As a practical matter, there is a large observed disparity in income earning and wage rates among a variety of demographic groups, classified by sex, race, ethnicity and other characteristics. Thus far we have considered characteristics of individuals that affect earnings—but it may be the case that there are differences in earnings across groups which are not explained by their characteristics.

Defining Discrimination
Specifically, we can think of discrimination as a situation in which essentially identical goods (e.g. labor by otherwise equivalent black and white workers) will have different prices in competitive markets. Labor services are considered “essentially identical” if they have the same productivity in the physical or material sense. This does exclude the psychic disutility of cross-group interaction (e.g. preferences for discrimination) in order draw a distinction between “discrimination” which refers to behavioral outcomes and “prejudice” which refers to attitudes.

Forms of Discrimination:
Define
\[ Y_i \equiv \text{the outcome of the process, such as income earnings, or wage for the } i\text{th person.} \]
\[ X_i \equiv \text{a vector of productivity characteristics of the } i\text{th person that are independent of } Y \text{ and of the particular form of economic discrimination under study (exogenous)} \]
\[ Z_i \equiv [\text{in the majority group}] \]
\[ e_i \equiv \text{random error term} \]

Then, suppressing subscripts we have:
\[ Y = X'B + AZ + e \]
If \( A > 0 \) then there is evidence of discrimination (null is \( A = 0 \), one sided test so we’re not considering “reverse discrimination” where \( A < 0 \). So in this case we define discrimination to be:
\[ D = (\hat{Y} \mid X, Z = 1) - (\hat{Y} \mid X, Z = 0), \text{ where } \hat{Y} = E(Y \mid X) \]
All \( X \) characteristics are endogenous and any difference in \( X \)'s is due to the process of discrimination under study. The corresponding specification is:
\[ Y = CZ + u \]
where \( u \) is a random error and \( C > 0 \) is evidence of discrimination. In this case, we define discrimination now using within group unconditional means as:
\[ D = \bar{Y}_{maj} - \bar{Y}_{min} \]
Lots of attention given to the roles of tastes and non-pecuniary aspects in market transactions. This limits what we can talk about because from the economist’s perspective, tastes are fundamentally taken as given and explaining their sources or how they may be changed tends to be considered outside the realm of economics. From this perspective, market outcomes
become indirect measures of tastes and the surveys (used in sociology and psychology) are not really used.

But measurements of outcomes are difficult as is shown above by the contrast between equation 1 and equation 2. If minority and majority groups are equal both in their productive capacity and their willingness to produce then Model II makes a lot of sense. But if there is a difference in these or “voluntary” sorting by profession is that due to innate differences (as per Model II) or due to discrimination (as per Model I).

State of technology: usually this is taken as given, and is the production analog of tastes. However, this raises questions of whether if the state of technology makes it disadvantages a specific minority group, this disadvantage constitutes discrimination. Logically, if technology is costly to change and the minority group is equally (not more) productive then it may be profit maximizing and not “discriminatory” to not hire minorities. However, if the technology is not costly to change.

1. Individual discrimination – unequal treatment of an individual or by an individual firm
2. Market discrimination – unequal outcomes for all members of a particular group; in labor markets, typically wage outcomes
3. Prejudice – psychic disutility associated with a worker’s demographic or other characteristics, which are unrelated to the worker’s productivity (motivation for individual discrimination)
4. Segregation – unequal representation of different groups with equal productivity and motivation in different markets or occupations

Types of Theories

Consumer Discrimination
This theory is almost entirely demand-side (the supply-side can be ignored because of equal productivity/tastes assumption). The demand side is characterized as either competitive or monopolistic and the models are either “exact” or “stochastic”

Discrimination by consumers (Becker): assume that consumers are prejudiced (have tastes for discrimination) and are willing to pay a different price to associate only majority workers

. The model:
  - price of a majority worker, \( p \)
  - price of a minority worker, \( p' = p - d \), where \( d \) captures the value of the taste for discrimination

advantages of measure:
  - continuity of measure: discrimination is not just an on-off variable
  - potentially measurable with an easily interpretable unit (monetary units)

disadvantages:
  - does not measure stigma felt by victim,
  - requires workers-consumers interaction, most goods not this way.
  - may lead to segregation but not necessarily wage differentials if minorities can segregate into non-customer contact industries

Discrimination by employers
Let’s formalize this a bit. Suppose that employers will maximize a utility function that is the sum of profits plus the monetary value of utility from employing members of particular groups. Let $d$ be the taste parameter of the firm, which Becker called the “coefficient of discrimination.”

