Industry Heterogeneity and Wage Inequality

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What this talk is about?

- I want to explore how the differences in industries' workforce composition impact the increasing wage disparities between workers.

Motivation

- Wage Inequality has risen since the 1980s.
- The distribution of wages inside firms does not follow the same trend as the entire economy.
- **?** Show that a substantial part of the rise in dispersion happened between firms instead of within firms.
- At the same time there has been an increase in occupational, educational, and ability segregation of employees.

Motivation

- I will focus on industry level educatiuonal segregation.
- CITE HAILTWANGER HERE!!!

INDUSTRY TRENDS

FIUGURE WITH THREE INDUSTRIES

Industry Level Trends

Back

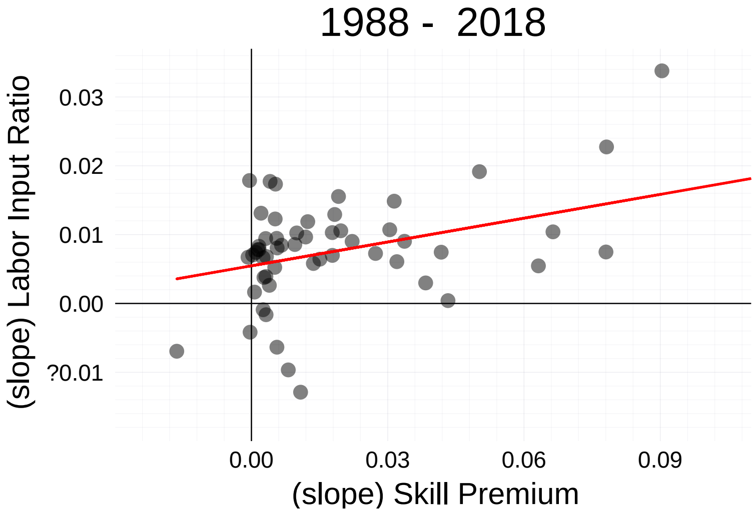

Figure:

Increasing Industry Heterogeneity

Say Why I will KORV.

Increasing Industry Heterogeneity

Say Why I will KORV.

Model

- I will use the model by **?** (henceforth **KORV**).
- Allows me to decompose the change of the wage premium paid to skilled workers in to two effects:
  - The effect of the relative supply of skilled to unskilled labor.
  - The capital-skill complementary effect.

LITERATURE

My work is related to....

- I will use the model by **?** (henceforth **KORV**).
- Allows me to decompose the change of the wage premium paid to skilled workers in to two effects:
  - The effect of the relative supply of skilled to unskilled labor.
  - The capital-skill complementary effect.

KORV

- Two types of capital
  - k_s, structures.
    - Buildings.
  - k_e, equipment, with relative price equal to $1/q$
    - Machines, computers, intellectual property.

- Two types of labor
  - u low-skilled labor.
    - $u = \psi^u h_u$ where h_u is hours (observed) and ψ^u is the quality of low-skilled labor (unobserved).
  - s high-skilled labor.
    - $s = \psi^S h_s$ where h_s is hours (observed) and ψ^s is the quality of high-skilled labor (unobserved).

KORV

- There are three final goods:
  - Consumption c
  - Structure investment i_s
  - Equipment investment i_e.

- Aggregate production:

$$c_t + i_{e_t} + i_{s_t} = Y_t = A_t G(k_{s_t}, k_{e_t}, u_t, s_t) \tag{1}$$

Production function

- The production function is:

$$G(k_{s_t}, k_{e_t}, u_t, s_t) = k_{s_t}^{\alpha} \left(\mu u_t^{\sigma} + (1-\mu) \left(\lambda k_{s_t}^{\rho} (1-\lambda) s_t^{\rho} \right)^{\frac{\sigma}{\rho}} \right)^{\frac{1-\alpha}{\sigma}} \tag{2}$$

- $\sigma_H = 1/(1-\rho)$ is the elasticity between equipment and high-skilled.
- $\sigma_L = 1/(1-\sigma)$ is the elasticity between low-skilled and equipment + high-skilled.
- Firms solve the following profit maximization problem

$$\max_{k_{s_t}, k_{e_t}, u_t, s_t} G(k_{s_t}, k_{e_t}, u_t, s_t) - r_{s_t} k_{s_t} - r_{e_t} k_{e_t} - w_{u_t} h_{u_t} - w_{s_t} h_{s_t} \tag{3}$$

Production Function

- My objective is to use this model to test whether the evolution of the change in the wage premium for skilled labor in different industries can be explained using the capital-skill complementarity hypothesis.

