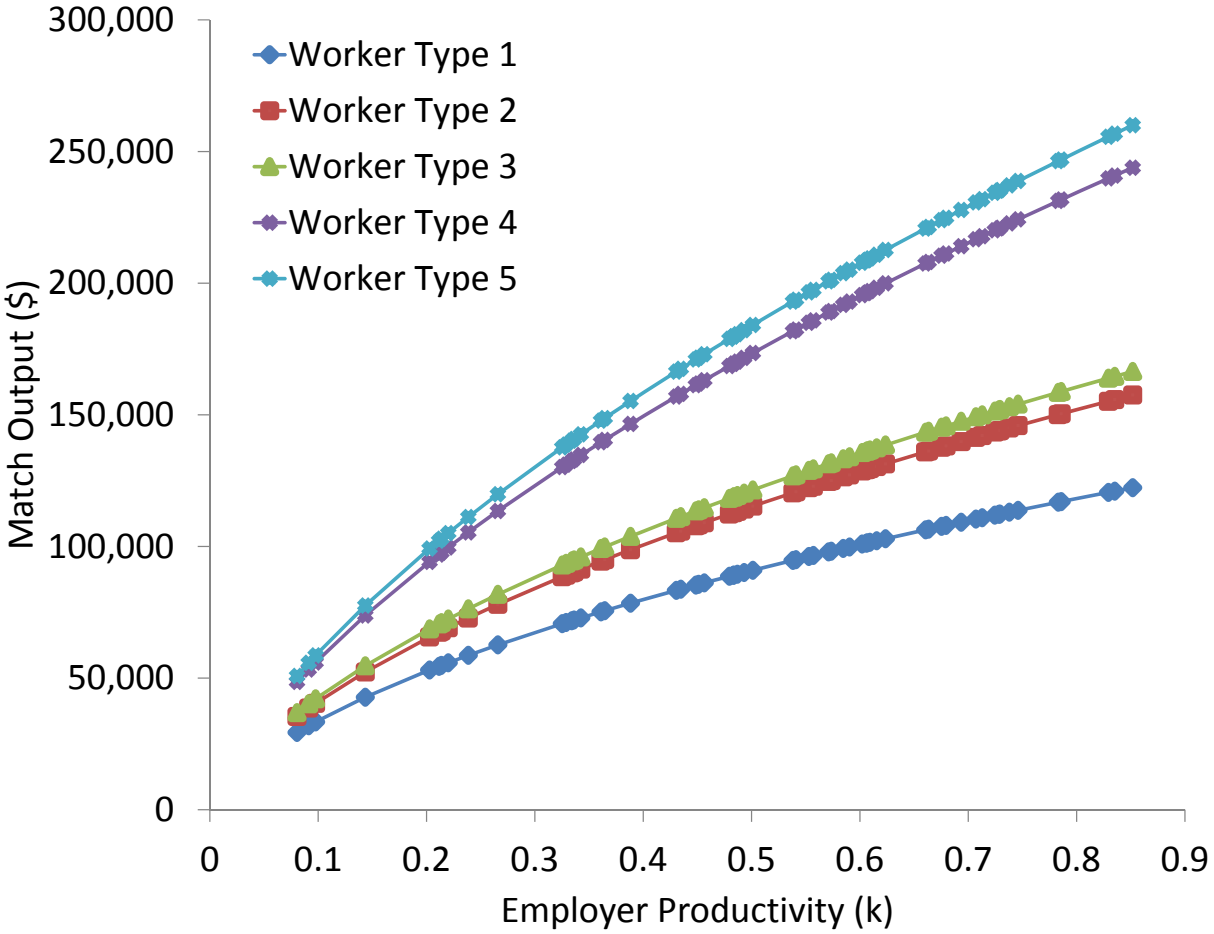
- We fit 52 parameters to 159 moments by simulated annealing
- Inner loop:
  1. Given parameters, construct model primitives
  2. Given primitives, derive eqm. $w_{m,n}$ and $\lambda_{m,n}$.
  3. Given eqm., derive model analogues to empirical moments

- **Formal Identification:**
  - Wage data identify equilibrium wage offers, $w_{m,n}$
  - Given ranking of types, vacancy data identify number of openings, ν_n
  - Ranking is identified by monotonicity of expected income
  - Output, $x_{m,n}$, identified from value-added data and wage equation