Firms will maximize

$$U = pF(N_a + N_b) - w_aN_a - w_bN_b - dN_b,$$

$p$ is the price level, $F$ is the production function, $N_j$ is the number of workers of group $j = \{a, b\}$, and $wx$ is the wage paid to members of each group.

Employers who are prejudiced ($d > 0$) will act as if the wage of $b$ group members is $wb + d$. Hence, they will only hire $b$ group members if $w_a - w_b \geq d$.

Let $G(d)$ denote the CDF of the prejudice parameter $d$ in the population of employers. The optimal number of workers hired at each firm is determined by the solutions to

$$pF'(N_a) = w_a,$$
$$pF'(N_b) = wb + d.$$

Treating $p$ as fixed and aggregating across firms in the economy leads to the market demand functions $N^d_a(w_a, w_b, G(d))$, $N^d_b(w_a, w_b, G(d))$ for each worker type. Wages are determined by

$$N^d_a(w_a, w_b, G(d)) = N^s_a(w_a)$$
$$N^d_b(w_a, w_b, G(d)) = N^s_b(w_b)$$

where $Ns(\cdot)$ are the supply functions for the worker types.

Notice the main point that comes out of this setup is this: A wage differential $w_b < w_a$ will arise if and only if the fraction of discriminating employers (or discriminating jobs) is sufficiently large that the demand for $B$ workers when $wb = w_a$ is less than the supply. In other words, discrimination on average does not mean discrimination at the margin.

If there are enough non-discriminating employers, then discrimination is competed away. This also implies that minority workers don’t work for discriminating employers. If the share of prejudice employers is sufficiently large, then some $b$ group members will work at $d > 0$ employers, and this implies that $w_b < w_a$. In this case, the strength of prejudice at the margin (that is $d$ for the marginal employer of $b$ workers) is what affects determines the size of the wage gap.

With free entry or constant returns to scale (CRS), these employers may be competed out of business. In a competitive market, each worker must earn his marginal product. Under CRS, non-discriminating firms would simply expand to arbitrage the wage differential born by minority workers. In equilibrium, discriminating employers must fund the cost

Variants of the model:

Model A: (Becker) assume all employers discriminate and set wages for minority workers at $w - d$. This is a sustainable equilibrium if the differential in money costs is compensated by a differential in profits, which is in turn compensated by the differential in psychic costs.

Model B: (Arrow 1972) employer discriminatory tastes increasing function of the ratio of black-to-white employees. Or distaste may depend on “social distance” rather than “physical distance”. This makes empirical measurements much more complicated, although it does add realism. Equilibrium result is similar to Becker’s.
Model C (Becker): Employers discriminate to varying degrees so that there is a distribution of \( d \). If there are enough employers with low \( d \)'s who are willing to hire minorities then the wage gap will be smaller. The general insight is that black workers benefit from greater dispersion in \( d \)'s. A wider spread will narrow the wage gap if some of the increased variance was in the lower tail of the distribution. The magnitude of \( d \) is irrelevant in the upper tail as those employers won't be hiring minority workers. The way in which discrimination is entirely eliminated happens in two steps:

1. The lowest \( d \), call it \( d_0 \), will determine the market wage differential, even if it is only a small percentage of employers. These employers could decreased prices and increase market shares relative to employers with higher \( d \)'s. Inflow of investment would increase because of high profits and assuming long-run constant costs, the stopping point would be reached only when wages for all workers were equal.
2. \( d_0 \) will become zero—incenites for nondiscriminating owners would encourage individuals with low \( d \)'s to enter and discourage high \( d \)'s from entering.

But: Might not happen because the constant long-term costs assumption is false

Key testable implications of this model are:
Wage differentials: Minority workers earn less than majority workers of identical productivity.
Preferential hiring: Employers are less likely to hire minority workers of identical productivity.
However, these may not apply in equilibrium at the margin — so it’s not clear that we should observe them in our regressions.

