

# The Challenge of Measuring Labor Market Discrimination Against Women

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July 19, 2010











# Gender Equality as a Global Issue

- United Nations Organizations
  - Commission on the Status of Women (CSW)
  - Inter-Agency Network on Women and Gender Equality (IANWGE)
  - Division for the Advancement of Women (DAW)
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- UN resolutions regarding women's rights
  - General Assembly Resolution 34/180 of 18 December 1979















# Theories of Discrimination

## Tastes and Preferences

- Gary Becker (1957)
- Discrimination Coefficient
  - Measures the extent of an agent's willingness to forfeit income in order to avoid economic transactions with members of certain demographic groups.
  - Interpreted as the "psychic" cost of engaging in economic transactions with members of the discriminated against group.
  - Relies on the economist's monetary yardstick applied to utility maximizing behavior.
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  - A discriminating employer acts as if the net wage of hiring a female in a given job exceeds the nominal wage.
  - If  $d_e = 0.15$  is the employer's discrimination coefficient and the nominal wage is \$20/hr, the perceived net wage is \$23/hr ( $= 1.15 \times \$20$ ).





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- Worker Discrimination
  - A discriminating worker acts as if the net wage of working with a female in a given job is less than the nominal wage.
  - If  $d_w = 0.10$  is the worker's discrimination coefficient and the nominal wage is \$20/hr, the perceived net wage is \$18/hr ( =  $0.9 \times \$20$ ).





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  - See Baldwin et. al (2001) for a model of discrimination by males against female supervisors.
- Consumer Discrimination
  - A discriminating consumer acts as if the net price of a product produced or sold by a female exceeds the nominal price.
  - If  $d_c = 0.15$  is the consumer's discrimination coefficient and the nominal price is \$115, the perceived net price is \$132.25 (=  $1.15 \times \$115$ ).



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  - The profit maximizing monopsonist will hire labor up to the point where the incremental cost of the last unit of labor hired equals the incremental revenue generated from the last unit of labor.

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  - Workers consequently receive a wage less than the incremental revenue generated by labor. This gap is commonly referred to as "monopsonistic" exploitation.

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  - Because of the less elastic labor supply of women, the female wage will be less than that of males.
  - Practical problems
    - ① The labor supply of males to the market is generally less elastic than that of women. Since men are usually not paid less than women, the general labor market must be reasonably competitive.
    - ② It is difficult to find many real world examples of single employer, geographically isolated, labor markets.

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    - ① Equilibrium search model (Burdett and Mortensen (1998))
    - ② Labor market frictions arise from the effects on job mobility of costly search and imperfect information.
    - ③ In equilibrium the elasticity of labor supply to the firm is  $-2 \times$  the elasticity of the probability of job separations with respect to the wage.
  - The fact that employers face upward sloping labor supply curves in what is seemingly a competitive labor market, means that employers have a degree of monopsony power.

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  - Data are examined from an American employer who lost a lawsuit over employment discrimination against its female employees.
  - The estimated labor supply elasticity of the female employees was less than that of the males.
  - The predicted gender wage gap for the regional labor market is very nearly the same as the "unexplained" gap estimated by conventional econometric methods.

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- Second moment variety
  - Two groups of workers with the same average productivity differ in the actual or perceived variance of productivity.
  - Given sufficiently high screening costs, risk averse employers will be indifferent in hiring if there is a wage differential that compensates for the actual or perceived difference in the variance of productivity.

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  - Auto insurance premiums are higher in the U.S. for young men because of their unfavorable actuarial experience with automobile accident rates. (legal and socially acceptable).
  - Lower monthly pension payments to women because they outlive men on average. (illegal in the U.S. and probably not socially acceptable).

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  - Laboratory experiments with a double-auction labor market.
  - Experimental treatments involved varying degrees and notions of risk.



# Measurement of Labor Market Discrimination

## Basic Wage Decompositions

- Blinder (1973), Oaxaca (1973)

$$Y_{mi} = X'_{mi}\beta_m + \varepsilon_{mi}, i = 1, \dots, N_m \quad (1)$$

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  - Standard wage specifications are used, so why are these equations suddenly misspecified when it is learned that they will be used to estimate discrimination against women?