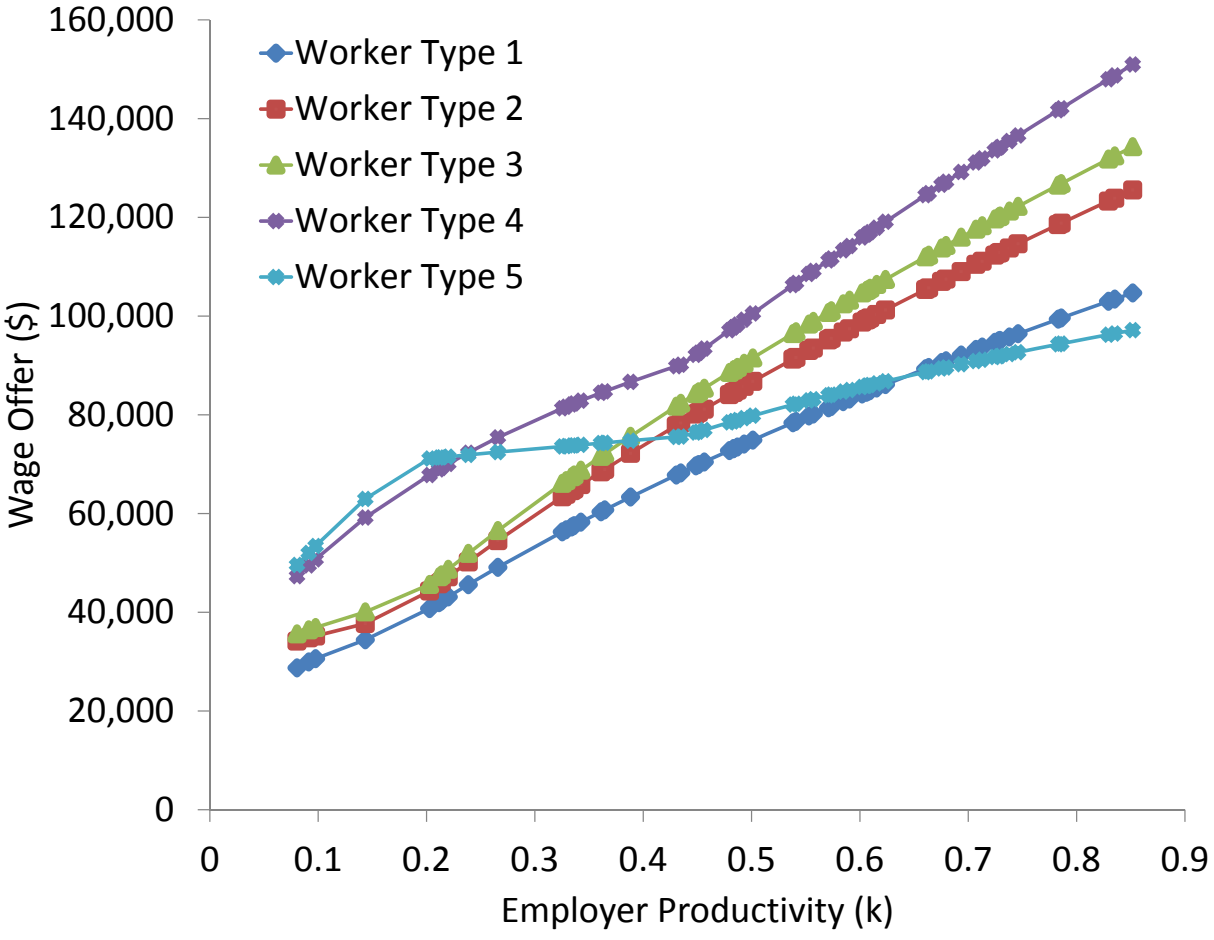
- **Local Identification**

Results

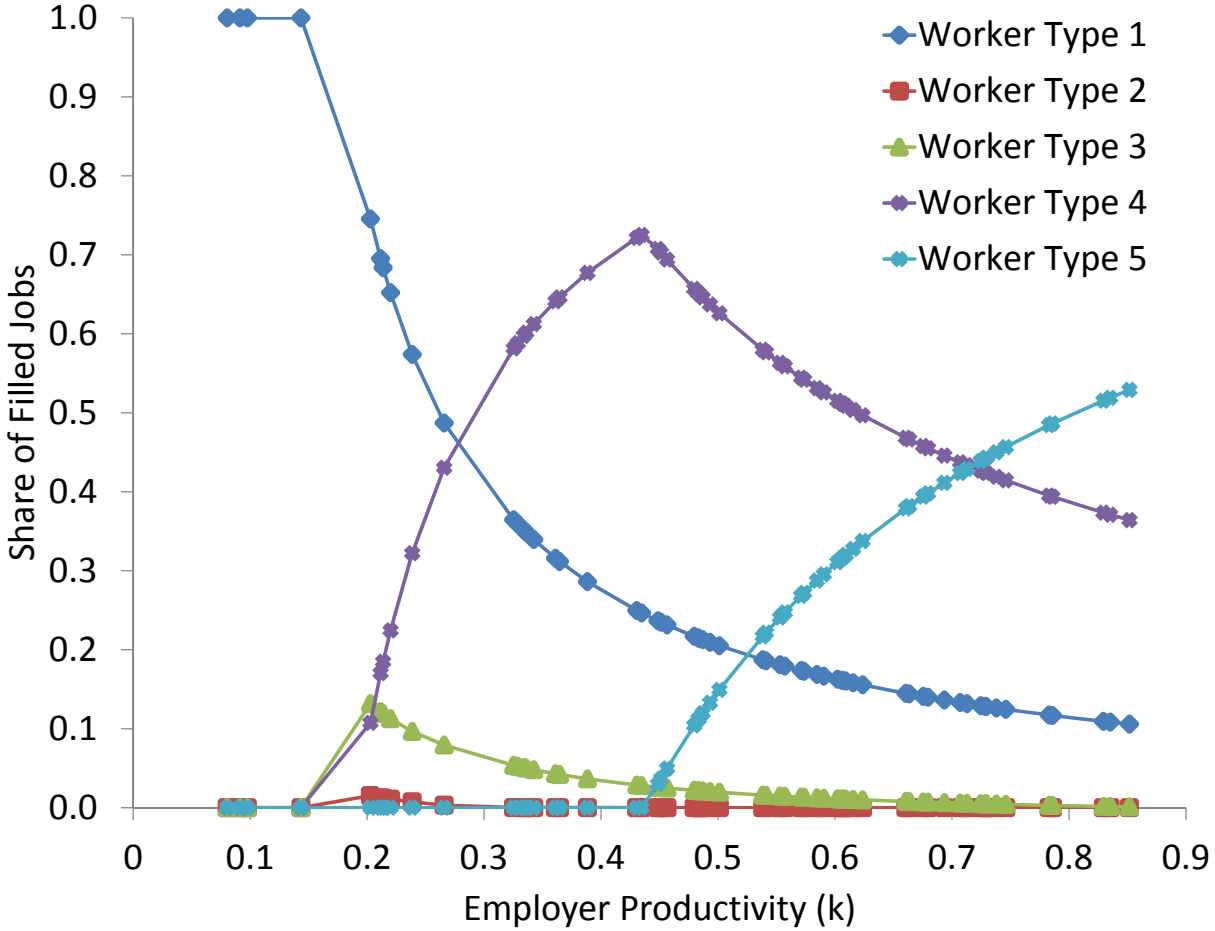
Output (Sub. Elasticity=0.828)