Noncompetitive Markets Models (non-stochastic, monopolistic)
(1) Product monopoly: monopoly has characteristics that permit long-run discrimination: because by definition it has uniform tastes and its above-competitive profits to support \( d \). Regulated monopolies may be able to exercise their pref. for discrimination since they have a cushion of profits and tend to be protected from takeover.
There may still not be long-run discrimination since monopoly power in product market does not necessarily translate into monopoly power in labor market, so profit maximization would imply that the firm would still have to pay \( w \) to minority workers, though it could segregate workers or pay higher wages to majority workers. This would create incentives for low \( d \) takeovers. We have also not considered social costs to firms in which case public prominence may work to discourage discrimination—lower effective \( d \). However, in past, this would work in opposite direction.

(2) Monopsony firms
Model: a single buyer of labor faces an upward sloping supply curve of labor. Sets \( VMP=MC \) and hires less labor than if the same demand for labor was made by competitive firms. Pays the labor its supply price, which is under competitive demand condition and retains \( VPM - w \).
Genuine monopsonies (e.g., one company towns) are rare; although it’s not hard to imagine that some firms at some times had a substantial amount of market power. In practice, we need to consider the elasticity of labor supply carefully; for instance, the model does not explain discrimination against women (who presumably have more elastic labor supply curves than men).
Labor unions can in many ways be thought of as monopolies where to secure rents, some method of restricting entry is a necessary first step. If discrimination is consistent with members’ tastes, could help to prevent members from defecting. It’s not clear that union story matches up with time series evidence on discrimination and also is not consistent with recent trends in union membership.
**Statistical Discrimination**

We’ve already talked about the role signals in wages and labor market outcomes. Statistical discrimination comes from differences in the “quality” of the signal. If an employer observes a noisy signal of applicant productivity and also has prior information about correlates of productivity (let’s say a group-specific mean), then the expectation of applicant productivity should place weight on both the signal and the mean.

Assume that when workers apply for jobs, the employer sees race of the applicant \( x = \{a, b\} \) and some error-ridden signal \( \eta \) of productivity. Employers know (or think they know) that:

\[
\eta_x \sim N(n_x, \sigma^2_{\eta}) \quad \text{where} \quad n_a > n_b, \text{and} \quad \sigma^2_{\eta} \text{ is the same for both groups.}
\]

Hence, b group members are less productive on average, but the dispersion of productivity is the same for both groups. Notice that we can write \( \eta_i = \eta_x + \varepsilon_i \).

Suppose the signal is error ridden but unbiased so employers observe \( \tilde{\eta} = \eta + \varepsilon = n_x + \varepsilon + \nu \) where \( E[\tilde{\eta} | \eta] = \eta \). We can imagine a simple regression where we estimate

\[
E[\eta | \tilde{\eta}, x] = n_x (1 - \gamma) + \tilde{\eta} \gamma = n_x + (\tilde{\eta} - n_x) \gamma \quad \text{where} \quad \gamma = \sigma^2_\nu / (\sigma^2_\eta + \sigma^2_\nu). \]

Notice that \( \gamma_a = \gamma_b \) but \( n_a > n_b \). This implies that for a given signal, the expected productivity of b workers is below that of a workers.

Common example given for this case is gender differences in market work. The idea is based on two facts (1) Men have a higher probability of market work than women (2) Employers benefit from this higher probability (e.g. OTJ)

Employer faces this difference in work probability will practice statistical discrimination. *Ex ante* employer can’t tell which women will leave. Because OTJ/investment, women as a group will be underpaid even though there is no real taste for discrimination

This example does not imply group discrimination for 2 reasons
1. Women who participate for only the briefest period will be overpaid. As before, because the employer can’t know which women are short term, she gets the mean wage for women. On average, if the over- and underpayments cancel out, then the resulting average will be the same as for men.
2. Suppose all workers are the same gender but different education. Could be wage segregation but not discrimination. Moreover, if the choice to work or not is a reflection of discrimination then this example is useless.