- I can observe, $w_u, w_{s_t}, k_{s_t}, k_{e_t}, h_{u_t}, h_{s_t}$

Skill Premium in the Model

- Assuming competitive markets, workers are paid their marginal products per unit, of work:

$$\omega_t = \frac{w_{s_t}}{w_{u_t}} = \frac{G_{h_s}(k_{s_t}, k_{e_t}, u_t, s_t)}{G_{h_u}(k_{s_t}, k_{e_t}, u_t, s_t)}$$

- We can obtain the following (log-linearized) expression for ω_t:

$$\ln \omega_t \simeq \lambda \frac{\sigma - \rho}{\rho} \left(\frac{k_{e_t}}{s_t} \right)^{\rho} + (1 - \sigma) \ln \left(\frac{h_{u_t}}{h_{s_t}} \right) + \sigma \ln \left(\frac{\psi_t^s}{\psi_t^u} \right) \tag{4}$$

- Which in turn can be written in terms of growth rates (g_x):

$$\begin{aligned} g_{\omega t} \simeq & (1 - \sigma) \left(g_{h_{u_t}} - g_{h_{s_t}} \right) + \sigma \left(g_{\psi_t^s} - g_{\psi_t^u} \right) \\ & + (\sigma - \rho) \lambda \left(\frac{k_{e_t}}{s_t} \right)^{\rho} \left(g_{k_{e_t}} - g_{h_{s_t}} - g_{\psi_t^s} \right) \end{aligned} \tag{5}$$

Skill Premnium Decomposition

We have decomposed the skill premium into three parts:

- $(1-\sigma)(g_{h_{u_t}} - g_{h_{s_t}})$ depends on the difference of the growth rates of skilled and unskilled and labor.
  - If both types of labor are substitutes i.e $\sigma_u < 0 \implies (1-\sigma) < 0$
  - If skilled labor grows at a faster rate than unskilled labor, then the skill premium decreases. Data

Skill Premnium Decomposition

We have decomposed the skill premium into three parts:

- $\sigma\left(g_{\psi_t^s} - g_{\psi_t^u}\right)$ depends on the growth rate of the productivity of skilled and unskilled and labor.
  - I follow KORV in making the following stochastic assumptions about labor productivity:

$$\psi_t^i = \psi_0^i + \epsilon \qquad \epsilon \sim N(0, \eta_\omega^2) \qquad i \in \{s, u\} \tag{6}$$

  - On average $\sigma(g_{\psi_t^s} - g_{\psi_t^u})$ is constant over time and does not affect the growth rate of the skill premium.

Skill Premnium Decomposition

We have decomposed the skill premium into three parts:

- $(\sigma - \rho)\lambda \left(\frac{k_{e_t}}{s_t}\right)^{\rho} \left(g_{k_{e_t}} - (g_{h_{s_t}} + g_{\psi_{s_t}})\right)$. This component depends on two factors:

  1. The growth rate of equipment relative to the growth rates of skilled labor input.
     - Characterize the capital-skill complementarity hypothesis as $\sigma > \rho$.
     - If equipment capital grows faster than skilled labor, the skill-premium will increase.
  2. The ratio of capital equipment to skilled labor
     - The effect will get larger (smaller) over time if $\rho > 0$ $(\rho < 0)$.

Estimation

- I follow the same methodology as KORV to estimate the model parameters.

- To simplify notation :

$$
\begin{aligned}
\psi_t &= \{\psi_t^u, \psi_t^s\} \\
X_t &= \{k_{s_t}, k_{e_t}, h_{s_t}, h_{u_t}\} \\
\Phi &= \{\alpha, \sigma, \rho, \mu, \lambda, \psi_0^u, \psi_0^s, \eta_\omega\}
\end{aligned}
$$

- Any $\{\mu, \lambda, \psi_0^u, \mu, \lambda, \psi_0^u, \psi_0^s\}$ act as scalling parameters thus, one can be fixed.

- There are 7 parameters to be estimated.

Estimation

- I follow the same methodology as KORV to estimate the model parameters.

- The parameters are estimated using the following structural equations:

$$A_{t+1} G_{k_s}(X_{t+1}, \psi_{t+1} \mid \Phi) = q_t A_{t+1} G_{k_s}(X_{t+1}, \psi_{t+1} \mid \Phi) + (1 - \delta_e) \left(\frac{q_t}{q_{t+1}} \right) + \nu_t$$

$$\frac{w_{s_t} h_{s_t} + w_{u_t} h_{u_t}}{Y_t} = lsh(X_t, \psi_t \mid \Phi)$$

$$\frac{w_{s_t} h_{s_t}}{w_{u_t} h_{u_t}} = wbr(X_t, \psi_t \mid \Phi)$$

Estimation

- I follow the same methodology as KORV to estimate the model parameters.
- The estimation method is a two-stage simulated pseudo-maximum likelihood estimation (SPMLE).
- In the first stage labor input is condeir potentially endogenous and is inteumented using: both capital series, lagged capital series, lagged prices and indicators of the bussiness cycle.
- In the second stage:
  - Taking the variance η_ω as given, for each date *t* generate *S* realizations of the model.
  - For eacgh date *t* calculate the mean and variance of the realizations.
  - Minimize the distance between the first momens of the model and the data, using the second moment as a weighting matrix.