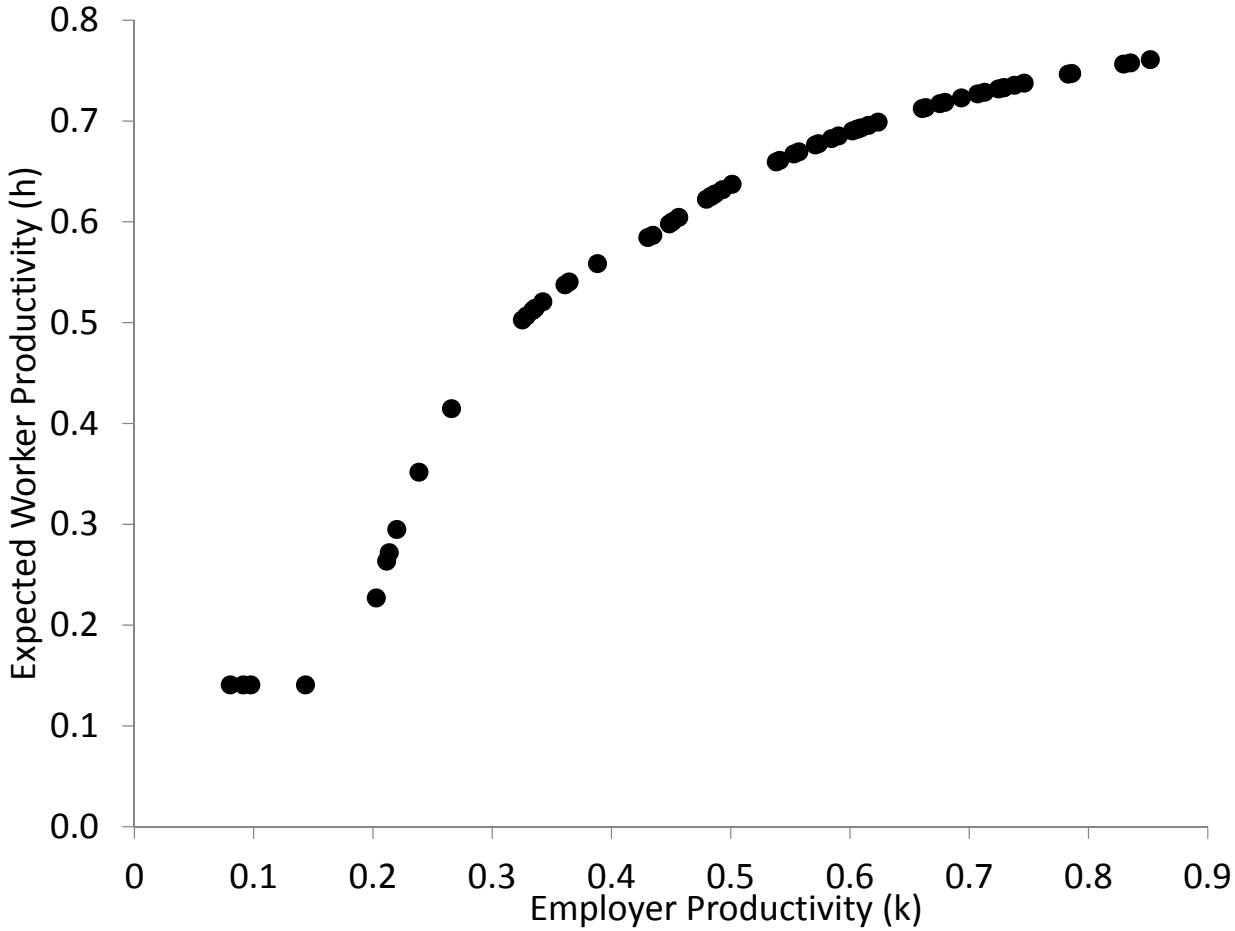
Wage Offers


160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
Wage Offer ($)
Worker Type 1
Worker Type 2
Worker Type 3
Worker Type 4
Worker Type 5
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
Employer Productivity (k)