Then main point is that with differences in productivity, we do not end up with equal pay for equal productivity in this model. Instead there is equal pay for equal expected productivity. Hence, for some workers, statistical discrimination is ‘discrimination’ in our standard way that workers with the same true productivity are paid different wages. But this will not be true on average within each group – on average expected productivity equals true productivity on average.

Suppose now instead on average the groups have the same productivity, i.e. \( n_a=n_b=n \) but the signal quality differs between groups. This implies that \( \sigma^2_{\eta_a} \neq \sigma^2_{\eta_b} \) and thus it follows that \( \gamma_a \neq \gamma_b \).

For which ever group has the lower variance, the signal will be more informative. Depending on whether you are above or below the mean of your group, you are differentially helped or harmed by a steeper \( \gamma \). If you are above the mean, you want the signal to be as informative as possible. If you are below the mean, you prefer an uninformative signal.
Decomposing Differences in Characteristics Across Groups:
When thinking about how to test the theories in empirical work, a crucial factor is how to use the characteristics of individuals (e.g., age, marital status, schooling, etc.). An important innovation was introduced by Oaxaca. The measure of discrimination is Becker’s generalized measure divided by the wage ratio in the absence of discrimination:

\[
D = \frac{W_m/W_f - (W_m/W_f)^0}{(W_m/W_f)^0}
\]

where \((W_m/W_f)^0\) = the observed male-female wage ratio in the absence of discrimination.

Assuming employers are cost minimizing the non-discriminating ratio should be equal to the ratio of marginal products. This is equivalent to the natural log formulation of:

\[
\ln(D+1) = \ln(W_m/W_f) - \ln(W_m/W_f)^0
\]

The issue is, of course, that \((W_m/W_f)^0\) is unknown and the estimation depends heavily on estimating this ratio. So we must pick one of two assumptions:

Option 1. the wage structure currently faced by females would also apply to males if discrimination did not exist
Option 2. the wage structure currently faced by males would also apply to females if discrimination did not exist.

To do this, imagine estimating an OLS estimating wage equation:

\[
\ln(W_i) = Z_i'\beta + u_i
\]

with \(Z\) being a vector of individual characteristics

Define: \(G = \frac{\bar{W}_m - \bar{W}_f}{\bar{W}_m}\) and then \(\ln(G + 1) = \ln(\bar{W}_m) - \ln(\bar{W}_f)\) where \(\bar{W}_i\) is the average wage for group \(i\). We can then use OLS estimates to get: \(\ln(\bar{W}_i) = Z_i'\hat{\beta}_i\) for \(i = m, f\)

Defining \(\Delta Z = Z_m - Z_f\) and \(\Delta \beta = \hat{\beta}_f - \hat{\beta}_m\) we can write the male-female wage differential as:

\[
\ln(G + 1) = \Delta Z' \Delta \beta
\]

The first term corresponds to the wage differences in individual characteristics and the second term corresponds to wage differential due to discrimination.

Examples of control variables:
- potential experience (age-education-6)
- Education
- Class of worker, e.g. union status (for private wage and salaried workers),
- government employed, self-employed. The base category is non-union private
- wage and salary workers
- Industry
- Occupation
- Health problems (=1 if individual has health problems that affect his/her amount or kind of work)
- Part time (=1 if individual works less than 35hrs/week)
- Migration (=1 if individuals has maintained a residence more than fifty miles from his or her current address since the age of 17.
- YRSM: number of years since the individual has last migrated
- Marital status: spouse present, spouse absent, widowed and divorced. Base category is never married.
• Size of Urban Area
• Region

This is a useful way to begin to think about the ways in which discrimination may operate and provides us a natural counterfactual which we can return to as we think about the empirical strategies to test discrimination. It is important to note some caveats though. First, differences in investment on OTJ, for example, may produce different parameters of the experience variables, but these differences contribute to the effects of discrimination under Oaxaca’s analysis. Second, this does not take into account feedback from labor market discrimination on the between group differences in the selected individual characteristics. For example, different characteristics for women relative to men (for example in educational investment) may be due to women’s response to a discriminatory labor market.

Nevertheless it is useful to think about how much of the difference in wages can be explained by differences in ‘pre-market’ characteristics and putting that aside, how much can be explained by differences in returns to these characteristics. We can then think about why those characteristics may differ.