# Measurement of Labor Market Discrimination

## Basic Wage Decompositions

- Generalized wage decomposition: Neumark (1988) and Oaxaca and Ransom (1988, 1994)
  - Identification of favoritism toward men and pure discrimination against women

$$\bar{Y}_m - \bar{Y}_f = (\bar{X}'_m - \bar{X}'_f) \hat{\beta}^* + \bar{X}'_m (\hat{\beta}_m - \hat{\beta}^*) + \bar{X}'_f (\hat{\beta}^* - \hat{\beta}_f), \quad (4)$$

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- $\bar{X}'_m (\hat{\beta}_m - \hat{\beta}^*) + \bar{X}'_f (\hat{\beta}^* - \hat{\beta}_f)$  is an estimate of overall discrimination against women.

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- $\beta_o$  is the constant term,  $\underline{\beta}$  is the vector of coefficients for the remaining variables in  $\underline{X}'_i$ ,  $F_i$  is the indicator variable for whether or not the worker is female, and  $\delta$  is the discriminatory (unexplained?) wage gap.

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$$Y_i = \beta_o + \underline{X}'_i \underline{\beta} - \delta F_i + \varepsilon_i, \quad i = 1, \dots, N_m + N_f$$

- $\beta_o$  is the constant term,  $\underline{\beta}$  is the vector of coefficients for the remaining variables in  $\underline{X}'_i$ ,  $F_i$  is the indicator variable for whether or not the worker is female, and  $\delta$  is the discriminatory (unexplained?) wage gap.
- The wage decomposition may be expressed as

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- In general when indicator variables are used to pick up the effects of unionism, private sector vs. public sector wage effects, etc., the corresponding  $\delta$  coefficients are never labeled "unexplained".

# Measurement of Labor Market Discrimination

## Basic Wage Decompositions

- Analogous to terms like “union/nonunion wage differential” or “private sector/public sector wage differentials”, we could refer to measures such as  $\hat{\delta}$  or  $\bar{X}'_f (\hat{\beta}_m - \hat{\beta}_f)$  as the “gender wage differential” or the “male/female” wage differential.



# Measurement of Labor Market Discrimination

## Residual Wage Decompositions

- Juhn-Murphy-Pierce (1991)
- Account for changes in the unobserved prices and quantities that comprise the change in the unexplained wage gap over time.

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- Adopting the male wage structure as the standard, the gender wage gap is decomposed as  $\Delta\bar{Y}_t = \Delta\bar{X}'_t\hat{\beta}_{mt} + \hat{\sigma}_{\varepsilon mt}\Delta\hat{v}_t$ , where  $\Delta\bar{Y}_t = \bar{Y}_{mt} - \bar{Y}_{ft}$ ,  $\Delta\bar{X}'_t = (\bar{X}'_{mt} - \bar{X}'_{ft})$ , and  $\hat{\sigma}_{\varepsilon mt}\Delta\hat{v}_t$  represents the gender difference in standardized residuals (unobserved components).

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- It is easily seen that  $\hat{\sigma}_{\varepsilon mt}\Delta\hat{v}_t = \bar{X}'_{ft}(\hat{\beta}_{mt} - \hat{\beta}_{ft})$ .



# Measurement of Labor Market Discrimination

## Residual Wage Decompositions

- Datta Gupta et. al (2006) relates the JMP decomposition to the Oaxaca and Ransom (2004) generalized decomposition.

- $\hat{\sigma}_{\varepsilon t} \bar{v}_{mt} = \bar{X}'_{mt} (\hat{\beta}_{mt} - \hat{\beta}_t^*)$  and  $\hat{\sigma}_{\varepsilon t} \bar{v}_{ft} = -\bar{X}'_{ft} (\hat{\beta}_t^* - \hat{\beta}_{ft})$  so that

$$\begin{aligned} \hat{\sigma}_{\varepsilon t} \Delta \bar{v}_t &= \hat{\sigma}_{\varepsilon t} \bar{v}_{mt} - \hat{\sigma}_{\varepsilon t} \bar{v}_{ft} \\ &= \bar{X}'_{mt} (\hat{\beta}_{mt} - \hat{\beta}_t^*) + \bar{X}'_{ft} (\hat{\beta}_t^* - \hat{\beta}_{ft}). \end{aligned}$$

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- JMP decomposition of changes in the gender wage gap between period  $t$  and period  $t_0$ ,

$$\begin{aligned} \Delta \bar{Y}_t - \Delta \bar{Y}_{t_0} &= (\Delta \bar{X}'_t - \Delta \bar{X}'_{t_0}) \hat{\beta}_{mt_0} + \Delta \bar{X}'_t (\hat{\beta}_{mt} - \hat{\beta}_{mt_0}) \\ &\quad + (\Delta \hat{v}_t - \Delta \hat{v}_{t_0}) \hat{\sigma}_{\varepsilon mt_0} + \Delta \hat{v}_t (\hat{\sigma}_{\varepsilon mt} - \hat{\sigma}_{\varepsilon mt_0}). \end{aligned}$$