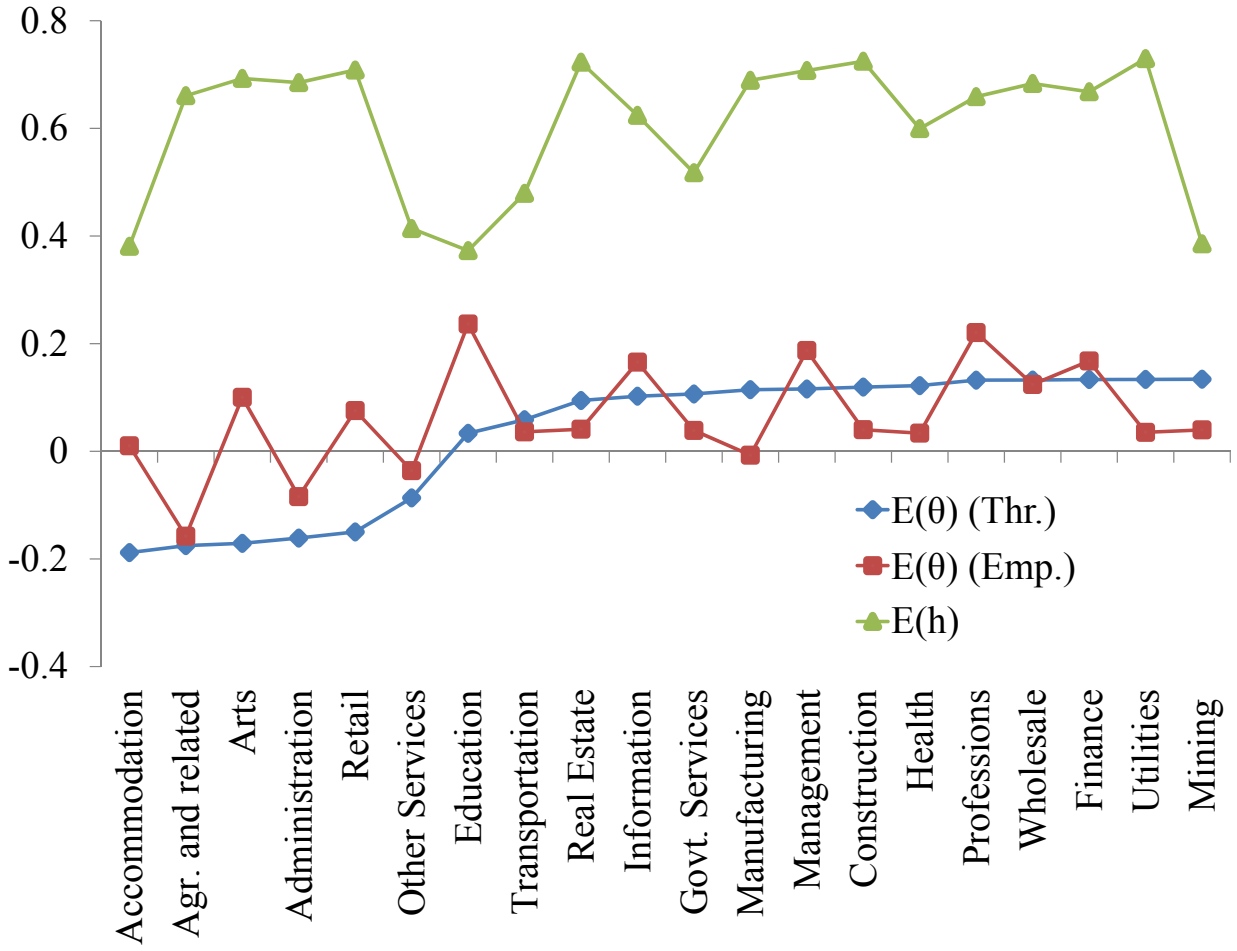
Equilibrium Matching



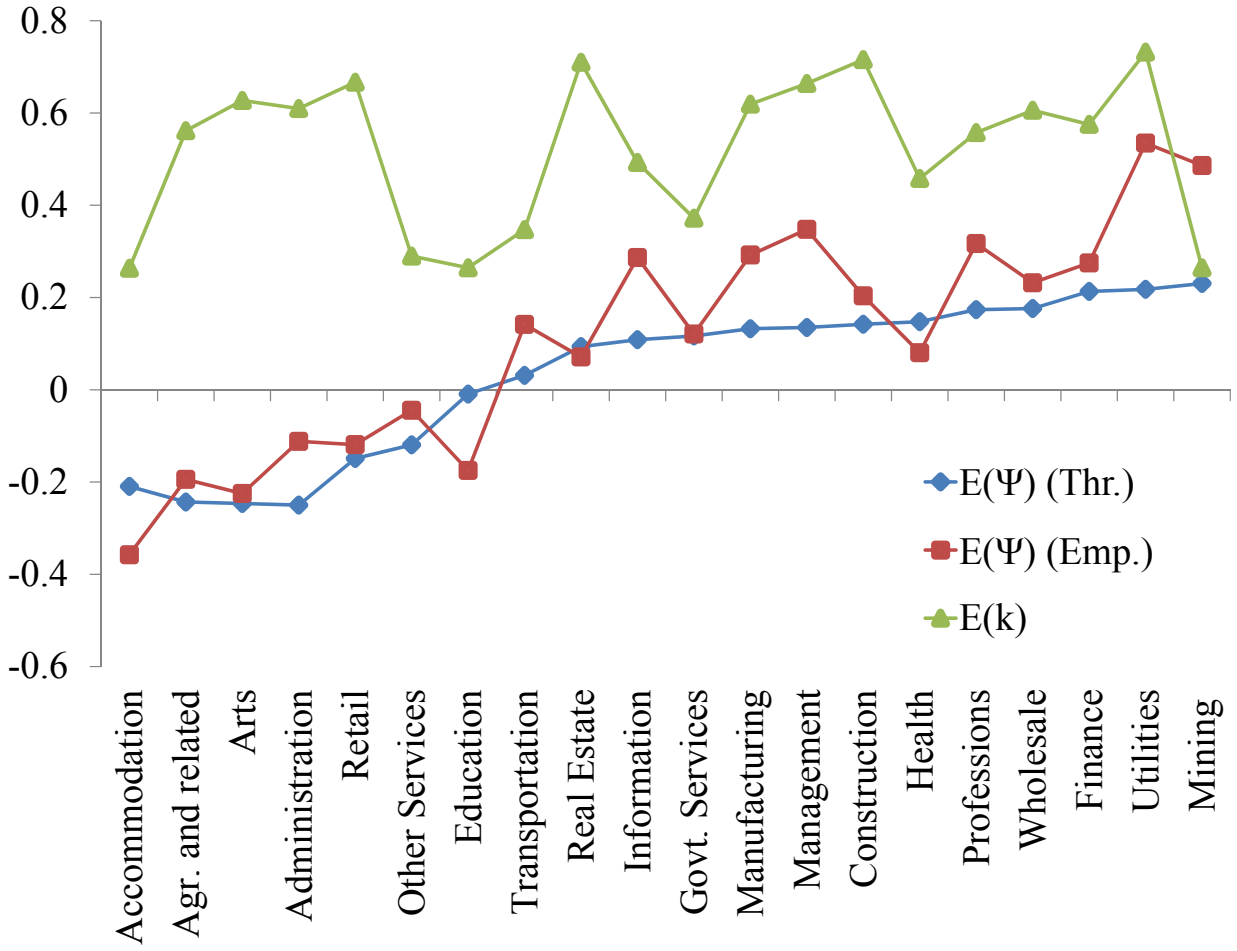