Results

- First, I will show the results of the replication of the modelm using updated data.
- Second, I will show the results of apply the model to each industry.

KORV Replication

	KORV Estimation 1963 – 1992	**Replication** 1963 – 1992	**Updated Data** 1963 – 2018	**Updated Data** 1988 – 2018
α	0.117	0.113	0.118	0.08
σ	0.401	0.464	0.503	0.313
ρ	-0.495	-0.56	-0.343	-0.154
η_ω	0.043	0.043	0.083	0.043

Table: Parameter estimates KORV model.

KORV Replication

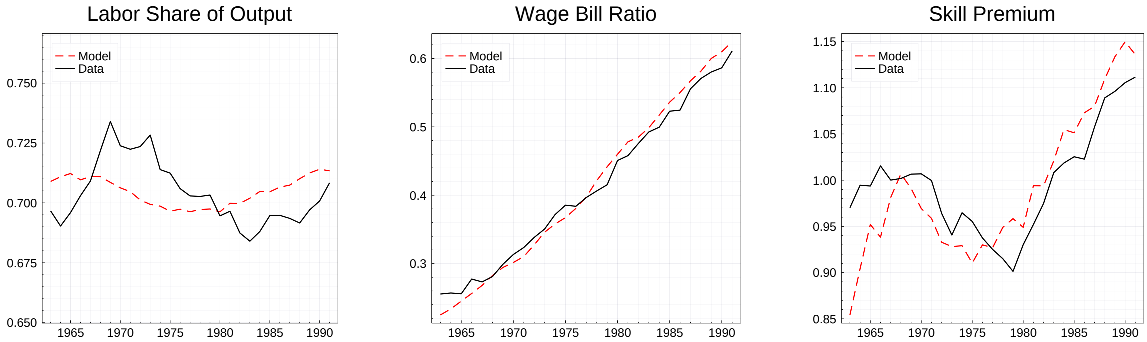

Figure: The model Fit for the 1963 - 1992 period with KORV Data.

KORV Replication

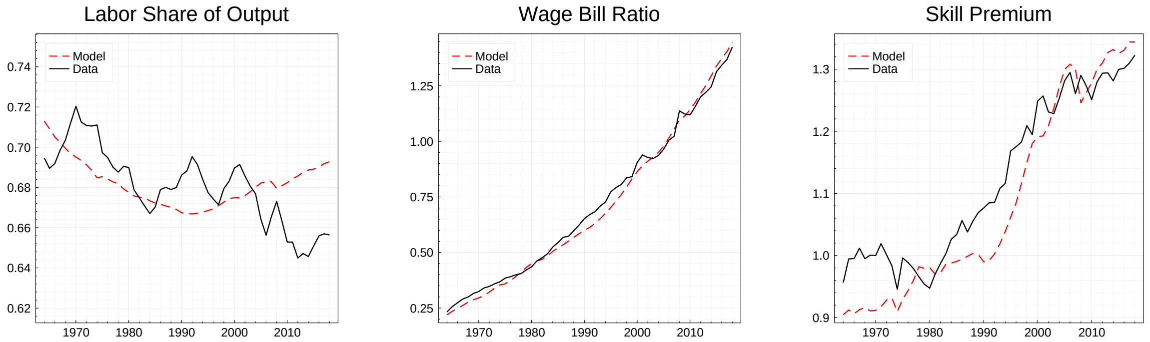

Figure: The model Fit for the 1963 - 2018 period with Updated Data.

KORV Replication

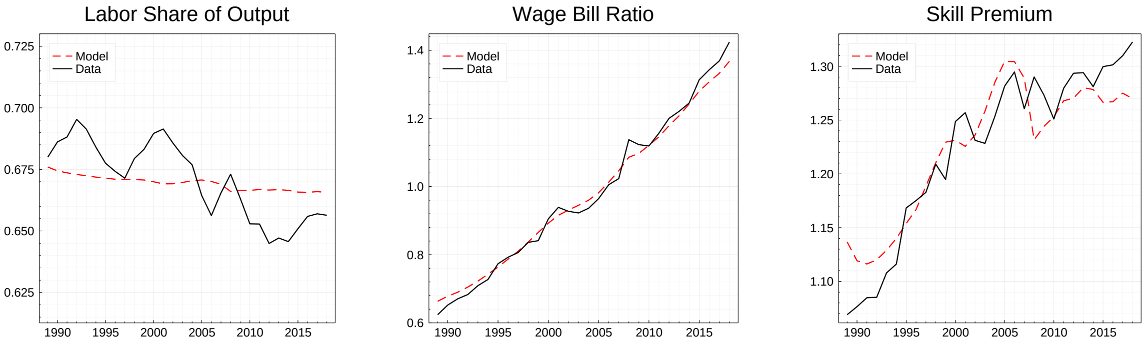

Figure: The model Fit for the 1988 - 2018 period with Updated Data.

Industry Level Results

References