# Measurement of Labor Market Discrimination

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- $(\Delta \hat{v}_t - \Delta \hat{v}_{t_0}) \hat{\sigma}_{\varepsilon mt_0} + \Delta \hat{v}_t (\hat{\sigma}_{\varepsilon mt} - \hat{\sigma}_{\varepsilon mt_0})$  is the sum of the effects of changes in unobserved quantities and unobserved prices but can also be interpreted as the change in the unexplained or discriminatory gap.



# Measurement of Labor Market Discrimination

## Identification Issues

- Jones (1983), Oaxaca and Ransom (1999)
- With indicator variables, the separate effects of gender differences in individual coefficients change with the choice of omitted reference groups even though the overall decomposition between the explained and the unexplained components is unchanged.

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- Jones (1983), Oaxaca and Ransom (1999)
- With indicator variables, the separate effects of gender differences in individual coefficients change with the choice of omitted reference groups even though the overall decomposition between the explained and the unexplained components is unchanged.
- Gender differences in the estimated constant terms changes simultaneously with the change of omitted reference groups.

# Measurement of Labor Market Discrimination

## Identification Issues

- Example: decomposition where  $G$  is an indicator variable for university graduate (non university graduate is the omitted reference group) and  $T$  is work experience

$$\begin{aligned} \bar{Y}_m - \bar{Y}_f &= (\bar{G}_m - \bar{G}_f) \hat{\beta}_{1m} + (\bar{T}_m - \bar{T}_f) \hat{\beta}_{2m} \\ &\quad + (\hat{\beta}_{0m} - \hat{\beta}_{0f}) + (\hat{\beta}_{1m} - \hat{\beta}_{1f}) \bar{G}_f + (\hat{\beta}_{2m} - \hat{\beta}_{2f}) \bar{T}_f \end{aligned}$$

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- Suppose instead that the omitted reference group is non university graduate ( $S = 1 - G$ ), the resulting decomposition is

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- Unfortunately,  $(\hat{\beta}_{0m} - \hat{\beta}_{0f}) \neq (\hat{\theta}_{0m} - \hat{\theta}_{0f})$ , and

$(\hat{\beta}_{1m} - \hat{\beta}_{1f}) \neq (\hat{\theta}_{1m} - \hat{\theta}_{1f})$  even though

$$(\hat{\beta}_{0m} - \hat{\beta}_{0f}) + (\hat{\beta}_{1m} - \hat{\beta}_{1f}) \bar{G}_f =$$

$$(\hat{\theta}_{0m} - \hat{\theta}_{0f}) + (\hat{\theta}_{1m} - \hat{\theta}_{1f}) \bar{S}_f.$$

# Measurement of Labor Market Discrimination

## Identification Issues

- Solutions





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- Nielsen (2000)
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  - Force coefficients on a set of indicator variables to sum to zero

$$\begin{aligned} Y_i &= b_0 + b_1 G_i + c_1 S_i + \beta_2 T_i + \varepsilon_i \\ &= b_0 + b_1 (G_i - S_i) + \beta_2 T_i + \varepsilon_i \end{aligned}$$

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- the choice of omitted reference group no longer matters, i.e.
 
$$(\hat{b}_{1m} - \hat{b}_{1f}) (\bar{G}_f - \bar{S}_f) = -(\hat{c}_{1m} - \hat{c}_{1f}) (\bar{G}_f - \bar{S}_f).$$

# Measurement of Labor Market Discrimination

## Sample Selection

- James Heckman (1976, 1979)



# Measurement of Labor Market Discrimination

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- Individuals who are labor force participants are generally not a random sample of the working age population, especially women.
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- Individuals who are labor force participants are generally not a random sample of the working age population, especially women.
  - Unobserved factors that determine whether or not an individual is employed may be correlated with the unobserved factors that determine wages.
  - Failure to take account of self selection can result in bias when estimating wage equations for the sample of employed workers.