Expected Worker Productivity per Match



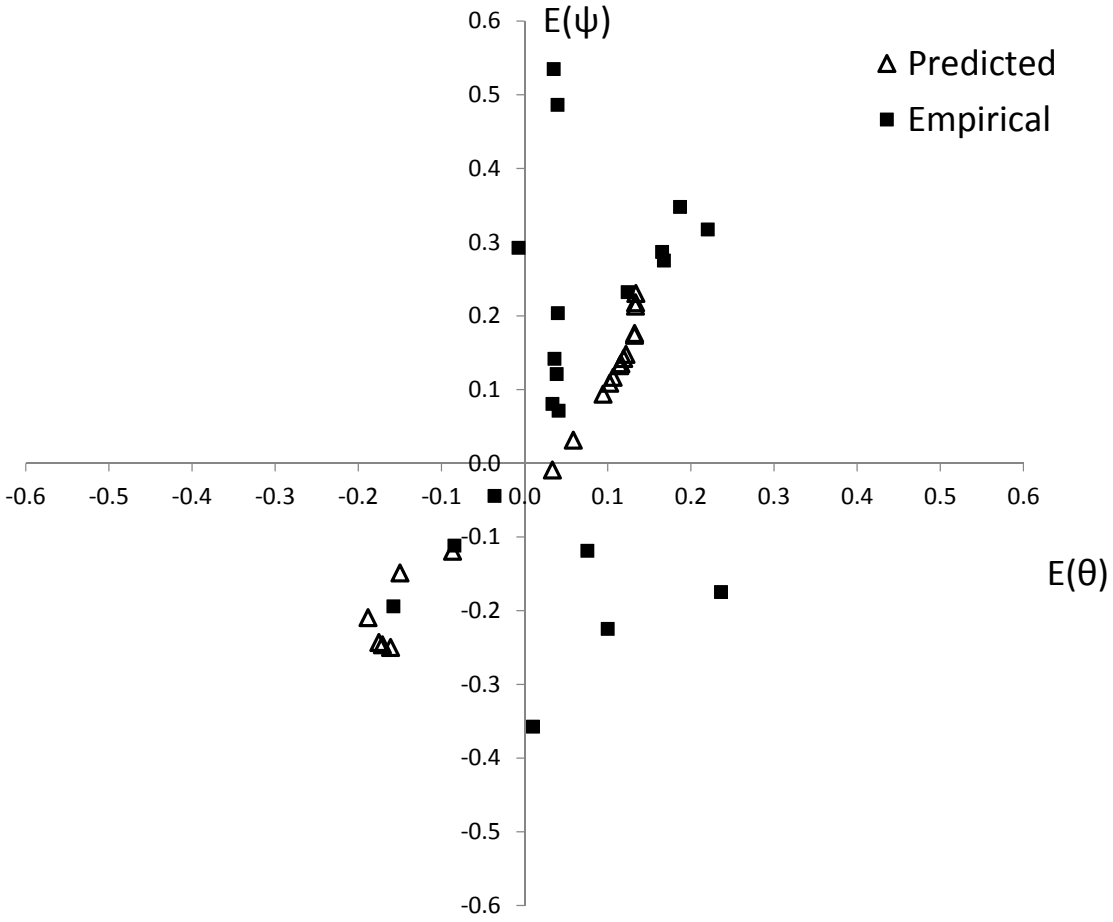
Expected Worker Effect