# Measurement of Labor Market Discrimination

## Sample Selection

- "Heckit" model

# Measurement of Labor Market Discrimination

## Sample Selection

- "Heckit" model



$$\text{prob}(E_i = 1) = \text{prob}(u_i \leq Z_i' \gamma), i = 1, \dots, N \quad (6)$$

$$Y_i = X_i' \beta + \varepsilon_i, i = 1, \dots, N_e \quad (7)$$

where  $E$  is an indicator variable that takes on the value 1 if the individual is working in the market sector and 0 otherwise,  $Z'$  is a vector of observed variables that determine the probability that one would be working in the market sector,  $\gamma$  is a vector of coefficients,  $u$  and  $\varepsilon_i$  are mean zero, normally distributed random error terms,  $N$  is the total sample size, and  $N_e$  is the subsample of individuals who are observed to be working ( $N_e < N$ ).

# Measurement of Labor Market Discrimination

## Sample Selection

- In the presence of selection, the wage equation is more properly expressed as

$$\begin{aligned}
 Y_i \mid (E_i = 1) &= X_i' \beta + \varepsilon_i \mid (E_i = 1) \\
 &= X_i' \beta + \rho \sigma \lambda_i + \psi_i
 \end{aligned} \tag{8}$$

where  $\rho$  is the correlation between  $u$  and  $\varepsilon$ ,  $\sigma$  is the standard deviation of  $\varepsilon$ ,  $\lambda$  is a function of  $Z'\gamma$  known as the Inverse Mills Ratio, and  $\psi$  is a mean zero error term.

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- Omission of the term  $\rho \sigma \lambda_i$  from the wage model leads to bias in the estimation of the  $\beta$  parameters.

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- Neuman and Oaxaca (2004,2005) point to the difficulty in attempting to assign gender differences in the subcomponents of the selection term  $\hat{\rho}_m \hat{\sigma}_m \hat{\lambda}_m - \hat{\rho}_f \hat{\sigma}_f \hat{\lambda}_f$  to explained and discriminatory (unexplained) categories. How the assignments are made are shown to have major impacts on inferences one would draw governing labor market discrimination.

# Measurement of Labor Market Discrimination

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  - Another drawback is that such a settlement could be construed as discriminatory toward men since a monetary adjustment is given solely based on one's gender and not on the basis of individual merit (statistical discrimination).
- An alternative adjustment might award each female the predicted male salary for her characteristics.
  - An asymmetry is introduced in that not even males are paid according to their own salary regression, except on average.



# Measurement of Labor Market Discrimination

## Equity Salary Adjustments

- A symmetric adjustment would award each female the sum of the predicted male salary for her characteristics and her own residual from the female wage regression.
  - By construction these residuals sum to zero so that the average adjusted wage for women is identical to what it would be if each female were paid exactly according to the male wage regression.

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  - By construction these residuals sum to zero so that the average adjusted wage for women is identical to what it would be if each female were paid exactly according to the male wage regression.
  - A possible drawback is that in some cases this method would imply wage reductions for women whose current salaries exceed the calculated equity wage.



# Measurement of Labor Market Discrimination

## Equity Salary Adjustments

- To avoid wage reductions, the salary adjustment could be made only for women who would receive positive adjustments.
  - The problem here is that it can be shown that the aggregate salary adjustment would exceed the originally estimated aggregate amount of discrimination.

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- To avoid wage reductions, the salary adjustment could be made only for women who would receive positive adjustments.
  - The problem here is that it can be shown that the aggregate salary adjustment would exceed the originally estimated aggregate amount of discrimination.
  - This extra cost to employers arises because the original estimate of discrimination implicitly assumes that some women would receive wage reductions if they were over compensated relative to the male wage regression standard.



# Measurement of Labor Market Discrimination

## Equity Salary Adjustments

- The challenge is to award the original amount of aggregate underpayment without anyone receiving a negative wage adjustment.
- One solution is to award each female employee who would receive a positive adjustment a share of the aggregate underpayment determined by her original share of the sum of the positive wage adjustments that would have been made.

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- One solution is to award each female employee who would receive a positive adjustment a share of the aggregate underpayment determined by her original share of the sum of the positive wage adjustments that would have been made.
  - The only drawback here is that some women would receive less than their originally estimated equity adjustment. This is because they must in effect subsidize those who would have received negative adjustments.

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  - Gender differences in planned market work over the life cycle.
- Hourly wages versus annual earnings
  - In most countries women work in the market sector fewer hours annually than men.
  - How much of the gender gap in hours of work can be imputed to voluntary labor supply?

# Parting Thoughts

- What society ultimately labels as discrimination is decided by a complex cultural and political process.