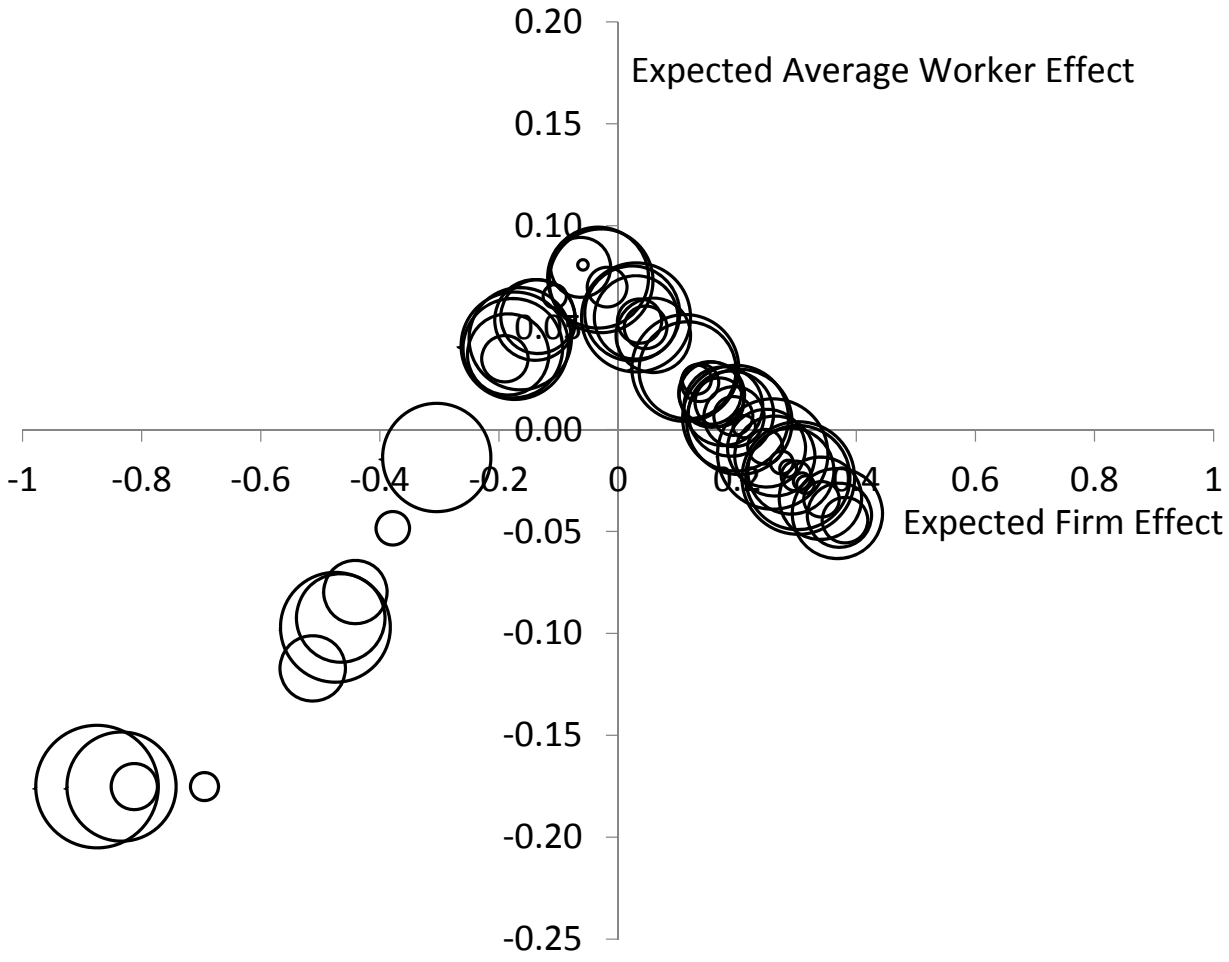
Expected Employer Effect



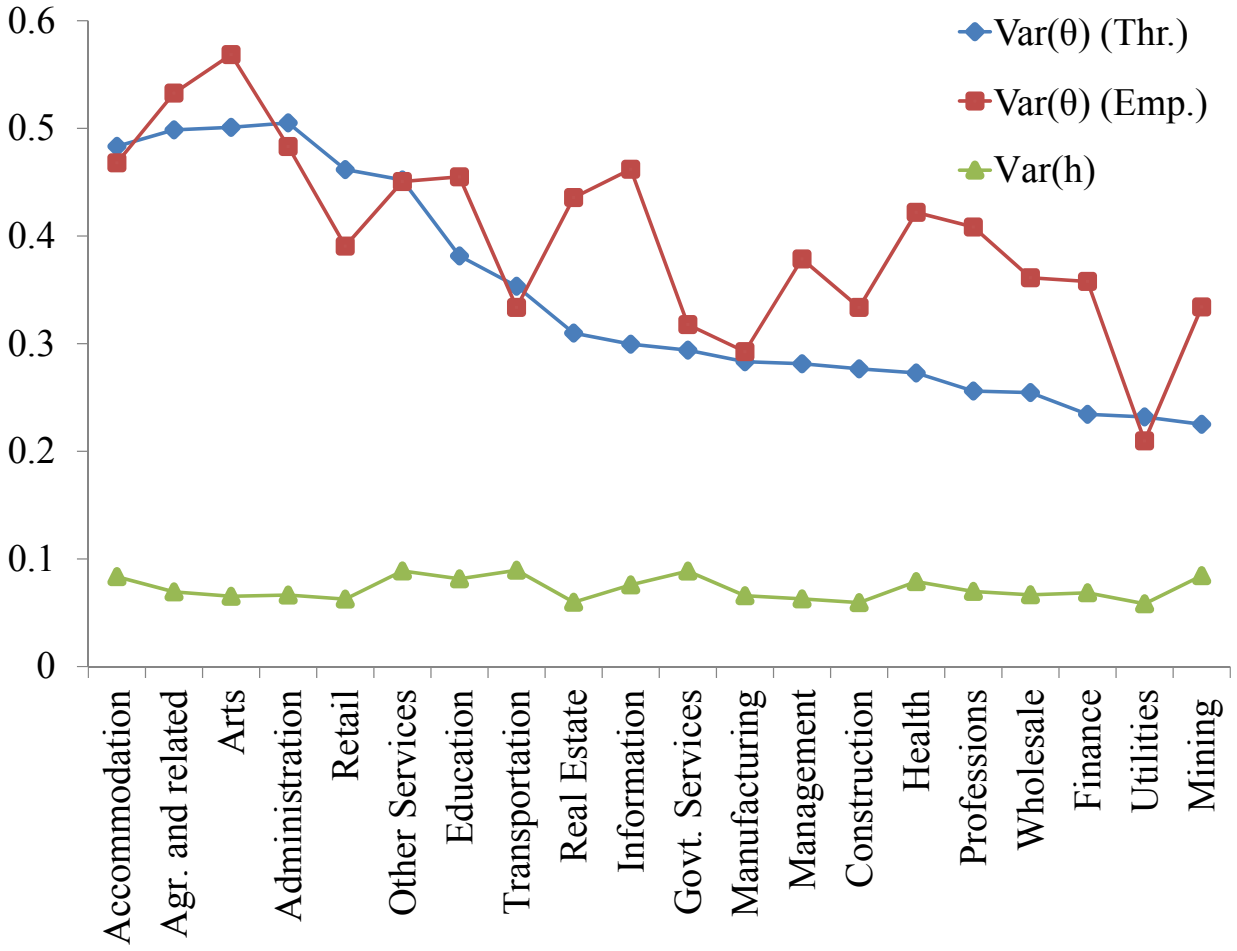
Between Industry Matching



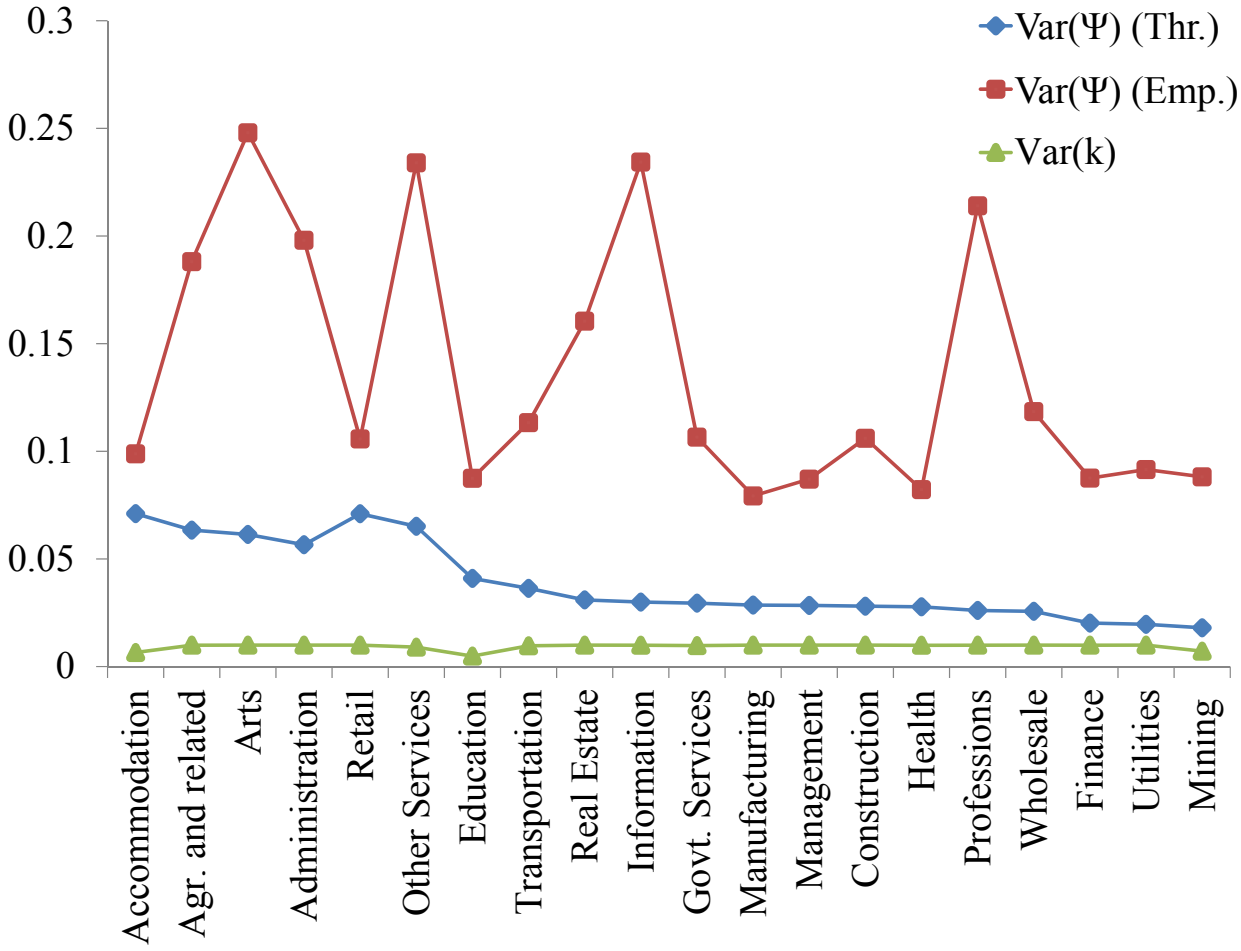
Non-monotonicity



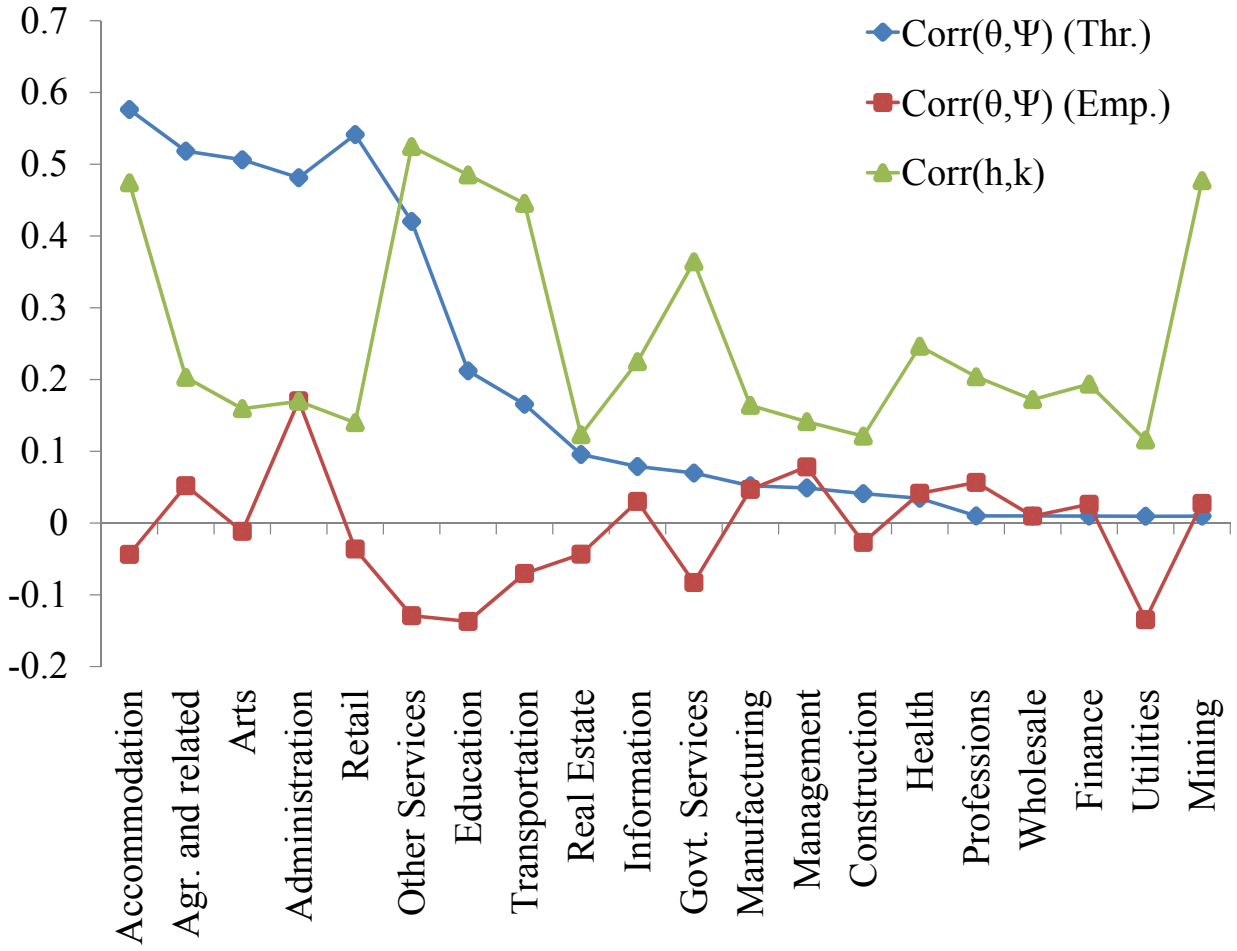
Variance of Worker Effects



Variance of Employer Effects



Correlation of Worker/Employer Effects



Thank You.

Ian M. Schmutte